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Sigma II Indexer User's Manual

⚠ WARNING

YASKAWA manufactures component parts that can be used in a wide variety of industrial applications. The selection and application of YASKAWA products remains the responsibility of the equipment designer or end user. YASKAWA accepts no responsibility for the way its products are incorporated into the final system design.

Under no circumstances should any YASKAWA product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to that part's safe use and operation. Any warnings provided by YASKAWA must be promptly provided to the end user.

YASKAWA offers an express warranty only as to the quality of its products in conforming to standards and specifications published in YASKAWA's manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. YASKAWA assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

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 products and systems.

⚠ WARNING

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

⚠ CAUTION

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

Overview

Manual Outline

This manual provides the following information for the Sigma II Series SGM□H/SGDH servodrives with a JUSP-NS600 Indexer Application Module.

- Procedures for installing and wiring the Sigma II Indexer Application Module.
- Procedures for trial operation of the servodrive.
- Specifications and methods for serial communications.
- Procedures for setting parameters and program tables.
- Procedures for digital I/O and serial mode operation.
- Troubleshooting procedures.

Related Manuals

Refer to the following manuals as required.

Read this manual carefully to ensure the proper use of Sigma 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
Sigma II Series Servo System User's Manual	YEA-S1A-S800-32.2	Describes the procedure used to select Sigma II Series servodrives and capacities and detailed information.
Sigma II Series Servo System Product Catalog Supplement	G-M1#99001D	Describes the procedure used to select Sigma II Series servodrives and capacities.

Refer to Sigma II User's Manual for the following information.

- Procedures for installing and wiring the servomotor and servo amplifier (encoder, motor and power).
- Procedures for using functions and adjusting the servodrives:
  Selecting a regen resistor, special wiring, tuning and analog monitor.
- Procedures for using the built-in panel operator and the hand-held digital operator.
- Ratings and specifications for standard models.

Using This Manual

Intended Audience

This manual is intended for the following users.

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

Description of Technical Terms

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

- **Servomotor** = Sigma II Series SGMAH/SGMPH/SGMGH/SGMSH servomotor.
- **Servo Amplifier** = Sigma II Series SGDH servo amplifier.
- **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 computer and peripheral devices.

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 equations:

- /S–ON = $\overline{\text{S–ON}}$
- /RGRT = $\overline{\text{RGRT}}$
- /START-STOP;/HOME = $\overline{\text{START-STOP}}$; $\overline{\text{HOME}}$ (dual purpose input)

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 servo amplifier 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 a class 3 ground (100Ω or less).**
  Improper grounding may result in electric shock or fire.
- Required for 7.5kW amplifiers: Use Yaskawa kit Number XXX for wiring the power input and output terminals, or equivalent UL listed closed-loop ring terminals designed to accept 4 AWG wires.

⚠ 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

⚠ CAUTION

- **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.**
  Not doing so may result in burns due to high temperatures.

Maintenance and Inspection

⚠ WARNING

- **Do not remove the panel cover while the power is ON.**
  Doing so carries a risk of electric shock.
- **Do not touch terminals for five minutes after the power has been turned OFF.**
  Residual voltage may cause electric shock.
- **Never touch the inside of the servo amplifier.**
  Doing so may result in 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.

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1

Checking Products and Part Names

This chapter describes the procedure for checking the Sigma II Indexer application module upon delivery. It also describes the name of product parts.

1.1 Introduction

The Sigma II Indexer application module (P/N JUSP-NS600) is a single-axis position controller with registration capabilities which connects to an SGDH servo amplifier via dual-port RAM.

This combination expands the amplifier's functionality to include simple point-to-point positioning with an available registration function. The Sigma II Indexer option has two operating modes, serial command mode and digital I/O mode.
The serial command mode allows immediate interpretation and execution of ASCII command strings sent via RS232/422/485 to the Sigma II Indexer. The digital I/O mode consists of the program or index table (mode 0) and the jog speed table and homing (mode 1). While in Mode □ the program table allows execution of stored index moves, selected with input-signal patterns (binary format). While in Mode 1, the jog speed table allows execution of stored jog speeds, selected with input-signal patterns (binary format).Three types of homing routines are also available while in Mode 1.

Figure 1.1 JUSP-NS600 Indexer/SGDH Combination

Table 1.1: Sigma II Indexer Functions

Function	Description
Digital I/O Mode- Program (Index) Table (Mode 0)	Positioning data are selected from the program table stored in the indexer by using the positioning data selection input signals (binary format). The indexer can store up to 128 program steps. All 128 program steps may be addressed with inputs.The program steps may be linked together to generate more complex moves.
Digital I/O Mode- Jog Speed Table and Homing (Mode 1)	Up to 16 jog speeds are available. Speeds are selected by using the jog selection input-signals (binary format). Homing is available while in this mode.
Serial Command Mode	Positioning data are input by ASCII command strings sent via RS232/RS422/RS485 to the indexer. Commands can be sent up to 16 axes with one master controller. Positioning data can also be selected from the program table stored in the indexer by ASCII commands.
Registration	Both serial command and program table mode support the registration function (external positioning).
Programmable Output Signals	5 programmable output signals are available.
Zone Signals	Up to 32 different zones can be defined to program the 5 programmable output signals (/POUT0 - /POUT4) based on position.
Homing	Used for zero-point return (homing) when incremental encoder is used. Both serial command and homing mode allow execution of the available homing routines. Three types of homing routines are available: 1. Decel limit switch and encoder cø-pulse are used. 2. Only decel limit switch is used. 3. Only encoder cø-pulse is used.

1.2 Checking Products on Delivery

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

Table 1.2:

Check items	Comments
Are the delivered products the ones that were ordered?	Check the model numbers marked on the nameplates of the application module.
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Can the application module be installed on the SGDH servo amplifier used?	Check the model number given on the SGDH servo amplifier nameplate. The model number must contain "SGDH- ▬□▬□▬ E" to support the Sigma II Indexer application module.

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

1.2.1 External Appearance And Nameplate Examples

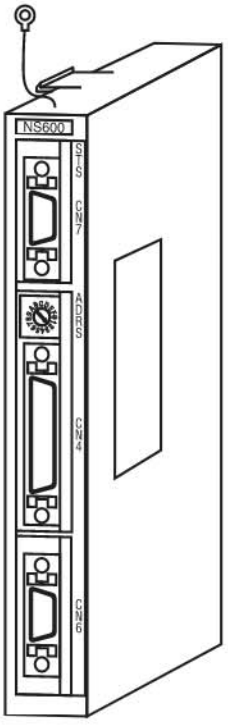


Figure 1.2 External Appearance of Sigma II Indexer Application Module

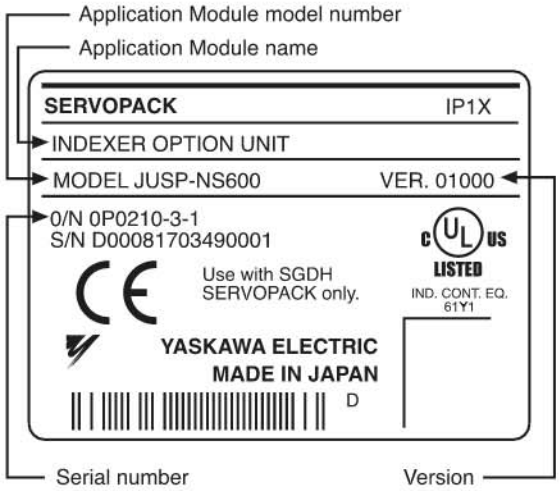


Figure 1.3 Nameplate

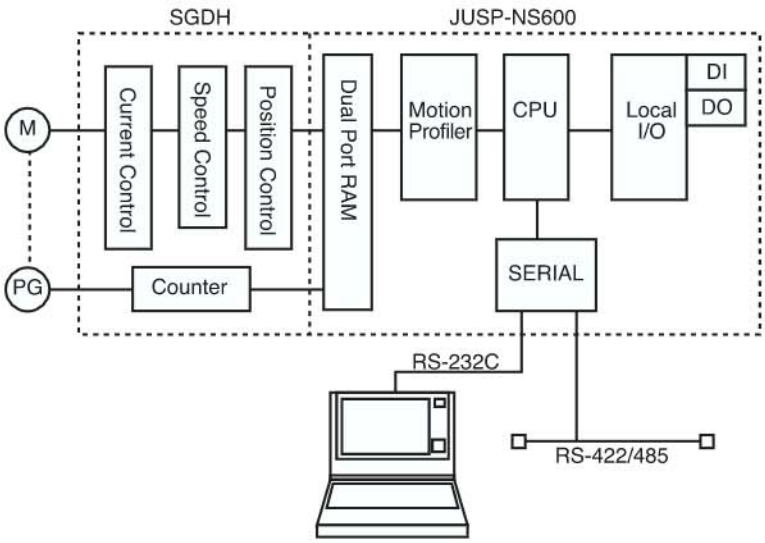


Figure 1.4 Block Diagram of Sigma II Indexer Functions.

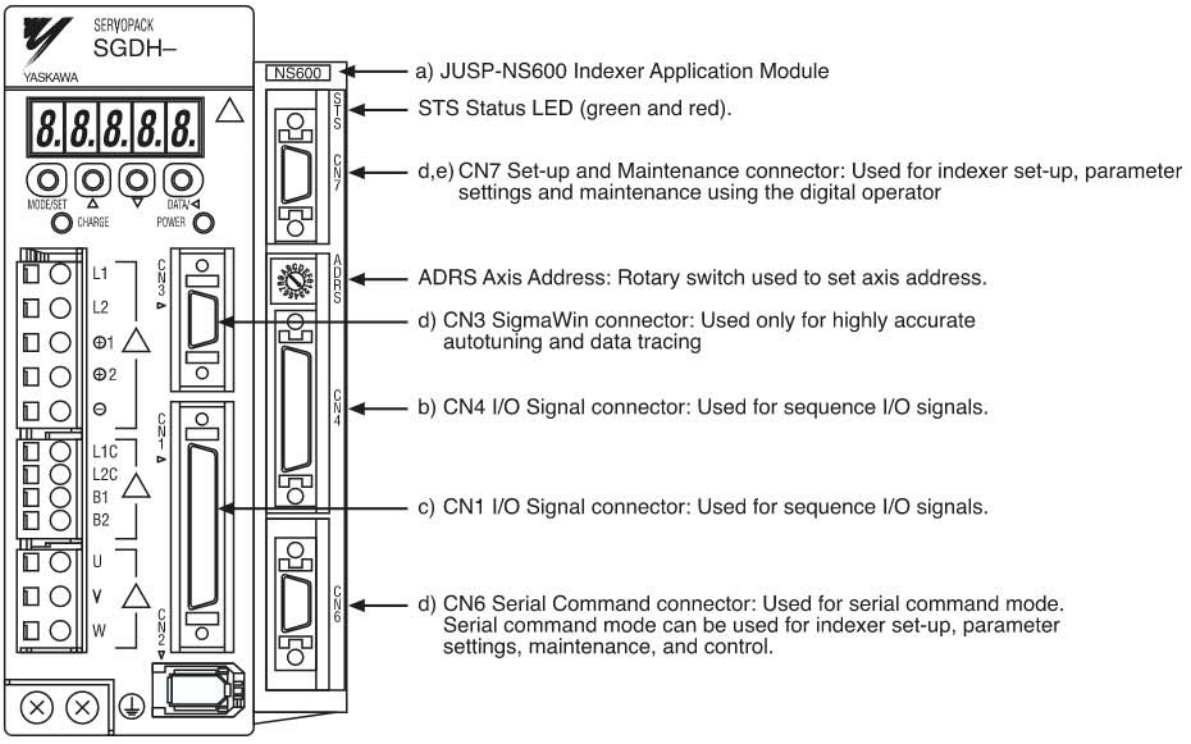


Figure 1.5

Note: Refer to Table 1.3 for part numbers of items a-e.

Table 1.3: Part Numbers

Description			Item Number
Indexer	a	Sigma II Indexer	JUSP-NS600
I/O Cables	b	CN4 I/O Cable (with pigtail leads), 36 pin, 1.0m	CKI-NS600-01
		CN4 I/O Cable (with pigtail leads), 36 pin, 2.0m	CKI-NS600-02
		CN4 I/O Cable (with pigtail leads), 36 pin, 3.0m	CKI-NS600-03
		CN4 I/O Cable (with terminal block)	JUSP-TA36P
	c	CN1 I/O Cable (with pigtail leads), 50 pin, 1.0m	JZSP-CKI01-1(A)
		CN1 I/O Cable (with pigtail leads), 50 pin, 2.0m	JZSP-CKI01-2(A)
		CN1 I/O Cable (with pigtail leads), 50 pin, 3.0m	JZSP-CKI01-3(A)
		CN1 I/O Cable (with terminal block)	JUSP-TA50P
Serial Cables	d	CN3, CN6, CN7 Serial Communication Cable (RS232 only), 2.0m	YS-12
		CN6 Serial Communication Cable (with pigtail leads), 2.0m	YS-14
Accessories	e	Hand-held Digital Operator Panel	JUSP-OP02A-1 + JZSP-CMSOO-1
		CN3, CN6, CN7 Mating Connector	YSC-1
		CN4 Mating Connector, 36 pin	DP9420007
		CN1 Mating Connector, 50 pin	JZSP-CKI9
Software		IndexWorks Indexer Support Software	NS600-GUI

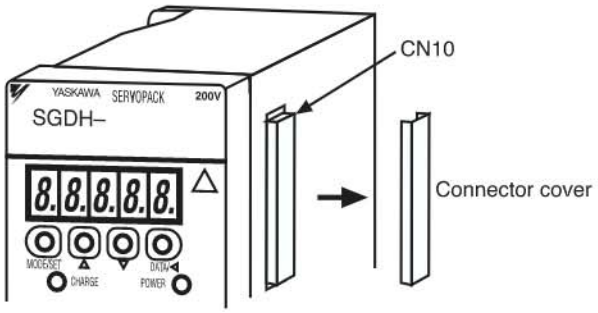
Note: See *Sigma II Servo System Product Catalog Supplement* for part numbers and additional information on servo motors, servo amplifier, motor power cables, encoder cables and accessories.

1.3 Mounting the Sigma II Indexer Application Module to an SGDH Servo Amplifier

This section describes how to mount a Sigma II Indexer application module on the SGDH servo amplifier.

Use the following procedure to ensure the Sigma II Indexer application module is mounted correctly.

1. Remove the connector cover from the CN10 connector on the SGDH servo amplifier.



2. Insert the lower two mounting notches into the mounting holes at the bottom of the right side of the SGDH servo amplifier.

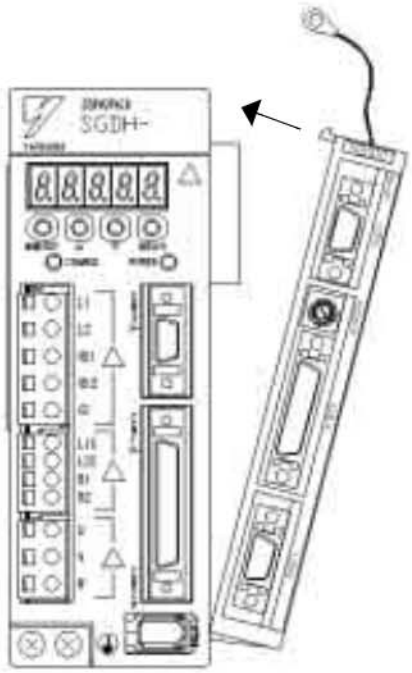


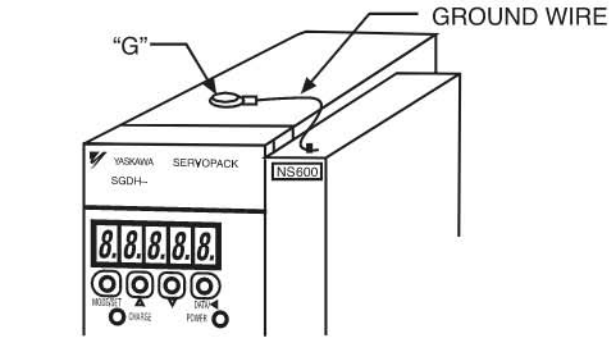
Figure 1.6 Mounting the JUSP-NS600 to an SGDH Servo Amplifier

3. Push the Sigma II Indexer application module in the direction indicated by the arrows in the figure above, and insert the upper mounting notches of the Sigma II Indexer application module into the upper mounting holes on the right side of the SGDH servo amplifier.

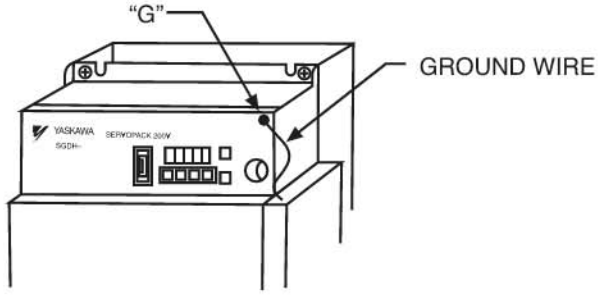
4. For grounding, connect the ground wire of the Sigma II Indexer application module to the point marked "G" on the SGDH servo amplifier. Refer to table 1.4 for the selection of the proper screw size. Screws are provided with the application module.

Table 1.4: Sigma II Indexer Ground Wire Screw

Servo Amplifier	Screw	Note
SGDH-A3~02BE SGDH-A3~10AE	M3x10 (round head phillips with split lock washer and flat washer)	-
SGDH-15~50AE SGDH-05~50DE	M4x10 (round head phillips with split lock washer and flat washer)	-
SGDH-60~1EAE SGDH-60~1EDE	M4x8 (round head phillips with split lock washer and flat washer)	Use front panel side screw hole.



For SGDH (30 W to 5.0 kW)



For SGDH (6.0 kW to 15 kW)

Figure 1.7

When the Sigma II Indexer application module has been mounted correctly, the SGDH servo amplifier will appear as shown in the following diagram.

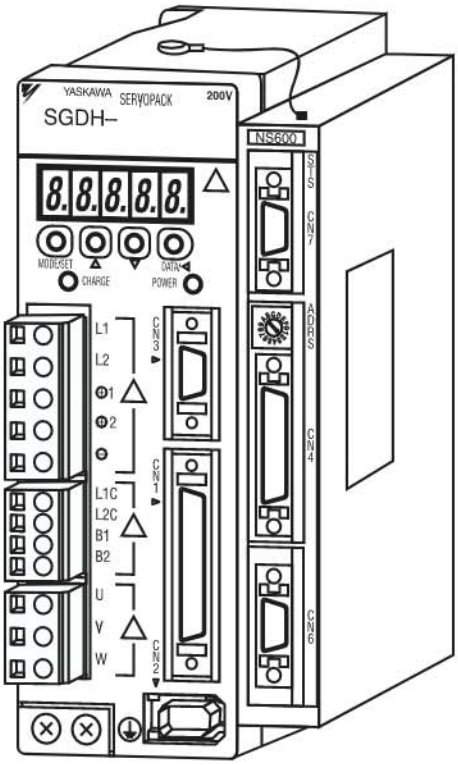


Figure 1.8

2

Installation

This chapter describes precautions for Sigma II Series and Indexer application module installation.

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

2.1 Storage Conditions

Store the servo amplifier within the following temperature range, as long as it is stored with the power cable disconnected.

-20 to 85°C

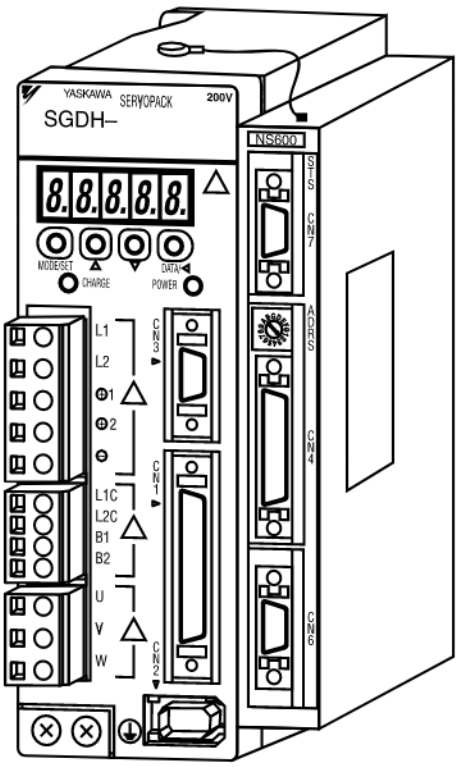


Figure 2.1 Sigma II Series Servo Amplifier with Sigma II Indexer Application Module Mounted

2.2 Installation Site

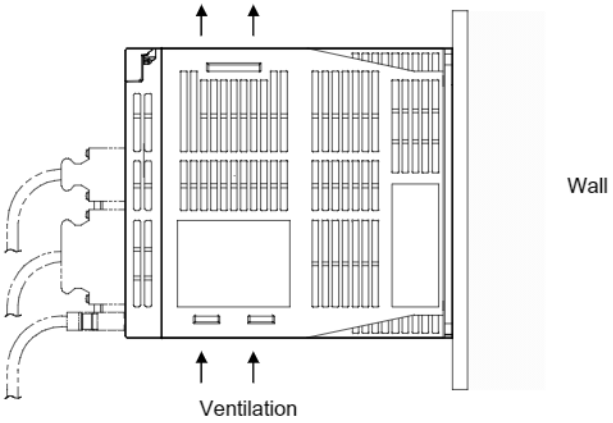
Table 2.1: The following precautions apply to the installation site.

Situation	Installation Precaution
Installation in a control panel	Design the control panel size, unit layout, and cooling method so the temperature around the servo amplifier 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 the temperature around the servo amplifier does not exceed 55°C.
Installation near a source of vibration	Install a vibration isolator beneath the servo amplifier to avoid subjecting it to vibration.
Installation at a site exposed to corrosive gas	Corrosive gas does not have an immediate effect on the servo amplifier, 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 servo amplifier in hot and humid locations or locations subject to excessive dust or iron powder in the air.

2.3 Orientation

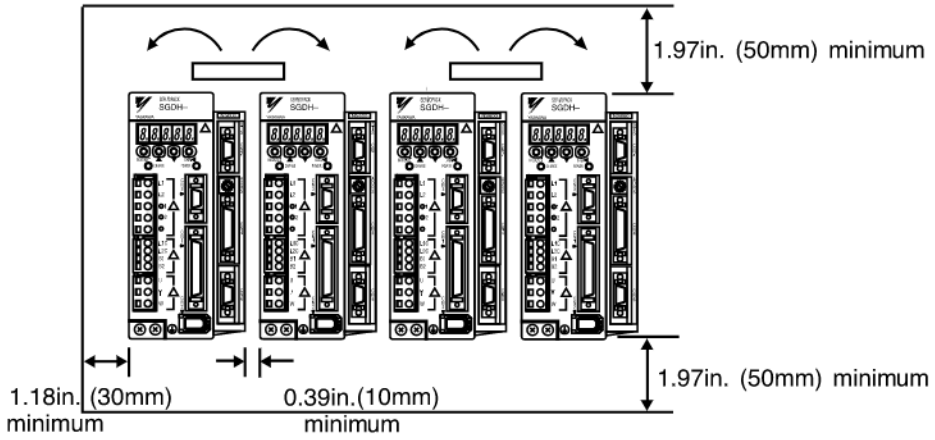
Install the servo amplifier perpendicular to the panel wall as shown in the figure. The servo amplifier must be oriented this way because it is designed to be cooled by natural convection or cooling fan.

Secure the servo amplifier using the mounting holes. The number of holes varies (from two to four) with the frame size of the servo amplifier.



2.4 Installation

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



2.4.1 Servo Amplifier Orientation

Install the servo amplifier perpendicular to the wall so the front panel containing connectors faces outward.

2.4.2 Cooling

As shown in the figure above, allow sufficient space around each servo amplifier for cooling by cooling fans or natural convection.

2.4.3 Side-by-side Installation

When installing servo amplifiers side by side as shown in the figure above, allow at least 0.39in. (10mm) between and at least 1.97in. (50mm) above and below each servo amplifier. Install cooling fans above the servo amplifiers 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% r.h., or less
- Vibration: 0.5 G (4.9 m/s^2)
- Condensation and Freezing:None
- Ambient Temperature for Long-term Reliability:45°C maximum

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3

Connectors

3.1 I/O Signals (CN1, CN4)

The section describes I/O signals for the SGDH Servo Amplifier and Sigma II Indexer application module.

3.1.1 Connection Example of I/O Signal Connector (CN1, CN4)

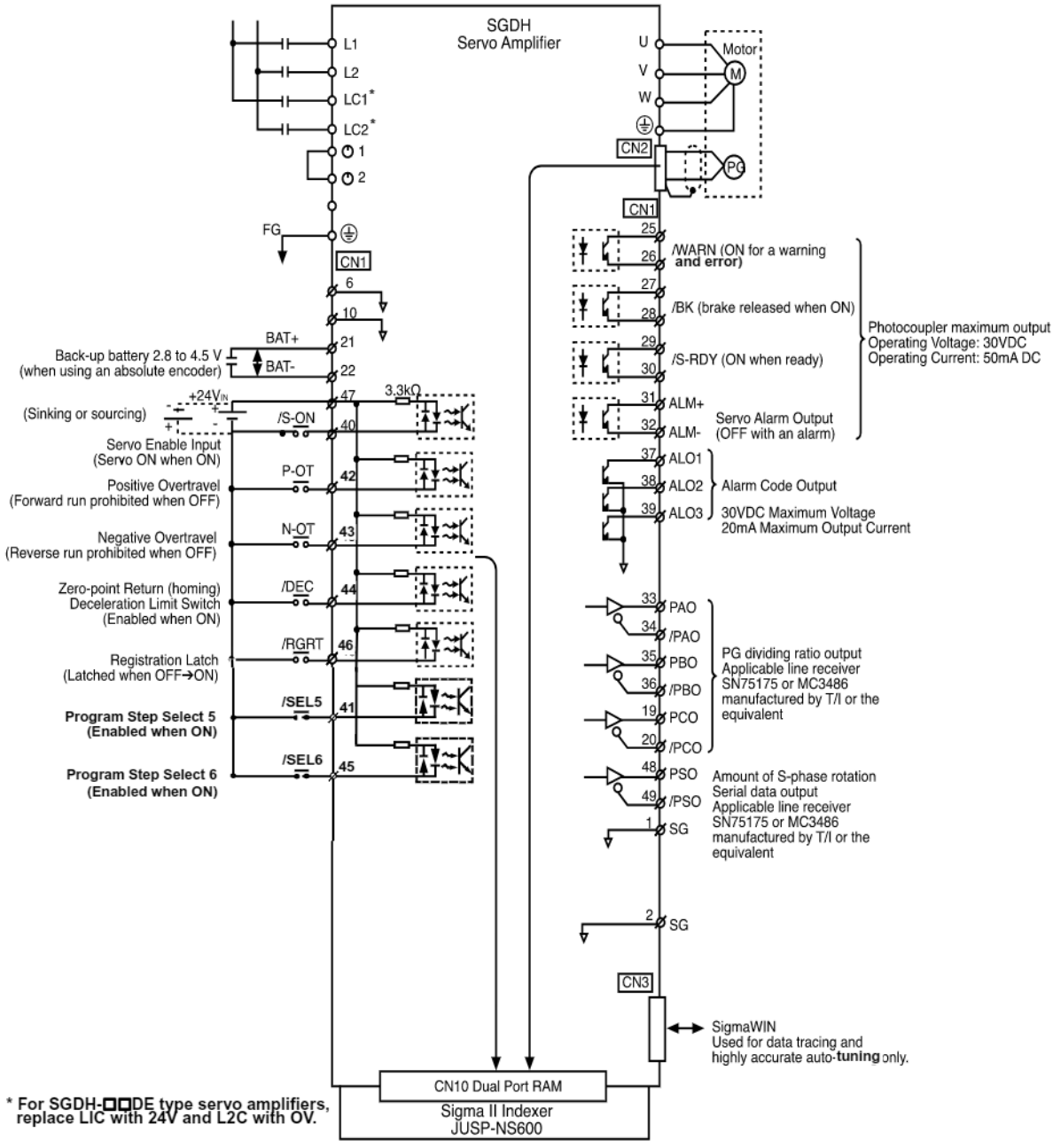


Figure 3.1 SGDH I/O (CN1)

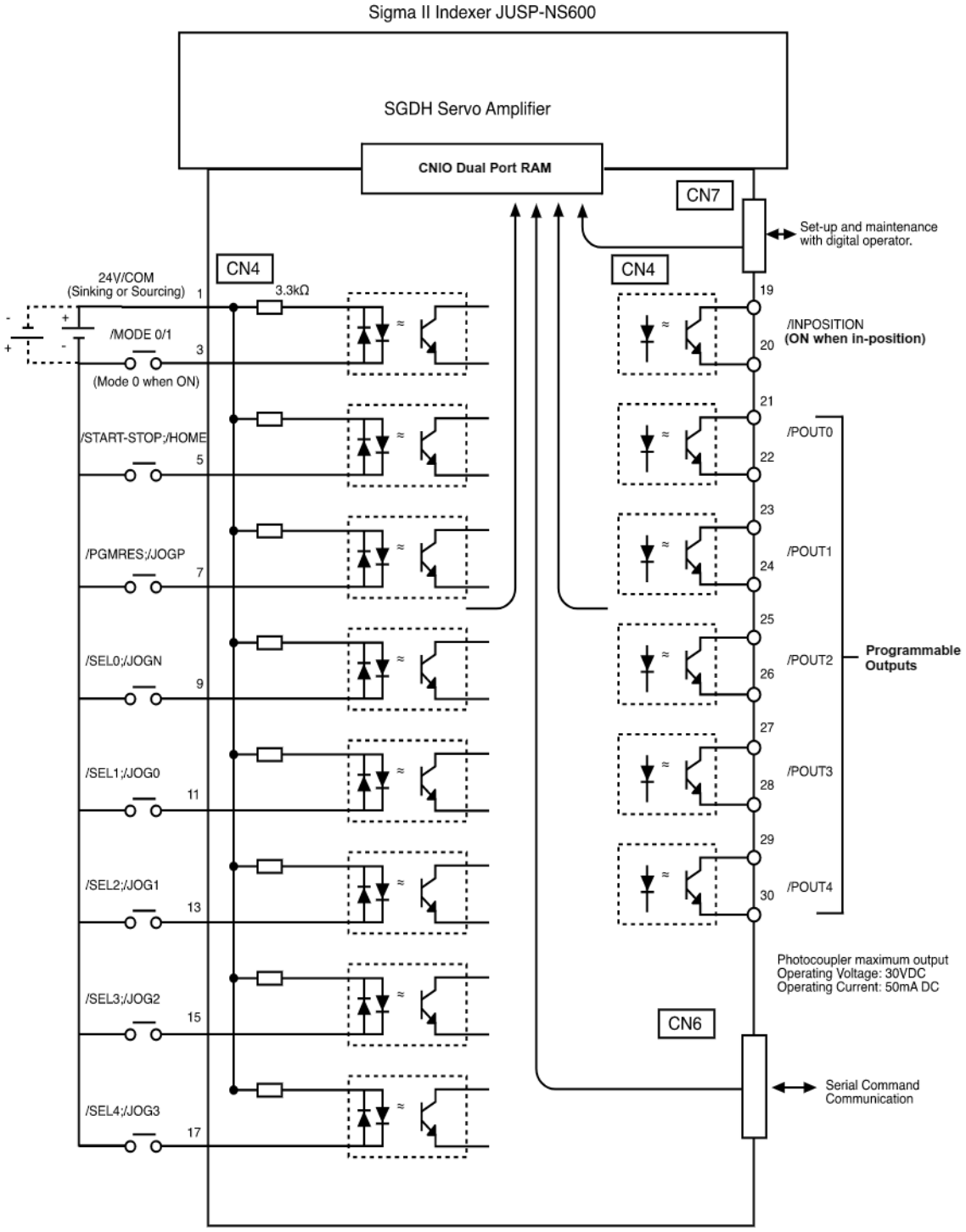


Figure 3.2 Sigma II Indexer JUSP-NS600 I/O (CN4)

Note: Mode 0 enables input functions /START-STOP, /PGMRES, /SEL0, /SEL1, /SEL2, /SEL3, /SEL4.
Mode 1 enables input functions /HOME, /JOGP, /JOGN, /JOG0, /JOG1, /JOG2, /JOG3.

3.1.2 I/O Signals Connector (CN1, CN4)

The following diagrams show the layout of CN1 and CN4 terminals.

Table 3.1: CN1 Terminal Layout (Servo Amplifier)

2	SG	Signal Ground	1	SG	Signal Ground	27	/BK+	Brake interlock output	26	/WARN-	Servo warning output
4	-	-	3	-	-	29	/S-RDY+	Servo ready output	28	/BK-	Brake interlock output
6	SG	Signal Ground	5	-	-	31	ALM+	Servo alarm output	30	/S-RDY-	Servo Ready Output
8	-	-	7	-	-	33	PAO	PG Divided Output A-Phase	32	ALM-	Servo alarm output
10	SG	Signal Ground	9	-	-	35	PBO	PG Divided Output B-Phase	34	/PAO	PG Divided Output A-Phase
12	-	-	11	-	-	37	AL01	Alarm code output (open-collector output)	36	/PBO	PG Divided Output B-Phase
14	-	-	13	-	-	39	AL03		38	AL02	Alarm code output
16	-	-	15	-	-	41	/SEL5	Program select 5	40	/S-ON	Servo ON input
18	-	-	17	-	-	43	N-OT	Reverse run prohibited input	42	P-OT	Forward drive prohibited input
20	/PCO	PG Divided Output C-Phase	19	PCO	PG Divided Output C-Phase	45	/SEL6	Program select 6	44	/DEC	Zero point return deceleration LS input
22	BAT (-)	Battery (-)	21	BAT (+)	Battery (+)	47	+24VIN	External power supply input	46	/RGRT	Registration latch
24	-	-	23	-	-	49	/PSO	S-Phase Signal Output	48	PSO	S-Phase Signal Output
			25	/WARN+	Servo warning output				50	-	-

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 servo amplifier-end connector.

Table 3.2: CN4 Terminal Layout (Sigma II Indexer)

1	24V/COM	External input power supply	2	-	-	19	/INPOSITION+	In-position output	20	/INPOSITION-	In-position output
3	/MODE 0/1	Mode select input	4	-	-	21	/POUT0+	Programmable Output 0	22	/POUT0-	Programmable Output 0
5	/START-STOP; /HOME	Start-Stop/ Home input	6	-	-	23	/POUT1+	Programmable Output 1	24	/POUT1-	Programmable Output 1
7	/PGMRES; /JOGP	Program reset/Jog forward input	8	-	-	25	/POUT2+	Programmable Output 2	26	/POUT2-	Programmable Output 2
9	/SEL0; /JOGN	Program select 0/Jog reverse input	10	-	-	27	/POUT3+	Programmable Output 3	28	/POUT3-	Programmable Output 3
11	/SEL1; /JOG0	Program select 1/Jog select 0 input	12	-	-	29	/POUT4+	Programmable Output 4	30	/POUT4-	Programmable Output 4
13	/SEL2; /JOG1	Program select 2/Jog select 1 input	14	-	-	31	-	-	32	-	-
15	/SEL3; /JOG2	Program select 3/Jog select 2 input	16	-	-	33	-	-	34	-	-
17	/SEL4; /JOG3	Program select 4/Jog select 3 input	18	-	-	35	-	-	36	-	-

Table 3.3: CN1 Specifications (Servo Amplifier)

Specifications for Servo Amplifier Receptacle	Applicable Mating Connector		
	Connector	Case	Manufacturer
10250–52A2JL or Equivalent 50–pin Right Angle Receptacle	10150–3000VE	10350–52A0–008	Sumitomo 3M Co.

Note: Yaskawa P/N JZSP-CKI9 includes 3M connector and case.

Table 3.4: CN4 Specifications (Sigma II Indexer)

Specifications for Servo Amplifier Receptacle	Applicable Mating Connector		
	Connector	Case	Manufacturer
10236–52A25L or Equivalent 36–pin Right Angle Receptacle	10136–3000VE	10336–52A0–008	Sumitomo 3M Co.

Note: Yaskawa P/N DP9420007 includes 3M connector and case.

3.1.3 I/O Signal Names and Functions

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

Table 3.5: CN1 Input Signals (Servo Amplifier)

Signal Name	Pin No.	Function	
/S-ON	40	Servo ON: Turns ON the servomotor when the gate block in the inverter is released.	
/SEL5	41	Mode 0: Program select input 5. Mode 1: No effect.	
P-OT N-OT	42 43	Forward run prohibit Reverse run prohibit	Overtravel prohibited: Stops Servo motor when movable part travels beyond the allowable range of motion
/DEC	44	Zero point return deceleration limit switch: Deceleration LS used when the motor returns to the zero point during homing.	
/SEL6	45	Mode 0: Program select input 6. Mode 1: No effect.	
/RGRT	46	Registration latch signal: used for external positioning.	
+24VIN	47	Control power supply input for sequence signals: User must provide the +24-V power supply. Minimum operating voltage: 11V Maximum operating voltage: 25V	
BAT (+)	21	Connecting pin for the absolute encoder backup battery	
BAT (-)	22	Connect to either CN8 or CN1-21,22.	

Table 3.6: CN1 Output Signals (Servo Amplifier)

Signal Name	Pin No.	Function
ALM+ ALM-	31 32	Servo alarm: Turns OFF when an alarm is detected.
/WARN+ /WARN-	25 26	Servo Warning: ON when an error or warning 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.

Note 1. Pin numbers in parenthesis () indicate signal grounds.

Table 3.7: CN4 Input Signals (Sigma II Indexer)

Signal Name	Pin No.	Function
+24V/COM	1	Control power supply input for sequence signals. User must provide the +24V power supply. Minimum operating voltage: 11V Maximum operating voltage: 25V
/Mode 0/1	3	Switches between Mode 0 and Mode 1. Mode 0: Index table mode when ON. Mode 1: Jog and homing mode when OFF.
/START-STOP; /HOME	5	Mode 0: Starts selected index table program when ON. Stops program operation when OFF. Mode 1: Starts homing routine when ON. Stops homing routing when OFF.
/PGMRES;/JOGP	7	Mode 0: Resets index table program when OFF →ON. Mode 1: Forward jog enabled when ON. Stops forward jog when OFF
/SEL0;/JOGN	9	Mode 0: Program select input 0 Mode 1: Reverse jog enabled when ON. Stops reverse jog when OFF.
/SEL1;/JOG0	11	Mode 0: Program select input 1 Mode 1: Jog speed select input 0
/SEL2;/JOG1	13	Mode 0: Program select input 2 Mode 1: Jog speed select input 1
/SEL3;/JOG2	15	Mode 0: Program select input 3 Mode 1: Jog speed selected input 2
/SEL4;/JOG3	17	Mode 0: Program select input 4 Mode 1: Jog speed select input 3

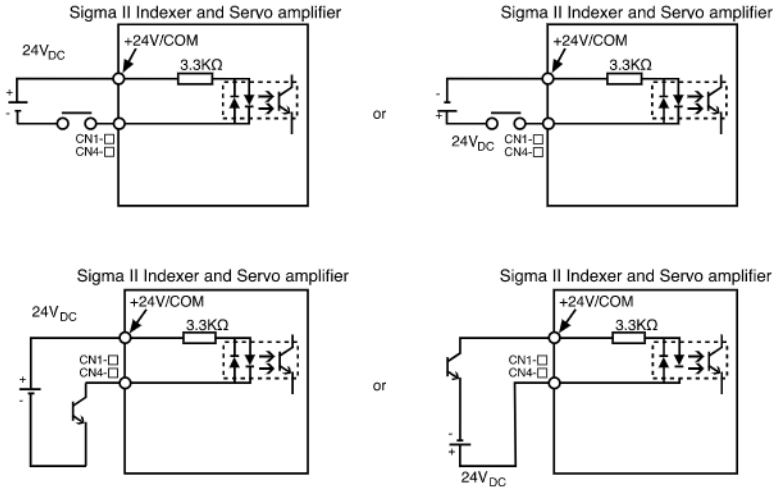
Table 3.8: CN4 Output Signals (Sigma II Indexer)

Signal Name	Pin No.	Functions
/INPOSITION +	19	In-position: Turns ON when the position error is within the inposition window setting. Pn821 and when the commanded position profile has ended (also known as DEN, distribution end).
/INPOSITION -	20	
/POUT 0+	21	Programmable Outputs
/POUT0-	22	
/POUT1+	23	
/POUT1-	24	
/POUT2+	25	
/POUT2-	26	
/POUT3+	27	
/POUT3-	28	
/POUT4+	29	
/POUT4-	30	

3.1.4 Interface Circuits

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.



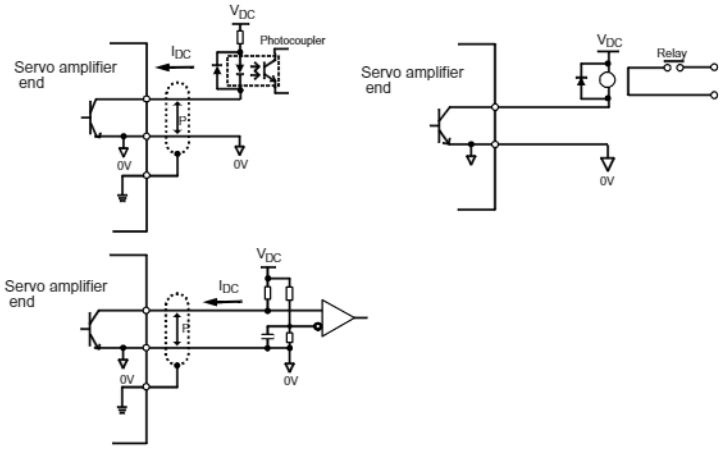
Output Circuit Interfaces

Any of the following three types of servo amplifier output circuits can be used. Connect an input circuit at the host controller following one of these types.

- **Connecting to an Open-Collector Output Circuit (Alarm Code Outputs)**

  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.



CAUTION

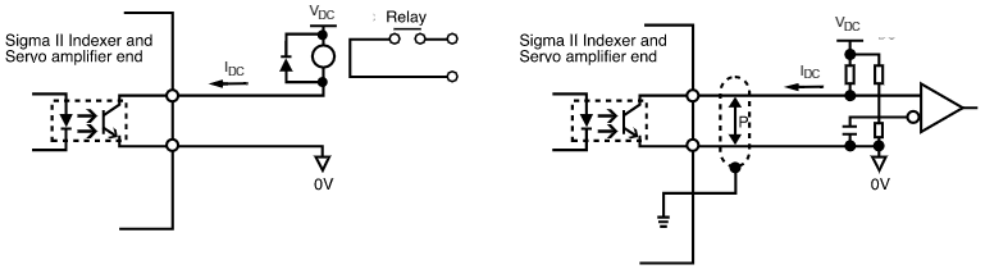
The maximum allowable voltage and current capacities for open-collector circuits are:

- V_{DC}, Voltage: $30V_{DC}$ max.
- I_{DC}, Current: $20mA_{DC}$ max.

- **Connecting to a Photocoupler Output Circuit**

  Photocoupler output circuits are used for SGDH servo amplifier alarm, servo ready, holding brake, warning, and all Sigma II Indexer outputs.

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



CAUTION

The maximum allowable capacities for photocoupler output circuits are:

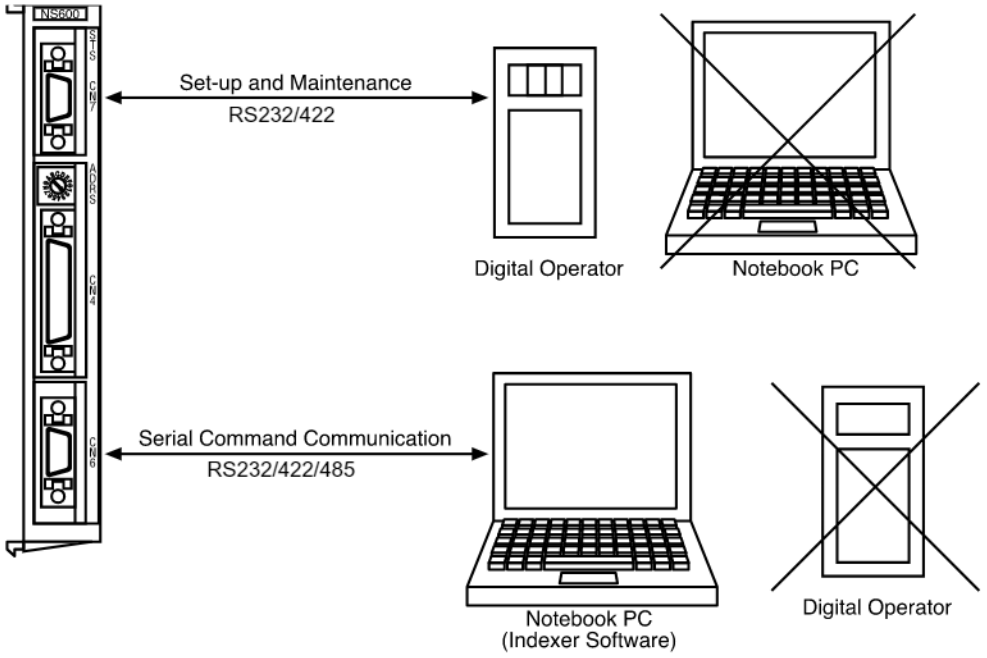
- V_{DC}, Voltage: $30V_{DC}$ max.
- I_{DC}, Current: $50mA_{DC}$ max.

3.2 Serial Communication Connectors (CN6, CN7)

This section describes the wiring for the serial communication connectors (CN6, CN7)

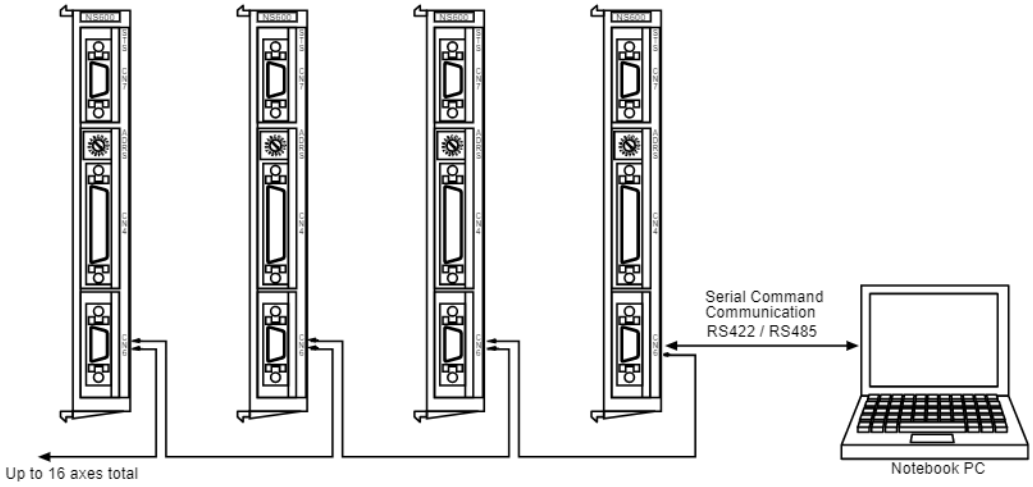
3.2.1 Single Axis System Example (CN6, CN7)

The figure below illustrates connection for single-axis communication between a PC and Sigma II Indexer (CN6, CN7)



3.2.2 Multi-Axis System Example (CN6 only)

The figure below illustrates connection for multi-axis communication between a PC and up to 16 Sigma II Indexers (CN6 only)



3.2.3 Communication Specifications (CN6, CN7)

The following table shows the communications specifications for CN6 and CN7.

Table 3.9: Communication Specifications

Item	Port	Specification
Interface	CN6	RS232/RS422/RS485
	CN7	RS232/RS422
Transmission Range	CN6 CN7	RS232: 3m maximum RS422/RS485: 50m maximum
Baud Rate	CN6	9.6, 19.2, 38.4 Kbaud
	CN7	9.6 Kbaud
Synchronization Type	CN6	Asynchronous (start-stop synchronization)
Transmission Format	CN6 CN7	Start: 1 bit Data: 7 bit, ASCII code Parity: 1 bit, Even Stop: 1 bit
X On/X Off Control	CN6 CN7	None
Shift Control	CN6 CN7	None
Communication	CN6 CN7	Half-duplex

3.2.4 Communication Connectors (CN6, CN7)

Table 3.10: CN6 Terminal Layout

1	TXD	2	/TXD	8	TXD	9	/TXD
3	RXD	4	/RXD	10	RXD	11	
5		6	/RXD	12		13	
7	RT (Terminal Resistance)			14	GND		

.

Table 3.11: CN7 Terminal Layout

1	TXD	2	/TXD	8	TXD	9	/TXD
3	RXD	4	/RXD	10	RXD	11	Reserved
5	Reserved	6	/RXD	12	Reserved	13	Reserved
7	RT (Terminal Resistance)			14	GND		

Table 3.12: CN6, CN7 Specifications

Specifications for Sigma II Indexer Receptacle	Applicable Mating Connectors		
	Connector	Case	Manufacturer
10214-52A2JL 14-Pin Right Angle Plug	10114-3000VE	10314-52AO-008	Sumitomo 3M Co.
Note: Yaskawa P/N YSC-1 includes 3M case and connector.			

3.2.5 Connector Signal Names (CN6,CN7)

Table 3.13:

Pin No.	Signal name	Signal Circuit Name	Signal Direction
1	TXD	Transmit data (not inverted)	P←S
2	/TXD	Transmit data (inverted)	P←S
3	RXD	Receive data (not inverted)	P→S
4	/RXD	Receive data (inverted)	P→S
5	Reserved	Reserved pin	-
6	/RXD	Short pins 6 and 7 apply an internal 220 Ω terminating resistance between RXD and / RXD.	
7	RT		
8	TXD	Transmit data (not inverted)	P←S
9	/TXD	Transmit data (inverted)	P←S
10	RXD	Receive data (not inverted)	P→S
11	Reserved	Reserved pin	#
12	Reserved	Reserved pin	#
13	Reserved	Reserved pin	-
14	GND	Signal ground: 0 V	-

P: Personal computer
S: Servopack
#: Reserved terminal (leave open).

3.2.6 Connection Examples

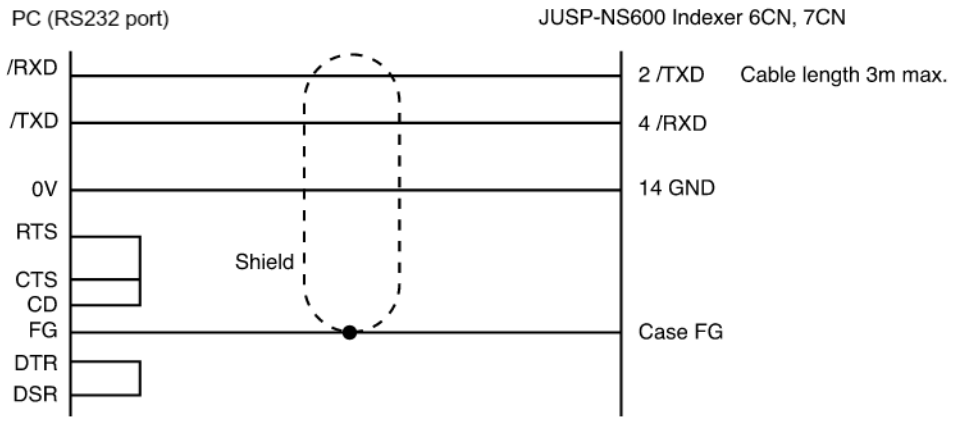


Figure 3.3 RS232C Single-Axis Communication (CN6, CN7)

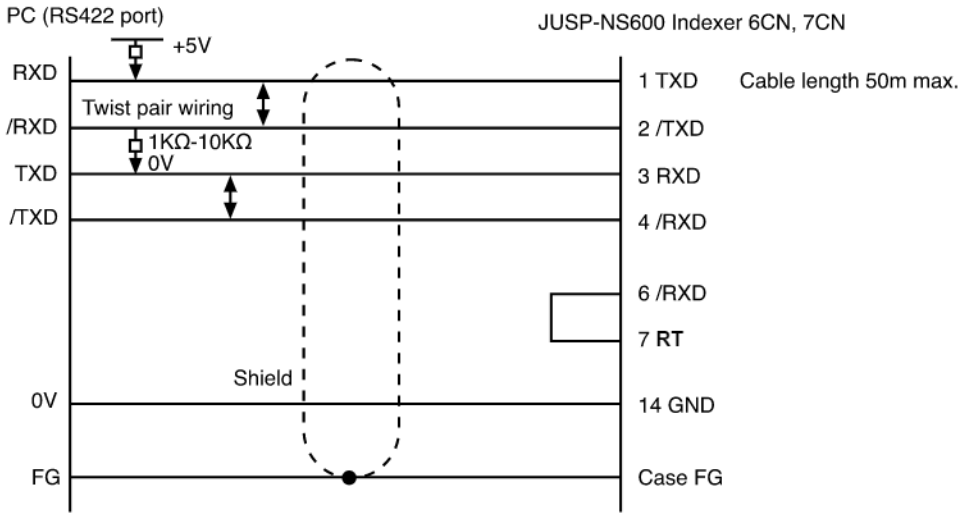


Figure 3.4 RS422 Single-Axis Communication (CN6, CN7)

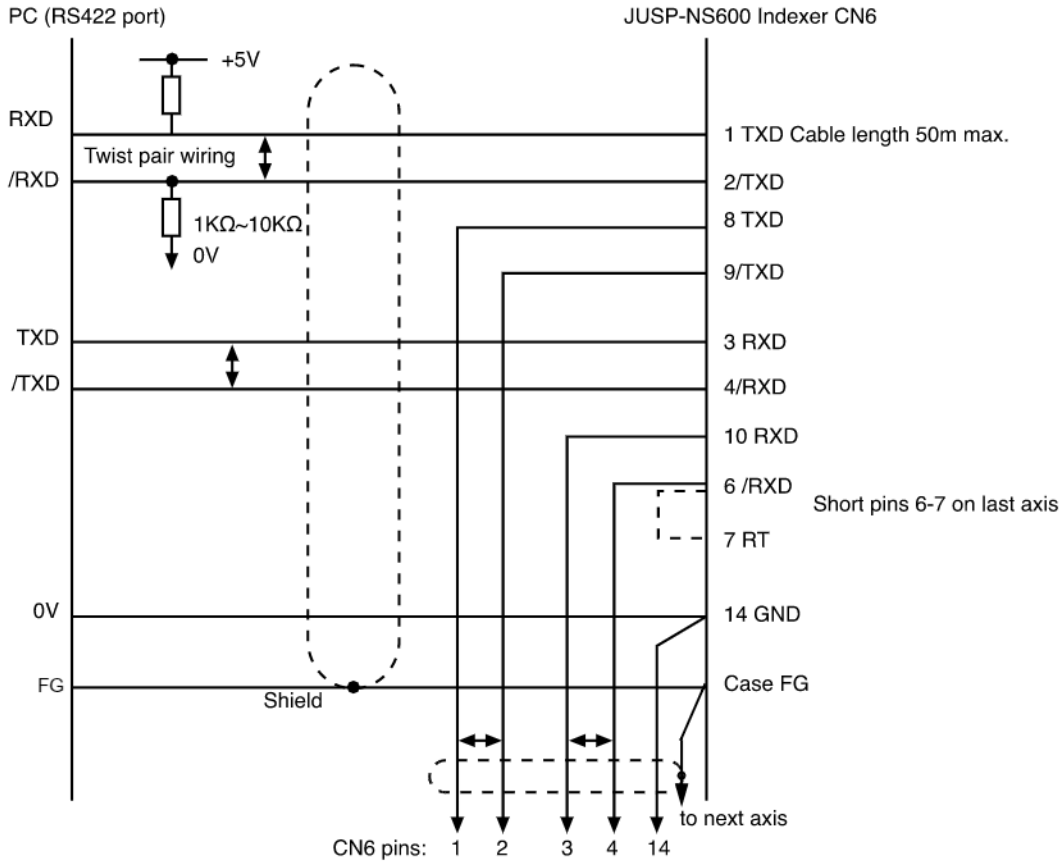


Figure 3.5 RS422 Multi-Axis Communication (CN6)

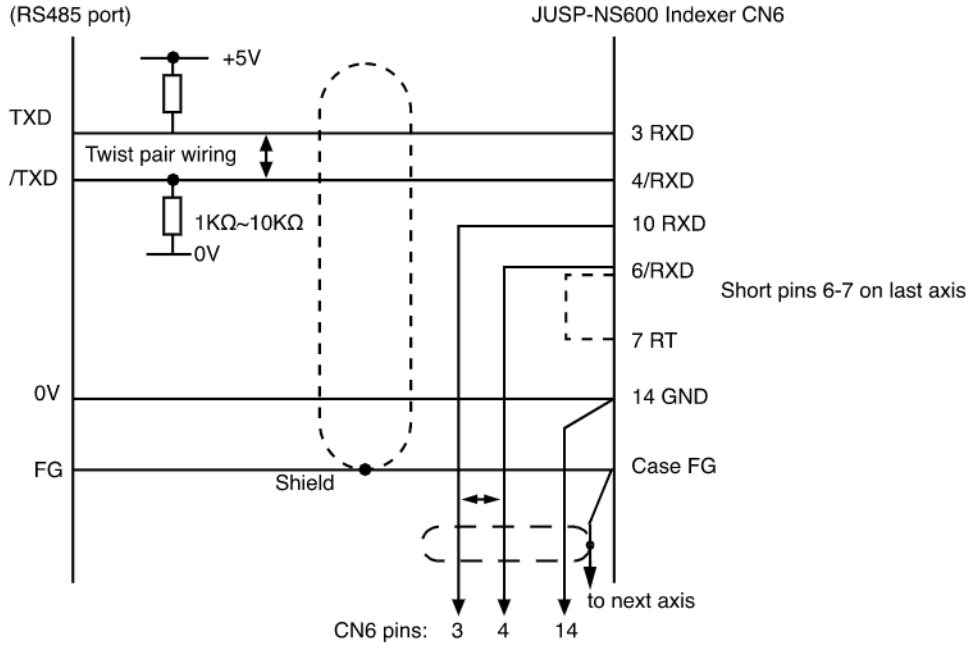


Figure 3.6 RS485 Multi-Axis Communication (CN6)

RS422/485 Interface Cable

1. Make sure that the drive system, control system, power system, and other transmission systems are separate from each other (i.e., do not run the power wire with the control wire).

2. The RS422/485 cable length is 50 m maximum. Use the minimum length necessary.

3. The Sigma II Indexer module RS422/485 interface is a non-isolated system. Errors may occur from noise in the connected terminal. If noise occurs use a shield-type cable and/or ferrite core to reduce the noise.

4. In the case of RS422, insert a terminating resistor (100Ω) as needed. Make the termination on the PC side receiving line. Short pins 6 and 7 only on the last axis.

5. In the case of RS485, attach a terminating resistor (100Ω) to the PC side transmission line. Short pins 6 and 7 only on the last axis.

6. If noise persists in the case of RS422 or RS485, it may be necessary to add pull-up/pull-down resistors as shown in Fig. 3.5 and 3.6.

3.3 Sigma II Indexer Power Loss

See the *Sigma II Series Servo System User's Manual (3.3.4 Servo Amplifier Power Losses)* for information on servo amplifier power losses at rated output.

Table 3.14: Sigma II Indexer Specifications

Item	Specification
Minimum operating voltage	5.05V min.
Maximum operating voltage	5.25V max.
Maximum operating current	500 mA max.
Maximum power loss	2.6 W max.

Note: Power to the Sigma II Indexer Application Module (JUSP-NS600) is supplied by the SGDH servo amplifier.

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4

Trial Operation

This chapter describes a two-step trial operation. Be sure to complete step 1 before proceeding to step 2.

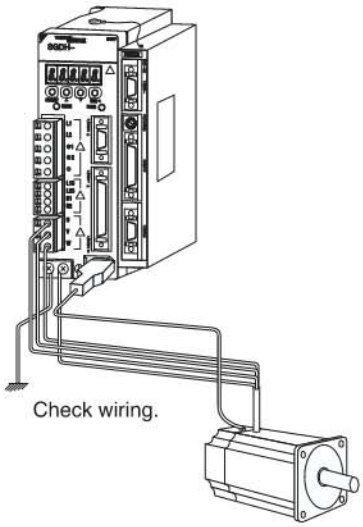
4.1 Two-Step Trial Operation

Make sure that all wiring is completed prior to starting trial operation.

Perform the trial operation in the order given below (step 1 and 2) for your safety. See *4.1.1 and 4.1.2* for more details on the trial operation.

Step 1: Trial Operation for Servomotor without Load

Make sure the servomotor is wired properly and then turn the shaft prior to connecting the servomotor to the equipment.

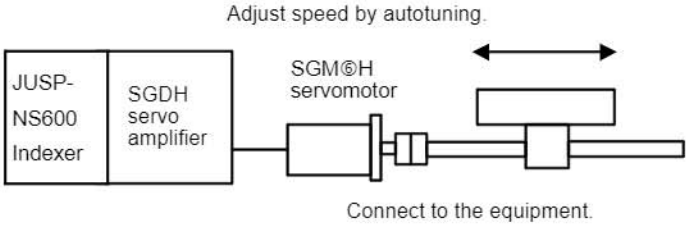


Check wiring.

Do not connect to the equipment.

Step 2: Trial Operation with the Equipment and Servomotor Connected

Adjust the servomotor according to equipment characteristics. Connect the servomotor to the equipment, and perform the trial operation.



4.1.1 Step 1: Trial Operation for Servomotor without Load

⚠ CAUTION

- **Do not operate the servomotor while it is connected to the equipment.**
  To prevent accidents, initially perform step 1 where the trial operation is conducted under no-load conditions (with all couplings and belts disconnected).

In step 1, make sure that the servomotor is wired properly as shown below. Incorrect wiring is generally the reason why servomotors fail to operate properly during trial operation.

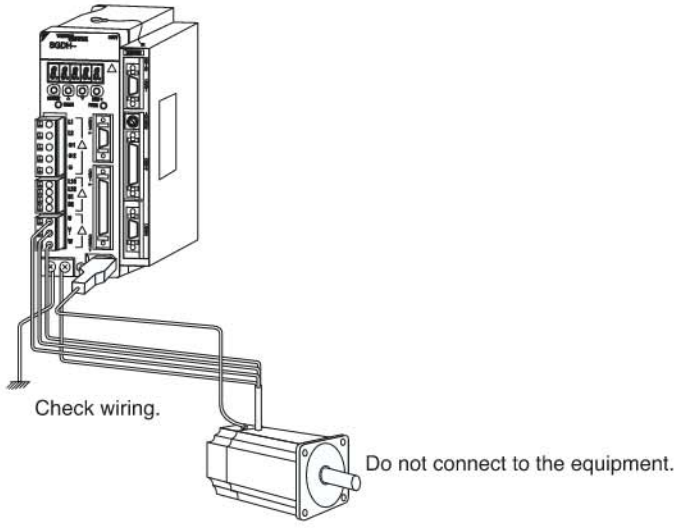
⌘ Check main power supply circuit wiring.

⌘ Check servomotor wiring.

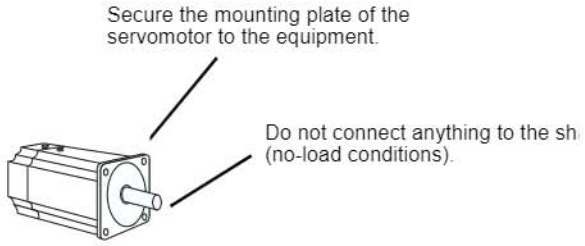
⌘ Check CN1 and CN4 I/O signal wiring (if applicable).

⌘ Check CN6 serial command wiring (if applicable).

Make sure the host device and other adjustments are completed as much as possible in step 1 (prior to connecting the servomotor to equipment).

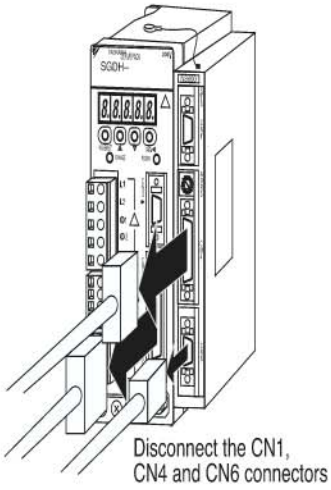


1. Secure the servomotor.



Secure the servomotor mounting plate to the equipment in order to prevent the servomotor from moving during operation.

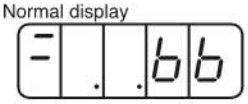
2. Check the wiring.



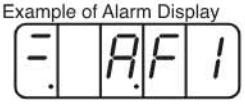
Disconnect the CN1, CN4, and CN6 connectors and check servomotor wiring in the power supply circuit. The CN1 I/O, CN4 I/O and CN6 serial command signals are not used, so leave the connectors disconnected.

3. Turn ON power.

Normal display



Example of Alarm Display



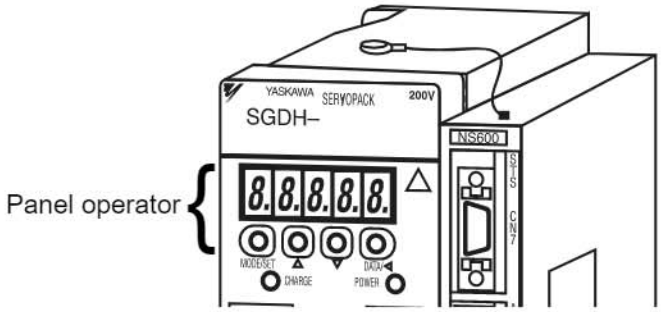
Turn ON servo amplifier power. If the servo amplifier has turned ON normally, the LED display on the front panel of the servo amplifier will appear as shown above. It may take approximately 3 minutes before any display appears on the front panel. Power is not supplied to the servomotor because the servo is OFF.

If an alarm display appears on the LED indicator as shown above, the power supply circuit, servomotor wiring, or encoder wiring is incorrect. The STS status LED will

also appear in red immediately at power-up if an alarm occurs. In this case, turn OFF power and take appropriate action. See *8 Troubleshooting.*

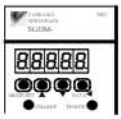
Note If an absolute encoder is used, it must be set up. Refer to *5.6.4 Absolute Encoder Setup.*

4. Operate with the Panel Operator.

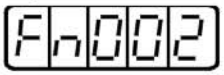


Operate the servomotor using the Panel Operator. Check to see if the servomotor runs normally. If using a servomotor with a holding brake, refer to *5.3.3 Using the Holding Brake.*

Jog Mode Operation



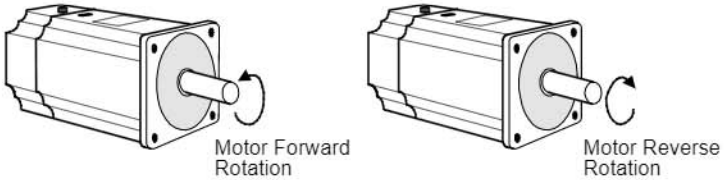
a) Press the **MODE/SET** key to select Fn002 in the auxiliary function mode.



b) Press the **DATA/SHIFT** key for a minimum of one second to select the Panel Operator operation mode. Operation is now possible using the panel operator.

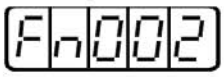
c) Press the **MODE/SET** key to set to the servo ON (with motor power turned ON).

d) Press the **Up Arrow** □ or **Down Arrow** □ key to operate the motor. The motor keeps operating while the key is pressed.



e) Press the **MODE/SET** key to set to the servo OFF state (with motor power turned OFF). Alternatively, press the **DATA/SHIFT** key for a minimum of one second to set to the servo OFF state.

f) Press the **DATA/SHIFT** key for a minimum of one second, and the display will revert to Fn002 in the auxiliary function mode.



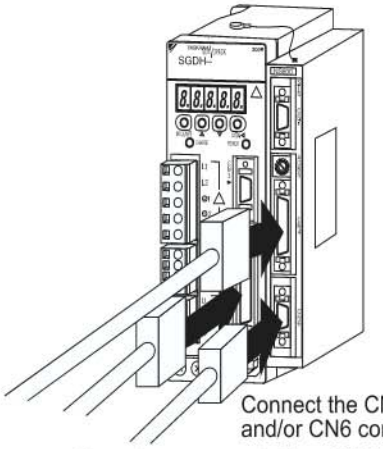
This ends operation under panel operator control.

The motor speed for operation under digital operator control can be changed with parameter:

Parameter	Signal	Setting (rpm)
Pn304	Jog Speed	Default Setting: 500

Note: The rotation direction of the servomotor depends on the setting of parameter Pn000.0 "Rotation Direction." The above example shows a case where Pn000.0 is set to "0" as a default setting.

5. Connect the signal lines.

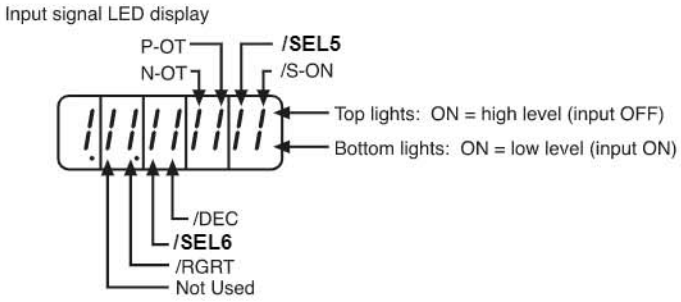


Use the following procedure to connect the CN1, CN4, and/or CN6 connectors.
a) Turn OFF power.
b) Connect the CN1, CN4 and/or CN6 connector.
c) Turn ON power again.

6. Check the CN1 input signals (if applicable).

Check input signal wiring in Monitor Mode using the panel operator. Select monitor Un005 SGDH Input Signal Monitor. See *Sigma II User's Manual 7.1.7 Operation in Monitor Mode* for more details on the procedure.

Turn ON and OFF each signal line to see if the LED monitor bit display on the panel changes as shown below.

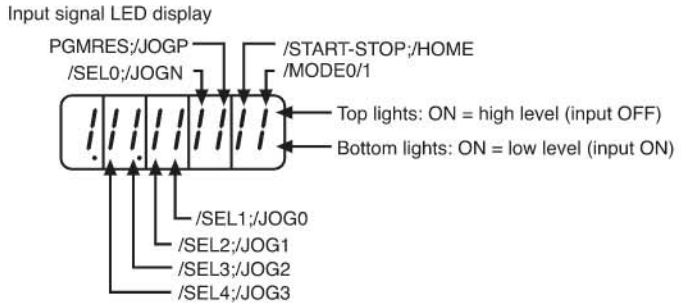


Note: The servomotor will not operate properly if the following signal lines are not wired correctly. Always wire them correctly. Short the signal lines if they will be unused. The input signal selections (parameters Pn803 to Pn80F) can be used to eliminate the need for external short circuiting.

Signal Symbol	Connector Pin No.	Description
P-OT	CN1-42	The servomotor can rotate in the forward direction when this signal line is low (0V).
N-OT	CN1-43	The servomotor can rotate in the reverse direction when this signal line is low (0V).
/S-ON	CN1-40	The servomotor is turned ON when this signal line is low (0V). Leave the servomotor OFF.
+24VIN	CN1-47	Control power supply terminal for sequence signals.

7. Check CN4 input signals (if applicable)

Check input signal wiring in Monitor mode using a handheld digital operator via CN7. Select monitor Un801 NS600 Input Signal Monitor. See *Sigma II User's Manual 7.1.7 Operation in Monitor Mode* for more details.

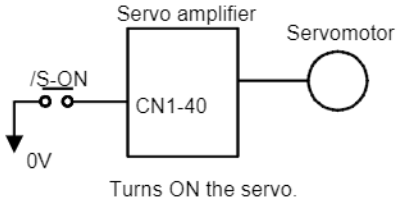


Note: CN1 and CN4 input signals can also be monitored by serial commands, IN1 and IN2, respectively, via CN6. See *6 Serial Commands* for serial communication specifications, command format, and serial command descriptions.

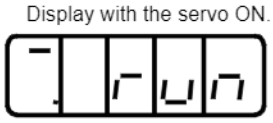
8. Check CN6 Serial Command Port (if applicable)

   Establish serial communication using either the Indexer software or terminal emulator. Refer to *6 Serial Commands* for serial communication specifications, command format, and serial command descriptions for more details when using a terminal emulator or similar device.

9. Turn ON the servo.



   Turn ON the servo ON signal.



   Set /S-ON (CN1-40) to 0V. If normal, the servomotor will turn ON and the LED indicator on the front panel will display as shown above. If an alarm display appears, take appropriate action as described in *8 Troubleshooting*.

Note: Serial command, SVON can also be used to turn on the servo.

4.1.2 Step 2: Trial Operation with the Servomotor Connected to the Machine

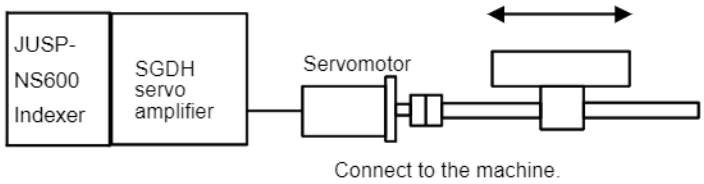
⚠ WARNING

Follow the procedure below for step 2 operation precisely as given.
Malfunctions that occur after the servomotor is connected to the equipment not only damage the equipment, but may also cause an accident resulting in death or injury.

Before proceeding to step 2, repeat step 1 (servomotor trial operation without a load) until all concerns including parameters and wiring have fully satisfied expectations.

After step 1 has been completed, proceed to step 2 for trial operation with the servomotor connected to the equipment. The servo amplifier is now adjusted in the following ways to meet the specific equipment's characteristics.

- Using autotuning to match the servo amplifier to the equipment's characteristics.
- Matching the direction of rotation and speed to the equipment's specifications.
- Checking the final control form.



Follow the procedures below to perform the trial operation.

1. Make sure power is OFF.
2. Connect the servomotor to the equipment.
   See *Sigma II User's Manual 2.1 Servomotors* for more details on connecting the servomotor.
3. Use autotuning to match the servo amplifier to equipment characteristics.
   See *Sigma II User's Manual 6.3 Autotuning.*
4. Operate the servomotor by digital I/O or serial mode operation. See *5 Parameter Settings and Functions* and *6 Serial Commands* for more information.
5. Set and record user settings.
   Set parameters as required and record all settings for use later in maintenance.

Note: The servomotor will not be broken in completely during the trial operation. Therefore, let the system run for a sufficient amount of time after the trial operation has been completed to ensure that it is properly broken in.

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5

Parameter Settings and Functions

Before Reading this Chapter

This chapter describes the use of each CN1 and CN4 I/O signal for the SGDH Servo amplifier with the Sigma II Indexer. 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 and CN4 I/O signal list: Refer to *3.1.3 I/O Signal Names and Functions*.
- CN1 and CN4 I/O signal terminal layout: Refer to *3.1.2 I/O Signals Connector (CNI, CN4) Terminal Layout*
- Parameter list: Refer to *Appendix A List of Parameters*

The CN1 and CN4 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 A List of Parameters.

Table 5.1: Parameter Configurations

Type	Parameter No.	Description
Function Selection Parameters	Pn000 to Pn005 Pn819	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	Set position parameters such as the position reference movement averaging time.
Speed Parameters	Pn308	Set speed parameters such as the speed feed forward filter time constant.
Torque Parameters	Pn401 to Pn409	Set torque parameters such as the forward/reverse torque limits.
Sequence Parameters	Pn500 to Pn509 Pn803 to Pn818 Pn833 to Pn834	Set output conditions for sequence signals and flexible I/O signal configuration.
Motion Parameters	Pn81A to Pn828	Set motion parameters, such as the zero point return direction.
Others	Pn600 to Pn601	Specify the capacity for an external regenerative resistor.
Serial Communication Parameters	Pn800 to Pn802	Set parameters for serial command communication settings.
Auxiliary Function Execution	Fn000 to Fn014 Fn800 to Fn808	Execute auxiliary functions such as JOG Mode operation
Monitor Modes	Un000 to Un00D Un800 to Un811	Enable speed, torque, I/O and position monitoring.

5.1 Parameter Limits with Sigma II Indexer

This section explains the limits for parameters and standard settings with the Sigma II Indexer mounted.

Parameter Limits

When the Sigma II Indexer application module is mounted on a SGDH servo amplifier, the following parameters are automatically set. The following parameters will be treated as "reserved for system use," so do not change them. The SGDH servo amplifier will be set for position control. It is not necessary to set parameters for speed and torque control, so do not change the settings.

Table 5.2: List of Parameters for System Use with the JUSP-NS600

Parameter	Digit	Parameter Name	Set Value	Contents/Description
Pn000	1	Control Method	1	Position Control
	2	Axis Address	(ADRS)	Copies ADRS setting on rotary switch of JUSP-NS600
Pn002	0	T-REF Allocation (Torque Limit / Torque Feed-For-ward)	0	Not used
	3	Full Closed Loop Usage	0	Not available
Pn004	1	Reserved	0	Not used
Pn005	0	BK Control	0	Not used. SGDH controls /BK.
Pn200	2	Clear Operation	0	Clears position error when servo is off
Pn207	0	Position Reference Filter Selection	1	Average Movement Filter
	1	Position Control Option (V-REF as Speed Forward	0	Not used
Pn50A	0	Input Signal Mapping	1	Input Signal Mapping
	1	/S-ON Mapping	8	NS600 monitors SIO as /S-ON
	2	/P-CON Mapping	8	NS600 monitors SI1 as /SEL5
	3	/P-OT Mapping	8	NS600 monitors SI2 as P-OT
Pn50B	0	/N-OT Mapping	8	NS600 monitors SI3 as N-OT
	1	/ALM-RST Mapping	8	NS600 monitors SI4 as /DEC
	2	/P-CL Mapping	8	NS600 monitors SI5 as /SEL6
	3	/N-CL Mapping	8	NS600 monitors SI6 as /RGRT
Pn50C	0	/SPD-D Mapping	8	Not used
	1	/SPD-A Mapping	8	Not used
	2	/SPD-B Mapping	8	Not used
	3	/C-SEL Mapping	8	Not used
Pn50D	0	/Z-CLAMP Mapping	8	Not used
	1	/INHIBIT Mapping	8	Not used
	2	/G-SEL Mapping	8	Not used
	3	Reserved Mapping	8	Not used
Pn50E	0	/COIN	0	Not used
	1	/V-CMP	0	Not used
	2	/TGON	0	Not used
	3	/S-RDY	3	Fixed at S03

Table 5.2: List of Parameters for System Use with the JUSP-NS600

Parameter	Digit	Parameter Name	Set Value	Contents/Description
Pn50F	0	/CLT	0	Not used
	1	/VLT	0	Not used
	2	/BK	2	Fixed at S02
	3	/WARN	1	Fixed at S01
Pn510	0	/NEAR	0	Not used
	1	Reserved	0	Not used
	2	Not used	0	Not used
	3	Not used	0	Not used
Pn512	0	S01 Reverse	-	Equivalent to setting in Pn816
	1	S02 Reverse	-	Equivalent to setting in Pn817
	2	S03 Reverse	-	Equivalent to setting in Pn818
	3	Not Used	0	Not used

These parameters are set automatically the first time the power to the servo amplifier is turned ON after the Sigma II Indexer has been mounted. Startup will take approximately 2 seconds when these parameters are being set.

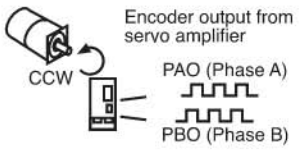
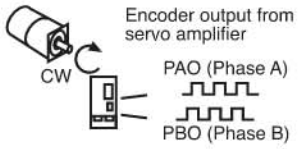
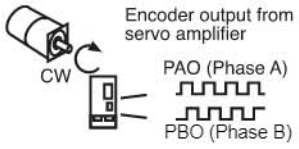
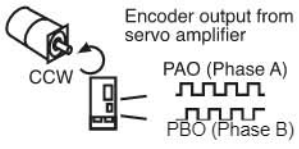
5.2 Settings According to Device Characteristics

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

5.2.1 Switching Servomotor Rotation Direction

The servo amplifier 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 parameters. Only the direction (+, □) of shaft motion is reversed.

	Standard Setting	Reverse Rotation Mode
Forward Reference		
Reverse Reference		

Setting Reverse Rotation Mode

Use the parameter Pn000.0.

Parameter	Signal	Setting
Pn000.0	Direction Selection	Default Setting: 0

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)

5.2.2 Setting the Overtravel Limit Function

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

Using the Hardware Overtravel Function

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

Input o P-OT CN1-42	Forward Run Prohibited (Forward Overtravel)
Input o N-OT CN1-43	Reverse Run Prohibited (Reverse Overtravel)

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

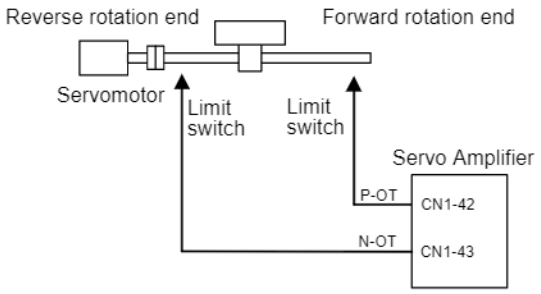


Figure 5.1 Hardware Overtravels

Drive status with an overtravel input signal (P-OT, N-OT) ON or OFF is shown in the following table. These are the default settings.

Signal	State	Description
P-OT	ON= Input signal closed	Forward rotation allowed, (normal operation status).
	OFF=Input signal open	Forward run prohibited (reverse rotation allowed).
N-OT	ON= Input signal closed	Reverse rotation allowed, (normal operation status).
	OFF=Input signal open	Reverse run prohibited (forward rotation allowed).

Set the following parameters to specify whether or not the input signals are used for overtravels. The factory setting is that the input signals are used for overtravels.

Parameter	Signal	Pin No.	Setting	Default
Pn80C	P-OT	CN1-42	0 = Input Signal Open = OT Status, Forward Run Prohibited 1 = Input Signal Closed = OT Status, Forward Run Prohibited 2 = Always OT Status, Forward Run Prohibited 3 = Forward Run Always Allowed	0
Pn80D	N-OT	CN1-43	0 = Input Signal Open = OT Status, Reverse Run Prohibited 1 = Input Signal Closed = OT Status, Reverse Run Prohibited 2 = Always OT Status, Reverse Run Prohibited 3 = Reverse Run Always Allowed	0

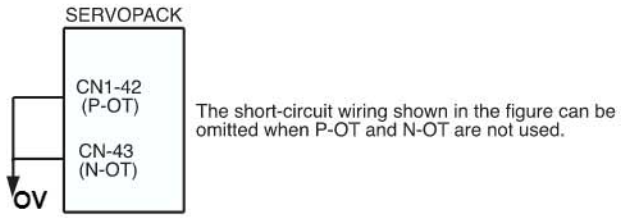


Figure 5.2 Hardware Overtravel Short-Circuiting

Using the Software Position Limits

Set the following parameters to specify the software position limits.

Parameter	Name	Unit	Setting	Default
Pn81A	Moving Method	-	0 = Linear 1 = Rotary (Shortest Path) 2 = Rotary (Forward Rotation) 3 = Rotary (Reverse Rotation)	0
Pn81B	Position Reference Forward Limit	Reference Unit	- 99999999 ~ + 99999999	+99999999
Pn81C	Position Reference Reverse Limit	Reference Unit	-99999999 ~ + 99999999	-99999999

Moving Method Settings

1. Pn81A=0=Linear:
   An error will occur if commanded position is beyond forward or reverse position reference limits. Motor will not move. If motor reaches the software limits while jogging, motor will decelerate to a stop at the deceleration rate set in Pn820. Disable the software limits by setting both the forward and reverse position reference limits to 0.

   The software limits are ignored until homing is complete when a homing routine is specified for an incremental encoder. Refer to 5.11.3 Homing Routine Parameters for more information regarding homing.

2. Pn81A=1=Rotary (Shortest Path): Used for rotary motion.
   Absolute move commands rotate in the direction of the shortest path of travel.

The forward and reverse position reference limits are used to set the roll-over position. When rotating in the forward direction, the position reference rolls over to the reverse position limit after reaching the forward position limit. When rotating in the reverse direction, the position reference rolls over to the forward position limit after reaching the reverse position limit.

Pn81D is the home position. Alarm, E16A, will occur if Pn81D is outside the position reference limits (Pn81D>|Pn81B, Pn81C|) when pn81A=1, 2, or 3.

3. Pn81A=2=Rotary (Forward): Used for rotary motion.
   Absolute move commands rotate in the forward direction only.

   The forward and reverse position reference limits are used to set the roll-over position (same as Pn81A=1).

4. Pn81A=3=Rotary (Reverse): Used for rotary motion.
   Absolute move commands rotate in the reverse direction only.

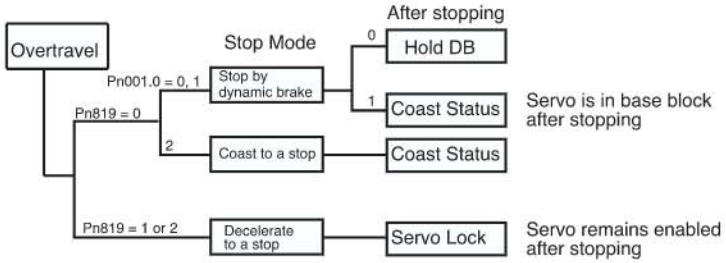
   The forward and reverse position reference limits are used to set the roll-over position (same as Pn81A=1).

Servomotor Stop Mode for Hardware Overtravels (P-OT and N-OT)

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 are input during servomotor operation.

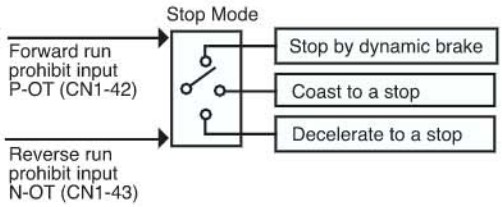
- Forward run prohibited input (P-OT,CN1-42)
- Reverse run prohibited input (N-OT,CN1-43)



Parameter	Signal	Setting
Pn819	Overtravel Stop Mode	Default Setting: 0

Parameter	Signal	Setting	Description
Pn819	Overtravel Stop Mode	0	Stops the servomotor the same way as turning the servo OFF (according to Pn001.0). Servo is in baseblock after stopping.
		1	Decelerates the servomotor immediately to a stop and puts the servomotor in servo lock.
		2	Decelerates the servomotor to a stop at the preset deceleration and puts the servomotor in servo lock. Deceleration setting: Pn820 deceleration parameter

Parameter	Signal	Setting (x1000 ref. units/min/msec)	Default
Pn820	Deceleration	Range: 1 to 99999999	1000



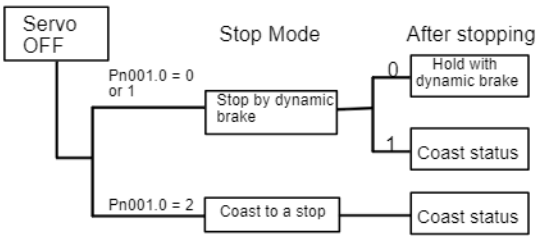
Servo OFF Stop Mode Selection

The SGDH servo amplifier turns OFF under the following conditions:

- Servo ON input signal (/S-ON, CN1-40) is turned OFF.
- Servo alarm occurs.
- Power is turned OFF.

Specify the Stop Mode if any of these occur during operation.

Parameter	Signal	Setting
Pn001.0	Servo OFF or Alarm Stop Mode	Default Setting: 0



The dynamic brake stops the servomotor electrically by shorting the motor windings and diverting the energy to a resistor.

Parameter	Signal	Setting	Description	Default
Pn001.0	Servo OFF or Alarm Stop Mode	0	Uses the dynamic brake to stop the servomotor, and maintains dynamic brake status after stopping.	0
		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 equipment friction.	

Note: If the Servomotor is stopped or rotating at extremely low speed when the items above are set at 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.

5.2.3 Limiting Torques

The SGDH servo amplifier limits the maximum output torque to protect the equipment or workplace.

Internal Torque Limits

Maximum torque is limited to the values set in the following parameters for forward and reverse rotation.

Parameter	Signal	Setting (%)	Default
Pn402	Forward Torque Limit	Range: 0 to 800	800
Pn403	Reverse Torque Limit	Range: 0 to 800	800

The torque limits are specified as a percentage of the rated torque.

Note: 1) If torque limit is set higher than the maximum torque of the servomotor, the maximum torque of the servomotor is the limit.
2) External Torque Limits (/P-CL, /N-CL) are not available on the SGDH with the Sigma II Indexer.

5.3 Sequence I/O Signals

Sequence I/O signals are used to control servo amplifier and indexer operation. Connect these signal terminals as required.

Input Signal Connections (CN1)

Connect the sequence input signals as shown below.

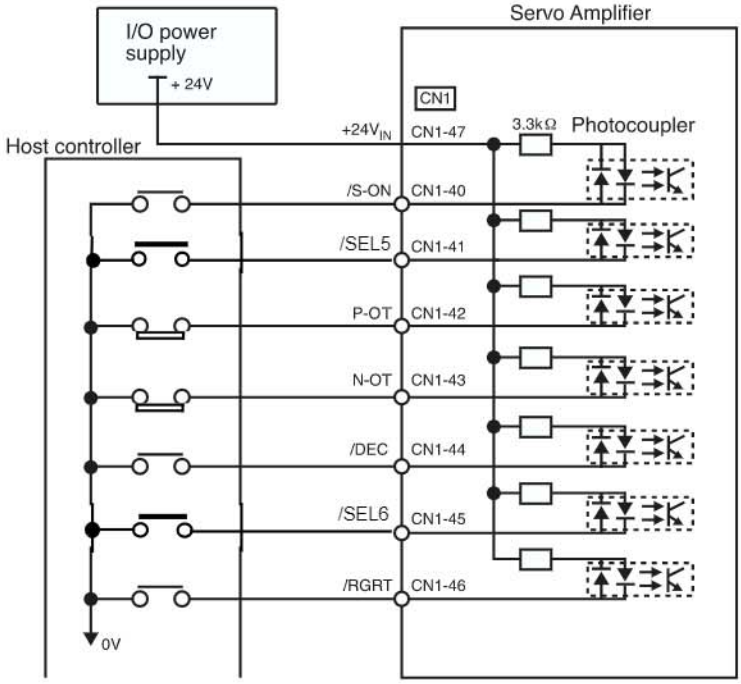


Figure 5.3 Input Signal Connections (CN1)

Input Signal Connections (CN4)

Connect the sequence input signals as shown below.

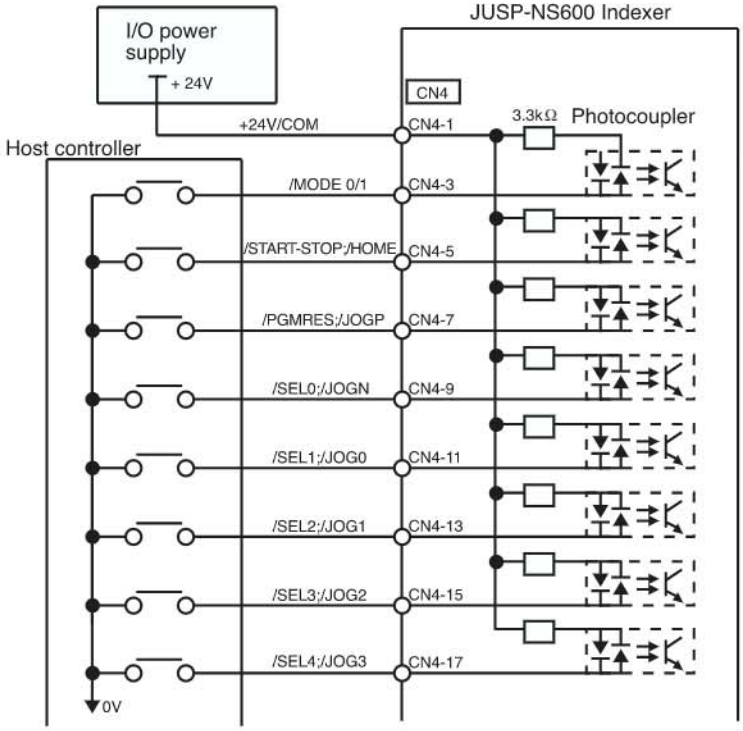


Figure 5.4 Input Signal Connections (CN4)

Note: Provide a separate external I/O power supply; neither the servo amplifier or Sigma II Indexer have an internal 24V power supply.

Table 5.3: Input Signal Specifications (CN1, CN4)

Item	Specification
Inputs	CN1: /S-ON, /SEL5, P-OT, N-OT, /DEC, /SEL6, /RGRT CN4: /MODE0/1, /START-STOP;/HOME, /PGMRES;/JOGP, /SEL0;/JOGN, /SEL1;/JOG0, /SEL2;/JOG1, /SEL3;/JOG2, /SEL4;/JOG3
Input Format	Sinking or Sourcing
Isolation	Optical
Voltage	11 to 25 VDC
Input Imped-ance	3.3 k :
Current Rating (ON)	8 mA maximum
OFF Current	0.1 mA maximum (OFF Voltage = 1.0 V)

Output Signal Connections (CN1)

Connect the sequence output signals as shown in the following figure.

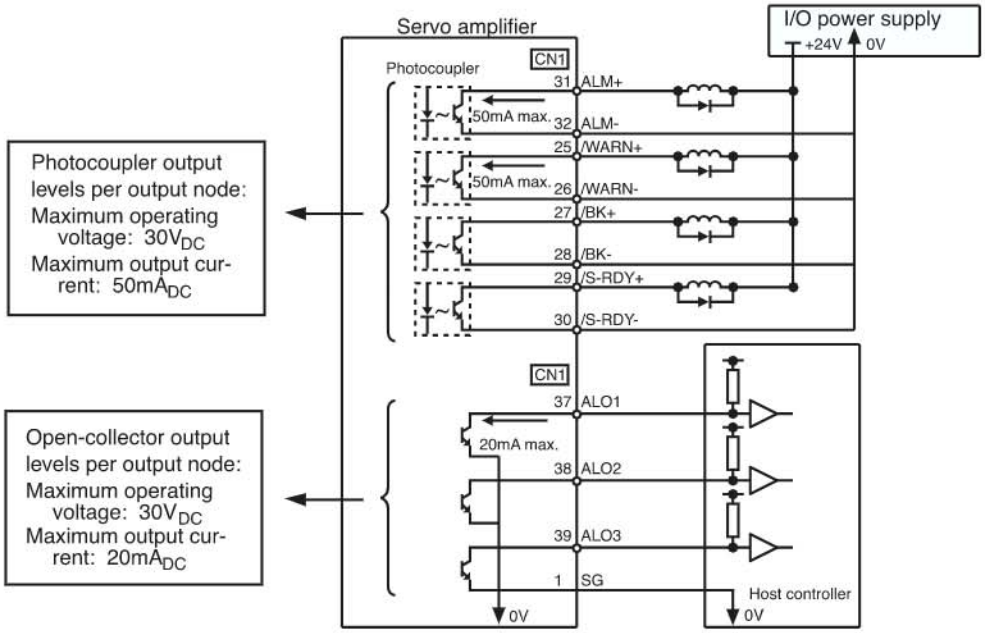


Figure 5.5 Output Signal Connections (CN1)

Output Signal Connections (CN4)

Connect the sequence output signals as shown in the following figure.

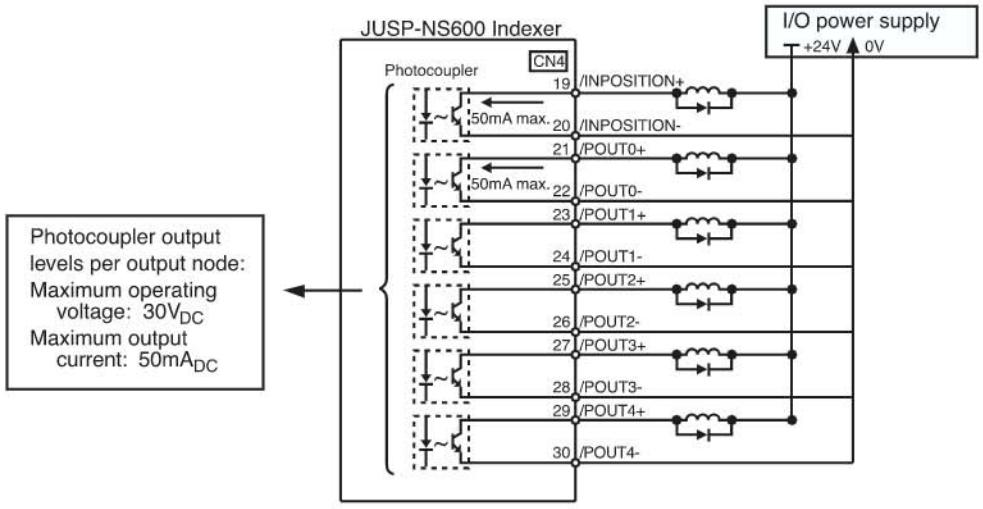
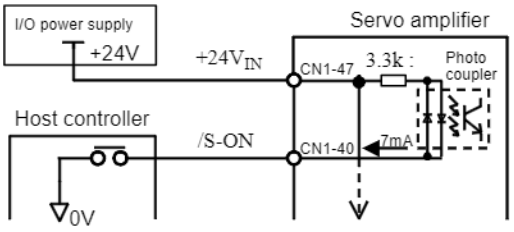


Figure 5.6 Output Signal Connections (CN4)

Note: Provide a separate external I/O power supply; neither the servo amplifier or the Sigma II Indexer have an internal 24V power supply.

5.3.1 Using the Servo ON Input Signal

The basic use and wiring procedure for the Servo ON (/S-ON) input signal (sequence input signal) is described below. Use this signal to forcibly turn OFF the servomotor from the host controller.



O Input /S-ON CN1-40	Servo ON

This signal is used to turn the servomotor ON and OFF.

CN1-40 State	Status	Result
ON	Input Closed	Turns ON the servomotor: operates according to signal input. This is the default state.
OFF	Input Open	Servomotor cannot operate. Do not turn OFF the servomotor while it is operating except in an emergency.

⚠ CAUTION

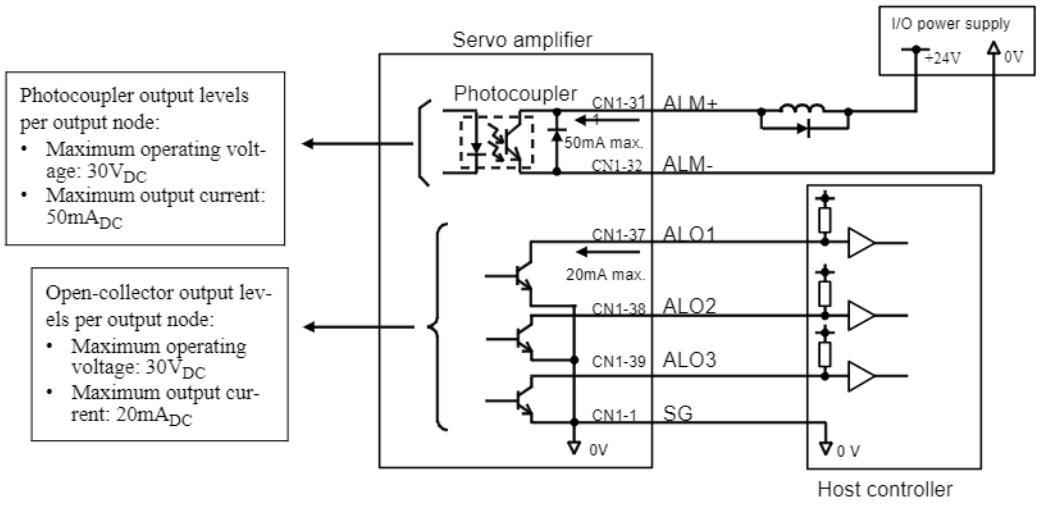
Do not use the Servo ON (/S-ON) signal to start or stop the motor. Doing so will shorten the life of the servo amplifier. Always use a stop input or command to start or stop the servomotor.

The following parameter is used to set the state of the /S-ON signal.

Parameter	Signal	Pin No.	Setting	Default
Pn80B	/S-ON	CN1-40	0 = Input Signal Closed = Servo ON 1 = Input Signal Open = Servo ON 2 = Always Servo ON 3 = Always Servo OFF	0

5.3.2 Using Servo Alarm and Alarm Code Outputs

The basic procedure for connecting alarm output signals is described below.

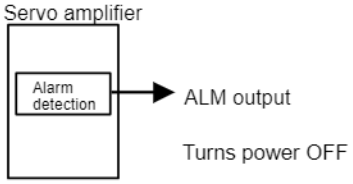


A suitable external I/O power supply must be provided by the user separately because there is no internal 24V power supply in the servo amplifier.

The use of the photocoupler output signals is described below.

Output o ALM+ CN1-31	Servo Alarm Output
Output o ALM- CN1-32	Signal Ground for Servo Alarm Output

These alarms are output when a servo amplifier alarm is detected.



Form an external circuit so this alarm output (ALM) turns the servo amplifier OFF.

State	Status	Result
ON	Circuit between CN1-31 and 32 is closed, and CN1-31 is at low level.	Normal state.
OFF	Circuit between CN1-31 and 32 is open, and CN1-31 is at high level.	Alarm state.

Alarm codes ALO1, ALO2 and ALO3 are output to indicate each alarm type.

The uses of open-collector output signals ALO1, ALO2 and ALO3 is described below.

Output o ALO1 CN1-37	Alarm Code Output
Output o ALO2 CN1-38	Alarm Code Output
Output o ALO3 CN1-39	Alarm Code Output
Output o SG CN1-1	Signal Ground for Alarm Code Output

These signals output alarm codes to indicate the type of alarm detected by the servo amplifier. Use these signals to display alarm codes at the host controller. See *8.2.1& 8.3.1 Alarm Status Display Table* for more on the relationship between alarm display and alarm code output.

Form an external circuit so the servo amplifier turns OFF when an alarm occurs. Alarms are reset automatically when the control power supply is turned OFF.

Alarms can also be reset using a digital operator via CN7, by serial command ARES via CN6, or by the built-in panel display (SGDH alarms only).

Note: 1. Encoder alarms cannot always be reset by digital operator or by serial command. See *8.2.1 & 8.3.1 Alarm Status Display Table* for list of resettable alarms. In that case, turn the control power supply OFF to reset the alarm.

2. When an alarm occurs, always eliminate the cause before resetting the alarm.

5.3.3 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 the force of gravity when system power goes OFF.

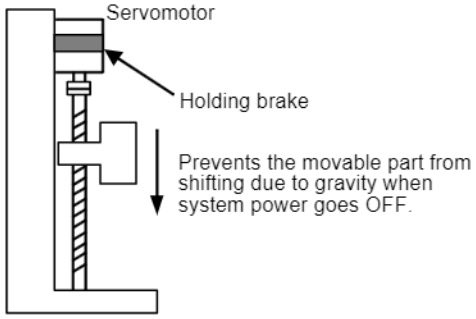


Figure 5.7 Holding Brake

Note: The brake built into the servomotor SGM⑤H 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 servo amplifier output signal /BK and the brake power supply to form a brake ON/OFF circuit. The following diagram shows a standard wiring example.

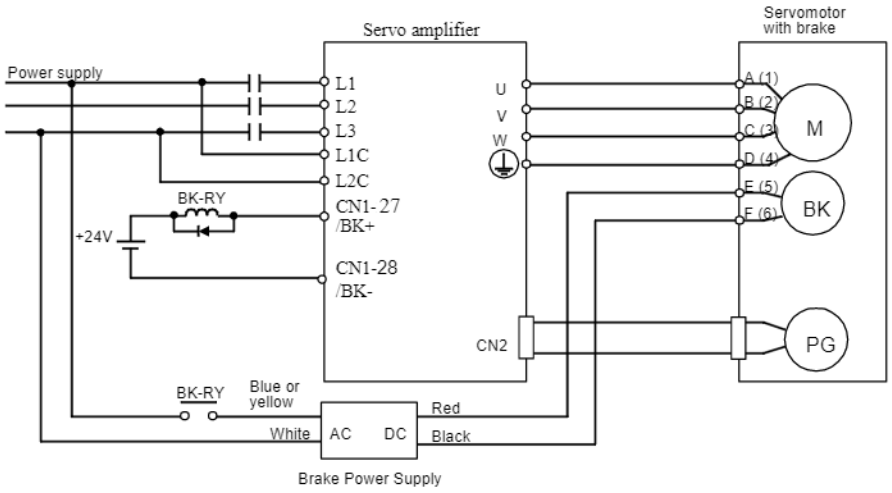


Figure 5.8 Wiring Example

Output o /BK	Brake Interlock Output

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.

State	Status	Result (default state)
ON:	Output Closed or low level	Releases the brake.
OFF:	Output Open or high level	Applies the brake.

The following parameter is used to set the state of /BK output.

Parameter	Signal	Pin No.	Setting	Default
Pn817	/BK	CN1-27, 28	0 = Output Closed = Releases the brake. 1 = Output Open = Releases the brake.	0

Related Parameters

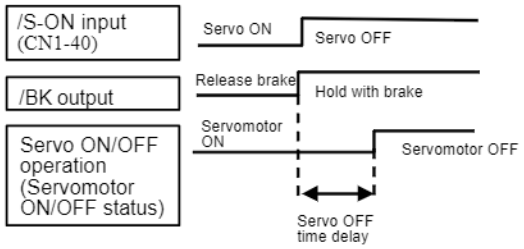
Parameter	Description
Pn506	Time Delay from Brake Reference until Servo OFF
Pn507	Speed Level for Brake Reference Output during Motor Operation
Pn508	Timing for Brake Reference Output during Motor Operation

Brake ON Timing

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

Parameter	Signal	Setting (10ms)	Default
Pn506	Brake Reference Servo OFF Delay Time	Setting Range: 0 to 50	0

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



With the standard setting, the servo is turned OFF when the /BK signal (brake operation) is active. The equipment may move slightly due to gravity depending on equipment 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 508 for brake ON timing during operation.

Note: The servomotor will turn OFF immediately if an alarm occurs. The equipment 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.

Parameter	Signal	Setting	Default
Pn507	Brake Reference Output Speed Level	Setting Range: 0 to 10000rpm	100
Pn508	Timing for Brake Reference Output during Motor Operation	Setting Range: 0 to 100 x 10ms	50

Set the brake timing used when the servo is turned OFF by input signal /S-ON (CN1-40) or when an alarm occurs during motor operation.

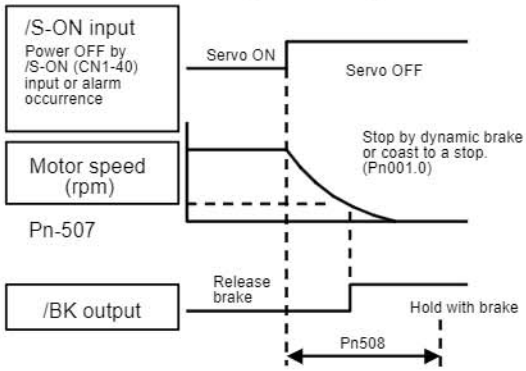


Figure 5.9 Holding Brake Setting

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 equipment operation.

/BK Signal Output Conditions During Servomotor Operation
The circuit is open under either of the following conditions:

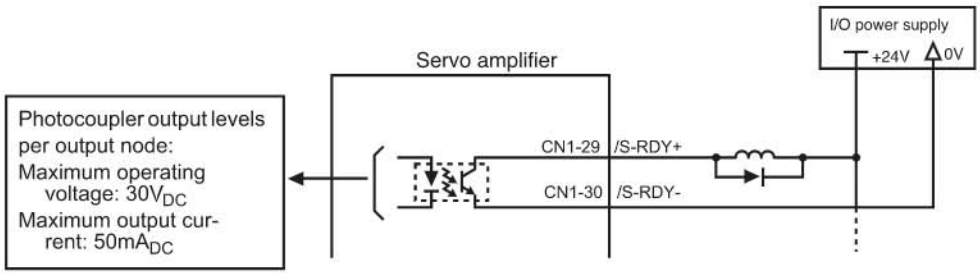
- Motor speed drops below the setting at Pn507 after servo OFF.
- The time set at Pn508 has elapsed since servo OFF.

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

5.3.4 Using the Servo Ready Output Signal

The basic use and wiring procedures for the Servo Ready (/S-RDY) output signal (photocoupler output signal) are described below.

Servo Ready means there are no servo alarms and the main and control circuit power supply is turned ON.



Output o /S-RDY CN1-29, 30	Servo Ready Output Signal

This signal indicates that the servo amplifier has completed all preparations and is ready to receive the Servo ON signal.

/S-RDY State	Status	Result (default state)
ON	Output Closed or low level.	Servomotor is ready.
OFF	Output Open or high level.	Servomotor is not ready.

The following parameter is used to set the state of the /S-RDY output.

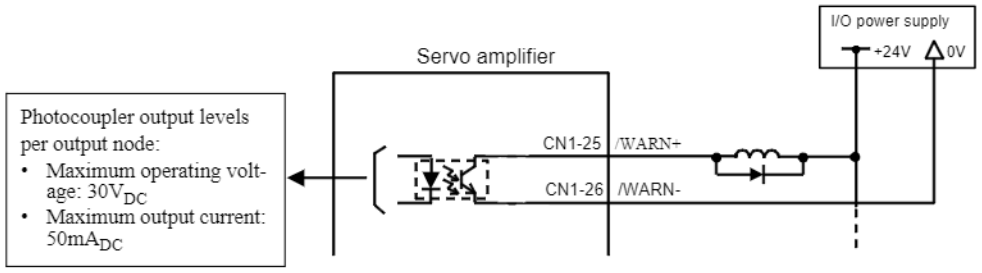
Parameter	Signal	Pin No.	Setting	Default
Pn818	/S-RDY	CN1-29, 30	0 = Output Closed = Servo ready. 1 = Output Open = Servo ready.	0

5.3.5 Using the Warning Output Signal

The basic use and wiring procedure for the warning (/WARN) output signal (photocoupler output signal) are given below.

The signal consists of the following output signals.

/WARN signals: overload, regenerative overload, low battery, and indexer error



Output o /WARN CN1-25, 26	Warning Output Signal

This output signal indicates an overload, regenerative overload warning, low battery, or indexer error.

/WARN State	Status	Result (default state)
ON	Output Closed or low level.	Error warning. (overload, regenerative overload, low battery, and indexer error).
OFF	Output Open or high level.	Normal operation. No warning.

The following parameter is used to set the state of /WARN output.

Parameter	Signal	Pin No.	Setting	Default
Pn816	/WARN	CN1-25, 26	0 = Output Closed = Error Warning. 1 = Output Open = Error Warning.	0

The following parameter is used to output warning details (overload, regenerative overload, and low battery only) with an alarm code.

Parameter	Signal	Setting
Pn001.3	Warning Code Output Selection	Default Setting: 0

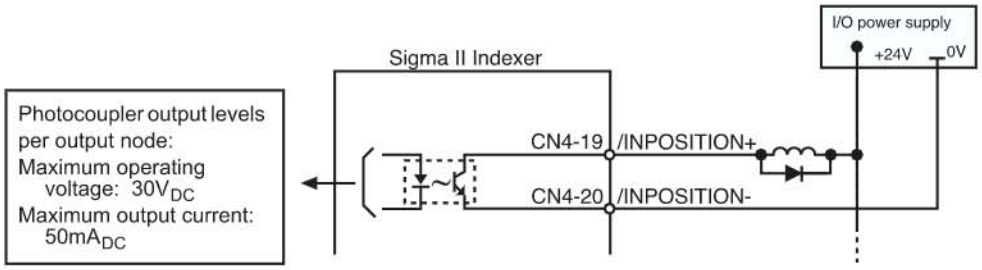
Pn001.3 Setting	Result
0	Outputs alarm codes alone for alarm codes ALO1, ALO2 and ALO3.
1	Outputs both alarm and warning codes for alarm codes ALO1, ALO2 and ALO3 and outputs an alarm code when an alarm occurs.

The following warning codes are output in 3 bits.

Warning Indication	Warning Code Output			Warning Description
	ALO1	ALO2	ALO3	
A.91	ON signal (low level)	OFF signal (high level)	OFF signal (high level)	Overload
A.92	OFF signal (high level)	ON signal (low level)	OFF signal (high level)	Regenerative overload
A.93	ON signal (low level)	ON signal (low level)	OFF signal (high level)	Low Battery

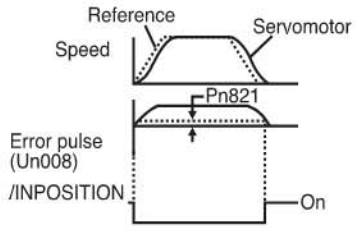
5.3.6 Using the /INPOSITION Output Signal

The basic use and wiring procedure for the positioning completed (/INPOSITION) output signal (photocoupler output signal) is described below. The signal is output to indicate that servomotor operation is completed.



Output o /INPOSITION CN4-19,20	Positioning Completed Output Signal

This signal indicates that servomotor movement has been completed. The /INPOSITION output signal turns ON when the position error is within the inposition window width, Pn821, and when the position distribution ends (DEN). The Indexer continuously outputs position commands while positioning, similar to a pulse train. This is known as a "distribution". Therefore, the /INPOSITION output signal does not turn on while the distribution continues.



INPOSITION State	Status	Result (default state)
ON	Circuit between CN4–19 and 20 is closed.	Positioning is completed. (Position error is below the setting.)
OFF	Circuit between CN4–19 and 20 is open.	Positioning is not completed. (Position error is above the setting.)

The following parameter is used to set the number of error pulses.

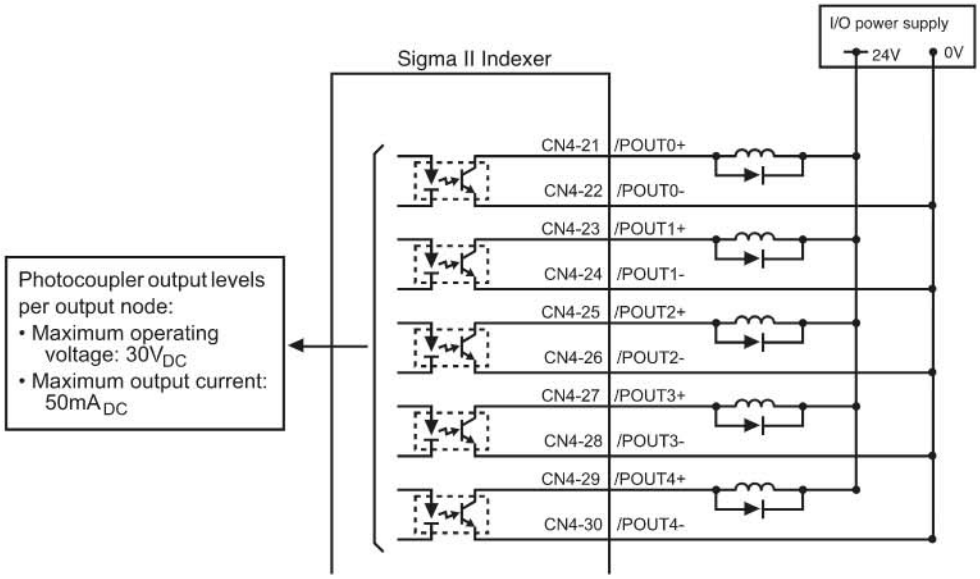
Parameter	Signal	Setting (reference units)	Default
Pn821	/INPOSITION Width	Setting Range: 1 to 99999	1

Set the number of error pulses in reference units.

The /INPOSITION width setting has no effect on final positioning accuracy.

5.3.7 Using the Programmable Output Signals (/POUT0 ~ /POUT4)

The basic use and wiring procedures for the programmable output signals (/POUT0 ~ /POUT4) are described below. The outputs can be used in either program table mode or serial mode operation. Refer to *5.7.4 Program Table Set-Up* and *6.5 Serial Command Functions* for more information.



Output o /POUT0+ CN4-21	Programmable Output 0
Output o /POUT0- CN4-22	
Output o /POUT1+ CN4-23	Programmable Output 1
Output o /POUT1- CN4-24	
Output o /POUT2+ CN4-25	Programmable Output 2
Output o /POUT2- CN4-26	
Output o /POUT3+ CN4-27	Programmable Output 3
Output o /POUT3- CN4-28	
Output o /POUT4+ CN4-29	Programmable Output 4
Output o /POUT4- CN4-30	

/POUT0 ~ /POUT4 State	State	Result (default state)
ON	Output Closed or Low Level	Output Active
OFF	Output Closed or High Level	Output Non-Active

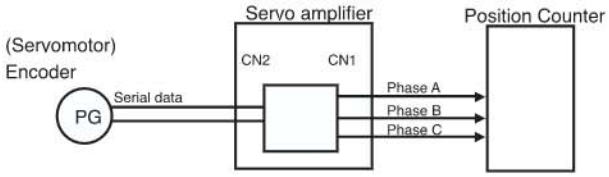
The following parameters are used to set the state of the /POUT0 ~ /POUT4 outputs.

Parameter	Signal	Pin No.	Setting	Default
Pn811	/POUT0	CN4-21, 22	0 = Output Closed = Active. 1 = Output Open = Active.	0
Pn812	/POUT1	CN4-23, 24		
Pn813	/POUT2	CN4-25, 26		
Pn814	/POUT3	CN4-27, 28		
Pn815	/POUT4	CN4-29, 30		

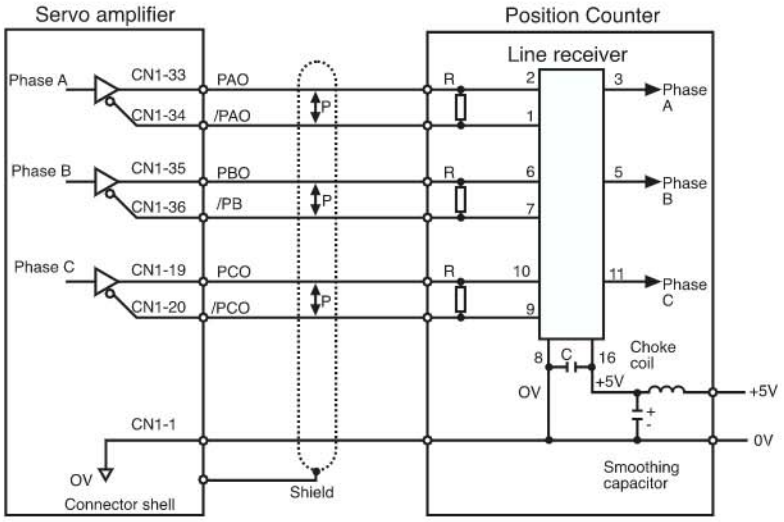
5.4 Using the Encoder Signal Output

Encoder output signals divided inside the servo amplifier can be output externally.

These signals can be used to monitor the encoder feedback for speed and position data.



The output circuit is for line-driver output. Connect each signal line according to the following circuit diagram.



P: Indicates twisted pair wires.

I/O Signals

I/O signals are described below.

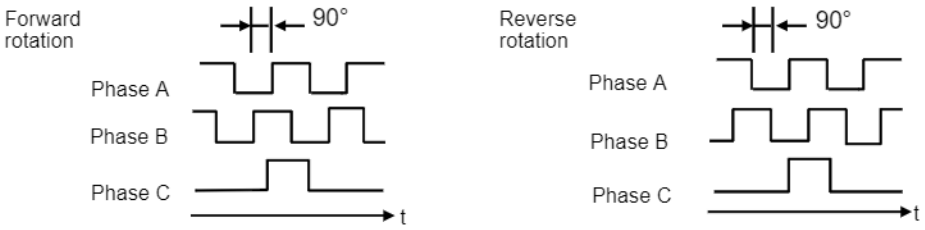
Output o PAO CN1-33	Encoder Output Phase A
Output o /PAO CN1-34	Encoder Output Phase /A
Output o PBO CN1-35	Encoder Output Phase B
Output o /PBO CN1-36	Encoder Output Phase /B
Output o PCO CN1-19	Encoder Output Phase C
Output o /PCO CN1-20	Encoder Output Phase /C

Divided encoder signals are output.

The dividing ratio setting is not related to the gear ratio setting (Pn202 and 203) for setting reference units.

Note: Dividing means converting an input pulse train from the encoder mounted on the servomotor according to the preset pulse density and outputting the converted pulse. The units are pulses per revolution (ppr).

Output Phase Form



Output□ o SG CN1-1	Signal ground

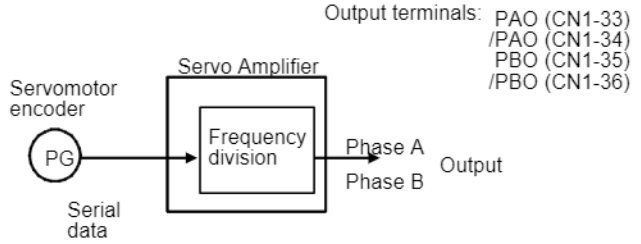
SG: Connect to 0V on the position counter.

Pulse Divider Setting

Set the pulse dividing ratio in the following parameter.

Parameter	Signal	Setting (p/rev)
Pn201	PG Divider	Range: 16 to 16384 Default Setting: 16384

Set the number of pulses for PG output signals (PAO, /PAO, PBO, /PBO).

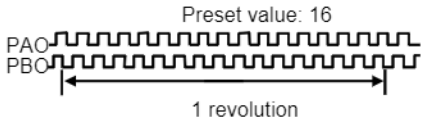


Pulses from the servomotor encoder (PG) are divided by the preset number before being output.

The number of output pulses per revolution is set at this parameter.

The setting range varies with the encoder used.

Setting Example

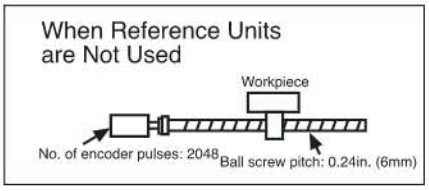


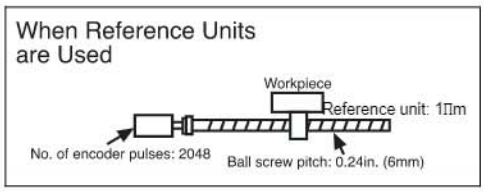
Servomotor Model and Encoder Specifications	Resolution (Bits)	Number of Encoder Pulses Per Revolution (p/rev)	Setting Range
A	13	2048	16 to 2048
B, 1	16	16384	16 to 16384
C, 2	17		

Note: 1. Turn OFF power once and turn ON again after changing the parameter.
2. A 13-bit encoder will run at 2048p/rev even if the setting at Pn201 is set higher than 2049.

5.5 Setting up the Reference Units

The Sigma II Indexer stores all positioning data in units of [Reference Units]. Reference units allow the user to program in terms of load (or workpiece) travel distance instead of servomotor travel distance.





To move a workpiece 0.39in. (10mm):

1 revolution = 6mm. Therefore,
10 ÷ 6 = 1.6667 revolutions.
(2048 υ 4) pulses = 1 revolution. So,
(1.6667 υ 2048 υ 4) = 13653 pulses
13563 pulses are input as the reference.

To move a workpiece 0.39in. (10mm):

units must be defined in the servo Equipment conditions and reference amplifier beforehand.
Reference unit is 1µm. Therefore,

$$\frac{10\text{mm}}{1\mu\text{m}} \quad \text{10000 reference units}$$

Setting the Reference Units

Set the reference units by calculating the electronic gear ratio (B/A) using the following procedure, and set the values in parameters Pn202 and 203.

1. Check equipment specifications related to the reference units:

- Speed Reduction Ratio, N_2:N_1
  N_1= rotation of the load shaft
  N_2= rotation of the motor

- Ball screw pitch

- Pulley diameter

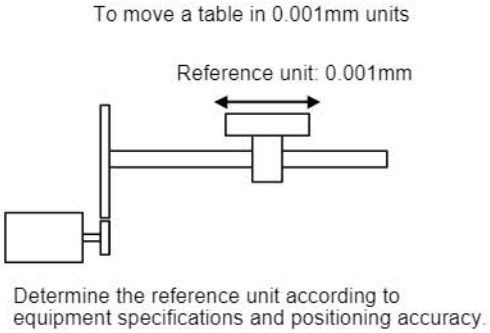
2. Check the number of encoder pulses for the SGM⑦H servomotor.

Servomotor Model and Encoder Specifications	Encoder Type	Number of Encoder Pulses Per Revolution (p/rev) ("pre-quadrature")	
A	Incremental encoder	13–bit	2048
B		16–bit	16384
C		17–bit	32768
1	Absolute encoder	16–bit	16384
2		17–bit	32768

Note: The number of bits representing the resolution of the applicable encoder is not the same as the number of encoder signal pulses (A and B phase) output from the servo amplifier.

3. Determine the reference unit used.

A reference unit is the minimum position data unit (positioning resolution) used to move a load.



- Reference unit can be 0.1in., or 0.01in., or 0.01mm, or 0.001mm, etc.

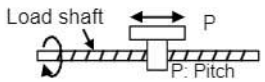
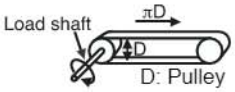
- When the reference unit is 1μm
  If a reference of 50000 units is input, the load moves 50mm (1.97in.)
  (50000 υ 0.00□mm = 50mm).

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

$$\text{Travel distance per load shaft revolution [reference units]} = \frac{\text{Travel distance per load shaft revolution [in, mm, degrees, etc.]}}{\text{Reference Unit}}$$

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

$$\frac{0.20 \text{ in}}{0.00004 \text{ in}} = 5000 \text{ (reference units)}$$

Ball Screw	Disc Table	Belt and Pulley
 1 revolution = $\frac{P}{\text{reference unit}}$	 Load shaft 1 revolution = $\frac{360°}{\text{reference unit}}$	 1 revolution = $\frac{\Sigma D}{\text{reference unit}}$

5. Electronic gear ratio is given as: $\frac{B}{A}$

If the gear ratio of the motor and the load shaft is given as: $\frac{N_2}{N_1}$

where N_2 is the rotation of the motor and N_1 is the rotation of the load shaft,

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Number of encoder pulses} \times 4}{\text{Travel distance per load shaft revolution (reference unit)}} \times \frac{N_2}{N_1}$$

Note: Make sure the electronic gear ratio satisfies the following condition:

$0.01 \leq \text{Electreconic gear ratio } \frac{B}{A} \leq 100$

The servo amplifier will not work properly if the electronic gear ratio exceeds this range. In that case, modify either the load configuration or the reference unit.

6. Set the parameters.
Reduce the electronic gear ratio to the lower terms so that both A and B are integers smaller than 65535, then set A and B in the respective parameters:

$\left(\frac{B}{A}\right)$ →

Pn202	Electronic Gear Ratio (Numerator)
Pn203	Electronic Gear Ratio (Denominator)

Parameter	Signal	Setting	Default
Pn202	Electronic Gear Ratio (Numerator)	Range: 1 to 65535	4
Pn203	Electronic Gear Ratio (Denominator)	Range: 1 to 65535	1

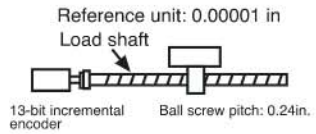
$$\text{Electronic gear ratio} = \frac{B}{A} = \frac{Pn202}{Pn203}$$

- B = [(Number of encoder pulses) x 4] x [motor speed]
- A = [Travel distance per load shaft revolution (reference units)] x [load shaft revolution speed]

5.5.1 Electronic Gear Setting Examples

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

Ball Screws

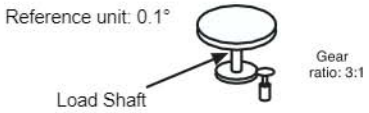


$$\text{Travel distance per load shaft revolution} = \frac{0.24\text{in.}}{0.00001\text{in.}} = 24000 \text{ ref units}$$

$$\text{Electronic gear ratio} = \frac{B}{A} = \frac{2048 \upsilon 4 \upsilon 1}{24000 \times 1} = \frac{Pn202}{Pn203}$$

Preset Values	Pn202	8192
	Pn203	24000

Circular Tables



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

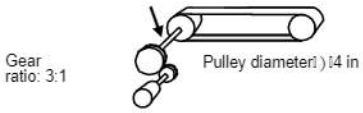
$$\text{Electronic gear ratio} = \frac{B}{A} = \frac{2048 \upsilon 4 \upsilon 3}{3600 \times 1} = \frac{Pn202}{Pn203}$$

Preset Values	Pn202	24576
	Pn203	3600

Belts and Pulleys

Reference unit: 0.0010in.
Load shaft

$$\text{Travel distance per load shaft revolution} = \frac{3.14 \upsilon 4 \text{ in.}}{0.0010\text{in.}} = 12{,}566.37 \text{ ref. units}$$



$$\text{Electronic gear ratio} = \frac{B}{A} = \frac{16{,}384 \upsilon 4 \upsilon 3}{12566.37} = \frac{Pn202}{Pn203}$$

$$= \frac{196{,}608}{12566.37} = \frac{20{,}480}{1{,}309}$$

Preset Values	Pn202	20,480
	Pn203	1,309

5.5.2 Setting Speed [x1000 Reference Units / min.]

The Sigma II Indexer stores all speed data in units of [X1000 Reference Units/min.]

- Determine load (workpiece) speed in terms of 1,000 reference units per minute.

Example:

Reference Unit = 0.01 mm
Desired speed is 15 m/min.:

$$\frac{15{,}000 \text{ mm /min.}}{0.01\text{mm}} = 1{,}500{,}000 \text{ reference units / min.}$$

Speed = 1,500 [x 1000 reference units / min.]

The following parameter is used to set the default positioning and registration speed if no speed is specified during program execution while in serial mode.

Parameter	Signal	Setting [x1000 ref. units/min]	Default
Pn81E	Positioning/ Registration Speed	1~99999999	1000

5.5.3 Setting the Acceleration / Deceleration Rate [x 1000 Reference Units/ min/ms]

The Sigma II Indexer stores the acceleration and deceleration data in units of [X1000 Reference Units/min/ms].

- Determine load (workpiece) acceleration or deceleration in terms of 1,000 reference units per minute per millisecond.

Example:

Reference unit = 0.01 mm

Desired acceleration is 0.1 second from 0 to 15 m/min:

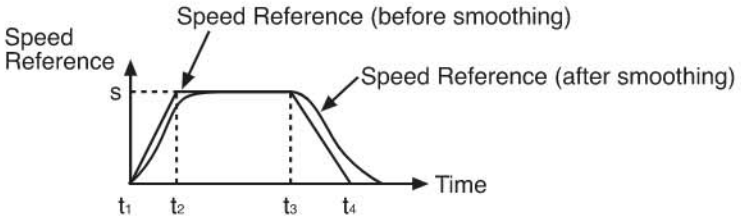
$$\frac{15{,}000 \text{ mm/min}}{0.01 \text{ mm}} = 1{,}500{,}000 \text{ reference units/min.}$$

$$\frac{1{,}500{,}000 \text{ ref. units/min}}{0.1 \text{ sec}} \times \frac{0.1 \text{ sec}}{100 \text{ msec}} = 15{,}000 \text{ reference units/min/ms}$$

Acceleration = 15 [x1000 reference units/min/ms]

The following parameters are used to set the acceleration and deceleration rate.

Parameter	Signal	Setting	Default
Pn81F	Acceleration	1~99999999 [x1000 ref. units/min/ms]	1000
Pn820	Deceleration	1~99999999 [x1000 ref. units/min/ms]	1000
Pn208	Position Reference Movement Averaging Time	0~6400 [0.01 msec]	0



$$\text{Acceleration} = \frac{s}{t_2 - t_1} = \frac{[\text{x1000 ref. unit/min}]}{[\text{msec}]}$$

$$\text{Deceleration} = \frac{s}{t_4 - t_3} = \frac{[\text{x1000 ref. unit/min}]}{[\text{msec}]}$$

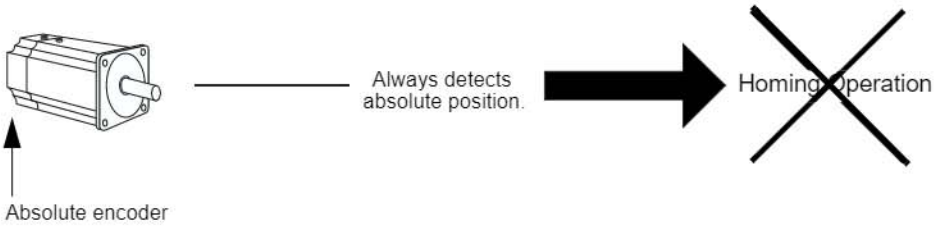
Note: Smoothing Filter (Average Movement Filter) set by Pn208 = Movement Averaging Time = 0 to 6400 [0.01msec].

5.6 Absolute Encoders

If a motor with an absolute encoder is used, the absolute position is detected in the Sigma II Indexer. Consequently, automatic operation can be performed without a homing operation immediately after the power is turned ON.

Motor SGM⑥H–⑤⑤⑤1⑤···With 16-bit absolute encoder

SGM⑥H–⑤⑤⑤2⑤···With 17-bit absolute encoder



5.6.1 Interface Circuit

The following diagram shows the standard connections for an absolute encoder mounted to a servomotor.

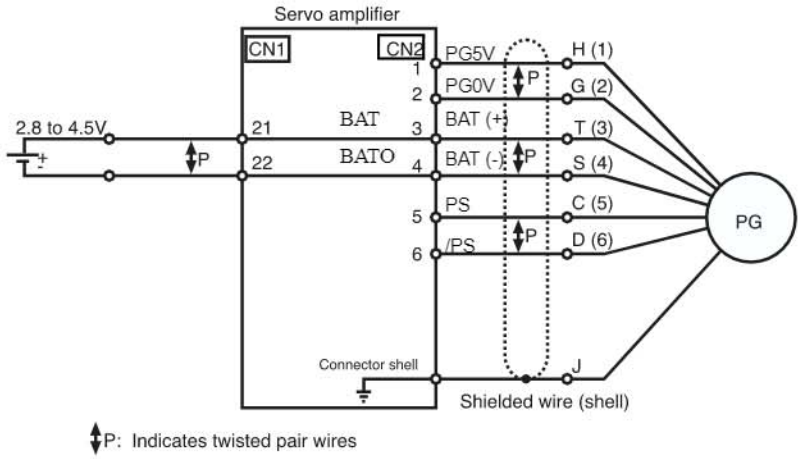


Figure 5.10 Absolute Encoder Interface Circuit

5.6.2 Configuring an Absolute Encoder

Select the absolute encoder's application with the following parameter.

Parameter	Signal	Setting	Default
Pn002.2	Absolute Encoder Application	Setting Range: 0 or 1	0

Either "0" or "1" in the following table must be set in order to enable the absolute encoder.

Pn002.2 Setting	Result
0	Uses the absolute encoder as an absolute encoder.

Pn002.2 Setting	Result
1	Uses the absolute encoder as an incremental encoder.

The following parameter is used to periodically clear the encoder's counter (return the setting to 0) after a designated ratio of motor to load axis revolutions. This function is called the multi-turn limit.

Note: The term Multi-turn Limit refers to the highest number of rotations the encoder's counter will display before returning the counter to 0.

Parameter	Signal	Setting	Default
Pn205	Multi-turn Limit Setting	Setting Range: 0 to 65535	65535

- When Pn205 is set to the default (65535), multi-turn data varies in the range of □32768 to +32767.
- With any other Pn205 value entered, data varies from 0 to the set value.

Note: To activate reassignment of this value, the user must first change the parameter, and then cycle (turn OFF and then turn ON) the power.

Since the encoder's multi-turn limit value is set as default to 65535, the following alarm occurs if the servo amplifier's power supply is cycled (turned OFF and ON) after changing parameter Pn205:

Alarm Display	Alarm Code Output			Description
	ALO1	ALO2	ALO3	
A.CC	O	X	O	Encoder multi-turn limit value does not match with that of the servo amplifier.

Note: O: ON ("L") signal
X: OFF ("H") signal

In order to set a multi-turn limit value to the encoder, perform the multi-turn limit setting operation (Fn013 or serial command MLTLIMSET).

This operation can be executed using the hand-held digital operator, the servo amplifier panel operator (Fn013), or by serial command (MLTLIMSET).

Note: The multi-turn limit setting is enabled only during the multi-turn limit value mismatch alarm. Cycle the power after performing this operation.

⚠ WARNING

Connect the ground terminal to a class–3 ground (100 : or less).
Improper grounding may result in electric shock or fire.

5.6.3 Handling Batteries

In order for the absolute encoder to retain position data when the power is turned OFF, the data must be backed up by a battery.

Installing the Battery at the Host Device (CN1 - 21, 22)

Lithium battery, by Toshiba: ER6VC3, 3.6V, 2000mAh

Battery Provided for Servo Amplifier (CN8)

Lithium battery: JZSP–BA01 (includes battery and connector)
Battery: Toshiba, ER3 V, 3.6V, 1000mAh

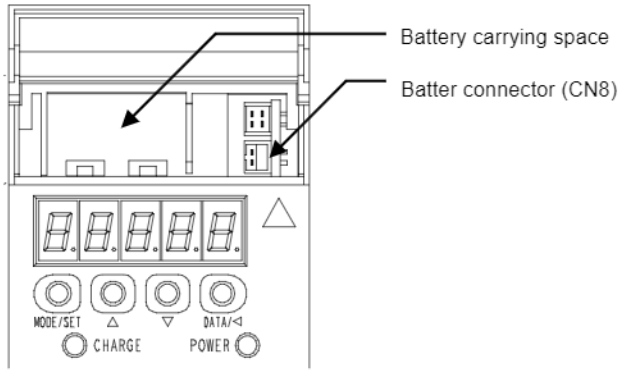


Figure 5.11 Battery Provided for Servo Amplifier

⚠ WARNING

Install the battery at either the CN1-21, 22 or CN8, NEVER at both simultaneously.
Such a connection would create a circuit between the batteries, which could lead to electric shock, injury, or equipment damage.

5.6.4 Absolute Encoder Setup

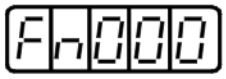
Perform the setup operation for the absolute encoder in the following circumstances:

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

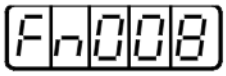
The setup operation can be performed by using the hand-held digital operator, the servo amplifier's panel operator, or by serial command (see *Appendix B2 Auxiliary Functions*).

Setup Using the Hand-held Digital Operator

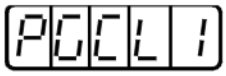
1. Press the DSPL/SET key to select the auxiliary function mode.



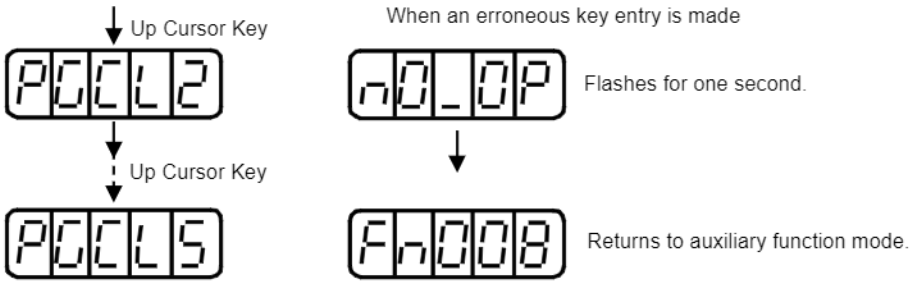
2. Select the user function Fn008. Press the Left Arrow ← or Right Arrow → key to select the digit to set, and then press the Up Arrow ↑ or Down Arrow ↓ key to change the number.



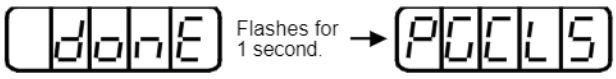
3. Press the DATA/ENTER key. The following display will appear.



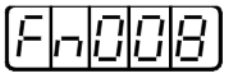
4. Pressing the Up Arrow ↑ key will change the display as shown below. Continue pressing the Up Arrow ↑ key until "PGCL5" is displayed. If an erroneous key entry is made, "nO_OP" will flash for one second and the display will return to the auxiliary function mode. In that case, go back to step 3 above and perform the operation again.



5. When "PGCL5" is displayed, press the DSPL/SET key. The display will change as follows, and the absolute encoder's multi–turn data will be cleared.



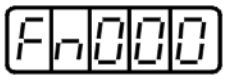
6. Press the DATA/ENTER key to return to the auxiliary function mode.



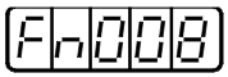
This completes the absolute encoder's setup operation. Cycle the power to the servo amplifier.

Setup Using the Built–in Panel Operator

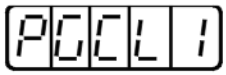
1. Press the MODE/SET key to select the auxiliary function mode.



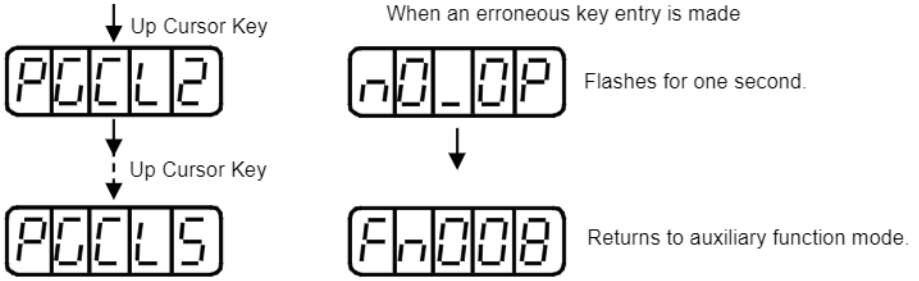
2. Press the Up Arrow ↑ or Down Arrow ↓ key to select the parameter Fn008.



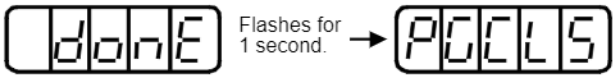
3. Press the DATA/SHIFT key, holding it down for at least one second. The following display will appear.



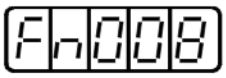
4. Press the Up Arrow ↑ key, holding it down until "PGCL5" is displayed. If an erroneous key entry is made, "nO_OP" will flash for one second and the display will return to the auxiliary function mode. In that case, go back to step 3 above and perform the operation again.



5. When "PGCL5" is displayed, press the MODE/SET key. The display will change as follows, and the absolute encoder's multi–turn data will be cleared.



6. Press the DATA/SHIFT key to return to the auxiliary function mode.



This completes the absolute encoder's setup operation. Cycle the power to the servo amplifier.

Setup Using Serial Command

1. Transmit serial command ABSPGRES.

2. Transmit serial command RES.

This completes the absolute encoder's setup operation.

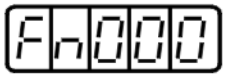
Note: If the following absolute encoder alarms are displayed, the alarms must be cleared using the method described above for the setup operation.

- Encoder backup alarm (A.81)
- Encoder sum check alarm (A.82)

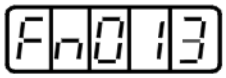
In addition, if a monitoring alarm is generated in the encoder, the alarm must be cleared by turning OFF the power.

Multi-turn Setup Using the Hand-held Digital Operator

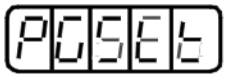
1. Press the DSPL/SET key to select the auxiliary function mode.



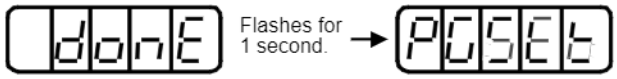
2. Select the user function Fn013. Press the Left Arrow ← or Right Arrow → key to select the digit to set, and then press the Up Arrow ↑ or Down Arrow ↓ key to change the number.



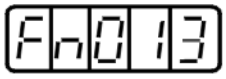
3. Press the DATA/ENTER key. The following display will appear.



4. Press the DSPL/SET key. The display will change as follows, and the absolute encoder's multi–turn data will be cleared.



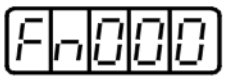
5. Press the DATA/ENTER key to return to the auxiliary function mode.



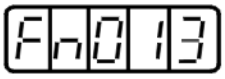
This completes the absolute encoder's multi-turn limit setting operation. Cycle the power.

Multi-turn Setup Using the Built-in Panel Operator

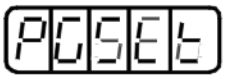
1. Press the MODE/SET key to select the auxiliary function mode.



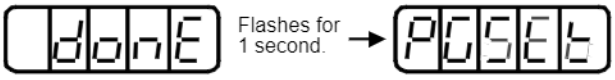
2. Press the Up Arrow ↑ or Down Arrow ↓ key to select the parameter Fn013.



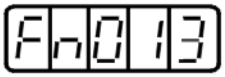
3. Press the DATA/SHIFT key. The following display will appear.



4. Press the MODE/SET key. The display will change as follows, and the absolute encoder's multi–turn limit setting operation will be performed.



5. Press the DATA/SHIFT key to return to the auxiliary function mode.



This completes the absolute encoder's multi-turn limit setting operation. Cycle the power to the servo amplifier.

Multi-turn Setup Using Serial Command

1. Transmit serial command MLTLIMSET

2. Transmit serial command RES

This completes the absolute encoder's multi-turn limit setting operation.

Machine Zero-Point Setup

The following parameter is used to set the absolute offset position from the initial setup position. This offset position will be the new machine zero-point.

Parameter	Signal	Setting [reference units]	Default
Pn81D	Home Position	-99999999 ~ +99999999	0

Note: 1. Serial command ZSET ±nnnnnnnn automatically sets the current position to ±nnnnnnnn [reference units]. Pn81D is set accordingly. See *6.5 Serial Command Functions* for more details on the ZSET command.
2. Alarm E16A will occur if Pn81D>| Pn81B, Pn81C| when Pn81A=1, 2, or 3. Refer to 5.2.2 setting the Overtravel Limit Function.

⚠ WARNING

The multi-turn limit value should be changed only for special applications.
Changing it inappropriately or unintentionally can be dangerous.

If the Multi-turn Limit Value Disagreement Alarm occurs, check the setting of parameter Pn205 in the servo amplifier to be sure that it is correct. If Fn013 or MLTLIMSET is executed when an incorrect value is set in Pn205, that same incorrect value will be set in the encoder. There will not be an additional alarm, even if an incorrect value is set, but incorrect positions will be detected.
This results in a potentially dangerous situation where the machine will move to an unexpected position.

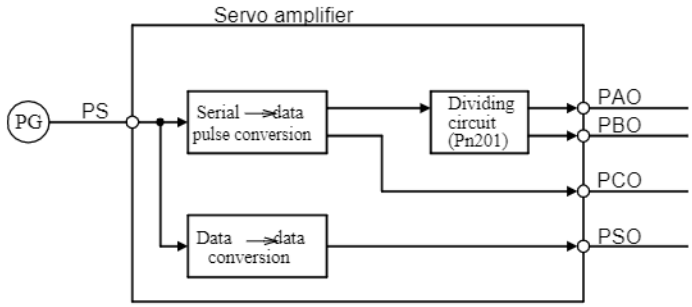
5.6.5 Absolute Encoder Reception Sequence

A host device can be used to monitor the absolute encoder feedback. The sequence in which the servo amplifier receives data from the absolute encoder and transmits them to the host device is shown below.

Be sure you understand this section when designing a host device to monitor the absolute encoder feedback.

Outline of Absolute Signals

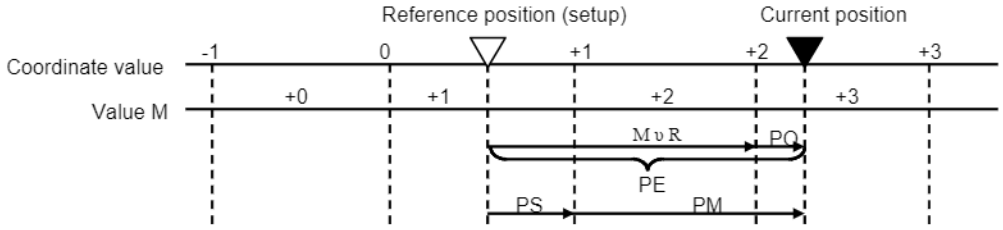
The absolute encoder's outputs are PAO, PBO, PCO, and PSO signals as shown below.



Signal	Status	Contents
PAO	Initial State	Serial data Initial incremental pulse
	Normal State	Incremental pulse
PBO	Initial State	Initial incremental pulse
	Normal State	Incremental pulse
PCO		Home position pulse
PSO		Rotation count serial data

Contents of Absolute Data

- Serial data: Indicates how many turns the motor shaft has made from the reference position (position specified at setup).
- Initial incremental pulse: Outputs pulses at the same pulse rate as when the motor shaft rotates from the home position to the current position at approximately 2500rpm (for 16 bits when the dividing pulse is at the default setting).



The final absolute data P_M can be found by using the following formula:

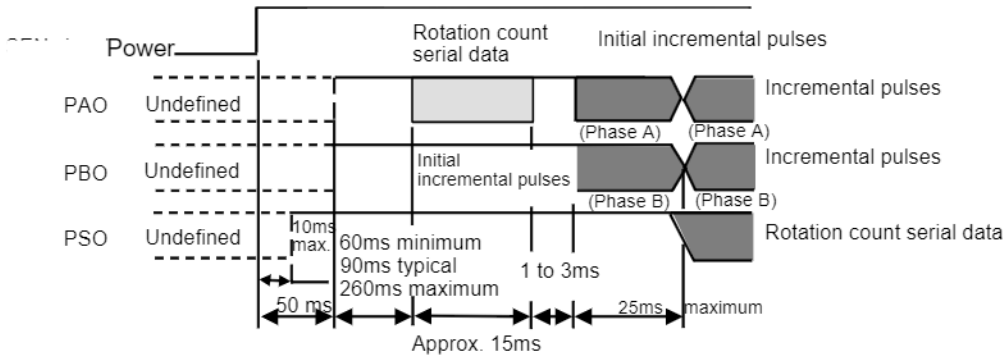
Forward rotation mode:	$P_E = M \upsilon R + P_O$ $P_M = P_E - P_S$	Reverse rotation mode: (Pn0000.0 = 1)	$P_E = -(M \upsilon R) + P_O$ $P_M = P_E - R_S$

Where: P_E = The current value read by the encoder.
M = The multi-turn data (rotation count data).
P_O = The number of initial incremental pulses.
P_S = The number of initial incremental pulses read at setup. (This is saved and controlled by the host controller).
P_M = The current value required for the user's system.
R = The number of pulses per encoder revolution. (Pulse count after dividing by the value of Pn201)

Absolute Encoder Transmission Sequence

1. Turn power on.
2. After 100ms, set the system to serial data reception-waiting-state. Clear the incremental pulse up/down counter to zero.
3. Receive eight bytes of serial data.

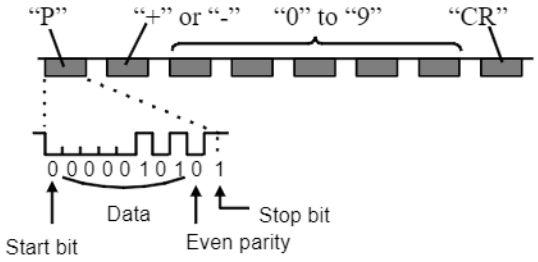
4. The system enters a normal incremental operation state approximately 50ms after the last serial data is received.



Detailed Signal Specifications

PAO Serial Data Specifications
The number of revolutions is output in five digits.

Data Transfer Method	Start–stop Synchronization (ASYNC)
Baud rate	9600bps
Start bits	1 bit
Stop bits	1 bit
Parity	Even
Character code	ASCII 7–bit code
Data format	8 characters, as shown below.

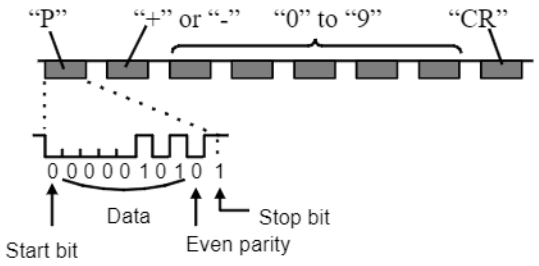


Note: 1. Data is "P+00000" (CR) or "P-00000" (CR) when the number of revolutions is zero.
2. The revolution range is "+32767" to "-32768." When this range is exceeded, the data change from "+32767" to "-32768" or from "-32768" to "+32767"

PSO Serial Data Specifications

The number of revolutions and the absolute position within one revolution are always output in five and seven digits, respectively. The data output cycle is approximately 40ms.

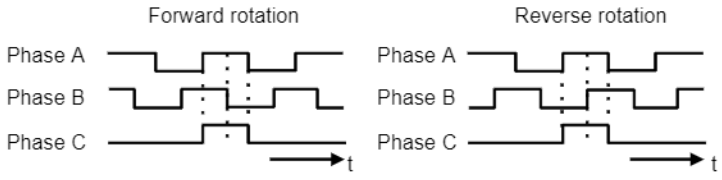
Data Transfer Method	Start–stop Synchronization (ASYNC)
Baud rate	9600 bps
Start bits	1 bit
Stop bits	1 bit
Parity	Even
Character code	ASCII 7–bit code
Data format	13 characters, as shown below.



Note: 1. The absolute position data within one revolution is the value before dividing.
2. Absolute position data increases during forward rotation. (Not valid in reverse rotation mode).

Incremental Pulses and Origin Pulses

Just as with normal incremental pulses, initial incremental pulses which provide absolute data are first divided by the frequency divider inside the Servo Amplifier and then output.



Setting the Pulse Dividing Ratio

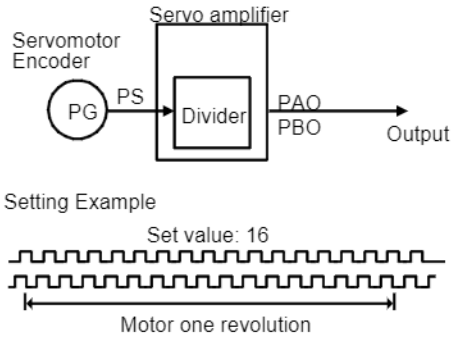
Use the following parameter to set the pulse dividing ratio.

Parameter	Signal	Setting (p/rev)	Default
Pn201	PG Divider	Setting Range: 16 to 16384	16384

This parameter sets the number of output pulses for PG output signals (PAO, /PAO, PBO, /PBO).

Pulses from the motor encoder (PG) are divided by the preset number before being output.

The set value is the number of output pulses per revolution.
The setting range varies according to the encoder used.



Output terminals:
PAO (CN1-33)
/PAO (CN1-34)
PBO (CN1-35)
/PBO (CN1-36)

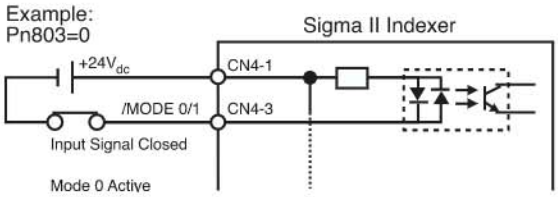
5.7 Program Table Mode (Mode 0)

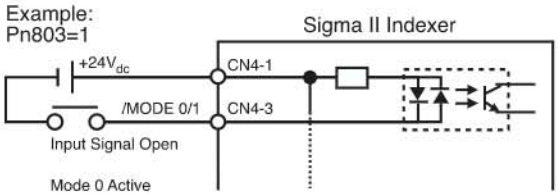
5.7.1 Program Table Mode Setting

Set the /MODE 0/1 input signal to Mode 0 for Program Table Mode. The following parameter is used to define the /MODE 0/1 input signal.

Table 5.4:

Parameter	Signal	Pin No.	Setting	Default
Pn803	/Mode 0/1	CN4-3	0 = Input signal Closed = Mode 0 1 = Input signal Open = Mode 0 2 = Always Mode 0 3 = Always Mode 1	0





5.7.2 Program Operation Inputs Setting

The following parameters are used to define the inputs used in the program table operation.

Table 5.5:

Parameter	Signal	Pin No.	Setting	Default
Pn804	/START – STOP	CN4-5	0 = Input Signal Closed = Motor Start, Program Start 1 = Input Signal Open = Motor Stop, Program Stop 2 or 3 = No Program Start	0
Pn805	/PGMRES	CN4-7	0 = Input Signal Open o Closed = Program Reset 1 = Input Signal Closed o Open = Program Reset 2 or 3 = No Program Reset	0
Pn806	/SEL0	CN4-9	0 = Input signal Closed = Program Select 1= Input Signal Open = Program Select 2 = Always Program Select 3 = No Program Select	0
Pn807	/SEL1	CN4-11		
Pn808	/SEL2	CN4-13		
Pn809	/SEL3	CN4-15		
Pn80A	/SEL4	CN4-17		
Pn833	/SEL5	CN1-41		
Pn834	/SEL6	CN1-45		

5.7.3 Program Step Selection

The Sigma II Indexer can store up to 128 program steps. All 128 program steps may be addressed in binary format by the 7 program step selection input signals (/SEL0~/SEL6). The program steps can be linked together for more complex moves.

Program Step	Program Step Selection Inputs						
	/SEL6	/SEL5	/SEL4	/SEL3	/SEL2	/SEL1	/SEL0
0							
1							X
2						X	
3						X	X
4					X		
5					X		X
6					X	X	
7					X	X	X
8				X			
9				X			X
10				X		X	
11				X		X	X
12				X	X		
13				X	X		X
14				X	X	X	
ξ ξ ξ							
114	X	X	X			X	
115	X	X	X			X	X
116	X	X	X		X		
117	X	X	X		X		X
118	X	X	X		X	X	
119	X	X	X		X	X	X
120	X	X	X	X			
121	X	X	X	X			X
122	X	X	X	X		X	
123	X	X	X	X		X	X
124	X	X	X	X	X		
125	X	X	X	X	X		X
126	X	X	X	X	X	X	
127	X	X	X	X	X	X	X

X = Input Signal Active
Blank = Input Signal Non-Active

5.7.4 Program (Index) Table Set-up

Table 5.6: Example program table

Program Step	Target Position	Positioning Speed	Registration Position	Registration Speed	Programmable Output	Event	Loop	Next Step
0	A+100000	1000	250000	1000	NNNAA	IT0	1	1
1	I-200000	200	400000	2000	NNAA:	SEL3	2	127
2	+Infinite	4000	-	3000	ZZZZZ	IT1000	1	END
3	I+300000	500	-	4000	NA: ZZ	DT500	3	END
4	Stop	3000	-	5000	: : : : :	IT0	2	END
…	…	…	…	…	…	...	…	…
127	-	1000	100000	4000	AA: ZZ	IT0	5	END

Table 5.7: Functions of the program table

	FUNCTION
Program Step	128 (0~127) available program steps. All 128 (0~127) program steps can be addressed either by inputs /SEL0~/SEL6 or by serial command STARTsss Program steps can be repeated (see Loop) or linked together (see Next)
Target Position	Setting: I +/- 99999999 Relative position reservation [Reference Unit] A +/- 99999999 Absolute position reservation [Reference Unit] +Infinite Equivalent to Jog Forward. -Infinite Equivalent to Jog Reverse. Stop Stop positioning. - No position reservation. Typically used for POUT reservation. Setting at shipping: Stop Note: □□ρ□Infinite will not work if software position reference limits, Pn81B and Pn81C, are used when Pn81A = 0 (linear). 2. Cannot combine ρ□Infinite with I +/- 99999999 or A+/- 99999999 unless a stop position reference is specified after the ρ□Infinite reference.
Positioning Speed	Setting: 1 ~ 99999999 Speed reservation [x1000 Reference Unit/min.] Setting at shipping: 1000

Table 5.7: Functions of the program table

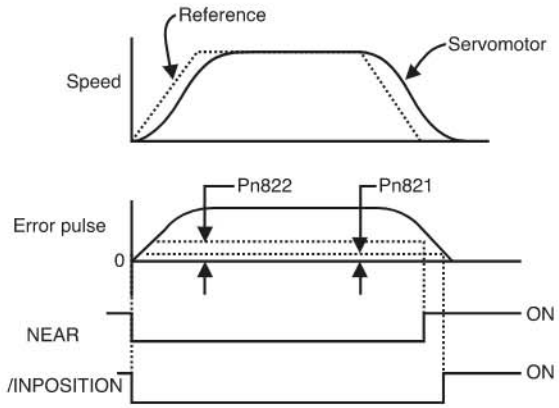
	FUNCTION
Registration Position	Setting: 0 ~ 99999999 Registration position [Reference Unit] - No registration position reserved. Setting at shipping: –
Registration Speed	Setting: 1 ~ 99999999 Registration speed [x1000 Reference Unit/min.] Setting at shipping: 1000
Programmable Output	Setting: nnnnn n = N,A,Z, or : /POUT0 N = Non Active /POUT1 A = Active /POUT2 Z = Zone signal. Status of output signal dependent upon Zone Table. (see *5.9 Zone Table Set-up*) /POUT3 : = Maintains previous status. /POUT4 The POUT function sets the output signal configuration at the start of the block. If the output signals need to change at the end of a block, specify a "-" position move and set the outputs on the following block. Setting at shipping :::::

Table 5.7: Functions of the program table

<table>
<tr><th></th><th>FUNCTION</th></tr>
<tr><td>Event</td><td>
Event Condition
Sets condition for execution of next program step, either repeat same program step (LOOP) or go to next program step (NEXT) each time the event condition is satisfied (true).
Conditions:

I /INPOSITION active
N NEAR active

The following parameters are used to set the timing for the INPOSITION and NEAR signals.
<table>
<tr><th>Parameter</th><th>Signal</th><th>Settings (reference units)</th><th>Default</th></tr>
<tr><td>Pn821</td><td>/INPOSITION Signal Width</td><td>Setting Range: 0~99999</td><td>1</td></tr>
<tr><td>Pn822</td><td>Near Signal Width</td><td>Setting Range: 0~99999</td><td>1</td></tr>
</table>
Generally set the Near width higher than the /INPOSITION width.
The /INPOSITION output signal is dependent on the logic of the /INPOSITION width and DEN. The near signal turns on by the near width only.
See also 5.3.6 Using the /INPOSITION Output Signal.



D DEN active (commanded position complete). DEN = distribution end.
SELx, x=0~6 Input signal (/SEL0~/SEL6) active
Tn,n=0~99999 Time [ms] from start of program step.
: Uses same event condition as the previous program step.

Note: I, N, D, SELx can be combined with Tn. Program waits the reserved time after event condition is satisfied (true) before execution of next program step.

ITn Program waits n ms (Tn) after /INPOSITION becomes active before next program step.
NTn Program waits n ms (Tn) after NEAR becomes active before next program step.
DTn Program waits n ms (Tn) after DEN becomes active before next program step.
SELxTn Program waits n ms (Tn) after SELx becomes active before next program step.

Setting at shipping: IT0
See also 5.7.5 Event Condition Examples
</td></tr>
</table>

Table 5.7: Functions of the program table

	FUNCTION
Loop	Setting: 1~99999 Repeats program step specified number of time. Setting at shipping: 1 Note: LOOP=1: Executes program step once (no repeat). LOOP has priority over NEXT. Therefore a program step will repeat the specified number of times (LOOP) before it executes next program step (NEXT).
Next Step	Setting: n, n=0-127 Executes program step n END Program (cancellation status) end. Setting at shipping END

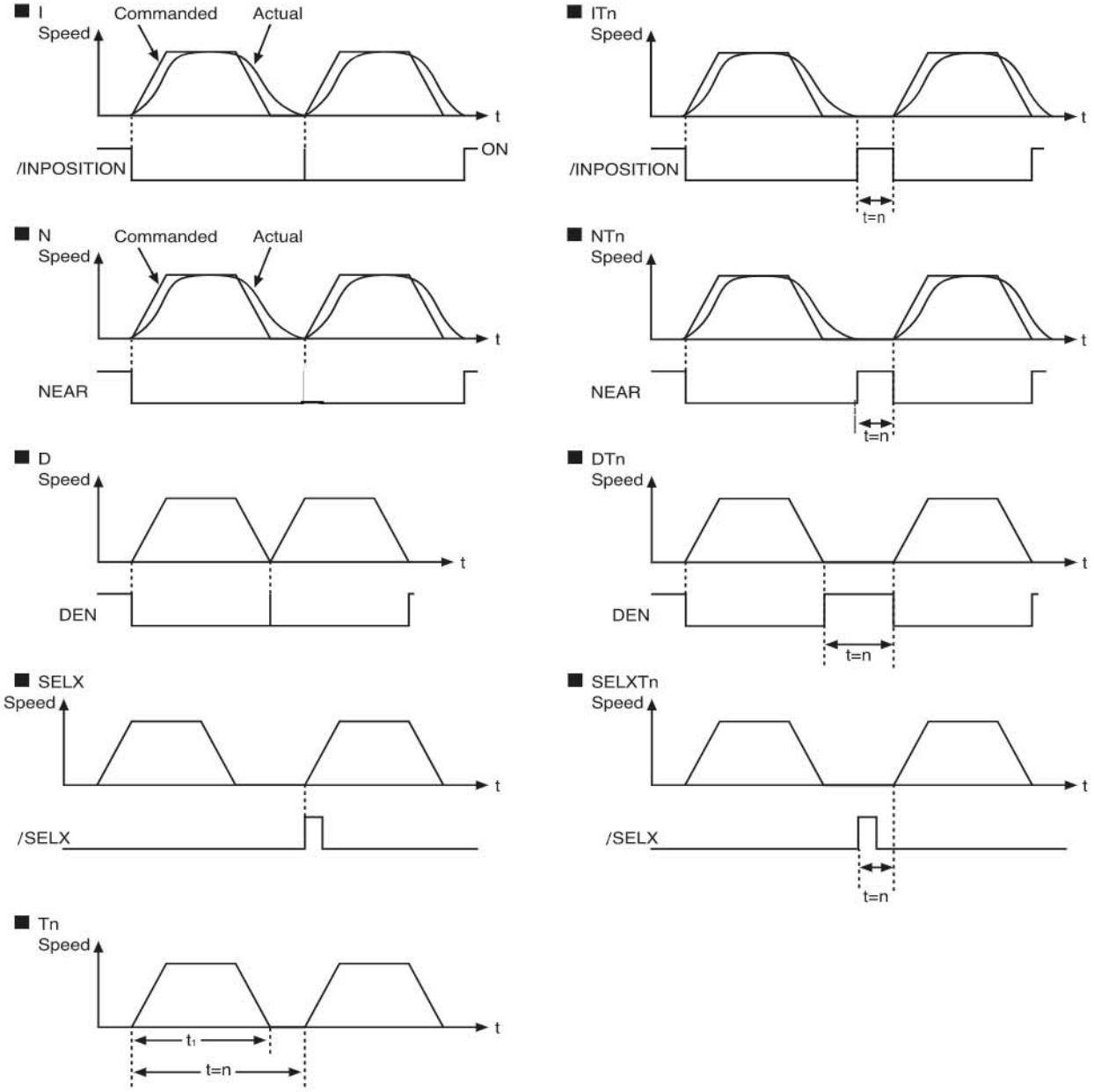
Note:

1. When program moves to the next program step and a new position is commanded while the previous commanded position is not complete, program ignores the new position and displays error E53E. At this time, programming is also discontinued. To restart the program, cycle the /START-STOP input to Non-Active and again back to Active.

2. When moving to the next program step during Infinity operation and a new Infinity operation is ordered, program changes to the new speed.

Note: See *6.5.4 Program Table Set-up* for setting up the program table by serial commands.

5.7.5 Event Condition Examples

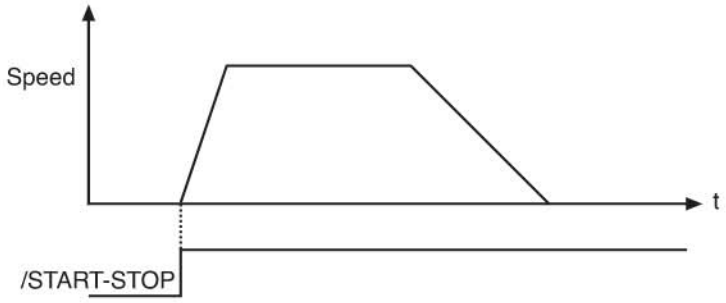


Note: If $t<t_1$, then new positioning is ignored and error E53E is displayed. Original programming is also discontinued.

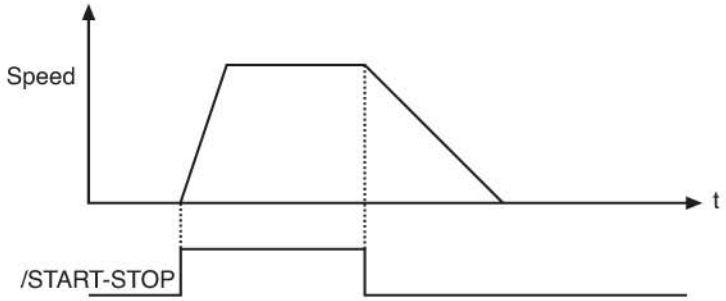
5.7.6 Program Operation

Program Start-Stop

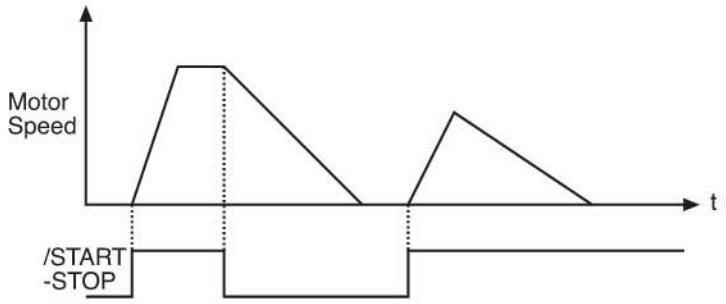
When changing /START-STOP to Active, program operation mode starts from the program step reserved by /SEL0 ~ /SEL6.



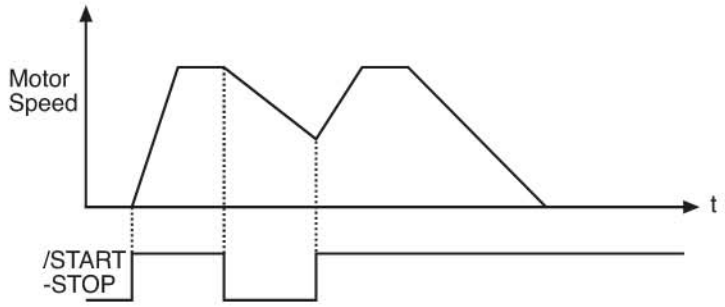
When changing /START-STOP back to Non-Active, both motor operation and program are discontinued.



When /START-STOP becomes Active after discontinuing positioning and stopping motor, program resumes positioning.



When /START-STOP becomes Active again during motor deceleration, program resumes positioning.



Program Reset

When changing /PGMRES to Active after changing /START-STOP to Non-Active, both motor operation and program under execution are canceled.

When changing /START-STOP to Active after program has been canceled, program operation mode starts from the program step reserved by /SEL0~/SEL6.

5.7.7 Evaluation of Program Operation Input Conditions

The following tables evaluate all possible conditions of the /START-STOP and /PGMRES inputs and their effect on program operation while no program is running or while a program is running.

Table 5.8: Evaluation of Program Operation Input Conditions

PROGRAM STATUS	START-STOP	PGMRES	PROGRAM OPERATION
Program End (program finished or canceled)	Non Active	Non Active	No Change
	Non Active	Leading Edge	No Change
	Active	Non Active	Not Applicable
	Active	Leading Edge	Not Applicable
	Leading Edge	Non Active	Latches /SEL0~/SEL6 Executes selected program
	Leading Edge	Leading Edge	Latches /SEL0~/SEL6 Executes selected program
	Trailing Edge	Non Active	Not Applicable
	Trailing Edge	Leading Edge	Not Applicable

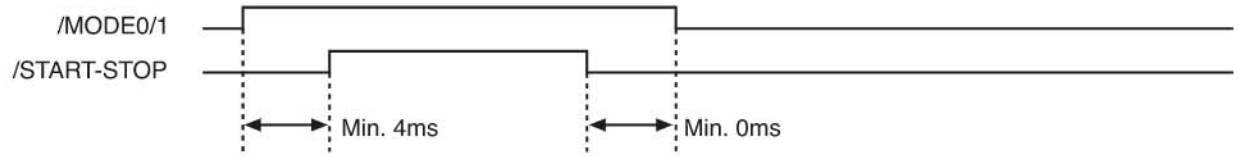
Table 5.8: Evaluation of Program Operation Input Conditions

PROGRAM STATUS	START-STOP	PGMRES	PROGRAM OPERATION
Program Running (program running or held, but not cancelled)	Non Active	Non Active	Program Held
	Non Active	Leading Edge	Cancels program
	Active	Non Active	No change
	Active	Leading Edge	No change
	Leading Edge	Non Active	Continues program
	Leading Edge	Leading Edge	Continues program
	Trailing Edge	Non Active	Program Held
	Trailing Edge	Leading Edge	Program Held

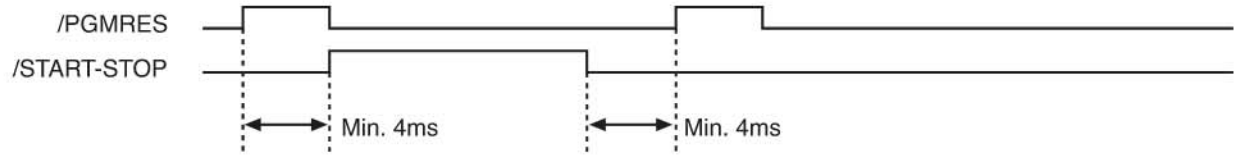
5.7.8 Minimum Input Signal Timing for Program Operation

The following charts show the minimum timing requirements between inputs for program operation

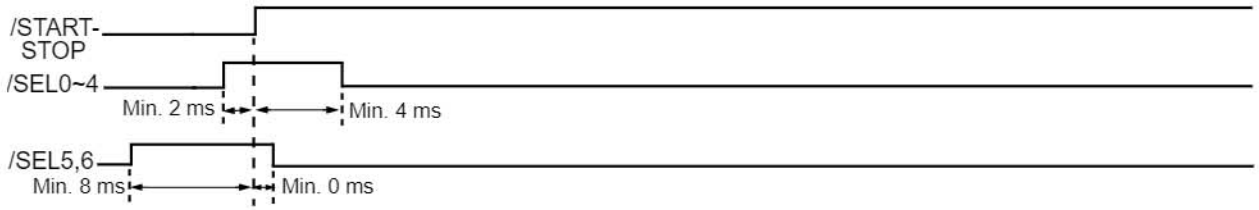
When selecting Mode 0 and starting a program step:



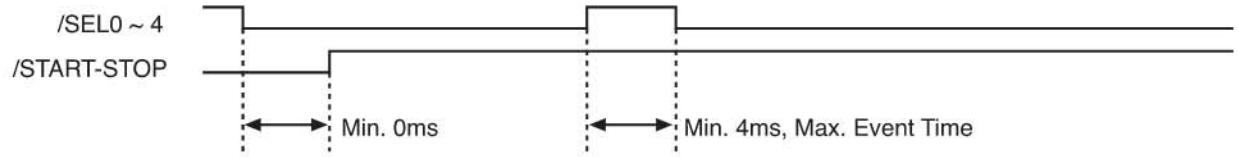
When resetting a program step:



When reserving /SEL0~6 for program step operation:



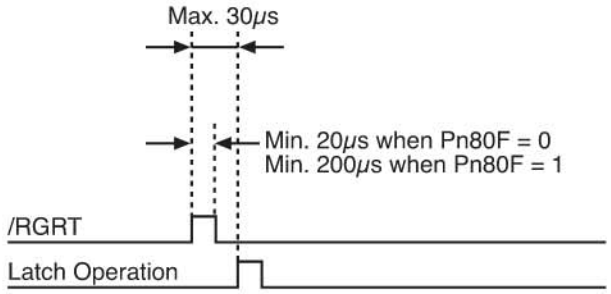
When reserving /SEL0 ~ 4 in EVENT:



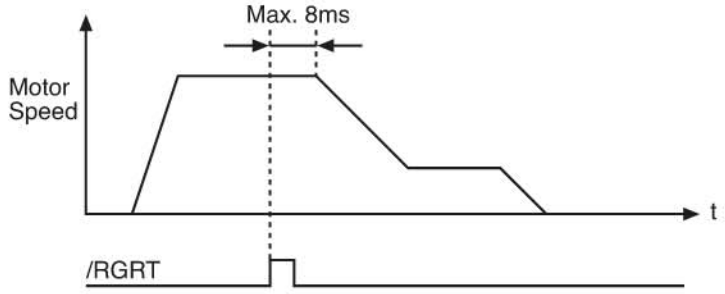
5.8 Registration

5.8.1 Registration Specifications

Latch delay time caused by /RGRT at the time of registration (maximum time delay to latch position):



Move time from /RGRT input signal to registration move at the time of registration (maximum time delay to change motor operation):



5.8.2 Registration Input Setting

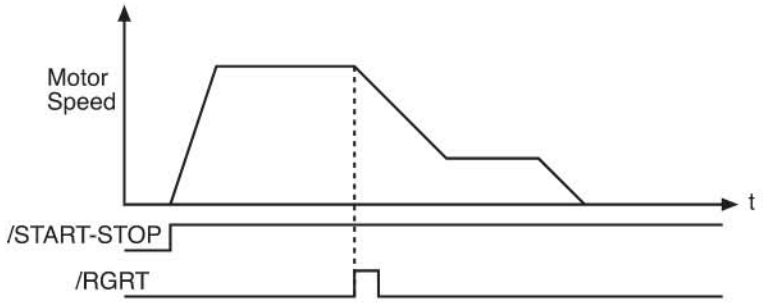
The following parameters are used to define the registration input

Table 5.9:

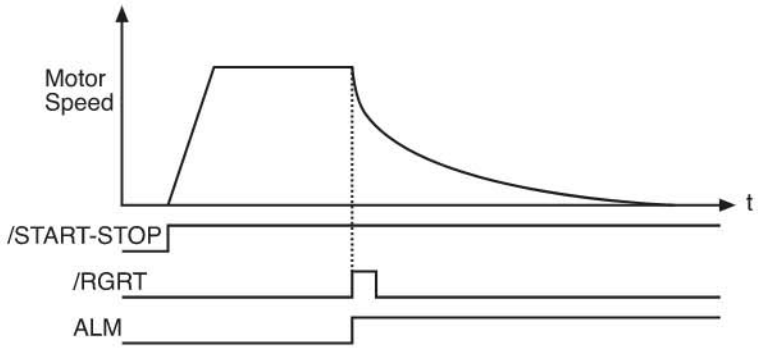
PARAMETER	SIGNAL	PIN No.	SETTING
Pn80F	/RGRT	CN1-46	0= Input Signal Closed = Registration Start 1= Input Signal Open = Registration Start

5.8.3 Registration Operation

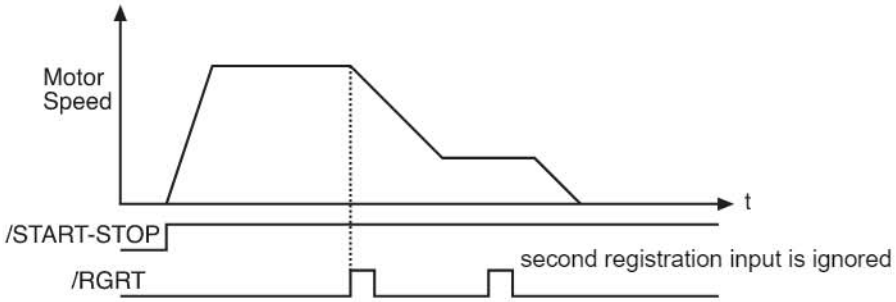
When /RGRT becomes Active during positioning, registration starts.



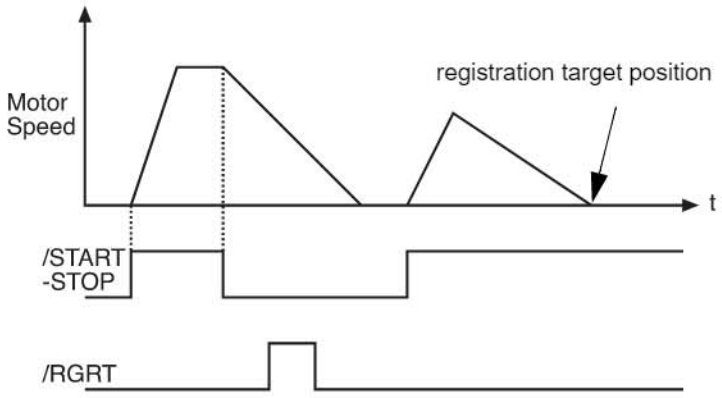
If the reserved registration distance (RDST) is too small compared to the distance it takes for the motor to decelerate to the reserved registration speed (RSPD), alarm E23E occurs. The motor does not stop at the reserved registration distance.



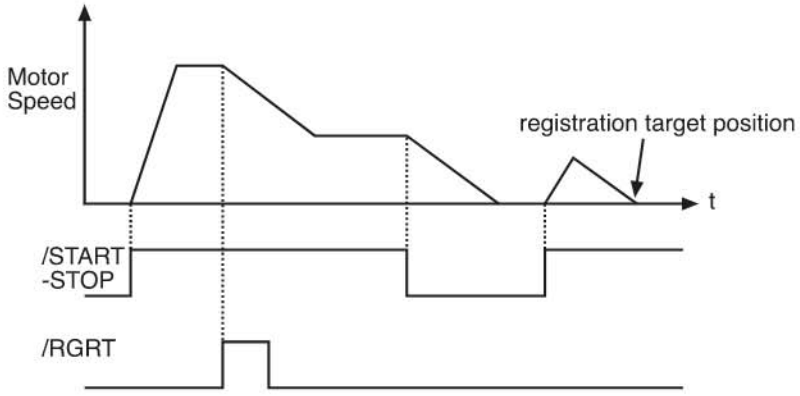
A second /RGRT is ignored, while positioning to the reserved registration distance.



When /RGRT becomes Active during motor deceleration and /START-STOP becomes Active later, registration starts.



When /START-STOP becomes Non-Active during registration, program discontinues registration and stops motor. When /START-STOP becomes Active, registration resumes.



5.9 Zone Table Set-up

Zone signals are used to set the five programmable outputs (/POUT0 – /POUT4) based on position. Up to 32 zones are available. The zone signal outputs function like a programmable function.

Table 5.10: Zone Table

ZONE ID	ZONE N	ZONE P	Z4	Z3	Z2	Z1	Z0
0	±nnnnnnnn	±nnnnnnnn					
1	±nnnnnnnn	±nnnnnnnn					X
2	±nnnnnnnn	±nnnnnnnn				X	
3	±nnnnnnnn	±nnnnnnnn				X	X
4	±nnnnnnnn	±nnnnnnnn			X		
5	±nnnnnnnn	±nnnnnnnn			X		X
6	±nnnnnnnn	±nnnnnnnn			X	X	
7	±nnnnnnnn	±nnnnnnnn			X	X	X
8	±nnnnnnnn	±nnnnnnnn		X			
9	±nnnnnnnn	±nnnnnnnn		X			X
10	±nnnnnnnn	±nnnnnnnn		X		X	
11	±nnnnnnnn	±nnnnnnnn		X		X	X
12	±nnnnnnnn	±nnnnnnnn		X	X		
13	±nnnnnnnn	±nnnnnnnn		X	X		X
14	±nnnnnnnn	±nnnnnnnn		X	X	X	
15	±nnnnnnnn	±nnnnnnnn		X	X	X	X
16	±nnnnnnnn	±nnnnnnnn	X				
17	±nnnnnnnn	±nnnnnnnn	X				X
18	±nnnnnnnn	±nnnnnnnn	X			X	
19	±nnnnnnnn	±nnnnnnnn	X			X	X
20	±nnnnnnnn	±nnnnnnnn	X		X		
21	±nnnnnnnn	±nnnnnnnn	X		X		X
22	±nnnnnnnn	±nnnnnnnn	X		X	X	
23	±nnnnnnnn	±nnnnnnnn	X		X	X	X
24	±nnnnnnnn	±nnnnnnnn	X	X			
25	±nnnnnnnn	±nnnnnnnn	X	X			X
26	±nnnnnnnn	±nnnnnnnn	X	X		X	
27	±nnnnnnnn	±nnnnnnnn	X	X		X	X
28	±nnnnnnnn	±nnnnnnnn	X	X	X		
29	±nnnnnnnn	±nnnnnnnn	X	X	X		X
30	±nnnnnnnn	±nnnnnnnn	X	X	X	X	
31	±nnnnnnnn	±nnnnnnnn	X	X	X	X	X

X = Input Active
Blank = Input Non-Active

ZONE ID = Zone number (32 available zones)

ZONE N = Negative side zone boundary position.

ZONE P = Positive side zone boundary position.

Z0~Z4: Z0 = /POUT0, Z1 = /POUT1, Z2 = /POUT2, Z3 = /POUT3, Z4 = /POUT4 only when the programmable output (/POUT0 ~ /POUT4) is defined as a zone output. (See note 2.)

Setting Range: -99999999 ~ +99999999 reference units
Setting at Shipping: ZONE N = ZONE P = 0

Note: 1. Status of Z0~Z4 fixed for each zone.
2. Zone signals function only when the programmable outputs (/POUT0-/POUT4) are defined as a zone output o Z. Example: POUT = ZAZZN. Status of programmable outputs /POUT1, /POUT2, and /POUT4 dependent upon zone table.

5.9.1 Zone Signal Conditions

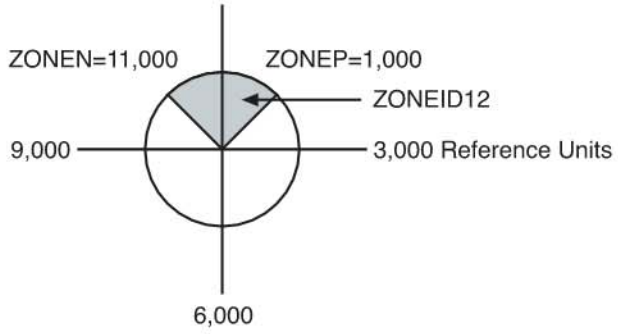
1. ZONEN δ ZONEP
Condition for Z0~Z4 true when ZONEN δ Current Position δ ZONEP

2. ZONEID with lower number is used when the current position falls within multiple zones (overlapping zones).

3. Z0~Z4 Non-Active when there is no ZONEN δ Current Position δ ZONEP.

4. ZONEN > ZONEP:
Condition for Z0~Z4 true when Current Position τ ZONEN or Current Position δ ZONEP

For example: When position 0 is within a zone of a rotary application



Therefore, Z3 and Z2 active when current position is within ZONEID12.

5. ZONEN = ZONEP = 0:
Zone is not reserved.

5.10 Program Table Examples

The following are examples of program tables. Also, see Appendix D Example Exercises for Indexer exercises using the programming software IndexWorks.

Table 5.11: Simple Reciprocating Operation (Example)

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	15000	-	1000	NNNNA	IT2000	1	1
1	I-200000	30000	-	1000	NNNAN	IT2000	2	0

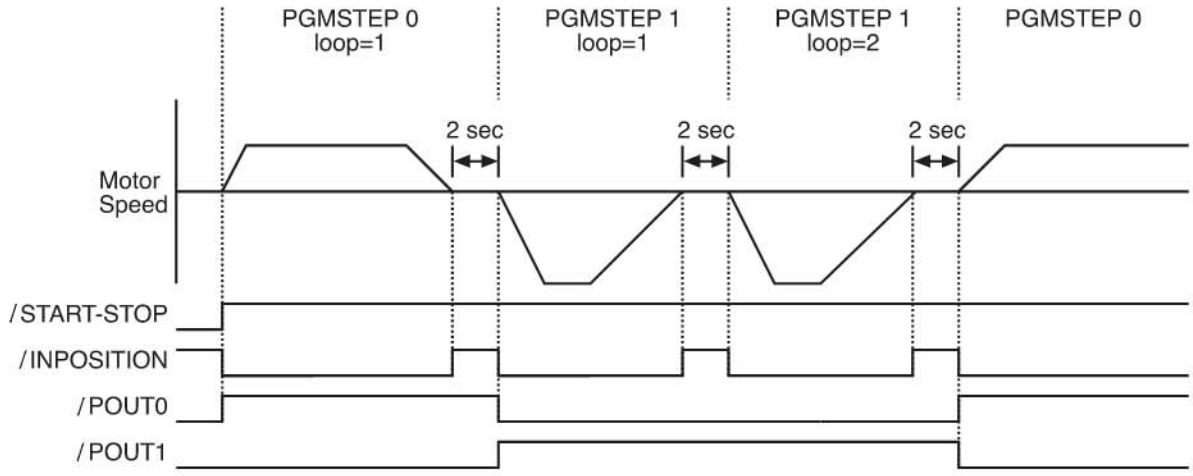


Table 5.12: POUT Signal Output for Specified Time after Completing Positioning (Example)

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	15000	-	1000	NNNNN	IT0	1	1
1	-	15000	-	1000	: : : : A	T2000	1	2
2	I-200000	30000	-	1000	NNNNN	IT0	1	3
3	-	30000	-	1000	: : : A:	T2000	1	4
4	I-200000	30000	-	1000	NNNNN	IT0	1	5
5	-	30000	-	1000	: : A: :	T2000	1	0

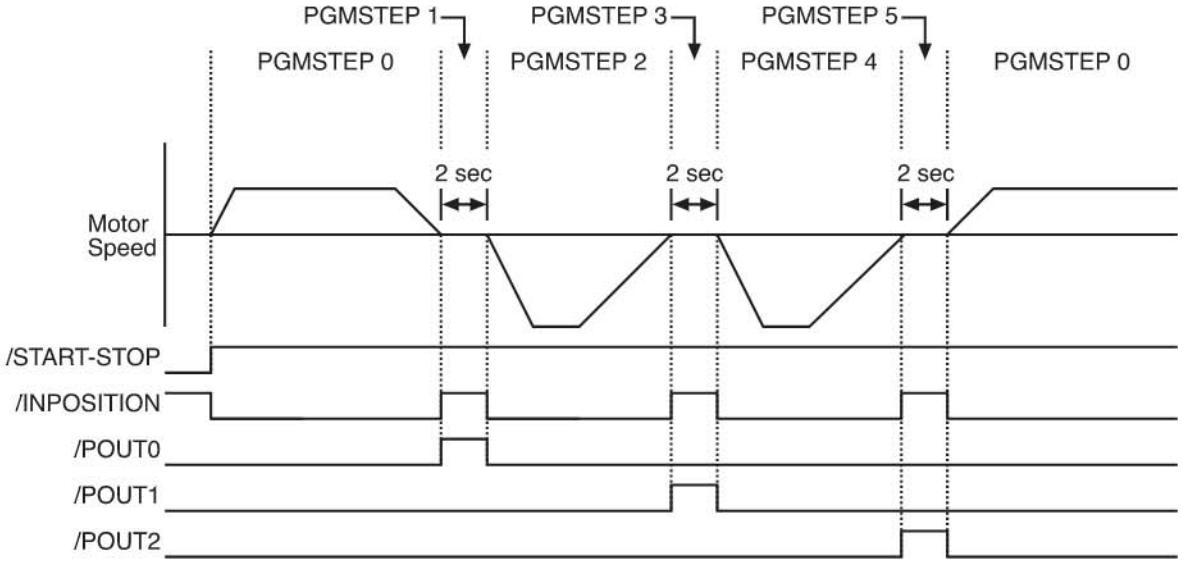


Table 5.13: Event with SEL Signal (Example)

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	15000	-	1000	NNNNA	SEL0T2000	1	1
1	I-200000	30000	-	1000	NNNAN	SEL1T2000	2	0

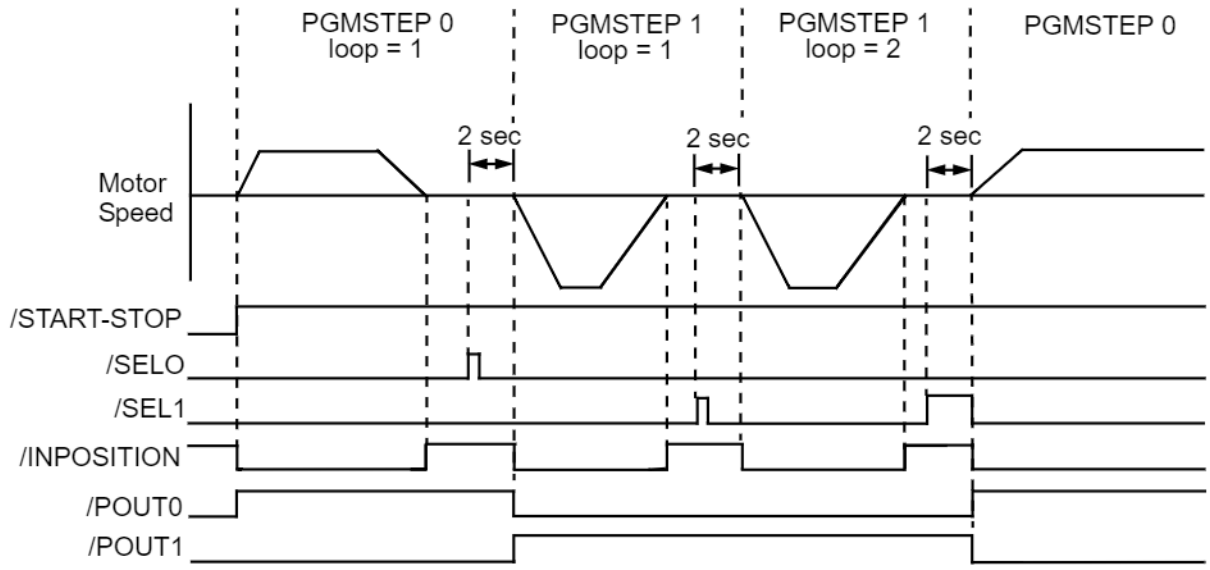


Table 5.14: Use of ZONE Table (Example)

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	A+500000	30000	-	1000	ZZZZZ	IT0	1	1
1	A+000000	30000	-	1000	ZZZZZ	IT0	1	0

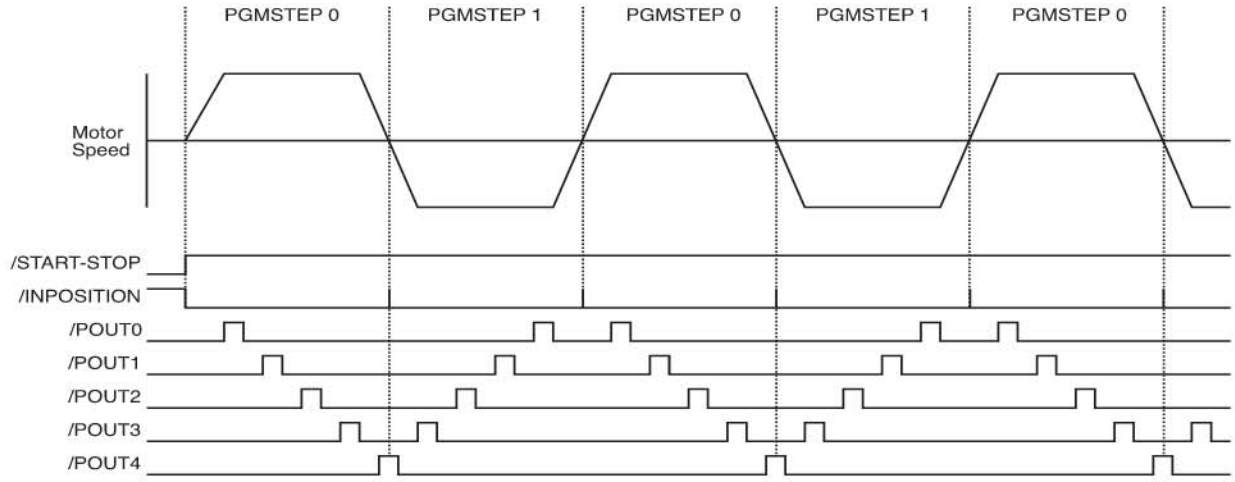


Table 5.14a: Zone Table

	ZONEN	ZONEP
0	0	0
1	+099995	+100004
2	+199995	+200004
3	0	0
4	+299995	+300004
5	0	0
6	0	0
7	0	0
8	+399995	+400004
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0

	ZONEN	ZONEP
16	+499995	+500004
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0

Table 5.15: Use as Positioning Table (Example)

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	A+000000	30000	-	1000	AZZZZ	IT0	1	END
1	A+100000	30000	-	1000	NZZZZ	IT0	1	END
2	A+200000	30000	-	1000	AZZZZ	IT0	1	END
3	A+300000	30000	-	1000	NZZZZ	IT0	1	END
4	A+400000	30000	-	1000	AZZZZ	IT0	1	END

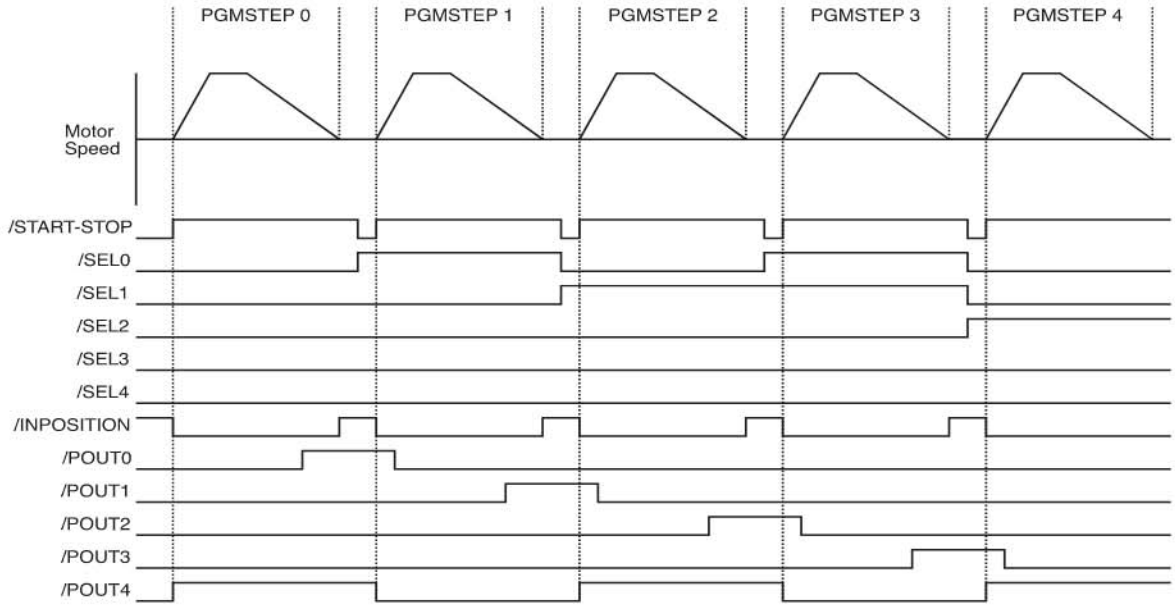


Table 15a: Zone Table

	ZONEN	ZONEP
0	0	0
1	-001000	+001000
2	+099000	+101000
3	0	0
4	+199000	+201000
5	0	0
6	0	0
7	0	0
8	+299000	+301000
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0

	ZONEN	ZONEP
16	+399000	+401000
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0

Table 15a: Zone Table

	ZONEN	ZONEP
14	0	0
15	0	0

	ZONEN	ZONEP
30	0	0
31	0	0

Table 5.16: Use of Constant Speed Operation (Example)

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	+INFINITE	15000	-	1000	NNNNN	T2000	1	1
1	+INFINITE	30000	-	1000	: : : : :	SEL0TO	1	2
2	STOP	30000	-	1000	: : : : :	IT0	1	3
3	A+400000	30000	-	1000	: : : : :	SEL1TO	1	0

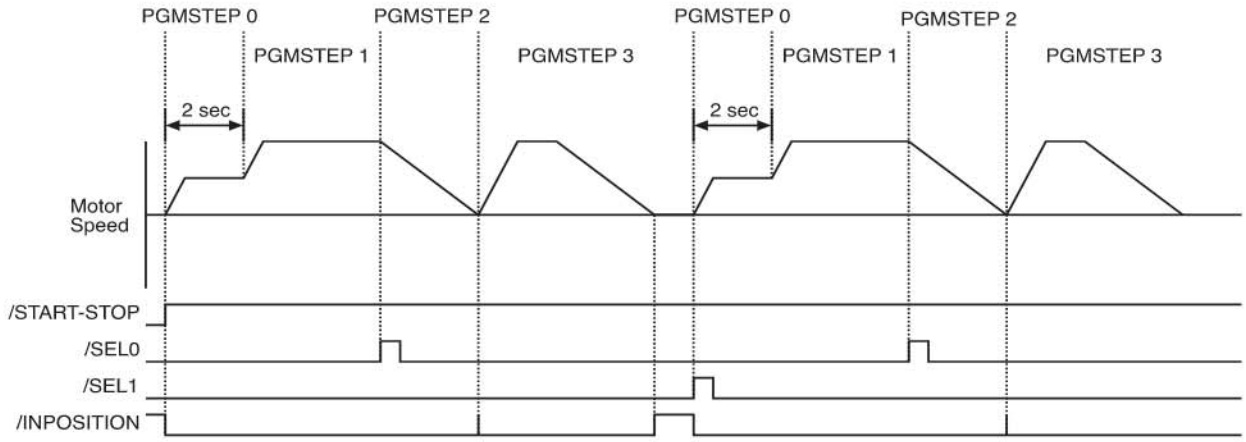
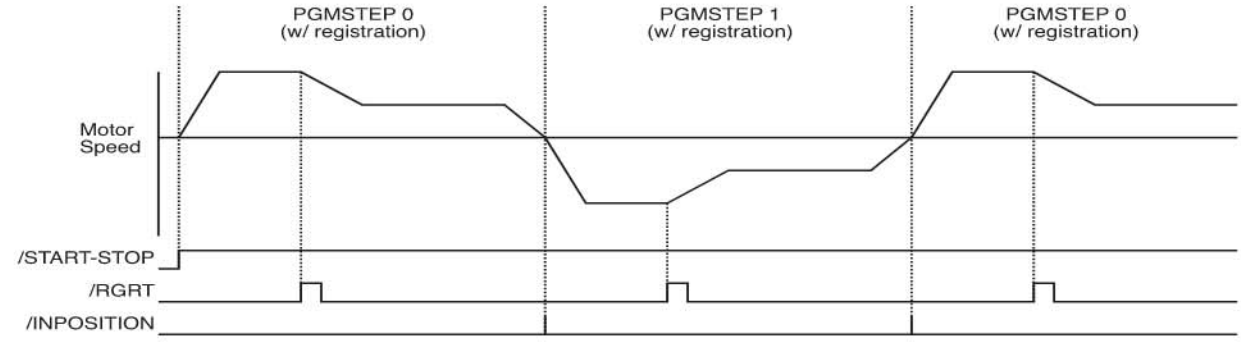


Table 5.17: Use of Registration (Example)

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	30000	100000	15000	NNNNN	IT0	1	1
1	I-200000	30000	100000	15000	: : : : :	IT0	1	0



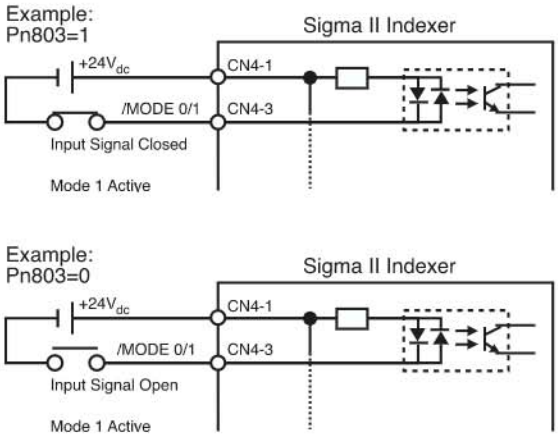
5.11 Homing / Jog Speed Table Mode (Mode 1)

5.11.1 Homing /Jog Mode Setting

Set the /MODE 0/1 input signal to Mode 1 for Homing / Jog Speed table mode. The following parameter is used for defining the /MODE 0/1 input signal.

Table 5.18:

PARAMETER	SIGNAL	PIN No.	SETTING	DEFAULT
Pn803	MODE0/1	CN4-3	0 = Input Signal Closed = Mode 0 1 = Input Signal Open = Mode 0 2 = Always Mode 0 3 = Always Mode 1	0



5.11.2 Homing / Jog Speed Table inputs Setting

The following parameters are used to define the input signals used in homing and jog speed table (Mode 1).

Table 5.19:

PARAMETER	SIGNAL	PIN No.	SETTING	DEFAULT
Pn804	/HOME	CN4-5	0 = Input Signal Closed = Homing Start 1 = Input Signal Open = Homing Start 2 or 3 = No Homing	0
Pn80E	/DEC	CN1-44	0 = Close = Zero-point Deceleration LS 1 = Open = Zero-point Deceleration LS 2 = Always = Zero-point Deceleration LS 3 = No Zero-point Deceleration LS	0
Pn805	/JOGP	CN4-7	0 = Input Signal Closed = Jog Forward 1 = Input Signal Open = Jog Forward 2 or 3 = No Jog Forward	0
Pn806	/JOGN	CN4-9	0 = Input Signal Closed = Jog Reverse 1 = Input Signal Open = Jog Reverse 2 or 3 = No Jog Reverse	0

Table 5.19:

PARAMETER	SIGNAL	PIN No.	SETTING	DEFAULT
Pn807	/JOG0	CN4-11	0 = Input Signal Closed = Jog Select 1 = Input Signal Open = Jog Select 2 = Always Jog Select 3 = No Jog Select	0
Pn808	/JOG1	CN4-13		0
Pn809	/JOG2	CN4-15		0
Pn80A	/JOG3	CN4-17		0

5.11.3 Homing Routine Parameters

The following parameters are used to setup the homing routines for incremental encoders only.

Table 5.20:

PARAMETER		SETTING RANGE	UNITS	DEFAULT
Pn81D	Home Position	-99999999~ +99999999	Ref. Units	0
Pn823	Homing Method	0 = No Homing 1 = /DEC and CØ-Pulse 2= /DEC only 3= CØ-Pulse only	-	0
Pn824	Homing Direction	0 = Forward 1 = Reverse	-	0
Pn825	Homing Move Speed	0 ~ 99999999	x1000 Ref. Unit / min.	1000
Pn826	Homing Approach Speed	0 ~ 99999999	x1000 Ref. Unit / min.	1000
Pn827	Homing Creep Speed	0 ~ 99999999	x1000 Ref. Unit / min.	1000
Pn828	Homing Final Move Distance	-99999999 ~ +99999999	Ref. Units	0

Home Position, Pn 823:

Once homing is complete, the position reference is automatically set to the value set in Pn81D.

Alarm E16A will occur if Pn81D is set outside the forward and reverse position limits, Pn81B and Pn81C, when Pn81A=1, 2, or 3 (rotary). Refer to 5.2.2 Setting the Overtravel Limit Function.

Note:

If a homing method, Pn823 is specified, then homing must be executed before the forward and reverse position reference limits are recognized when Pn81A=0 (linear). Refer to 5.2.2 Setting the Overtravel Limit Function.

5.12 Homing Routine Operation

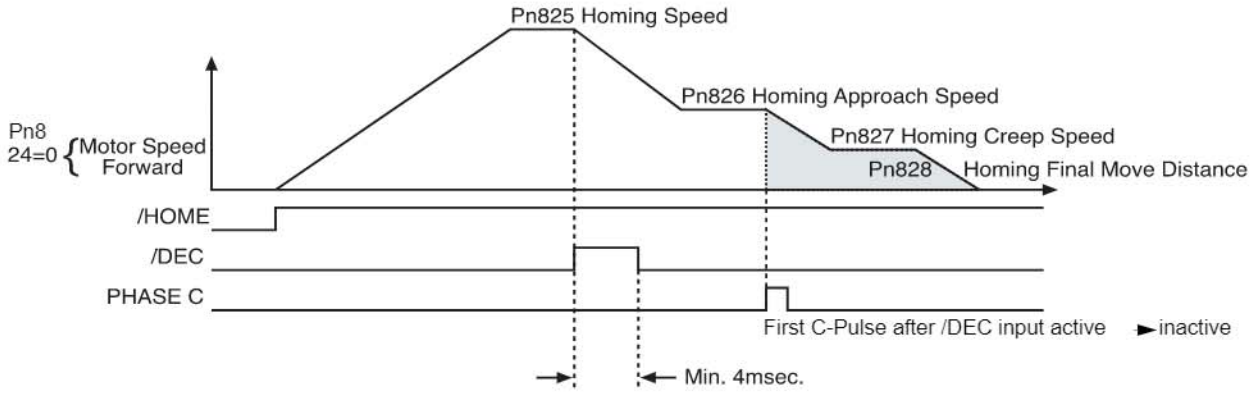
Use homing routine for incremental encoders only. Homing routines cannot be performed on absolute encoders. Error E61E will occur when trying to home an absolute encoder.

When changing /HOME to Active, homing starts.

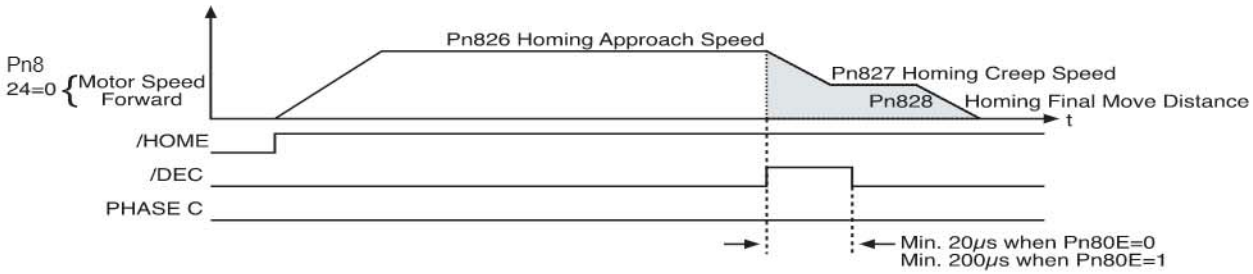
When changing /HOME back to Non-Active, homing is interrupted and status is maintained. When changing /HOME back to Active again, homing resumes.

Homing is canceled when jogging forward or reverse with /JOGP or /JOGN, respectively.

Mode I : Pn823=1 Use /DEC and C-Pulse



Mode II: Pn823=2 Use only /DEC



Note: Must see rising edge of /DEC before deceleration to creep speed.

Mode III: Pn823=3 Use only C-Pulse

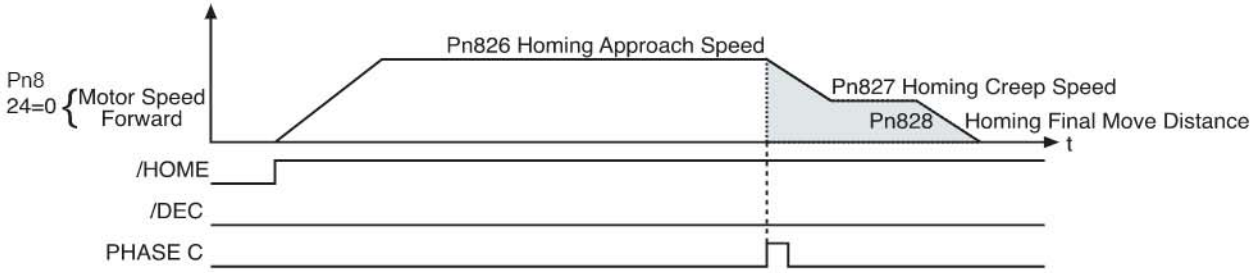


Figure 5.12 Homing Routines

5.13 Jog Speed Table Operation

When changing /JOGP to Active, motor forwards with jog speed reserved by input signals /JOG0 ~ /JOG3. (See *5.13.2 Jog Speed Table selection*)

When changing /JOGN to Active, motor reverses with jog speed reserved by input signals /JOG0 ~ /JOG3. (See *5.13.2 Jog Speed Table Selection*)

5.13.1 Jog Speed Table Example

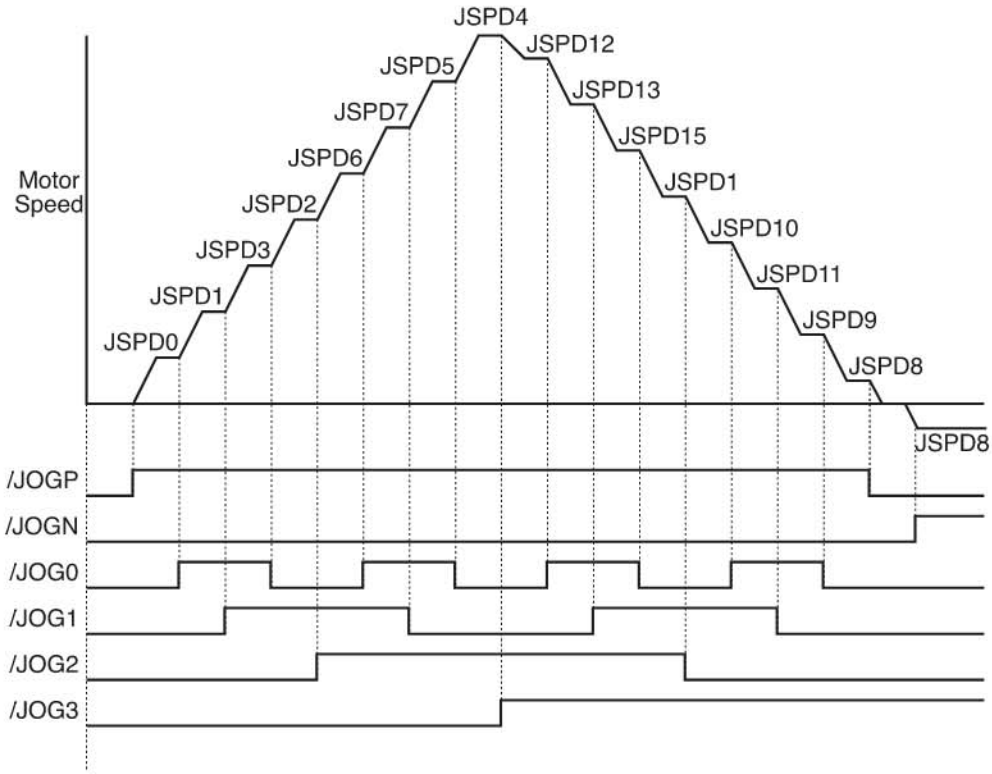


Figure 5.13 Jog Speed Table

5.13.2 Jog Speed Table Selection

Table 5.21: Jog Speed Table Selection

Jog Speed ID	Jog Speed (JSPD)	Jog Speed Selection Input Signals			
		/JOG3	/JOG2	/JOG1	/JOG0
0	nnnnnnnn				
1	nnnnnnnn				X
2	nnnnnnnn			X	
3	nnnnnnnn			X	X
4	nnnnnnnn		X		
5	nnnnnnnn		X		X
6	nnnnnnnn		X	X	
7	nnnnnnnn		X	X	X
8	nnnnnnnn	X			
9	nnnnnnnn	X			X
10	nnnnnnnn	X		X	
11	nnnnnnnn	X		X	X
12	nnnnnnnn	X	X		
13	nnnnnnnn	X	X		X
14	nnnnnnnn	X	X	X	
15	nnnnnnnn	X	X	X	X

X = Active
Blank = Non-Active

Jog Speed ID: Jog speed number (16 available jog speeds)
/JOG0 ~ /JOG3: Jog speed table selection input signals.
Jog Speed (JSPD): Jog Speed
Setting: 1 ~ 99999999 [x1000 reference unit/min]
Setting at Shipping = 1000

5.13.3 Jog Speed Table and Homing Operation Input Conditions

The following table evaluates all possible conditions of the /HOME, /JOGP, and /JOGN inputs and their effect on jog and homing operation.

Table 5.22: Jog Speed Table and Homing Operation Input Conditions

/HOME	/JOGP	/JOGN	OPERATION
Non Active	Non Active	Non Active	Motor Stop
Non Active	Non Active	Leading Edge	Motor Reverse
Non Active	Leading Edge	Non Active	Motor Forward

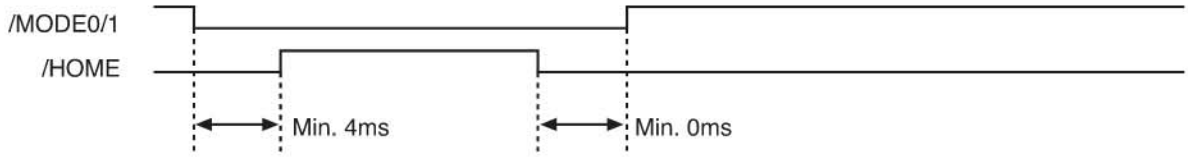
Table 5.22: Jog Speed Table and Homing Operation Input Conditions

/HOME	/JOGP	/JOGN	OPERATION
Non Active	Active	Active	Motor Stop
Leading Edge	Non Active	Non Active	Homing Execution
Active	Non Active	Active	Motor Stop
Active	Active	Non Active	Motor Stop
Active	Active	Active	Motor Stop

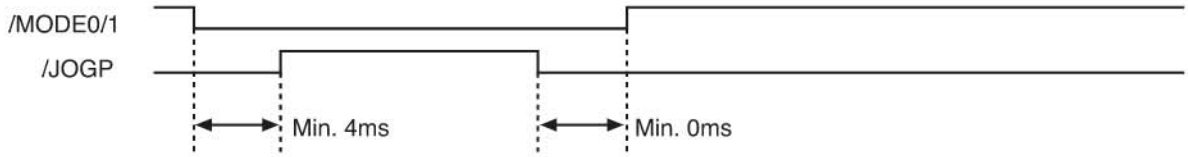
5.13.4 Minimum Input Signal Timing for Homing and Jog Operation

The following charts show the minimum timing requirements between inputs for homing and jog operation:

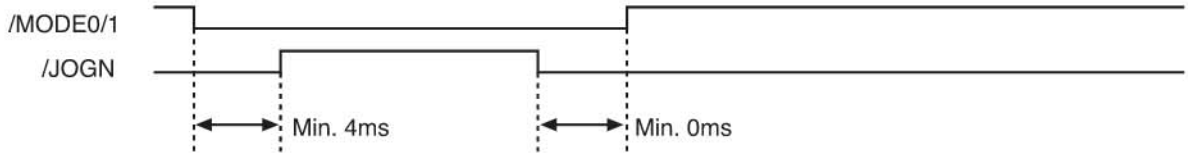
When selecting Mode 1 and starting home operation:



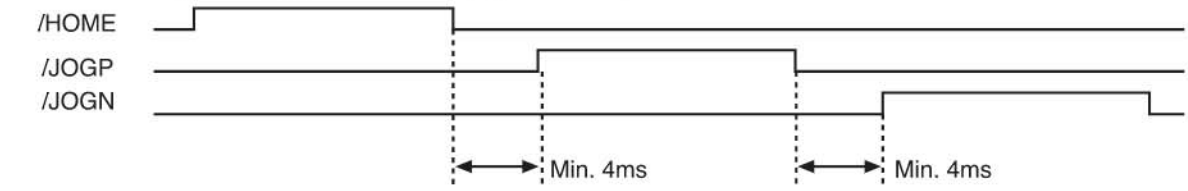
When selecting Mode 1 and starting jog forward:



When selecting Mode 1 and starting jog reverse:



When selecting home, jog forward and jog reverse operation:



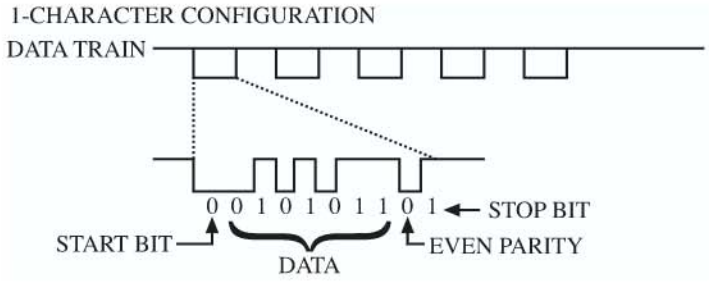
6

Serial Commands

6.1 Specifications (CN6)

Table 6.1: Specifications (CN6)

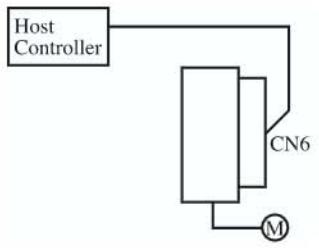
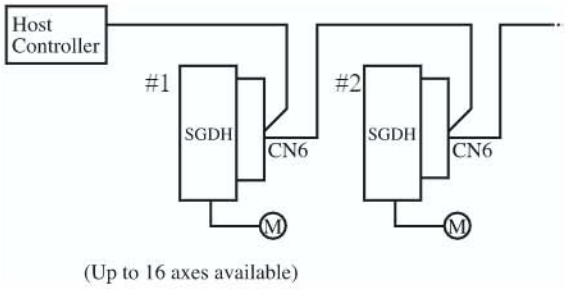
ITEMS	SPECIFICATIONS
Standard in complying with	RS232 / RS422 / RS485
Communication method	Asynchronous (ASYNC)
Baud rate	9600; 19,200; 38,400 Baud; (9,600 Baud setting at shipping)
Start bit	1 bit
Data	7 bits, ASCII Code
Parity	1 bit Even
Stop bit	1 bit
XON / XOFF Control	Not Available
DTR/SDR Control	Not Available
RTS/CTS Control	Not Available
Echo Back	Available



6.2 Control Configuration

6.2.1 Control Overview

Table 6.2:

	Single-Axis Control	Multi-Axis Control
Outline		 (Up to 16 axes available)
Initial Settings	◊ Protocol, Pn800 ◊ Baud Rate, Pn801 ◊ Axis Address, ADRS	◊ Protocol ◊ Baud Rate ◊ Axis Address

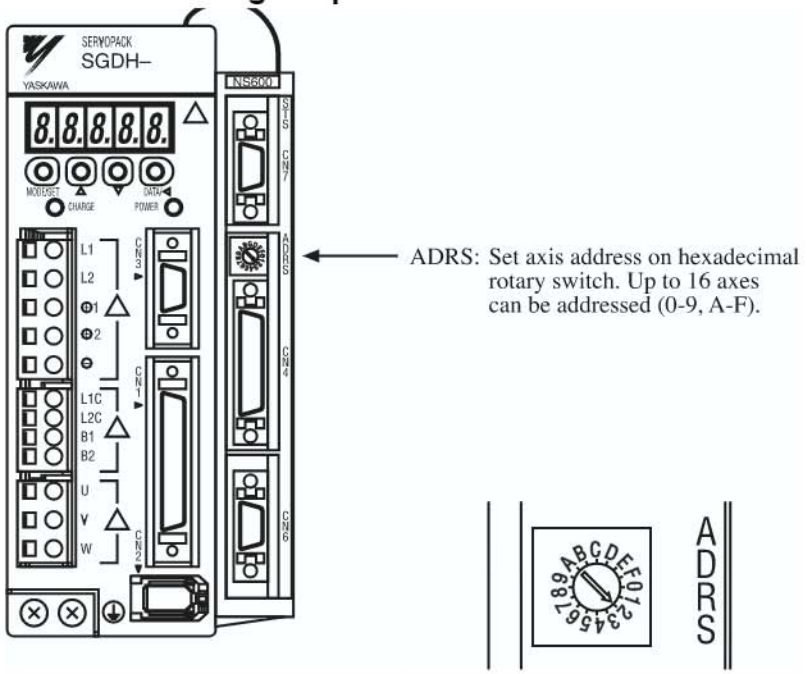
6.2.2 Serial Communication Parameters

The following parameters are used to set-up the communication protocol, baud rate and command response.

PARAMETER	DESCRIPTION	Setting	DEFAULT
Pn800	Protocol	0 = RS422 (RS232) 1 = RS422 + Echo Back (RS232 + Echo Back) 2 = RS485 Delimiter CR 3 = RS485 Delimiter CR + Echo Back per Character 4 = RS485 Delimiter CR + Echo Back per Command 5 = RS485 Delimiter CR LF 6 = RS485 Delimiter CR LF + Echo Back per Character 7 = RS485 Delimiter CR LF + Echo Back per Command	1
Pn801	Baud Rate	0 = 9,600 1 = 19,200 2 = 38,400	0
Pn802	Answer	0 = No Answer 1 = OK = Answer	1

Note: 1. For RS232 set Pn800 to 0 or 1
2. Echo Back is not available for global address, *, regardless of parameter setting.
3. Answer is not sent back for global address, *, regardless of parameter setting.

6.2.3 Axis Address Setting Graph



6.3 Command Transmission (Host Controller o Sigma II Indexer)

6.3.1 Command Format

Table 6.3: Transmission Method

<table>
<tr><td></td><td>Single-Axis Control</td><td colspan="2">Multi-Axis Control</td></tr>
<tr><td rowspan="2">Command</td><td colspan="3">When an axis is specified:
[AXIS NO.] [COMMAND CHARACTER LINE] [CR]
Axis No: 0-9, A-F. Only specified axis is applicable.</td></tr>
<tr><td>—</td><td colspan="2">When all axes are specified:
[*] [COMMAND CHARACTER LINE] [CR]
*Global address. All axes are applicable.</td></tr>
<tr><td>Example</td><td>1SVON [CR]
1SPD2000 [CR]
1POS10000 [CR]
1ST [CR]</td><td>1SVON [CR]
2SVON [CR]
1SPD2000 [CR]
2SPD1000 [CR]
1POS10000 [CR]
2POS15000 [CR]
*ST [CR]</td><td>Axis 1: Servo ON
Axis 2: Servo ON
Axis 1: Speed reservation
Axis 2: Speed reservation
Axis 1: Position reservation
Axis 2: Position reservation
Note: Both axes start simultaneously</td></tr>
</table>

Note: 1. An axis number or * must be specified prior to each command.
2. Commands are not case sensitive.
3. In Echo Back, add LF after CR.

6.3.2 Echo Back Response Time

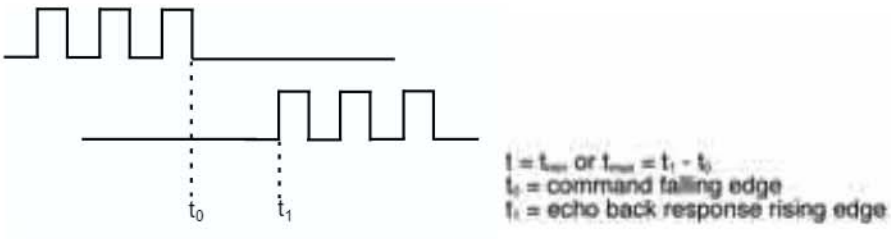


Table 6.4:

Parameter Pn800	t_{min}	t_{max}
Pn800 = 1 = RS422 + Echo Back	$-\frac{1}{(\text{baud rate X } 2)}$	$100\ \mu\text{sec} + \frac{1}{(\text{baud rate X } 2)}$
Pn800 = 3 = RS485 Delimiter CR + Echo Back per Character	$250\ \mu\text{sec} - \frac{1}{(\text{baud rate X } 2)}$	$600\ \mu\text{sec} + \frac{1}{(\text{baud rate X } 2)}$
Pn800 = 4 = RS485 Delimiter CR + Echo Back per Command		
Pn800 = 6 = RS485 Delimiter CRLF + Echo Back per Character		
Pn800 = 7 = RS485 Delimiter CRLF + Echo Back per Command		

6.4 Transmission Data (Sigma II Indexer o Host Controller)

6.4.1 Transmission Data Format

AXIS NO.	DATA CHACARTER LINE	CR	LF

Note:
1. Answers are displayed in all capital letters.
2. No answer is returned to a command when a parity error (E48E), framing error (E49E) or overrun error (E4AE) is detected.
3. No answer is returned to a command when axis address '*' (global command) is used.
4. No answer is returned if the wrong axis address is used.

6.4.2 Positive Response Format

OK	OK [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF]

No positive response, OK, returned when parameter Pn802=0.
Factory setting is Pn802=1 where a positive response, OK, is returned.

6.4.3 Negative Response Format

Other	ExxE [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF]
E56E	E56E [SP] ERR [SP] SN [CR] [LF]
E57E	E57E [SP] ERR [SP] PN [CR] [LF]
E58E	E58E [SP] ERR [SP] OV [CR] [LF]

Note: [SP]: Space (ASCII Code 20h)
[CR]: Carriage Return (ASCII Code ODh)
[LF]: Line Feed (ASCII Code OAh)

6.5 Serial Command Functions

An axis address must be assigned at the beginning of each serial command (0-F or *)

6.5.1 Basic Operation Commands

Table 6.5: Basic Operation Command

Serial Command	Function / Description	Answer
SVON	Servo ON Performs current conduction to motor. (Performs same operation as /S-ON input signal)	Positive Response: OK Negative Response: ExxE
SVOFF	Servo OFF Releases current conduction to motor. (Performs same operation as /S-ON input signal)	Positive Response: OK
ARES	Alarm Reset When the servo amplifier detects an alarm, the alarm is reset by this command.	Positive Response: Repeat OK when an alarm is OFF after execution. Repeat Alarm Code when the alarm is not OFF. ALM [SP]A. xx [SP] [CR] [LF] (xx: SGDH Alarm Code) ALM [SP]ExxA [SP] [CR] [LF] (ExxA: NS600 Alarm Code) Negative Response: No Response
RES	Reset Provides initial reset; the same condition as when control power supply is switched from OFF to ON.	Positive Response: OK Negative Response: ExxE

6.5.2 Moving Commands

Table 6.6: Moving Command

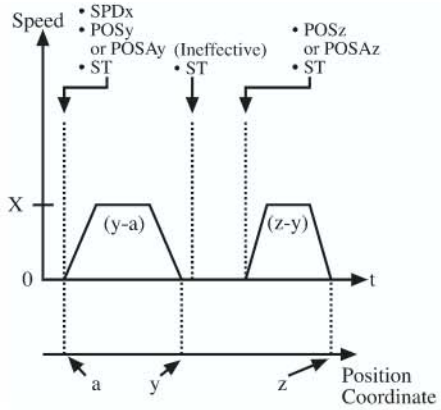
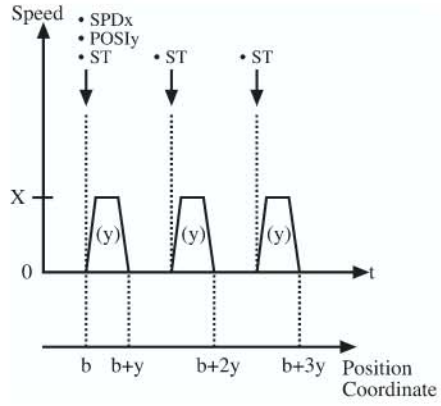
Serial Command	Function / Description	Answer
POS (±) nnnnnnnn POSA (±) nnnnnnnn (+ can be omitted)	Target Position Reservation (Absolute Position) Setting Range: -99999999 ð nnnnnnnn ð +99999999 [Reference Units] Reserves target position with absolute position. Position reference value becomes 0 when power supply is turned OFF/ON or after RES command is executed.  Note: When reserving a new position while positioning, the new position is executed with the following ST command.	Pos: OK Neg: ExxE
POSI (±) nnnnnnnn (+ can be omitted)	Target Position Reservation (Relative Position) Setting Range: -99999999 ð nnnnnnnn ð +99999999 [Reference Units] Reserves target position with relative position. Position reference becomes 0 when power supply is turned OFF/ON or after RES command is executed.  Note: When reserving a new position while positioning, the new position is executed with the following ST command	Pos: OK Neg: ExxE

Table 6.6: Moving Command

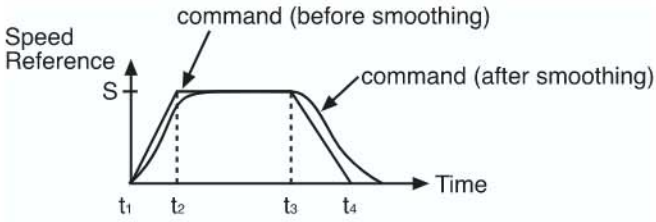
Serial Command	Function / Description	Answer
SPDnnnnnnnn	Positioning Speed Reservation Setting Range: 1 ô nnnnnnnn ô +99999999 [x1000 Reference Unit/min.] Reserves speed reference. Default speed is set in parameter, Pn81E. Speed reference value is the set value of parameter Pn81E when the power supply is turned ON or RES command is executed. Example: Reference unit = 0.01mm: When desired position is 15m/min.; 1500mm/min. / 0.01mm =1,500,000 reference units/min. = 1500 [X1000 reference units/min.] SPD1500 Note: When reserving a new speed while positioning: the new speed is reserved with the following ST command.	Pos: OK Neg: ExxE
ACCnnnnnnnn	Acceleration Reservation (Equivalent to "TRM81F =") Setting Range: 1 ô nnnnnnnn ô 99999999 [x 1000 Reference Unit/min./ms] Default acceleration is set in Pn81F.  $ACC = \frac{S}{t_2 - t_1} = \frac{[x1000\ ref.\ unit/min]}{[msec]}$ $DEC = \frac{S}{t_4 - t_3} = \frac{[x1000\ ref.\ unit/min]}{[msec]}$ Note: Smoothing Filter (Average Movement Filter) set by Pn208 = Movement Averaging Time = 0 to 6400 [0.01 msec].	Pos: OK Neg: ExxE
DECnnnnnnnn	Deceleration Reservation (Equivalent to "TRM820 =") Setting Range: 1 ô nnnnnnnn ô 99999999 [x 1000 Reference Unit/min./ms] Default deceleration is set in Pn820.	Pos: OK Neg: ExxE

Table 6.6: Moving Command

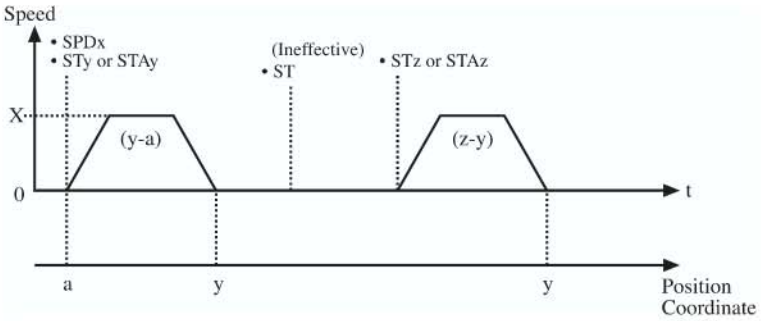
Serial Command	Function / Description	Answer
ST	Positioning Start Performs positioning defined in POS, POSA, or POSI command at speed defined by SPD. Normally, same relative positioning is repeated by repeating ST. When the positioning is interrupted with HOLD, restart it with ST. (Example) 1) SPD nnnnnnnn ...Speed reservation POS +nnnnnnnn ... Position reservation ST ... Operation start 2) POS +nnnnnnnn ... Position reservation ST ... Operates at speed which was set before. If no speed is reserved, operates at default speed set in parameter, Pn81E. Notes: 1. Error E51E will occur if no position is reserved. 2. Error E53E will occur if a ST command is sent during positioning.	Pos: OK Neg: ExxE
ST (±) nnnnnnnn STA (±) nnnnnnnn (+ can be omitted)	Positioning Start (Absolute Position) Setting Range: -99999999 δ nnnnnnnn δ +99999999 [Reference Units] Command to perform positioning to absolute position reference. Equivalent to POS± nnnnnnnn or POSA± nnnnnnnn o ST  Note: Speed set by SPD command. If no SPD command given, then default speed set in Pn81E is used.	Pos: OK Neg: ExxE

Table 6.6: Moving Command

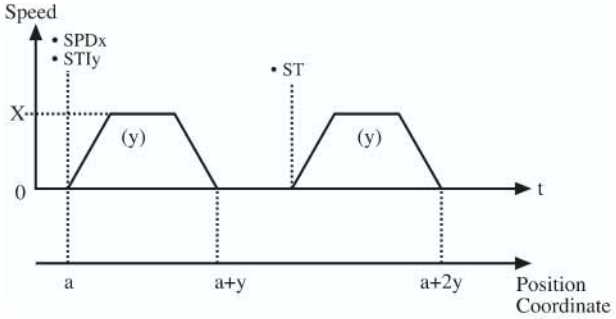
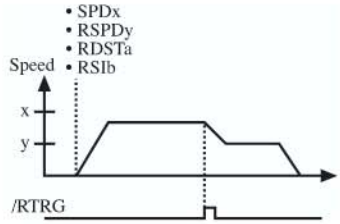
Serial Command	Function / Description	Answer
STI(±) nnnnnnnn (+ can be omitted)	Positioning Start (Relative Position) Setting Range: -99999999 ð nnnnnnnn ð +99999999 [Reference Units] Command to perform positioning to relative (incremental) position reference. Equivalent to POSI±nnnnnnnn o ST  Note: Speed set by SPD command. If no SPD command given, then default speed set in Pn81E is used.	Pos: OK Neg: ExxE
RDSTnnnnnnnn	Registration Distance Reservation Setting Range: 0 ð nnnnnnnn ð 99999999 [Reference Units] Command to set (relative) registration distance. Registration distance value becomes 0 when the power supply is turned OFF/ON or after RES command is executed. 	Pos: OK Neg: ExxE
RSPDnnnnnnnn	Registration Speed Reservation Setting Range: 1 ð nnnnnnnn ð 99999999 [x 1000 Reference Unit/min.] Command to set registration speed. Registration speed is set value of Pn81E when the power supply is turned OFF/ON or after RES command is executed.	Pos: OK Neg: ExxE

Table 6.6: Moving Command

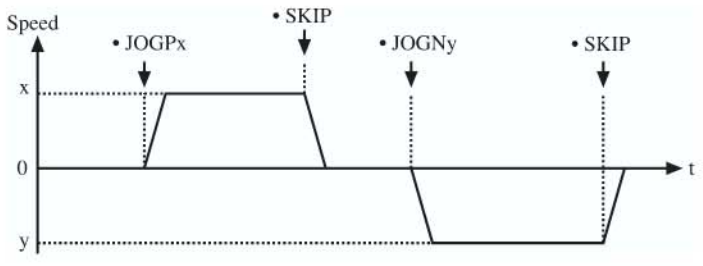
Serial Command	Function / Description	Answer
RS	Positioning Start with Registration Perform positioning defined in POS, POSA, POSI command. Normally, same relative positioning is repeated by repeating RS. When the positioning is interrupted with HOLD, restart it with RS. Also allows for registration defined by RDST (registration distance) and RSPD (registration speed). Note: 1. Error E52E will occur if no registration distance is reserved. 2. If no registration speed is reserved, speed set in Pn81E is used. 3. Registration starts only after /RGRT input becomes active.	Pos: OK Neg: ExxE
RS (±) nnnnnnnn RSA (±) nnnnnnnn (+ can be omitted)	Positioning Start with Registration (Absolute Position) Setting Range: 99999999 ô nnnnnnnn ô + 99999999 [Reference Units] Command also allows for registration. Equivalent to POS±nnnnnnnn or POSA±nnnnnnnn o RS	Pos: OK Neg: ExxE
RSI (±) nnnnnnnn (+ can be omitted)	Positioning Start (Relative) with Registration (Relative Position) Setting Range: 99999999 ô nnnnnnnn ô + 99999999 [Reference Units] Command also allows for registration. Equivalent to POSI ±nnnnnnnn o RS	Pos: OK Neg: ExxE
POUTnnnnn	POUT Reservation Command to set the 5 programmable outputs. POUT n n n n n └ /POUT0 └ /POUT1 └ /POUT2 └ /POUT3 └ /POUT4 N = Non-Active A = Active Z = Zone signal (status of output dependent on Zone Table). : = Maintains previous status.	Pos: OK Neg: ExxE
JOGPnnnnnnnn JOGNnnnnnnnn	Jog Forward/Reverse Setting Range: 1 ô nnnnnnnn ô + 99999999 [x 1000 Reference Unit/min.] Jog operation start command. JOGP: Jog forward at speed nnnnnnnn JOGN: Jog reverse at speed nnnnnnnn  	Pos: OK Neg: ExxE

Table 6.6: Moving Command

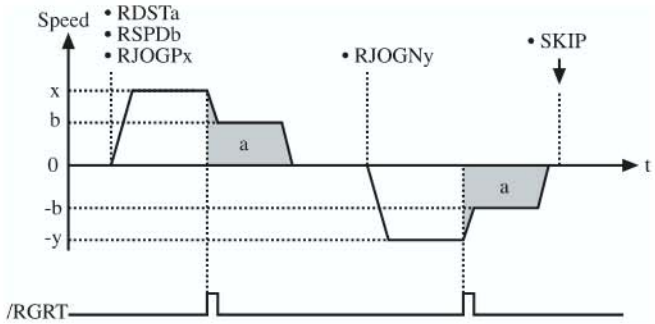
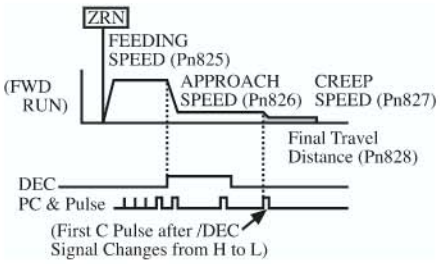
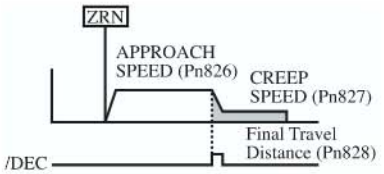
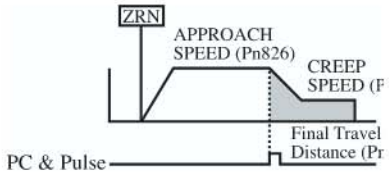
Serial Command	Function / Description	Answer
RJOGPnnnnnnnn RJOGNnnnnnnnn	Jog Forward/Reverse with Registration (Relative Position) Setting Range: 1 δ nnnnnnnn δ + 99999999 [x 1000 Reference Unit/min.] Jog operation start command. RJOGP: Jog forward at speed nnnnnnnn RJOGN: Jog reverse at speed nnnnnnnn Also allows for registration defined by RDST (registration distance) and RSPD (registration speed). Note: 1 Error E52E will occur if no registration distance is reserved. 2. If no registration speed is reserved, speed set in Pn81E is used. 3. Registration starts only after /RGRT input becomes active.  	Pos: OK Neg: ExxE

Table 6.6: Moving Command

<table>
<tr><th>Serial Command</th><th>Function / Description</th><th>Answer</th></tr>
<tr><td>ZRN</td><td>
Homing Start

Command to start zero-point return (homing) operation as shown below: Command only used for incremental encoders. Homing routine defined in parameters Pn823-Pn828.
<table>
<tr><th>Zero-point Return Method</th><th>Operation Pattern</th></tr>
<tr><td>Mode 0 (Pn823=0)
None</td><td>No homing.</td></tr>
<tr><td>Mode I (Pn823 =1)
3-step deceleration method using /DEC signal (decel LS) and C-phase pulse signal</td><td> 
</td></tr>
<tr><td>Mode II (Pn823 =2)
2-step deceleration method using /DEC signal (decel LS) only</td><td> 
</td></tr>
<tr><td>Mode III (Pn823 =3)
2-step deceleration method using C-phase pulse only</td><td> 
</td></tr>
</table>
<table>
<tr><th>Parameter No.</th><th>Name</th><th>Unit</th><th></th></tr>
<tr><td>Pn823</td><td>Homing Method</td><td colspan="2">0 = Mode 0 = No homing
1 = Mode I = /DEC and C-Phase
2 = Mode II = /DEC only
3 = Mode III = C-Phase only</td></tr>
<tr><td>Pn824</td><td>Zero-point return direction</td><td colspan="2">0: FWD direction
1: REV direction</td></tr>
<tr><td>Pn825</td><td>Zero-point feeding speed</td><td>0 to 99999999</td><td rowspan="3">x1000 reference unit/ min.</td></tr>
<tr><td>Pn826</td><td>Zero-point return approach speed</td><td>0 to 99999999</td></tr>
<tr><td>Pn827</td><td>Zero-point return creep speed</td><td>0 to 99999999</td></tr>
<tr><td>Pn828</td><td>Zero-point return final move distance</td><td>-99999999 to +99999999</td><td>reference unit</td></tr>
</table>
</td><td>Pos: OK

Neg: ExxE</td></tr>
</table>

Table 6.6: Moving Command

Serial Command	Function / Description	Answer
ZSET (±) nnnnnnnn	Coordinates Setting Setting Range: - 99999999 δ nnnnnnnn δ + 99999999 [Reference Units] Absolute PG: Re-writes machine zero-point to (±)nnnnnnnn. Incremental PG: Re-writes current position to (±)nnnnnnnn. Incremental PG: Command to re-write the current position to [±nnnnnnnn]. After execution of this command, a new coordinate becomes effective. Parameter, Pn81D Home Position is not renewed. The new coordinate is invalid after the RES command or turning ON/OFF the control power supply. Absolute PG: Command to re-write machine zero-point (absolute offset position from initial set-up position), so that current position will be [±nnnnnnnn] After execution of this command, the new coordinate becomes effective immediately. Parameter, Pn81D Home Position, saves the new offset position. The new coordinate remains valid even after the RES command or after turning OFF/ON the control power supply. Note: Pn81D is used as a home position.	Pos: OK Neg: ExxE

Table 6.6: Moving Command

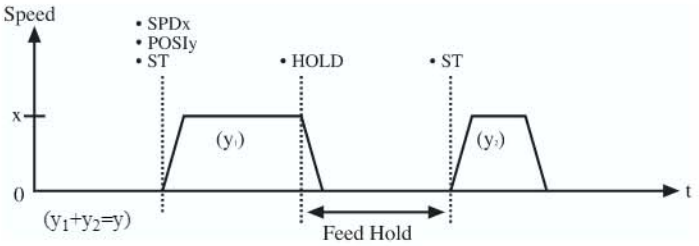
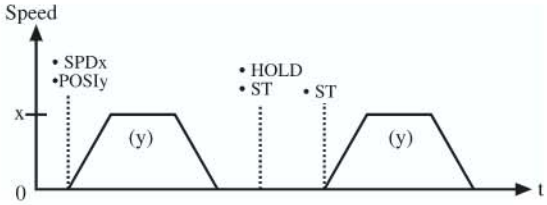
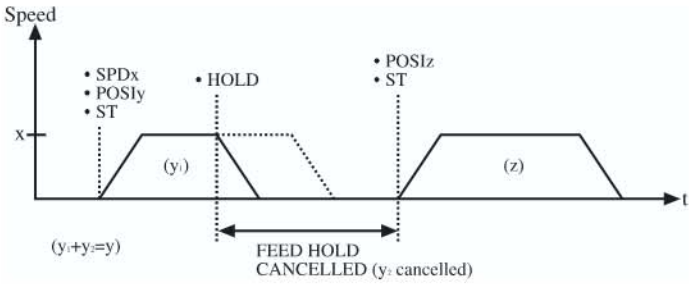
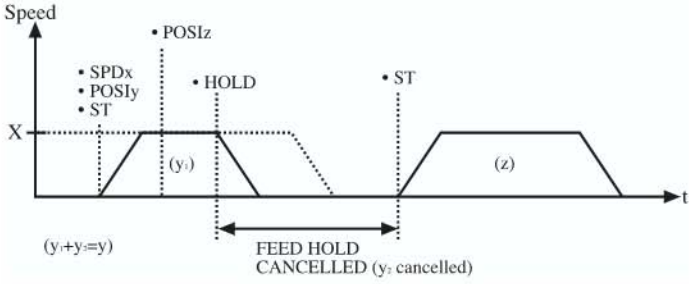
Serial Command	Function / Description	Answer
HOLD	Positioning Interruption (or Jog Stop) Command to interrupt positioning. Remaining position is held. (1) When this command is sent during positioning by ST command, operation stops at a specified deceleration. However, the remaining amount is held. (Feed hold function). The remaining position is executed by the following ST command.  (2) When HOLD command is sent during JOG operation (JOGP, JOGN) the same operation is performed as SKIP command. Motor decelerates to a stop. (3) When HOLD and ST commands are sent after positioning complete, no move is executed. Repeat positioning with an additional ST command.  (4). When reserving a new position after positioning is interrupted by HOLD command, the new positioning is executed.  (5) When reserving a new position while positioning before a HOLD command the following ST command starts positioning to the new reserved position.  	Pos: OK Neg: ExxE

Table 6.6: Moving Command

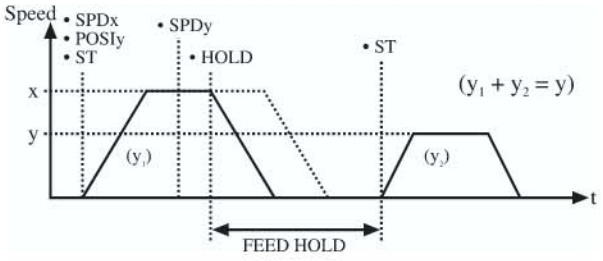
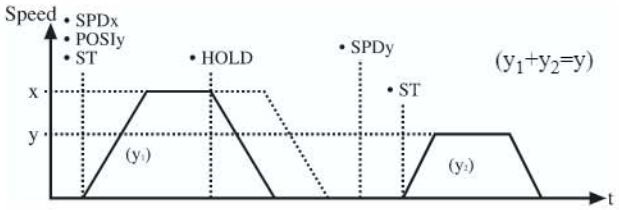
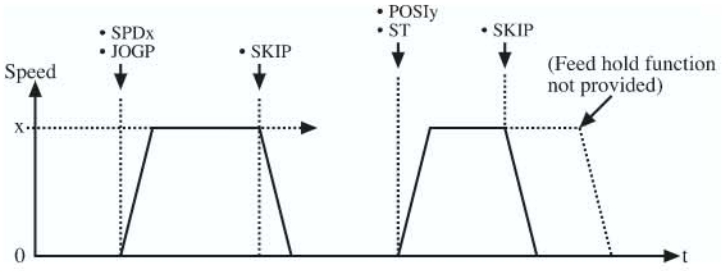
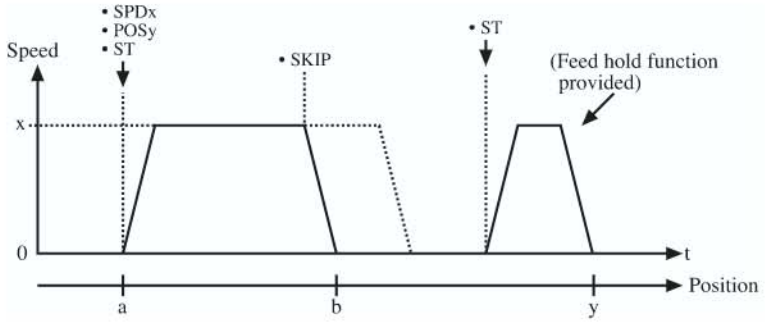
Serial Command	Function / Description	Answer
HOLD (Continued)	(6) When reserving a new speed with SPD command while positioning before a HOLD command (example 1) or after a HOLD command (example 2), the speed is reserved with positioning restart by the following ST command. (Example 1)  (Example 2)  	Pos: OK Neg: ExxE

Table 6.6: Moving Command

Serial Command	Function / Description	Answer
SKIP	Positioning Stop (or Jog Stop) Command to stop operation at specified deceleration. (1) When SKIP command is input during a jog or positioning by POSI command (relative move), the remaining position is cancelled.  (2) When SKIP command is input during positioning by POS or POSA command (absolute move), the remaining positioning is executed only by ST command after stopping.  	Pos: OK Neg: ExxE

6.5.3 Parameter Operation Commands

The following serial commands are used to monitor or re-write parameter contents.

Table 6.7: Parameter Operation Commands

Serial Command	Function/Description	Answer
PRMppp [ppp: parameter number] (0 ≤ ppp ≤ FFF)	Parameter Read Contents of parameter ppp is sent from SGDH servo amplifier. (Example) Command: 1PRM800 Response: 1PRM800=00000001	Positive Response: Return PRM81B = + 12345678 [CR] [LF] in coded decimal and 8 digits to PRM81B, PRM81C, PRM81D,PRM828. Return PRM000 = 00001234 [CR] [LF] in hexadecimal and 8 digits is back to PRM000, PRM001, PRM002, PRM003, PRM004, PRM005, PRM10B, PRM110, PRM200, PRM207, PRM408, PRM50A, PRM50B, PRM50C, PRM50D, PRM50E, PRM50F, PRM510, PRM511 PRM512, PRM080. Return PRM800 = 12345678 [CR] [LF] in decimal and 8 digits to the serial commands other than above. Negative Response: ExxE
PRMppp = nnnnnnnn [ppp: parameter number] (0 ≤ ppp ≤ FFF)	Parameter Write Re-writes parameter with parameter number ppp to (nnnnnnnn). For offline parameters, execute command RES after this command or cycle control power OFF / ON. Offline parameters: Parameter is renewed only after RES command is sent or control power supply is cycled after command. Online parameters: Parameter is renewed by parameter write-in command. Parameters are stored in EEPROM, therefore the contents are not erased if the control power supply is turned off. See also *Appendix A Parameter List* for details of online and offline parameters.	Positive Response: OK Negative Response: ExxE

Table 6.7: Parameter Operation Commands

Serial Command	Function/Description	Answer
TRMppp = nnnnnnnn [ppp: parameter number] (0 ≤ ppp ≤ FFF)	Temporary Parameter Write For applications where the online parameter is re-written frequently during operation, use this command instead of PRMppp = nnnnnnnn. Functions are the same (Number of write-in times is limited on EEPROM physical characteristic). Contents set by this command are returned to the contents set by PRMppp = nnnnnnnn command at the beginning by turning ON/OFF the control power supply or executing RES command.	Positive Response: OK Negative Response: ExxE
PRMINIT	Parameter Initialization Returns parameter settings to setting at shipping. Cycle control power OFF/ON or command RES to enable setting.	Positive Response: OK Negative Response: ExxE

6.5.4 Program Table Set-up Commands

Table 6.8: Program Table Set-up

Serial Command	Function / Description	Answer
PGMINIT	Program Initialization Returns program table settings to setting at shipping.	Positive Response: OK Negative Response: ExxE
ZONEINIT	ZONE Table Initialization Returns zone table settings to setting at shipping.	Positive Response: OK Negative Response: ExxE
JSPDINIT	JOG Speed Table Initialization Returns jog speed table setting to setting at shipping.	Positive Response: OK Negative Response: ExxE
PGMSTORE	Program Table Save Saves program table settings in Flash memory. At power ON, program table last saved by PGMSTORE is restored.	Positive Response: OK Negative Response: ExxE
ZONESTORE	ZONE Table Save Saves zone table settings in Flash memory. At power ON, zone table last saved by ZONESTORE is restored.	Positive Response: OK Negative Response: ExxE
JSPDSTORE	JOG Speed Table Save Saves jog speed table settings in Flash memory. At power ON, jog speed table last saved by JSPDSTORE is restored.	Positive Response: OK Negative Response: ExxE
POSTsss (0 ≤ sss ≤ 127)	Program Table POS Read Program table POS (target position reservation) read.	Positive Response: POST123 = STOP [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF] POST123 = A + 12345678 [CR] [LF] POST123 = I + 12345678 [CR][LF] POST123 = + INFINITE [SP] [CR] [LF] POST123 = - [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF] Negative Response: ExxE
POSTsss = nnnnnnnn (0 ≤ sss ≤ 127)	Program Table POS Write Program table POS (target position reservation) write. Settings: I± 99999999 Relative position [reference unit] A± 99999999 Absolute position [reference unit] +Infinite Equivalent to Jog forward. -Infinite Equivalent to Jog reverse. STOP Stop positioning - No positioning reservation (used for POUT reservation only). Setting at shipping: STOP	Positive Response: OK Negative Response: ExxE
SPDTsss (0 ≤ sss ≤ 127)	Program Table SPD Read Program table SPD (position speed reservation) read.	Positive Response: SPDT123 = 12345678 [CR] [LF] Negative Response: ExxE

Table 6.8: Program Table Set-up

Serial Command	Function / Description	Answer
SPDTsss = (0 ≤ sss ≤ 127)	Program Table SPD Write Program table SPD (positioning speed reservation) write. Setting: 1 ~ 99999999 Positioning speed [x1000 reference unit/min.] Setting at shipping: 1000	Positive Response: OK Negative Response: ExxE
RDSTTsss (0 ≤ sss ≤ 127)	Program Table RDST Read Program table RDST (registration distance) read.	Positive Response: RDSTT123 = 12345678 [CR] [LF] RDSTT123 = - [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF] Negative Response: ExxE
RDSTTsss = (0 ≤ sss ≤ 127)	Program Table RDST Write Program table RDST (registration distance) write. Settings: 0 ~ 99999999 Registration distance [reference unit]. - No registration Setting at shipping: -	Positive Response: OK Negative Response: ExxE
RSPDTsss (0 ≤ sss ≤ 127)	Program Table RSPD Read Program table RSPD (registration speed reservation) read.	Positive Response: RSPDT123 = 12345678 [CR] [LF] Negative Response: ExxE
RSPDTsss = nnnnnnnn (0 ≤ sss ≤ 127)	Program Table RSPD Write Program table RSPD (registration speed reservation) write. Settings: 1 ~ 99999999 Registration speed [x1000 reference unit/min]. Setting at shipping: 1000	Positive Response: OK Negative Response: ExxE
POUTTsss (0 ≤ sss ≤ 127)	Program Table POUT Read Program table POUT (programmable output reservation) read.	Positive Response: POUTT123 = ANANA [CR] [LF] Negative Response: ExxE
POUTTsss = (0 ≤ sss ≤ 127)	Program Table POUT Write Program table POUT (programmable output reservation) write. Settings: N = Non-Active A = Active Z = Zone Signal. Output status depends on Zone Table. : = Maintains previous status. Setting at shipping: :::::	Positive Response: OK Negative Response: ExxE

Table 6.8: Program Table Set-up

Serial Command	Function / Description	Answer
EVENTTsss (0 ≤ sss ≤ 127)	Program Table EVENT Read Program table EVENT (event condition) read.	Positive Response: EVENTT123 = T12345 [SP] [SP] [SP] [SP] [CR] [LF] EVENTT123 = IT12345 [SP] [SP] [SP] [CR] [LF] EVENTT123 = NT12345 [SP] [SP] [SP] [CR] [LF] EVENTT123 = DT12345 [SP] [SP] [SP] [CR] [LF] EVENTT123 = :SEL1T12345 [CR] [LF] EVENTT123 = [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF] Negative Response: ExxE
EVENTTsss = (0 ≤ sss ≤ 127)	Program Table EVENT Write Program table EVENT (event condition) write. Event conditions for execution of next program operation. Settings: I Inposition Active N Near Active D DEN (distribution end) active SELx Input signal active x= 0 ~ 4 Tn Time from start of program step [ms] n = 0 ~ 99999 ITn Time from Inposition Active [ms] n = 0 ~ 99999 NTn Time from Near Active [ms] n = 0 ~ 99999 DTn Time from DEN active [ms] n = 0 ~ 99999 SELxTn Time from Input signal active [ms] n = 0 ~ 99999 : Uses same event condition as the previous program step. Setting at shipping: IT0	Positive Response: OK Negative Response: ExxE
LOOPTsss (0 ≤ sss ≤ 127)	Program Table LOOP Read	Positive Response: LOOPT123 = 12345 [CR] [LF] Negative Response: ExxE
LOOPTsss = nnnnn (0 ≤ sss ≤ 127)	Program Table LOOP Write. Settings: 1 ~ 99999 Number of times program step is repeated. Setting at shipping: 1	Positive Response: OK Negative Response: ExxE
NEXTTsss (0 ≤ sss ≤ 127)	Program Table NEXT Read	Positive Response: NEXTT123 = 12345 [CR] [LF] NEXTT123 = END [SP] [SP] [CR] [LF] Negative Response: ExxE
NEXTTsss = nnn (0 ≤ sss ≤ 127)	Program Table NEXT Write. Setting: 0 ~ 127 Next program step. END Program end Setting at shipping: END	Positive Response: OK Negative Response: ExxE

Table 6.8: Program Table Set-up

Serial Command	Function / Description	Answer
ZONEPTzz (0 ≤ zz ≤ 31)	Zone table ZONEP (positive-side zone position limit) read.	Positive Response: ZONEPT123 = +12345678 [CR] [LF] Negative Response: ExxE
ZONEPTzz = (0 ≤ zz ≤ 31)	Zone Table ZONEP (positive-side zone position limit) Write. Setting: -99999999 ~ +99999999 Zone position limit [reference unit] Setting at shipping: 0	Positive Response: OK Negative Response: ExxE
ZONENTzz (0 ≤ zz ≤ 31)	Zone Table ZONEN (negative side zone position limit) Read.	Positive Response: ZONENT123 = +12345678 [CR] [LF] Negative Response: ExxE
ZONENTzz = nnnnnnnn (0 ≤ zz ≤ 31)	Zone Table ZONEN (negative side zone position limit) Write. Setting: -99999999 ~ +99999999 Zone position limit [reference unit] Setting at shipping: 0	Positive Response: OK Negative Response: ExxE
JSPDTdd (0 ≤ dd ≤ 15)	Jog Speed Table JSPD (jog speed reservation) Read.	Positive Response: JSPDT123 = +12345678 [CR] [LF] Negative Response: ExxE
JSPDTdd = nnnnnnnn (0 ≤ dd ≤ 15)	JOG Speed Table Write Jog Speed Table JSPD (jog speed reservation) Write. Setting: 1 ~ 99999999 Jog speed [x1000 reference unit/min] Setting at shipping: 1000	Positive Response: OK Negative Response: ExxE

sss = Program Step
zz = Zone Table ID
dd = Jog Speed Table ID

Note: 1. See also *5.7 Program Table Mode*, *5.9 Zone Table*, *5.11 Jog Speed Table* for more details.
2. Changes to program table become effective immediately. Use the PGMSTORE command to save the changes, otherwise the settings last saved by PGMSTORE will become effective on next power ON or after RES command. The same holds true for Zone Table (ZONESTORE) and Jog Speed Table (JSPDSTORE)

6.5.5 Program Table Operation Commands.

Table 6.9: Program Table Operation

Serial Command	Function / Description	Answer
START	Program Operation Restart Command restarts program step of program table last reserved by START sss. If no program step is reserved, start program step 0. Also restarts program step interrupted by STOP command. sss = Program Step	Positive Response: OK Negative Response: ExxE
STARTss 0 ô sss ô 127	Program Operation Start Starts program step sss. Command operation equivalent to /START-STOP signal input operation. sss = Program Step	Positive Response: OK Negative Response: ExxE
STOP	Program Operation Interruption Command interrupts program table operation. Command operation equivalent to /START-STOP signal input operation.	Positive Response: OK
PGMRES	Program Reset Command resets reserved program step when program operation is interrupted. Command operation equivalent to /PGMRES signal input operation.	Positive Response: OK

6.5.6 Monitor and Function Commands

Table 6.10: Monitors and Functions

Serial Command	Function / Description	Answer
ALM	Alarm or Warning Read	Positive Response: Returns one of the followings depending on its status: ALM [SP]A. xx [SP] [CR] [LF] (xx: SGDH Alarm/Warning Code) ALM[SP] ExxA [SP] [CR] [LF] (ExxA: NS600 Alarm Code) ALM [SP] P-OT [SP] [CR] [LF] ALM [SP] N-OT [SP] [CR] [LF] ALM [SP] P-LS [SP] [CR] [LF] ALM [SP] N-LS [SP] [CR] [LF] ALM [SP] BB [SP] [SP] [SP] [CR] [LF] ALM [SP] HOLD [SP] [CR] [LF] ALM [SP] INPOS [CR] [LF] ALM [SP] NEAR [SP] [CR] [LF] ALM [SP] RUN [SP] [SP] [CR] [LF] ALM [SP]. [SP] [SP] [SP] [SP] [CR] [LF]
ALMn (0 ô n ô 9)	Alarm History Read	Positive Response: Returns one of the following: ALM1 = NONE [CR] [LF] No Alarm. ALM1 = A. xx [CR] [LF] Specific SGDH alarm. ALM1 = ExxA [CR] [LF] Specific NS600 alarm. Negative Response: ExxE
ERR	Error Read Displays only the latest error	Positive Response: Returns one of the following: ERR [SP] NONE [SP] [CR] [LF] No error. ERR [SP] ExxE [SP] [CR] [LF] Specific error.
IN1	SGDH Input Signal Monitor	Positive Response: IN1 = 01010101 [CR] [LF] : Photocoupler OFF 1: Photocoupler ON bit 0: /S-ON bit 1: /SEL5 bit 2: P-OT bit 3: N-OT bit 4: /DEC bit 5: /SEL6 bit 6: /RGRT bit 7: 0 (fixed) Note: Response sent as characters, not as one byte.

Table 6.10: Monitors and Functions

Serial Command	Function / Description	Answer
IN2	NS600 Input Signal Monitor	Positive Response: IN2 = 01010101 [CR] [LF] □: Photocoupler OFF 1: Photocoupler ON bit 0: MODE 0/1 bit 1: /START-STOP;/HOME bit 2: /PGMRES;/JOGP bit 3: /SEL0;/JOGN bit 4: /SEL1;/OG0 bit 5: /SEL2;/JOG1 bit 6: /SEL3;/JOG2 bit 7: /SEL4;/JOG3 Note; Response sent as characters, not as one byte.
IN2TESTbbbbbbbb	NS600 Side Input Signal Reservation (00000000 δ bbbbbbbb δ 11111111) 0: Photocoupler OFF 1: Photocoupler ON bit 0: /MODE 0/1 bit 1: /START-STOP;/HOME bit 2: /PGMRES;/JOGP bit 3: /SEL0;/JOGN bit 4: /SEL1;/OG0 bit 5: /SEL2;/JOG1 bit 6: /SEL3;/JOG2 bit 7: /SEL4;/JOG3 Send IN2TESTEND to recognize CN4 inputs. Note: Sigma II Indexer inputs (CN4-3, 5, 7, 9, 11, 13, 15, 17) are not recognized when the IN2TESTbbbbbbbb command is used. Cycle power to re-enable these inputs.	Positive Response: OK Negative Response: ExxE Return Error E56E when bbbbbbbb is less than 8 digits.
POUT	POUT Monitor	Positive Response: OK POUT [SP] ANANA [CR] [LF] A: output active N: output inactive Z: output dependent upon zone table bit 0: /POUT 0 bit 1: /POUT 1 bit 2: /POUT 2 bit 3: /POUT 3 bit 4: /POUT 4

Table 6.10: Monitors and Functions

Serial Command	Function / Description	Answer
OUT 1	SGDH Side Output Signal Monitor	Positive Response: OUT1 = 01010101 [CR] [LF] 0: Photocoupler OFF 1: Photocoupler ON bit 0: ALM bit 1: /WRN bit 2: /BK bit 3: /S-RDY bit 4: AL01 bit 5: AL02 bit 6: AL03 bit 7: 0 (fixed) Note: Response sent back as characters, not as one byte.
OUT 2	NS600 Side Output Signal Monitor	Positive Response: OUT2 = 01010101 [CR] [LF] 0: Photocoupler OFF 1: Photocoupler ON bit 0: /INPOSITION bit 1: /POUT0 bit 2: /POUT1 bit 3: /POUT2 bit 4: /POUT3 bit 5: /POUT4 bit 6: 0 (fixed) bit 7: 0 (fixed) Note: Response sent back as characters, not as one byte.
OUT2TESTbbbbbb	NS600 Side Output Signal Reservation (000000 ô bbbbbb ô 111111) O: Photo Coupler OFF 1: Photo Coupler ON bit 0: /INPOSITION bit 1: /POUT0 bit 2: /POUT1 bit 3: /POUT2 bit 4: /POUT3 bit 5: /POUT4 bit 6: 0 (fixed) bit 7: 0 (fixed) Send OUT2TESTEND to recognize CN4 outputs.	Positive Response: OK Negative Response: ExxE Return Error E56E when bbbbbbbb is less than 8 digits.
MONn (1 ô n ô 11)	Monitor Read Same as the following STS/MON1 ~ RDST/MON11 monitors.	Positive Response: Same as STS ~ RDST. Negative Response: ExxE
PUN or MON1	Current Issue (commanded) Position Monitor [reference units]	Positive Response: PUN = + 12345678 [CR] [LF]

Table 6.10: Monitors and Functions

Serial Command	Function / Description	Answer
PER or MON2	Position Error Monitor [reference units]	Positive Response: PER = + 12345678 [CR] [LF] Negative Response: ExxE
NFB or MON3	Motor Speed Monitor [rpm]	Positive Response: NFB = + 12345678 [CR] [LF] Negative Response: ExxE
NREF or MON4	Speed Reference Monitor [rpm]	Positive Response: NREF = + 12345678 [CR] [LF] Negative Response: ExxE
TREF or MON5	Torque Reference Monitor [% rated torque]	Positive Response: TREF = + 12345678 [CR] [LF] Negative Response: ExxE
STS or MON6	Status Flag Monitor	Positive Response: STS = 1010101 [CR] [LF] bit 0: 1 in INPOSITION bit 1: 1 in NEAR bit 2: 1 in DEN (Command Position Complete) bit 3: 1 in HOLD or Program Interruption bit 4: 1 in Program Operation in Progress bit 5: 1 in Current Limitation bit 6: 1 when Main Power ON Note: Response sent as characters, not as one byte.
PFB or MON7	Current Motor (actual) Position Monitor [reference units]	Positive Response: PFB = + 12345678 [CR] [LF]
POS or MON8	Target Position Monitor [reference units]	Positive Response: POS = + 12345678 [CR] [LF] When using an incremental position reference, monitor shows target position (absolute position from 0).
DST or MON9	Target Distance Monitor [reference units]	Positive Response: DST = + 12345678 [CR] [LF] When using an incremental position reference, monitor shows reserved relative distance.
RPOS or MON10	Registration Target Position Monitor [reference units]	Positive Response: RPOS = + 12345678 [CR] [LF]
RDST or MON11	Registration Target Distance Monitor [reference units]	Positive Response: RDST = 12345678 [CR] [LF]

Table 6.10: Monitors and Functions

Serial Command	Function / Description	Answer
PGMSTEP	Program PGMSTEP Pass Through Monitor Displays the current program step in progress	Positive Response: PGMSTEP = + 12345 [CR] [LF]
EVTIME	Program EVENT Lapse of Time Monitor [ms] Displays elapsed time of event condition time delay.	Positive Response: EVTIME = + 12345 [CR] [LF]
LOOP	Program LOOP Pass Through Monitor Displays current loop of program step in progress	Positive Response: LOOP = + 12345 [CR] [LF]
TRMS	RMS Torque Monitor [%] Value for the rated torque as 100%. Displays effective torque in 10 second cycles.	Positive Response: TRMS = +12345678 [CR] [LF] Negative Response: ExxE
RGRMS	Regenerative Load Ratio Monitor [%] Value for the processable regenerative power as 100%. Displays effective power in 10 second cycles.	Positive Response: RGRMS = +12345678 [CR] [LF] Negative Response: ExxE
DBRMS	DB Load Ratio Monitor [%] Value for the processable power when dynamic brake is applied as 100%. Displays effective power in 10 second cycles.	Positive Response: DBRMS = +12345678 [CR] [LF] Negative Response: ExxE
VER	NS600 Software Version Display	Positive Response: VER = 00001234 [CR] [LF] (Display in Hexadecimal)
SVTYPE	SGDH Type Code (xx02H) Display	Positive Response: SVTYPE: 00001234 [CR] [LF] (Display in Hexadecimal) Negative Response: ExxE

Table 6.10: Monitors and Functions

Serial Command	Function / Description	Answer
MTTYPE	Motor Type Display	Positive Response: MTTYPE = 00000001 [CR] [LF] (Display in Hexadecimal) Voltage / Servomotor Model 00 = 100VAC / 00 = SGMAH 01 = 200VAC / 01 = SGMPH 02 = 400VAC / 02 = SGMSH 03 = SGMG 06 = SGMUH Negative Response: ExxE
MTSIZE	Motor Capacity Display [x 10W]	Positive Response: MTSIZE = 12345678 [CR] [LF] (Display in Hexadecimal) Negative Response: ExxE
PGTYPE	PG Type Display	Positive Response: MTSIZE = 00000110 [CR] [LF] (Display in Hexadecimal) 000D = 13-bit incremental 0011 = 17-bit incremental 0110 = 16-bit absolute 0111 = 17-bit absolute Negative Response: ExxE
SVYSPEC	SGDH Y Spec. No. Display	Positive Response: SVYSPEC = 12345678 [CR] [LF] Negative Response: ExxE
SVVER	SGDH Software Version Display	Positive Response: VER = 00001234 [CR] [LF] (Display in Hexadecimal) Negative Response: ExxE
PGVER	PG Software Version Display	Positive Response: VER = 00001234 [CR] [LF] (Display in Hexadecimal) Negative Response: ExxE
TYPE	NS600 Type Code (0600H) Display	Positive Response: TYPE = 00001234 [CR] [LF] (Display in Hexadecimal)
YSPEC	NS600 Y Spec. No. Display	Positive Response: YSPEC = 12345678 [CR] [LF]
STIFF	Rigidity Monitor	Positive Response: STIFF = 12345 [CR] [LF] Negative Response: ExxE
STIFFd	Rigidity Reservation (1 ô d ô 10)	Positive Response: OK Negative Response: ExxE

Table 6.10: Monitors and Functions

Serial Command	Function / Description	Answer
ABSPGRES	Absolute PG Reset	Positive Response: OK Negative Response: ExxE
MLTLIMSET	Multi Turn Limit Setting	Positive Response: OK Negative Response: ExxE
ALMTRCCLR	Alarm Trace Clear	Positive Response: OK Negative Response: ExxE
INERTIA	Auto-tuning Inertia Display	Positive Response: INERTIA = 12345 [CR] [LF] Negative Response: ExxE
TUNESTORE	Auto-tuning Inertia Save	Positive Response: OK Negative Response: ExxE
CURZERO	Motor Current Zero Adjustment	Positive Response: OK Negative Response: ExxE

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7

Using the Digital Operator

7.1 Basic Operation

This section provides information on the basic operation of the digital operator for setting operating conditions. All parameter settings and motor operations can be executed by simple, convenient operations.

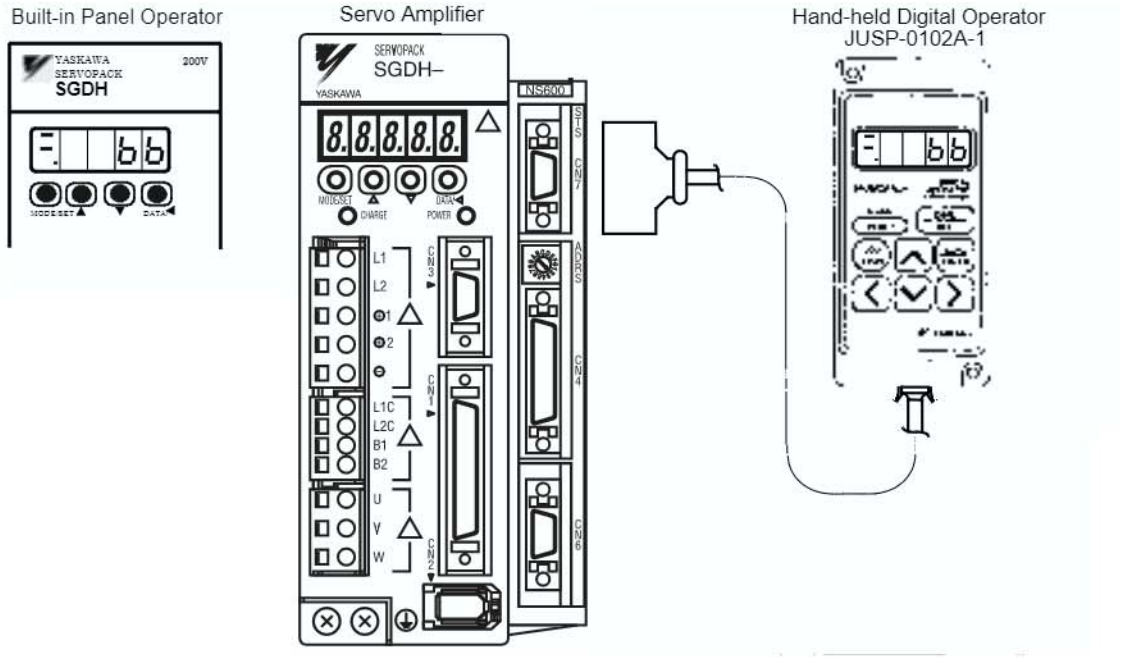
Additional information on using the digital operator is available in engineering document "Using the Digital Operator with the Sigma II Indexer" (pub. #eng/01.054/MCD).

Also, refer to the Sigma II User's Manual for information on using the digital operator with the SGDH servo amplifier.

7.1.1 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 servo amplifier. This type of digital operator is also called a panel operator. The other one is a hand-held operator (i.e., the JUSP-OP02A-1 digital operator), which can be connected to either the servo amplifier through connector CN3 or to the indexer through connector CN7. Only the servo amplifier's parameters, monitors, and functions can be accessed when using the built-in operator or the digital operator connected through connector CN3. However, all of the parameters, monitors, and functions of both the servo amplifier and indexer, including the indexers tables, can be accessed from the digital operator connected through connector CN7.

There is no need to turn OFF the servo amplifier to connect this hand-held operator to the servo amplifier. Refer to the following illustrations to connect the hand-held digital operator to the servo amplifier.

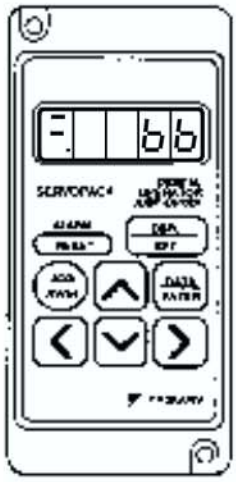


Note: If the hand-held digital operator is connected to the servo amplifier or indexer, the built-in panel operator does not display anything.

7.1.2 Functions

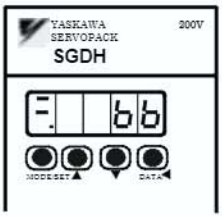
The digital operator can be used for parameter settings, operating references, and status displays.

This section provides information on the keys and their functions available from the initial displays.



Key	Name		Function
	RESET Key		Press this key to reset the servo alarm
	DSPL/SET Key		• Press this key to select the status display mode, auxiliary function mode, parameter setting mode, or monitor mode. • This key is used for data selection in parameter setting mode
	DATA/ENTER Key		Press this key to set each parameter or display the set value of each parameter.
	Value Change/ JOG Key	**Up Arrow** Key	Press this key to increase the set value. This key is used as a forward start key in JOG operation.
		Down Arrow Key	Press this key to decrease the set value. This key is used as a reverse start key in JOG operation.
	Digit Select Key	**Right Arrow** Key	• Press this key to select the digit to be changed. The selected digit flashes. • Press the **Right Arrow** key to shift to the next digit on the right. • Press the **Left Arrow** key to shift to the next digit on the left.
		Left Arrow Key	
	SVON Key		Press this key to perform the JOG operation with the digital operator.

Built-in Panel Operator



Key	Name	Function
	**Up Arrow** Key	• Press this key to set parameters or display the set values of parameters. • Press the **Up Arrow** key to increase the set value. • Press the **Down Arrow** key to decrease the set value. • Press the **Up** and **Down Arrow** keys together to reset a servo alarm.
	**Down Arrow** Key	
	**MODE/SET** Key	Press this key to select the status indicator mode, auxiliary function mode, parameter setting mode, or monitor mode.
	**DATA/SHIFT** Key	• Press this key to set each parameter or display the set value of each parameter. • This key is used for selecting the editing (flashing) digit or data setting.

Note: The panel display may be blank for up to 3 minutes each time control power is applied. The servo system is still operational. Monitor the STS status LED for alarm conditions.

7.1.3 Resetting Servo Alarms

Servo alarms can be reset using the digital operator.

Using the Hand-Held Digital Operator

Press the **RESET** key in status display mode.
Only SGDH servo amplifier alarms can be cleared by the digital operator connected through connector CN3. All alarms can be cleared by the digital operator connected through connector CN7.

The servo alarm will be reset if the control power supply is turned OFF.

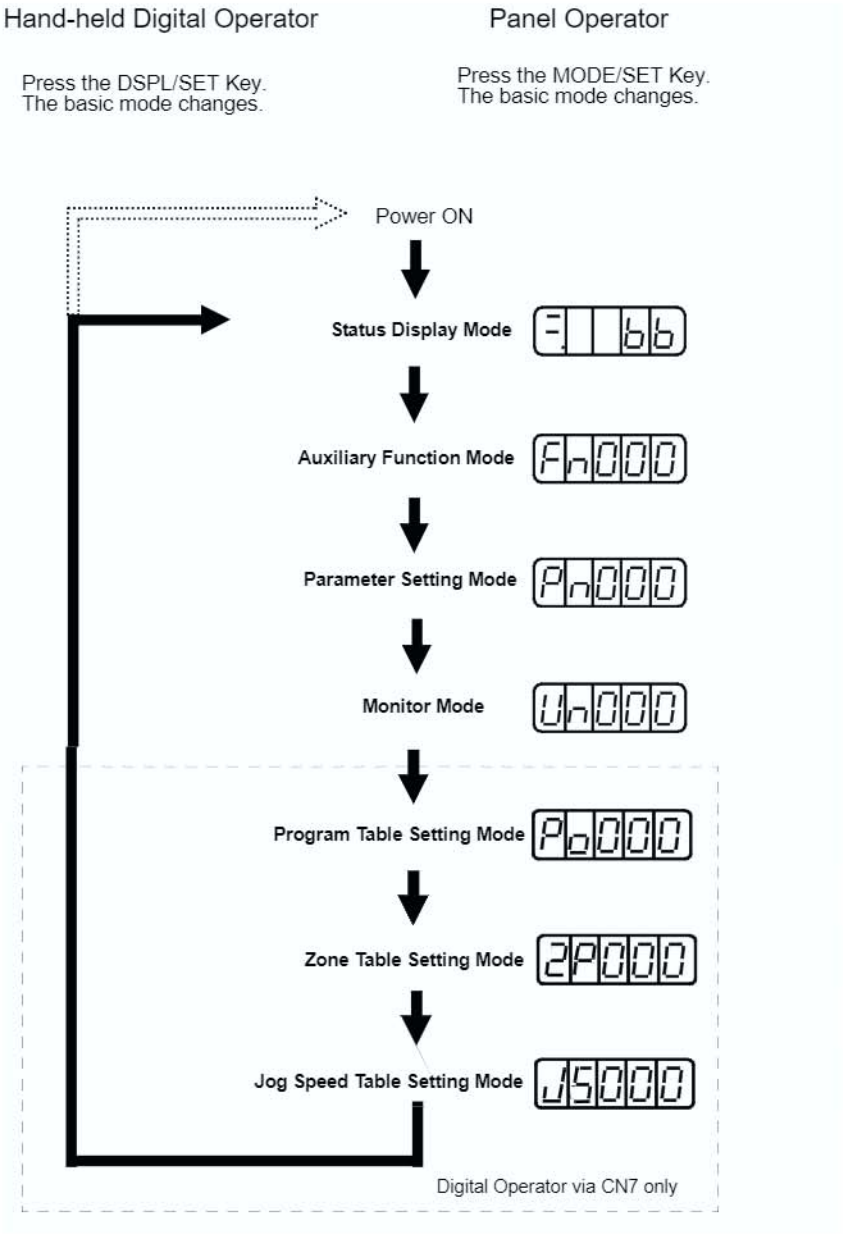
IMPORTANT

- If an alarm is ON, reset the alarm after eliminating the cause of the alarm first. Refer to *Chapter 9 Troubleshooting.*

7.1.4 Basic Mode Selection

The basic mode selection of the digital operator is used for indicating the status of the servo amplifier and indexer in operation and setting a variety of parameters and operation references.

The status display, auxiliary function, parameter setting, monitor modes, and table settings are the basic modes. As shown below, the mode is selected in the following order by pressing the key.



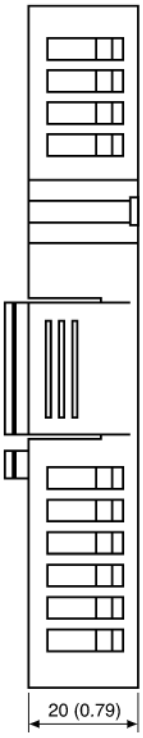
Additional information regarding each mode is available in engineering document, "Using the Digital Operator with the Sigma II Indexer" (pub.#eng/01.054/MCD)

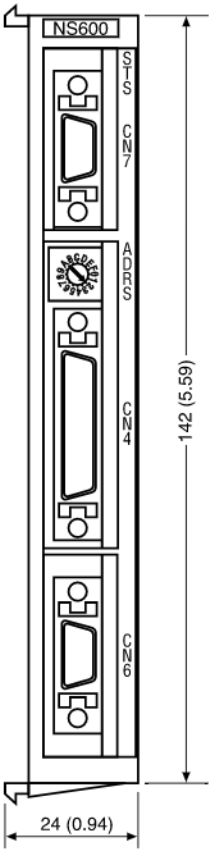
8

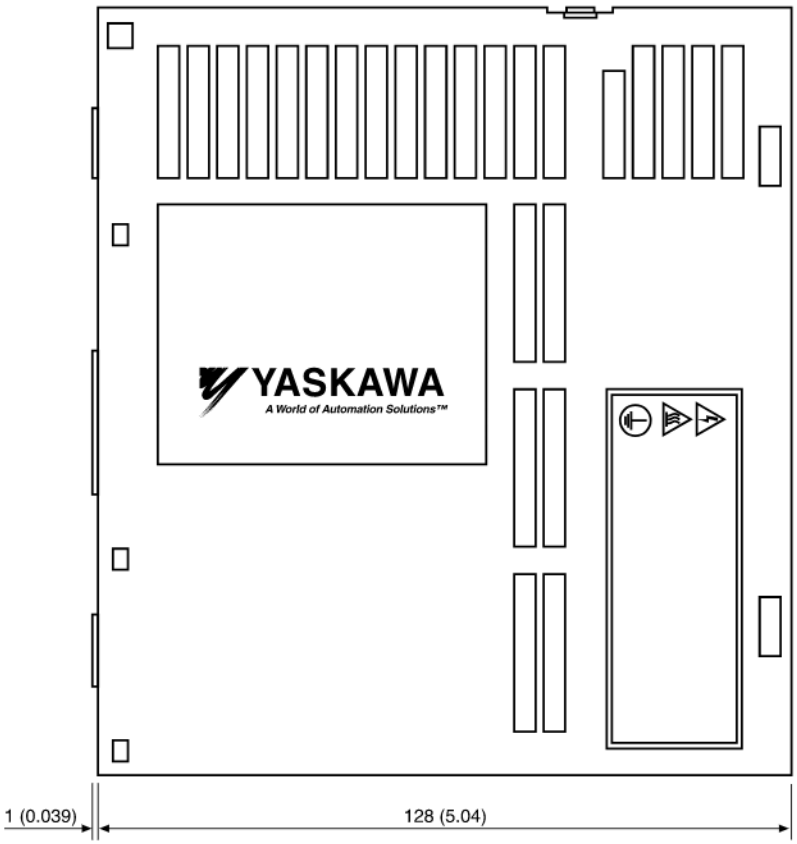
Dimensional Drawings

8.1 Dimensions of the JUSP-NS600 Indexer are shown below.

Dimensional Drawing Units in mm (inches).







Approximate mass: 0.2 Kg (0.44 lb.)

9

Troubleshooting

9.1 Troubleshooting Problems with No Alarm Display

Use the tables below to identify the cause of a problem that causes no alarm display and follow the described corrective procedure.

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

Contact Yaskawa if the problem cannot be solved by carefully following the described procedure.

Table 9.1: Troubleshooting Table with No Alarm Display

Symptom	Cause	Comment	Solution
Servomotor does not start	Power not connected	Check voltage between power supply terminals.	Correct the power circuit.
	Loose connection	Check terminals of connectors (CN1, CN2, CN4, CN6).	Tighten any loose parts.
	Connector (CN1, CN4, CN6) external wiring incorrect	Check connector (CN1, CN4, CN6) 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.
	Servo not enabled	—	Turn /S-ON input ON or use the SVON command
	P-OT and N-OT inputs are turned OFF.	Refer to section *5.2.2*.	Turn P-OT and N-OT input signals ON.
	Software position limit (P-LS or N-LS) reached.	Check error code from JUSP-NS600	Check position of motor and move off of the position limit.
	No position reference	Check error code from JUSP-NS600	Reserve a position reference before a program start.
Servomotor moves suddenly, then stops	Servomotor or encoder wiring incorrect.	—	Refer to Chapter 3 of Sigma II Servo System User's Manual.
Unstable servomotor speed.	Defective wiring connection to the motor.	Check the connections of the power lead (U-, V-, and W-phases) and the encoder connectors.	Tighten any loose terminals or connectors
Servomotor vibrates at approximately 200 to 400Hz.	Speed loop gain value too high.	—	Reduce speed loop gain (Pn100) preset value.
High rotation speed overshoot on starting and stopping.	Speed loop gain value 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 the value of parameter Pn100 (speed loop gain). Reduce the integration time constant (Pn101).

Symptom	Cause	Comment	Solution
Servomotor over-heated	Ambient temperature too high	Measure servomotor ambient temperature.	Reduce ambient temperature to 40ºC maximum.
	Servomotor surface 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	Incorrect mechanical mount-ing	Servomotor mounting screws loose?	Tighten mounting screws.
		Coupling not centered?	Center coupling.
		Coupling unbalanced?	Balance coupling.
	Bearing defective	Check noise and vibration near bearing.	Consult your Yaskawa represen-tative if defective.
	Machine causing vibrations	Foreign object intrusion, dam-age, or deformation of sliding parts of machine.	Consult with machine manufac-turer.

9.2 Sigma II Indexer Status Display Table

9.2.1 Sigma II Indexer Alarm Status Display Table

Indexer Status	Status[1] Code	Panel[2] Display	Detail	ALM[3] Output	/WARN[4] Display	Motor Operation	Reset[5]
Alarm[3]	A.xx	A.xx	SGDH Alarm Activation Alarm[3]	Follow SGDH	OFF	Servo OFF	Follow SGDH
	CPF00	A.E0	Internal Flash Memory Alarm (Detected only during initialization)	OFF	OFF	Servo OFF	NO
	E12A	A.EF	Firmware Execution Alarm	OFF	OFF	Servo OFF	NO
	E13A	A.EF	Firmware Version Unmatched (Only during initialization) Firmware version does not match hardware version.	OFF	OFF	Servo OFF	NO
	E14A	A.EF	Parameter Checksum Alarm (Detected only during initialization)	OFF	OFF	Servo OFF	NO
	E15A	A.EF	Parameter Version Unmatched (Detected only during initialization) Parameter version does not match firmware version	OFF	OFF	Servo OFF	NO
	E16A	A.EF	Parameter "Out of Range" Alarm (Detected only during initialization) Value set in parameter is out of range. Example: If Pn81D = Home Position exceeds Pn81B= P-LS or Pn81C =N-LS when Pn81A Moving Method = 1, 2 or 3, then alarm E16A will occur.	OFF	OFF	Servo OFF	NO
	E17A	A.E0	Initial Communication Alarm between NS600 and SGDH (Detected only during initialization) Communication between SGDH and NS600 failed during initialization. Example: In the case of an absolute encoder, if CN3 is being used at power-on, the alarm E17A will occur. NS600 cannot get the initial absolute position data from SGDH when CN3 is in use.	OFF	OFF	Servo OFF	NO
	E18A	A.E2	Communication (after initialization) Alarm between NS600 and SGDH Communication between SGDH and NS600 failed. Watchdog timer checks communication between NS600 and SGDH.	OFF	OFF	Servo OFF	YES

9.2.1 Sigma II Indexer Alarm Status Display Table

Indexer Status	Status[1] Code	Panel[2] Display	Detail	ALM[3] Output	/WARN[4] Display	Motor Operation	Reset[5]
Alarm[3]	E19A	A.EF	Program Checksum Alarm (Detected only during initialization) Example: Power loss during PGM-STORE, results in corrupt program table.	OFF	OFF	Servo OFF	YES
	E1AA	A.EF	Program Version Unmatched (Detected only during initialization) Index table version does not match firmware version.	OFF	OFF	Servo OFF	YES
	E1BA	A.EF	Program "Out of Range" Alarm (Detected only during initialization) Value set in program table is out of range.	OFF	OFF	Servo OFF	YES
	E1CA	A. EF	ZONE Table Checksum Alarm (Detected only during initialization)	OFF	OFF	Servo OFF	YES
	E1DA	A. EF	ZONE Table Version Unmatched (Detected only during initialization) Zone table version does not match firmware version.	OFF	OFF	Servo OFF	YES
	E1EA	A. EF	ZONE Table "Out of Range" Alarm (Detected only during initialization) Value set in zone table is out of range.	OFF	OFF	Servo OFF	YES
	E1FA	A. EF	JOG Speed Table Checksum Alarm (Detected only during initialization)	OFF	OFF	Servo OFF	YES
	E21A	A. EF	JOG Speed Table Version Unmatched (Detected only during initialization) Jog speed table version does not match firmware version.	OFF	OFF	Servo OFF	YES
	E22A	A. EF	JOG Speed Table "Out of Range" Alarm (Detected only during initialization) Value set in jog speed table is out of range.	OFF	OFF	Servo OFF	YES
	E23A	A.EF	Insufficient Registration Distance Alarm The reserved registration distance is too small compared to the distance it takes the motor to decelerate to the reserved registration speed.	OFF	OFF	Servo OFF	YES

Notes:

1. Status Codes are displayed via the Sigma II Indexer JUSP-NS600. (CN7-digital operator, CN6-response to serial commands ALM and ERR or denial response to other commands).

2. The Panel Display is the built-in panel display on the SGDH Servo Amplifier. The panel display may be deleted depending on the communication status between the SGDH and the JUSP-NS600.

3: OFF: Output transistor is OFF = Alarm status
ON: Output transistor is ON = No alarm.
Alarms continue to keep their status until they are released.

4. OFF: Output transistor is OFF= No error/warning.
ON: Output transistor is ON = Error/Warning Status.
Errors and Warnings are displayed for 2 seconds only.

5. Some alarms cannot be reset by the panel display, digital operator, or serial command ARES. Eliminate the cause of the alarm and then cycle the power supply to reset the alarms.

6. A.9x is a SGDH Warning code. Refer to *8.3.1 SGDH Servo Amplifier Alarm Display Table*.

9.2.2 Sigma II Indexer Error/Warning Status Display Table

Indexer Status	Status[1] Code	Panel[2] Display	Detail	ALM[3] Output	/WARN[4] Display	Motor Operation
Error[4]	E41E	A.9F	Program Table Save Failure Error	ON	ON	No Change
	E42E	A.9F	ZONE Table Save Failure Error	ON	ON	No Change
	E43E	A.9F	JOG Speed Table Save Failure Error	ON	ON	No Change
	E44E	A.9F	Program Table Checksum Error	ON	ON	No Change
	E46E	A.9F	JOG Speed Table Checksum Error	ON	ON	No Change
	E47E	A.9F	Serial Communication Receiving Buffer Overflow Error Buffer has a 100 command capacity. If overflow error occurs, then all commands stored in the buffer are cleared.	ON	ON	No Change
	E48E	A.9F	Serial Communication Parity Error	ON	ON	No Change
	E49E	A.9F	Serial Communication Framing Error	ON	ON	No Change
	E4AE	A.9F	Serial Communication Overrun Error	ON	ON	No Change
	E4BE	A.9F	Moving Disable Error due to P-OT	ON	ON	No Change
	E4CE	A.9F	Moving Disable Error due to N-OT	ON	ON	No Change
	E4DE	A.9F	Moving Disable Error due to P-LS	ON	ON	No Change
	E4EE	A.9F	Moving Disable Error due to N-LS	ON	ON	No Change
	E4FE	A.9F	Position Reference "Out of Range" Error	ON	ON	No Change
	E51E	A.9F	Position Non Reservation Error A position must be reserved before a ST command.	ON	ON	No Change
	E52E	A.9F	Registration Distance Non Reservation Error A registration distance (RDST) must be reserved before a RS command.	ON	ON	No Change
	E53E	A.9F	Move Reference Duplication Error New positioning move command sent before previous commanded positioning move complete. Previous commanded positioning move must be complete before commanding a new positioning move.	ON	ON	No Change

9.2.2 Sigma II Indexer Error/Warning Status Display Table

Indexer Status	Status[1] Code	Panel[2] Display	Detail	ALM[3] Output	/WARN[4] Display	Motor Operation
Error[4]	E54E	A.9F	Servo ON Incomplete Error Servo is not enabled. Turn servo on.	ON	ON	No Change
	E55E	A.9F	Servo ON Failure Error SGDH failed to turn ON servo. Check to see if main power is ON or if SGDH is in the alarm state. Cannot execute a ST, start, command during program operation, etc.	ON	ON	No Change
	E56E	A.9F	Serial Communication Non Definition Command Error Command syntax error.	ON	ON	No Change
	E57E	A.9F	Address "Out of Range" Error Serial command address is out of range.	ON	ON	No Change
	E58E	A.9F	Data "Out of Range" Error Serial command data is out of range.	ON	ON	No Change
	E59E	A.9F	Communication Failure Error between NS600 and SGDH Communication error between NS600 and SGDH. Cannot send commands via CN6 when CN3 is in use.	ON	ON	No Change
	E5AE	A.9F	Execution Disable Error while Servo ON Some functions can only be executed when servo is off: 1) Origin search (Fn003) 2) Absolute encoder reset (Fn008 or ABSPGRES) 3) Jog mode operation (Fn002) 4) Automatic zero adjustment of motor current detection signal (Fn00E or CURZERO) 5) Offline auto-tuning	ON	ON	No Change
	E5BE	A.9F	Execution Disable Error while Alarm Activated Servo is in an alarm state. Clear alarm before sending a SVON, servo ON, command.	ON	ON	No Change

9.2.2 Sigma II Indexer Error/Warning Status Display Table

Indexer Status	Status[1] Code	Panel[2] Display	Detail	ALM[3] Output	/WARN[4] Display	Motor Operation
Error[4]	E5CE	A.9F	Execution Disable Error while Main Power OFF Main power is off. Restore main power before sending a SVON, servo ON, command.	ON	ON	No Change
	E5DE	A.9F	Homing Method Non Reservation Error No homing method is reserved. Set Pn823 Homing Method = 1, 2 or 3.	ON	ON	No Change
	E5EE	A.9F	Error during Program Operation	ON	ON	No Change
	E5FE	A.9F	Session Conflict Error Cannot execute a positioning command during jog operation, etc.	ON	ON	No Change
	E61E	A.9F	PG Non Coincide Error 1. Cannot execute absolute encoder specific commands with an incremental encoder. 2. Cannot execute a homing routine with an absolute encoder, etc.	ON	ON	No Change
	E62E	A.9F	Error due to no A. CC (Multi-turn Limit was executed without A. CC)	ON	ON	No Change
Warning[4]	A.xx	A.9x	SGDH Warning Activation Warning [7]	ON	ON	No Change
Over Travel[5]	Pot	bb or run	P-OT[6]	ON	OFF	Forward Motion Prohibited
	not	bb or run	N-OT[6]	ON	OFF	Reverse Motion Prohibited
Software Limit[5]	PLS	bb or run	P-LS	ON	OFF	Forward Motion Prohibited
	nLS	bb or run	N-LS	ON	OFF	Reverse Motion Prohibited
Normal	bb	bb	Servo OFF	ON	OFF	-
	run	run	Servo ON	ON	OFF	-

Notes:

1. Status codes are displayed via the Sigma II Indexer JUSP-NS600. (CN7-digital operator, CN6-response to serial commands ALM/ERR or denial response to other commands).

2. The Panel Display is the built-in panel display on the SGDH Servo Amplifier. Operation panel display may be deleted depending on the communication status between SGDH and NS600.

3: OFF: Output transistor is OFF = Alarm status
ON: Output transistor is ON = No alarm.
Alarms continue to keep their status until they are released.

4. OFF: Output transistor is OFF= No error/warning.
ON: Output transistor is ON = Error/Warning Status.
Errors and Warnings are displayed for 2 seconds only.

5. Over Travel and Software Limits continue to keep their status until they are released.

6. P-OT/N-OT is detected by the JUSP-NS600. SGDH does not detect P-OT/N-OT signals, therefore both "pot"/"not" is not displayed in the operation panel. Error is displayed on the JUSP-NS600 when a moving reference is received.

7. A.9x is a SGDH Warning code. Refer 7.3.2 SGDH Servo Amplifier Warning Display Table.

9.3 SGDH Servo Amplifier Status Display Tables

9.3.1 SGDH Servo Amplifier Alarm Display Table

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

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

Alarm Display	Alarm Code Output			ALM Output	Alarm Name	Description
	ALO1	ALO2	ALO3			
A.81	OFF	OFF	OFF	OFF	Absolute Encoder Backup Error*	All the power supplies for the absolute encoder have failed and position data was cleared.
A.82					Encoder Checksum Error*	The checksum results of encoder memory is abnormal.
A.83					Absolute Encoder Battery Error	Battery voltage for the absolute encoder has dropped.
A.84					Absolute Encoder Data Error*	Received absolute data is abnormal.
A.85					Absolute Encoder Over-speed	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.bF					System Alarm*	A system error occurred in the servo amplifier.
A.C1	ON	OFF	ON	OFF	Servo Overrun Detected	The servomotor ran out of control.
A.C8					Absolute Encoder Clear Error and Multi-Turn Limit Setting Error*	The multi-turn for the absolute encoder was not properly cleared or set.
A.C9					Encoder Communications Error*	Communications between servo amplifier and encoder is not possible.
A.CA					Encoder Parameter Error*	Encoder parameters are faulty.
A.Cb					Encoder Echoback Error*	Contents of communications with encoder is incorrect.
A.CC	ON	OFF	ON	OFF	Multi-Turn Limit Dis-agreement	Different multi-turn limits have been set in the encoder and servo amplifier.
A.d0	ON	ON	OFF	OFF	Position Error Pulse Overflow	Position error pulse exceeded parameter (Pn505).
A.F1	OFF	ON	OFF	OFF	Power Line Open Phase	One phase is not connected in the main power supply
CPF00	Not Specified				Digital Operator Trans-mission Error	Digital operator (JUSP-OP02A-2) fails to communicate with servo amplifier (e.g., CPU error).
CPF01						
A.--	OFF	OFF	OFF	ON	Not an error	Normal operation status

Notes:

1. OFF: Output transistor is OFF.
   ON: Output transistor is ON.
2. (*) These alarms are not reset by the panel display, digital operator, or serial command ARES. Eliminate the cause of the alarm and then turn OFF the power supply to reset the alarms.
3. (**) This alarm display appears only within the range of 30 to 1000W.

9.3.2 SGDH Servo Amplifier Warning Display Table

The correlation between warning displays and warning code outputs is shown in the following table.

Warning Display	Warning Code Outputs			Warning Name	Meaning of Warning
	ALO1	ALO2	ALO3		
A.91	ON	OFF	OFF	Overload	This warning occurs before either of the overload alarms (A.71 or A.72) occurs. If the warning is ignored and operation continues, a regenerative overload alarm may result.
A.92	OFF	ON	OFF	Regenerative Overload	This warning occurs before the regenerative overload alarm (A.32) occurs. If the warning is ignored and operation continues, an overload alarm may result.
A.93	ON	ON	OFF	Low Battery	Low battery when used with an absolute encoder.
A.9F	OFF	OFF	OFF	Indexer Error	Refer to 9.2.2 Sigma Indexer Error/Warning Status Display Table

9.4 STS Status LEDs

Status	Green LED	Red LED
Control Power OFF	OFF	OFF
Parameter Automatic Setting in Progress (Approx. 2 sec.)	ON and OFF	OFF
Normal	ON	OFF
Over Travel/Software Limit	ON	OFF
Reset in Progress Table Save in Progress Table Initialization in Progress Parameter Initialization in Progress	ON and OFF	No Change
Error (2 seconds)/Warning	No Change	ON and OFF
Alarm	OFF	ON

Note: One multi-color LED (green and red) is located on the Sigma II Indexer indicated by STS.

Appendix A

List of Parameters

A.1 JUSP-NS600 Indexer Parameters

The following list shows JUSP-NS600 parameters and their settings

Table A.1: Indexer Parameters

Parameter Number	Name	Unit	Setting Range	Default Setting
Pn800	**Serial Communication Protocol (see note 1)**	-	0 = RS422 1 = RS422 + Echo Back 2 = RS485 Delimiter CR 3 = RS485 Delimiter CR + Echo Back per Character 4 = RS485 Delimiter CR + Echo Back per Command 5 = RS485 Delimiter CRLF 6 = RS485 Delimiter CRLF + Echo Back per Character 7 = RS485 Delimiter CRLF + Echo Back per Command	1
Pn801	**Baud rate (see note 1)**	-	0 = 9600 1 = 19200 2 = 38400	0
Pn802	Answer	-	0 = OK = No Answer 1 = OK = Answer	1
Pn803	**/MODE 0/1 (see note 1)**	-	0 = Close = Mode 0 1 = Open = Mode 0 2 = Always Mode 0 3 = Always Mode 1	0
Pn804	**/START-STOP; /HOME (see note 1)**	-	0 = Close = Program Start (Mode 0) 0 = Close = Homing Start (Mode 1) 1 = Open = Program Start (Mode 0) 1 = Open = Homing Start (Mode 1) 2 or 3 = No Program Start (Mode 0) 2 = No Motion (Mode 1) 3 = No Homing Start (Mode 1)	0
Pn805	**/PGMRES; /JOGP (see note 1)**	-	0 = Open -> Close = Program Reset (Mode 0) 0 = Close = Jog Forward (Mode 1) 1 = Close -> Open = Program Reset (Mode 0) 1 = Close = Jog Forward (Mode 1) 2 or 3 = No Program Reset (Mode 0) 2 = No Motion (Mode 1) 3 = No Jog Forward (Mode 1)	0
Pn806	**/SEL0;/JOGN (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Reverse (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Reverse (Mode 1) 2 = Always Program Select (Mode 0) 2 = No Motion (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Reverse (Mode 1)	0

Table A.1: Indexer Parameters

Parameter Number	Name	Unit	Setting Range	Default Setting
Pn807	**/SEL1;/JOG0 (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Select (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Select (Mode 1) 2 = Always Program Select (Mode 0) 2 = Always Jog Select (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Select (Mode 1)	0
Pn808	**/SEL2;/JOG1 (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Select (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Select (Mode 1) 2 = Always Program Select (Mode 0) 2 = Always Jog Select (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Select (Mode 1)	0
Pn809	**/SEL3;/JOG2 (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Select (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Select (Mode 1) 2 = Always Program Select (Mode 0) 2 = Always Jog Select (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Select (Mode 1)	0
Pn80A	**/SEL4;/JOG3 (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Select (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Select (Mode 1) 2 = Always Program Select (Mode 0) 2 = Always Jog Select (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Select (Mode 1)	0
Pn80B	**/S-ON (see note 1)**	-	0 = Close = Servo ON 1 = Open = Servo ON 2 = Always Servo ON 3 = Always Servo OFF	0
Pn80C	**P-OT (see note 1)**	-	0 = Open = Forward OT Status 1 = Close = Forward OT Status 2 = Always Forward OT Status 3 = Always Moveable	0
Pn80D	**N-OT (see note 1)**	-	0 = Open = Reverse OT Status 1 = Close = Reverse OT Status 2 = Always Reverse OT Status 3 = Always Moveable	0
Pn80E	**/DEC (see note 1)**	-	0 = Close = Zero-point Deceleration LS Start 1 = Open = Zero-Point Deceleration LS Start 2 = Always Zero-Point Deceleration LS Start 3 = No Zero-Point Deceleration LS Start	0

Table A.1: Indexer Parameters

Parameter Number	Name	Unit	Setting Range	Default Setting
Pn80F	**/RGRT (see note 1)**	-	0 = Close = Registration Start 2 = No Registration 1 = Open = Registration Start 3 = No Registration	0
Pn810	**/INPOSITION (see note 1)**	-	0 = Close = Positioning is Complete 1 = Open = Positioning is Complete	0
Pn811	**/POUT0 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn812	**/POUT1 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn813	**/POUT2 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn814	**/POUT3 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn815	**/POUT4 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn816	**/WARN (see note 1)**	-	0 = Close = Error/Warning Status 1 = Open = Error/Warning Status	0
Pn817	**/BK (see note 1)**	-	0 = Close = Brake Release 1 = Open = Brake Release	0
Pn818	**/S-RDY (see note 1)**	-	0 = Close = Servo is Ready 1 = Open = Servo is Ready	0
Pn819	**Overtravel (OT) Stop Method (see note 1)**	-	0 = Servo OFF (Same as setting in Pn001.0) 1 = Emergency Stop 2 = Deceleration Stop	0
Pn81A	**Moving Method (see note 1)**	-	0 = Linear 1 = Rotary (Shortest Path) 2 = Rotary (Forward) 3 = Rotary (Reverse)	0
Pn81B	**P-LS Position Reference Forward Limit (see note 1)**	Reference Unit	-99999999 ~ +99999999	+99999999
Pn81C	**N-LS Position Reference Reverse Limit (see note 1)**	Reference Unit	-99999999 ~ +99999999	-99999999
Pn81D	**Home Position (see note 1)**	Reference Unit	-99999999 ~ +99999999	0
Pn81E	**Positioning/Registration Speed (see note 1)**	x1000 Reference Unit/min.	1 ~ 99999999	1000

Table A.1: Indexer Parameters

Parameter Number	Name	Unit	Setting Range	Default Setting
Pn81F	Acceleration	x1000 Reference Unit/min/ ms.	1 ~ 99999999	1000
Pn820	Deceleration	x1000 Reference Unit/min/ ms.	1 ~ 99999999	1000
Pn821	/INPOSITION Width	Reference Unit	0 ~ 99999	1
Pn822	Near Width	Reference Unit	0 ~ 99999	1
Pn823	**Homing Method**	-	0 = No Homing 1 = /DEC and C-phase 2 = /DEC only 3 = C-phase only	0
Pn824	Homing Direction	-	0 = Forward 1 = Reverse	0
Pn825	Homing Moving Speed	x1000 Reference Unit/min.	1 ~ 99999999	1000
Pn826	Homing Approach Speed	x1000 Reference Unit/min.	1 ~ 99999999	1000
Pn827	Homing Creep Speed	x1000 Reference Unit/min.	1 ~ 99999999	1000
Pn828	Homing Final Move Distance	Reference Unit	-99999999 ~ 99999999	0
Pn833	**/SEL5 (See note 1)**	-	0 = Close = Program Select (Mode 0) 1 = Open = Program Select (Mode 0) 2 = Always Program Select (Mode 0) 3 = No Program Select (Mode 0)	0
Pn834	**/SEL6 (See note 1)**	-	0 = Close = Program Select (Mode 0) 1 = Open = Program Select (Mode 0) 2 = Always Program Select (Mode 0) 3 = No Program Select (Mode 0)	0

Notes: 1. Parameters Pn800, Pn801, Pn803-Pn81E, Pn823, Pn833, Pn834 (parameters in bold) are offline parameters. After changing these offline parameters, cycle power (or send serial command RES) to enable the new setting.

Pn802, Pn81F, Pn820, Pn821, Pn822, Pn824, Pn825, Pn826, Pn827, Pn828, are online parameters (parameters not in bold). New settings become effective immediately.

2. Pn829 - Pn832 are reserved for programming software. Do not change these parameters.

3. Close = Photocoupler On Open = Photocoupler OFF

A.2 Servo Amplifier Parameters

The following list shows parameters and their settings when used with the Sigma II Indexer option unit.

Category	Parameter Number	Name	Unit	Setting Range	Default Setting
Function Selection Parameters	**Pn000**	**Function Selection Basic Switches** (See note 3).	—	—	0010
	Pn001	**Function Selection Application Switches 1** (See notes 1 and 3).	—	—	0000
	Pn002	**Function Selection Application Switches 2** (See note 3).	—	—	0000
	Pn003	Function Selection Application Switches 3	—	—	0002
Gain Parameters	Pn100	Speed Loop Gain	Hz	1 to 2000	40
	Pn101	Speed Loop Integral Time Constant	0.01ms	15 to 51200	2000
	Pn102	Position Loop Gain	s^{-1}	1 to 2000	40
	Pn103	Inertia Ratio	%	0 to 10000	0
	Pn104	Not Used	—	—	—
	Pn105	Not Used	—	—	—
	Pn106	Not Used	—	—	—
	Pn107	Bias	rpm	0 to 450	0
	Pn108	Bias Width Addition	ref. units	0 to 250	7
	Pn109	Feed-forward	%	0 to 100	0
	Pn10A	Feed-forward Filter Time Constant	0.01ms	0 to 6400	0
	Pn10B	**Gain-related Application Switches** (See note 3).	—	—	0000
	Pn10C	Mode Switch Torque Reference	%	0 to 800	200
	Pn10D	Mode Switch Speed Reference	rpm	0 to 10000	0
	Pn10E	Mode Switch Acceleration	10rpm/s	0 to 3000	0
	Pn10F	Mode Switch Error Pulse	ref. units	0 to 10000	0
	Pn110	**Online Autotuning Switches** (See note 3.)	—	—	0010
	Pn111	**Speed Feedback Compensation** (See note 2).	%	1 to 100	100

Category	Parameter Number	Name	Unit	Setting Range	Default Setting
Gain Parameters	Pn112	Reserved parameters (Do not change.)	%	0 to 1000	100
	Pn113		—	0 to 10000	1000
	Pn114		—	0 to 400	200
	Pn115		—	0 to 1000	32
	Pn116		—	0 to 1000	16
	Pn117		%	20 to 100	100
	Pn118		%	20 to 100	100
	Pn119		s^{-1}	1 to 2000	50
	Pn11A		0.1%	1 to 2000	1000
	Pn11B		Hz	1 to 150	50
	Pn11C		Hz	1 to 150	70
	Pn11D		%	1 to 150	100
	Pn11E		%	1 to 150	100
	Pn11F	Reserved parameters (Do not change).	ms	1 to 2000	0
	Pn120		0.01ms	1 to 51200	0
	Pn121		Hz	10 to 250	50
	Pn122		Hz	0 to 250	0
	Pn123		%	0 to100	0
Position Parameters	**Pn200**	**Position Control Reference Selection Switches** (See note 3).	—	—	0000
	Pn201	**PG Divider** (See note 3).	p/r	16 to 16384	16384
	Pn202	**Electronic Gear Ratio (Numerator)** (See note 3).	—	1 to 65535	4
	Pn203	**Electronic Gear Ratio (Denominator)** (See note 3).	—	1 to 65535	1
	Pn204	Not Used	—	—	—
	Pn205	**Multi-turn Limit Setting** (See notes 1 and 3).	rev	0 to 65535	65535
	Pn206	Not Used	—	—	—
	Pn207	**Position Control Function Switches** (See note 3).	—	—	0001
	Pn208	**Position Reference Movement Averaging Time** (See note 3).	0.01ms	0 to 6400	0

Category	Parameter Number	Name	Unit	Setting Range	Default Setting
Speed Parameters	Pn300	Not Used	—	—	—
	Pn301	Not Used	—	—	—
	Pn302	Not Used	—	—	—
	Pn303	Not Used	—	—	—
	Pn304	Not Used	—	—	—
	Pn305	Not Used	—	—	—
	Pn306	Not Used	—	—	—
	Pn307	Not Used	—	—	—
	Pn308	Speed Feed-Forward Filter Time Constant	0.01ms	0 to 65535	0
Torque Parameters	Pn400	Not Used	—	—	—
	Pn401	Torque Reference Filter Time Constant	0.01ms	0 to 65535	100
	Pn402	Forward Torque Limit	%	0 to 800	800
	Pn403	Reverse Torque Limit	%	0 to 800	800
	Pn404	Not Used	—	—	—
	Pn405	Not Used	—	—	—
	Pn406	Not Used	—	—	—
	Pn407	Not Used	—	—	—
	Pn408	Torque Function Switches	—	—	0000
	Pn409	Notch Filter Frequency	Hz	50 to 2000	2000
Sequence Parameters	Pn500	Not Used	—	—	—
	Pn501	Not Used	—	—	—
	Pn502	Rotation Detection Level	rpm	1 to 10000	20
	Pn503	Not Used	—	—	—
	Pn504	Not Used	—	—	—
	Pn505	Overflow Level	256 ref. units	1 to 32767	1024
	Pn506	Brake Reference Servo OFF Delay Time	10ms	0 to 50	0
	Pn507	Brake Reference Output Speed Level	rpm	0 to 10000	100
Sequence Parameters	Pn508	Timing for Brake Reference Output during Motor Operation	10ms	10 to 100	50
	Pn509	Momentary Hold Time	ms	20 to 1000	20
	Pn50A	Input Signals Selection 1	—	—	8881 (fixed)
	Pn50B	Input Signals Selection 2	—	—	8888 (fixed)
	Pn50C	Input Signals Selection 3	—	—	8888 (fixed)
	Pn50D	Input Signals Selection 4	—	—	8888 (fixed)
	Pn50E	Output Signals Selection 1	—	—	3000 (fixed)
	Pn50F	Output Signals Selection 2	—	—	1200 (fixed)
	Pn510	Output Signals Selection 3	—	—	0000 (fixed)
	Pn511	Reserved (do not change)	—	—	8468 (fixed)
	Pn512	Output Signals Reversal Settings	—	—	0000

Category	Parameter Number	Name	Unit	Setting Range	Default Setting
Other Parameters	Pn600	Regenerative Resistor Capacity (See note 4).	10 W	0 to capacity (See note 5).	0
	Pn601	Reserved parameter (Do not change.)	—	0 to capacity (See note 5).	0

Notes:

1. The multi-turn limit is valid only when parameter Pn002.2 Absolute Encoder Usage is set to "0".
- There is no need to change the multi-turn limit except for in special cases. Be careful not to change the setting unless necessary.

2. The setting of parameter Pn111 is valid only when parameter Pn110.1 is set to 0.

3. Offline parameters in bold: After changing these parameters, cycle the main circuit and control power (or send serial command RES) to enable the new settings.

4. Normally set to "0". When using an external regenerative resistor, set the capacity (W) of the regenerative resistor.

5. The upper limit is the maximum output capacity (W) of the servo amplifier.

A.3 Servo Amplifier Switches

The following list shows the switches and their default settings.

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn000 Function Selection Basic Switches	0	Direction Selection	0	Sets CCW as forward direction.	0
			1	Sets CW as forward direction (reverse rotation mode).	
	1	Control Method	1	Position control (pulse train reference).	1 (fixed)
	2	Axis Address	0 to F	Sets servo amplifier axis address.	ADRS
	3	Reserved		—	0
Pn001 Function Selection Application Switches	0	Servo OFF or Alarm Stop Mode	0	Stops the motor by applying dynamic brake (DB).	0
			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	Not Used	—	—	0
	2	AC/DC Power Input Selection	0	Not applicable to DC power input: Input AC power supply through L1, L2, and (L3) terminals.	0
			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
			1	ALO1, ALO2, and ALO3 output both alarm codes and warning codes. While warning codes are output, ALM signal output remains ON (normal state).	
Pn002 Function Selection Application Switches	0	Not Used	—	—	0 (fixed)
	1	Not Used	—	—	0
	2	Absolute Encoder Usage	0	Uses absolute encoder as an absolute encoder.	0
			1	Uses absolute encoder as an incremental encoder.	
	3	Not used.	0	—	0 (fixed)

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn003 Function Selection Application Switches	0	Analog Monitor 1 Torque Reference Monitor	0	Motor speed: 1V/1000rpm.	2
			1	Speed reference: 1V/1000rpm.	
			2	Torque reference: 1V/100%.	
			3	Position error: 0.05V/1 reference units.	
			4	Position error: 0.05V/100 reference units.	
			5	Reference pulse frequency (converted to rpm): 1V/1000rpm.	
			6	Motor speed × 4: 1V/250rpm.	
			7	Motor speed × 8: 1V/125rpm.	
	1	Analog Monitor 2 Speed Reference Monitor	8	Reserved parameter (Do not change.).	0
			9		
			A		
			B		
			C		
			D		
			E		
			F		
	2	Not used.	—	—	0
	3	Not used.	—	—	0
Pn10B Gain Application Switches	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	Not used.	0	—	0
	3	Reserved	0 to 2	Reserved parameter. (Do not change).	0
Pn110 Online Autotuning Switches	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
			1	Disabled.	
	2	Friction Compensation Selection	0	Friction compensation: Disabled.	0
			1	Friction compensation: Small.	
			2	Friction compensation: Large.	
	3	Reserved	0 - 3	Reserved parameter (Do not change).	0

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn200 Position Control References Selection Switches	0	Not Used	—	—	0
	1	Not Used	—	—	0
	2	Clear Operation	0	Clears error at base block	0 (fixed)
	3	Not Used	—	—	0
Pn207 Position Control Function Switches	0	Position Reference Filter Selection	1	Acceleration/deceleration filter.	1 (fixed)
	1	Not Used	—	—	0
	2			—	0
	3			—	0
Pn408 Torque Control Function Switches	0	Notch Filter Selection	0	Disabled.	0
			1	Uses a notch filter for torque reference.	
	1	Not used.	—	—	0
	2				
	3				

Appendix B

Monitor Modes and Functions

B.1 Monitor Modes

The following list shows monitor modes available via the CN7 port when using a digital operator

Table B.1: Monitor Modes

Digital Operator (CN7)	Content of Display	Unit	Remarks	Equivalent Serial Command (CN6)
Un000	Actual Motor Speed	rpm	—	NFB or MON3
Un001	N/A	—	—	N/A
Un002	Internal Torque Reference	%	Value for rated torque	TREF or MON5
Un003	Rotational Angle 1	Pulse	Number of Pulses from Origin	None
Un004	Electrical Angle 2	Degree	Angle from Origin (electrical)	None
Un005	SGDH Input Signal Monitor	—	—	IN1
Un006	SGDH Output Signal Monitor	—	—	OUT1
Un007	Input Reference Pulse Speed	rpm	—	NREF or MON4
Un008	Position Error	reference units	—	PER or MON2
Un009	Accumulated Load Rate	%	(1)	TRMS
Un00A	Regenerative Load Rate	%	(2)	RGRMS
Un00B	Power Consumed by DB Resistor	%	(3)	DBRMS
Un00C	SGDH Position Reference Counter	—	Display in Hexadecimal	None
Un00D	PG Counter Feedback Pulse Counter	—	Display in Hexadecimal	None
Un800	Last Error	—	—	ERR
Un801	NS600 Input Signal Monitor	—	—	IN2
Un802	NS600 Output Signal Monitor	—	—	OUT2
Un803	Status Flag Monitor	—	—	STS or MON6
Un804	Current Issue Position Monitor	reference units	—	PUN or MON1
Un805	Current Motor Position Monitor	reference units	—	PFB or MON7
Un806	Target Position Monitor	reference units	—	POS or MON8
Un807	Target Distance Monitor	reference units	—	DST or MON9
Un808	Registration Target Position Monitor	reference units	—	RPOS or MON10
Un809	Registration Target Distance Monitor	reference units	—	RDST or MON11

Table B.1: Monitor Modes

Digital Operator (CN7)	Content of Display	Unit	Remarks	Equivalent Serial Command (CN6)
Un80A	Program PGMSTEP Pass Through Monitor	—	—	PGMSTEP
Un80B	Program EVENT Lapse Time Monitor	msec	—	EVTIME
Un80C	Program LOOP Pass Through Monitor	—	—	LOOP
Un80D	Serial Command Receipt Letter Trace	—	—	None
Un80E	Serial Command Receipt Letter (Number of Letters)	—	—	None
Un80F	Serial Command Transmission Error Letter (Number of Letters)	—	—	None
Un810	Serial Command Transmission Letter Trace	—	—	None
Un811	Serial Command Transmission Letter (Number of Letters)	—	—	None

(1) Value for the rated torque as 100%. Displays effective torque in 10 second cycles.
(2) Value for the processable regenerative power as 100%. Displays effective power in 10 second cycles.
(3) Value for the processable power when dynamic brake is applied as 100%. Displays effective power in 10 second cycles.

B.2 Auxiliary Functions

The following list shows the auxiliary functions available via the CN7 port when using a digital operator

Table B.1: Available Auxiliary Functions

Digital Operator (CN7)	Function	Equivalent Serial Command (CN6)
Fn000	Alarm trace back data	ALM0~9
Fn001	Rigidity setting during online autotuning	STIFF, STIFFd
Fn002	JOG mode operation	None
Fn003	Origin search mode	None
Fn004	N/A	N/A
Fn005	Parameter setting initialization	PRMINIT
Fn006	Alarm trace back data clear	ALMTRCCLR
Fn007	Inertia ratio data obtained from online autotuning save	INERTIA, TUNESTORE
Fn008	Absolute encoder multi-turn reset and encoder alarm reset	ABSPGRES
Fn009	N/A	N/A
Fn00A	N/A	N/A
Fn00B	N/A	N/A
Fn00C	Manual zero - adjustment of analog monitor output	None
Fn00D	Manual gain adjustment of analog monitor output	None
Fn00E	Automatic zero - adjustment of motor current detection signal	CURZERO
Fn00F	Manual zero - adjustment of motor current detection signal	None
Fn010	Password setting (Protects parameters from being changed)	None
Fn011	Motor model display	MTTYPE, MTSIZE, PGTYPE, SVYSPEC
Fn012	SGDH software version display, PG software version display	SVVER, PGVER
Fn013	Multi turn limit setting: Change when a multi-turn limit disagreement alarm occurs	MLTLIMSET
Fn014	N/A	N/A
Fn800	NS600 software version display	VER
Fn801	NS600 type code (0600H) display	TYPE
Fn802	NS600 Y spec. no. display	YSPEC
Fn803	Program table save	PGMSTORE

Table B.1: Available Auxiliary Functions

Digital Operator (CN7)	Function	Equivalent Serial Command (CN6)
Fn804	ZONE table save	ZONESTORE
Fn805	JOG speed table save	JOGSTORE
ALARM RESET Button	Alarm Reset	ARES
Fn806	Program table initialization	PGMINIT
Fn807	ZONE table initialization	ZONEINIT
Fn808	JOG speed table initialization	JSPDINIT

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Appendix C

Serial Commands

C.1 Alphabetical List of Serial Commands

The following table shows an alphabetical list of available serial commands. For more details, refer to the corresponding reference table in *6.5 Serial Command Functions.*

Serial Command	Function	Reference Table
ABSPGRES	Absolute PG Reset	6.10
ACCnnnnnnnn	Acceleration Reservation	6.6
ALM	Alarm or Warning Read	6.10
ALMn	Alarm History Read	6.10
ALMTRCCLR	Alarm Trace Clear	6.10
ARES	Alarm Reset	6.5
CURZERO	Motor Current Zero Adjustment	6.10
DBRMS	DB Load Ratio Monitor	6.10
DECnnnnnnnn	Deceleration Reservation	6.6
DST or MON9	Target Distance Monitor	6.10
ERR	Error Read Displays only the latest error	6.10
EVENTTsss	Program Table EVENT Read	6.8
EVENTTsss =	Program Table EVENT Write	6.8
EVTIME	Program EVENT Lapse of Time Monitor	6.10
HOLD	Positioning Interruption (or Jog Stop)	6.6
IN1	SGDH Input Signal Monitor	6.10
IN2	NS600 Input Signal Monitor	6.10
IN2TESTbbbbbbbb	NS600 Side Input Signal Reservation	6.10
IN2TESTEND	IN2TEST Clear Command	6.10
INERTIA	Auto-tuning Inertia Display	6.10
JOGPnnnnnnnn JOGNnnnnnnnn	Motor Forward	6.6
JSPDINIT	JOG Speed Table Initialization	6.8
JSPDSTORE	JOG Speed Table Save	6.8
JSPDTdd	Jog Speed Table JSPD (jog speed reservation) Read.	6.8
JSPDTdd =	JOG Speed Table Write	6.8
LOOP	Program LOOP Pass Through Monitor	6.10
LOOPTsss	Program Table LOOP Read	6.8
LOOPTsss =	Program Table LOOP Write.	6.8
MLTLIMSET	Multi Turn Limit Setting	6.10
MONn	Monitor Read	6.10
MTSIZE	Motor Capacity Display	6.10
MTTYPE	Motor Type Display	6.10
NEXTTsss	Program Table NEXT Read	6.8
NEXTTsss =	Program Table NEXT Write.	6.8
NFB or MON3	Motor Speed Monitor	6.10
NREF or MON4	Speed Reference Monitor	6.10
OUT 1	SGDH Side Output Signal Monitor	6.10
OUT 2	NS600 Side Output Signal Monitor	6.10
OUT2TESTbbbbbb	NS600 Side Output Signal Reservation	6.10
OUT2TESTEND	OUT2TEST Clear Command	6.10

Serial Command	Function	Reference Table
PER or MON2	Position Error Monitor	6.10
PFB or MON7	Current Motor (actual) Position Monitor	6.10
PGMINIT	Program Initialization	6.8
PGMRES	Program Reset	6.9
PGMSTEP	Program PGMSTEP Pass Through Monitor	6.10
PGMSTORE	Program Table Save	6.8
PGTYPE	PG Type Display	6.10
PGVER	PG Software Version Display	
POS (±) nnnnnnnn POSA (±) nnnnnnnn	Target Position Reservation (Absolute Position)	6.6
POS or MON8	Target Position Monitor	6.10
POSI (±) nnnnnnnn	Target Position Reservation (Relative Position)	6.6
POSTsss	Program Table POS Read	6.8
POSTsss =	Program Table POS Write	6.8
POUT	POUT Monitor	6.10
POUTnnnnn	POUT Reservation	6.6
POUTTsss	Program Table POUT Read	6.8
POUTTsss =	Program Table POUT Write	6.8
PRMINIT	Parameter Initialization	6.7
PRMppp	Parameter Read	6.7
PRMppp =	Parameter Write	6.7
PUN or MON1	Current Issue (commanded) Position Monitor	6.10
RDST or MON11	Registration Target Distance Monitor	6.10
RDSTnnnnnnnn	Registration Distance Reservation	6.6
RDSTTsss	Program Table RDST Read	6.8
RDSTTsss =	Program Table RDST Write	6.8
RES	Reset	6.5
RGRMS	Regenerative Load Ratio Monitor	6.10
RPOS or MON10	Registration Target Position Monitor	6.10
RS	Positioning Start with Registration	6.6
RS (±) nnnnnnnn RSA (±) nnnnnnnn	Positioning Start with Registration	6.6
RSI (±) nnnnnnnn	Positioning Start (Relative) with Registration	6.6
RSPDnnnnnnnn	Registration Speed Reservation	6.6
RSPDTsss	Program Table RSPD Read	6.8
RSPDTsss =	Program Table RSPD Write	6.8
SKIP	Positioning Stop (or Jog Stop)	6.6
SPDnnnnnnnn	Positioning Speed Reservation	6.6
SPDTsss	Program Table SPD Read	6.8
SPDTsss =	Program Table SPD Write	6.8
ST	Positioning Start	6.6
ST (±) nnnnnnnn STA (±) nnnnnnnn	Positioning Start (Absolute Position)	6.6
START	Program Operation Restart	6.9
STARTss	Program Operation Start	6.9

Serial Command	Function	Reference Table
STI(±) nnnnnnnn	Positioning Start (Relative Position)	6.6
STIFF	Rigidity Monitor	6.10
STIFFd	Rigidity Reservation	6.10
STOP	Program Operation Interruption	6.9
STS or MON6	Status Flag Monitor [reference units]	6.10
SVOFF	Servo OFF	6.5
SVON	Servo ON	6.5
SVTYPE	SGDH Type Code (xx02H) Display	6.10
SVVER	SGDH Software Version Display	6.10
SVYSPEC	SGDH Y Spec. No. Display	6.10
TREF or MON5	Torque Reference Monitor	6.10
TRMppp =	Temporary Parameter Write	6.7
TRMS	Total Load ratio Monitor	6.10
TUNESTORE	Auto-tuning Inertia Save	6.10
TYPE	NS600 Type Code (0600H) Display	6.10
VER	NS600 Software Version Display	6.10
YSPEC	NS600 Y Spec. No. Display	6.10
ZONEINIT	ZONE Table Initialization	6.8
ZONENTzz	Zone Table ZONEN (negative side zone position limit) Read.	6.8
ZONENTzz =	Zone Table ZONEN (negative side zone position limit) Write.	6.8
ZONEPTzz	Zone table ZONEP (positive-side zone position limit) read.	6.8
ZONEPTzz =	Zone Table ZONEP (positive-side zone position limit) Write.	6.8
ZONESTORE	ZONE Table Save	6.8
ZRN	Homing Start	6.6
ZSET (±) nnnnnnnn	Coordinates Setting	6.6

Appendix D

Example Exercises

D.1 Example Indexer Exercise #1

The following exercises are presented as a self-learning tool for the NS600 indexer and IndexWorks software. Answers to the exercises are also provided at the end of this section.

Exercise #1a
Enter and download the following program into the Indexer using IndexWorks. Test the program after downloading.

It is recommended to reset the Indexer to all factory defaults before starting a new application. This can be done in IndexWorks by selecting Tools, Reset to Factory Defaults, All Defaults.

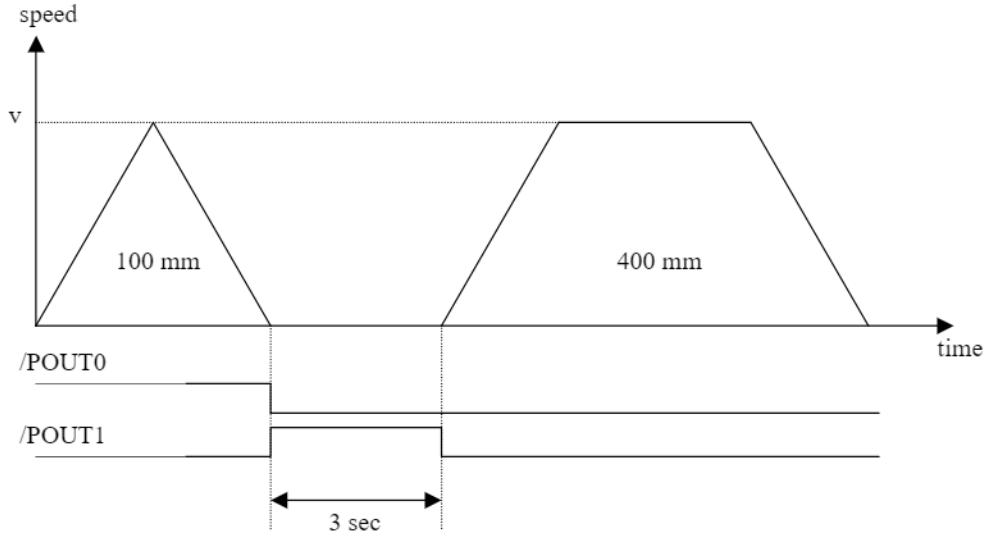
Application:

Mechanical: Ballscrew Actuator with 20mm lead
10:1 gearbox

Move Profile: Positioning Resolution=0.001mm
Typical Index: 100mm in 1.6 sec (triangular move profile)
Turn on output /POUT0 at the start of the index (as shown below).

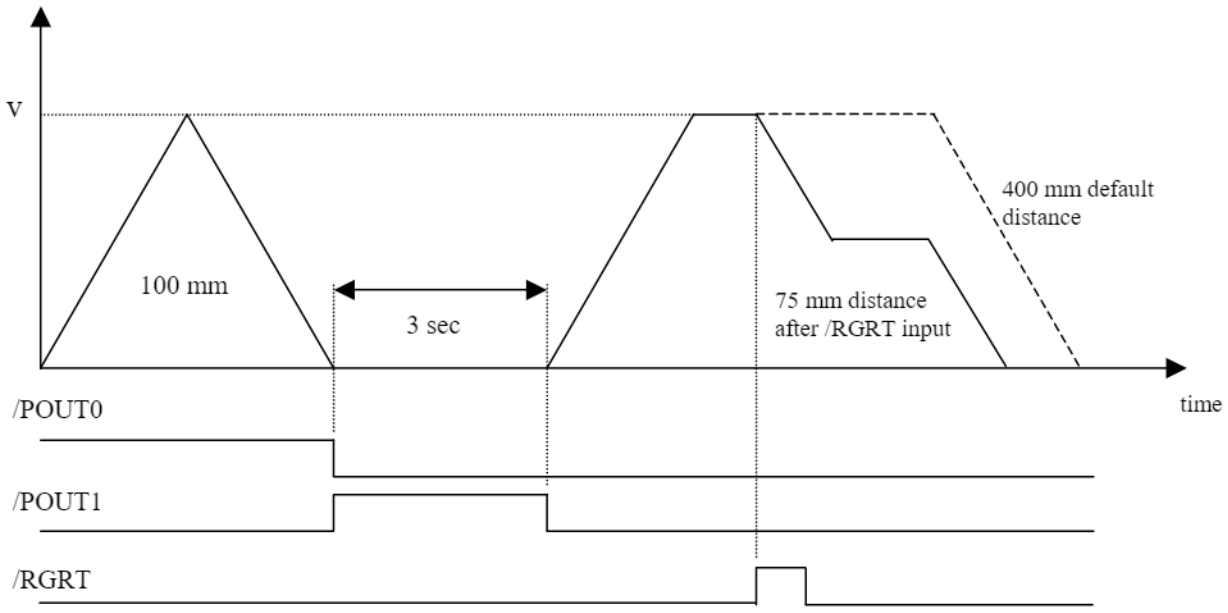
Exercise #1b

Add a second index of 400 mm. /POUT1 should turn on at the end of the first index and turn off at the start of the second index (as shown below).

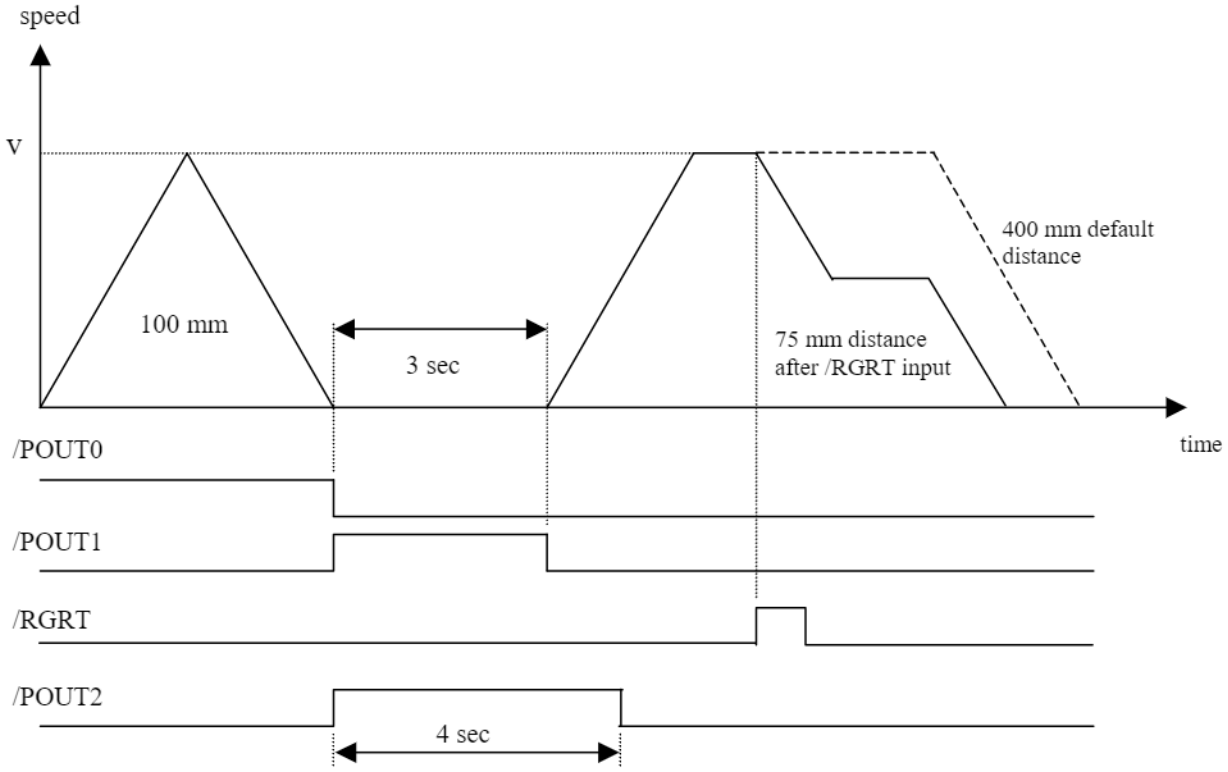


Exercise #1c

Add in a 75 mm registration distance and a 100 mm/sec registration speed to the second index.



Exercise #1d
Add output /POUT2 as shown below.



Exercise #1e:
Add a homing routine:
1. Actuator should start homing at 50 mm/sec in the forward direction, decelerate to a 25 mm/sec approach speed once the home sensor is reached.
2. After the home sensor, stop at the C-phase pulse, and then creep 5 mm from the C-phase pulse in the opposite direction (creep speed is 10 mm/sec).

Exercise #1f
Add a final index (after the 2nd index above) to return the actuator to position 0 at the maximum speed of the motor (5000 rpm).

D.2 Example Indexer Exercise #2

Exercise #2a:
Start a New Project. Enter and download the following program into the Indexer using IndexWorks. Test the program after downloading.

It is recommended to reset the Indexer to all factory defaults before starting a new application. This can be done in IndexWorks by selecting Tools, Reset to Factory Defaults, All Defaults.

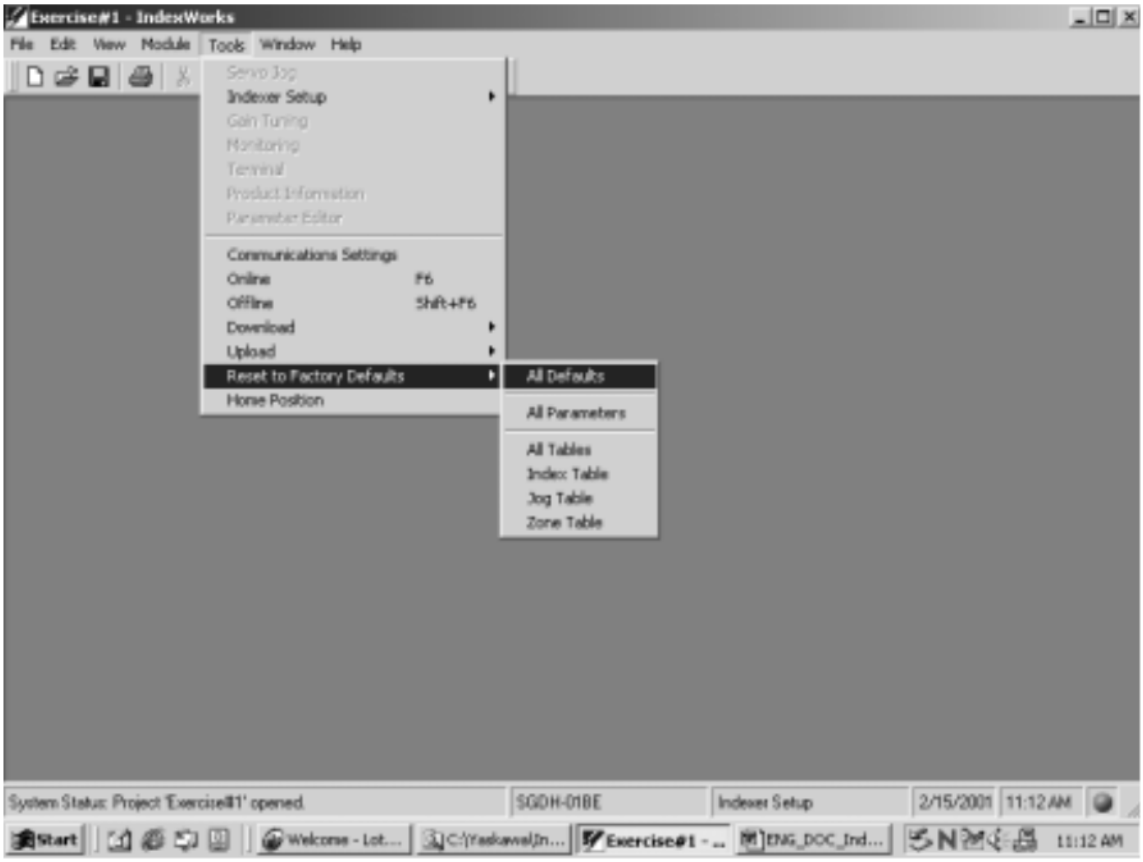
Application:
Mechanical System: Rotary table with 6 positions (0°, 60°, 120°, 180°, 240°, and 300°) 1 to1 gearbox.
Move Profile: Positioning Resolution: 0.01°
60° in 0.10 seconds (triangular move profile)
Moves should take the shortest path of travel.

Set up a program table such that program step 0 is 0°, program step 1 is 60°, program step 2 is 120°, etc. Output /POUT0 should turn on when within 20° of each position. Output /POUT4 should turn on when within 10° of each position. All outputs should turn off at the start of the next move.

Exercise #2b:
Outputs /POUT2 and /POUT3 should turn on whenever the rotary table is between 90° and 180°.

D.3 Example Indexer Exercise #1 Solution

Solution to Exercise #1a:
First reset the Indexer to all factory defaults.

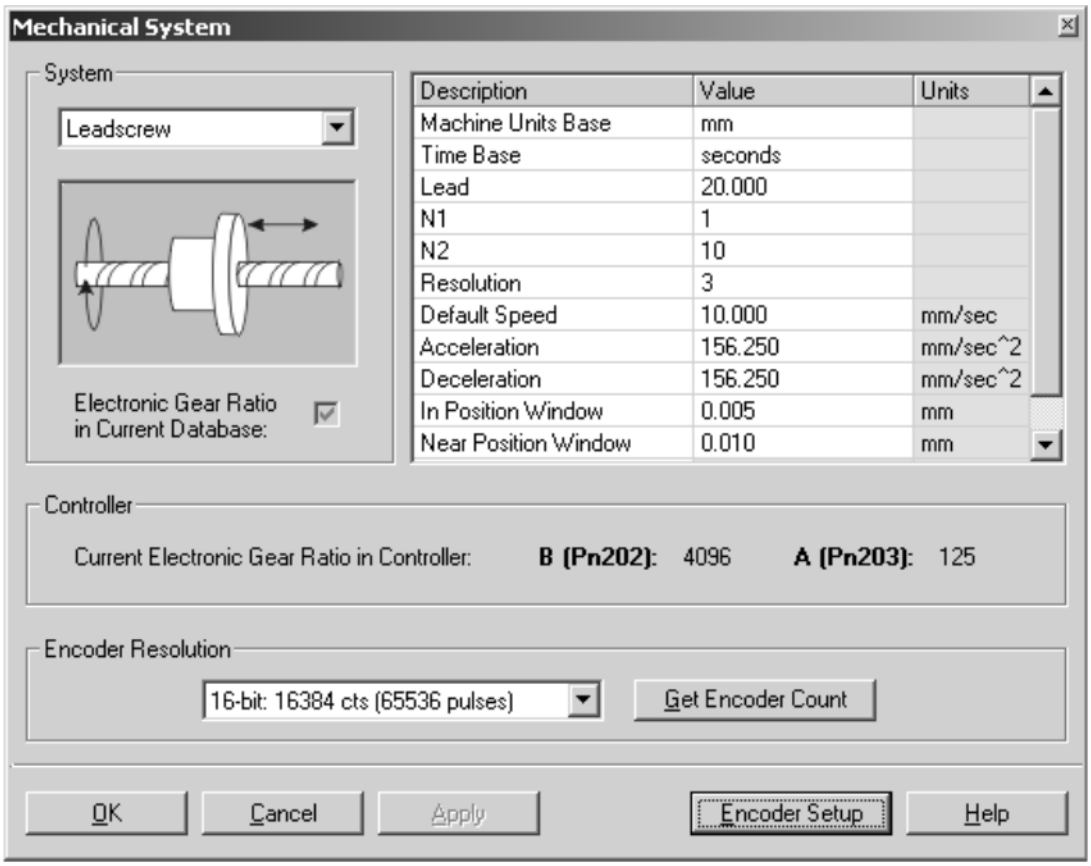


Calculate the desired speed, acceleration, and deceleration for a triangular move profile.

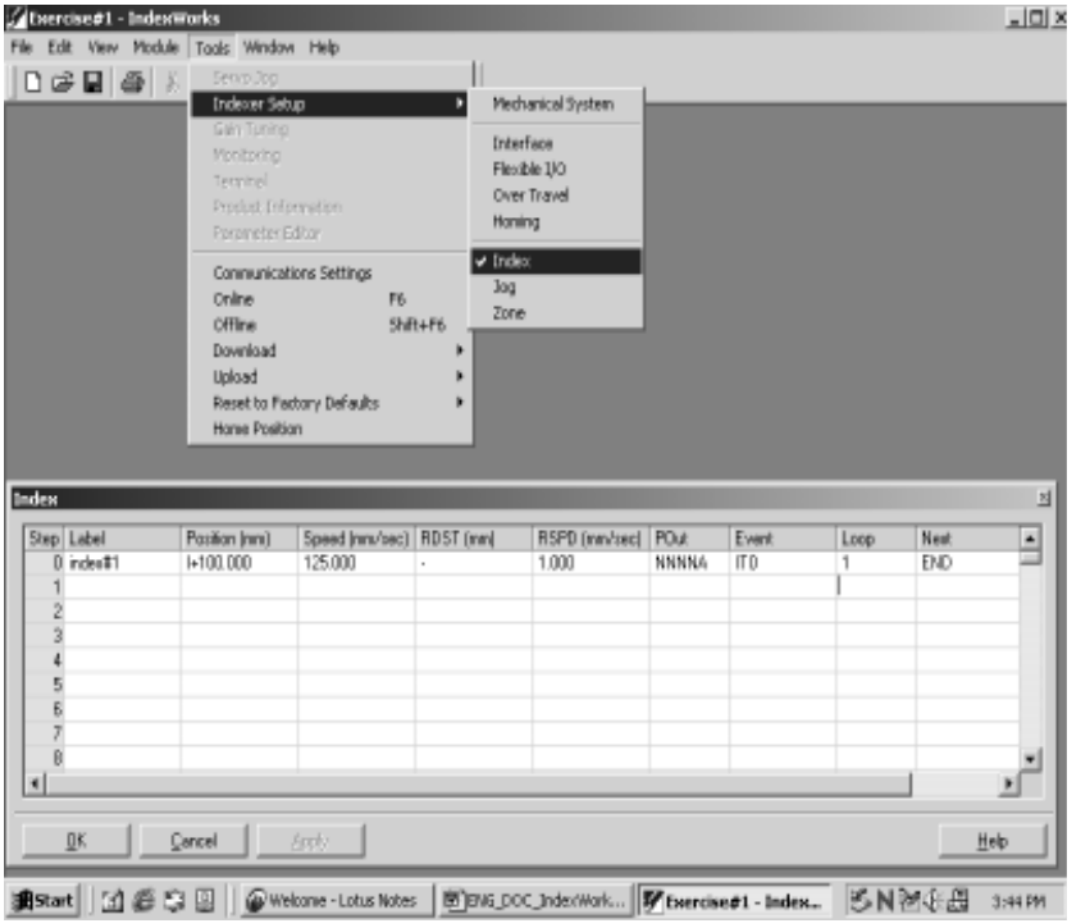
$$Speed \quad \frac{2\,100mm}{1.6\,\text{sec}} \quad 125mm/\text{sec}$$

$$Accel \quad Decel \quad \frac{125mm/\text{sec}}{0.8\,\text{sec}} \quad 156.25mm/\text{sec}/\text{sec}$$

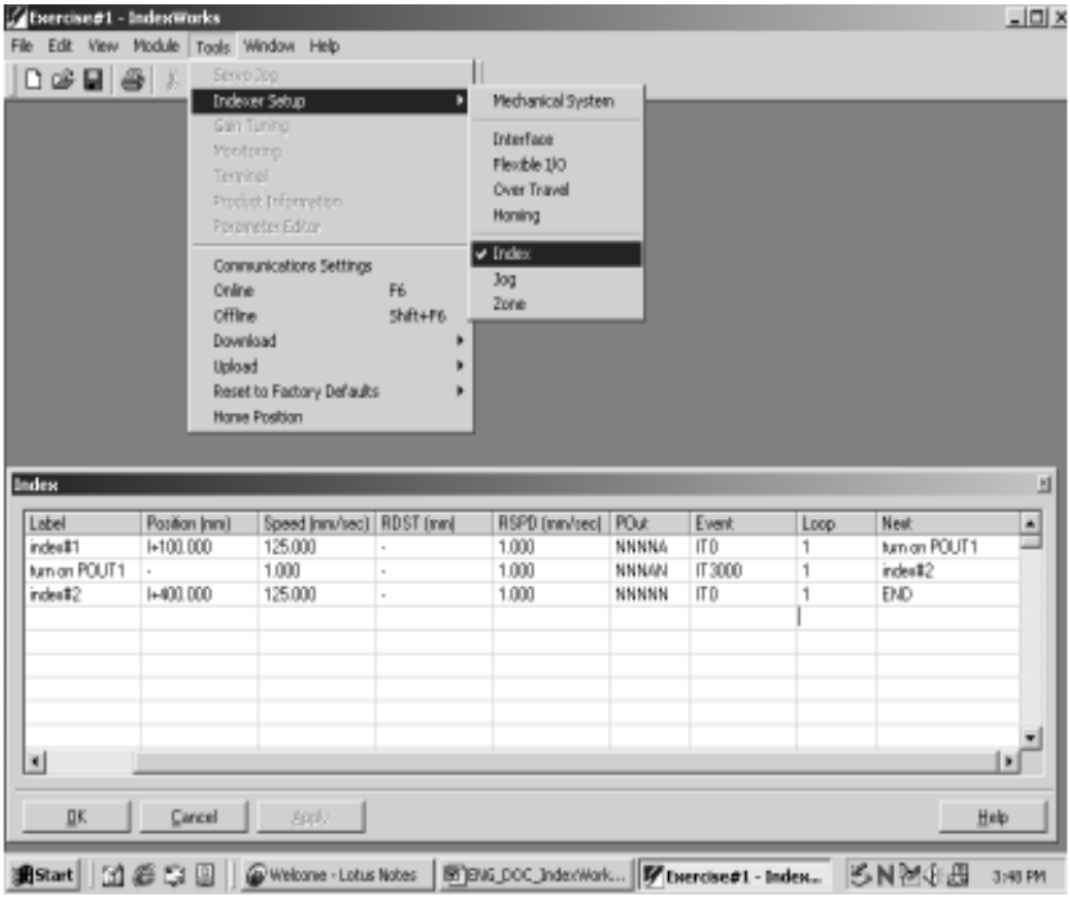
Edit the Mechanical System window by selecting the Indexer Setup Module and then Tools, Indexer Setup, Mechanical System. Make sure to select the correct encoder resolution or select Get Encoder Count while online. Select Apply or OK to accept the changes.



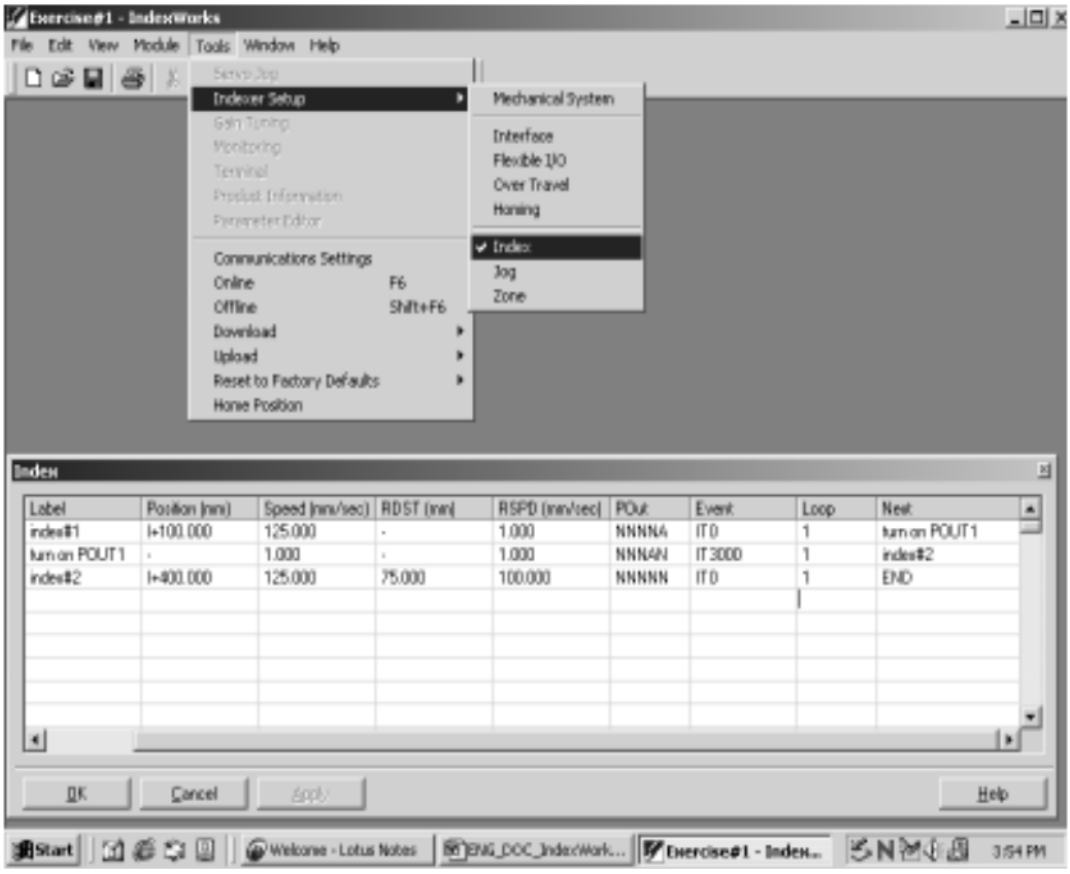
Enter the index into the Index Table by selecting the Indexer Setup Module and then Tools...Indexer Setup...Index. Select Apply or OK to accept the changes. Select Tools...Download...Download All or Download New to send changes to the Indexer.



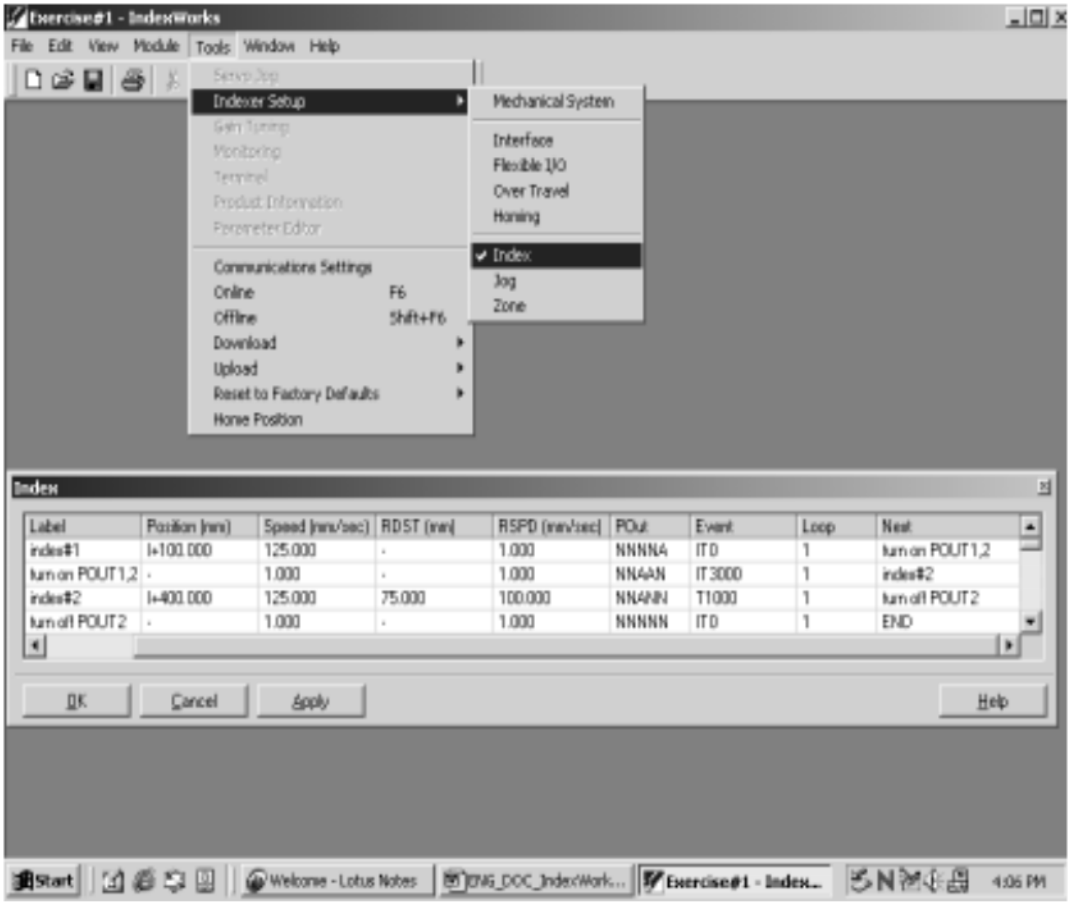
Solution to Exercise #1b:
Enter the new changes to the Index Table. Select Apply or OK and Download the new changes to the Indexer.



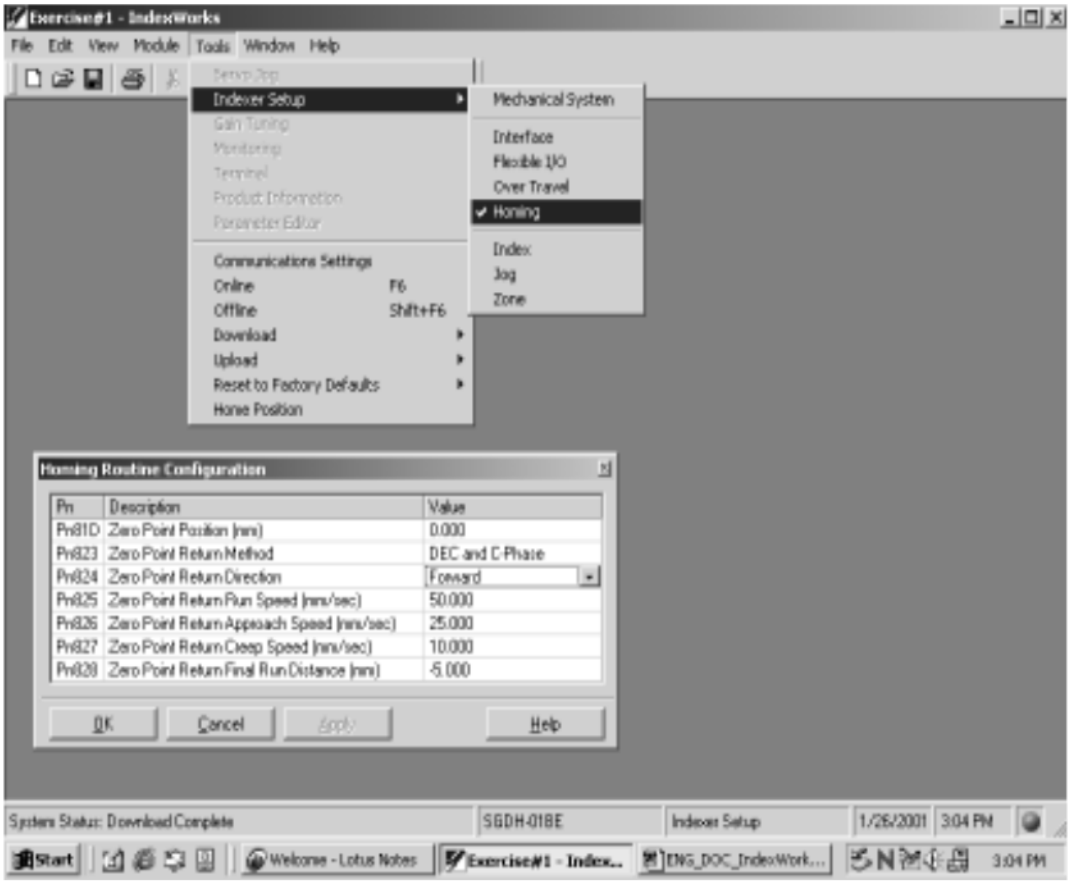
Solution to Exercise #1c:
Add the registration distance and speed to index#2. Select Apply or OK and Download the new changes to the Indexer.



Solution to Exercise #1d:
Enter the new changes to the Index Table. Select Apply or OK and Download the new changes to the Indexer.



Solution to Exercise #1e:
Enter the Homing parameters into the Homing window. Select Apply or OK to accept the changes.



Solution to Exercise #1f:
Convert 5000 rpm into mm/sec:

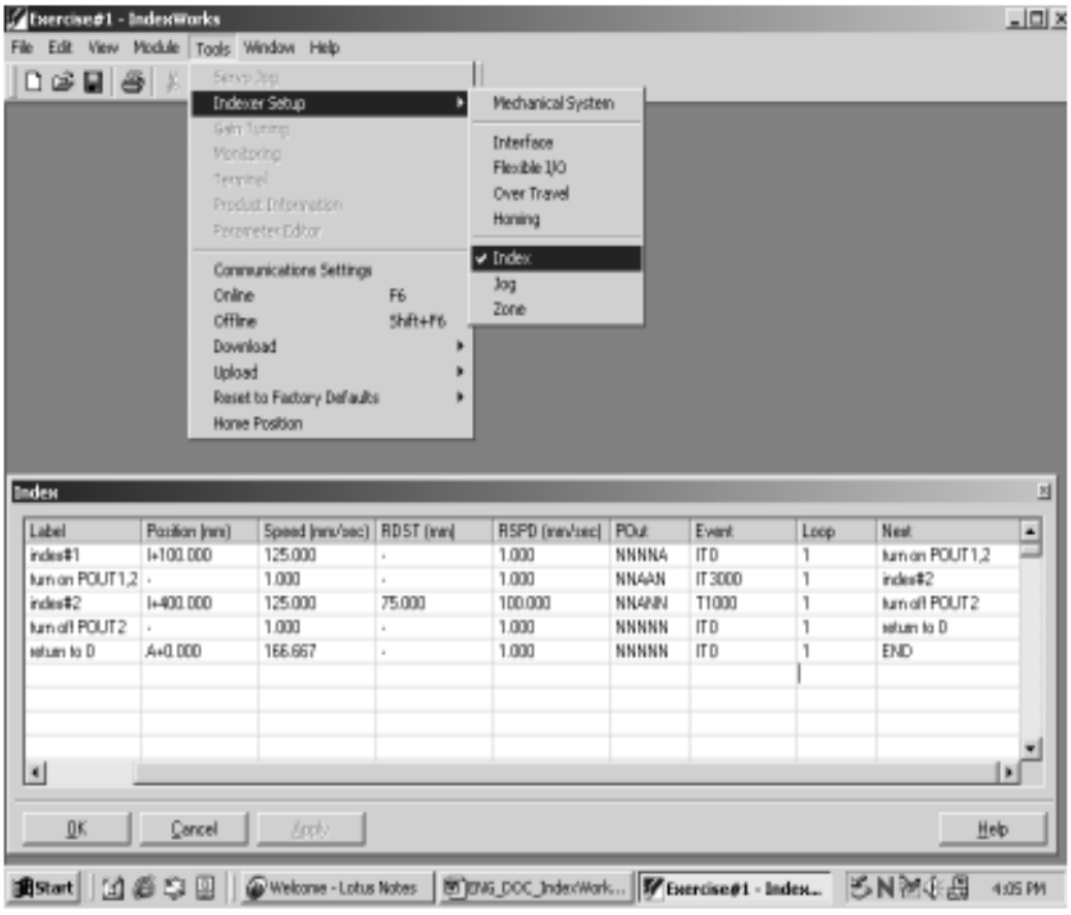
$$rpm \upsilon \frac{encoder.pulses}{revolution} \upsilon \frac{Pn203ElectronicGearRatioA(ref.units)}{Pn202ElectronicGearRatioB(encoder.pulses)} \upsilon \frac{\min}{60\sec} \upsilon \frac{1x10^{\square Resolution} mm}{ref.units} \quad mm/\sec$$

$$5000rpm \upsilon \frac{65{,}536encoder.pulses}{rev.} \upsilon \frac{125ref.units}{4096encoder.pulses} \upsilon \frac{\min}{60\sec} \upsilon \frac{0.001mm}{ref.units} \quad 166.667mm/\sec$$

Note: Value used assumes a 16-bit encoder is used.

Enter the return speed in the Index Table. Select Apply or OK and Download the new changes to the Indexer

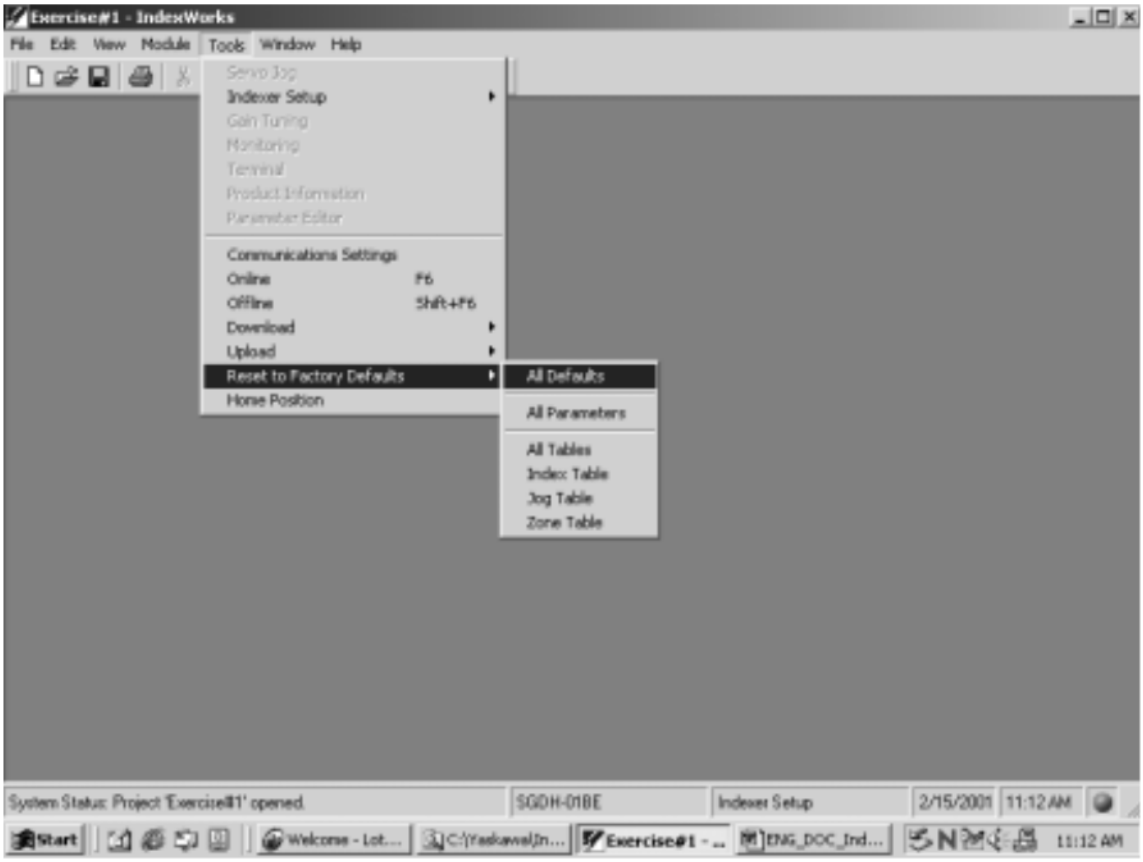
Enter the return speed in the Index Table. Select Apply or Ok and Download the new changes to the Indexer.



D.4 Example Indexer Exercise #2 Solution

Solution to Exercise #2a:

First reset the Indexer to all factory defaults.

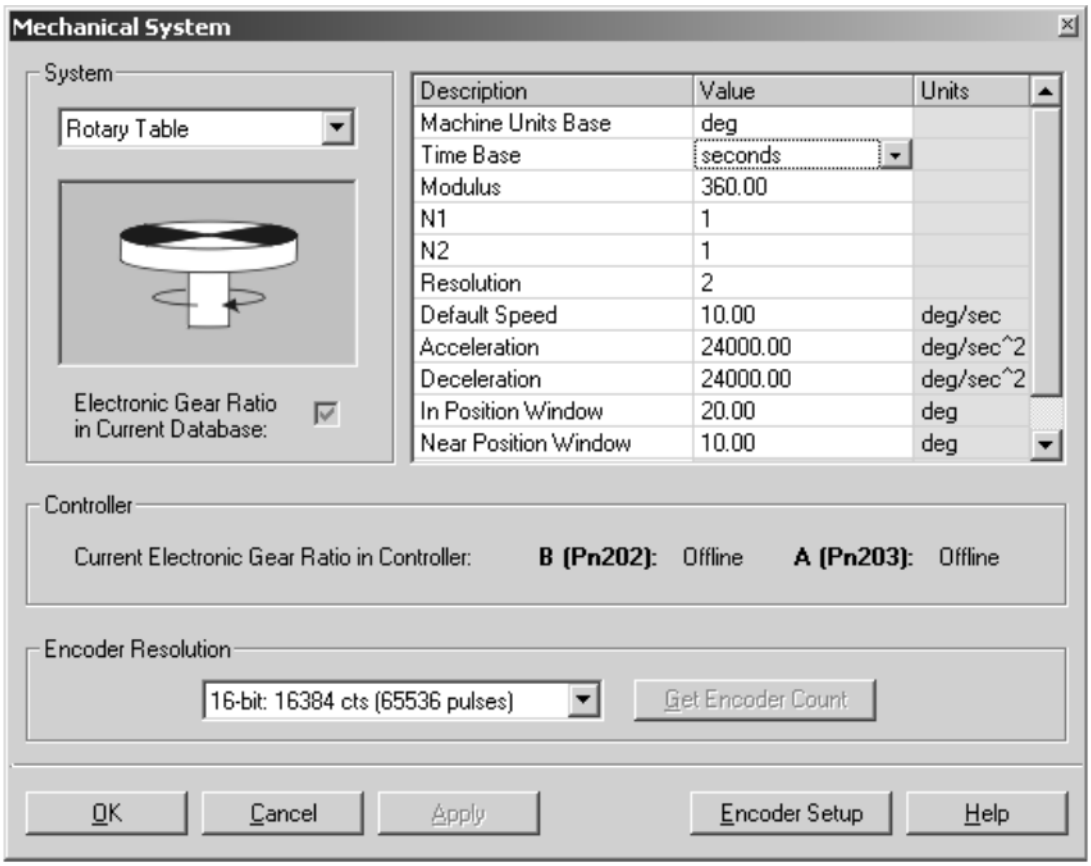


Calculate the desired speed, acceleration, and deceleration.

$$Speed \quad \frac{2\ 60\,\text{deg}}{0.1\,\text{sec}} \quad 1{,}200\,\text{deg/sec}$$

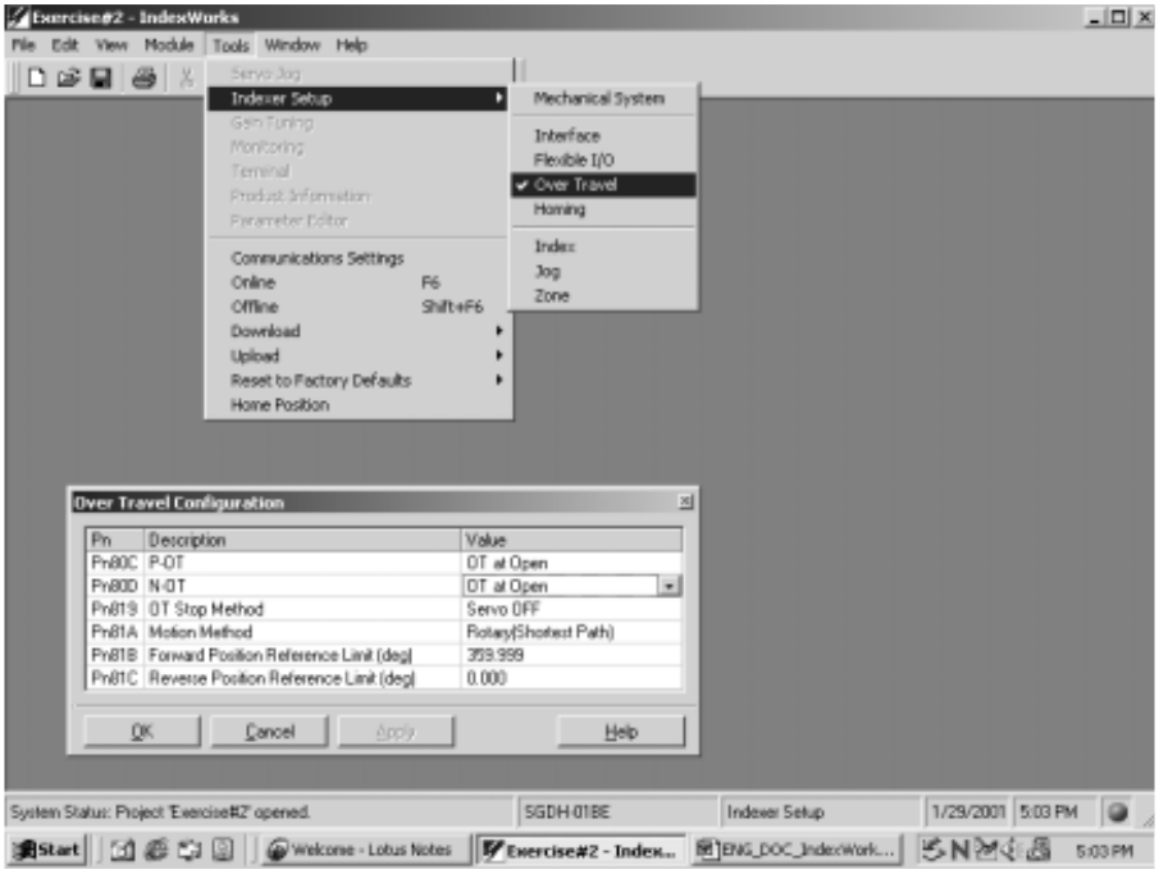
$$Accel \quad Decel \quad \frac{1{,}200\,\text{deg/sec}}{0.05\,\text{sec}} \quad 24{,}000\,\text{deg/sec/sec}$$

Edit the Mechanical System window by selecting the Indexer Setup Module and then Tools...Indexer Setup...Mechanical System. Make sure to select the correct encoder resolution or select Get Encoder Count while online. Select Apply or OK to accept the changes.

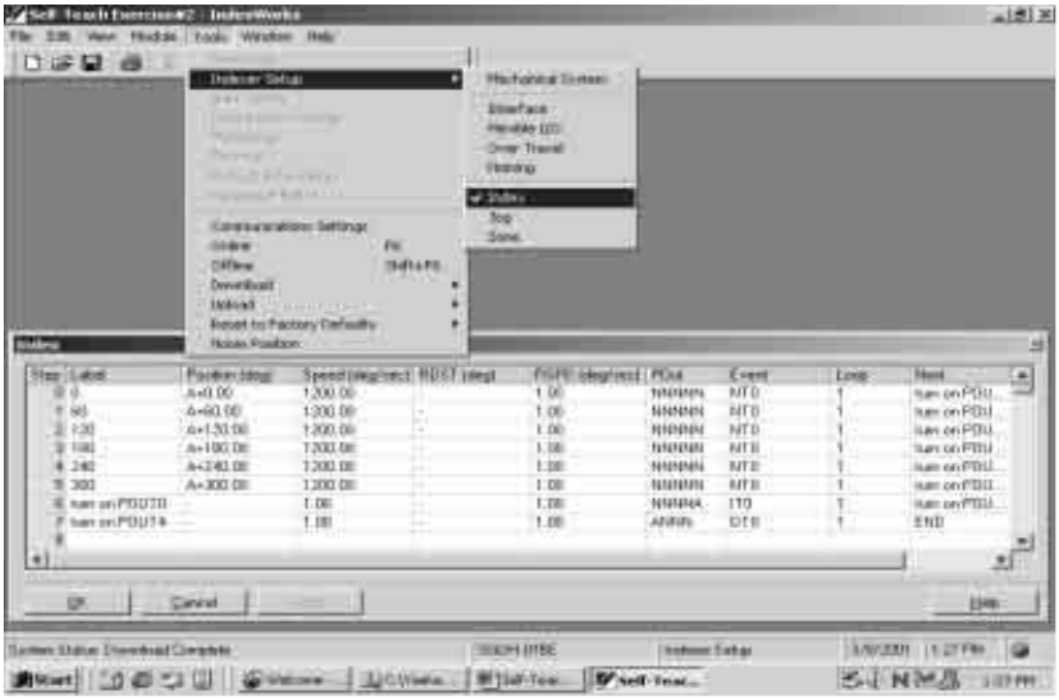


Edit the Over Travel window by selecting Tools, Indexer Setup, Over Travel. This window is used to select the type of motion, whether it be linear or rotary (Motion Method) and to set position limits (linear-software position limits, linear - modulus). Select Apply or OK to accept the changes.

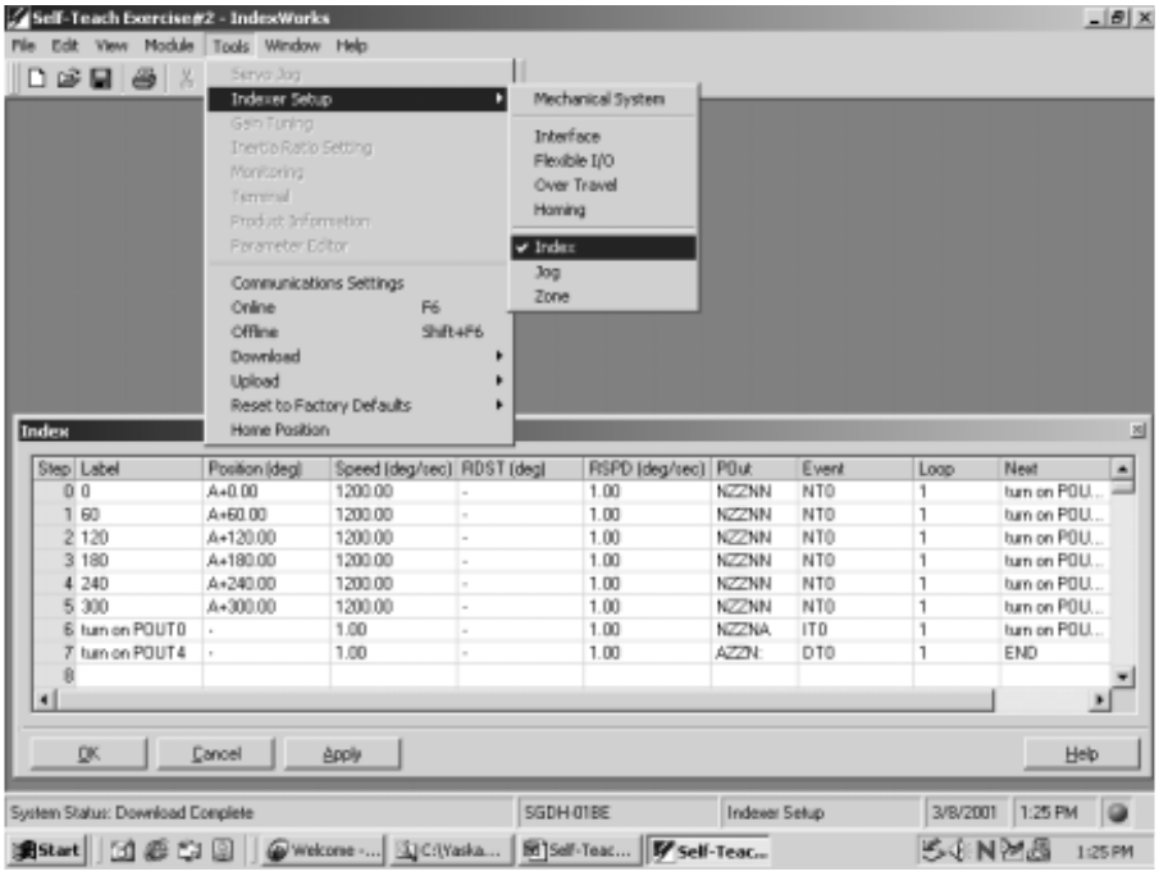
IndexWorks 1.3.5 and above will automatically select Rotary (Shortest Path) and set the position limits according to the Modulus entered in the Mechanical System window when a rotary mechanical system is selected. Note that there are also Motion Method options for Rotary (Forward) and Rotary (Reverse).



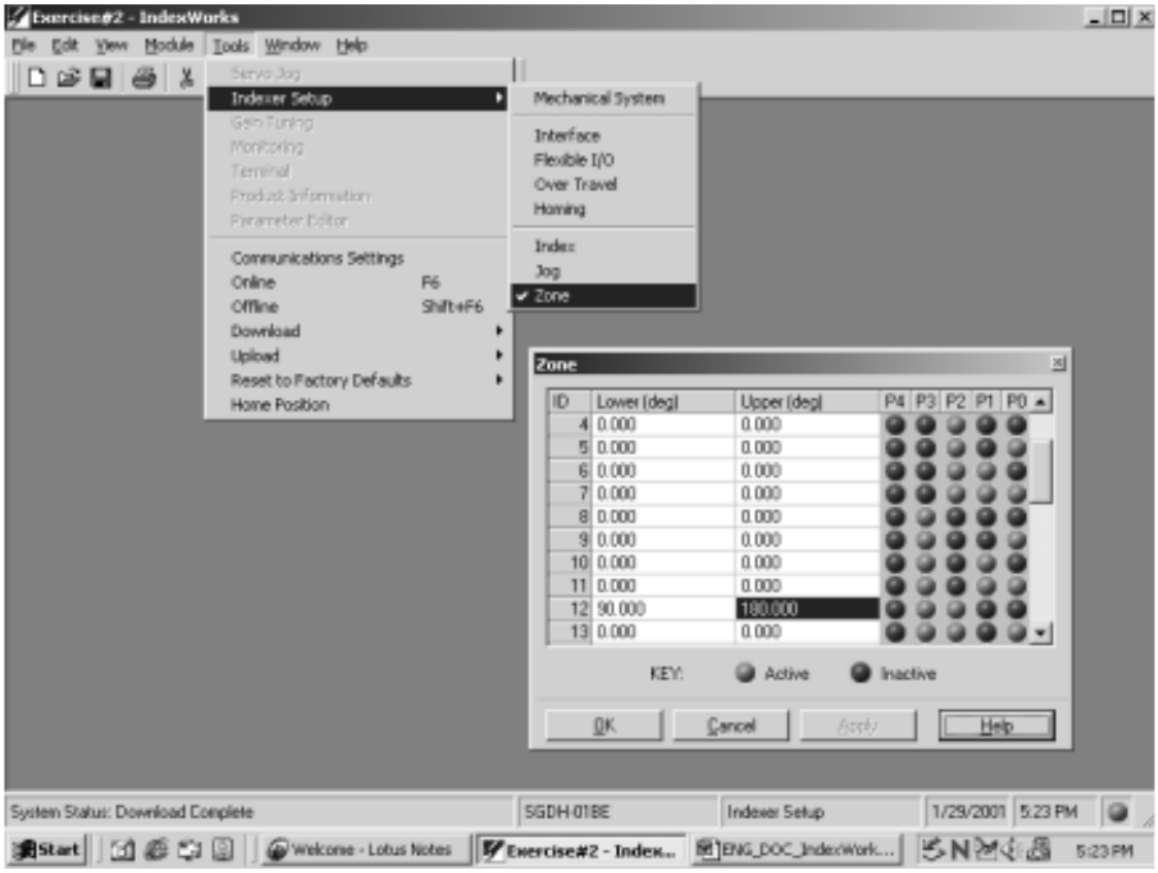
Enter the rotary positions and output conditions into the Index Table by selecting the Indexer Setup Module and then Tools...Indexer Setup...Index. Select Apply or OK to accept the changes. Select Tools...Download...Download All or Download New to send changes to the Indexer.



Solution to Exercise #2b:
Edit the Index Table POUT column to accommodate for the zone conditions. Select Apply or OK to accept the changes.



Edit the Zone Table by selecting the Indexer Setup Module and then Tools, Indexer Setup, Zone. Enter the zone boundary limits to the appropriate zone number. Select Apply or OK to accept the changes. Select Tools, Download, Download All (or Download New) to send changes to the Indexer.



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