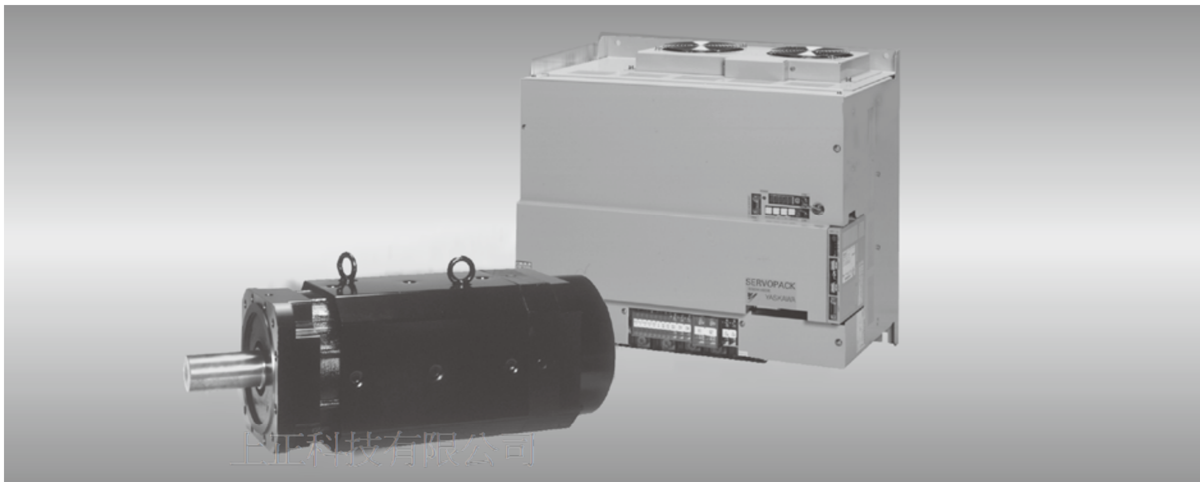
Σ-Ⅱ Series SGMBH/SGDM/SGDH
USER'S MANUAL

AC Servodrive (200 V, 22 to 37 kW)
(400 V, 22 to 55 kW)

SGMBH Servomotor
SGDM/SGDH SERVOPACK



YASKAWA

MANUAL NO. SIE-S800-32.4B

About this Manual

■ This manual provides the following information for the Σ-II Series SGMBH Servomotor, 22-kW to 37-kW SGDM SERVOPACK, and 22-kW to 55-kW SGDH SERVOPACK.

- Procedures for installing and wiring the servomotor and the SERVOPACK.
- Procedures for trial operation of the Servodrive.
- Procedures for using functions and adjusting the servodrives.
- Procedures for using the built-in Panel Operator and the Hand-held Digital Operator.
- Ratings and specifications for standard models.
- Procedures for maintenance and inspection.

■ Intended Audience

This manual is intended for the following users.

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

■ Description of Technical Terms

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

- Servomotor = Σ-II Series SGMBH servomotor.
- SERVOPACK = Σ-II Series SGDM and SGDH SERVOPACK.
- Servodrive = A set including a servomotor and Servo Amplifier.
- Servo System = A servo control system that includes the combination of a servodrive with a host 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 example:

- $\overline{\text{S-ON}}$ = /S-ON
- $\overline{\text{P-CON}}$ = /P-CON

■ Visual Aids

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

IMPORTANT

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

INFO

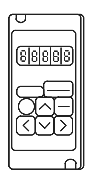
Indicates supplemental information.

◀ EXAMPLE ▶

Indicates application examples.

TERMS

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


JUSP-OP02A-2

The text indicated by this icon explains the operating procedure using Hand-held type Digital Operator (Type: JUSP-OP02A-2).

Related Manuals

- Refer to the following manuals as required.
- Also, keep this manual in a safe place so that it can be referred to whenever necessary.

Manual Name	Manual Number	Contents
Σ Series/Σ-II Series SERVOPACKs Personal Computer Monitoring Software Operation Manual	SIE-S800-35	Describes the applications and operation of software for the Σ Series/Σ-II Series servodrive monitoring devices for use on personal computers.
Σ-II Series SGM☐H/SGDM Digital Operator Operation Manual	TOE-S800-34	Provides detailed information on the operation of the JUSP-OP02A-2 Digital Operator, which is an optional product.

Safety Information

The following conventions are used to indicate precautions in this manual.

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

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

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

⃠ PROHIBITED — Indicates actions that must never be taken.

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 the SERVOPACK in one of the specified combinations. Not doing so may cause fire or malfunction.

■ Installation

⚠ CAUTION
• Never use the products in an environment subject to water, corrosive gases, inflammable gases, or combustibles. • Doing so may result in electric shock or fire.

■ Storage and Transportation

⚠ CAUTION
• If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used. Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more. • If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

■ Wiring

⚠ WARNING

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

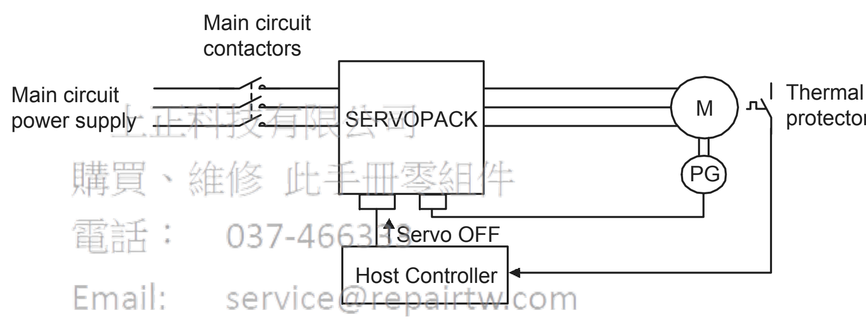
  Improper grounding may result in electric shock or fire.

- Use the thermal protector built into the servomotor according to either of the two following methods.

  SGMBH servomotors are cooled by a fan. If the fan is defective or power to the fan is disconnected, heat from the motor may result in burns or fire.

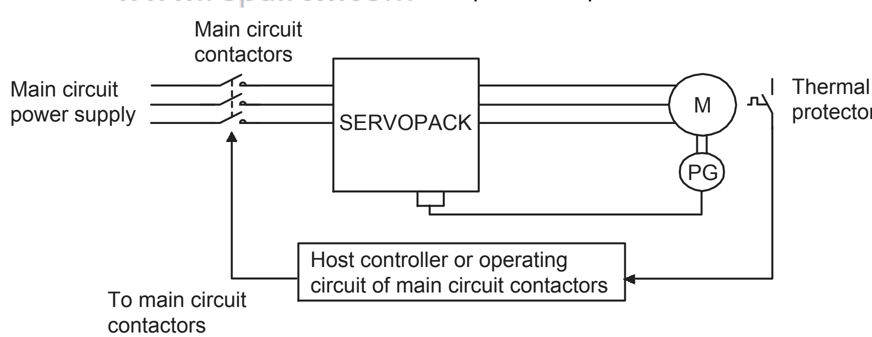
Method 1:

- Wire the output from the thermal protector to the host controller and turn OFF the servo when the thermal protector operates.



Method 2:

- Wire the thermal protector to the operating circuit of the main circuit contactors or the host controller and turn OFF the main circuit when the thermal protector operates.



⚠ CAUTION

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

  Doing so may result in injury or fire.

- Securely fasten the power supply terminal screws and motor output terminal screws.

  Not doing so may result in fire.

■ Operation

WARNING

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

  Doing so may result in injury.

CAUTION

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

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

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

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

  Doing so may result in burns due to high temperatures.

■ Maintenance and Inspection

WARNING

- Never touch the inside of the SERVOPACKs.

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

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

  Residual voltage may cause electric shock.

CAUTION

- Do not disassemble the servomotor.

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

  Doing so may result in electric shock or injury.

■ General Precautions

Note the following to ensure safe application.
• The drawings presented in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual. • The drawings presented in this manual are typical examples and may not match the product you received. • This manual is subject to change due to product improvement, specification modification, and manual improvement. When this manual is revised, the manual code is updated and the new manual is published as a next edition. • 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.

SGDM and SGDH SERVOPACKs Standards and Certification

SGDM and SGDH SERVOPACKs conform to the following standards. However, because this product is a built-in type, reconfirmation is required after being installed in the final product.

- EN55011 group 1 class A
- EN50082-2

CONTENTS

3 Trial Operation

4 Parameter Settings and Functions

1

1 For First-time Users of AC Servos

This chapter is intended for first–time users of AC servos. It describes the basic configuration of a servo mechanism and basic technical terms relating to servos. Users who already have experience in using a servo should also take a look at this chapter to understand the features of Σ-II Series AC Servos.

1.1 Basic Understanding of AC Servos

This section describes the basic configuration of a servo mechanism and technical terms relating to servos and also explains the features of Σ-II Series AC Servos.

1.1.1 Servo Mechanisms

You may be familiar with the following terms:

- Servo
- Servo mechanism[1]
- Servo control system

In fact, these terms are synonymous. They have the following meaning:

A control mechanism that monitors physical quantities such as specified positions.

In short, a servo mechanism is like a servant who does tasks faithfully and quickly according to his master's instructions. In fact, "servo" originally derives from the word "servant."

Servo system could be defined in more detail as a mechanism that:

- Moves at a specified speed and
- Locates an object in a specified position

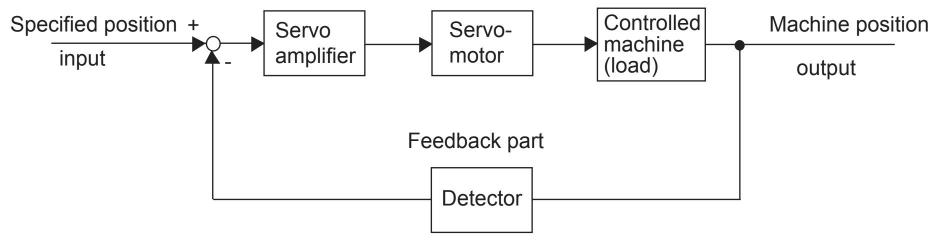
TERMS

[1] Servo mechanism

According to Japanese Industrial Standard (JIS) terminology, a "servo mechanism" is defined as a mechanism that uses the position, direction, or orientation of an object as a process variable to control a system to follow any changes in a target value (set point). More simply, a servo mechanism is a control mechanism that monitors physical quantities such as specified positions. Feedback control is normally performed by a servo mechanism. (Source: JIS B0181)

To develop such a servo system, an automatic control system involving feedback control[1] must be designed. This automatic control system can be illustrated in the following block diagram:

Configuration of Servo System



This servo system is an automatic control system that detects the machine position (output data), feeds back the data to the input side, compares it with the specified position (input data), and moves the machine by the difference between the compared data.

In other words, the servo system is a system to control the output data to match the specified input data.

If, for example, the specified position changes, the servo system will reflect the changes.

In the above example, input data is defined as a position, but input data can be any physical quantities such as orientation (angle), water pressure, or voltage.

Position, speed, force (torque), electric current, and so on are typical controlled values for a servo system.

TERMS

1 Feedback control

A control method in which process variables are returned to the input side to form a closed loop. It is also called closed-loop control. If a negative signal is returned to the input side, it is called negative feedback control. Normally, negative feedback control is used to stabilize the system. If feedback is not returned, the control method is called open-loop control.

1.1.2 Technical Terms

The main technical terms used in this manual are as follows:

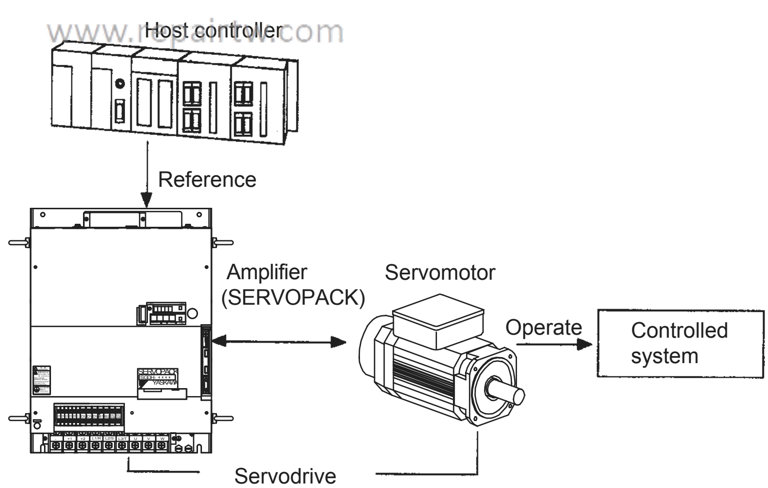
- Servo mechanism
- Servo

  Normally, servo is synonymous with servo mechanism. However, because “mechanism” is omitted, the meaning becomes somewhat ambiguous. Servo may refer to the entire servo mechanism but may also refer to an integral part of a servo mechanism such as a servomotor or a servo amplifier. This manual also follows this convention in the use of the term “servo.”

- Servo control system

  Servo control system is almost synonymous with servo mechanism but places the focus on system control. In this manual, the term “servo system” is also used as a synonym of servo control system.

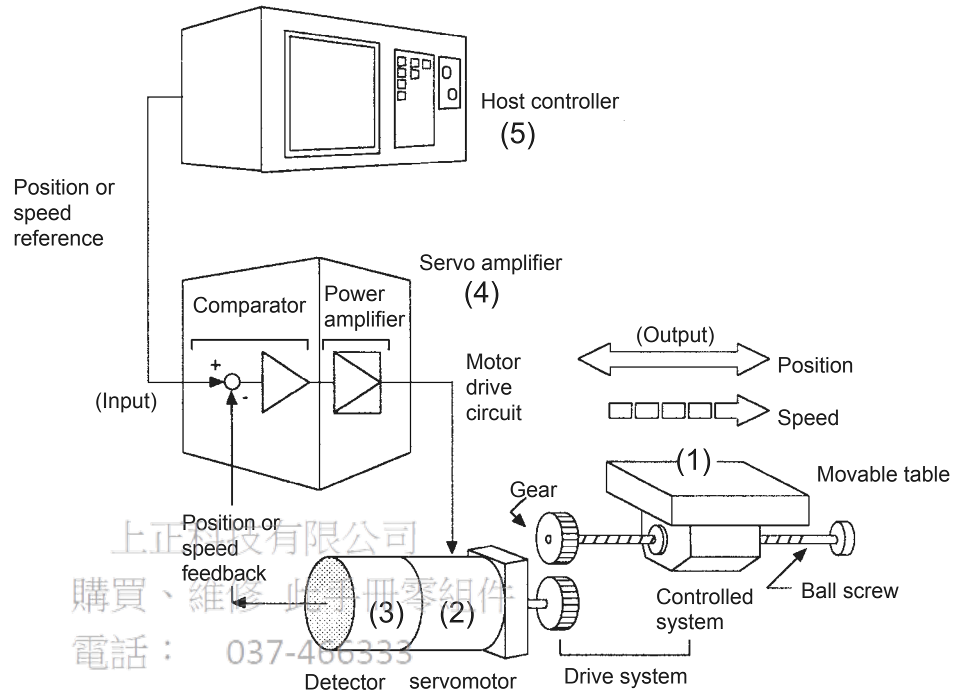
Related Terms	Meaning
Servomotor	General servomotors or Yaskawa SGMBH servomotors. In some cases, a position detector (encoder) is included in a servomotor.
SERVOPACK	Trademark of Yaskawa servo amplifier “SGDM and SGDH SERVOPACKs.”
Servodrive	A servomotor and amplifier pair. Also called “servo.”
Servo system	A closed control system consisting of a host controller, servodrive and controlled system to form a servo mechanism.



Servo system

1.2 Configuration of Servo System

The following diagram illustrates a servo system in detail:



(1) Controlled system: Mechanical system for which the position or speed is to be controlled. This includes a drive system that transmits torque from a servomotor.

(2) Servomotor: A main actuator that moves a controlled system. Two types are available: AC servomotor and DC servomotor.

(3) Detector: A position or speed detector. Normally, an encoder mounted on a motor is used as a position detector.

(4) Servo amplifier: An amplifier that processes an error signal to correct the difference between a reference and feedback data and operates the servomotor accordingly. A servo amplifier consists of a comparator, which processes error signals, and a power amplifier, which operates the servomotor.

(5) Host controller: A device that controls a servo amplifier by specifying a position or speed as a set point.

Servo components (1) to (5) are outlined below:

1. Controlled System

   In the previous figure, the controlled system is a movable table for which the position or speed is controlled. The movable table is driven by a ball screw and is connected to the servomotor via gears. So, the drive system consists of:

- Gears + Ball Screw

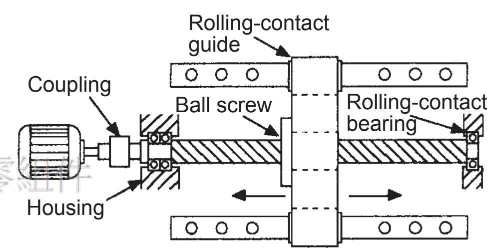
  This drive system is most commonly used because the power transmission ratio (gear ratio) can be freely set to ensure high positioning accuracy. However, play in the gears must be minimized.

  The following drive system[1] is also possible when the controlled system is a movable table:

- Coupling + Ball Screw

  When the power transmission ratio is 1 : 1, a coupling is useful because it has no play.

  This drive system is widely used for machining tools.

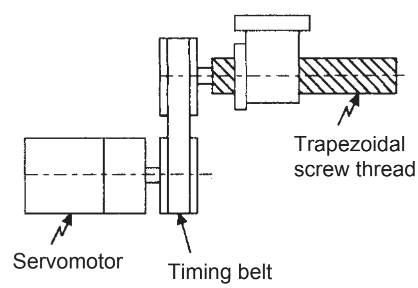


- Timing Belt + Trapezoidal Screw Thread

  A timing belt is a coupling device that allows the power transmission ratio to be set freely and that has no play.

  A trapezoidal screw thread does not provide excellent positioning accuracy, so can be treated as a minor coupling device.

  To develop an excellent servo system, it is important to select a rigid drive system that has no play.



  Configure the controlled system by using an appropriate drive system for the control purpose.

TERMS

[1] Drive system

Also called a drive mechanism. A drive system connects an actuator (such as a servomotor) to a controlled system and serves a mechanical control component that transmits torque to the controlled system, orientates the controlled system, and converts motion from rotation to linear motion and vice versa.

2. Servomotor

- DC Servomotor and AC Servomotor

Servomotors are divided into two types: DC servomotors and AC servomotors.

DC servomotors are driven by direct current (DC). They have a long history. Up until the 1980s, the term “servomotor” used to imply a DC servomotor.

From 1984, AC servomotors were emerging as a result of rapid progress in microprocessor technology. Driven by alternating current (AC), AC servomotors are now widely used because of the following advantages:

- Easy maintenance: No brush
- High speed: No limitation in rectification rate

Note however that servomotors and the SERVOPACKs use some parts that are subject to mechanical wear or aging. For preventive maintenance, inspect and replace parts at regular intervals. For details, refer to *Chapter 8 Inspection, Maintenance, and Troubleshooting.*

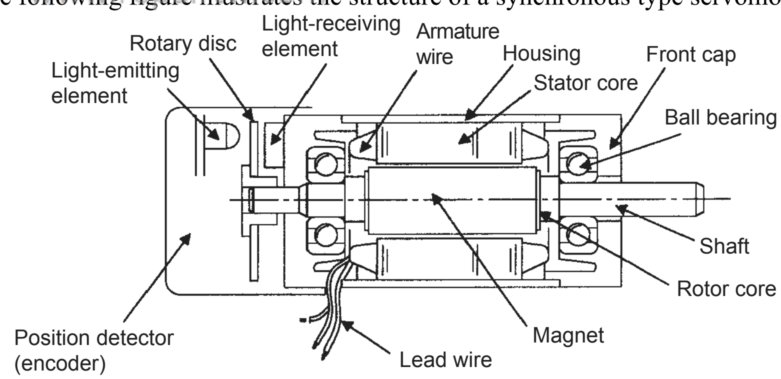
- AC Servomotor

AC servomotors are divided into two types: Synchronous type and induction type. The synchronous type is more commonly used.

For a synchronous type servomotor, motor speed is controlled by changing the frequency of alternating current.

A synchronous type servomotor provides strong holding torque when stopped, so this type is ideal when precise positioning is required. Use this type for a servo mechanism for position control.

The following figure illustrates the structure of a synchronous type servomotor:



Yaskawa SGMBH servomotors are of the synchronous type.

- Performance of Servomotor

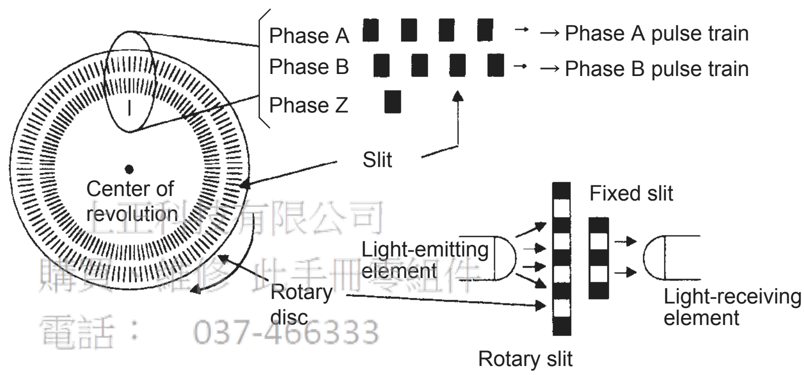
A servomotor must have “instantaneous power” so that it can start as soon as a start reference is received. The term “power rating (kW/s)” is used to represent instantaneous power. It refers to the electric power (kW) that a servomotor generates per second. The greater the power rating, the more powerful the servomotor.

3. Detector

   A servo system requires a position or speed detector. It uses an encoder mounted on a servomotor for this purpose. Encoders are divided into the following two types:

- Incremental Encoder

  An incremental encoder is a pulse generator, which generates a certain number of pulses per revolution (e.g., 2,000 pulses per revolution). If this encoder is connected to the mechanical system and one pulse is defined as a certain length (e.g., 0.001 mm), it can be used as a position detector. However, this encoder does not detect an absolute position and merely outputs a pulse train. Hence zero point return operation must be performed before positioning. The following figure illustrates the operation principle of a pulse generator:



- Absolute Encoder

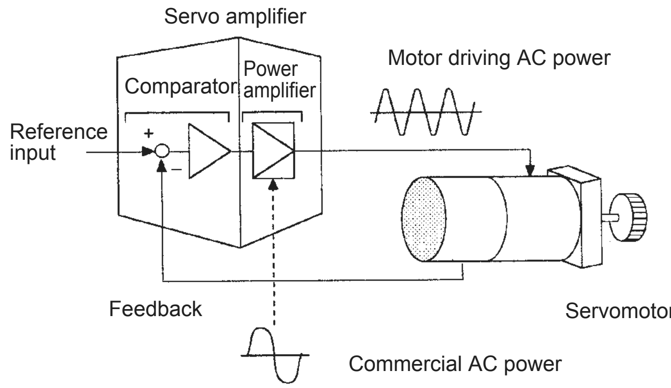
  An absolute encoder is designed to detect an absolute angle of rotation as well as to perform the general functions of an incremental encoder. With an absolute encoder, therefore, it is possible to create a system that does not require zero point return operation at the beginning of each operation.

- Difference between an Absolute and Incremental Encoder

  An absolute encoder will keep track of the motor shaft position even if system power is lost and some motion occurs during that period of time. The incremental encoder is incapable of the above.

4. Servo Amplifier

A servo amplifier is required to operate an AC servomotor. The following figure illustrates the configuration of a servo amplifier:



A servo amplifier consists of the following two sections:

- Comparator

A comparator consists of a comparison function and a control function. The comparison function compares reference input (position or speed) with a feedback signal and generates a differential signal.

The control function amplifies and transforms the differential signal. In other words, it performs proportional (P) control or proportional/integral (PI) control[1]. (It is not important if you do not understand these control terms completely at this point.)

- Power Amplifier

A power amplifier runs the servomotor at a speed or torque proportional to the output of the comparator. In other words, from the commercial power supply of 50/60 Hz, it generates alternating current with a frequency proportional to the reference speed and runs the servomotor with this current.

5. Host Controller

A host controller controls a servo amplifier by specifying a position or speed as a set point.

For speed reference, a position control loop may be formed in the host controller when a position feedback signal is received. Yaskawa machine controller MP920 is a typical host controller.

TERMS

[1] Proportional/integral (PI) control

PI control provides more accurate position or speed control than proportional control, which is more commonly used.

1.3 Features of Σ-II Series Servos

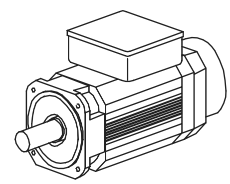
A Σ-II Series Servo consists of an SGMBH servomotor and an SGDM SERVOPACK or an SGDH SERVOPACK.

1.3.1 Outline

This section outlines SGMBH servomotor types and the control types of SGDM and SGDH SERVOPACKs.

■ SGMBH Servomotor Type

Σ-II Series SGMBH servomotors are synchronous type servomotors and have the following features:

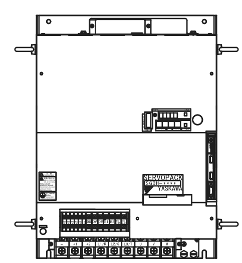


SGMBH Servomotor

Rated Motor Speed Maximum Motor Speed	Voltage	Maximum Torque	Rated Output
1500 min^{-1}	400 V	200 %	22 to 55 kW
2000 min^{-1}	200 V		22 to 37 kW

■ Control Types of SGDM and SGDH SERVOPACKs

The SGDM and SGDH SERVOPACKs allow the control of speed, position and torque.



SGDM or SGDH SERVOPACK

Speed Control (Analog Reference)

Accepts an analog voltage speed reference.

Position Control (Pulse Reference)

Accepts a pulse train position reference.

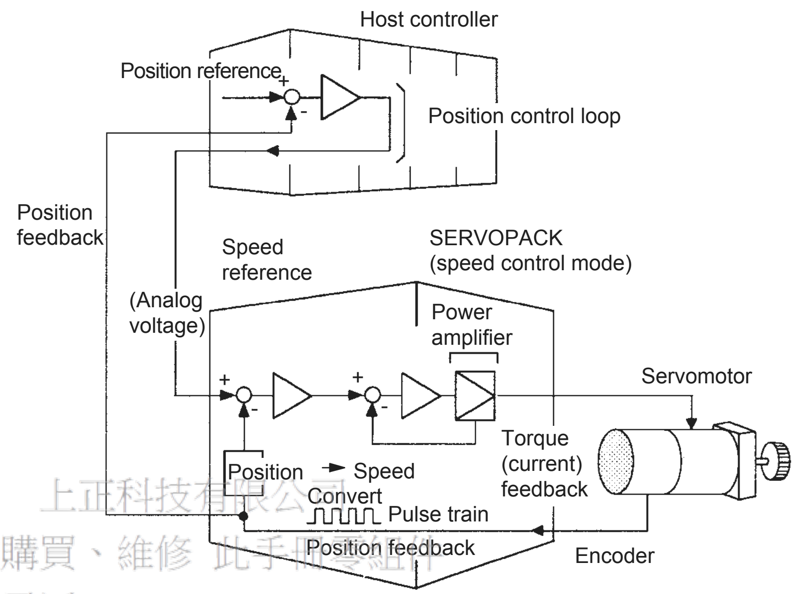
Torque Control (Analog Reference)

Accepts an analog voltage torque reference.

1.3.2 Using the SGDM and SGDH SERVOPACK

■ Using the SERVOPACK for Speed Control

The most common use of a SERVOPACK for speed control is shown below:



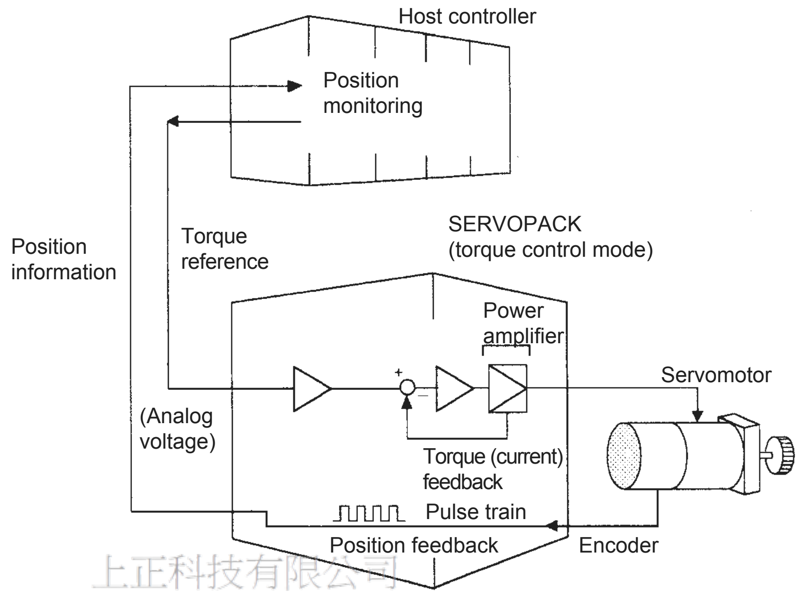
As shown in the above figure, a position control loop is formed in the host controller. The host controller compares a position reference with a position feedback signal and sends the processed result to the SERVOPACK as a speed reference.

In this way the host controller can be freed from performing the servo mechanism control. The SERVOPACK undertakes the speed control loop and subsequent control processing.

A machine controller from Yaskawa's MP900/MP2000 series is an example of a typical host controller.

■ Using the SERVOPACK for Torque Control

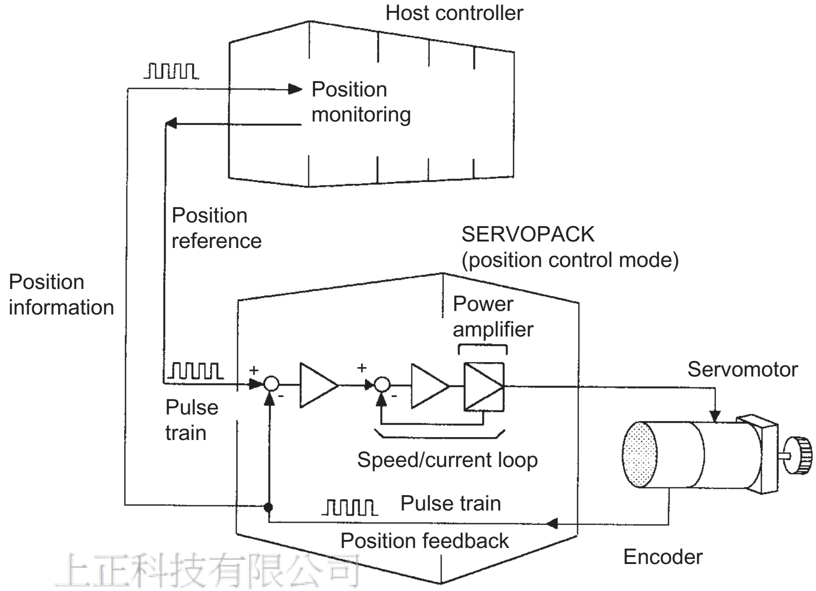
The SERVOPACK can be used for torque control as shown below.



The host controller outputs a torque reference to control the SERVOPACK. It also receives a pulse train (position information) from the SERVOPACK and uses it to monitor the position.

■ Using the SERVOPACK for Position Control

The SERVOPACK can be used for position control as shown below.



The host controller can send a position reference (pulse train) to the SERVOPACK to perform positioning or interpolation. This type of the SERVOPACK contains a position control loop.

Parameters can be used to select either of the following pulse trains:

- Sign + pulse train
- Two-phase pulse train with 90° phase difference
- Forward and reverse pulse trains

The host controller receives a pulse train (position information) from the SERVOPACK and uses it to monitor the position.

■ Parameter Setting

A Digital Operator can be used to set parameters for a SERVOPACK as follows:

- Setting parameters to enable or disable each function
- Setting parameters required for functions to be used

Set parameters according to the servo system to be set up.

2

Basic Operation

2

This chapter describes the first things to do when Σ-II Series products are delivered. It also explains the most fundamental ways of connecting and operating Σ-II Series products. Both first-time and experienced servo users **must read** this chapter.

2.1 Precautions

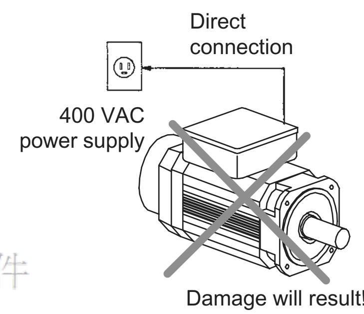
This section provides notes on using Σ-II Series products.

■ Use a 200-VAC or a 400-VAC power supply.

Use a 200-VAC or a 400-VAC power supply. The voltage of the power supply depends on your SERVOPACK model. For more information, refer to *7.3 SERVOPACK Ratings and Specifications*.

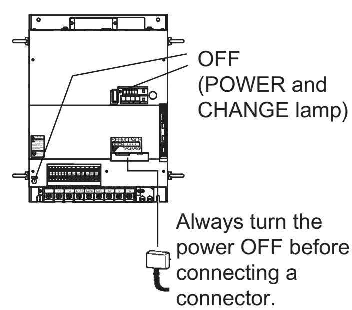
■ Do not connect the servomotor directly to a commercial power line.

Direct connection to the power frequency supply will damage the servomotor. The servomotor cannot be operated without an SGDM or an SGDH SERVOPACK.



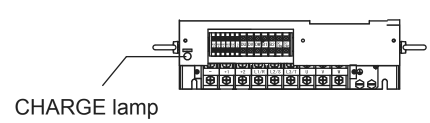
■ Do not change wiring when power is ON.

Always turn the power OFF before connecting or disconnecting a connector. (Except for Digital Operator (Model: JUSP-OP02A-2))



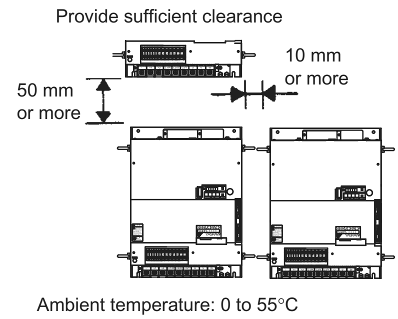
■ Before inspecting, always wait 5 minutes after turning power OFF.

Even after the power is turned OFF, residual electric charge still remains in the capacitor inside the SERVOPACK. To prevent an electric shock, always wait for the CHARGE lamp to go OFF before starting inspection (if necessary).



■ Always follow the specified installation method.

When installing SERVOPACKs side by side as shown in the figure on the right, allow at least 10 mm (0.39 in) between and at least 50 mm (1.97 in) above and below each SERVOPACK. The SERVOPACK generates heat. Install the SERVOPACK so that it can radiate heat freely. Note also that the SERVOPACK must be in an environment free from condensation, vibration and shock.

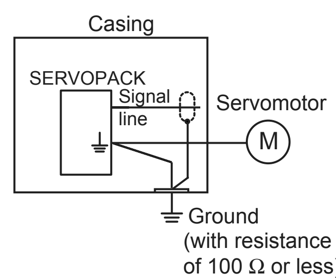


2

■ Perform noise reduction and grounding properly.

If the signal line is noisy, vibration or malfunction will result.

- Separate high-voltage cables from low-voltage cables.
- Use cables as short as possible.
- Perform the grounding with the ground resistance of 100 Ω or less for the servomotor and the SERVOPACK.
- Never use a line filter for the power supply in the motor circuit.



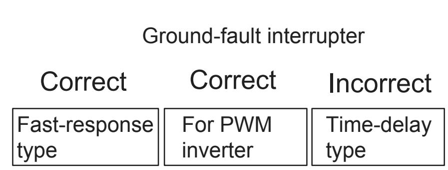
■ Conduct a voltage resistance test under the following conditions.

- Voltage: 1500 Vrms AC, one minute
- Current limit: 100 mA
- Frequency: 50/60 Hz
- Voltage application points: For the 200-V series, between the frame ground and the point where the L1C/r, L3C/t, L1/R, L2/S, and L3/T terminals are all connected. For the 400-V series, between the frame ground and the point where the 480 V, 460 V, 440 V, 400 V, 380 V, 0 V, L1/R, L2/S, and L3/T terminals are all connected.

Contact your Yaskawa representative before applying voltage to points not specified above when performing standards certification tests or such.

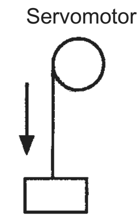
■ Use a fast-response type ground-fault interrupter.

For a ground-fault interrupter, always use a fast-response type or one designed for PWM inverters. Do not use a time-delay type.



■ Do not perform continuous operation under overhanging load.

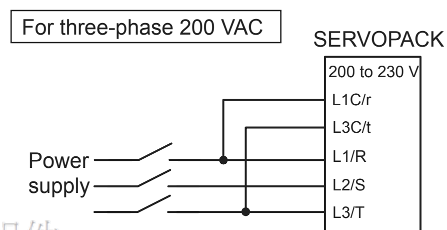
Continuous operation cannot be performed by rotating the motor from the load and applying regenerative braking. Regenerative braking by the SERVOPACK can be applied only for a short period, such as the motor deceleration time.

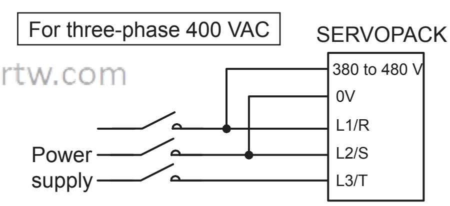


Do not apply regenerative braking continuously.

■ The servomotor cannot be operated by turning the power ON and OFF.

Frequently turning the power ON and OFF causes the internal circuit elements to deteriorate. Always start or stop the servomotor by using reference pulses.





Do not start or stop by tuning power ON and OFF.

2.2 Installation

This section describes how to check Σ-II Series products on delivery and how to install them.

2.2.1 Checking on Delivery

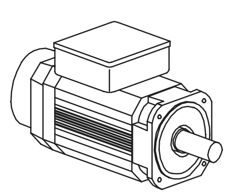
Check the following items when Σ-II Series products are delivered.

Check Items	Comments
Are the delivered products the ones that were ordered?	Check the model numbers marked on the nameplates of the servomotor and the SERVOPACK. (See the following.)
Does the servomotor shaft rotate smoothly?	The servomotor shaft is normal if it can be turned smoothly by hand. Servomotors with brakes, however, cannot be turned manually.
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Are there any loose screws?	Check screws for looseness using a screwdriver.

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

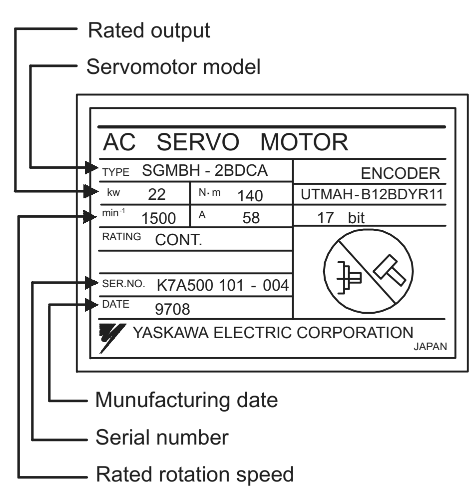
■ Servomotors

External Appearance and Nameplate Examples



SGMBH servomotor

(Example)



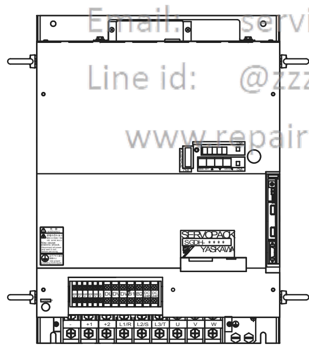
Model Numbers

SGMBH - 2B D C A □ □

- Σ-II Series Servomotor (SGMBH)
- Servomotor Capacity (2B)
  - 2B: 22 kW 4E: 45 kW (400 V only)
  - 3Z: 30 kW 5E: 55 kW (400 V only)
  - 3G: 37 kW
- Supply Voltage (D)
  - A: 200 V
  - D: 400 V
- Encoder Specifications (C)
  - 2: 17-bit absolute encoder
  - 3: 20-bit absolute encoder (optional)
  - C: 17-bit incremental encoder
- Design Revision Order (A)
  - A: Maximum torque 200%
- Shaft End Specifications (□)
  - 2: Flange mounted, straight without key
  - 6: Flange mounted, straight with key and tap
  - K: With foot, straight without key
  - L: With foot, straight with key and tap
- Options (□)
  - 1: With V-type oil seal
  - B: With V-type oil seal, 90-VDC holding brake
  - C: With V-type oil seal, 24-VDC holding brake
  - S: With S-type oil seal
  - D: With S-type oil seal, 90-VDC holding brake
  - E: With S-type oil seal, 24-VDC holding brake

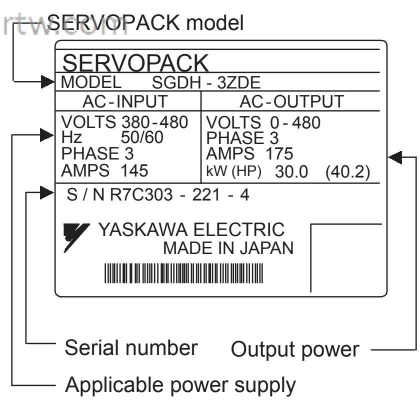
■ SERVOPACKs

External Appearance and Nameplate



Σ-II Series SGDM and SGDH SERVOPACKs

(Example)



SGDM Model Numbers

SGDM - 2B A D A

Σ-II Series
SGDM SERVOPACK

Rated Output (motor capacity)
- 2B: 22 kW
- 3Z: 30 kW
- 3G: 37 kW

Supply Voltage
A: 200 V

Model
- D: For torque, speed, and position control

Design revision order

SGDH Model Numbers

SGDH - 2B D E

Σ-II Series
SGDH SERVOPACK

Rated Output (motor capacity)
- 2B: 22 kW 4E: 45 kW (400 V only)
- 3Z: 30 kW 5E: 55 kW (400 V only)
- 3G: 37 kW

Supply Voltage
A: 200 V
D: 400 V

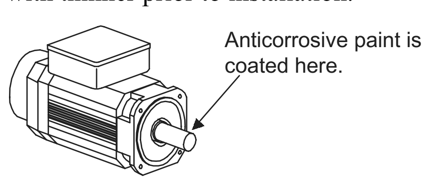
Model
- E: For torque, speed, and position control

2.2.2 Installing the Servomotor

SGMBH servomotors can be installed either horizontally or vertically. The service life of the servomotor will be shortened or unexpected problems will occur if the servomotor is installed incorrectly or in an inappropriate location. Always observe the following installation instructions.

■ Prior to Installation

The end of the motor shaft is coated with anticorrosive paint. Thoroughly remove the paint using a cloth moistened with thinner prior to installation.



IMPORTANT

Avoid getting thinner on other parts of the servomotor when cleaning the shaft.

■ Storage Temperature

Store the servomotor within the following temperature range if it is stored with the power cable disconnected.
Between -20 to 60 °C.

■ Installation Site

SGMBH servomotors are designed for indoor use. Install the servomotor in environments that satisfy the following conditions.

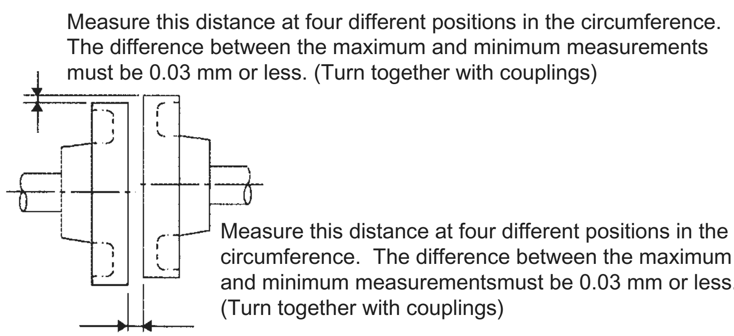
- Free of corrosive or explosive gases.
- Well-ventilated and free of dust and moisture.
- Ambient temperature of 0 to 40 °C.
- Relative humidity of 20% to 80% (non-condensing)
- Facilitates inspection and cleaning.
- Altitude : 1000 m max.

Install a protective cover over the servomotor if it is used in a location that is subject to water or oil mist. Also use a servomotor with an oil seal to seal the through shaft[1] section.

Install the electrical connector with the cable facing downward or in a horizontal position.

■ Alignment

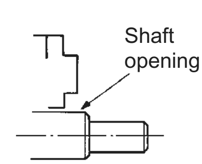
Align the shaft of the servomotor with that of the equipment to be controlled, then connect the shafts with flexible couplings. Install the servomotor so that alignment accuracy falls within the following range.



TERMS

[1] Through Sections of the shaft

This refers to the gap where the shaft protrudes from the end of the motor.



IMPORTANT

1. Vibration that will damage the bearings will occur if the shafts are not properly aligned.
2. Do not allow direct impact to be applied to the shafts when installing the coupling. Otherwise the encoder mounted on the opposite end of the shaft may be damaged.
3. Before mounting the pinion gear directly to the motor output shaft, consult your Yaskawa sales representative.

■ Wiring the Servomotor Power Lines

Connect the servomotor power lines (U, V, and W) to the servomotor terminal block (M10) in the servomotor terminal box. Connect the ground wire to the ground screw in the terminal box.

■ Wiring the Servomotor Thermostat

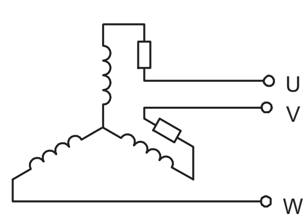
The servomotor has a built-in thermostat. Wire the thermostat leads (l, lb) to the terminal block (M4) in the servomotor's terminal box.

■ Wiring the Servomotor Fan

Wire the servomotor fan leads U(A), V(B), and W(C) so that the direction of air flows according to the following diagram. If the air flows in the opposite direction, change the wiring of any of the two phases U, V, and W.

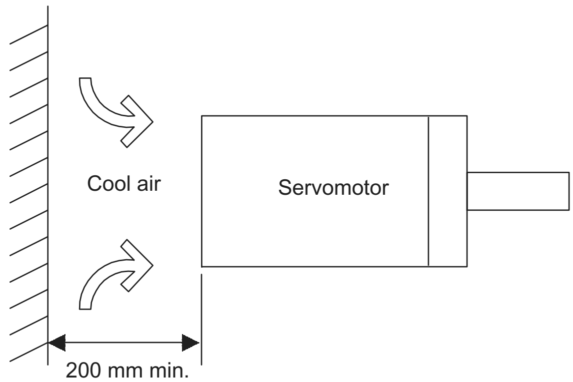
■ Protecting the Servomotor Fan

The servomotor fan has a built-in thermal protector, as shown in the following diagram, that operates at 140°C ±5 %. To protect the servomotor fan from overcurrent, use with a 2-A no-fuse breaker.



■ Installing the Servomotor Fan

To maximize the cooling capacity of the servomotor fan, install the fan at least 200 mm (7.87 in) from the inlet side of the servomotor as shown in the following diagram.



■ Servomotor Connector Specifications

• Encoder Connector at Servomotor

The connector specifications for the encoder on the servomotor are as follows:

Encoder Connectors			
Plug		Cable Clamp	Receptacle *1
L-shaped	Straight		
JA08A-20-29S-JA-EB *2, *3 or MS3108B20-29S	JA06A-20-29S-J1-EB *2, *3 or MS3106B20-29S	JL04-2022CKE (**) *2, *3 or MS3057-12A ** indicates the cable diameter.	97F-3102E20-29P *3

To be prepared by the customer

* 1. Connector at servomotor is already provided.
* 2. Manufactured by Japan Aviation Electronics Industry, Ltd.
* 3. Waterproof.

• Fan Connector on Servomotor

The connector specifications for the fan on the servomotor are as follows:

Fan Connectors			
Plug		Cable Clamp	Receptacle *1
L-shaped	Straight		
CE05-8A18-10SD-B-BAS *2, *3 or MS3108B18-10S	CE05-6A18-10SD-B-BSS *2, *3 or MS3106B18-10S	CE3057-10A-* (D265) *2, *3 or MS3057-10A ** indicates the cable diameter.	CE05-2A18-10PD-B *3

To be prepared by the customer

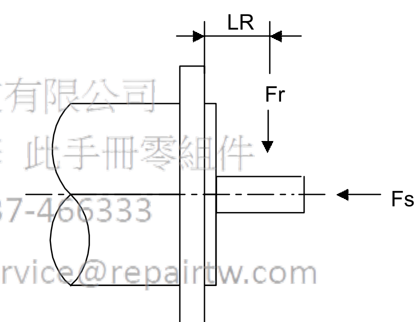
* 1. Connector at servomotor is already provided.
* 2. Manufactured by Daiichi Denshi Kogyo Co., Ltd.
* 3. Waterproof.

2.2.3 Allowable Radial and Thrust Loads

Design the mechanical system so radial and thrust loads[1] applied to the servomotor shaft end during operation falls within the ranges shown in the following table.

Servomotor Model SGMBH-	Allowable Radial Load Fr [N]	Allowable Thrust Load Fs [N]	LR [mm]
2BA□□, 2BD□□	5880	2156	100
3ZA□□, 3ZD□□	6272	2156	100
3GA□□, 3GD□□	7448	2156	100
4ED□□	7840	2156	100
5ED□□	8428	2156	110

Note: Allowable radial and thrust loads shown above are the maximum values that could be applied to the shaft end from motor torque or other loads.



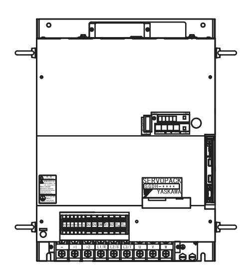
2.2.4 Installing the SERVOPACK

The SGDM and SGDH SERVOPACKs are the base-mounting servo controllers. Incorrect installation will cause problems. Always observe the installation instructions below.

■ Storage Temperature

Store the servomotor within the following temperature range if it is stored with the power cable disconnected.

Between -20 to +85 °C.

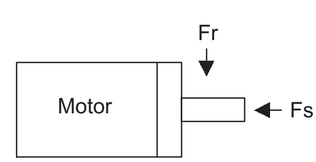


SGDM and SGDH SERVOPACK

TERMS

1 Radial and thrust loads

Thrust load (Fs): Load applied parallel to the centerline of the shaft.
Radial load (Fr): Load applied perpendicular to the centerline of the shaft.



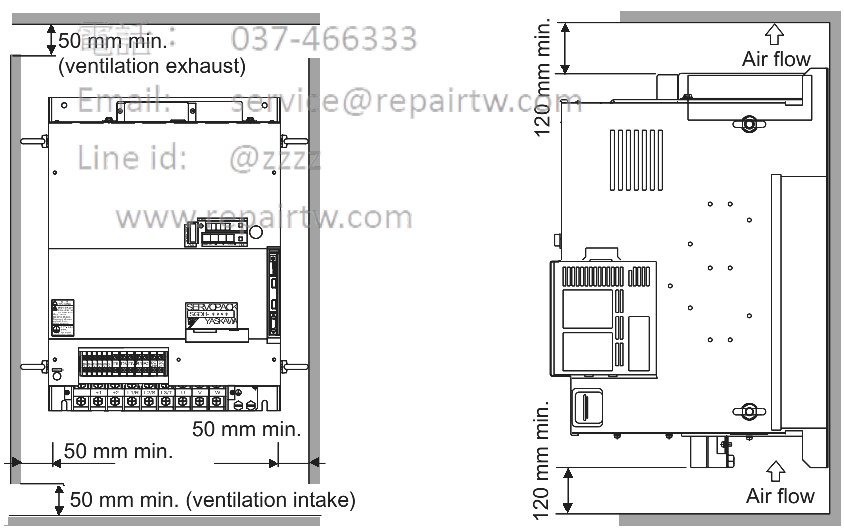
■ Installation Site

Take the following precautions at the installation site.

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

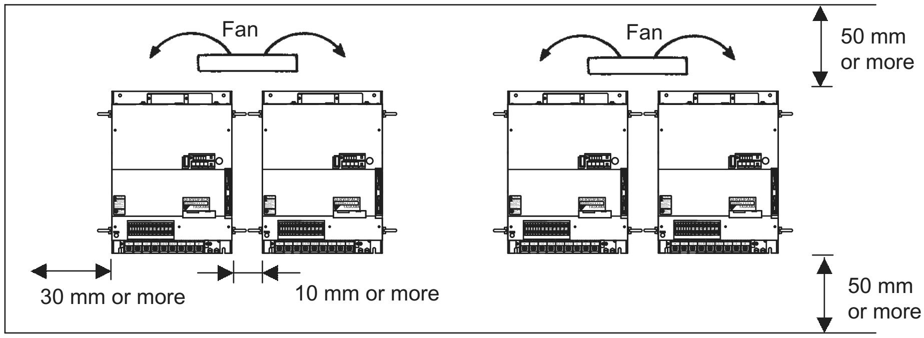
■ Orientation

Install the SERVOPACK perpendicular to the wall as shown in the figure.



■ Installation

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



SERVOPACK Orientation

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

Cooling

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

Side-by-side Installation

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

Environmental Conditions in the Control Panel

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

2.2.5 Power Loss

The following table shows the power loss of SGDM and SGDH SERVOPACK.

■ Three-phase, 200-VAC SERVOPACK

SERVOPACK Model	Output Current (Effective Value) [A]	Main Circuit Power Loss [W]	Control Circuit Power Loss [W]	Total Power Loss [W]
SGDM-2BADA	120	670	72	742
SGDM-3ZADA	175	980		1052
SGDM-3GADA	210	1700	120	1820
SGDH-2BAE	120	670	72	742
SGDH-3ZAE	175	980		1052
SGDH-3GAE	210	1700	120	1820

■ Three-phase, 400-VAC SERVOPACK

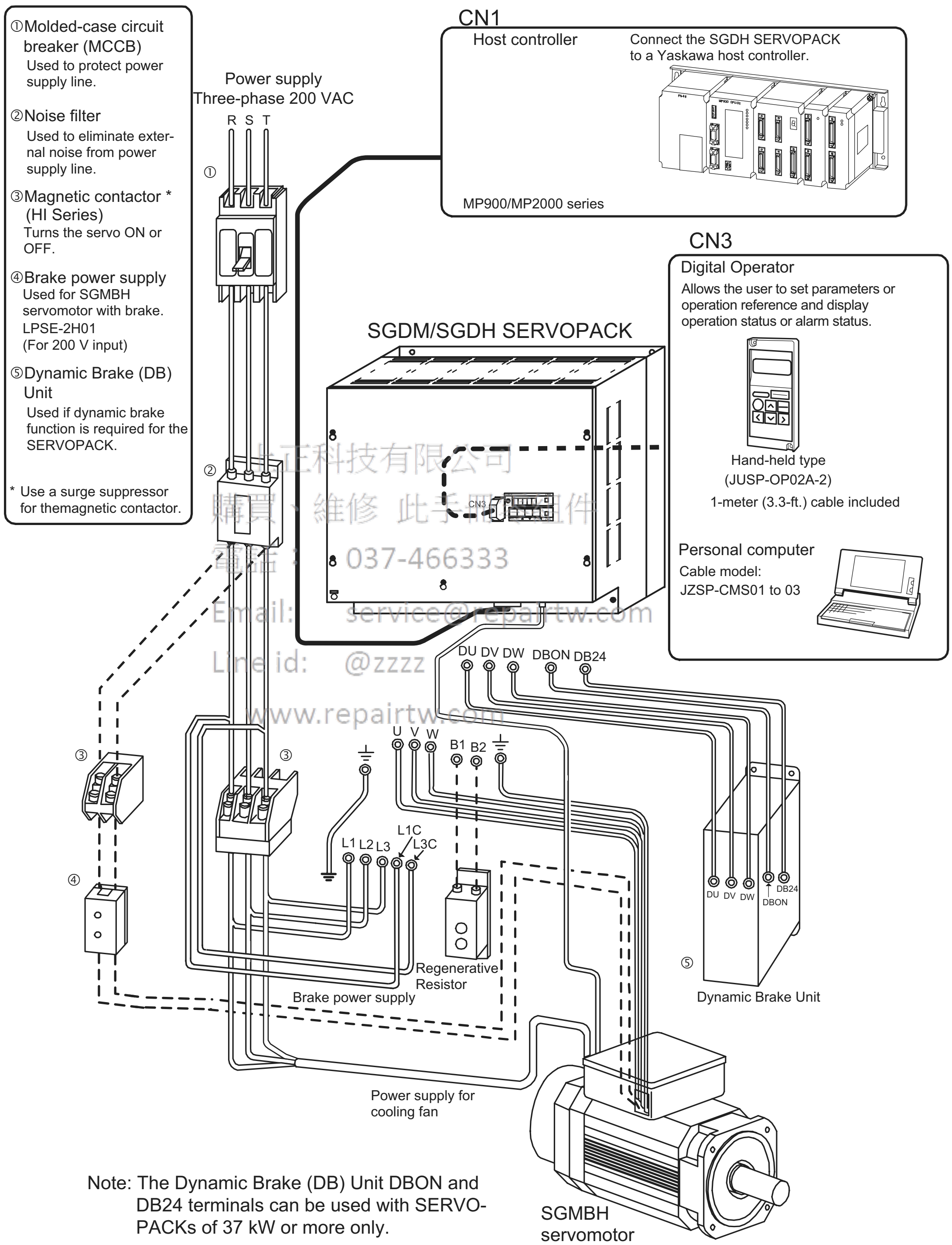
SERVOPACK Model	Output Current (Effective Value) [A]	Main Circuit Power Loss [W]	Control Circuit Power Loss [W]	Total Power Loss [W]
SGDH-2BDE	60	650	120	770
SGDH-3ZDE	88	970		1090
SGDH-3GDE	105	1140		1260
SGDH-4EDE	135	1440		1560
SGDH-5EDE	160	1720		1840

2.3 Connection and Wiring

This section describes how to connect Σ-II Series products to peripheral devices and explains a typical example of wiring the main circuit. It also describes an example of connecting to main host controllers.

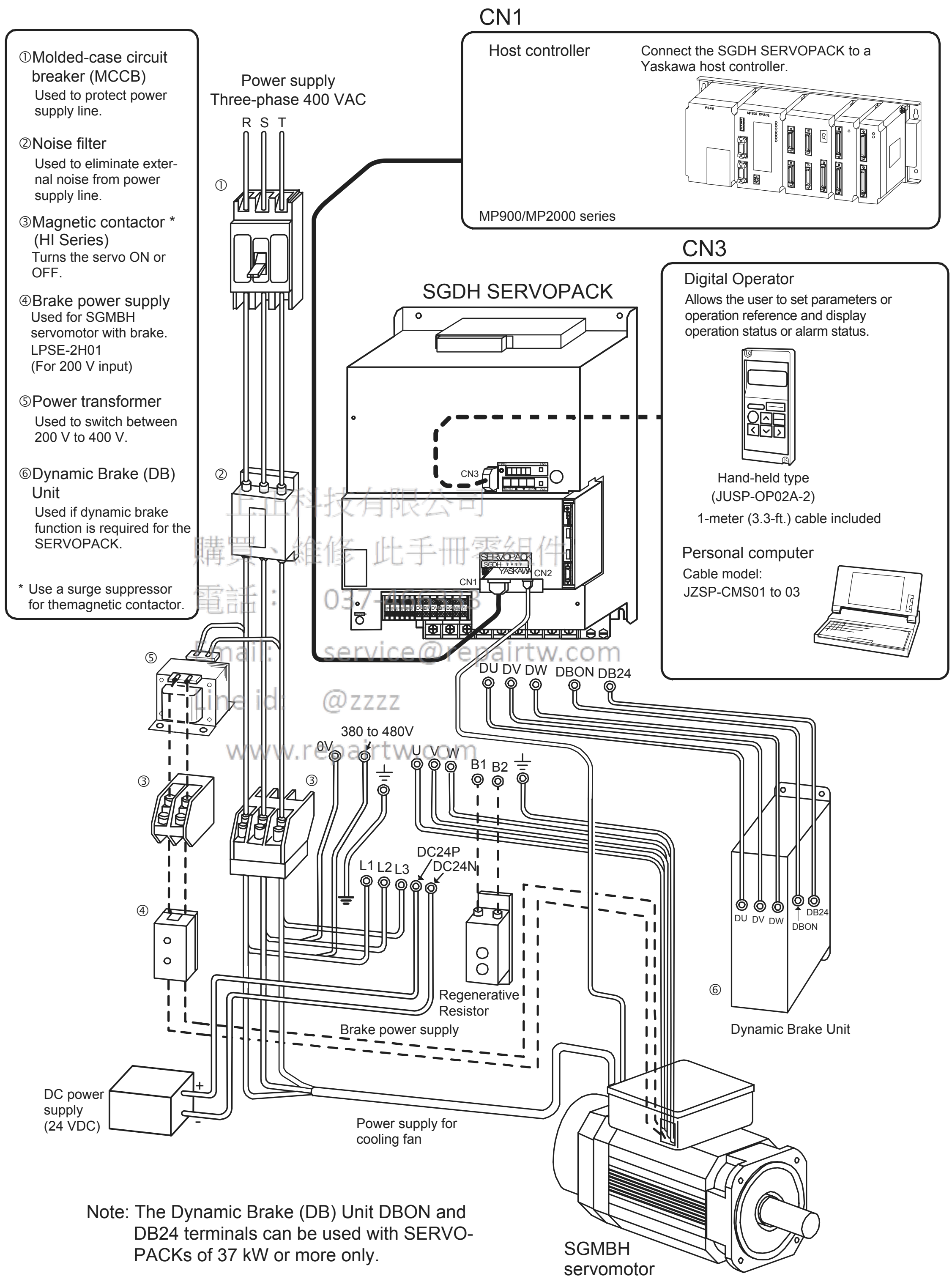
2.3.1 Connecting to Peripheral Devices

■ Three-phase, 200 V Series



Note: The Dynamic Brake (DB) Unit DBON and DB24 terminals can be used with SERVOPACKs of 37 kW or more only.

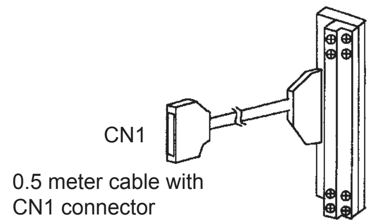
■ Three-phase, 400 V Series



Note: The Dynamic Brake (DB) Unit DBON and DB24 terminals can be used with SERVOPACKs of 37 kW or more only.

■ Connector terminal block converter unit (Model: JUSP-TA50P)

The terminal block allows connection to a host controller.

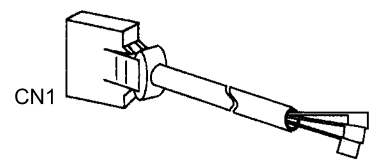


■ Cable with CN1 connector and one end without connector

1m (3.3ft): JZSP-CKI01-1

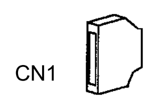
2m (6.6ft): JZSP-CKI01-2

3m (9.8ft): JZSP-CKI01-3



■ CN1 connector kit

Model: JZSP-CKI9



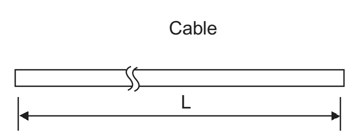
■ Cable for PG

This cable is used to connect the encoder of servomotor to the SERVOPACK.

The following cables are available according to encoder types.

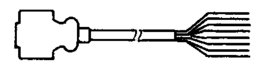
- Cable only (without connector at either end)

Cable Model	Length
JZSP-CMP29-05	5 m (196.85 in)
JZSP-CMP29-10	10 m (393.70 in)
JZSP-CMP29-15	15 m (590.55 in)
JZSP-CMP29-20	20 m (787.40 in)
JZSP-CMP29-30	30 m (1181.10 in)
JZSP-CMP29-40	40 m (1574.80 in)
JZSP-CMP29-50	50 m (1968.50 in)



- Cable with loose wire at encoder end

Cable Model	Length
JZSP-CMP23-03	3 m (118.11 in)
JZSP-CMP23-05	5 m (196.85 in)
JZSP-CMP23-10	10 m (393.70 in)
JZSP-CMP23-15	15 m (590.55 in)
JZSP-CMP23-20	20 m (787.40 in)



- Cable with connectors at both ends (straight plug at encoder end)

Applicable Servomotors		Cable Model	Length
SGMBH Servomotors	With Straight Plug	JZSP-CMP21-03	3 m (118.11 in)
		JZSP-CMP21-05	5 m (196.85 in)
		JZSP-CMP21-10	10 m (393.70 in)
		JZSP-CMP21-15	15 m (590.55 in)
		JZSP-CMP21-20	20 m (787.40 in)
	With L-shape Plug	JZSP-CMP22-03	3 m (118.11 in)
		JZSP-CMP22-05	5 m (196.85 in)
		JZSP-CMP22-10	10 m (393.70 in)
		JZSP-CMP22-15	15 m (590.55 in)
		JZSP-CMP22-20	20 m (787.40 in)

■ Connector for PG

Connector on SERVOPACK End Only	55102-0600 (Manufactured by Molex Japan Co., Ltd.)	Connector kit: JZSP-CMP9-1
Connector on Servomotor End Only	54280-0600 (Manufactured by Molex Japan Co., Ltd.)	-

2.3.2 Main Circuit Wiring and Power ON Sequence

This section describes typical examples of main circuit wiring for Σ-II Series servo products, functions of main circuit terminals, and the power ON sequence.

■ 200-V Power Supply: SGDM-□□A, SGDH-□□A

SERVOPACK Main Circuit Terminal Functions and Descriptions

The following table shows the functions and description of each main circuit terminal.

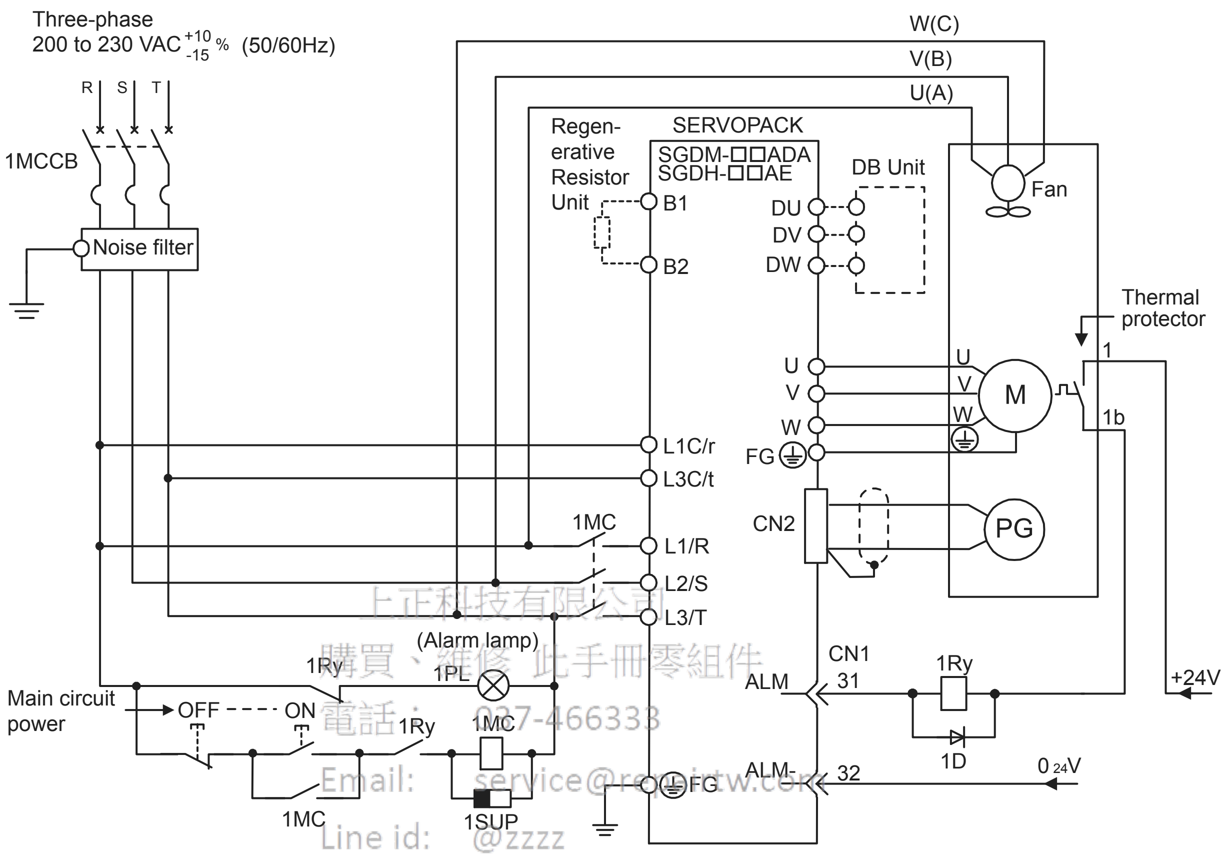
Terminal Symbol	Functions	Description
L1/R, L2/S, L3/T	Main power input terminals	Three-phase 200 to 230 VAC $^{+10}_{-15}$ %, 50/60 Hz
U, V, W	Servomotor connection terminal	Used to connect to the servomotor.
L1C/r, L3C/t	Control power input terminal	Single-phase, 200 to 220 VAC $^{+10}_{-15}$ %, 50 Hz Single-phase, 200 to 230 VAC $^{+10}_{-15}$ %, 60 Hz
⏚ (Two)	Ground terminal	Connected to ground. (For power ground and motor ground)
+1, +2	DC reactor connection terminal	Used to protect against harmonics (factory setting: short-circuited)
B1, B2	Regenerative Resistor Unit connection terminal	Used to connect the regenerative resistor.
–	Main circuit minus terminal	Normally, external connection is not required.
DU, DV, DW	Dynamic Brake Unit connection terminal	Used to connect the Dynamic Brake Unit.
DBON, DB24	Dynamic Brake Unit connection terminal	Used to connect the Dynamic Brake Unit to the DBON and DB24 terminals (when using 37-kW SERVOPACK only).

Servomotor Terminal Names and Descriptions

The following table shows the name and description of each motor terminal.

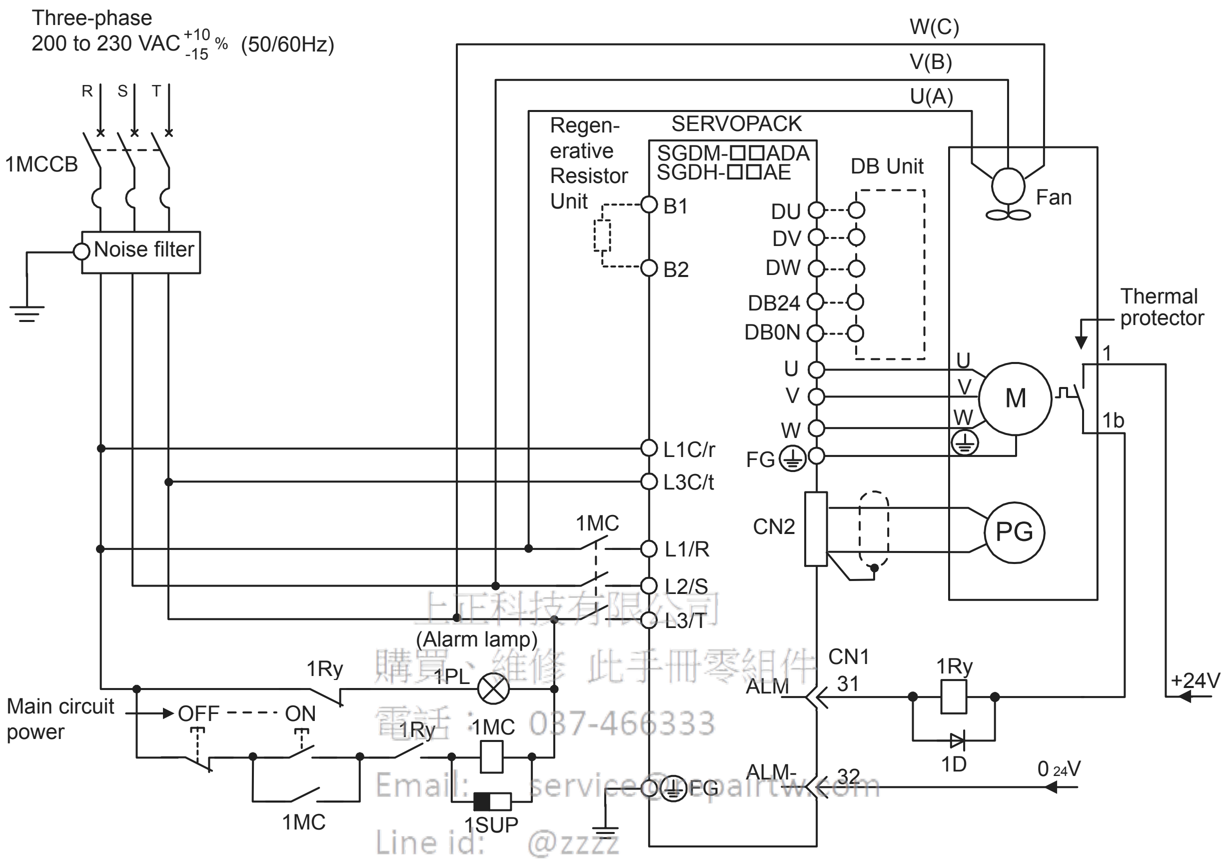
Terminal Symbol	Functions	Description
U, V, W	SERVOPACK connection terminals	Used to connect to the U, V, and W terminals of the SERVOPACK
U (A), V (B), W (C)	Fan terminals	Used to connect the fan power supply. Three-phase 200 to 230 VAC $^{+10}_{-15}$ %, 50/60 Hz
A, B	Brake power supply connection terminals	Used to connect the brake power supply (only when using servomotors with brakes).
1, 1b	Thermal protector terminals	Used to detect overheating of the servomotor and open the thermal protector circuit. Use a sequence that turns OFF the SERVOPACK's main circuit power or the servomotor when the thermal protector circuit opens.

Typical Wiring Example for 22-kW and 30-kW SERVOPACKs



1MCCB : Circuit breaker (for Inverters)
FIL : Noise filter
1MC : Contactor
1Ry : Relay
1PL : Lamp for display
1SUP : Surge suppressor
1D : Flywheel diode

Typical Wiring Example for 37-kW SERVOPACK



1MCCB : Circuit breaker (for Inverters)
FIL : Noise filter
1MC : Contactor
1Ry : Relay
1PL : Lamp for display
1SUP : Surge suppressor
1D : Flywheel diode

■ 400-V Power Supply: SGDH-□□□

SERVOPACK Main Circuit Terminal Functions and Descriptions

The following table shows the functions and a description of each main-circuit terminal.

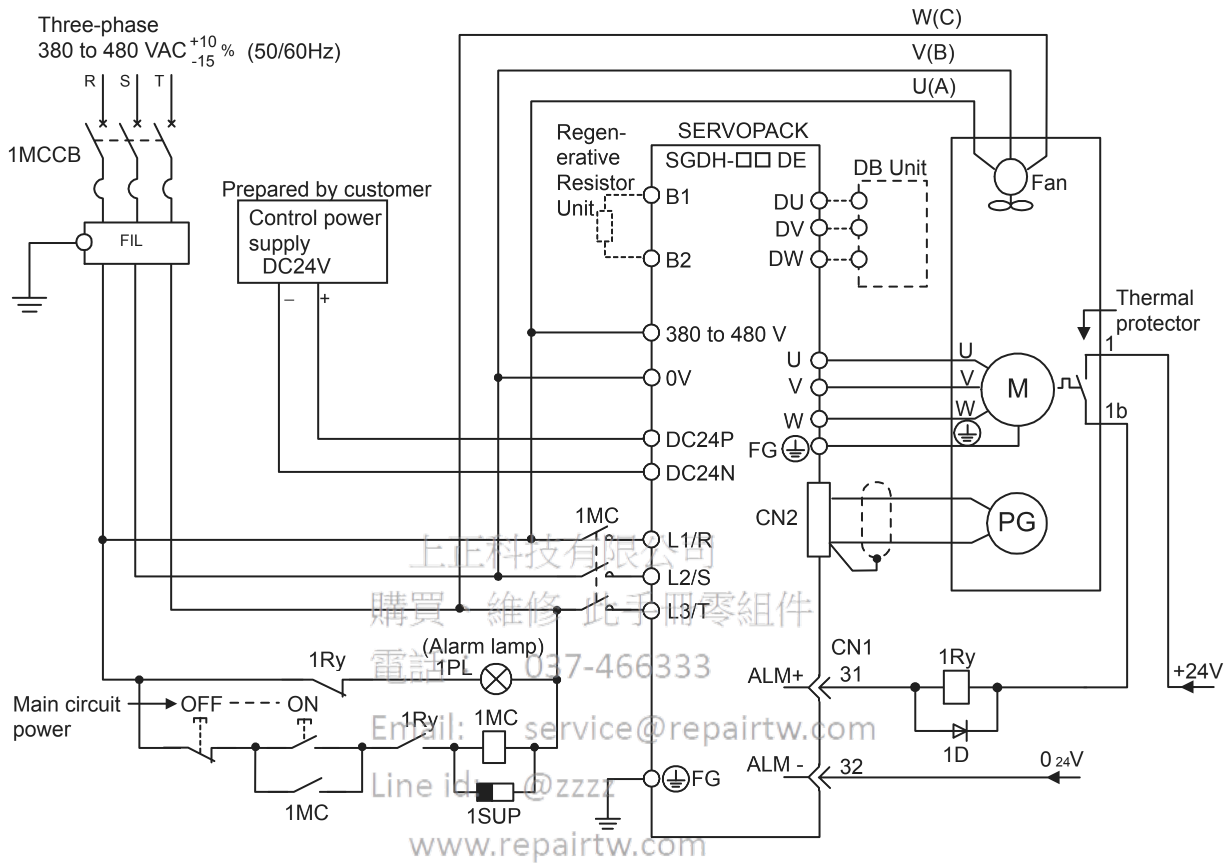
Terminal Symbol	Functions	Description
L1/R, L2/S, L3/T	Main power input terminals	Three-phase 380 to 480 VAC $^{+10}_{-15}$ %, 50/60 Hz
U, V, W	Servomotor connection terminal	Used to connect to the servomotor.
DC24P, DC24N	Control power input terminal	24 VDC±15 %
⏚ (Two)	Ground terminal	Connected to ground. (For power ground and motor ground)
+1, +2	DC reactor connection terminal	Used to protect against harmonics (factory setting: short-circuited)
B1, B2	Regenerative Resistor Unit connection terminal	Used to connect the regenerative resistor.
480 V, 460 V, 440 V, 400 V, 380 V, 0 V	Input terminals for control actuator	Single-phase 380 to 480 V, 50/60 Hz Power supply input terminals for the fan and the contactor.
−	Main circuit minus terminal	Normally, external connection is not required.
DU, DV, DW	Dynamic Brake Unit connection terminal	Used to connect the Dynamic Brake Unit.
DBON, DB24	Dynamic Brake Unit connection terminal	Used to connect the Dynamic Brake Unit to the DBON and DB24 terminals (when using 37-kW and 55-kW SERVOPACKs only).

Servomotor Terminal Names and Descriptions

The following table shows the name and description of each motor terminal.

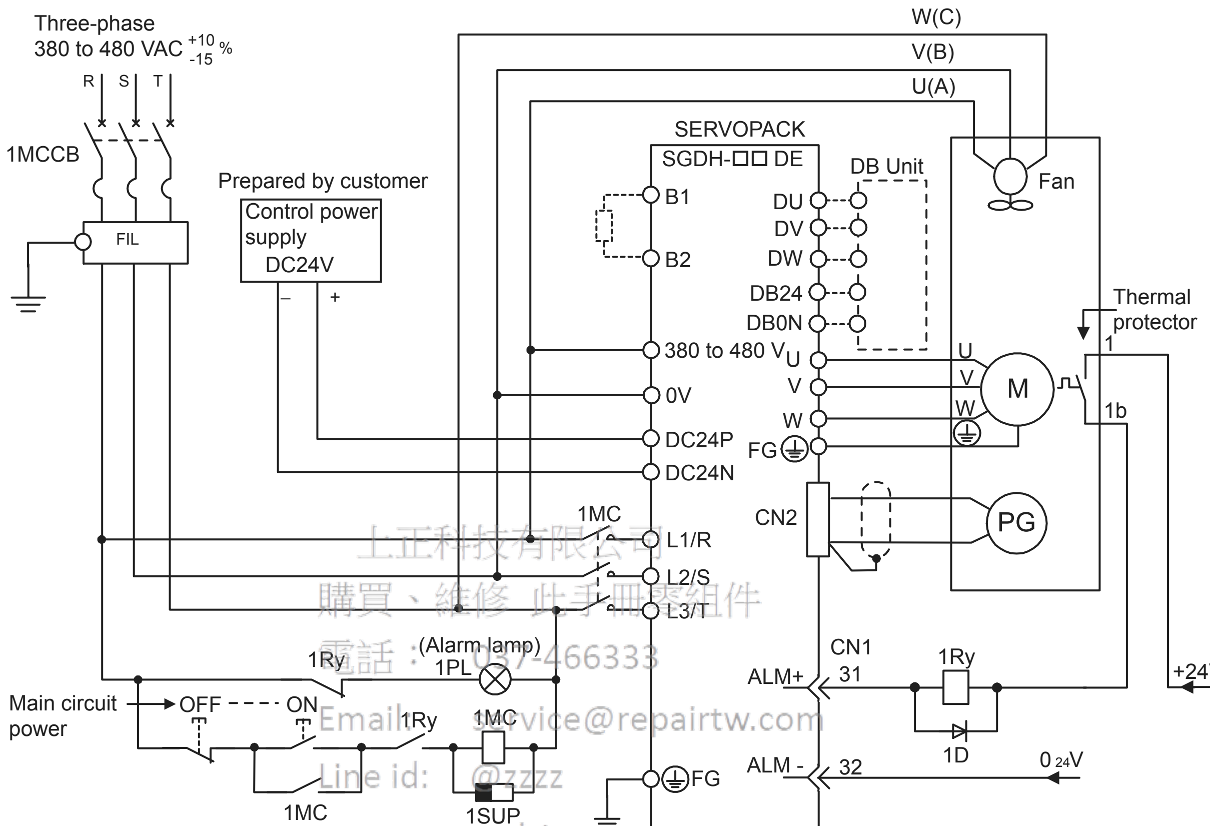
Terminal Symbol	Functions	Description
U, V, W	SERVOPACK connection terminals	Used to connect to the U, V, and W terminals of the SERVOPACK
U (A), V (B), W (C)	Fan terminals	Used to connect the fan power supply. Three-phase 380 to 480 VAC $^{+10}_{-15}$ %, 50/60 Hz
A, B	Brake power supply connection terminals	Used to connect the brake power supply (only when using servomotors with brakes).
1, 1b	Thermal protector terminals	Used to detect overheating of the servomotor and open the thermal protector circuit. Use a sequence that turns OFF the SERVOPACK's main circuit power or the servomotor when the thermal protector circuit opens.

Typical Wiring Example for 22-kW and 30-kW SERVOPACKs



1MCCB : Circuit breaker (for Inverters)
FIL : Noise filter
1MC : Contactor
1Ry : Relay
1PL : Lamp for display
1SUP : Surge suppressor
1D : Flywheel diode

Typical Wiring Example for 37-kW to 55-kW SERVOPACKs



1MCCB	: Circuit breaker (for Inverters)	1PL	: Lamp for display
FIL	: Noise filter	1SUP	: Surge suppressor
1MC	: Contactor	1D	: Flywheel diode
1Ry	: Relay		

■ Note

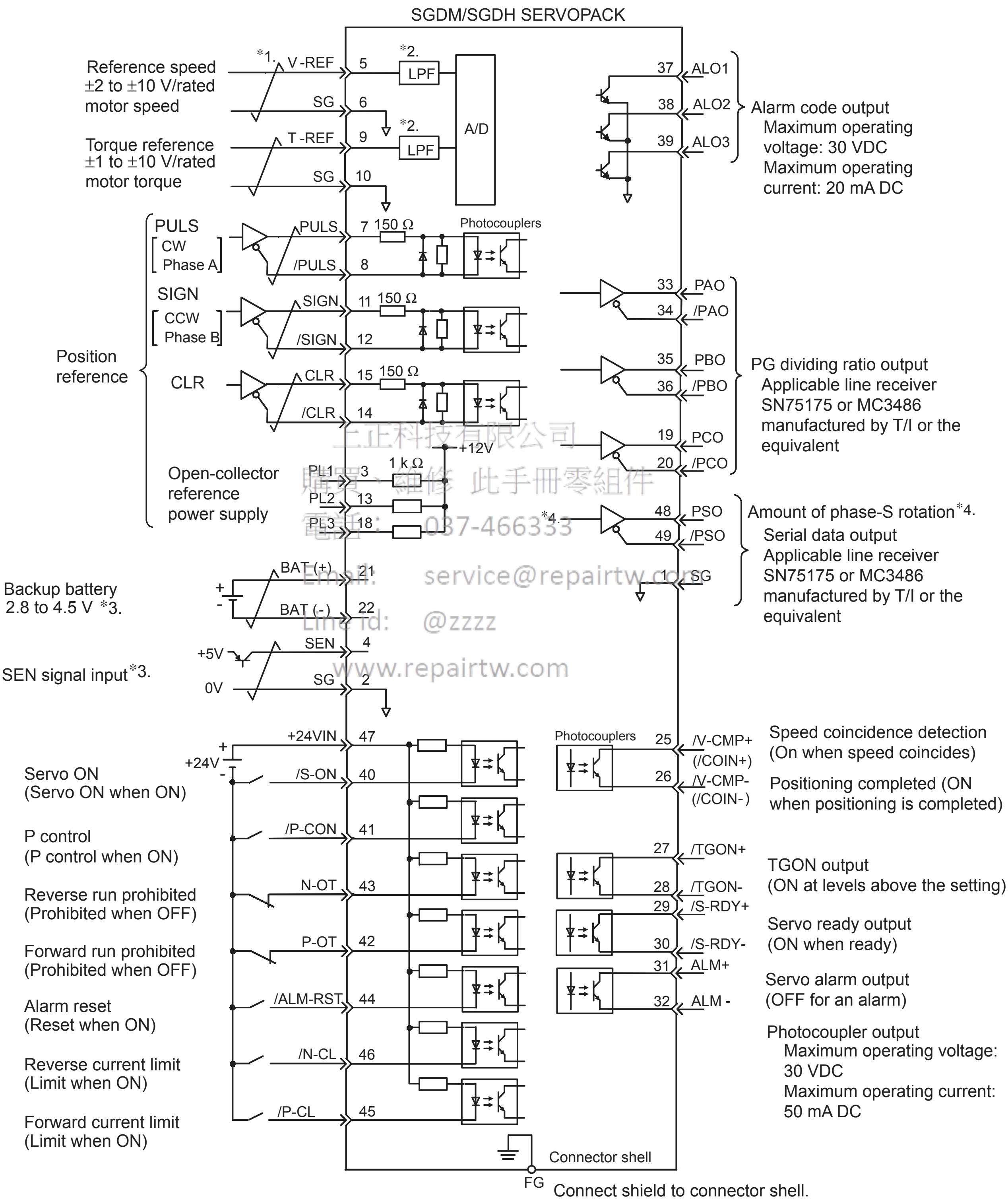
- Do not bundle or run power and signal lines together in the same duct. Keep power and signal lines separated by at least 30 cm (11.81 in).
- Use twisted-pair wires or multi-core shielded-pair wires for signal and encoder (PG) feedback lines. The length for wiring is 3 m (118.11 in) maximum for the reference input line.
- Do not touch the power terminal even if power was turned OFF. High voltage may still remain in the SERVOPACK. Make sure the charge indicator is out first before starting an inspection.
- Avoid frequently turning power ON and OFF. Since the SGDM/SGDH SERVOPACK has a capacitor in the power supply, a high charging current flows for 0.2 seconds when power is turned ON. Therefore, frequently turning the power ON and OFF causes the main circuit devices (such as capacitors and fuses) to deteriorate, resulting in unexpected problems.

2.4 I/O Signals

This section describes I/O signals for the SGDM/SGDH SERVOPACK.

2.4.1 Examples of I/O Signal Connections

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



* 1. represents twisted-pair wires.
* 2. The time constant for the primary filter is 47 μs.
* 3. Connector when using an absolute encoder.
* 4. Used only with an absolute encoder.

2.4.2 List of CN1 Terminals

The following diagram shows the layout and specifications of CN1 terminals.

■ CN1 Terminal Layout

Pin	Signal	Function
1	SG	GND
2	SG	GND
3	PL1	Open-collector reference power supply
4	SEN	SEN signal input
5	V-REF	Speed Reference Input
6	SG	GND
7	PULS	Reference pulse input
8	/PULS	Reference pulse input
9	T-REF	Torque Reference Input
10	SG	GND
11	SIGN	Reference sign input
12	/SIGN	Reference sign input
13	PL2	Open-collector reference power supply
14	/CLR	Clear input
15	CLR	Clear input
16	–	–
17	–	–
18	PL3	Open-collector reference power supply
19	PCO	PG divided output phase C
20	/PCO	PG divided output phase C
21	BAT (+)	Battery (+)
22	BAT (-)	Battery (-)
23	–	–
24	–	–
25	/V-CMP+ (/COIN+)	Speed coincidence detection output
26	/V-CMP- (/COIN-)	Speed Coincidence Detection Output
27	/TGON+	TGON signal output
28	/TGON-	TGON signal output
29	/S-RDY+	Servo ready output
30	/S-RDY-	Servo ready output
31	ALM+	Servo alarm output
32	ALM-	Servo alarm output
33	PAO	PG divided output phase A
34	/PAO	PG divided output phase A
35	PBO	PG divided output phase B
36	/PBO	PG divided output phase B
37	ALO1	Alarm code outputs
38	ALO2	Alarm code outputs
39	ALO3	(open-collector output)
40	/S-ON	Servo ON input
41	P-CON	P operation input
42	P-OT	Forward overtravel input
43	N-OT	Reverse overtravel input
44	/ALM-RST	Alarm reset input
45	/P-CL	Forward current limit ON input
46	/N-CL	Reverse current limit ON input
47	+24V -IN	External input power supply
48	PSO	Phase-S signal output
49	/PSO	Phase-S signal 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. Connect to the FG (frame ground) at the SERVOPACK-end connector.

■ CN1 Specifications

Specifications for SERVOPACK Connectors	Applicable Receptacles		
	Solder Type	Case	Manufacturer
10250-52A2JL or Equivalent 50-p Right Angle Plug	10150-3000VE	10350-52A0-008	Sumitomo 3M Co.

2.4.3 I/O Signal Names and Functions

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

■ Input Signals

Table 2.1 Input Signal Names and Functions

Single Name		Pin No.	Functions		Reference
Common	/S-ON	40	Servo ON: Turns ON the servomotor when the gate block in the inverter is released.		4.5.2
	/P-CON	41	* Function selected via parameter.		–
			Proportional operation reference	Switches the speed control loop from PI (proportional/ integral) to P (proportional) control when ON.	4.2.1
			Direction reference	With internal reference speed selected: Switches the direction of rotation.	4.2.6
			Control mode switching	Position ↔ speed Control ↔ torque Torque ↔ speed Enables control mode switching.	4.2.7
			Zero-clamp reference	Speed control with zero-clamp function: Reference speed is zero when ON.	4.4.3
			Reference pulse block	Position control with reference pulse stop: Stops reference pulse input when ON.	4.2.12
	P-OT N-OT	42 43	Forward Run prohibited Reverse Run prohibited	Overtravel prohibited: Stops servomotor when movable part travels beyond the allowable range of motion.	4.1.2
	/P-CL /N-CL	45 46	* Function selected via parameter.		–
			Forward current limit ON Reverse current limit ON	Current limit function used when ON.	4.1.3
			Internal speed switching	With internal reference speed selected: Switches the internal speed settings.	4.2.6
	/ALM - RST	44	Alarm reset: Releases the servo alarm state.		4.5.1
	+24VIN	47	Control power supply input for sequence signals: Users must provide the +24-V power supply. Allowable voltage fluctuation range: 11 to 25 V		4.2.4
	SEN	4 (2)	Initial data request signal when using an absolute encoder.		4.7.1
	BAT (+) BAT (-)	21 22	Connecting pin for the absolute encoder backup battery.		4.7.1

Table 2.1 Input Signal Names and Functions (cont'd)

Single Name		Pin No.	Functions		Reference
Speed	V-REF	5 (6)	Speed reference speed input: ±2 to ±10 V/rated motor speed (Input gain can be modified using a parameter.)		4.2.1
Torque	T-REF	9 (10)	Torque reference input: ±1 to ±10 V/rated motor torque (Input gain can be modified using a parameter.)		4.2.7
Position Reference	PULS /PULS SIGN /SIGN	7 8 11 12	Reference pulse input • Line driver • Open collector	Input mode • Sign + pulse train • CCW/CW pulse • Two-phase pulse (90° phase differential)	4.2.2
	CLR /CLR	15 14	Error counter clear: Clears the error counter during position control.		4.2.2
	PL1 PL2 PL3	3 13 18	+12-V pull-up power supply when PULS, SIGN and CLR reference signals are open-collector outputs (+12-V power supply is built into the SERVOPACK).		4.2.2

Note: 1. The functions allocated to /S-ON, /P-CON. P-OT, N-OT, /ALM-RST, /P-CL, and /N-CL input signals can be changed via parameters. Refer to *4.3.3 Input Circuit Signal Allocation*.
2. Pin numbers in parenthesis () indicate signal grounds.
3. The voltage input range for speed and torque references is a maximum of ±12 V.

■ Output Signals

Table 2.2 Output Signal Names and Functions

Signal Name		Pin No.	Functions		Reference
Common	ALM+ ALM-	31 32	Servo alarm: Turns OFF when an error is detected.		4.5.1
	/TGON+ /TGON-	27 28	Detection during servomotor rotation: Detects whether the servomotor is rotating at a speed higher than the motor speed setting. Motor speed detection can be set via parameter.		4.5.5
	/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.		4.5.6
	PAO /PAO PBO /PBO PCO /PCO	33 (1) 34 35 36 19 20	Phase-A signal Phase-B signal Phase-C signal	Converted two-phase pulse (phase A and B) encoder output signal and origin pulse (phase C) signal: RS-422 or the equivalent	4.2.3
	PSO /PSO	48 49	Phase-S signal	With an absolute encoder: Outputs serial data corresponding to the number of revolutions (RS-422 or equivalent)	4.7.5
	ALO1 ALO2 ALO3	37 38 39 (1)	Alarm code output: Outputs 3-bit alarm codes. Open-collector: 30 V and 20 mA rating maximum		4.5.1
	FG	Shell	Connected to frame ground if the shield wire of the I/O signal cable is connected to the connector shell.		–
Speed	/V-CMP+ /V-CMP-	25 26	Speed coincidence (output in Speed Control Mode): Detects whether the motor speed is within the setting range and if it matches the reference speed value.		4.5.4

Table 2.2 Output Signal Names and Functions (cont'd)

Signal Name		Pin No.	Functions	Reference
Position	/COIN+ /COIN-	25 26	Positioning completed (output in Position Control Mode): Turns ON when the number of error pulses reaches the value set. The setting is the number of error pulses set in reference units (input pulse units defined by the electronic gear).	4.5.3
Not used.		16 17 23 24 50	These terminals are not used. Do not connect relays to these terminals.	-

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

2. The functions allocated to /TGON, /S-RDY, and /V-CMP (/COIN) output signals can be changed via parameters. /CLT, /VCT, /BK, /WARN, and /NEAR signals can also be changed. Refer to *4.3.4 Output Circuit Signal Allocation*.

2.4.4 Interface Circuits

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

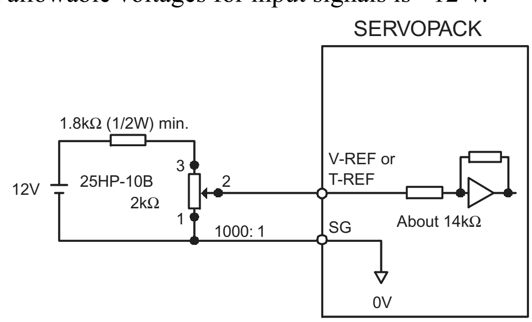
■ Interface for Reference Input Circuits

Analog Input Circuit

Analog signals are either speed or torque reference signals at the impedance below.

- Reference speed input: About 14 kΩ
- Reference torque input: About 14 kΩ

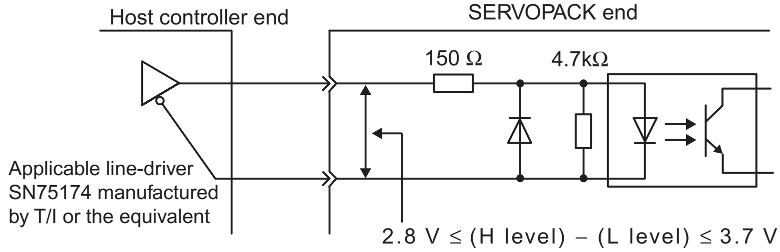
The maximum allowable voltages for input signals is ±12 V.



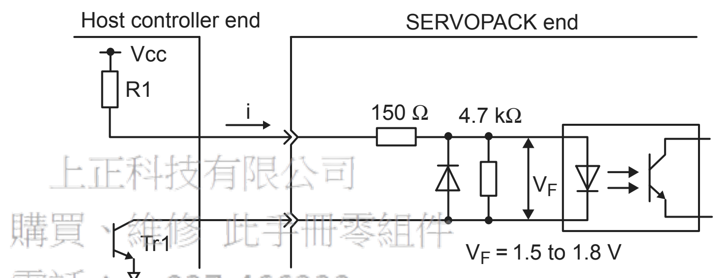
Reference Position Input Circuit

An output circuit for the reference pulse and error counter clear signal at the host controller can be either line-driver or open-collector outputs. These are shown below by type.

- Line-driver Output



- Open-collector Output, Example 1: Power Supply Provided by User

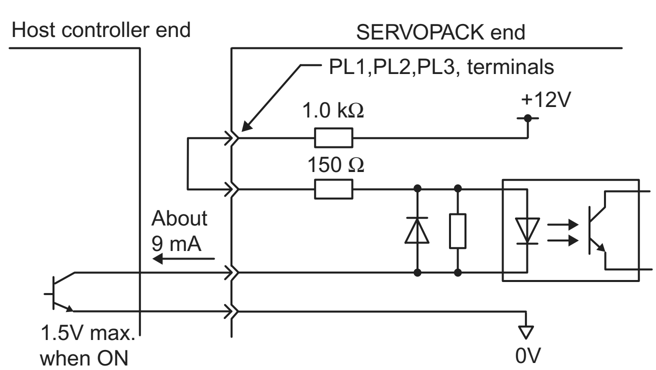


Use the examples below to set pull-up resistor R1 so the input current, i, falls between 7 and 15 mA.

Application Examples		
When Vcc is 24 V ± 5 %: R1 = 2.2 kΩ	When Vcc is 12 V ± 5 %: R1 = 1 kΩ	When Vcc is 5 V ± 5 %: R1 = 180 Ω

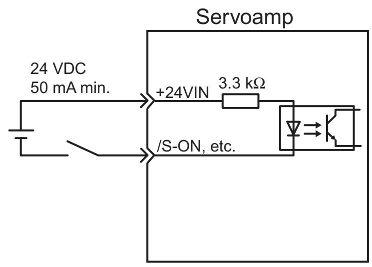
- Open-collector Output, Example 2: Using 12-V Power Supply Built into the SERVOPACK

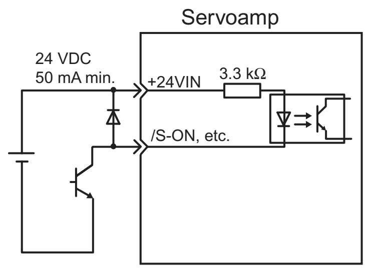
  This circuit uses the 12-V power supply built into the SERVOPACK. The input is not insulated in this case.



■ 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.





2

■ Output Circuit Interfaces

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

- Connecting to a Line-driver Output Circuit

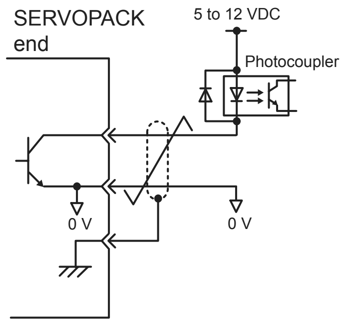
  Encoder serial data converted to two-phase (phase A and B) pulse output signals (PAO, /PAO, PBO, /PBO), origin pulse signals (PCO, /PCO) and phase-S rotation signals (PSO, /PSO) are output via line-driver output circuits that normally comprise the position control system at the host controller. Connect the line-driver output circuit through a line receiver circuit at the host controller.

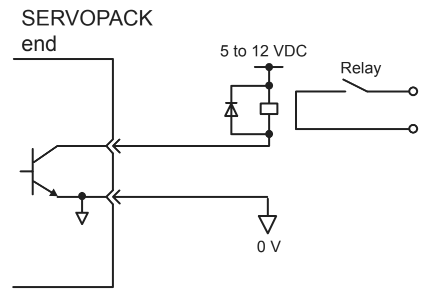
  See *2.5 Wiring Encoders* for connection circuit examples.

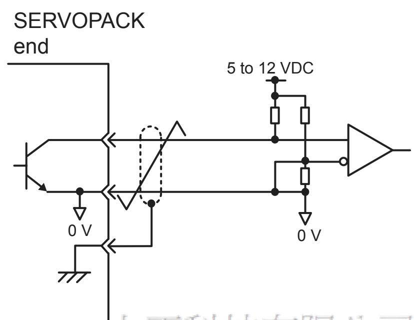
- Connecting to an Open-collector Output Circuit

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

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







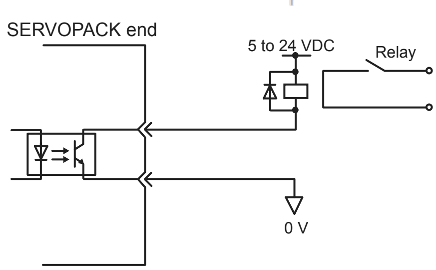
Note: The maximum allowable voltage and current capacities for open-collector output circuits are as follows.

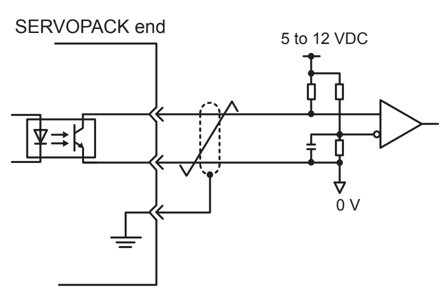
- Voltage: 30 VDC max.
- Current: 20 mA DC max.

- Connecting to a Photocoupler Output Circuit

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

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





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

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

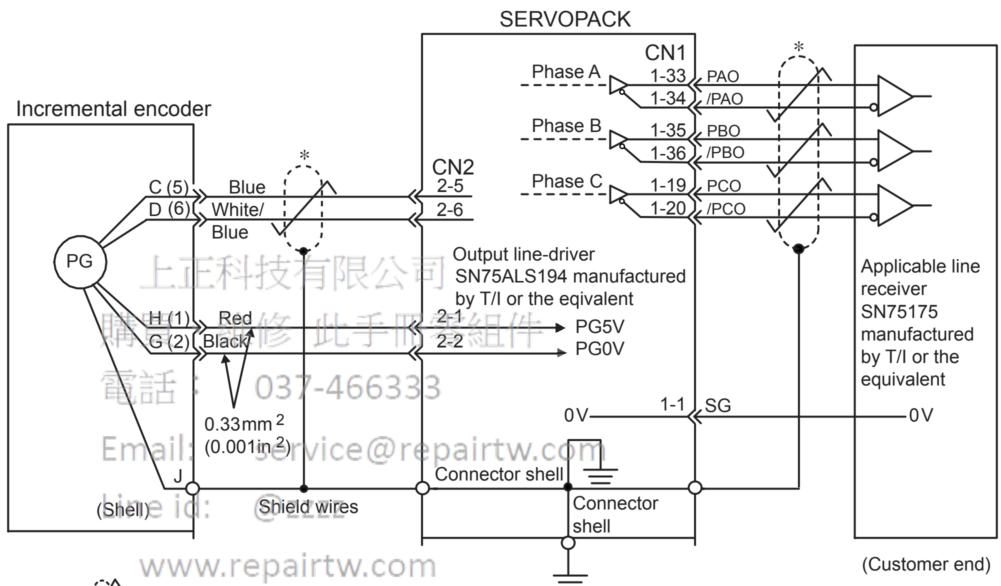
2.5 Wiring Encoders

The following sections describe the procedure for wiring a SERVOPACK to the encoder.

2.5.1 Connecting an Encoder (CN2) and Output Signals from the SERVOPACK (CN1)

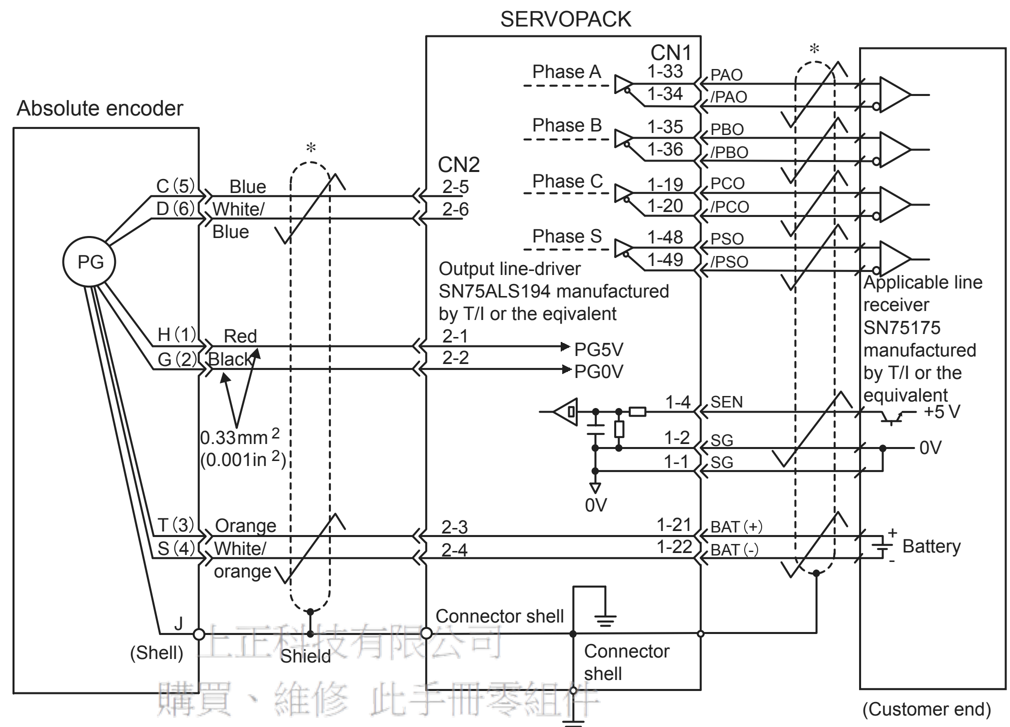
The following diagrams show wiring for incremental and absolute encoders.

■ Incremental Encoders



* : represents twisted-pair wires.

■ Absolute Encoders



* : represents twisted-pair wires.

2.5.2 Terminal Layout and Types of CN2 Encoder Connector

The following diagram shows the layout and types of CN2 terminals.

■ CN2 Connector Terminal Layout

1	PG5V	PG power supply +5 V	2	PG 0 V	PG power supply 0 V
3	BAT (+)	Battery (+) (For an absolute encoder)	4	BAT (-)	Battery (-) (For an absolute encoder)
5	PS	PG serial signal input	6	/PS	PG serial signal input

■ CN2 Connector Models

SERVOPACK Connectors	Applicable Plug (or Socket)	
	Soldered Relay Plug (SERVOPACK Connector)	Soldered Relay Plug (Servomotor Connector)
53460-0611 Molex Japan Co., Ltd.	55100-0600 Molex Japan Co., Ltd.	L-shaped plug: MS3108B20-29S or Straight : MS3106B20-29S Cable clamp : MS3057-12A

Note: FA1394 is the product number for the SERVOPACK-end plug set from Molex Japan Co., Ltd.

INFO

Encoder cables are available from Yaskawa. For more details on the cables, refer to *7.5.7 Encoder Cables*.

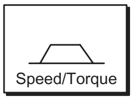
2.5.3 Examples of Connecting I/O Signal Terminals

SGDM/SGDH SERVOPACKs can be connected to the host controllers listed below. Connect the SERVOPACK to the host controller by referring to documentation for the host controller.

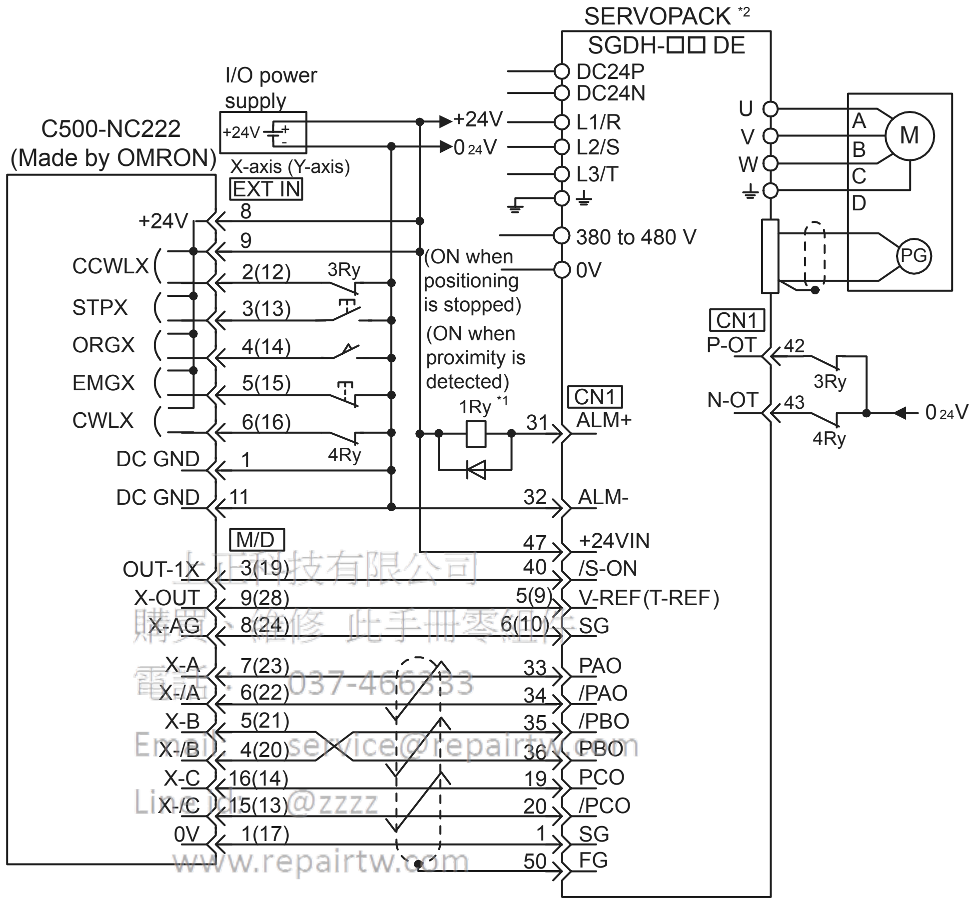
- MP900/MP2000 Series
- GL-series B2813 and B2833 Positioning Module
- OMRON C500-NC222 and C500-NC112 Position Control Units
- MITSUBISHI AD72 and AD71 (B Type) Positioning Unit

Typical connection examples for the OMRON Position Control Unit and MITSUBISHI Positioning Unit are provided below.

■ Connection to OMRON C500-NC222 Position Control Unit



SERVOPACK for Speed/Torque Control



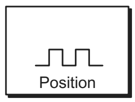
* 1. These signals are output for approximately two seconds when the power is turned ON. Take this into consideration when designing a power ON sequence. Relay 1Ry is used to stop main circuit power supply to the SERVOPACK.

* 2. Set the parameter Pn200.0 to 1.

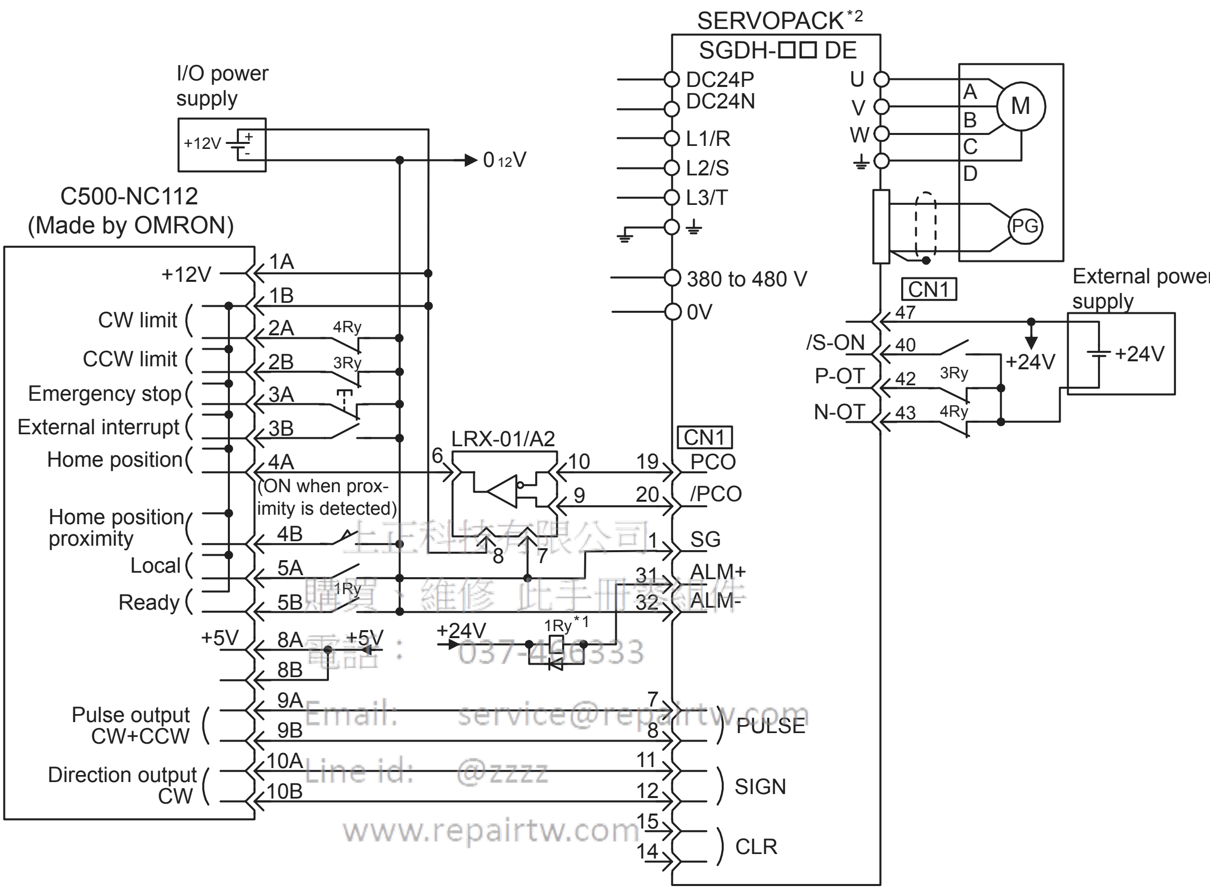
Note: 1. The signals shown here are applicable only to OMRON C500-NC222 Position Control Unit and Yaskawa SGDH-□□DE SERVOPACK for 400 V.

2. The connection of the SGDM/SGDH SERVOPACK for 200 V, excluding the main-circuit terminal, is the same as the one shown in this diagram.

■ Connection to OMRON C500-NC112 Position Control Unit



SERVOPACK for Position Control



* 1. These signals are output for approximately two seconds when the power is turned ON. Take this into consideration when designing a power ON sequence. Relay 1Ry is used to stop main circuit power supply to the SERVOPACK.

* 2. Set the parameter Pn200.0 to 1.

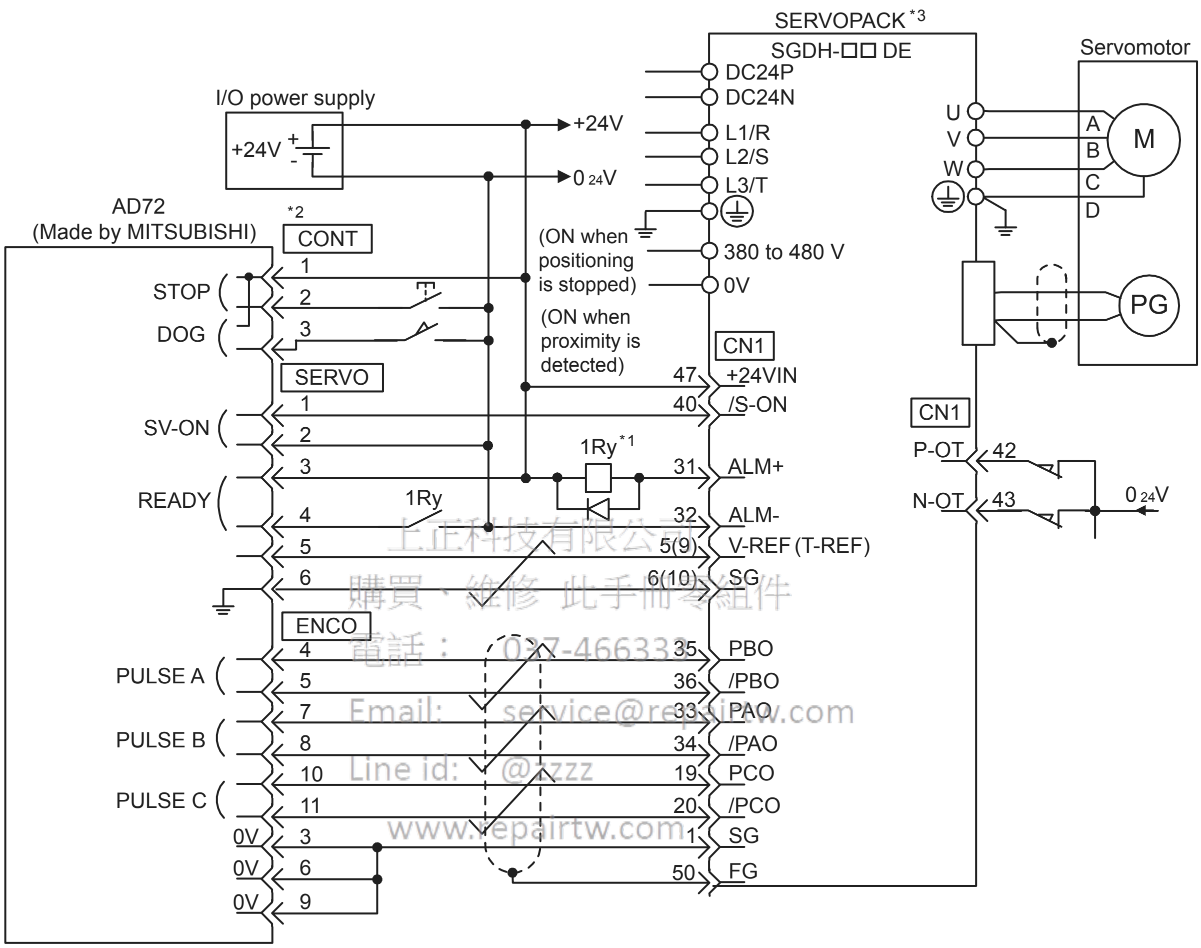
Note: 1. The signals shown here are applicable only to OMRON C500-NC112 Position Control Unit and Yaskawa SGDH-□□DE SERVOPACK for 400 V.

2. The connection of the SGDM/SGDH SERVOPACK for 200 V, excluding the main-circuit terminal, is the same as the one shown in this diagram.

■ Connection to MITSUBISHI AD72 Positioning Unit

Speed/Torque

SERVOPACK for Speed/Torque Control



* 1. These signals are output for approximately two seconds when the power is turned ON. Take this into consideration when designing a power ON sequence. Relay 1Ry is used to stop main circuit power supply to the SERVOPACK.

* 2. These pin numbers are the same for both X and Y axes.

* 3. Set the parameter Pn200.0 to 1.

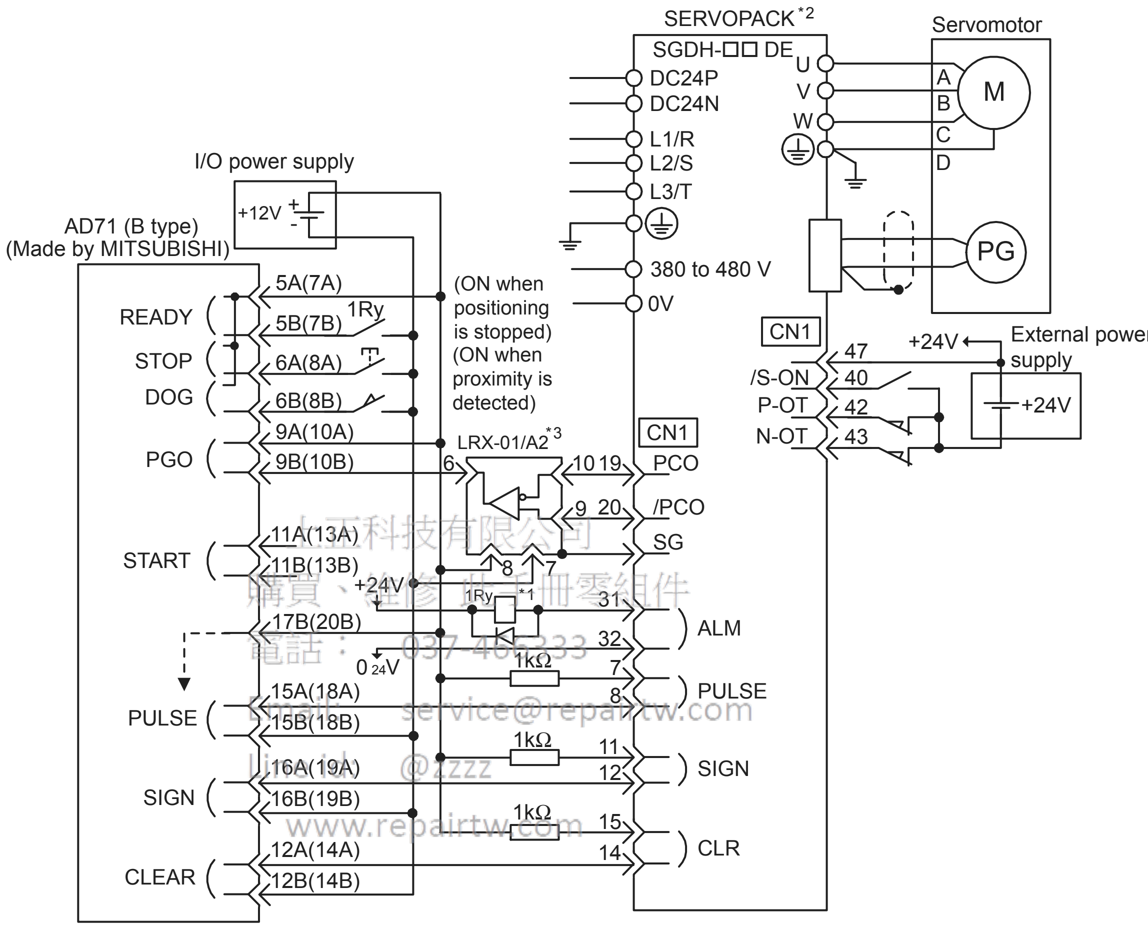
Note: 1. The signals shown here are applicable only to MITSUBISHI AD72 Positioning Unit and Yaskawa SGDH-□□DE SERVOPACK for 400 V.

2. The connection of the SGDM/SGDH SERVOPACK for 200 V, excluding the main-circuit terminal, is the same as the one shown in this diagram.

Position

■ Connection to MITSUBISHI AD71 (B Type) Positioning Unit

SERVOPACK for Position Control



* 1. These signals are output for approximately two seconds when the power is turned ON. Take this into consideration when designing a power ON sequence. Relay 1Ry is used to stop main circuit power supply to the SERVOPACK.

* 2. Set the parameter Pn200.0 to 1.

* 3. Manufactured by Yaskawa Controls Co., Ltd.

Note: 1. The signals shown here are applicable only to MITSUBISHI AD71 (B Type) Positioning Unit and Yaskawa SGDH-□□DE SERVOPACK for 400 V.

2. The connection of the SGDM/SGDH SERVOPACK for 200 V, excluding the main-circuit terminal, is the same as the one shown in this diagram.

3

Trial Operation

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

3

3.1 Two-step Trial Operation

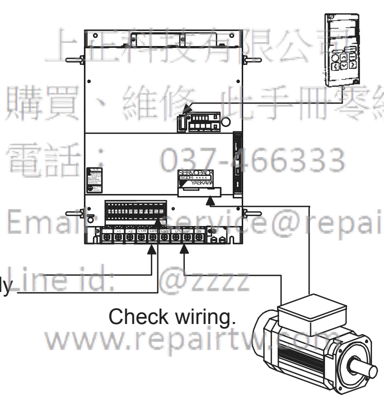
Make sure that all wiring is completed prior to starting trial operation. Perform the trial operation in the order given below (step 1 and 2) for your safety.

IMPORTANT

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

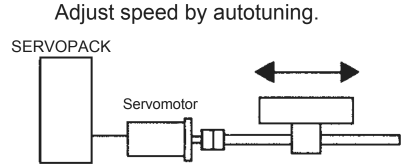
Step 1: Trial Operation for Servomotor without Load

Make sure the servomotor is wired properly and then turn the shaft prior to connecting the servomotor to the equipment.
For details on wiring, refer to *2.3.1 Connecting to Peripheral Devices*.



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.



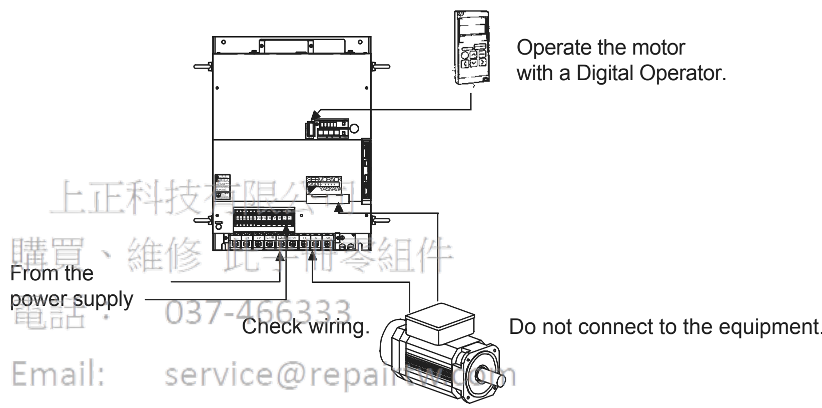
3.1.1 Step 1: Trial Operation for Servomotor without Load

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 I/O signal wiring.

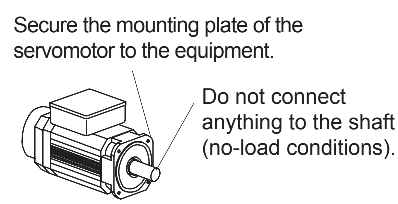
Make sure the host controller and other adjustments are completed as much as possible in step 1 (prior to connecting the servomotor to equipment).

Conduct a test run for the motor without load according to the following procedure. See *3.2.1 Servomotors with Brakes* if you are using a servomotor with brakes.



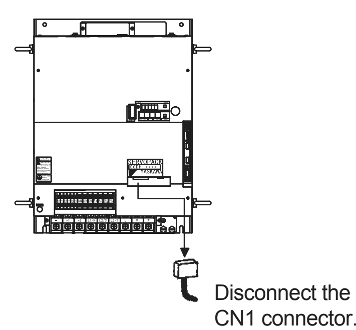
1. Secure the servomotor.

   Secure the servomotor mounting plate to the equipment in order to prevent the servomotor from moving during operation. In this case, be sure to disconnect the coupling and belt.



2. Check the wiring.

   Disconnect the CN1 connector and check servomotor wiring in the power supply circuit. CN1 I/O signals are not used, so leave the connector disconnected.

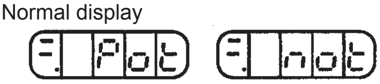


3. Turn ON power.

   Turn ON the SERVOPACK power. If the SERVOPACK has turned ON normally, the LED display on the Digital Operator will appear as shown on the right. Power is not supplied to the servomotor because the servo is OFF.

   If an alarm display appears on the LED indicator as shown on the right, the power supply circuit, servomotor wiring, or encoder wiring is incorrect. In this case, turn OFF power and take appropriate action. See *8.2.3 Alarm Display Table*.

Normal display



Alternate display

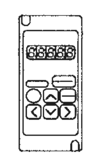
Example of Alarm Display

4. Operate with the Digital Operator.

   Operate the servomotor using the Digital Operator. Check to see if the servomotor runs normally.

   See *6.2.2 Controlling Operation Through the Digital Operator* for more details on the procedure.

Operation by Digital Operator



If an alarm occurs, the power supply circuit, motor wiring, or encoder wiring is incorrect.

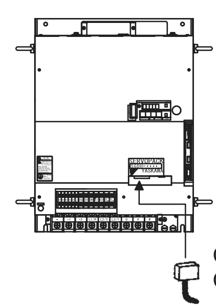
5. Connect the signal lines.

   Use the following procedure to connect the CN1 connector.

   a) Turn OFF power.

   b) Connect the CN1 connector.

   c) Turn ON power again.



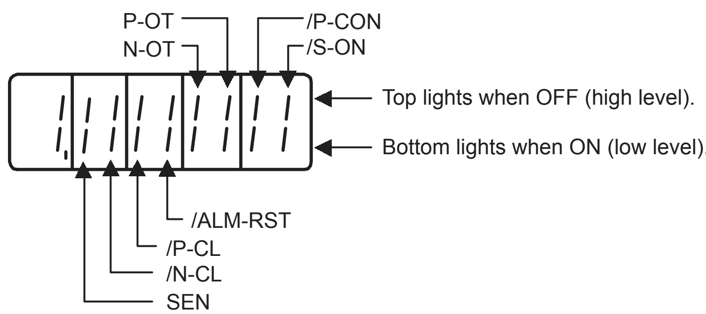
Connect CN1 connector.

6. Check the input signals.

   Check input signal wiring in Monitor Mode using the Digital Operator. See *6.1.7 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.

Input signal LED display



Input Signal Status	LED Display
OFF (high level)	Top LED indicators light.
ON (low level)	Bottom LED indicators light.

IMPORTANT

The servomotor will not operate properly if the following signal lines are not wired correctly. Short the signal lines if they will not be used. The input signal selections (parameters Pn50A to Pn50D) can be used to eliminate the need for external short circuiting.

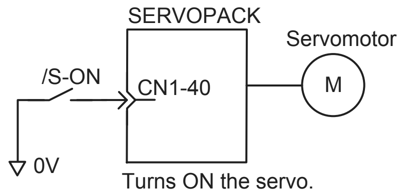
Signal Symbol	Connector Pin No.	Description
P-OT	CN1-42	The servomotor can rotate in the forward direction when this signal line is low (0 V).
N-OT	CN1-43	The servomotor can rotate in the reverse direction when this signal line is low (0 V).
/S-ON	CN1-40	The servomotor is turned ON when this signal line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

INFO

If an absolute encoder is being used, the servo will not turn ON when the servo ON signal (/S-ON) is input unless the SEN signal is also ON.

When the SEN signal is checked in monitor mode, the top of the LED will light because the SEN signal is high when ON.

7. Turn ON the servo.



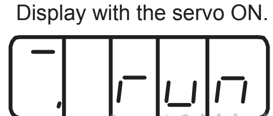
Turn ON the servo using the following procedure.

a) Make sure there are no reference signals input.

- Set V-REF (CN1-5) and T-REF (CN1-9) to 0 V for speed and torque control.
- Set PULS (CN1-7) and SIGN (CN1-11) to low for position control.

b) Turn ON the servo ON signal.

Display with the servo ON.



Set /S-ON (CN1-40) to 0 V. 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 *8.2 Troubleshooting*.

IMPORTANT

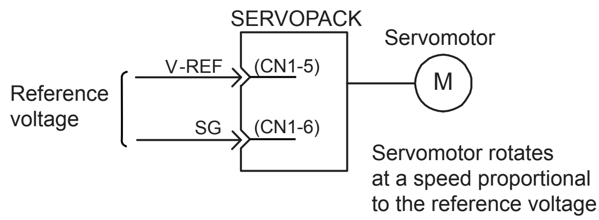
If there is noise in the reference voltage for speed control, the “-” on the left of the 7-segment LED may flash.

8. Operate using reference input.

The operating procedure here depends on the parameter settings (control mode selection at memory switch Pn000.1). Use the following procedure for operations with speed and position control.

■ Operating Procedure in Speed Control Mode: Set Pn000.1 to 0

Standard speed control setting is described here.



1. Gradually increase the reference speed input (V-REF, CN1-5) voltage. The servomotor will rotate.
2. Check the following items in Monitor Mode. See *6.1.7 Operation in Monitor Mode*.

Un000	Actual motor speed
Un001	Reference speed

- Has the reference speed been input?
- Is the motor speed as designed?
- Does the reference speed coincide the actual motor speed?
- Does the servomotor stop when the speed reference is 0?

3. If the servomotor rotates at extremely slow speed with 0 V specified for the reference voltage, correct the reference offset value as described in *6.2.3 Automatic Adjustment of the Speed and Torque Reference Offset* or *6.2.4 Manual Adjustment of the Speed and Torque Reference Offset*.
4. Reset the parameters shown below to change the motor speed or direction of rotation.

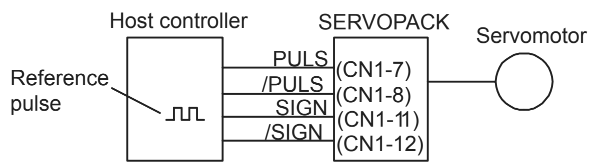
Pn300	Speed Reference Input Gain See *4.2.1 Speed Reference.*
Pn000.0	Rotation Direction Selection See *4.1.1 Switching Servomotor Rotation Direction.*

■ Operating Procedure in Position Control Mode: Set Pn000.1 to 1

1. Set the parameter Pn200.0 so the reference pulse form is the same as the host controller output form.

   Selecting the reference pulse form: See *4.2.2 Position Reference*.

2. Input a slow speed pulse from the host controller and execute low-speed operation.



3. Check the following items in Monitor Mode. See *6.1.7 Operation in Monitor Mode*.

Un000	Actual motor speed
Un007	Reference pulse speed display
Un008	Position offset

- Has the reference pulse been input?
- Is the motor speed as designed?
- Does the reference pulse coincide with the actual motor speed?
- Does the servomotor stop when the reference pulse is turned OFF?

4. Reset the parameters shown below to change the motor speed or direction of rotation.

Pn202, Pn203	Electronic Gear Ratio See *4.2.5 Using the Electronic Gear Function*.
Pn000.0	Rotation Direction Selection See *4.1.1 Switching Servomotor Rotation Direction*.

If an alarm occurs or the servomotor fails to operate during the above operation, CN1 connector wiring is incorrect or parameter settings do not match the host controller specifications. Check the wiring and review the parameter settings, then repeat step 1.

INFO

Reference

- List of Alarms: See *8.2.3 Alarm Display Table*.
- List of Parameters: See *Appendix A List of Parameters*.

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

⚠ CAUTION

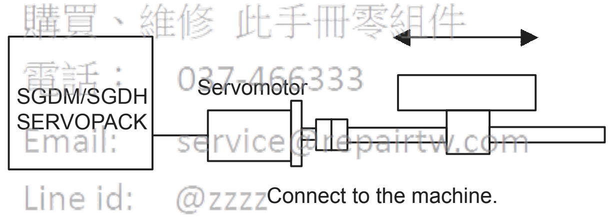
- **Follow the procedure below for step-2 operation precisely as given.**

  Malfunctions that occur after the servomotor is connected to the equipment not only damage the equipment, but may also cause an accident resulting death or injury.

Before proceeding to step 2, repeat step 1 (servomotor trial operation without a load) until you are fully satisfied that all items including parameters and wiring have been tested completely.

After step 1 has been completed, proceed to step 2 for trial operation with the servomotor connected to the equipment. The purpose of step 2 is to adjust the SERVOPACK according to equipment characteristics.

- Adjust the servo gain according to equipment characteristics.
- Match the direction of rotation and speed to the equipment's specifications.
- Check 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 *7.4.1 Servomotors* for more details on connecting the servomotor.
3. Tune the SERVOPACK to equipment characteristics.

   Refer to *5.4 Servo Gain Adjustments*.
4. Operate the servomotor by reference input.

   As in step 1 (servomotor trial operation with no-load), execute operation by reference input as described in *3.1.1 Step 1: Trial Operation for Servomotor without Load*. Tune to match the host controller at this time as well.
5. Set and record user settings.

   Set parameters as required and record all settings for use later in maintenance.

INFO The servomotor will not be broken in completely during the trial operation. Therefore, let it the system run for a sufficient amount of additional time to ensure that it is properly broken in.

3.2 Supplementary Information on Trial Operation

Always refer to this information before starting trial operation in the following instances:

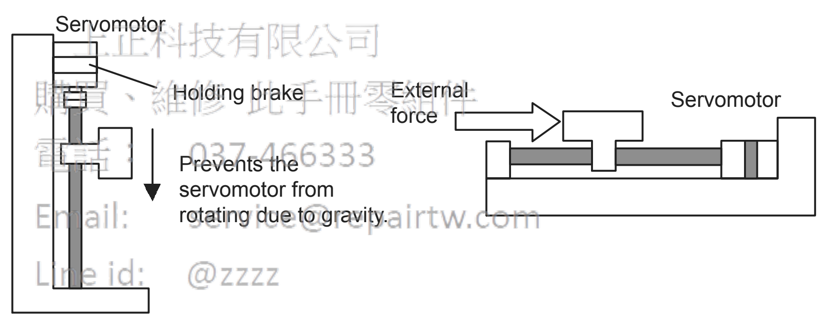
- 3.2.1 Servomotors with Brakes
- 3.2.2 Position Control by Host Controller

3.2.1 Servomotors with Brakes

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

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

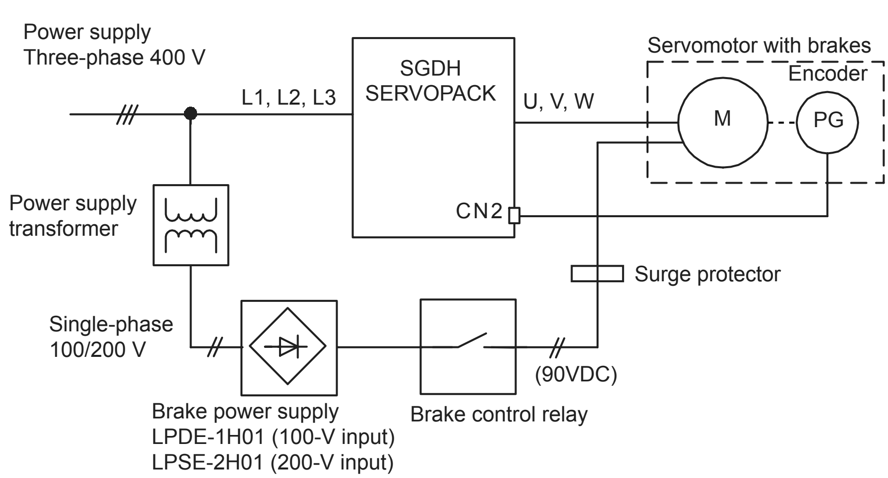
- Vertical Shaft
- Shaft with External Force Applied



IMPORTANT

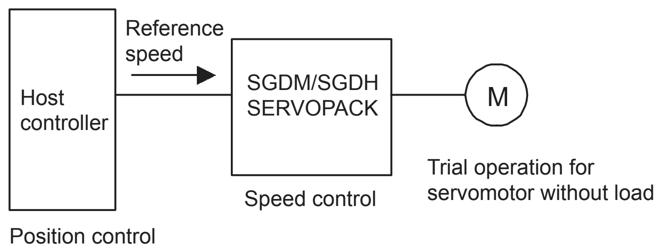
To prevent faulty operation due to gravity or external force, make sure that the servomotor and holding brake operate normally with the servomotor disconnected from the equipment. When both of them operate normally, connect the servomotor to the equipment to start trial operation.

The following figure shows a wiring example for a servomotor with brakes when a 400-V SERVOPACK is used. See *4.4.4 Using the Holding Brake* for details on wiring.



3.2.2 Position Control by Host Controller

If position control from the host controller has not been confirmed, disconnect the servomotor from the equipment and perform a trial operation, otherwise the servomotor may run out of control. Check servomotor operation as described in the following table.



Reference from the Host Controller	Check Item	Check Method	Review Items
JOG Operation (Constant Reference Speed Input from Host Controller)	Motor speed	Check motor speed as follows: • Use the speed monitor (Un000) on the Panel Operator. • Run the servomotor at low speed. Input a reference speed of 60 min^{-1} for example to check to see if the servomotor makes one revolution per second.	Check the parameter setting at Pn300 to see if reference speed gain is correct.
Simple Positioning	No. of motor rotations	Input a reference equivalent to one servomotor rotation and visually check to see if the shaft makes one revolution.	Check the parameter setting at Pn201 to see if the number of dividing pulses is correct.
Overtravel (P-OT and N-OT Used)	Whether the servomotor stops rotating when P-OT and N-OT signals are input	Check to see if the servomotor stops when P-OT and N-OT signals are input during continuous servomotor operation.	Review P-OT and N-OT wiring if the servomotor does not stop.

3.3 Minimum Parameters and Input Signals

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

3.3.1 Parameters

See *6.1.6 Operation in Parameter Setting Mode* for more details on setting parameters.

Turn OFF power once after changing any parameter except Pn300. The change will be valid when power is turned ON again.

Basic Parameters

Pn000.1	Function Selection Basic Switches: Control Method Selection	See *4.3.5*.

Speed Control

Pn300	Speed Reference Input Gain	See *4.2.1*.
Pn201	PG Divider	See *4.2.3*.

Position Control

Pn200.0	Reference Pulse Form	See *4.2.2*.
Pn202	Electronic Gear Ratio (Numerator)	See *4.2.5*.
Pn203	Electronic Gear Ratio (Denominator)	See *4.2.5*.

Changing Servomotor Rotation Direction

The wiring may be incorrect if the specified direction of rotation differs from the actual direction of rotation. Recheck the wiring and correct if necessary. Use the following parameter to reverse the direction of rotation.

Pn000.0	Function Selection Basic Switches: Direction Selection	See *4.1.1*.

3.3.2 Input Signals

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

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

Signal Name		Pin No.	Contents
/S-ON	Servo ON	CN1-40	See *4.5.2 Using the Servo ON Input Signal* for more details on turning ON and OFF the servomotor.
P-OT	Forward run prohibited	CN1-42	See *4.1.2 Setting the Overtravel Limit Function* for more details on the overtravel limit switch.
N-OT	Reverse run prohibited	CN1-43	

3

4

Parameter Settings and Functions

This chapter describes the procedure for setting and applying parameters.

■ Before Reading this Chapter

This chapter describes the use of each CN1 connector I/O signals in the SGDM/SGDH SERVOPACK as well as the procedure for setting the related parameters for the intended purposes.

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

- List of CN1 I/O signals: See *2.4.3 I/O Signal Names and Functions*.
- CN1 I/O signal terminal layout: See *2.4.2 List of CN1 Terminals*.
- List of Parameters: See *Appendix A List of Parameters*.
- Parameter setting procedure: See *6.1.6 Operation in Parameter Setting Mode*.

The CN1 connector is used to exchange signals with the host controller and external circuits.

■ Parameter Configurations

Parameters are comprised of the types shown in the following table. See *Appendix A List of Parameters.*

Type	Parameter No.	Description
Function Selection Constants	Pn000 to Pn003	Select basic and application functions such as the type of control or the stop mode used when an alarm occurs.
Servo Gain and Other Constants	Pn100 to Pn123	Set numerical values such as speed and position loop gains.
Position Control Constants	Pn200 to Pn208	Set position control parameters such as the reference pulse input form and gear ratio.
Speed Control Constants	Pn300 to Pn308	Set speed control parameters such as speed reference input gain and soft start acceleration/deceleration time.
Torque Control Constants	Pn400 to Pn409	Set torque control parameters such as the torque reference input gain and forward/reverse torque limits.
Sequence Constants	Pn500 to Pn512	Set output conditions for all sequence signals and changes I/O signal selections and allocations.
Others	Pn600 to Pn601	Specify the capacity for an external regenerative resistor and reserved constants.
Auxiliary Function Execution	Fn000 to Fn014	Execute auxiliary functions such as JOG Mode operation.
Monitor Modes	Un000 to Un00D	Enable speed and torque reference monitoring, as well as monitoring to check whether I/O signals are ON or OFF.

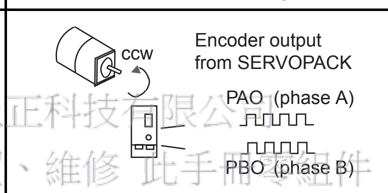
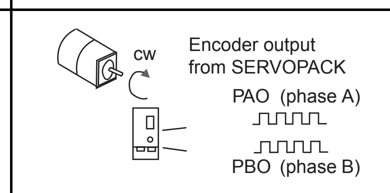
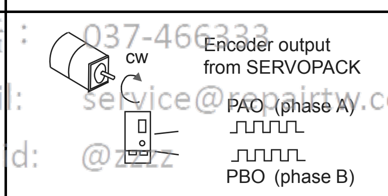
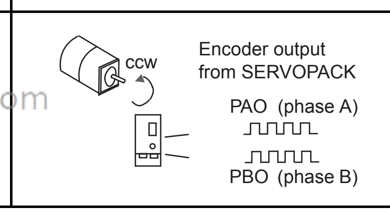
4.1 Settings According to Device Characteristics

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

4.1.1 Switching Servomotor Rotation Direction

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

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

	Standard Setting	Reverse Rotation Mode
Forward Reference		
Reverse Reference		

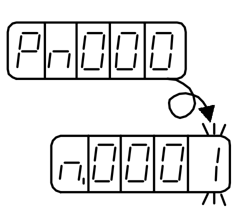
■ Setting Reverse Rotation Mode

Use parameter Pn000.0.

Pn000.0	Rotation Direction Selection	Factory Setting: 0	Speed/Torque Control, Position Control

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

Setting	Contents	
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)



4.1.2 Setting the Overtravel Limit Function

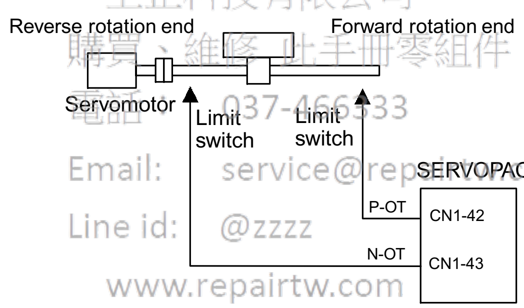
The overtravel limit function forces movable equipment parts to stop if they exceed the allowable range of motion.

■ Using the Overtravel Function

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

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

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



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

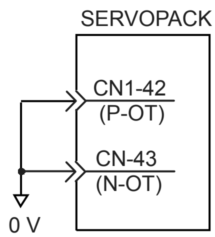
P-OT	CN1-42 at low level when ON	Forward rotation allowed. Normal operation status.
	CN1-42 at high level when OFF	Forward run prohibited (reverse rotation allowed).
N-OT	CN1-43 at low level when ON	Reverse rotation allowed. Normal operation status.
	CN1-43 at high level when OFF	Reverse run prohibited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

4

■ Enabling/Disabling Input Signals

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

Pn50A.3	P-OT Signal Mapping (Forward Run Prohibit Input Signal)	Factory Setting: 2	Speed/Torque Control, Position Control
Pn50B.0	N-OT Signal Mapping (Reverse Run Prohibit Input Signal)	Factory Setting: 3	Speed/Torque Control, Position Control



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

Parameter	Setting	Item
Pn50A.3	2 (Factory setting)	Uses the P-OT input signal for prohibiting forward rotation. (Forward rotation is prohibited when CN1-42 is open and is allowed when CN1-42 is at 0 V.)
	8	Does not use the P-OT input signal for prohibiting forward rotation. (Forward rotation is always allowed and has the same effect as shorting CN1-42 to 0 V.)
Pn50B.0	3 (Factory setting)	Uses the N-OT input signal for prohibiting reverse rotation. (Reverse rotation is prohibited when CN1-43 is open and is allowed when CN1-43 is at 0 V.)
	8	Does not use the N-OT input signal for prohibiting reverse rotation. (Reverse rotation is always allowed and has the same effect as shorting CN1-43 to 0 V.)

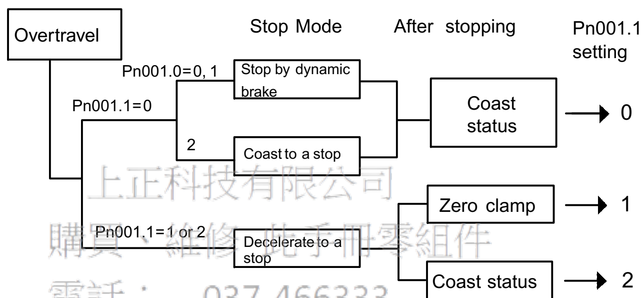
■ Servomotor Stop Mode for P-OT and N-OT Input Signals

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

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

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

Pn001.1	Overtravel Stop Mode	Factory Setting: 0	Speed/Torque Control, Position Control



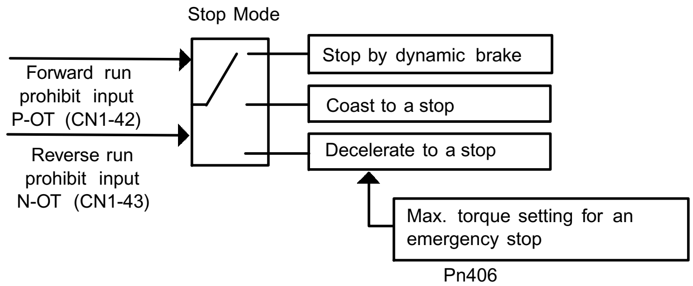
INFO For torque control, the servomotor will be placed in coast status after either decelerating or coasting to a stop (according to the stop mode set in Pn001.0), regardless of the setting of Pn001.1.

Parameter	Setting	Item
Pn001.1	0	Stops the servomotor the same way as turning the servo OFF (according to Pn001.0).
	1	Decelerates the servomotor to a stop at the preset torque, and then locks the servomotor in Zero Clamp Mode. Torque setting: Pn406 emergency stop torque
	2	Decelerates the servomotor to a stop at the preset torque, and puts the servomotor in coast status. Torque setting: Pn406 emergency stop torque

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

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

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



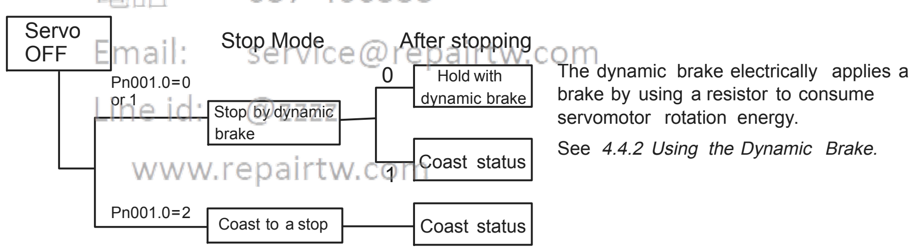
■ Servo OFF Stop Mode Selection

The SGDM/SGDH SERVOPACK turns OFF under the following conditions:

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

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

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



Parameter	Setting	Item
Pn001.0	0 (Factory setting)	Uses the dynamic brake to stop the servomotor. Maintains dynamic brake after the servomotor stops.
	1	Uses the dynamic brake to stop the servomotor. Releases dynamic brake after the servomotor stops, and the servomotor coasts to a stop.
	2	Coasts the servomotor to a stop. 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.

4.1.3 Limiting Torques

The SGDM/SGDH SERVOPACK limits torques as follows:

- Level 1: Limits maximum output torque to protect the equipment or workpiece. (Internal Torque Limit)
- Level 2: Limits torque after the servomotor moves the equipment to a specified position. (External Torque Limit)
- Level 3: Always limits output torque rather than speed.
- Level 4: Switches between speed and torque limit.

Application of levels 1 and 2 in the torque limit function are described below.

■ Setting Level 1: Internal Torque Limits

Maximum torque is limited to the values set in the following parameters.

Pn402	Forward Torque Limit	Unit: %	Setting Range: 0 to 800	Factory Setting: 800	Speed/Torque Control, Position Control
Pn403	Reverse Torque Limit	Unit: %	Setting Range: 0 to 800	Factory Setting: 800	Speed/Torque Control, Position Control

This parameter sets the maximum torque limits for forward and reverse rotation.

Use this parameter when torque must be limited due to equipment conditions.

The torque limit function always monitors torque and outputs the signals below when the limit is reached.

The following signals are output by the torque limit function.

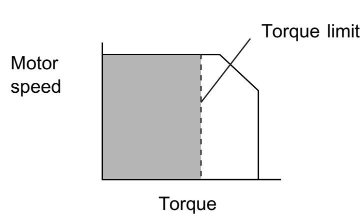
• /CLT • Monitor Mode Un006
Condition that outputs a /CLT signal: Pn50F.0 allocates an output terminal from SO1 to SO3.

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

INFO

If torque limit is set higher than the maximum torque of the servomotor, the maximum torque of the servomotor is the limit.

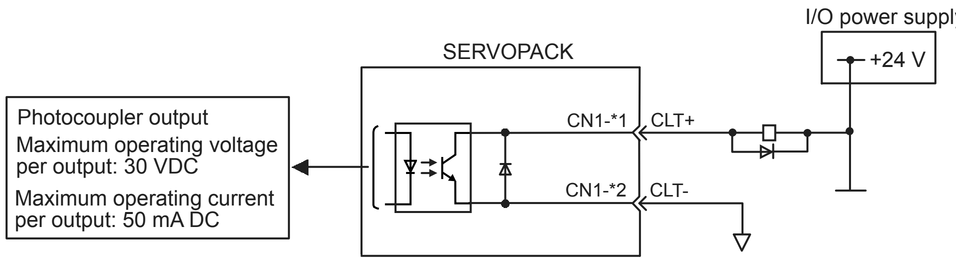
Application Example: Equipment Protection



Too small a torque limit will result in a insufficient torque during acceleration and deceleration.

Using /CLT Signal

The following section describes the use of the contact output signal /CLT as a torque limit output signal.



Output → /CLT CN1-*1	Torque Limit Output	Speed/Torque Control, Position Control

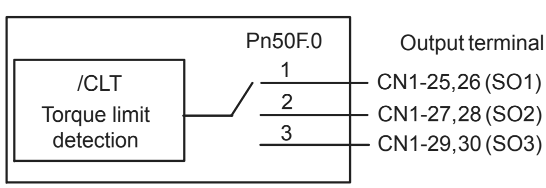
This signal indicates whether servomotor output torque (current) is being limited.

ON Status	The circuit between CN1-*1 and *2 is closed. CN1-*1 is at low level.	Servomotor output torque is being limited. (Internal torque reference is greater than the limit setting.)
OFF Status	The circuit between CN1-*1 and *2 is opened. CN1-*1 is at high level.	Servomotor output torque is not being limited. (Internal torque reference is less than the limit setting.)

Settings: Pn402 (Forward Torque Limit)
Pn403 (Reverse Torque Limit)
Pn404 (Forward External Torque Limit): /P-CL input only
Pn405 (Reverse External Torque Limit): /N-CL input only

When the /CLT signal is used, the following parameter must be used to select the output signal.

Pn50F	Output Signal Selections 2	Factory Setting: 0000	Speed/Torque Control, Position Control



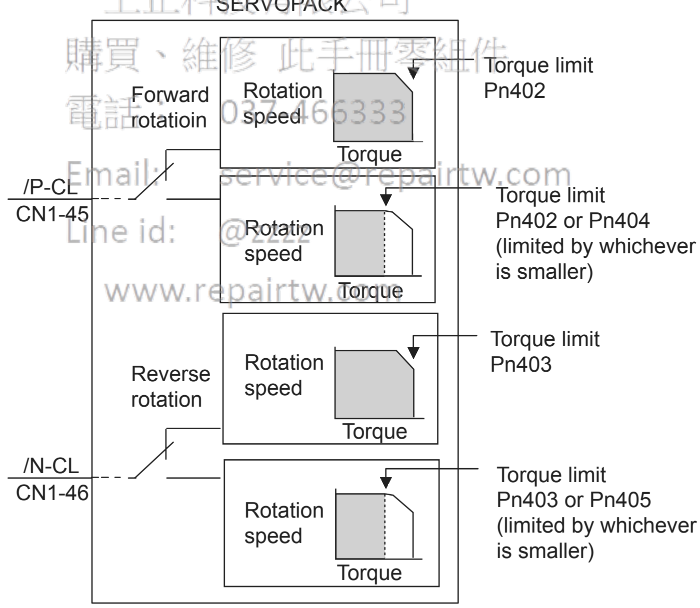
Use the following table to select which terminal will output the /CLT signal.

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

Note: Multiple signals allocated to the same output circuit are output using OR logic. Set other output signals to a value other than that allocated to the /CLT signal in order to output the /CLT signal alone. See *4.3.4 Output Circuit Signal Allocation*.

■ Setting Level 2: External Torque Limit

A contact input signal is used to enable the torque (current) limits previously set in parameters. Torque limits can be set separately for forward and reverse rotation.



→ Input /P-CL CN1-45	Forward External Torque Limit Input	Speed/Torque Control, Position Control
→ Input /N-CL CN1-46	Reverse External Torque Limit Input	Speed/Torque Control, Position Control

This is the external torque (current) limit input for forward and reverse rotation.

Confirm the allocation of input signals when using this function.(Refer to *4.3.3 Input Circuit Signal Allocation*.) Factory settings are given in the following table.

/P-CL	CN1-45 at low level when ON	Use forward torque limit.	Limit: Pn404
	CN1-45 at high level when OFF	Do not use forward torque limit. Normal operation.	-
/N-CL	CN1-46 at low level when ON	Use reverse torque limit.	Limit: Pn405
	CN1-46 at high level when OFF	Do not use reverse torque limit. Normal operation.	-

The following output signals and monitor methods are used when torque is being limited.

• /CLT • Monitor Mode Un005: Nos. 6 and 7 (With factory settings) (Refer to *6.1.7 Operation in Monitor Mode*.) Un006: Depending on output signal allocation conditions.
Condition that outputs a /CLT signal: Pn50F.0 allocates an output terminal from SO1 to SO3.

Application Examples:

- Forced stop.
- Robot holding a workpiece.

Pn404	Forward External Torque Limit	Unit: %	Setting Range: 0 to 800	Factory Setting: 100	Speed/Torque Control, Position Control
Pn405	Reverse External Torque Limit	Unit: %	Setting Range: 0 to 800	Factory Setting: 100	Speed/Torque Control, Position Control

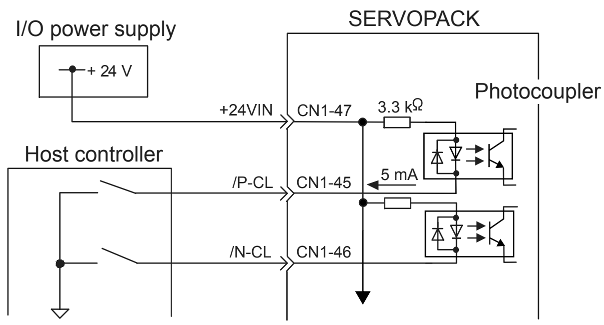
Set the torque limits when the torque is limited by an external contact input.

/P-CL (CN1-45) Input	Pn404 torque limit applied.
/N-CL (CN1-46) Input	Pn405 torque limit applied.

See *4.2.10 Torque Limiting by Analog Voltage Reference, Function 1*.

Using /P-CL and /N-CL Signals

The procedure for using /P-CL and /N-CL as torque limit input signals is illustrated below.

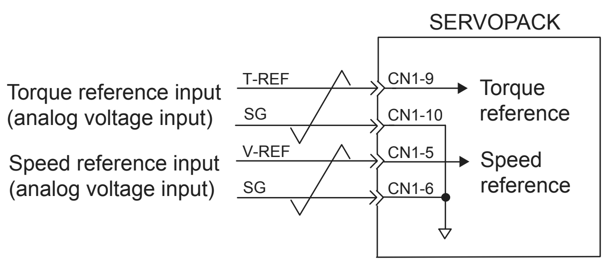


4.2 Settings According to Host Controller

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

4.2.1 Speed Reference

Input the speed reference using the following input signal speed reference input. Since this signal has various uses, set the optimum reference input for the system created.



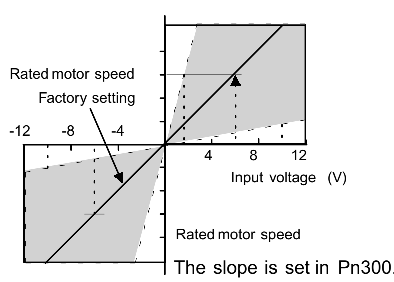
: represents twisted-pair wires.

→ Input V-REF CN1-5	Speed Reference Input	Speed Control
→ Input SG CN1-6	Signal Ground	Speed Control

The above inputs are used for speed control (analog reference). (Pn000.1 = 0, 4, 7, 9, or A)

Always wire for normal speed control.

The motor speed is controlled in proportion to the input voltage between V-REF and SG.



■ Setting Examples

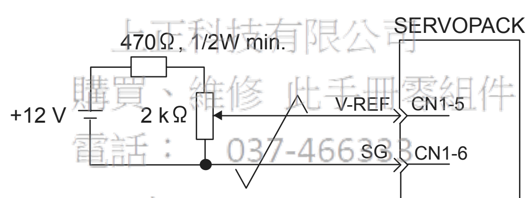
Pn300 = 600: This setting means that 6 V is equivalent to the rated motor speed.

◀ EXAMPLE ▶

Speed Reference Input	Rotation Direction	Motor Speed	SGMBH Servomotor
+6V	Forward rotation	Rated motor speed	1500 min^{-1}
+1V	Forward rotation	(1/6) rated motor speed	250 min^{-1}
-3V	Reverse rotation	(1/2) rated motor speed	750 min^{-1}

Parameter Pn300 can be used to change the voltage input range.

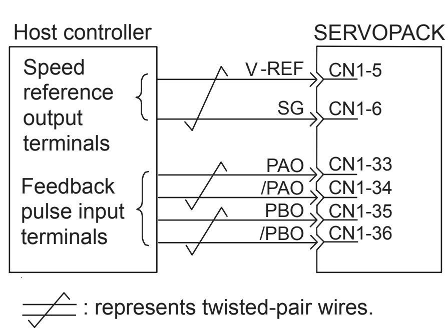
■ Input Circuit Example



- Always use twisted-pair cable for noise control.

Recommended variable resistor: Model 25HP-10B manufactured by Sakae Tsushin Kogyo Co., Ltd.

Connect V-REF and SG to the speed reference output terminals on the host controller when using a host controller, such as a programmable controller, for position control.

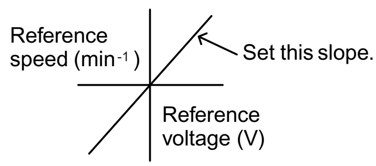


Adjust Pn300 according to output voltage specifications.

Adjust the speed reference input gain at the following parameter.

Pn300	Speed Reference Input Gain	Unit: 0.01V/rated motor speed	Setting Range: 150 to 3000	Speed Control

Set the analog voltage level for the V-REF speed reference input to operate the servomotor at a rated speed.



The factory setting is adjusted so that a 6-V input is equivalent to the rated motor speed of all applicable servomotors.

INFO

The maximum allowable voltage to the speed reference input (between CN1-5 and 6) is ± 12 VDC.

Using the /P-CON Signal

→ Input /P-CON CN1-41	Proportional Control Reference	Speed Control, Position Control

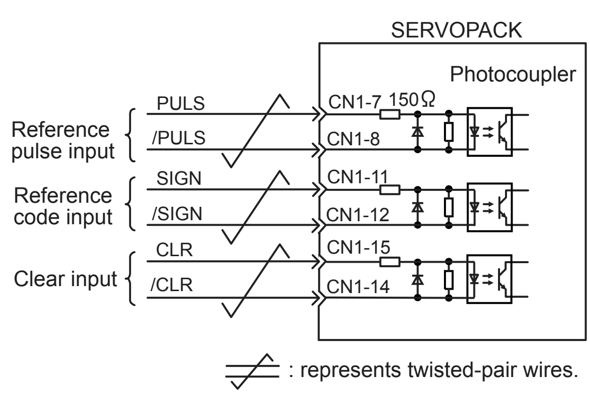
The /P-CON input signal switches the Speed Control Mode from PI (proportional-integral) to P (proportional) control in order to reduce servomotor rotation and minute vibrations due to speed reference input drift. The use of this signal will vary with applications because servomotor rigidity (holding force) drops when the servomotor is stopped.

4.2.2 Position Reference

The reference pulse, reference code, and clear inputs are used for the position reference. Since this signal can be used in different ways; set the optimum reference input for the system created.

■ Reference by Pulse Input

Positioning is controlled by inputting a move reference pulse.

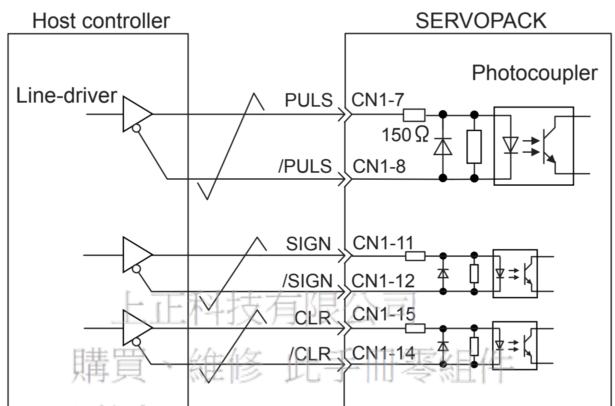


Any of the following forms can be used for the position reference:

- Line-driver output
- +12-V open-collector output
- +5-V open-collector output

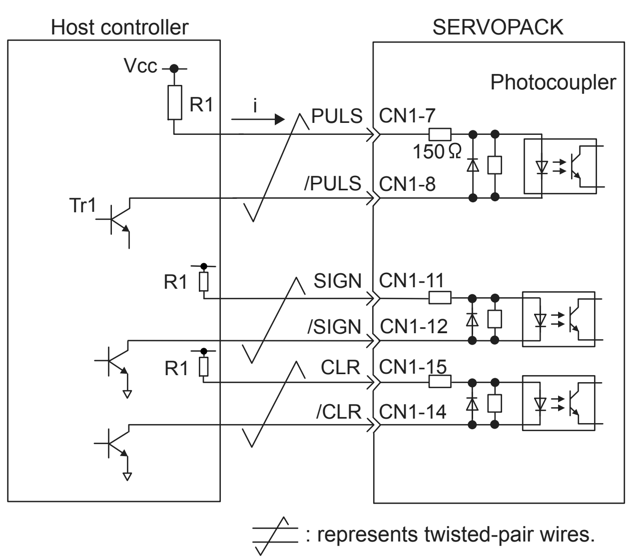
Connection Example 1: Line-driver Output

Applicable line driver: SN75174 manufactured by Texas Instruments Inc., MC3487 or equivalent



Connection Example 2: Open-collector Output

Set limiting resistor R1 so that input current, i, falls within the following range:
Input current i: 7 to 15 mA



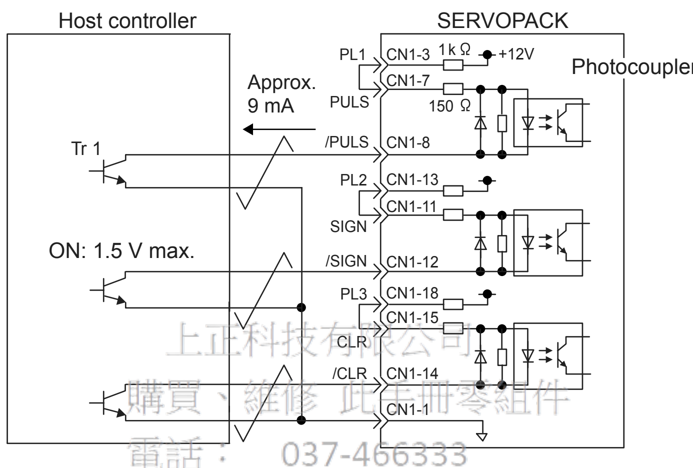
◀ EXAMPLE ▶

- When Vcc is +12 V: R1 = 1 kΩ
- When Vcc is +5 V: R1 = 180 Ω

Note: The following table shows the signal logic for an open-collector output.

When Tr1 is ON	Equivalent to high-level input
When Tr1 is OFF	Equivalent to low-level input

This circuit uses the 12-V power supply built into the SERVOPACK. Input is not insulated.



: represents twisted-pair wire.

IMPORTANT

The noise margin of the input signal will decrease if the reference pulse is given using an open-collector output. Set parameter Pn200.3 to 1 if the position drifts due to noise.

■ Selecting a Reference Pulse Form

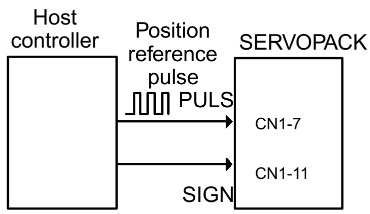
Use the following parameters to select the reference pulse form used.

→ Input PULS CN1-7	Reference Pulse Input	Position Control
→ Input /PULS CN1-8	Reference Pulse Input	Position Control
→ Input SIGN CN1-11	Reference Sign Input	Position Control
→ Input /SIGN CN1-12	Reference Sign Input	Position Control

The servomotor only rotates at an angle proportional to the input pulse.

Pn200.0	Reference Pulse Form	Factory Setting: 0	Position Control

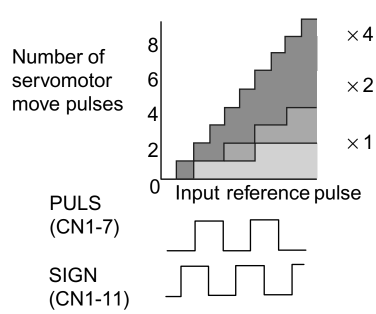
Set reference pulse form input to the SERVOPACK from the host controller.



Since the reference pulse form can be selected from among those listed below, set one according to host controller specifications.

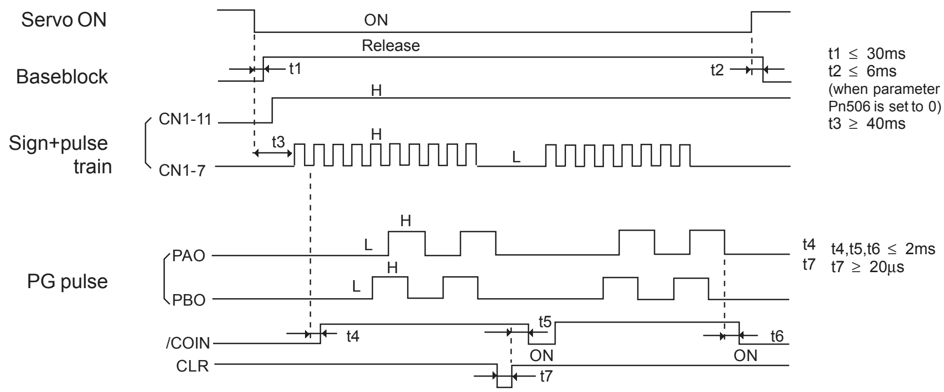
Parameter Pn200.0	Reference Pulse Form	Input Pulse Multiplier	Logic	Forward Rotation Reference	Reverse Rotation Reference
0	Sign + pulse train	-	Positive logic	PULS (CN1-7) SIGN (CN1-11) High	PULS (CN1-7) SIGN (CN1-11) Low
1	CW pulse + CCW pulse	-		PULS (CN1-7) Low SIGN (CN1-11)	PULS (CN1-7) SIGN (CN1-11) Low
2	Two-phase pulse train with 90° phase differential	×1		90° PULS (CN1-7) SIGN (CN1-11)	90° PULS (CN1-7) SIGN (CN1-11)
3		×2			
4		×4			
5	Sign + pulse train	-	Negative logic	PULS (CN1-7) SIGN (CN1-11) Low	PULS (CN1-7) SIGN (CN1-11) High
6	CW pulse + CCW pulse	-		PULS (CN1-7) High SIGN (CN1-11)	PULS (CN1-7) SIGN (CN1-11) High
7	Two-phase pulse train with 90° phase differential	×1		90° PULS (CN1-7) SIGN (CN1-11)	90° PULS (CN1-7) SIGN (CN1-11)
8		×2			
9		×4			

Input Pulse Multiplier



The input pulse multiplier function can be used if the reference form is a two-phase pulse train with a 90° phase differential. The electronic gear function can also be used to convert input pulses.

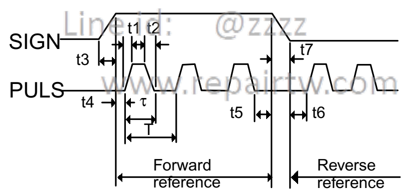
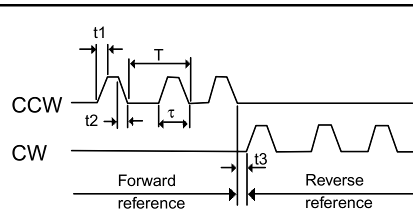
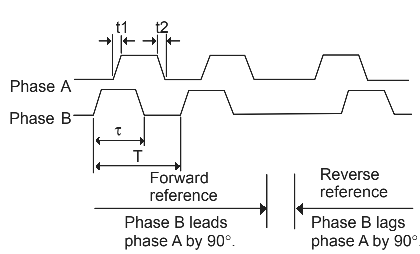
Example of I/O Signal Generation Timing



Note: 1. The interval from the time the servo ON signal is turned ON until a reference pulse is input must be at least 40 ms. Otherwise the reference pulse may not be input.

2. The error counter clear signal must be ON for at least 20 µs.

Reference Pulse Input Signal Timing

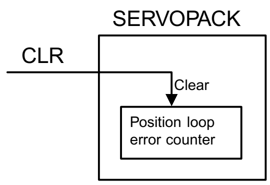
Reference Pulse Form	Electrical Specifications		Comments
Sign + pulse train input (SIGN + PULS signal) Maximum reference frequency: 500 kpps (200-kpps open-collector output)		t1, t2 ≤ 0.1µs t3, t7 ≤ 0.1µs t4, t5, t6 > 3µs τ ≥ 1.0µs (τ/T) × 100 ≤ 50 %	Sign (SIGN) H = Forward reference L = Reverse reference
CW pulse + CCW pulse Maximum reference frequency: 500 kpps (200-kpps open-collector output)		t1, t2 ≤ 0.1µs t3 > 3µs τ ≥ 1.0µs (τ/T) × 100 ≤ 50 %	
Two-phase pulse train with 90° phase differential (phase A + phase B) Maximum reference frequency × 1: 500 kpps (200-kpps open-collector output) × 2: 400 kpps × 4: 200 kpps		t1, t2 ≤ 0.1µs τ ≥ 1.0µs (τ/T) × 100 = 50 %	Parameter Pn200.0 is used to switch the input pulse multiplier mode.

■ Error Counter Clear Input

The procedure for clearing the error counter is described below.

→ Input CLR CN1-15	Clear Input	Position Control
→ Input /CLR CN1-14	Clear Input	Position Control

The following occurs when the CLR signal is set to high level.

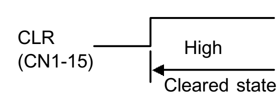
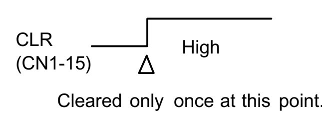
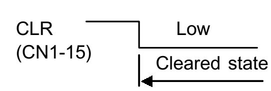
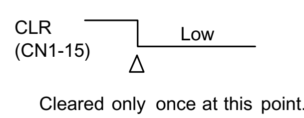


- The error counter inside the SERVOPACK is set to 0.
- Position loop control is prohibited.

Use this signal to clear the error counter from the host controller or select the following clear operation through parameter Pn200.1

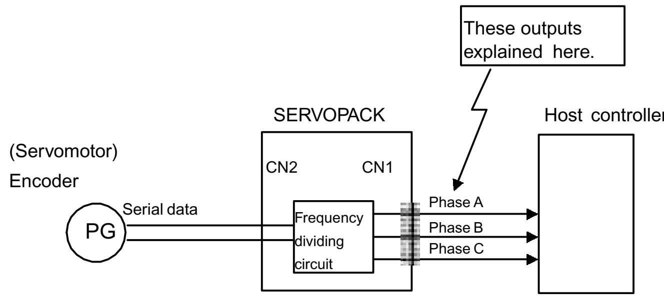
Pn200.1	Error Counter Clear Signal Form	Factory Setting: 0	Position Control

Select the pulse form for the error counter clear signal CLR (CN1-15).

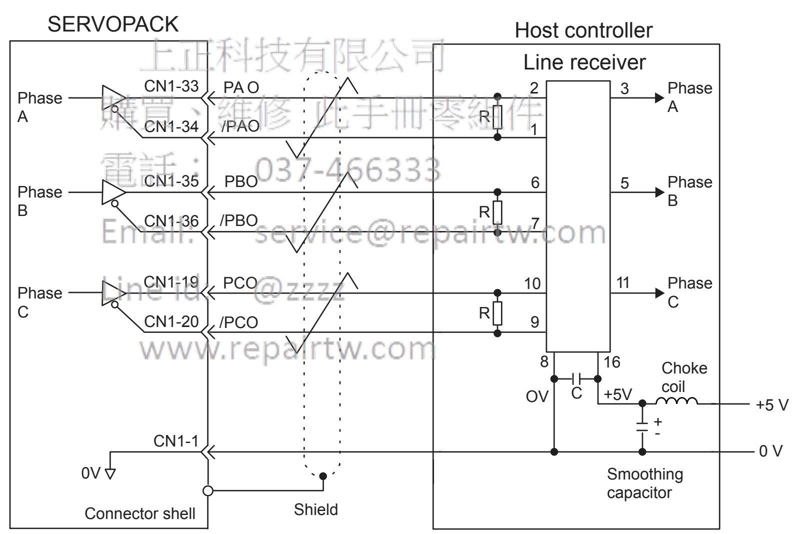
Pn200.1 Setting	Description	Clear Timing
0	Clears the error counter when the CLR signal goes high. Error pulses do not accumulate as long as the signal remains high.	
1	Clears the error counter on the rising edge of the CLR signal. Clears the error counter only once on the rising edge of the CLR signal.	
2	Clears the error counter when the CLR signal goes low. Error pulses do not accumulate as long as the signal remains low.	
3	Clears the error counter on the falling edge of the CLR signal. Clears the error counter only once on the falling edge of the CLR signal.	

4.2.3 Using the Encoder Signal Output

Encoder output signals divided [1] inside the SERVOPACK can be output externally. These signals can be used to form a position control loop in the host controller.



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



: represents twisted-pair wires.

Applicable line receiver: SN75175 manufactured by Texas Instruments Inc., MC3486 or the equivalent.

R (terminator): 220 to 470 Ω
C (decoupling capacitor): 0.1 μF

TERMS

[1] Dividing

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.

■ I/O Signals

I/O signals are described below.

Output → PAO CN1-33	Encoder Output Phase A	Speed/Torque Control, Position Control
Output → /PAO CN1-34	Encoder Output Phase /A	Speed/Torque Control, Position Control
Output → PBO CN1-35	Encoder Output Phase B	Speed/Torque Control, Position Control
Output → /PBO CN1-36	Encoder Output Phase /B	Speed/Torque Control, Position Control
Output → PCO CN1-19	Encoder Output Phase C	Speed/Torque Control, Position Control
Output → /PCO CN1-20	Encoder Output Phase /C	Speed/Torque Control, Position Control

Divided encoder signals are output.

Always connect these signal terminals when a position loop is formed in the host controller for position control.

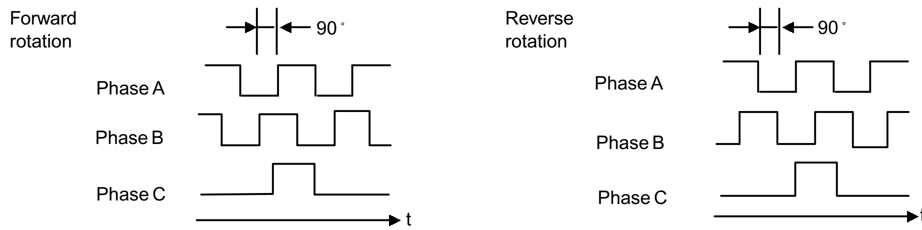
Set a dividing ratio at the following parameter.

PG Dividing Ratio	Pn201

The dividing ratio setting is not related to the gear ratio setting (Pn202 and 203) for the SERVOPACK electronic gear function during position control.

4

Output Phase Form



→ Input SEN CN1-4	SEN Signal Input	Speed/Torque Control
→ Input SG CN1-2	Signal Ground	Speed/Torque Control
Output → PSO CN1-48	Encoder Output Phase S	Speed/Torque Control, Position Control
Output → /PSO CN1-49	Encoder Output Phase /S	Speed/Torque Control, Position Control
→ Input BAT (+) CN1-21	Battery (+)	Speed/Torque Control, Position Control
→ Input BAT (-) CN1-22	Battery (-)	Speed/Torque Control, Position Control

Use SEN to BAT (-) signals for absolute encoders. See *4.7 Absolute Encoders* for more details.

Output → SG CN1-1	Signal Ground	Speed/Torque Control, Position Control

SG: Connect to 0 V on the host controller.

IMPORTANT

When using the SERVOPACK phase-C pulse signal to return to the machine origin, always turn the servomotor at least twice before starting the zero point return operation.

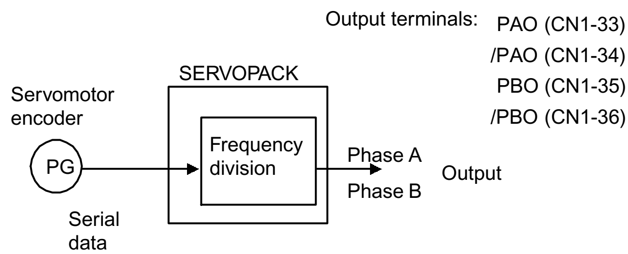
If the configuration of the mechanical system prevents turning the servomotor before the zero point return operation, then perform the zero point return operation at a servomotor speed of 600 min^{-1} or below.The phase-C pulse signal may not be correctly output if the servomotor is turned faster than 600 min^{-1}.

■ Pulse Divider Setting

Set the pulse dividing ratio in the following parameter.

Pn201	PG Divider	Unit: P/R	Setting Range: 16 to 16384	Factory Setting: 16384	Speed/Torque Control, Position Control

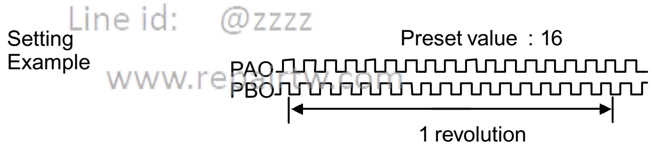
This parameter sets the number of output pulses for PG output signals (PAO, /PAO, PBO, /PBO) sent externally.



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

The set value is the number of output pulses per revolution. Set this value according to the reference unit of the machine or controller to be used.

The setting range varies according to the encoder used.



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

INFO

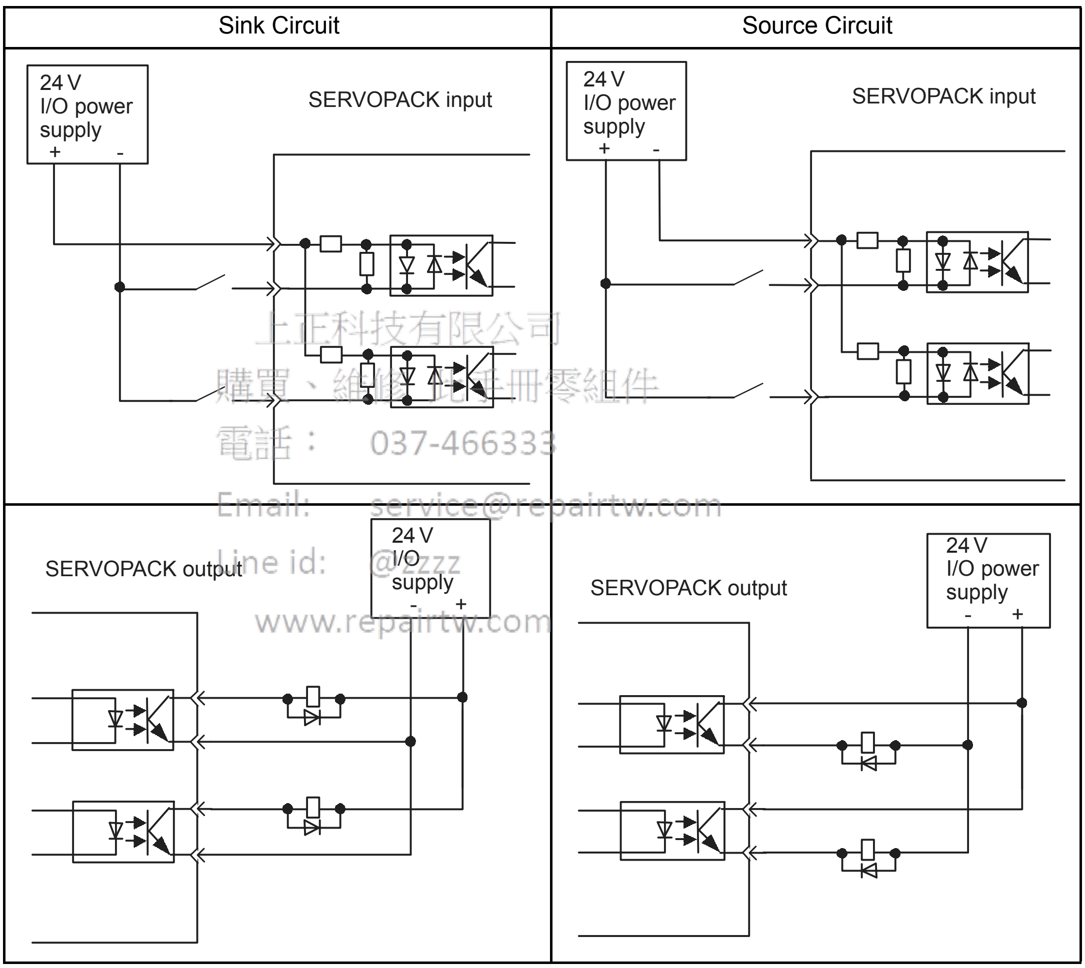
1. Turn OFF power once and turn ON again after changing the parameter.
2. A 13-bit encoder will run at 2048 P/R even if the setting at Pn201 is set higher than 2049.

4.2.4 Sequence I/O Signals

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

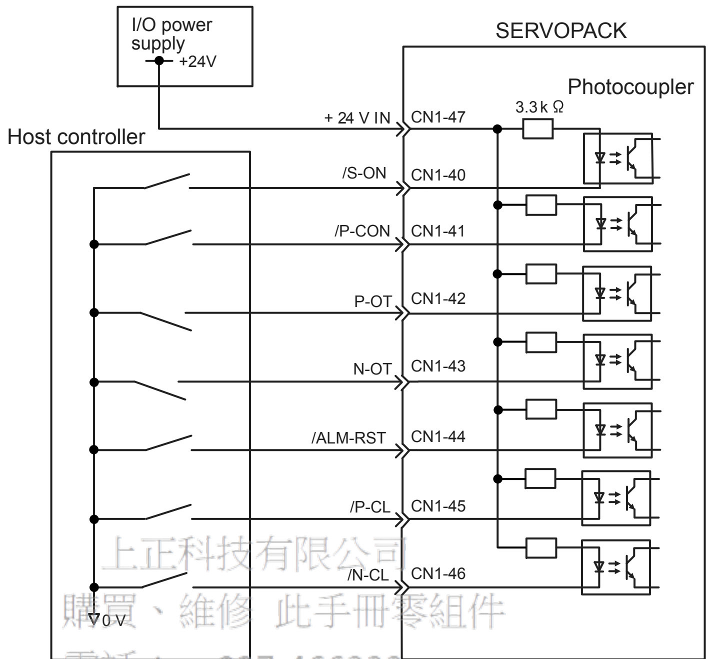
■ Sink Circuit and Source Circuit

The SERVOPACK's I/O circuit uses a bidirectional photocoupler. Select either the sink circuit or the source circuit according to the specifications required for each machine.



■ Input Signal Connections

Connect the sequence input signals as shown below.



IMPORTANT

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

- External power supply specifications: 24±1 VDC, 50 mA min.

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

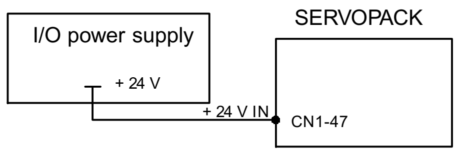
The function allocation for sequence input signal circuits can be changed.

See *4.3.3 Input Circuit Signal Allocation* for more details.

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

4

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

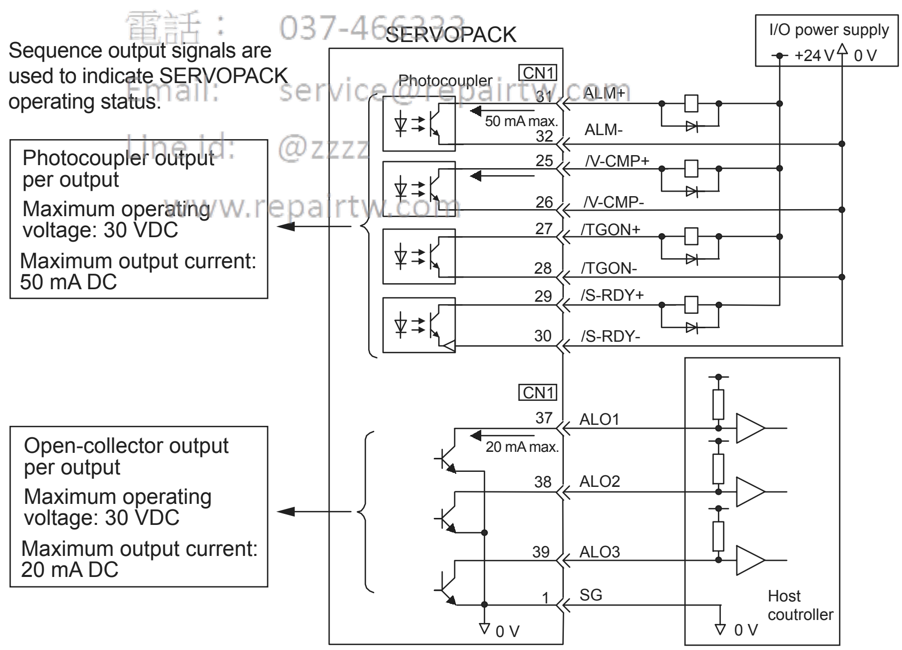


Connect a 24-V external I/O power supply.

Contact input signals:
/S-ON (CN1-40)
/P-CON (CN1-41)
P-OT (CN1-42)
N-OT (CN1-43)
/ALM-RST (CN1-44)
/P-CL (CN1-45)
/N-CL (CN1-46)

■ Output Signal Connections

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



IMPORTANT

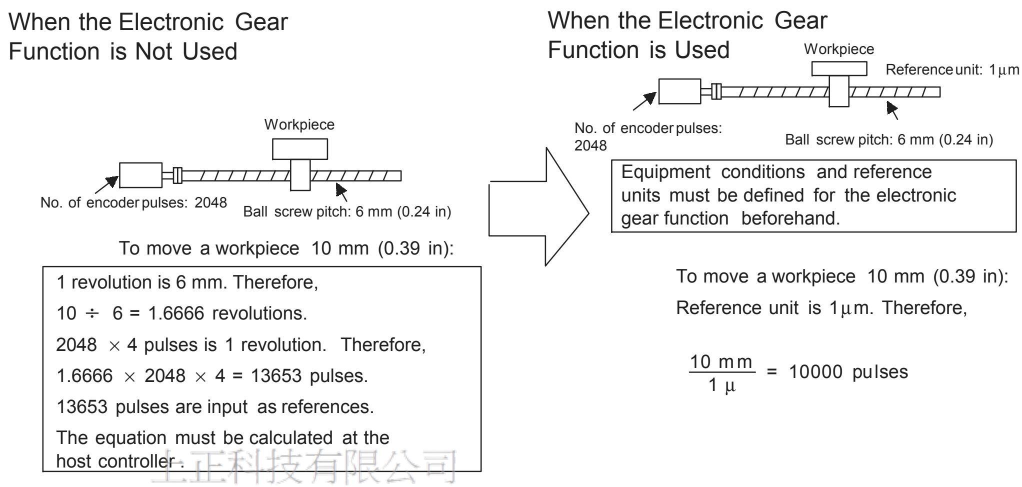
Provide an external input power supply; the SERVOPACK does not have an internal 24-V power supply. Yaskawa recommends using the same type of external power supply as that used for input circuits.

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

See *4.3.4 Output Circuit Signal Allocation* for more details.

4.2.5 Using the Electronic Gear Function

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

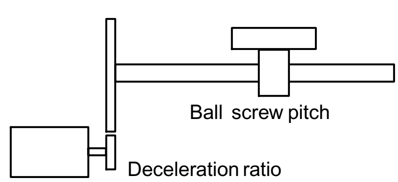


■ Setting the Electronic Gear

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

1. Check equipment specifications.

   Items related to the electronic gear:
   - Deceleration ratio
   - Ball screw pitch
   - Pulley diameter



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

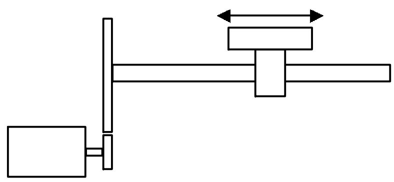
Servomotor Model and Encoder Specifications	Encoder Type	Number of Encoder Pulses Per Revolution (P/R)	
C	Incremental encoder	17-bit	32768
2	Absolute encoder	17-bit	32768
3	Absolute encoder (option)	20-bit	262144

INFO

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

3. Determine the reference unit used.

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



Determine the reference unit according to equipment specifications and positioning accuracy.

◀ EXAMPLE ▶

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

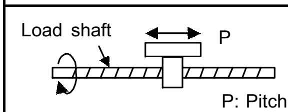
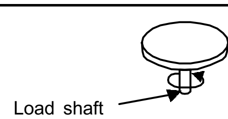
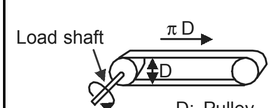
4. Determine the load travel distance per load shaft revolution in reference units.

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

◀ EXAMPLE ▶

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

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

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

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

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

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

IMPORTANT

Make sure the electronic gear ratio satisfies the following condition:

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

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

6. Set the parameters.

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

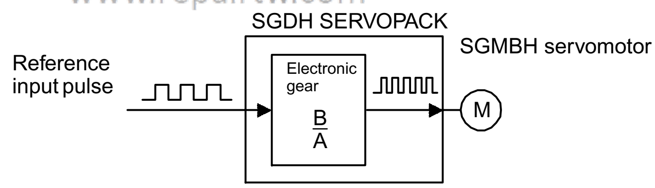
$\left(\frac{B}{A}\right)$

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

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

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

Set the electronic gear ratio according to equipment specifications.



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

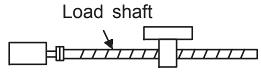
- B = [(Number of encoder pulses) × 4] × [motor speed]
- A = [Reference units (travel distance per load shaft revolution)] × [load shaft revolution speed]

■ Electronic Gear Setting Examples

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

Ball Screw

Reference unit: 0.001 mm (0.00004 in)



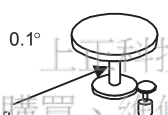
$$\text{Travel distance per load shaft revolution} = \frac{6\ \text{mm}}{0.001\ \text{mm}} = 6000$$

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

Preset Values	Pn202	8192
	Pn203	6000

Disc Tables

Reference unit: 0.1°



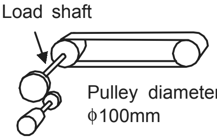
$$\text{Travel distance per load shaft revolution} = \frac{360°}{0.1°} = 3600$$

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

Preset Values	Pn202	24576
	Pn203	3600

Belts and Pulleys

Reference unit: 0.02 mm (0.0008 in)



Set a PG dividing ratio equivalent to 16 bit for the absolute encoder.

$$\text{Travel distance per load shaft revolution} = \frac{3.14 \times 100\ \text{mm}}{0.02\ \text{mm}} = 15700$$

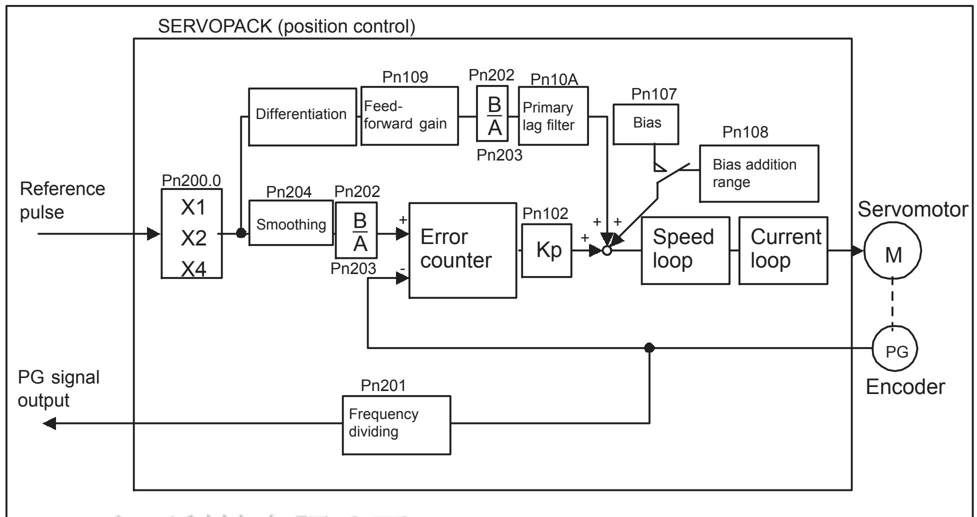
$$\text{Electronic gear ratio } \left(\frac{B}{A}\right) = \frac{16384 \times 4 \times 2}{15700 \times 1} = \frac{\text{Pn202}}{\text{Pn203}}$$

$$= \frac{131072}{15700} = \frac{32768}{3925}$$

Preset Values	Pn202	32768
	Pn203	3925

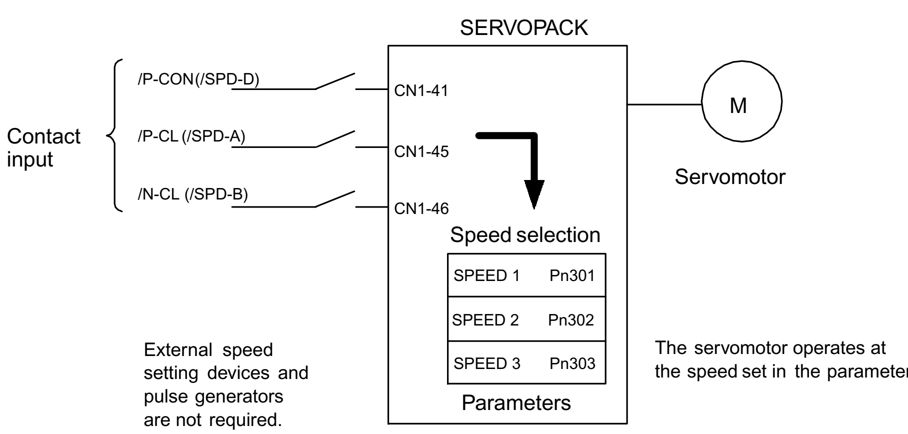
■ Control Block Diagram

The following diagram illustrates a control block for position control.



4.2.6 Contact Input Speed Control

The contact input speed control function provides easy-to-use speed control. It allows the user to initially set three different motor speeds with parameters, select one of the speeds externally by contact input, and operate the servomotor.



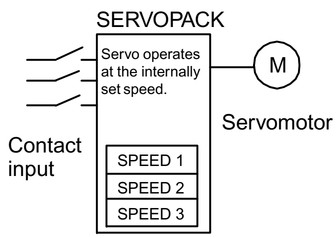
■ Using Contact Input Speed Control

Follow steps 1 to 3 below to use the contact input speed control function.

1. Set contact input speed control as shown below.

Pn000.1	Control Mode Selection	Factory Setting: 0	Speed/Torque Control, Position Control

The speed can be controlled via contact inputs.



Meanings for the following signals change when the contact input speed control function is used.

Pn000.1 Setting	Description	Input Signal			
0, 1, 2, 7, 8, 9, A, B	Contact input speed control function not used.	/P-CON (CN1-41)		Used to switch between P and PI control.	
		/P-CL (CN1-45)		Used to switch between forward external torque limit ON and OFF.	
		/N-CL (CN1-46)		Used to switch between reverse external torque limit ON and OFF.	
3, 4, 5, 6	Contact input speed control function used.	/P-CON (/SPD-D)	/P-CL (/SPD-A)	/N-CL (/SPD-B)	Speed Setting
		Direction of rotation 0: Forward 1: Reverse	0	0	0 reference, etc.
			0	1	SPEED1 (Pn301)
			1	1	SPEED2 (Pn302)
			1	0	SPEED3 (Pn303)

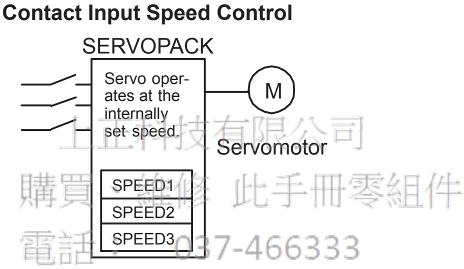
Note: 1. 0: OFF (high level); 1: ON (low level)
2. /P-CON, /P-CL and /N-CL functions change as shown in the table above when Pn000.1 is set to 3, 4, 5, or 6. The function is switched automatically when Pn50A. 0 is set to 0.
3. The /SPD-D, /SPD-A, and /SPD-B signals can be used only when signals are allocated to the input circuits. See *4.3.3 Input Circuit Signal Allocation*.

2. Set the motor speeds with the following parameters.

Pn301	Speed 1 (SPEED 1) (Contact Input Speed Control)	Unit: min^{-1}	Setting Range: 0 to 10000	Factory Setting: 100	Speed Control
Pn302	Speed 2 (SPEED 2) (Contact Input Speed Control)	Unit: min^{-1}	Setting Range: 0 to 10000	Factory Setting: 200	Speed Control
Pn303	Speed 3 (SPEED 3) (Contact Input Speed Control)	Unit: min^{-1}	Setting Range: 0 to 10000	Factory Setting: 300	Speed Control

These parameters are used to set motor speeds when the contact input speed control function is selected. If the setting is higher than the maximum motor speed of the servomotor, then the servomotor will rotate at its maximum speed.

Contact Input Speed Control

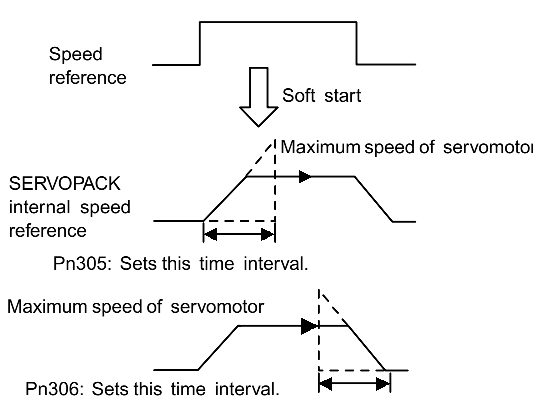


Speed selection input signals /P-CL (SPD-A) (CN1-45) and /N-CL (/SPD-B) (CN1-46) and the rotation direction selection signal /P-CON (/SPD-D) (CN1-41) enable the servomotor to run at the preset speeds.

3. Set the soft start time.

Pn305	Soft Start Acceleration Time	Unit: ms	Setting Range: 0 to 10000	Factory Setting: 0	Speed Control
Pn306	Soft Start Deceleration Time	Unit: ms	Setting Range: 0 to 10000	Factory Setting: 0	Speed Control

The SERVOPACK internal speed reference controls speed by applying this acceleration setting.



Smooth speed control can be performed by inputting a progressive speed reference or using contact input speed control. Set each constant to 0 for normal speed control.

Set these parameters as follows:

- Pn305: The time interval from the time the motor starts until the motor maximum speed is reached.
- Pn306: The time interval from the time the motor is operating at the motor maximum speed until it stops.

■ Operation by Contact Input Speed Control

The following describes operation by contact input speed control.

Start and Stop

The following input signals are used to start and stop the servomotor.

→ Input /P-CL CN1-45	Speed Selection 1 (Forward External Torque Limit Input)	Speed/Torque Control, Position Control
→ Input /N-CL CN1-46	Speed Selection 2 (Reverse External Torque Limit Input)	Speed/Torque Control, Position Control

- Use the following table when contact input speed control is used.

Contact Signal			Parameter	Selected Speed
/P-CON (/SPD-D)	/P-CL (/SPD-A)	/N-CL (/SPD-B)	Pn000.1	
-	0	0	3	Stopped by an internal speed reference of 0.
			4	Analog speed reference (V-REF) input
			5	Pulse reference input (position control)
			6	Analog torque reference input (torque control)
Direction of rotation 0: Forward 1: Reverse	0	1	3, 4, 5, 6 Common	SPEED 1 (Pn301)
	1	1		SPEED 2 (Pn302)
	1	0		SPEED 3 (Pn303)

Note: 1. 0: OFF (high level); 1: ON (low level)
2. Input signals indicated by the horizontal bar (-) are optional.

- When contact input speed control is not used, input signals are used as external torque limit inputs.

INFO

The contact input speed control function is used only when signals are allocated to /SPD-D, /SPD-A, and /SPD-B.

Direction of Rotation Selection

The input signal /P-CON (/SPD-D) is used to specify the direction of servomotor rotation.

→ Input P-CON CN1-41	Proportional Control Reference, etc.	Speed/Torque Control, Position Control

- When contact input speed control is used, the input signal /P-CON (/SPD-D) specifies the direction of servomotor rotation.

/P-CON (/SPD-D)	Meaning
0	Forward rotation
1	Reverse rotation

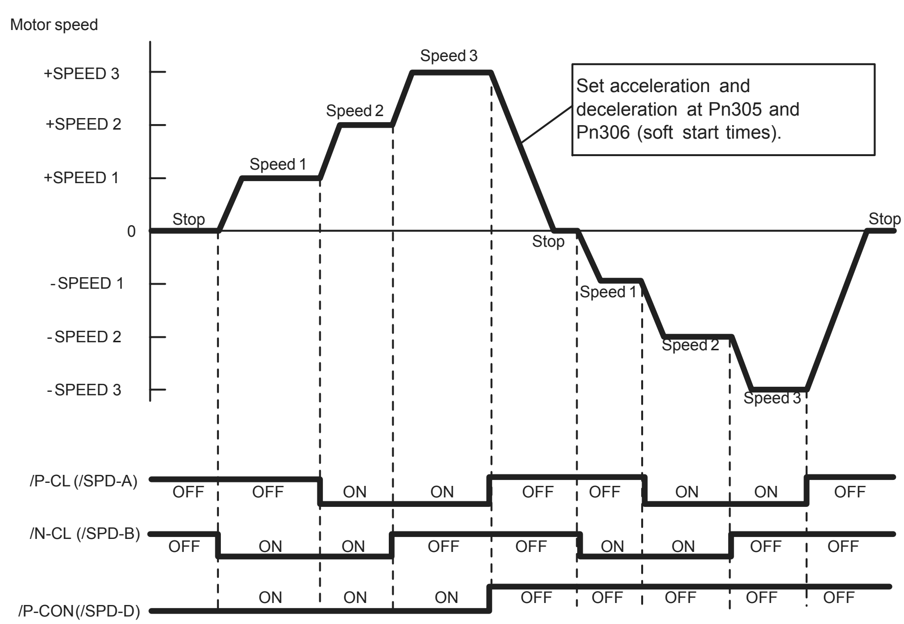
Note: 0: OFF (high level); 1: ON (low level)

When contact input speed control is not used, the /P-CON signal is used for proportional control, zero clamping, and torque/speed control switching.

■ Example of Contact Input Speed Control Operation

The following example shows operation by contact input speed control. Using the soft start function reduces physical shock when the speed is changed.

Contact Input Speed Control

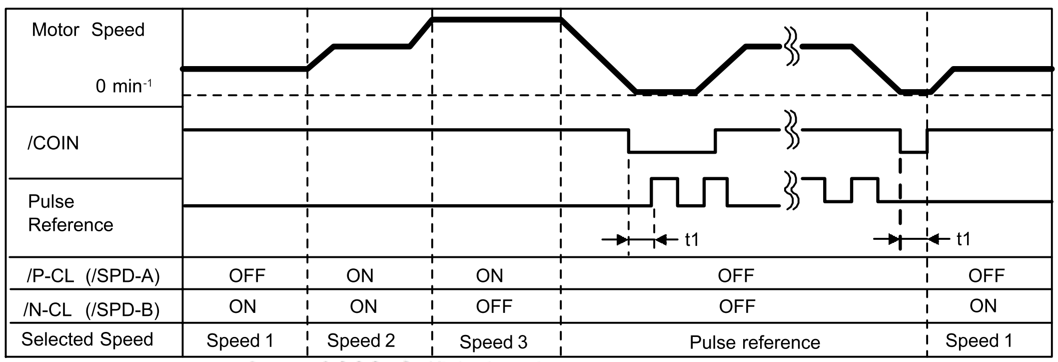


4

IMPORTANT

The soft start function is available only when contact input speed control is used with Pn000.1 set to 5, and is not available when a pulse reference input is used. If Contact Input Speed Control Mode is switched to Pulse Reference Input Mode while the servomotor is operating at speed 1, speed 2, or speed 3, the SERVOPACK will not receive a reference pulse until the positioning completed signal /COIN is output. Always start pulse reference output from the host controller after a positioning completed signal is output from the SERVOPACK.

Signal Generation Timing for Position Control



t1 > 2 ms

Note: 1. The above figure illustrates signal generation timing when the soft start function is used.

2. The value of t1 is not affected by the use of the soft start function. A maximum 2-ms delay occurs when the /P-CL (/SPD-A) or /N-CL (/SPD-B) signal is read.

4.2.7 Using Torque Control

The SGDM and SGDH SERVOPACKs limit torque as shown below.

- Level 1: Limits maximum output torque to protect the equipment or workpiece. (internal torque limit)
- Level 2: Limits torque after the servomotor moves the equipment to a specified position. (external torque limit)
- Level 3: Always limits output torque rather than speed.
- Level 4: Switches between speed and torque limit.

The following describes uses for levels 3 and 4 in the torque control function.

■ Torque Control Selection

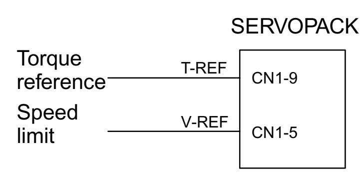
Set in the following parameters to select level 3 or 4 torque control.

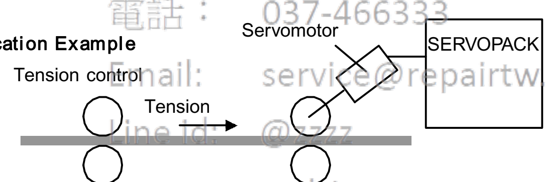
Pn000.1	Control Mode Selection	Factory Setting: 0	Speed/Torque Control, Position Control

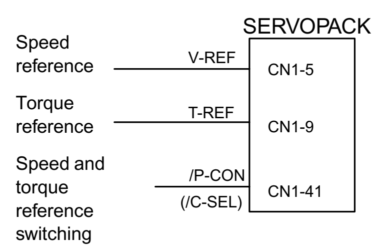
A torque reference is input from the host controller to the SERVOPACK in order to control torque.

Application Examples

- Tension control
- Pressure control

<table>
<tr><th>Pn000.1</th><th>Control Mode</th></tr>
<tr><td>2</td><td>
Torque Control
This is a dedicated Torque Control Mode.
• A torque reference is input from T-REF (CN1-9).
• Speed reference input V-REF (CN1-5) can be used for speed control if Pn002.1 is set to 1.
• Parameter Pn407 can be used for maximum speed control.


Application Example


</td></tr>
<tr><td>9</td><td>
Torque Control ↔ Speed Control (Analog Reference)
Switches between torque and speed control.
• V-REF (CN1-5) inputs a speed reference or speed limit.
• T-REF (CN1-9) inputs a torque reference, torque feed-forward reference or torque limit depending on the control mode.
• /P-CON (/C-SEL) (CN1-41) is used to switch between torque and speed control.


<table>
<tr><td>CN1-41 is open.</td><td>Torque control</td></tr>
<tr><td>CN1-41 is 0 V.</td><td>Speed control</td></tr>
</table>
Torque Control: When /P-CON (/C-SEL) is OFF
• The T-REF reference controls toque.
• V-REF can be used to limit servomotor speed when Pn002.1 is set to 1. V-REF voltage (+) limit servomotor speed during forward and reverse rotation.
• Parameter Pn407 can be used to limit the maximum servomotor speed.
</td></tr>
</table>

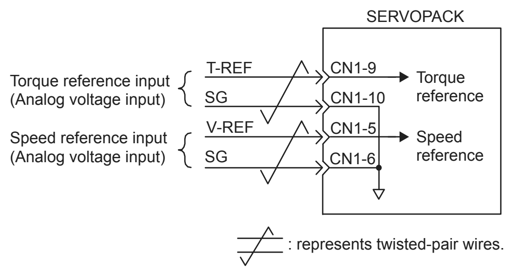
<table>
<tr><th>Pn000.1</th><th>Control Method</th></tr>
<tr><td>9</td><td>
Speed Control: When /P-CON (/C-SEL) is ON
Set the parameter Pn002.0 as shown below.
<table>
<tr><th>Parameter Pn002.0</th><th>Torque Reference Input (T-REF) (CN1-9,10)</th><th>Contents</th><th>Remarks</th></tr>
<tr><td>0</td><td>-</td><td>Normal speed control</td><td></td></tr>
<tr><td>1</td><td>Torque limit input</td><td>Torque limit speed control by analog voltage reference</td><td>See 4.2.10 Torque Limiting by Analog Voltage Reference, Function 1 for more details on torque limit speed control by analog voltage reference.</td></tr>
<tr><td>2</td><td>Torque feed-forward input</td><td>Speed control with torque feed-forward</td><td>See 4.2.8 Torque Feed-forward Function for more details on torque feed-forward speed control.</td></tr>
</table>
</td></tr>
<tr><td>8</td><td>
Position Control ↔ Torque Control
Can be used to switch between speed (contact reference) and torque control.
• /P-CON (/C-SEL) (CN1-41) is used to switch between position and torque control.
<table>
<tr><td>CN1-41 is open.</td><td>Position control</td></tr>
<tr><td>CN1-41 is 0 V.</td><td>Torque control</td></tr>
</table>
Position Control: When /P-CON (/C-SEL) is OFF
Set the parameter Pn002.0 as shown below.
<table>
<tr><th>Parameter Pn002.0</th><th>Torque Reference Input (T-REF) (CN1-9,10)</th><th>Contents</th><th>Remarks</th></tr>
<tr><td>0</td><td>-</td><td>Normal position control</td><td></td></tr>
<tr><td>1</td><td>Torque limit input</td><td>Torque limit position control by analog voltage reference</td><td>See 4.2.10 Torque Limiting by Analog Voltage Reference, Function 1 for more details on torque limit position control by analog voltage reference.</td></tr>
<tr><td>2</td><td>Torque feed-forward input</td><td>Position control with torque feed-forward</td><td>See 4.2.8 Torque Feed-forward Function for more details on torque feed-forward position control.</td></tr>
</table>
</td></tr>
<tr><td>6</td><td>
Speed Control (Contact Reference) ↔ Torque Control
Can be used to switch between speed (contact reference) and torque control.
• /P-CL (/SPD-A) (CN1-45) and /N-CL (SPD-B) (CN1-46) are used to switch control.
<table>
<tr><th>/P-CL (/SPD-A) CN1-45</th><th>/N-CL (/SPD-B) CN1-46</th><th></th></tr>
<tr><td>0</td><td>0</td><td>Torque control</td></tr>
<tr><td>0</td><td>1</td><td rowspan="3">Speed control (Contact reference)</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td></tr>
</table>
0: OFF
1: ON
</td></tr>
</table>

Note: Input signal /C–SEL can be used only when a signal is allocated to the input circuit. See *4.3.3 Input Circuit Signal Allocation*.

■ Input Signals

Torque Reference Inputs

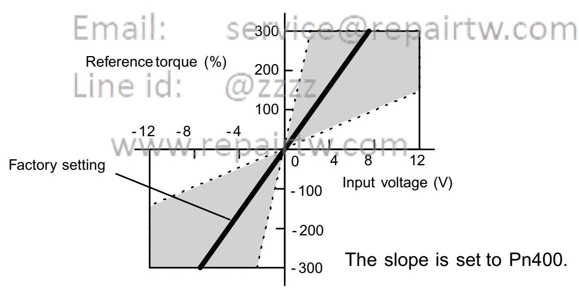
The following input signals are used for torque control.



→ Input T-REF CN1-9	Torque Reference Input	Speed/Torque Control
→ Input SG CN1-10	Signal Ground for the Torque Reference Input	Speed/Torque Control

These signals are used when torque control is selected.

Servomotor torque is controlled so that it is proportional to the input voltage between T-REF and SG.



- Factory Settings

  Pn400 = 30: This setting means that 3 V is equivalent to the rated torque.

◀ EXAMPLE ▶

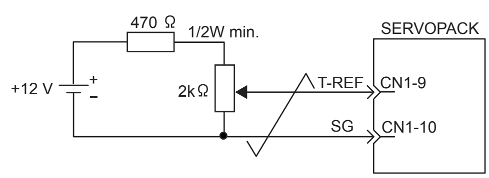
  +3 V input: Rated torque in the forward direction

  +9 V input: 300% of rated torque in the forward direction

  -0.3 V input: 10% of rated torque in the reverse direction

  Parameter Pn400 can be used to change the voltage input range.

- Example of an Input Circuit



Always use twisted-pair cable for noise control.

Recommended variable resistor: Model 25HP-10B manufactured by Sakae Tsushin Kogyo Co., Ltd.

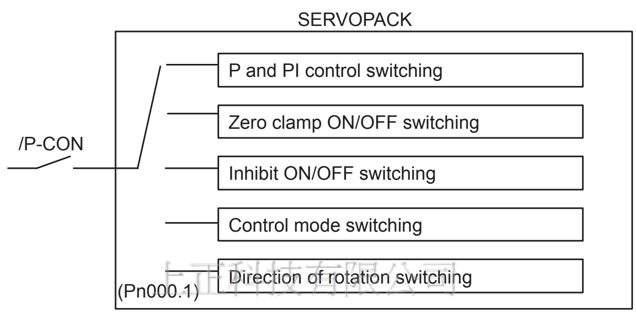
Speed Reference Inputs

Refer to *4.2.1 Speed Reference*.

Using the /P-CON Signal

→ Input /P-CON CN1-41	Proportional Control, etc.	Speed/Torque Control, Position Control

The function of the input signal /P-CON varies with the setting at Pn000.1.



Pn000.1 Setting	/P-CON Function
0, 1	Switches between P (proportional) and PI (proportional-integral) control.
2	Not used.
3, 4, 5, 6	Switches the direction of rotation in Contact Input Speed Control Mode.
7, 8, 9	Switches the control mode.
A	Turns ON/OFF zero clamp.
B	Turns inhibit ON/OFF.

INFO

The /P-CON signal function switches automatically when Pn50A.0 is set to 0.

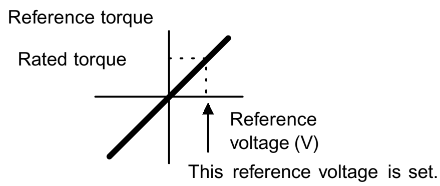
■ Parameters

The following parameter is used for torque control. Set the parameter according to the servo system used.

Pn400	Torque Reference Input Gain	Unit: 0.1 V/rated torque	Setting Range: 10 to 100	Factory Setting: 30	Speed/Torque Control

The parameter sets the voltage range for torque reference input T-REF (CN1-9). Set the range according to host computer and the output state of external circuit.

The factory setting is 30, so the rated torque output is 3 V (30 × 0.1).



Two speed limit functions during torque control are available by the parameter setting as shown below.

Pn200.1 Setting	Description
0	Uses speed limit set by Pn407. (internal speed limit function)
1	Uses V-REF (CN1-5 and 6) as external speed limit input and sets speed limit by voltage which input to V-REF and Pn300. (external speed limit function)

Internal Speed Limit Function

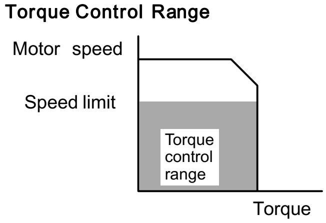
Pn407	Speed Limit during Torque Control	Unit: min^{-1}	Setting Range: 0 to 10000	Factory Setting: 10000	Speed/Torque Control

The parameter sets a motor speed limit when torque control is selected.

It is used to prevent excessive equipment speed during torque control.

Since the speed limit detection signal /VLT functions the same in torque control as the /CLT signal, see *4.1.3 Limiting Torques*, where the /CLT signal is described.

Torque Control Range



The maximum speed of the servomotor will be used if Pn407 is set to a value higher than the maximum speed of the servomotor.

External Speed Limit Function

This function uses V-REF (CN1-5) as external speed limit input and sets input voltage range by Pn300. Set the range according to host computer and the output state of external circuit.

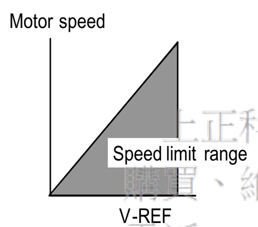
Pn300	Speed Reference Input Gain	Unit: 0.01V/rated speed	Setting Range: 150 to 3000	Factory Setting: 600	Speed/Torque Control

The factory setting is ±1% of the rated motor speed or 6 V.

INFO

■ Principle of Speed Control

Torque reversely proportional to the difference between the speed limit and the speed is fed back to return the system to within the control speed range when the control speed range is exceeded. The actual motor speed limit will thus be increased by negative loads.

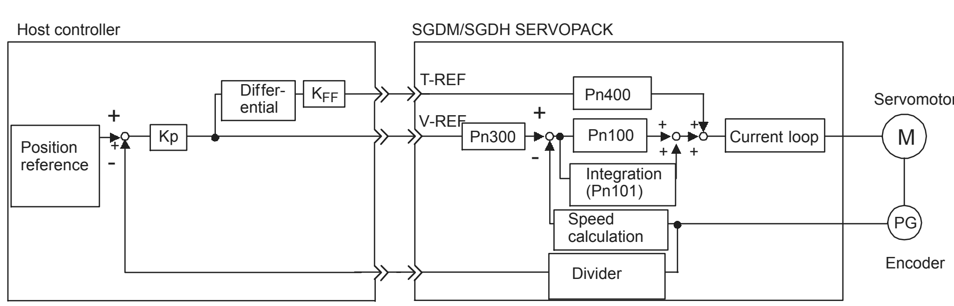


4.2.8 Torque Feed-forward Function

The torque feed-forward function is used only in control mode except for torque control.

This function shortens positioning time, differentiates a speed reference at the host controller to generate a torque feed-forward reference, and inputs this reference together with the speed reference to the SERVOPACK. Too high a torque feed-forward value will result in overshooting or undershooting. To prevent this, set the optimum value while observing system response.

Connect a speed reference signal line to V-REF (CN1-5 and 6) and a torque feed-forward reference signal line to T-REF (CN1-9 and 10).



Kp: Position loop gain
K_{FF}: Feed-forward gain

■ Using the Torque Feed-forward Function

To use the torque feed-forward function, set the following parameter to 2.

Pn002.0	Speed Control Option (T-REF Terminal Allocation)	Factory Setting: 0	Speed Control, Position Control

This setting enables the torque feed-forward function.

Pn002.0 Setting	Description
0	None.
1	T-REF terminal used for external torque limit input.
2	T-REF terminal used for torque feed-forward input.

The torque feed-forward function cannot be used with torque limiting by analog voltage reference described in *4.2.10 Torque Limiting by Analog Voltage Reference, Function 1*.

■ Setting

Torque feed-forward is set using parameter Pn400.

The factory setting at Pn400 is 30. If, for example, the torque feed-forward value is ±3 V, then torque is limited to ±100% of the rated torque.

Pn400	Torque Reference Input Gain	Unit: 0.1 V/rated torque	Setting Range: 10 to 100	Factory Setting: 30	Speed/Torque Control, Position Control

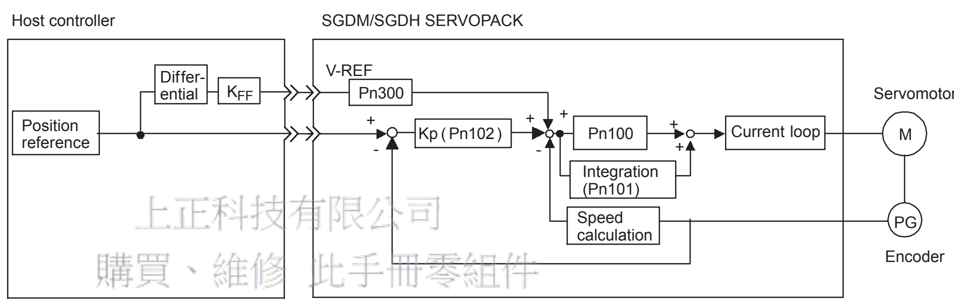
4.2.9 Speed Feed-forward Function

The speed feed-forward function uses analog voltages and is effective only for position control.

The feed-forward function can be used to shorten positioning time. The host controller creates a feed-forward reference based on the differential of the position reference.

Overshooting and undershooting can result if too much feed-forward is used. Set the optimum settings based on the actual response.

The position reference from the host controller is connected to PULS and SIGN (CN1-7, 8, 11, and 12) and the speed feed-forward reference is connected to V-REF (CN1-5 and 6).



Kp: Position loop gain
K_{FF}: Feed-forward gain

■ Using the Speed Feed-forward Function

Set the following parameter to 1 to use the analog voltage speed feed-forward function.

Pn207.1	Position Control Option	Factory Setting: 0	Position Control

This setting will enable the speed feed-forward function.

Pn207.1 Setting	Description
0	No feed-forward function
1	V-REF terminal used for a speed feed-forward input.

■ Setting

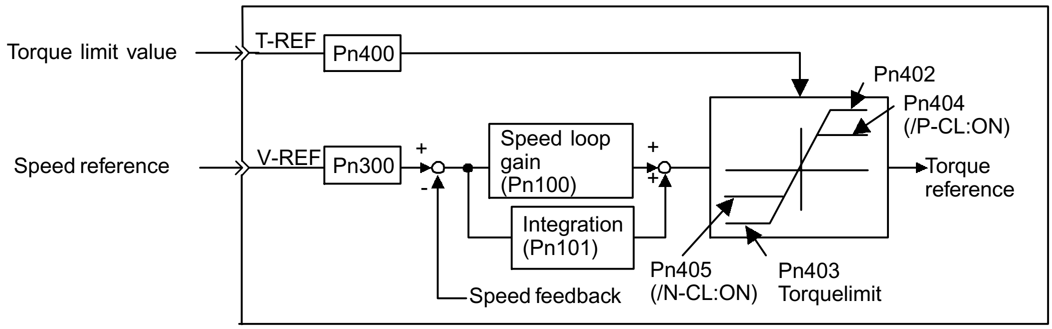
The speed feed-forward value is set in parameter Pn300.

The factory setting of Pn300 is 600, for which a speed feed-forward value of ±6 V will produce the rated speed.

Pn300	Speed Reference Input Gain	Unit: 0.01V/ rated speed	Setting Range: 150 to 3000	Factory Setting: 600	Speed/Torque Control, Position Control

4.2.10 Torque Limiting by Analog Voltage Reference, Function 1

Torque limiting by analog voltage reference limits torque by assigning a torque limit in an analog voltage to the T-REF terminal (CN1-9 and 10). It cannot be used for torque control because the torque reference input terminal T-REF is used as an input terminal.



■ Using Torque Limiting by Analog Voltage Reference

To use this function, set the following parameter to 1.

Pn002.0	Speed Control Option (T-REF Terminal Allocation)	Factory Setting: 0	Speed Control, Position Control

This parameter can be used to enable torque limiting by analog voltage reference.

Torque limiting cannot be set separately for forward and reverse rotation.

Pn002.0 Setting	Description
0	None.
1	T-REF terminal used for external torque limit input.
2	T-REF terminal used for torque feed-forward input.

This function cannot be used with the torque feed-forward function described in *4.2.8 Torque Feed-forward Function*.

■ Setting

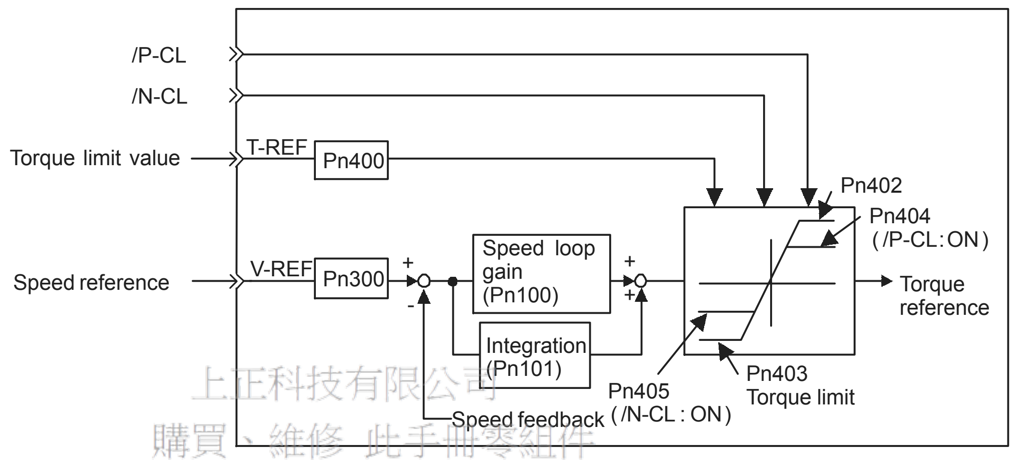
The torque limit input gain is set at parameter Pn400.

The factory setting at Pn400 is 30. If, for example, the torque limit is ±3 V, then torque is limited to 100% of the rated torque. (A torque value higher than 100% torque is clamped at 100%.)

Pn400	Torque Reference Input Gain	Unit: 0.1 V/rated torque	Setting Range: 10 to 100	Factory Setting: 30	Speed/Torque Control, Position Control

4.2.11 Torque Limiting by Analog Voltage Reference, Function 2

Torque limiting by analog voltage reference limits torque by assigning a torque limit in an analog voltage to the T-REF terminal (CN1-9 and 10). It cannot be used for torque control because the torque reference input terminal T-REF is used as an input terminal. If the /P-CL signal (CN1-45) is ON, a forward torque limit is applied, and if the /N-CL signal (CN1-46) is ON, a reverse torque limit is applied.



■ Using Torque Limiting by Analog Voltage Reference

To use this function, set the following parameter to 3.

Pn002.0	Speed Control Option (T-REF Terminal Allocation)	Factory Setting: 0	Speed/Position Control

This setting will enable torque limiting by analog voltage reference, function 2.

Pn002.0 Setting	Description
0	None
1	T-REF terminal used for external torque limit input.
2	T-REF terminal used for torque feed-forward input.
3	T-REF terminal used for external torque limiting input when P-CL or N-CL is ON.

This torque limiting function cannot be used at the same time as the torque feed-forward function.

Confirm the allocation of input signals when using this function. (Refer to *4.3.3 Input Circuit Signal Allocation*.) Factory settings are given in the following table.

/P-CL	CN1-45 at low level when ON	Forward torque limit applied.	Limit: Pn404 or T-REF input, whichever is smaller.
	CN1-45 at high level when OFF	Forward torque limit not applied. Normal operation.	-
/N-CL	CN1-46 at low level when ON	Reverse torque limit applied.	Limit: Pn405 or T-REF input, whichever is smaller.
	CN1-46 at high level when OFF	Reverse torque limit not applied. Normal operation.	-

■ Setting

The torque limit input gain is set at parameter Pn400.

The factory setting at Pn400 is 30. If, for example, the torque limit is ±3 V, then torque is limited to 100% of the rated torque. (A torque value higher than 100% torque is clamped at 100%. A 100% torque will also be used as the limit if the input torque limit value is -3 V.)

Pn400	Torque Reference Input Gain	Unit: 0.1 V/rated torque	Setting Range: 10 to 100	Factory Setting: 30	Speed/Torque Control, Position Control

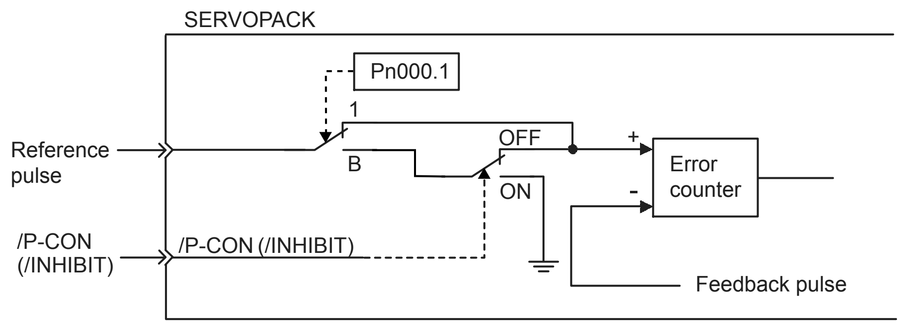
The settings of the following parameters are also valid. The torque limit will be either the torque limit value for the analog voltage reference or the setting of Pn404/Pn405, whichever is smaller.

Pn404	Forward External Torque Limit	Unit: %	Setting Range: 0 to 800	Factory Setting: 100	Speed/Torque Control, Position Control
Pn405	Reverse External Torque Limit	Unit: %	Setting Range: 0 to 800	Factory Setting: 100	Speed/Torque Control, Position Control

4.2.12 Reference Pulse Inhibit Function (INHIBIT)

This function inhibits the SERVOPACK from counting input reference pulses during position control.

The servomotor remains locked (clamped) while the function is in use. The /P-CON (/INHIBIT) signal is used to enable or disable the function.



■ Using Reference Pulse Inhibit Function (INHIBIT)

To use the inhibit function, set the parameter as shown below.

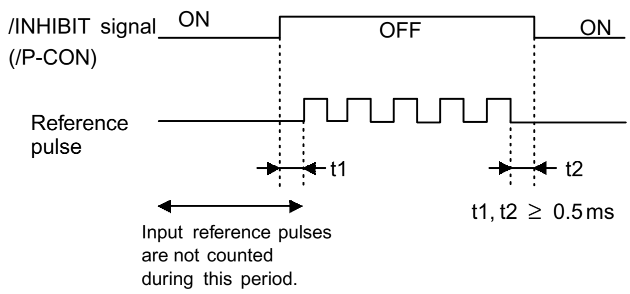
Pn000.1	Control Method Selection	Factory Setting: 0	Position Control

The following settings enable the inhibit function.

<table>
<tr><th>Pn000.1 Setting</th><th colspan="2">Description</th></tr>
<tr><td>1</td><td colspan="2">Disables the inhibit function.
Always counts reference pulses.</td></tr>
<tr><td rowspan="4">B</td><td colspan="2">Enables the inhibit function. The /P-CON (/INHIBIT) signal is used to enable or disable the inhibit function.</td></tr>
<tr><td>/P-CON (/INHIBIT)</td><td>Description</td></tr>
<tr><td>OFF</td><td>Counts reference pulses.</td></tr>
<tr><td>ON</td><td>Prohibits the SERVOPACK from counting reference pulses.
The servomotor remains locked.</td></tr>
</table>

Note: Parentheses () around an /INHIBIT signal indicate that a signal has been allocated to the input circuit. See *4.3.3 Input Circuit Signal Allocation*.

■ Relationship between Inhibit Signal and Reference Pulses



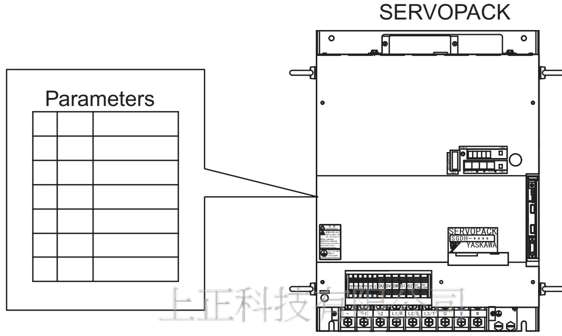
4

4.3 Setting Up the SERVOPACK

This section describes the procedure for setting parameters to operate the SGDM/SGDH SERVOPACKs.

4.3.1 Parameters

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



Parameters are divided into the following three groups.

Parameter	Function
Pn000 to Pn601	Specify SERVOPACK functions, set servo gains, etc.
Fn000 to Fn013	Execute auxiliary functions such as JOG Mode operations and zero point searches.
Un000 to Un00D	Enable monitoring the motor speed and torque reference on the panel display.

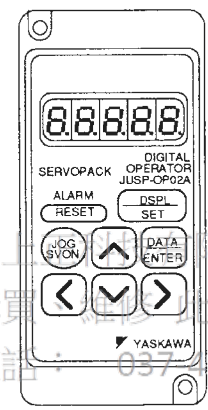
Appendix A List of Parameters shows a list of parameters provided for reference. Connect these signal terminals as required. See *6.1.6 Operation in Parameter Setting Mode* for more details on the procedure for setting parameters.

4.3.2 JOG Speed

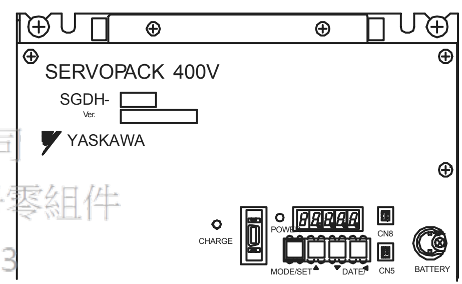
Use the following parameter to set or modify motor speed when operating the servomotor from a Panel or Digital Operator.

Pn304	Jog Speed	Unit: min^{-1}	Setting Range: 0 to 10000	Factory Setting: 500	Speed/Torqque Control, Position Control

Use this parameter to set the motor speed when operating the SERVOPACK from a Panel or Digital Operator. If the setting is higher than the maximum motor speed of the servomotor, then the servomotor will rotate at its maximum speed.



Digital Operator



Panel Operator

4.3.3 Input Circuit Signal Allocation

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

CN1 Connector Terminal Numbers	Input Terminal Name	Factory Setting	
		Symbol	Name
40	SI0	/S-ON	Servo ON
41	SI1.	/P-CON	(Proportional control reference) *
42	SI2	P-OT	Forward run prohibited
43	SI3	N-OT	Reverse run prohibited
44	SI4	/ALM-RST	Alarm reset
45	SI5	/P-CL	(Forward current limit) *
46	SI6	/N-CL	(Reverse current limit) *

* The functions of these input signals are automatically switched according to the setting at parameter Pn000.1 as long as Pn50A.0 is set to 0.

The following parameter is used to enable input signal allocation.

Pn50A.0	Input Signal Allocation Mode	Factory Setting: 0	Speed/Torque Control, Position Control

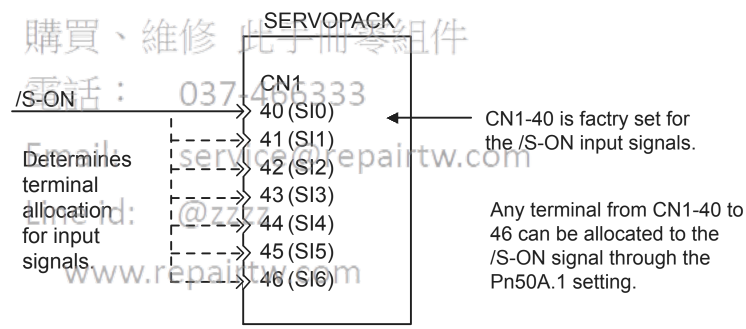
Pn50A.0 Setting	Description
0	Factory setting for sequence input signal allocation. This setting is the same as Yaskawa SGDB-□AD□ SERVOPACKs.
1	Enables any sequence input signal settings.

INFO

In the factory setting, Pn50A.0 is set to 0. Functions in this manual are generally described for the factory settings.

■ Input Signal Allocation

The following signal can be allocated when Pn50A.0 is set to 1.



The following table shows the parameter factory settings for input signal selections 1 to 4.

Pn50A	Input Signal Selections 1	Factory Setting: 2100	Speed/Torque Control, Position Control
Pn50B	Input Signal Selections 2	Factory Setting: 6543	Speed/Torque Control, Position Control
Pn50C	Input Signal Selections 3	Factory Setting: 8888	Speed/Torque Control, Position Control
Pn50D	Input Signal Selections 4	Factory Setting: 8888	Speed/Torque Control, Position Control

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

- Examples of Input Signal Allocation

  The procedure used to allocate sequence input signals is described using the /S-ON signal as a typical example.

Pn50A.1 Setting	Description	Remarks
0	Inputs the /S-ON signal from the SI0 (CN1-40) input terminal.	Signal Polarity: Normal Example: Servo-ON signal (/S-ON) is valid when low (ON).
1	Inputs the /S-ON signal from the SI1 (CN1-41) input terminal.	
2	Inputs the /S-ON signal from the SI2 (CN1-42) input terminal.	
3	Inputs the /S-ON signal from the SI3 (CN1-43) input terminal.	
4	Inputs the /S-ON signal from the SI4 (CN1-44) input terminal.	
5	Inputs the /S-ON signal from the SI5 (CN1-45) input terminal.	
6	Inputs the /S-ON signal from the SI6 (CN1-46) input terminal.	
7	Sets /S-ON signal so that it is always valid.	Set the Servo-ON signal (/S-ON) so that it is always valid or always invalid.
8	Sets /S-ON signal so that it is always invalid.	
9	Inputs the S-ON signal from the SI0 (CN1-40) input terminal.	Signal Polarity: Reversed * Example: Servo-ON signal (/S-ON) is valid when high (OFF).
A	Inputs the S-ON signal from the SI1 (CN1-41) input terminal.	
B	Inputs the S-ON signal from the SI2 (CN1-42) input terminal.	
C	Inputs the S-ON signal from the SI3 (CN1-43) input terminal.	
D	Inputs the S-ON signal from the SI4 (CN1-44) input terminal.	
E	Inputs the S-ON signal from the SI5 (CN1-45) input terminal.	
F	Inputs the S-ON signal from the SI6 (CN1-46) input terminal.	

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

IMPORTANT

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

As shown in the table above, the /S-ON signal can be allocated to any input terminal from SI0 to SI6. /S-ON is always input when Pn50A.1 is set to 7, and an external signal line would therefore not be needed.

The /S-ON signal is not used when Pn50A.1 is set to 8. This setting is meaningful only in the following instances.

- When the factory set input signal are to be replaced by another input signal.
- The signal must be left ON (low level) during normal operation to make the signal valid when OFF (high level) when forward run prohibit (P-OT) and reverse run prohibit (N-OT) are input. The input terminal signal line must be left ON even in system configurations that do not require this signal, but unnecessary wiring can be eliminated by setting Pn50A.1 to 8.

INFO

Signals are input with OR logic when multiple signals are allocated to the same input circuit.

• Allocating Other Input Signals

Input signal allocation can be changed as shown below.

Table 4.1 Allocation of Other Input Signals

Input Signal		Parameter		Description
Name	Applicable Logic	Number	Setting	
Proportional Control Reference (/P-CON)	ON (low level)	Pn50A.2	0	Inputs the signal on the left from the SI0 (CN1-40).
			1	Inputs the signal on the left from the SI1 (CN1-41).
			2	Inputs the signal on the left from the SI2 (CN1-42).
			3	Inputs the signal on the left from the SI3 (CN1-43).
			4	Inputs the signal on the left from the SI4 (CN1-44).
			5	Inputs the signal on the left from the SI5 (CN1-45).
			6	Inputs the signal on the left from the SI6 (CN1-46).
			7	Sets the signal on the left to always enabled.
			8	Sets the signal on the left to always disabled.
			9	Inputs the reverse of the signal on the left from the SI0 (CN1-40).
			A	Inputs the reverse of the signal on the left from the SI1 (CN1-41).
			B	Inputs the reverse of the signal on the left from the SI2 (CN1-42).
			C	Inputs the reverse of the signal on the left from the SI3 (CN1-43).
			D	Inputs the reverse of the signal on the left from the SI4 (CN1-44).
			E	Inputs the reverse of the signal on the left from the SI5 (CN1-45).
			F	Inputs the reverse of the signal on the left from the SI6 (CN1-46).
Forward Run Prohibit (P-OT)	OFF (high level)	Pn50A.3	0 to F	Same as above. *
Reverse Run Prohibit (N-OT)	OFF (high level)	Pn50B.0	0 to F	Same as above. *
Alarm Reset (/ARM-RST)	ON (low level)	Pn50B.1	0 to F	Same as above. *
Forward Current Limit (/P-CL)	ON (low level)	Pn50B.2	0 to F	Same as above. *
Reverse Current Limit (/N-CL)	ON (low level)	Pn50B.3	0 to F	Same as above. *
Contact Input Speed Control Selection (/SPD-D)	-	Pn50C.0	0 to F	Same as above. *
Contact Input Speed Control Selection (/SPD-A)	-	Pn50C.1	0 to F	Same as above. *
Contact Input Speed Control Selection (/SPD-B)	-	Pn50C.2	0 to F	Same as above. *
Control Mode Selection (/C-SEL)	ON (low level)	Pn50C.3	0 to F	Same as above. *
Zero Clamp (/ZCLAMP)	ON (low level)	Pn50D.0	0 to F	Same as above. *

Table 4.1 Allocation of Other Input Signals (cont'd)

Input Signal		Parameter		Description
Name	Applicable Logic	Number	Setting	
Reference Pulse Inhibit (/INHIBIT)	ON (low level)	Pn50D.1	0 to F	Same as above. *
Gain Switching (/G-SEL)	ON (low level)	Pn50D.2	0 to F	Same as above. *

* Same as above indicates that the parameter can be set to from 0 to F to allocate input signals to the following terminals, as shown in the example for the Proportional Control Reference (/P-CON).

1. Allocation to input terminals SI0 to SI6
2. Setting to always valid or always invalid
3. Allocation to input terminals SI0 to SI6 and receiving the signals at the SERVOPACK with the reverse logic of the input signal

4.3.4 Output Circuit Signal Allocation

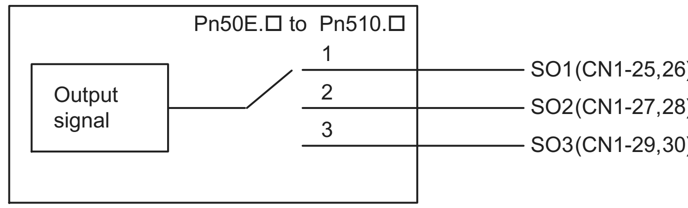
Output signal functions can be allocated to the sequence signal output circuits shown below.

CN1 Connector Terminal Numbers	Output Terminal Name	Factory Setting		Comments
		Symbol	Name	
25	SO1	/V-CMP+ (/COIN+)	Speed coincidence detection (positioning completed)	The signal output will vary depending on the control mode.
26 (SG)		/V-CMP- (/COIN-)		
27	SO2	/TGON+	Rotation detection	
28 (SG)		/TGON-		
29	SO3	/S-RDY+	Servo ready	
30 (SG)		/S-RDY-		

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

Pn50E	Output Signal Selections 1	Factory Setting: 3211	Speed/Torque Control, Position Control
Pn50F	Output Signal Selections 2	Factory Setting: 0000	Speed/Torque Control, Position Control
Pn510	Output Signal Selections 3	Factory Setting: 0000	Speed/Torque Control, Position Control

Select the CN1 connector terminals that will output the signals.



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

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

INFO

Multiple signals allocated to the same output circuit are output using OR logic. Signals that are not detected are invalid. For example, the positioning completed signal /COIN is invalid in Speed Control Mode.

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

Pn512	Output Signal Reversal Settings	Factory Setting: 0000	Speed/Torque Control, Position Control

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

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

4.3.5 Control Mode Selection

The SGDM and SGDH SERVOPACK offers speed control, position control, torque control, and the other control modes shown in the following table.

The following parameter is used to set the control mode.

Pn000.1	Control Mode Selection	Factory Setting: 0	Speed/Torque Control, Position Control

Pn000.1 Setting	Control Mode
0	Speed Control (Analog Reference)
1	Position Control (Pulse Train Reference)
2	Torque Control (Analog Reference)
3	Contact Input Speed Control Selection (Contact Reference)
4	Contact Input Speed Control Selection (Contact Reference) ↔ Speed Control (Analog Reference)
5	Contact Input Speed Control Selection (Contact Reference) ↔ Position Control (Pulse Train Reference)
6	Contact Input Speed Control Selection (Contact Reference) ↔ Torque Control (Analog Reference)
7	Position Control (Pulse Train Reference) ↔ Speed Control (Analog Reference)
8	Position Control (Pulse Train Reference) ↔Torque Control (Analog Reference)
9	Torque Control (Analog Reference) ↔ Speed Control (Analog Reference)
A	Speed Control (Analog Reference) ↔ Zero Clamp Control
B	Position Control (Pulse Train Reference) ↔ Position Control (Inhibit)

■ Description of Control Modes

The control modes are described below.

Speed Control (Analog Reference)

This mode controls speed using an analog voltage input reference. See *4.2.1 Speed Reference*.

Position Control (Pulse Train Reference)

This mode controls positioning using a pulse train input reference. See *4.2.2 Position Reference*.

Torque Control (Analog Reference)

This mode controls torque using an analog voltage input reference. See *4.2.7 Using Torque Control*.

Contact Input Speed Control Selection (Contact Reference)

This mode uses the /P-CON (/SPD-D), /P-CL (/SPD-A), and /N-CL (/SPD-B) input signals to control speed as it switches among the three preset operating speeds in the SERVOPACK. See *4.2.6 Contact Input Speed Control*.

Contact Input Speed Control Selection (Contact Reference) ↔ Speed Control (Analog Reference)

This mode controls speed by switching between contact reference and analog voltage reference speed control. Analog voltage reference speed control is enabled when both /P-CL (/SPD-A) and /N-CL (/SPD-B) input signals are OFF (high level). See *4.2.6 Contact Input Speed Control*.

Contact Input Speed Control Selection (Contact Reference) ↔ Position Control (Pulse Train Reference)

This mode switches between contact reference speed control and pulse train reference position control. Pulse train reference position control is enabled when both /P-CL (/SPD-A) and /N-CL (/SPD-B) input signals are OFF (high level). See *4.2.6 Contact Input Speed Control*.

Contact Input Speed Control Selection (Contact Reference) ↔ Torque Control (Analog Reference)

This mode switches between contact reference speed control and analog voltage reference torque control. Torque control using an analog voltage reference is enabled when both /P-CL (/SPD-A) and /N-CL (/SPD-B) input signals are OFF (high level). See *4.2.6 Contact Input Speed Control*.

Position Control (Pulse Train Reference) ↔ Speed Control (Analog Reference)

This mode switches between position and speed control through the /P-CON (/C-SEL) signal.

Position Control (Pulse Train Reference) ↔ Torque Control (Analog Reference)

This mode switches between position and torque control through the /P-CON (/C-SEL) signal.

Torque Control (Analog Reference) ↔ Speed Control (Analog Reference)

This mode switches between torque and speed control through the /P-CON (/C-SEL) signal. See *4.2.7 Using Torque Control*.

Speed Control (Analog Reference) ↔ Zero Clamp

This speed control mode is used to set the zero clamp function when the SERVOPACK is stopped. Zero clamp operates when the /P-CON (/ZCLAMP) signal is ON (low level). See *4.4.3 Using the Zero Clamp Function*.

Position Control (Pulse Train Reference) ↔ Position Control (Inhibit)

This mode controls positioning by inhibiting reference pulse input through the /P-CON (/INHIBIT) signal. See *4.2.12 Reference Pulse Inhibit Function (INHIBIT)*.

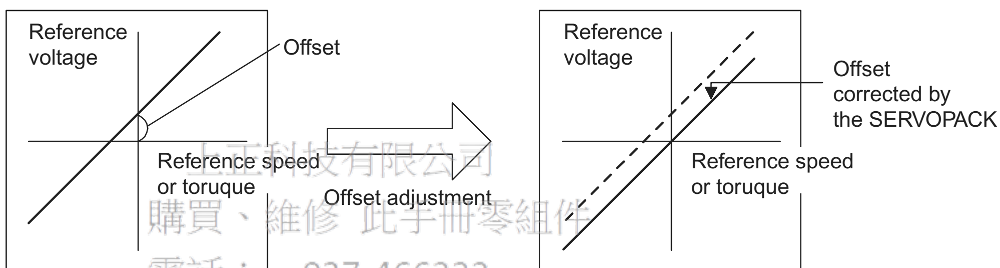
4.4 Setting Stop Functions

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

4.4.1 Adjusting Offset

■ When the Servomotor Will Not Stop

The servomotor may rotate at very low speed and not stop even when 0 V is specified as the reference voltage for the SERVOPACK speed and the torque control (analog reference). This happens when the reference voltage from the host controller or external circuit is slightly offset (in mV units). The servomotor will stop if this offset is properly adjusted to 0 V.



■ Reference Offset Adjustment

The following methods can be used to adjust the reference offset to 0 V.

Automatic Adjustment of Reference Offset	The reference offset value is automatically set to 0 V.
Manual Adjustment of Reference Offset	The reference offset value can be adjusted manually.

IMPORTANT

If a position loop is formed in the host controller, be sure to make manual offset adjustment and do not make automatic reference offset adjustment.

See the following sections in *Chapter 6 Using the Digital Operator* for more details on adjustment procedures.

Automatic Adjustment of Reference Offset	*6.2.3 Automatic Adjustment of the Speed and Torque Reference Offset*
Manual Adjustment of Reference Offset	*6.2.4 Manual Adjustment of the Speed and Torque Reference Offset*

4.4.2 Using the Dynamic Brake

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

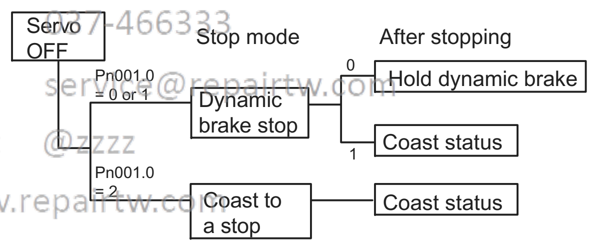
IMPORTANT

The dynamic brake is an emergency stop function. Do not repeatedly start and stop the servomotor using the servo ON signal (/S-ON) or by repeatedly turning power ON and OFF. Frequently turning power ON and OFF causes internal elements of the SERVOPACK to deteriorate, resulting in unexpected problems.

Pn001.0	Servo OFF or Alarm Stop Mode	Factory Setting: 0	Speed/Torque Control, Position Control

The SGDH SERVOPACK turns OFF under the following conditions:

- The Servo ON input signal (/S-ON, CN1-40) is turned OFF.
- A Servo alarm occurs.
- Main power is turned OFF.



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

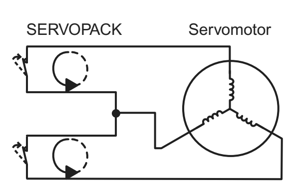
Pn001.0 Setting	Description
0	Uses the dynamic brake to stop the servomotor. Maintains dynamic brake after the servomotor stops. *
1	Uses the dynamic brake to stop the servomotor. Releases dynamic brake after the servomotor stops, and the servomotor coasts to a stop.
2	Coasts the servomotor to a stop.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

* If the servomotor is stopped or moving at extremely low speed, it will coast to a stop.

TERMS

[1] Dynamic brake (DB)

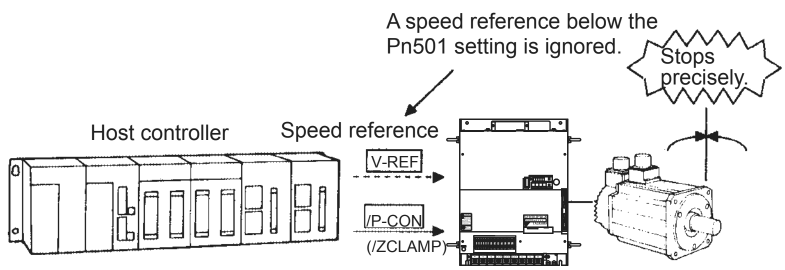
The dynamic brake is a common way of suddenly stopping a servomotor. Built into the SERVOPACK, the dynamic brake suddenly stops a servomotor by electrically shorting its electrical circuit.



4.4.3 Using the Zero Clamp Function

The zero clamp function is used for systems where the host controller does not form a position loop for the speed reference input.

In other words, this function is used to stop and lock the servomotor even when the input voltage of speed reference V-REF is not 0 V. An internal position loop is temporarily formed to clamp the servomotor within one pulse when the zero clamp function is turned ON. Even if the servomotor is forcibly rotated by external force, it will still return to the zero clamp position.



■ Parameter Setting

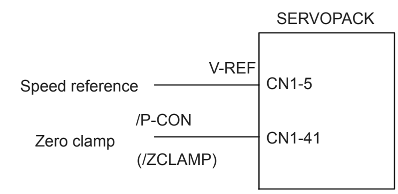
Set the following parameter so that the input signal /P-CON (/ZCLAMP) can be used to enable or disable the zero clamp function.

Pn000.1	Control Method Selection	Factory Setting: 0	Speed Control

→ Input /P-CON CN1-41	Proportional Control, etc.	Speed/Torque Control, Position Control

INFO

The /ZCLAMP signal can be used when an input circuit signal is allocated. See *4.3.3 Input Circuit Signal Allocation*.

<table>
<tr><th>Pn000.1 Setting</th><th colspan="2">Control Mode</th></tr>
<tr><td>A</td><td>Zero Clamp Control Mode
This mode allows the zero clamp function to be set when the servomotor stops.
• The speed reference is input from V-REF (CN1-5).
• /P-CON (/ZCLAMP)(CN1-41) is used to turn the zero clamp function ON and OFF.<table><tr><td>CN1-41 is open (OFF).</td><td>Turns the zero clamp function OFF.</td></tr><tr><td>CN1-41 is 0 V (ON).</td><td>Turns the zero clamp function ON.</td></tr></table></td><td>
Zero clamp is performed when the following two conditions are satisfied:
Condition 1: /P-CON (/ZCLAMP) is ON.
Condition 2: Speed reference is below the setting at Pn501.</td></tr>
</table>

■ Setting

Use the following parameter to set the motor speed level at which zero clamp is performed.

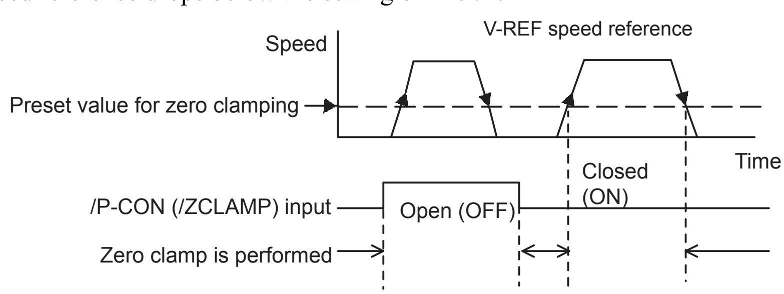
Pn501	Zero Clamp Level	Unit: min^{-1}	Setting Range: 0 to 10000	Factory Setting: 10	Speed Control

Set the motor speed at which zero clamp is performed if zero clamp speed control is selected. Even if this value is set higher than the maximum speed of the servomotor, the maximum speed will be used.

Zero Clamp Conditions

Zero clamp is performed when all the following conditions are satisfied:

- Zero clamp speed control is selected (parameter Pn000.1 is set to A).
- /P-CON (/ZCLAMP)(CN1-41) is ON (0V).
- Speed reference drops below the setting of Pn501.

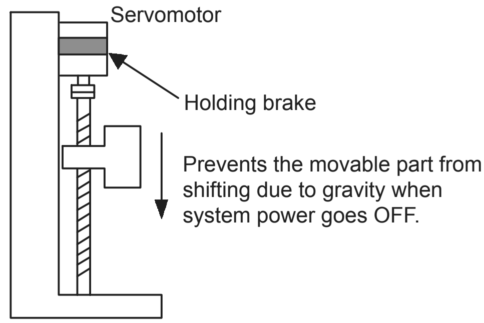


INFO

When the /ZCLAMP signal is allocated, the zero clamp operation will be used even for speed control (Pn000.1 = 0).

4.4.4 Using the Holding Brake

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

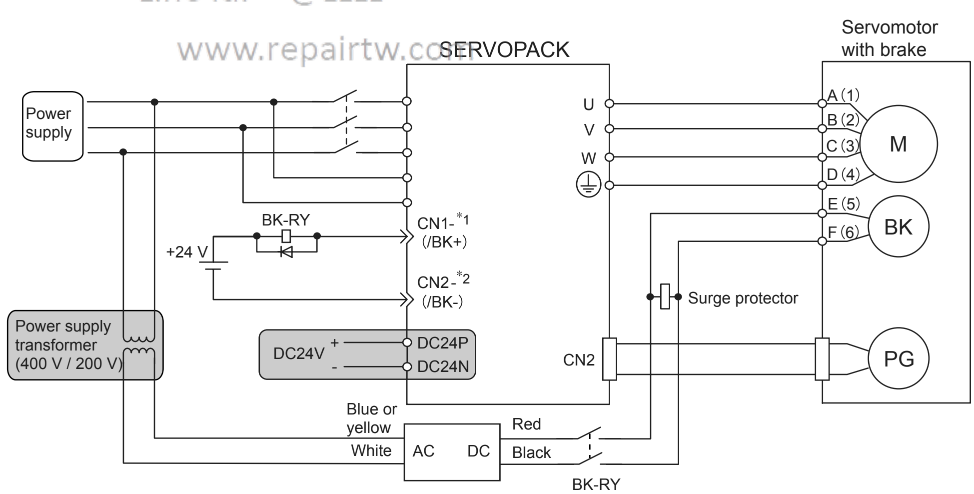


IMPORTANT

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

■ Wiring Example

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



Note: 1. If a 400-V SGDH-☐☐D SERVOPACK is used, the parts shown in the shaded areas are necessary.
2. The BK-RY means brake-control relay. The brake's power supply is 200 V and 100 V.
3. *1 and *2 are the output terminals allocated with Pn50F.2.
4. Connect a surge protector near the brake coil.

Output → /BK	Brake Interlock Output	Speed/Torque Control, Position Control

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

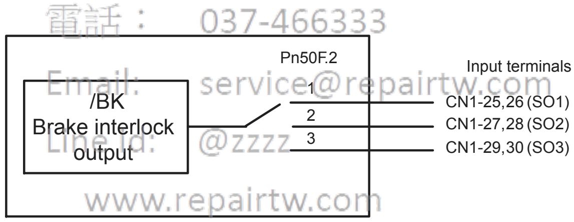
ON:	Closed or low level	Releases the brake.
OFF:	Open or high level	Applies the brake.

Related Parameters

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

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

Pn50F	Output Signal Selections 2	Factory Setting: 0000	Speed/Torque Control, Position Control



Select the /BK output terminal.

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

Note: Signals are output with OR logic when multiple signals are allocated to the same output circuit. Set other output signals to a value other than that allocated to the /BK signal in order to output the /BK signal alone. See *4.3.4 Output Circuit Signal Allocation*.

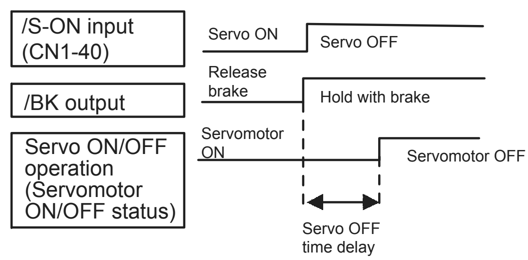
4

■ 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.

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

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 output. 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.

IMPORTANT

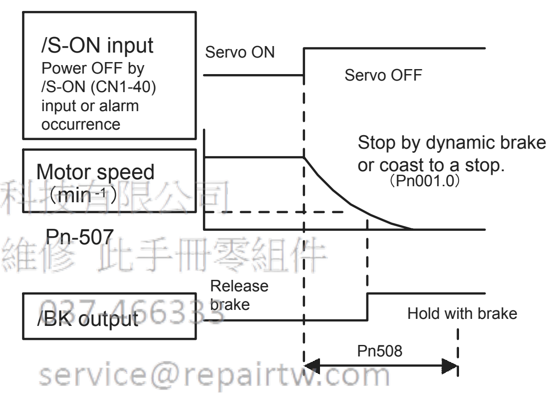
The servomotor will turn OFF immediately if an alarm occurs. The equipment may move due to gravity in the time it takes for the brake to operate.

■ Holding Brake Setting

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

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

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



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

/BK Signal Output Conditions During Servomotor Operation

The circuit is open under either of the following conditions:

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

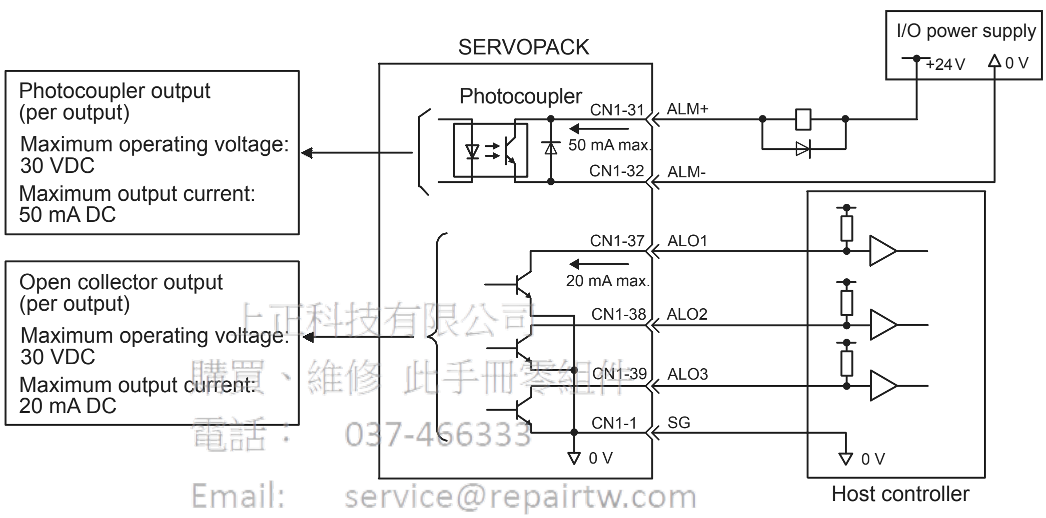
The actual setting will be the maximum speed even if Pn507 is set higher than the maximum speed.

4.5 Forming a Protective Sequence

This section describes the procedure for using I/O signals from the SERVOPACK to form a protective safety sequence.

4.5.1 Using Servo Alarm and Alarm Code Outputs

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

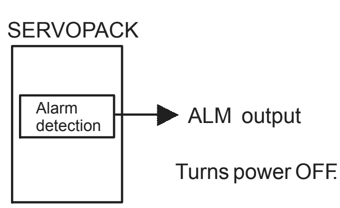


Provide an external input power supply; the SERVOPACK does not have an internal 24-V power supply.

The use of the photocoupler output signals is described below.

Output → ALM+ CN1-31	Servo Alarm Output	Speed/Torque Control, Position Control
Output → ALM- CN1-32	Signal Ground for Servo Alarm Output	Speed/Torque Control, Position Control

These alarms are output when a SERVOPACK alarm is detected.



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

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 status

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 → ALO1 CN1-37	Alarm Code Outputs	Speed/Torque Control, Position Control
Output → ALO2 CN1-38	Alarm Code Output	Speed/Torque Control, Position Control
Output → ALO3 CN1-39	Alarm Code Output	Speed/Torque Control, Position Control
Output → SG CN1-1	Signal Ground for Alarm Code Output	Speed/Torque Control, Position Control

These signals output alarm codes to indicate the type of alarm detected by the SERVOPACK.

Use these signals to display alarm codes at the host controller.

See *8.2.3 Alarm Display Table* for more details on the relationship between alarm display and alarm code output.

When a Servo alarm (ALM) occurs, eliminate the cause of the alarm and set the following /ALM-RST input signal to high level (ON) to reset the alarm.

→ Input /ALM-RST CN1-44	Alarm Reset	Speed/Torque Control, Position Control

The alarm reset signal is used to reset a Servo alarm.

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

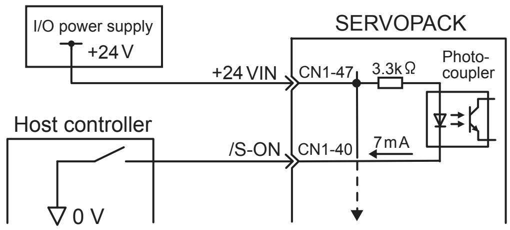
Alarms can also be reset using a Panel or Digital Operator.

IMPORTANT

1. Encoder alarms cannot always be reset by inputting the /ALM-RST signal. 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. See *8.2.1 Trouble-shooting Problems with Alarm Displays* for more details on troubleshooting the system when an alarm occurs.

4.5.2 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.



→ Input /S-ON CN1-40	Servo ON	Speed/Torque Control, Position Control

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

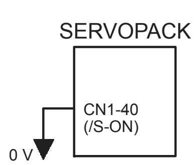
CN1-40 is ON (Low Level)	Turns the servomotor ON. This is the normal state (called the Servo ON state).	Servo ON	Servomotor is ON. The servomotor operates according to signal input.
CN1-40 is OFF (High Level)	Turns the servomotor OFF. The servomotor is OFF and cannot operate (called the Servo OFF state). Do not turn the servomotor OFF while it is operating except in an emergency.	Servo OFF	Servomotor is OFF. Servomotor cannot operate.

IMPORTANT

Do not use the Servo ON (/S-ON) signal but rather always use an input reference signal to start or stop the servomotor.

Set the following parameter to 7 if the /S-ON signal will not be used.

Pn50A.1	/S-ON Signal Mapping	Factory Setting: 0	Speed/Torque Control, Position Control



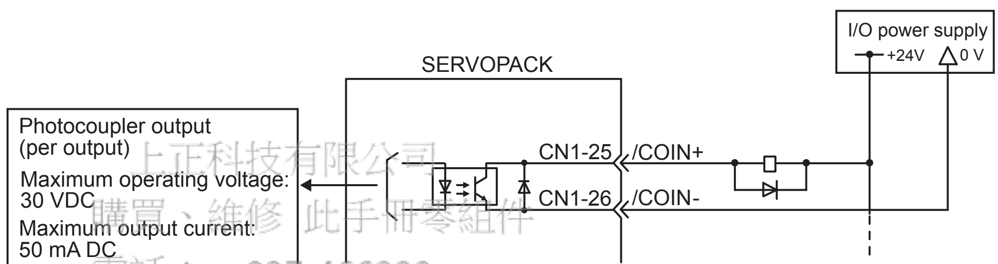
The external short-circuit wiring shown in the figure can be omitted if the Servo ON (/S-ON) input signal is not used.

Pn50A.1 Setting	Description
0	Enables the Servo ON (/S-ON) input signal. (The Servo is OFF when CN1-40 is open, and is ON when CN1-40 is at 0 V.)
7	Disables the Servo ON (/S-ON) input signal. (The Servo is always ON, and has the same effect as shorting CN1-40 to 0 V.)

Note: See *4.3.3 Input Circuit Signal Allocation* for other Pn50A.1 settings.

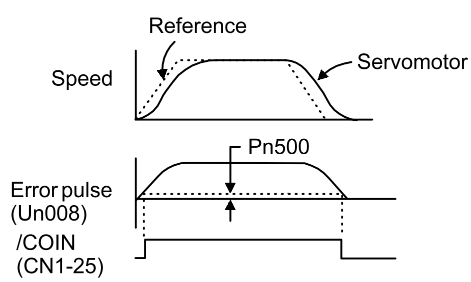
4.5.3 Using the Positioning Completed Output Signal

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



Output → /COIN CN1-25	Positioning Completed Output Signal	Position Control

This signal indicates that servomotor movement has been completed during position control. The host controller uses the signal as an interlock to confirm on the host controller that positioning is completed.



ON:	Circuit between CN1-25 and 26 is closed, and CN1-25 is at low level.	Positioning is completed. (Position error is below the setting.)
OFF:	Circuit between CN1-25 and 26 is open, and CN1-25 is at high level.	Positioning is not completed. (Position error is above the setting.)

Setting: Pn500 (positioning completed width)

The following parameter setting is used to change the CN1 connector terminal that outputs the /COIN signal.

Pn50E	Output Signal Selections 1	Factory Setting: 3211	Position Control

The parameter is factory set so the /COIN signal is output between CN1-25 and 26. See *4.3.4 Output Circuit Signal Allocation* for more details on parameter Pn50E.

The following parameter is used to set the number of error pulses and to adjust the output timing of the positioning completed signal.

Pn500	Positioning Completed Width	Unit: reference units	Setting Range: 0 to 250	Factory Setting: 7	Position Control

This parameter is used to set output timing for the positioning completed signal (/COIN) when the position reference pulse is input and servomotor operation is completed.

Set the number of error pulses in reference units (the number of input pulses defined using the electronic gear function).

Too large a value set at this parameter may output only a small error during low-speed operation that will cause the /COIN signal to be output continuously.

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

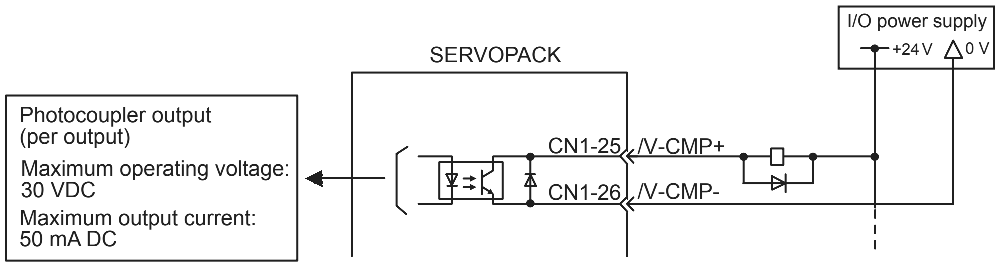
INFO

/COIN is a position control signal.

With the factory setting, this signal is used for the speed coincidence output /V-CMP for speed control, and it is always ON for torque control.

4.5.4 Speed Coincidence Output

The basic use and wiring procedures for the speed coincidence (/V-CMP) output signal used to indicate a match with the speed reference (photocoupler output signal) are described below. The host controller uses the signal as an interlock.

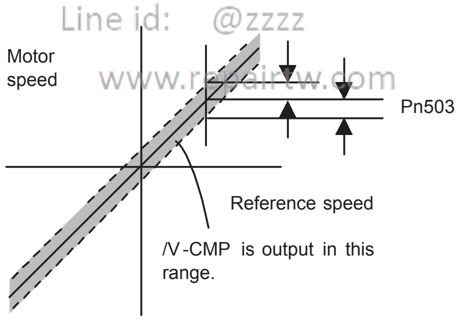


Output → /V-CMP CN1-25	Speed Coincidence Output	Speed Control

This signal is output when the actual motor speed during speed control is the same as the speed reference input.

ON:	Circuit between CN1-25 and 26 is closed, and CN1-25 is at low level.	Speed coincides. (Speed error is below the setting.)
OFF:	Circuit between CN1-25 and 26 is open, and CN1-25 is at high level.	Speed does not coincide. (Speed error is above the setting.)

Preset value: Pn503 (Speed Coincidence Signal Output Width)



The following parameter setting is used to change the CN1 connector terminal that outputs the /V-CMP signal.

Pn50E	Output Signal Selections 1	Factory Setting: 3211	Speed Control

The parameter is factory set so the /V-CMP signal is output between CN1-25 and 26. See *4.3.4 Output Circuit Signal Allocation* for more details on parameter Pn50E.

The following parameter is used to set conditions for speed coincidence output.

Pn503	Speed Coincidence Signal Output Width	Unit: min^{-1}	Setting Range: 0 to 100	Factory Setting: 10	Speed Control

4

This parameter is used to set conditions for speed coincidence signal /V-CMP output.

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

◀ EXAMPLE ▶ The /V-CMP signal turns ON at 1900 to 2100 min^{-1} if the parameter is set to 100 and the reference speed is 2000 min^{-1}.

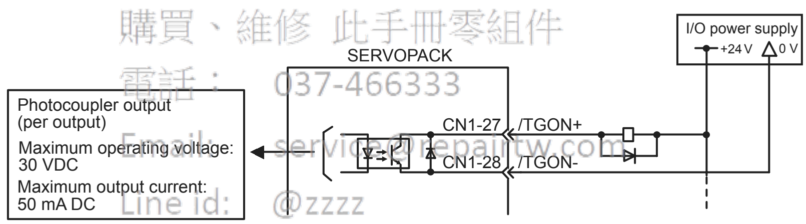
INFO

/V-CMP is a speed control signal.

With the factory setting, this signal is used as the positioning completed signal /COIN for position control, and it is always ON for torque control.

4.5.5 Using the Running Output Signal

The basic use and wiring procedures for the running (/TGON) output signal (photocoupler output signal) are described below. The signal is output to indicate that the servomotor is currently operating.

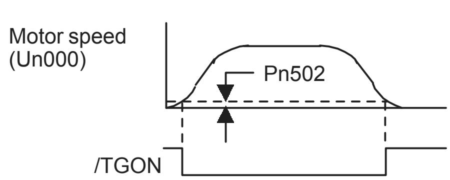


Output → /TGON CN1-27	Running Output Signal	Speed/Torque Control, Position Control

This signal is output to indicate that the servomotor is currently operating. It is used as an external interlock.

ON:	Closed or low level	Servomotor is operating (Motor speed is above the setting.)
OFF:	Open or high level	Servomotor is not operating. (Motor speed is below the setting.)

Preset value: Pn502 (Running Output Level)



The following parameter setting is used to change the CN1 connector terminal that outputs the /TGON signal.

Pn50E	Output Signal Selections 1	Factory Setting: 3211	Speed/Torque Control, Position Control

The parameter is factory set so the /V-CMP signal is output between CN1-27 and -28. See *4.3.4 Output Circuit Signal Allocation* for more details on parameter Pn50E.

This parameter is used to set output conditions for the operation detection output signal /TGON.

Pn502	Rotation Detection Level	Unit: min^{-1}	Setting Range: 1 to 10000	Factory Setting: 20	Speed/Torque Control, Position Control

This parameter is used to set the speed at which the SERVOPACK determines servomotor operation and outputs a signal. The following signals are output when motor speed exceeds the preset level.

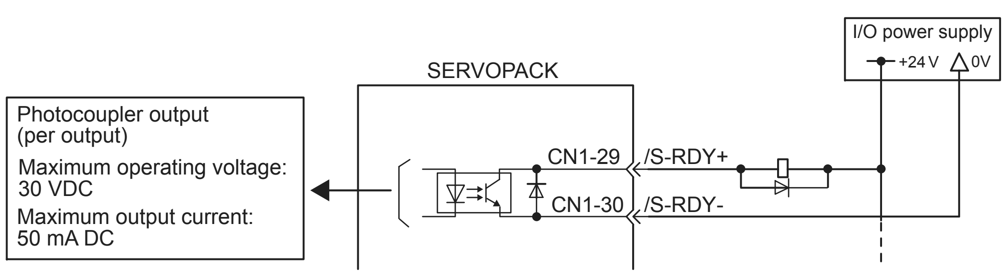
Signals output when servomotor operation is detected:

- /TGON
- Status Indication Mode
- Monitor Mode Un006

4.5.6 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 circuit power supply is turned ON. An added condition with absolute encoder specifications is that the SEN signal is at high level and absolute data was output to the host controller.



Output → /S-RDY CN1-29	Servo Ready Output Signal	Speed/Torque Control, Position Control

This signal indicates the SERVOPACK received the Servo ON signal and completed all preparations.

ON: Closed or low level		Servo is ready.
OFF: Open or high level		Servo is not ready.

The following parameter setting is used to change the CN1 connector terminal that outputs the /S-RDY signal.

Pn50E	Output Signal Selections 1	Factory Setting: 3211	Speed/Torque Control, Position Control

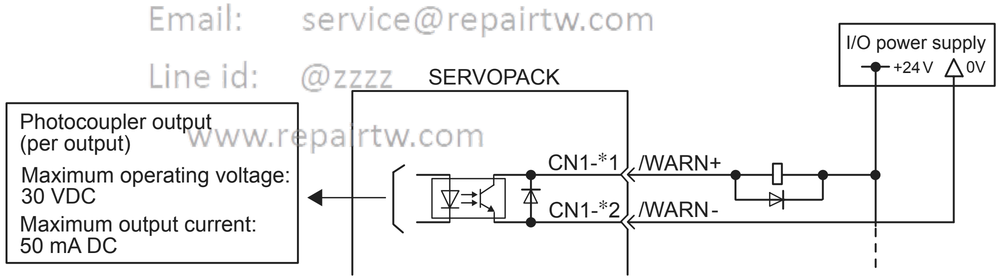
The parameter is factory set so the /V-CMP signal is output between CN1-29 and -30. See *4.3.4 Output Circuit Signal Allocation* for more details on parameter Pn50E.

4.5.7 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 two output signals.

/WARN signals: Overload and regenerative overload



Note: Parameter Pn50F.3 is used to allocate output terminals for *1 and *2.

Output → /WARN	Warning Output Signal	Speed/Torque Control, Position Control

This output signal indicates an overload or regenerative overload warning.

OFF:	Open or high level	Normal operation.
ON:	Closed or low level	Error warning status

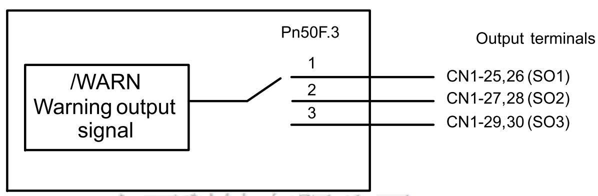
The following parameter setting is used to change the CN1 connector terminal that outputs the /WARN signal.

Pn50F	Output Signal Selections 2	Factory Setting: 0000	Speed/Torque Control, Position Control

Pn50F.3 is used to allocate the /WARN output signals above.

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

Note: Multiple signals allocated to the same output circuit are output using OR logic. Set other output signals to a value other than that allocated to the /WARN signal in order to use the /WARN output signal alone. See *4.3.4 Output Circuit Signal Allocation*.



The following parameter is used to output warning details with an alarm code.

Pn001.3	Warning Code Output Selection	Factory Setting: 0	Speed/Torque Control, Position Control

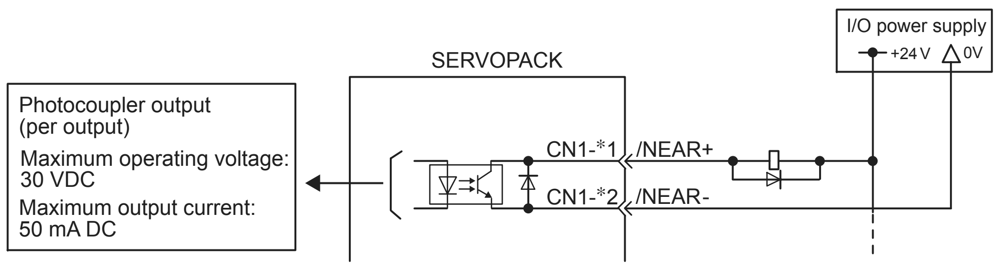
Pn001.3 Setting	Description
0	Outputs alarm codes alone for alarm codes ALO1, ALO2 and ALO3.
1	Outputs both alarm and warning codes for alarm codes ALO1, ALO2 and ALO3. Outputs an alarm code when an alarm occurs.

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

4.5.8 Using the Near Output Signal

The basic use and wiring procedures for the near (/NEAR) output signal (photocoupler output signal) are described below. The signal is a sequence signal that is generally output together with the positioning completed signal (/COIN), and it is used to indicate the servomotor is close to completing operation.



Note: *1 and *2 are the output terminals allocated with Pn510.0.

Output → /NEAR	Near Output Signal	Position Control

The SERVOPACK receives the near signal before the host controller checks the positioning completed signal and prepares the following sequence signal in order to reduce the number of operations required to complete servomotor operation during position control.

ON:	Closed or low level	The servomotor is close to completing operation. (Position error is below the near signal setting range.)
OFF:	Open or high level	The servomotor is not close to completing operation. (Position error is above the near signal setting range.)

Setting: Pn504 (near signal width)

To use the /NEAR signal, an output terminal must be allocated using the parameter below.

Pn510	Output Signal Selections 3	Factory Setting: 0000	Position Control

Pn510.0 is used to allocate the /NEAR output signals above.

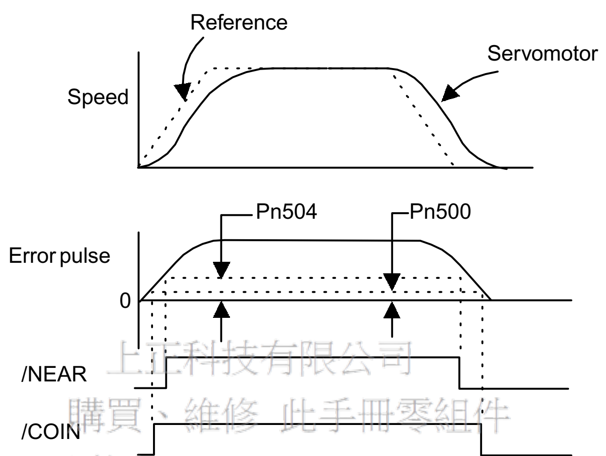
Parameter	Setting	Output Terminal (CN1-)	
		*1	*2
Pn510.0	0	-	-
	1	25	26
	2	27	28
	3	29	30

Note: Multiple signals allocated to the same output circuit are output using OR logic. Set other output signals to a value other than that allocated to the /NEAR signal in order to use the /NEAR output signal alone. See *4.3.4 Output Circuit Signal Allocation*.

The following parameter is used to set the timing for /NEAR signal output.

Pn504	NEAR Signal Width	Unit: reference units	Setting Range: 1 to 250	Factory Setting: 7	Position Control

Generally set the near signal width higher than the positioning completed width. Also see *4.5.3 Using the Positioning Completed Output Signal*.



4.5.9 Handling Power Loss

The following parameter is used to specify whether the servomotor holds or continues when a power loss occurs.

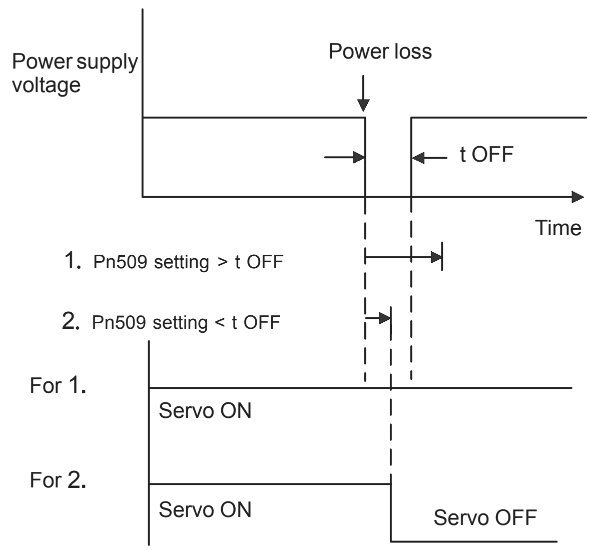
Pn509	Momentary Hold Time	Unit: ms	Setting Range: 20 to 1000	Factory Setting: 20	Speed/Torque Control, Position Control

The SERVOPACK turns the servomotor OFF if it detects an instantaneous voltage drop in the power supply. This factory setting of 20 ms means that servomotor operation will continue if power is lost for less than 20 ms.

In the following instances, however, a Servo alarm is generated or control is lost (equivalent to normal power OFF operation) regardless of the parameter setting.

- When an insufficient voltage alarm (A.41) occurs during power loss with a large servomotor load.
- When control is lost (equivalent to normal power OFF operation) with loss of the control power supply.

In power loss detection, the status of the main circuit power supply is detected and OFF status is ignored so servomotor operation will continue if the servomotor turns back ON within the time set at parameter Pn509.


Power supply voltage
Power loss
t OFF
Time
1. Pn509 setting > t OFF
2. Pn509 setting < t OFF
For 1.
Servo ON
For 2.
Servo ON
Servo OFF

4.6 External Regenerative Resistors

When installing an external regenerative resistor, set the regenerative resistor's capacity (W) at the following parameter.

Pn600	Regenerative Resistor Capacity	Unit: 10 W	Setting Range: 0 to SERVOPACK capacity	Factory Setting: 0	Speed/Torque Control, Position Control

The factory setting of "0" in the above table is the set value used when the SERVOPACK's built-in resistor is used or when a SERVOPACK without a built-in resistor is used.

When installing an external regenerative resistor, set the regenerative resistor's capacity (W).

◀ EXAMPLE ▶ When the external regenerative resistor's actual consumable capacity is 100 W, set the parameter to "10."

IMPORTANT

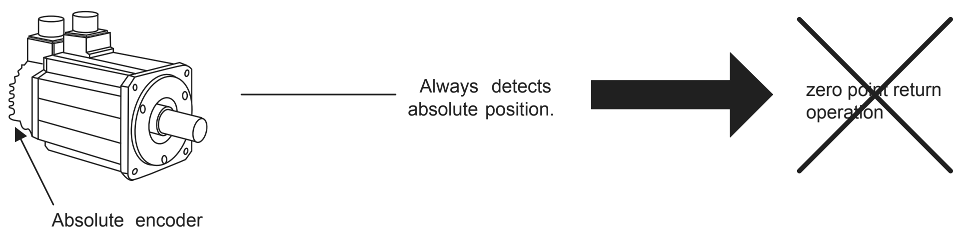
1. In general, when resistors for power are used at the rated load ratio, the resistor temperature increases to between 200°C and 300°C. The resistors must be used at or below the rated values. Check with the manufacturer for the resistor's load characteristics. Use resistors at no more than 20% of the rated load ratio with natural convection cooling, and no more than 50% of the rated load ratio with forced air cooling.
2. For safety's sake, it is recommended that resistors with thermoswitches be used.

4.7 Absolute Encoders

If a motor with an absolute encoder is used, a system to detect the absolute position can be made in the host controller. Consequently, operation can be performed without zero point return operation immediately after the power is turned ON.

Motor SGMBH-□□□2□···With 17-bit absolute encoder

SGMBH-□□□3□···With 20-bit absolute encoder (option)



⚠ WARNING

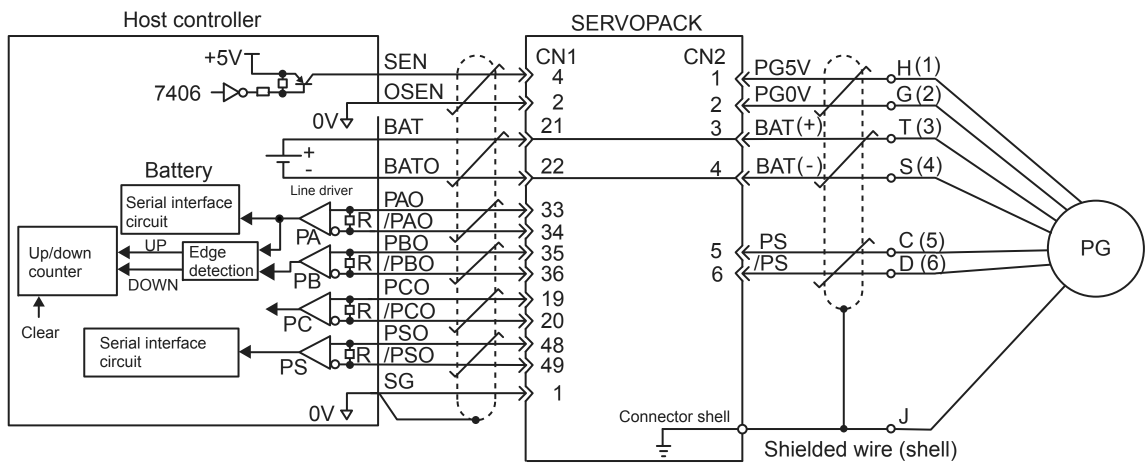
- The output range of multiturn data for Σ-II Series absolute detection system differs from that for conventional systems (15-bit encoder and 12-bit encoder). Specially when "Infinite length positioning system" of conventional type is to be configured with Σ-II Series, be sure to make the following system modification.

Absolute Encoder Type	Output Range of Multiturn Data	Motion When Exceeds the Limit
Conventional Types (12-bit and 15-bit)	-99999 to + 99999	• When exceeds the upper limit (+99999) in the positive direction, the multiturn data is 0. • When exceeds the lower limit (-99999) in the negative direction, the multiturn data is 0.
Σ-II Series (16-bit, 17-bit, and 20-bit)	-32768 to + 32767	• When exceeds the upper limit (+32767) in the positive direction, the multiturn data is -32768. • When exceeds the lower limit (-32768) in the negative direction, the multiturn data is +32767.*

* When the multiturn limit setting (Pn205) is changed, the motion differs.
Refer to *4.7.6 Multiturn Limit Setting*.

4.7.1 Interface Circuit

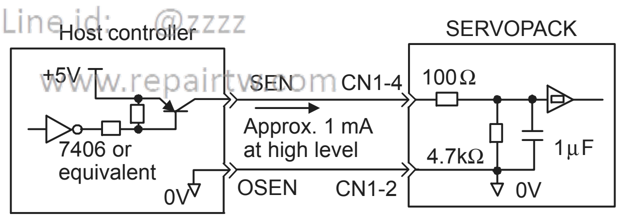
The following diagram shows the standard connections for an absolute encoder mounted to a servomotor.



: represents twisted-pair wires.

Applicable line drivers: SN75175 or KM3486 by T/I.
Terminating resistance R: 220 to 470 Ω

■ SEN Signals

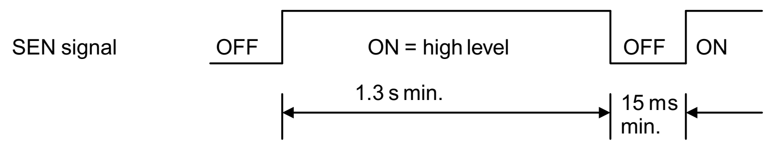


PNP is recommended for transistors.
Signal Levels
High level: 4.0 V min.; Low level: 0.8 V max.

- Let at least three seconds elapse after turning ON the power before raising the SEN signal to high level.
- When the SEN signal is changed from low level to high level, the multiturn data and initial incremental pulses are output.
- Until these operations are completed, the motor cannot be operated regardless of the status of the servo ON signal (/S-ON).
- For protection against leakage current from the host controller, turn OFF the power supply of the SERVOPACK and change the SEN signal from high level to low leve.

IMPORTANT

If for some reason it is necessary to turn OFF a SEN signal that is already ON, and then to turn it back ON again, maintain the high level for at least 1.3 seconds before turning it ON and OFF.



4.7.2 Selecting an Absolute Encoder

Select the absolute encoder usage with the following parameter.

Pn002.2	Absolute Encoder Usage	Factory Setting: 0	Speed/Torque Control, Position Control

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

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

Note: This user definition goes into effect when the power is turned OFF after the change has been made.

4.7.3 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

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

■ Battery Provided for the SERVOPACK

Lithium battery: JZSP-BA01-1 (includes battery and connector)

Battery: Toshiba, ER3 V, 3.6 V, 1000 mAh

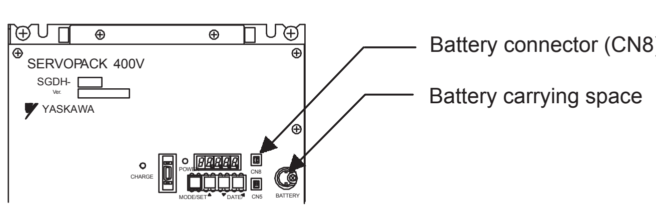


Fig. 4.1 SERVOPACKs with Capacities of 22 kW to 55 kW

PROHIBITED

- Install the battery at either the host controller or the SERVOPACK.

  It is dangerous to install batteries at both simultaneously, because that sets up a loop circuit between the batteries.

4.7.4 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 SERVOPACK'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 or the SERVOPACK's Panel Operator, or else personal computer monitor software can be employed.

The setup operation procedure shown here uses the Digital Operator. For more details, refer to *Chapter6 Using the Digital Operator*.

INFO

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

■ Setup Using the Hand-held Digital Operator

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

   Fn000

2. Select the parameter Fn008. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.

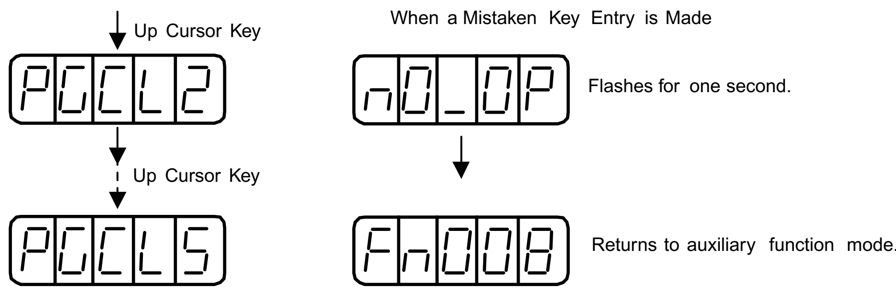
   Fn008

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

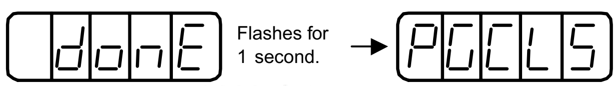
   PGCL1

4

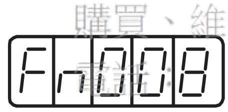
4. Pressing the Up Cursor Key will change the display as shown below. Continue pressing the Up Cursor Key until “PGCL5” is displayed. If an erroneous key entry is made, “nO_OP” will flash for one second and the display will return to the auxiliary function mode. In that case, go back to step 3 above 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 multiturn data will be cleared.



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



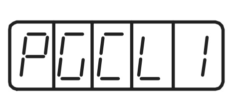
This completes the absolute encoder’s setup operation. Turn the power OFF and then back ON again.

■ Setup Using the Built-in Panel Operator

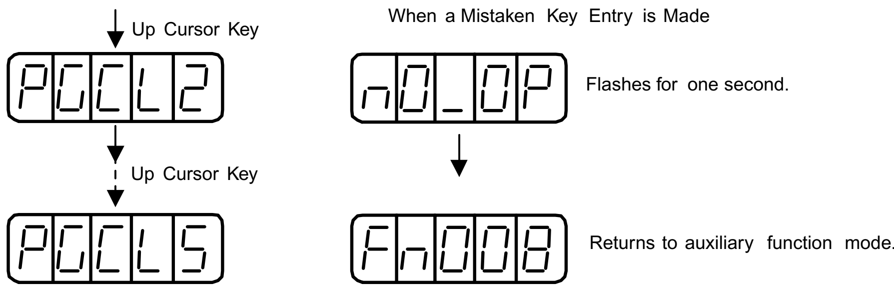
1. Press the MODE/SET Key to select the auxiliary function mode.

2. Press the Up or Down Cursor Key to select the parameter Fn008.

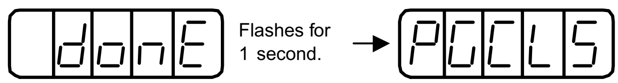
3. Press the DATA/SHIFT Key for at least one second. The following display will appear.



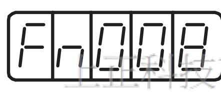
4. Pressing the Up Cursor Key will change the display as shown below. Continue pressing the Up Cursor Key until “PGCL5” is displayed. If an erroneous key entry is made, “nO_OP” will flash for one second and the display will return to the auxiliary function mode. In that case, go back to step 3 above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



5. When “PGCL5” is displayed, press the MODE/SET Key. The display will change as follows, and the absolute encoder’s multiturn data will be cleared.



6. Press the DATA/SHIFT Key for at least one second to return to the auxiliary function mode.



This completes the absolute encoder’s setup operation. Turn the power OFF and then back ON again.

IMPORTANT

If the following absolute encoder alarms are displayed, the alarms must be cleared using the method described on the previous page for the setup operation. They cannot be cleared by the SERVOPACK’s alarm reset (/ARM-RST) input signal.

- 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.

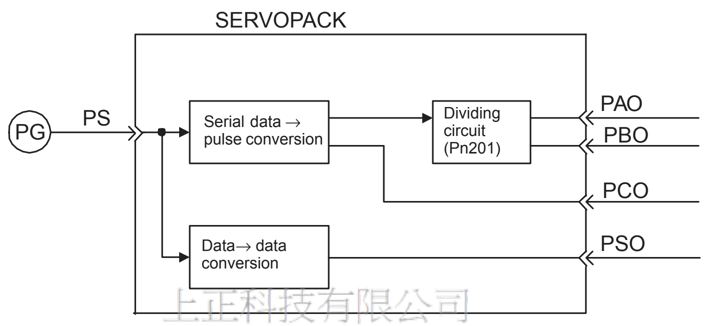
4.7.5 Absolute Encoder Reception Sequence

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

Be sure you understand this section when designing the host device.

■ Outline of Absolute Signals

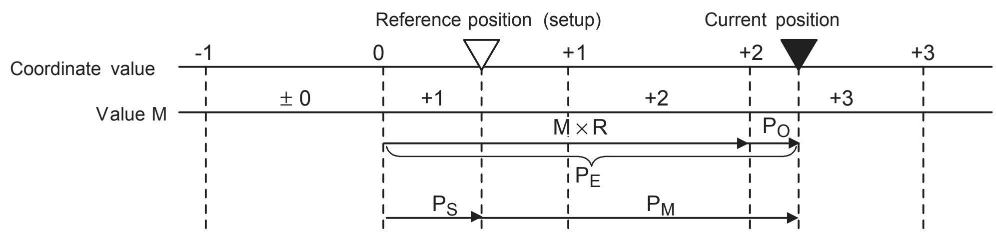
The absolute encoder's outputs are PAO, PBO, PCO, and PSO signals as shown below.



Signal Name	Status	Signal Contents
PAO	Initial state	Serial data Initial incremental pulse
	Normal state	Incremental pulse
PBO	Initial state	Initial incremental pulse
	Normal state	Incremental pulse
PCO	Always	Origin pulse
PSO	Always	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 origin to the current position at approximately 2500 min^{-1} (for 16 bits when the dividing pulse is at the factory setting)



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

$$P_E = M \times R + P_O$$
$$P_M = P_E - P_S$$

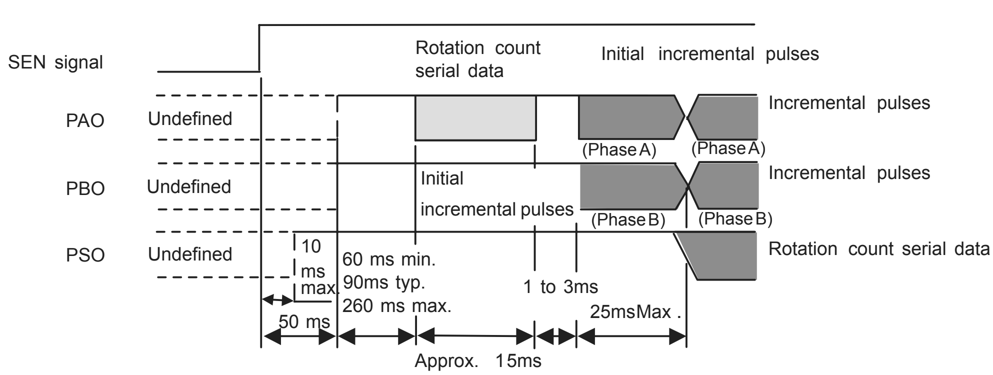
(Use the following for reverse rotation mode (Pn000.0 = 1).)

$$P_E = -M \times R + P_O$$
$$P_M = P_E - R_S$$

P_E	Current value read by encoder
M	Multiturn data (rotation count data)
P_O	Number of initial incremental pulses
P_S	Number of initial incremental pulses read at setup (This is saved and controlled by the host controller.)
P_M	Current value required for the user's system.
R	Number of pulses per encoder revolution (pulse count after dividing, value of Pn201)

■ Absolute Encoder Transmission Sequence

1. Set the SEN signal at high level.
2. After 100 ms, 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 50 ms after the last serial data is received.

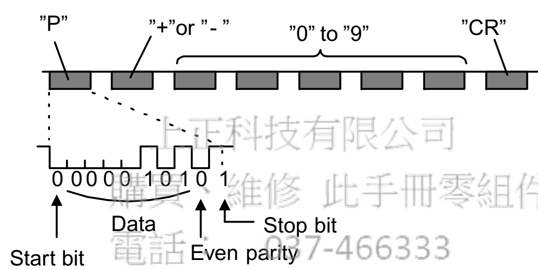


■ Detailed Signal Specifications

PAO Serial Data Specifications

The number of revolutions is output in five digits.

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



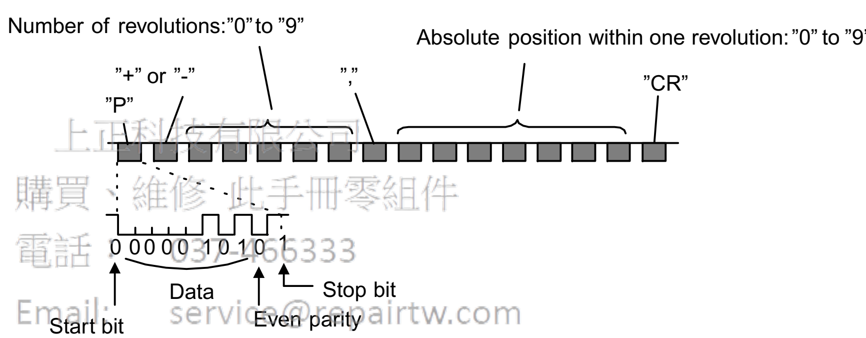
Note: 1. Data is "P+00000" (CR) or "P-00000" (CR) when the number of revolutions is zero.
2. The revolution range is "+32767" to "-32768." When this range is exceeded, the data changes from "+32767" to "-32768" or from "-32768" to "+32767. " When changing multiturn limit, the range changes. For details, see *4.7.6 Multiturn Limit Setting*.

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 40 ms.

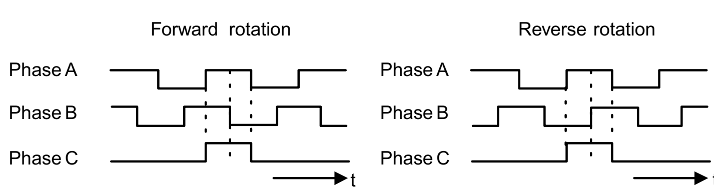
Data Transfer Method	Start-stop Synchronization (ASYNC)
Baud rate	9600 bps
Start bits	1 bit
Stop bits	1 bit
Parity	Even
Character code	ASCII 7-bit code
Data format	13 characters, as shown below.



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 SERVOPACK and then output.



Setting the Pulse Dividing Ratio

Use the following parameter to set the pulse dividing ratio.

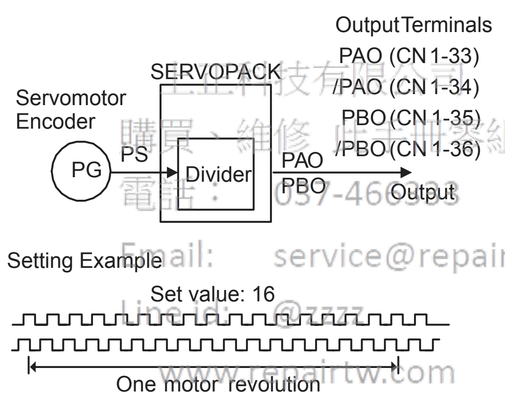
Pn201	PG Divider	Unit: P/R	Setting Range: 16 to 16384	Factory Setting: 16384	Speed/Torque Control, Position Control

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

Pulses from the motor encoder (PG) are divided by the number of pulses set here before being output.

The set value is the number of output pulses per revolution. Set this value according to the reference unit of the machine or controller to be used.

The setting range varies according to the encoder used.



■ Transferring Alarm Contents

When an absolute encoder is used, SEN signals can be utilized to transfer the alarm detection contents from PAO outputs to the host device as serial data.

Table 4.2 Alarm Contents Output Example

SEN Signal	"H" Error detection	"L"
Digital Operator Display	run or bb	A.81 Absolute encoder backup alarm
PAO Serial Data	Incremental pulses	ALM81 CR

Refer to *8.2.3 Alarm Display Table* for a table of alarm contents.

4.7.6 Multiturn Limit Setting

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

Select the absolute encoder usage with the following parameter.

Pn002.2	Absolute Encoder Usage	Factory Setting: 0	Speed/Torque Control, Position Control

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

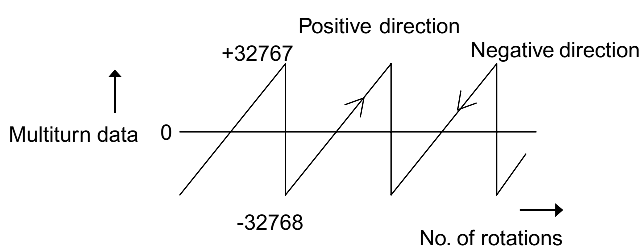
Pn002.2 Setting	Contents
0	Use the absolute encoder as an absolute encoder.
1	Use the absolute encoder as an incremental encoder.

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

Pn205	Multiturn Limit Setting	Unit: rev	Setting Range: 0 to 65535	Factory Setting: 65535	Speed/Torque Control, Position Control

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

- Variation of multiturn data when the multiturn limit value is 65535 (factory setting).

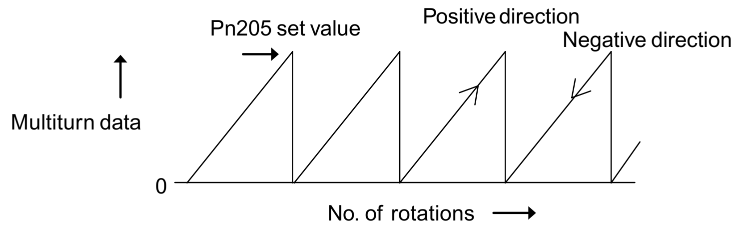


TERMS

[1] Multiturn limit

The multiturn limit is the upper limit of the multiturn data. If Pn002.2 = 0, the multiturn data will vary between 0 and the value set for Pn205 (Multiturn Limit Setting).

- Variation of multiturn data when the multiturn limit value is other than 65535 (factory setting).



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

INFO

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

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

Alarm Name: Multiturn Limit Disagreement

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

Note: OFF: Signals are high level. ON: Signals are low level.

When this alarm occurs, the multiturn limit in the Encoder must be changed. The auxiliary function mode of the Digital Operator is used to change this setting. It can also be set from a personal computer using the Monitor Software.

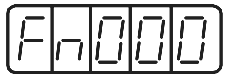
The procedure to set the multiturn limit in the Encoder using the Digital Operator is provided next. Refer also to *Chapter 6 Using the Digital Operator*.

INFO

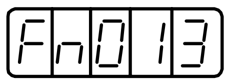
The multiturn limit setting in the Encoder can be changed only when the Multiturn Limit Disagreement alarm has occurred. After changing the setting, turn the power supply OFF and then back ON.

■ Changing the Setting with the Hand-held Digital Operator

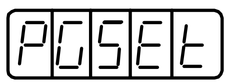
1. Press the DSPL/SET Key to select the auxiliary function mode.



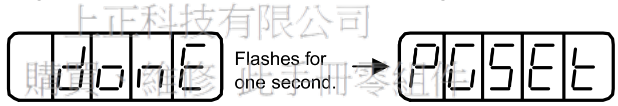
2. Select the parameter Fn013. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.



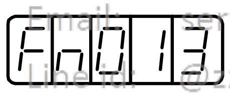
3. Press the DATA/ENTER Key. The following display will appear.



4. Press the DSPL/SET Key. The following display will appear and the multiturn limit setting in the absolute encoder will be changed.



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

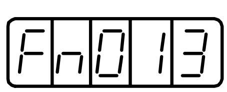


This completes the procedure to change the multiturn limit setting in the absolute encoder. Turn the power OFF and then back ON again.

■ Changing the Setting with the Built-in Panel Operator

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

2. Press the Up or Down Cursor Key to select the parameter Fn013.



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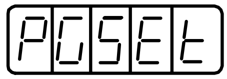
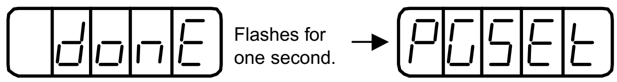
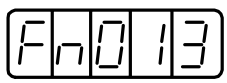
3. Press the DATA/SHIFT Key for at least one second. The following display will appear.



4. Press the MODE/SET Key. The following display will appear and the multiturn limit setting in the absolute encoder will be changed.



5. Press the DATA/SHIFT Key for at least one second to return to the auxiliary function mode.



This completes the procedure to change the multiturn limit setting in the absolute encoder. Turn the power OFF and then back ON again.

⚠ WARNING

- The multiturn limit value must be changed only for special applications.

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

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

4.8 Special Wiring

This section describes special wiring methods including the one for noise control. In addition to *4.8.1 Wiring Precautions* and *4.8.2 Wiring for Noise Control*, refer to other sections as necessary.

4.8.1 Wiring Precautions

To ensure safe and stable operation, always observe the following wiring precautions.

IMPORTANT

1. Always use the following cables for reference input and encoder wiring.

–	Cable Type	Yaskawa Drawing No.	Maximum Allowable Length
Reference Input	Twisted-pair wires	JZSP-CKI01	3 m (118 in)
Encoder	Multiconductor shielded twisted-pair wire	JZSP-CMP29	50 m (1969 in)

   - Trim off the excess portion of the cable to minimize the cable length.

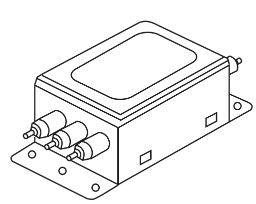
2. For a ground wire, use as thick a cable as possible (2 mm^2 or thicker).

   - Ground resistance of 100 Ω max. is recommended.
   - Ground to one point only.
   - If the motor is insulated from the machine, ground the motor directly.

3. Do not bend or apply tension to cables.

   The conductor of a signal cable is very thin (0.2 to 0.3 mm (0.0079 to 0.012 in)), so handle the cables with care.

4. Use a noise filter to prevent noise interference. (For details, refer to *4.8.2 Wiring for Noise Control*.)
   - If the equipment is to be used near private houses or may receive noise interference, install a noise filter on the input side of the power supply line.
   - Since this SERVOPACK is designed as an industrial device, it provides no mechanism to prevent noise interference.



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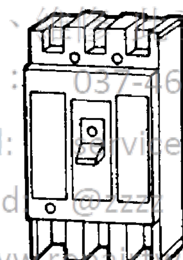
5. To prevent malfunction due to noise, take the following actions:
   - Position the input reference device and noise filter as close to the SERVOPACK as possible.
   - Always install a surge absorber circuit in the relay, solenoid and electromagnetic contactor coils.
   - The distance between a power line (such as a power supply line or motor cable) and a signal line must be at least 30 cm. Do not put the power and signal lines in the same duct or bundle them together.
   - Do not share the power supply with an electric welder or electrical discharge machine. When the SERVOPACK is placed near a high-frequency oscillator, install a noise filter on the input side of the power supply line.

   Note: 1. Since the SERVOPACK uses high-speed switching elements, signal lines may receive noise. To prevent this, always take the above actions.
   2. For details on grounding and noise filters, refer to *4.8.2 Wiring for Noise Control*.
6. Use a molded-case circuit breaker (QF) or fuse to protect the power supply line from high voltage.
   - This SERVOPACK connects directly to a commercial power supply without a transformer, so always use a QF or fuse to protect the servo system from accidental high voltage.
   - Refer to *7.5.10 Molded-case Circuit Breaker (MCCB)* to select an appropriate QF or fuse according to the SERVOPACK capacity.



4.8.2 Wiring for Noise Control

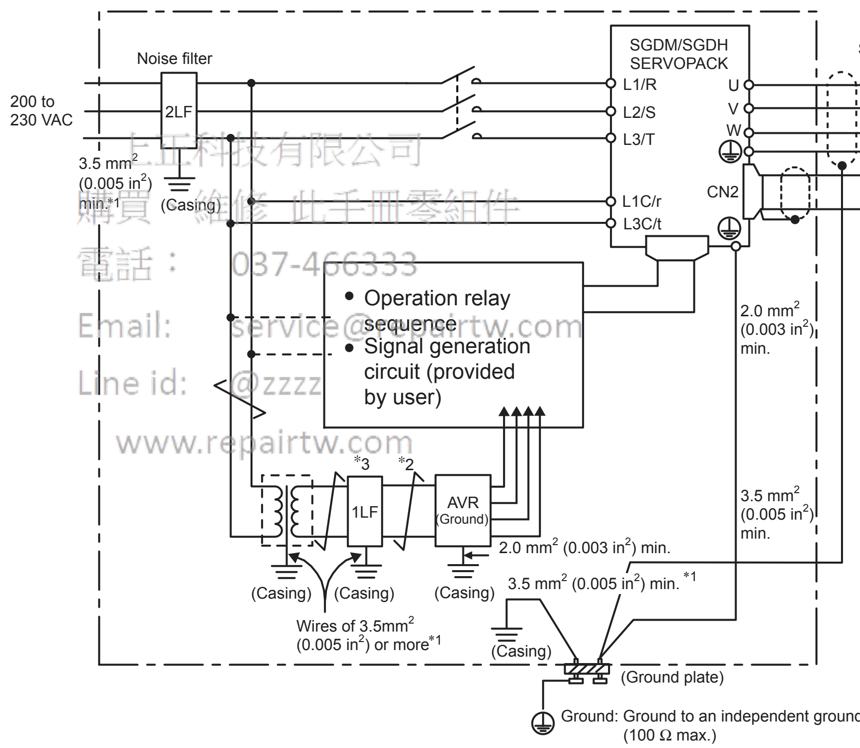
■ Wiring Example

This SERVOPACK uses high-speed switching elements in the main circuit. It may receive “switching noise” from these high-speed switching elements if wiring or grounding around the SERVOPACK is not appropriate. To prevent this, always wire and ground the SERVOPACK correctly.

This SERVOPACK has a built-in microprocessor (CPU), so it is necessary to protect it from external noise as much as possible by installing a noise filter in the appropriate place.

The following figure is an example of wiring for noise control.

Wiring with 200-V SERVOPACK



* 1. For ground wires connected to the casing, use a thick wire with a thickness of at least 3.5 mm² (0.005 in²) (preferably, plain stitch cooper wire).

* 2. For wires indicated by use twisted-pair wires whenever possible.

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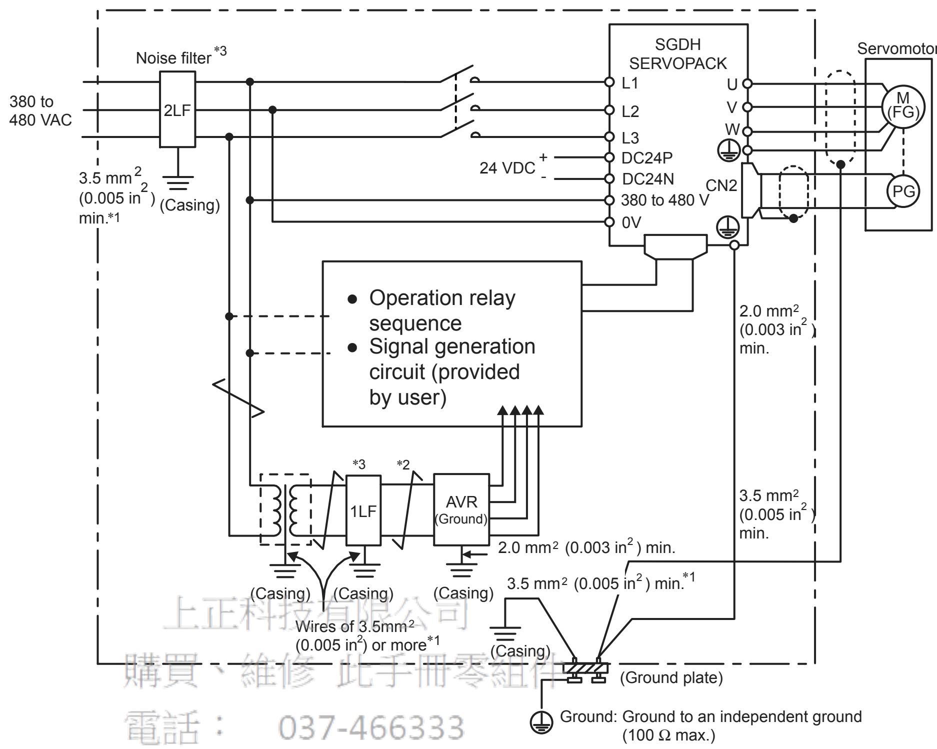
Wiring with 400-V SERVOPACK



* 1. For ground wires connected to the casing, use a thick wire with a thickness of at least 3.5 mm^2 (0.005 in^2) (preferably, plain stitch cooper wire).

* 2. For wires indicated by use twisted-pair wires whenever possible.

■ Correct Grounding

Grounding the Motor Frame

Always connect servomotor frame terminal FG to the SERVOPACK ground terminal ⏚ .

Also be sure to ground the ground terminal ⏚ .

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

Noise on the Reference Input Line

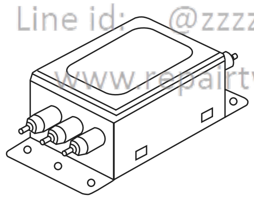
If the reference input line receives noise, ground the 0 V line (SG) of the reference input line. If the main circuit wiring for the motor is accommodated in a metal conduit, ground the conduit and its junction box.

For all grounding, ground at one point only.

■ Using Noise Filters

Use an inhibit type noise filter to prevent noise from the power supply line. Refer to *7.5.11 Noise Filter* for details on recommended noise filters for each SERVOPACK model.

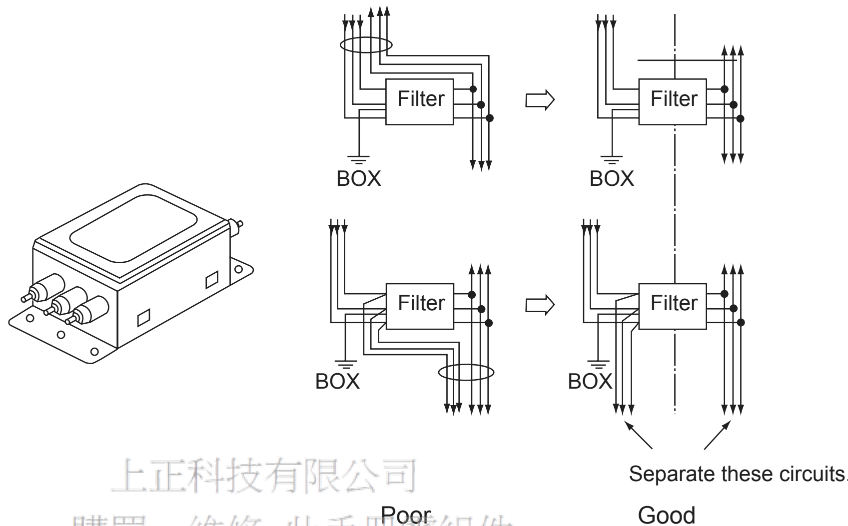
Install a noise filter on the power supply line for peripheral equipment as necessary.



Always observe the following installation and wiring instructions. Incorrect use of a noise filter halves its benefits.

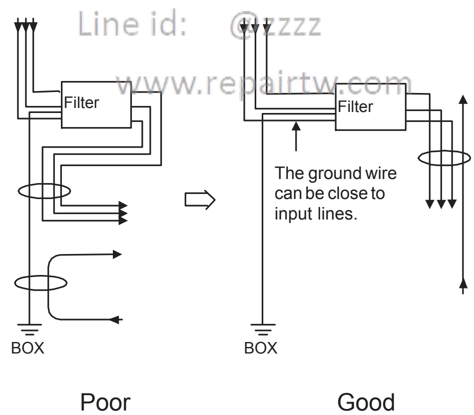
- Separate input lines from output lines.

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



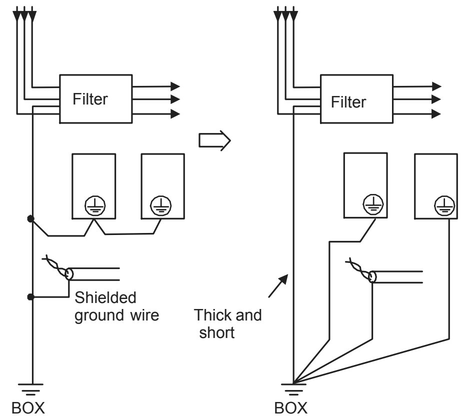
- Separate the noise filter ground wire from the output lines.

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



- Connect the noise filter ground wire directly to the ground plate.

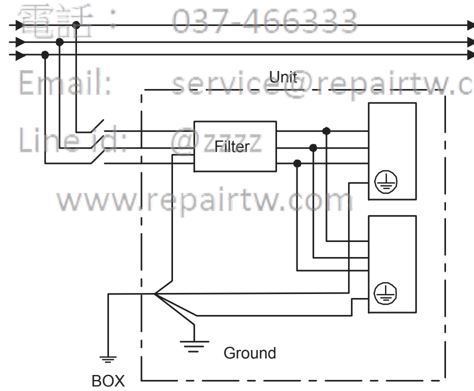
  Do not connect the noise filter ground wire to other ground wires.



Poor   Good

- When grounding a noise filter inside a Unit.

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



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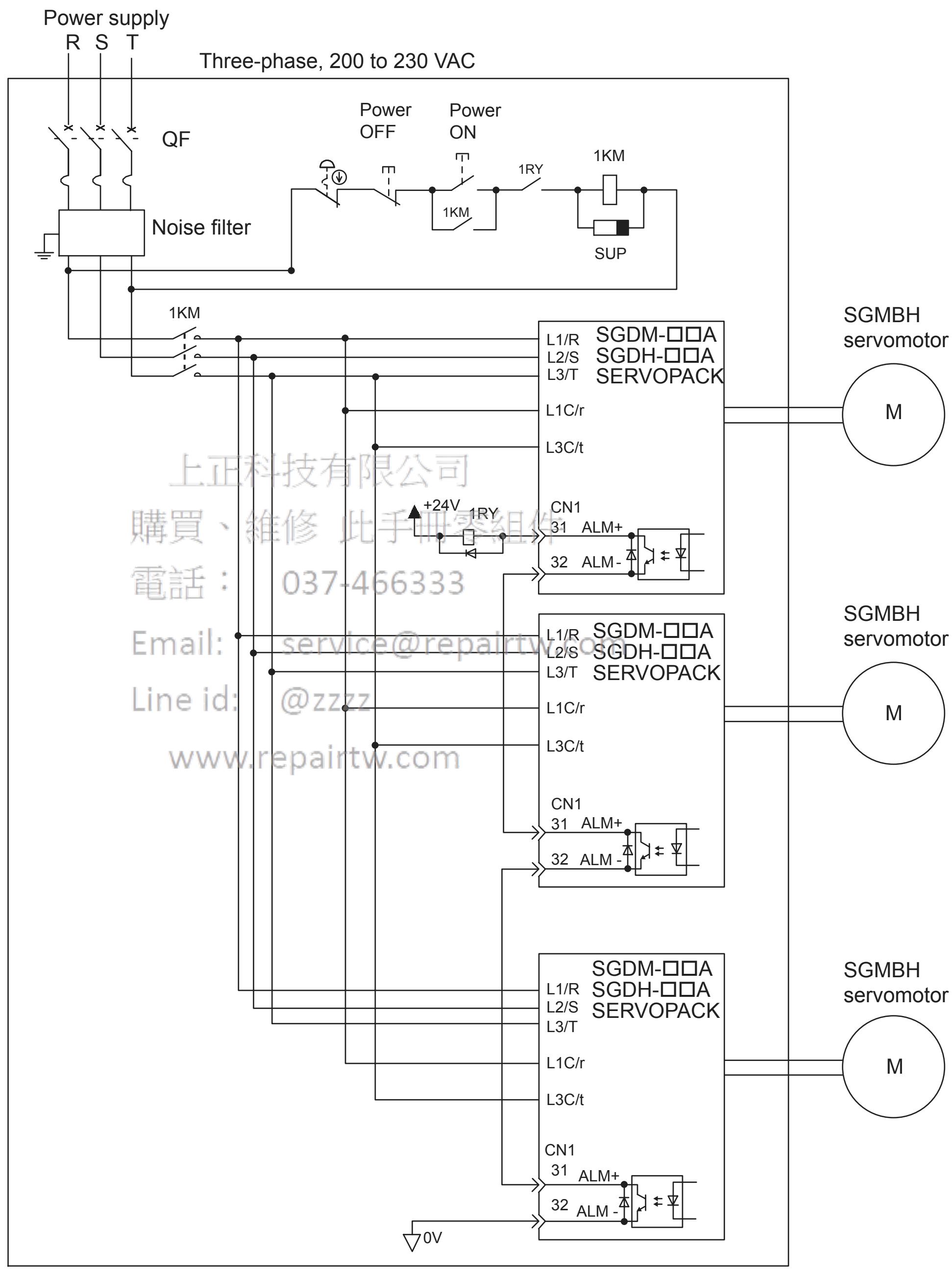
4.8.3 Using More Than One Servodrive

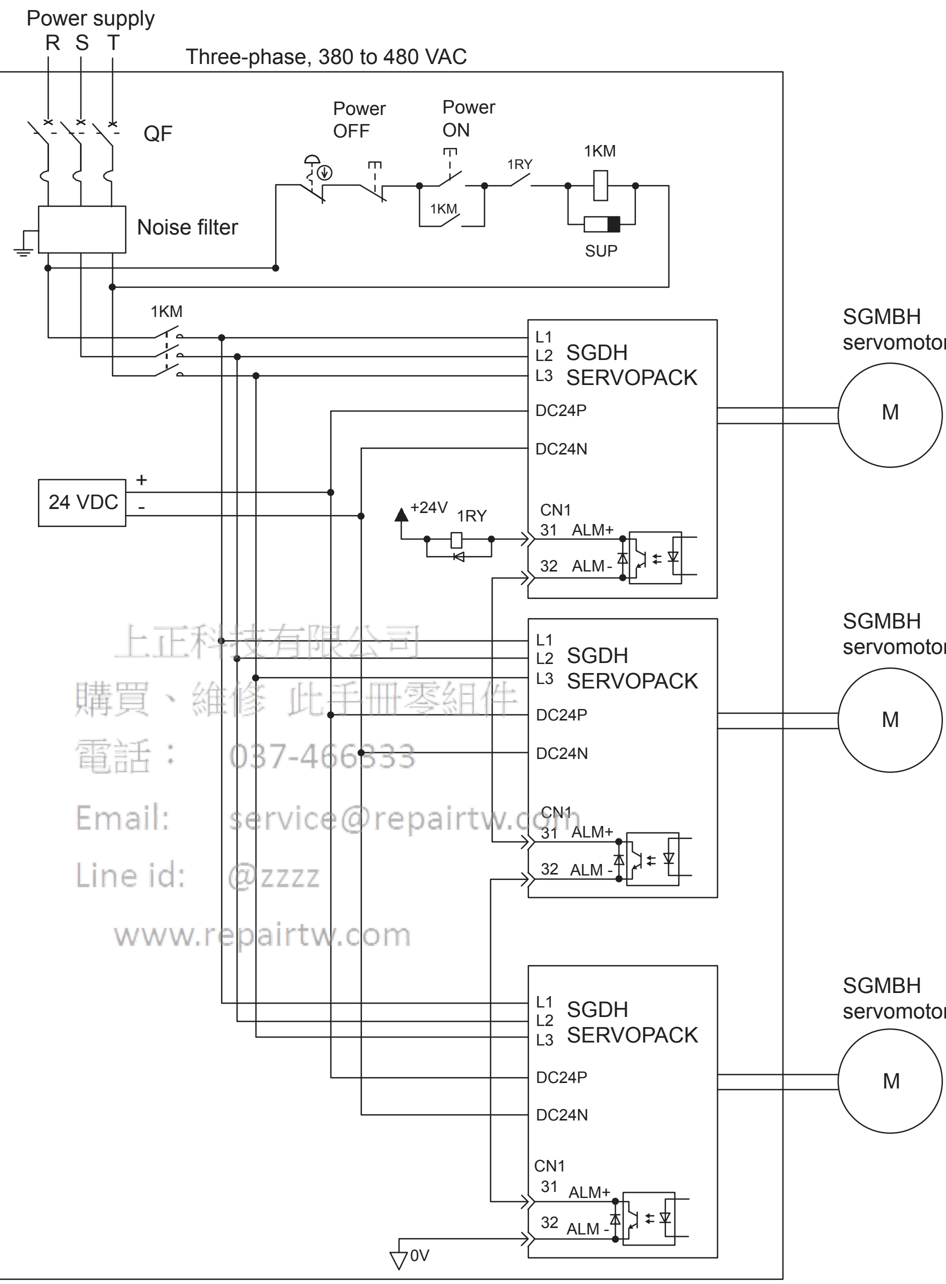
The following diagram is an example of the wiring when more than one Servodrive is used.

■ Three-phase, 200 VAC: SGDM-□□A/SGDH-□□A



Note: Wire the system so that the power supply's phase S is the ground.

■ Three-phase, 400 VAC: SGDH-□□D



Note: Wire the system so that the power supply's phase S is the ground.

Connect the alarm output (ALM) terminals for the three SERVOPACKs in series to enable alarm detection relay 1RY to operate.

The output transistor is turned OFF when the ALM output signal invokes the alarm state.

Multiple servos can share a single QF or noise filter. Always select a QF or noise filter that has enough capacity for the total power capacity (load conditions) of those servos. For details, refer to *7.5.10 Molded-case Circuit Breaker (MCCB)* and *7.5.11 Noise Filter*.

4.8.4 Extending Encoder Cables

Standard encoder cables have a maximum length of 20 m. If a longer cable is required, prepare an extension cable as described below. The maximum allowable cable length is 50 m. For 50-m encoder cables, only the cable lines and connectors are available. The cable must be prepared by the user.

For more details, refer to *7.5.7 Encoder Cables*.

Preparing 50-m (1968.50 in) Encoder Cables

- Cable Lines

Length	Cable Line Model Numbers
30 m (1181.10 in)	JZSP-CMP29-30
40 m (1574.80 in)	JZSP-CMP29-40
50 m (1968.50 in)	JZSP-CMP29-50

When specifying the cable length, just specify the model number:

JZSP-CMP29-□

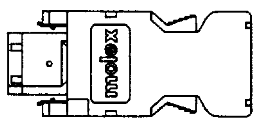
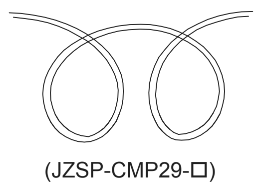
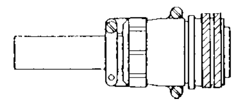
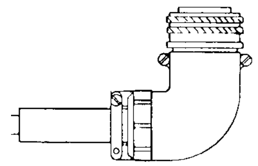
The □ in the model number designates the length of the cable (in meters).

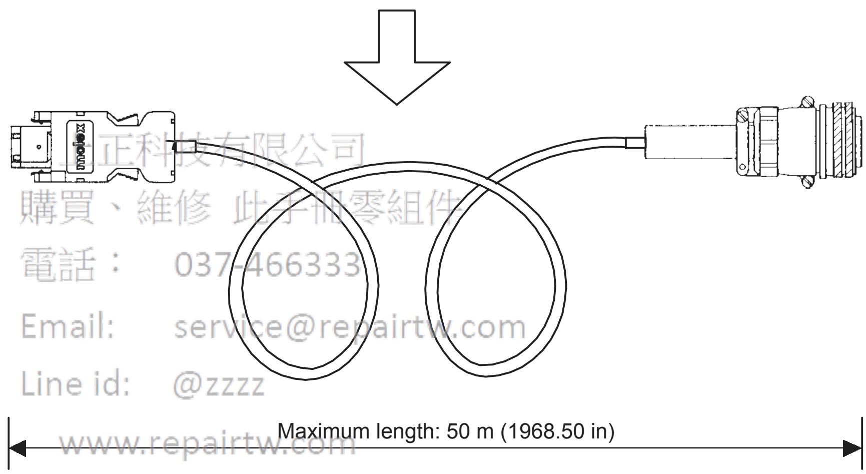
◀ EXAMPLE ▶ For example, to order 35-m cable, specify JZSP-CMP29-35 as the model number.

- Connectors or Connector Kits

Type		Model
SERVOPACK end	Encoder connector (CN2) socket	JZSP-CMP9-1
Servomotor end	Encoder connector plug and cable clamp for SGMBH servomotors	Plug L: MS3108B20-29S Straight: MS3106B20-29S Cable clamp: MS3057-12A

• Preparing Encoder Cables

• Encoder Connector at SERVOPACK	• Cable Line	• Encoder Connector at Servomotor	
 (JZSP-CMP9-1)	 (JZSP-CMP29-□)	 	For SGMBH servomotors



5

Servo Adjustment

This chapter describes the functions required for servo adjustment. Find the required information by selecting the section from the following table of contents.

5.1 Smooth Operation

This section provides technical information on the smooth operation of servomotors.

5.1.1 Using the Soft Start Function

The soft start function adjusts progressive speed reference input inside the SERVOPACK so that acceleration and deceleration can be as constant as possible.

To use this function, set the following parameters.

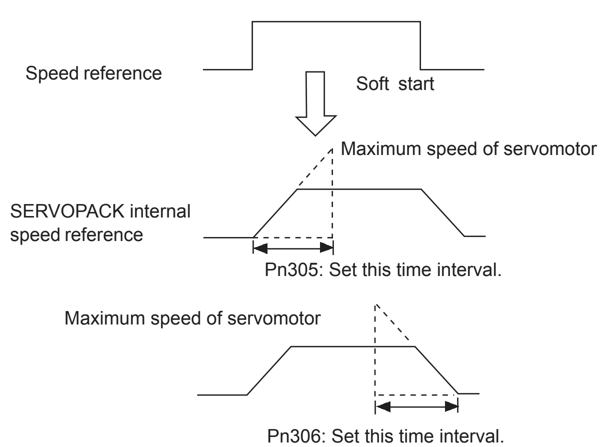
Pn305	Soft Start Acceleration Time	Unit: ms	Setting Range: 0 to 10000	Factory Setting: 0	Speed Control
Pn306	Soft Start Deceleration Time	Unit: ms	Setting Range: 0 to 10000	Factory Setting: 0	Speed Control

In the SERVOPACK, a speed reference is multiplied by the acceleration or deceleration value set in Pn305 or Pn306 to provide speed control.

The soft start function enables smooth speed control when inputting progressive speed references or when selecting internally-set speeds. Set both Pn305 and Pn306 to 0 for normal speed control.

Set these parameters as follows:

- Pn305: The time interval from the time the motor starts until the motor maximum speed is reached.
- Pn306: The time interval from the time the motor is operating at the motor maximum speed until it stops.



5.1.2 Smoothing

A filter can be applied in the SERVOPACK to a constant-frequency reference pulse. Use the following parameter to set the type of filter to be applied.

Pn207.0	Position Reference Filter Selection	Factory Setting: 0	Position Control

Either an acceleration/deceleration or average movement filter can be selected.

Pn207.0 Setting	Contents
0	Acceleration/deceleration filter
1	Average movement filter

The time constant and time for these filters are set in the following parameters.

Time Constant for Acceleration/Deceleration Filter

Pn204	Position Reference Acceleration/ Deceleration Time Constant	Unit: 0.01 ms	Setting Range: 0 to 6400	Factory Setting: 0	Position Control

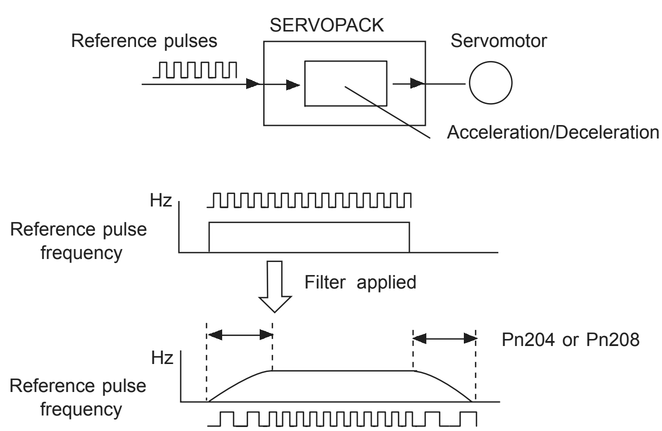
Averaging Time for Average Movement Filter

Pn208	Position Reference Movement Averaging Time	Unit: 0.01 ms	Setting Range: 0 to 6400	Factory Setting: 0	Position Control

This function provides smooth motor operating in the following cases:

- When the host device which outputs references cannot perform acceleration/deceleration processing.
- When the reference pulse frequency is too low.
- When the reference electronic gear ratio is too high (i.e., 10 × or more).

This function does not affect the travel distance (i.e., the number of pulses).



5.1.3 Adjusting Gain

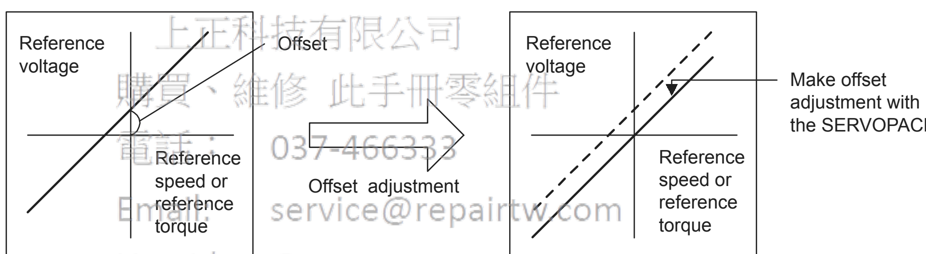
If speed loop gain or position loop gain exceeds the allowable limit for the servo system including the machine to be controlled, the system will tend to vibrate or become too sensitive. Smooth operation is not possible under such conditions, so reduce each loop gain value to an appropriate value.

Refer to *5.2.1 Setting Servo Gain* for details regarding servo gain adjustment.

5.1.4 Adjusting Offset

The servo system does not operate smoothly if reference voltage from the host controller or external equipment has a reference offset value in close proximity to 0 V. In this case, adjust the reference offset value to 0 V.

■ Reference Voltage Offset from Host Controller or External Circuitry



■ Reference Offset Adjustment

The following two methods are available to set the reference offset value to 0 V.

Reference offset automatic adjustment	The reference offset value is automatically set to 0 V.
Reference offset manual adjustment	The reference offset value can be adjusted manually.

IMPORTANT

If a position loop is formed in the host controller, be sure to make manual offset adjustment and do not make automatic reference offset adjustment.

Refer to the following sections in *Chapter 6 Using the Digital Operator* for reference offset adjustment in detail.

Reference offset automatic adjustment	*6.2.3 Automatic Adjustment of the Speed and Torque Reference Offset*
Reference offset manual adjustment	*6.2.4 Manual Adjustment of the Speed and Torque Reference Offset*

5.1.5 Setting the Torque Reference Filter Time Constant

If there is machine vibration which may be caused by the servodrive, try adjusting the filter time constant in Pn401. This may stop the vibration.

Pn401	Torque Reference Filter Time Constant	Unit: 0.01 ms	Setting Range: 0 to 65535	Factory Setting: 100	Speed/Torque Control, Position Control

The above constant is the filter time constant of the torque reference to be set in the SERVOPACK. The smaller the value, the faster the speed control response will be. There is, however, a certain limit depending on machine conditions.

5.1.6 Notch Filter

Vibration in the machine can sometimes be eliminated by using a notch filter for the frequency at which the vibration is occurring.

Pn408.0	Notch Filter Selection	Factory Setting: 0	Speed/Torque Control, Position Control

This parameter can be set to enable the notch filter.

Pn408.0 Setting	Contents
0	None
1	Notch filter used for torque reference.

The frequency at which the machine is vibrating is set in the following parameter.

Pn409	Notch Filter Frequency	Unit: Hz	Setting Range: 50 to 2000	Factory Setting: 2000	Speed/Torque Control, Position Control

5.2 High-speed Positioning

This section provides technical information on high-speed positioning.

5.2.1 Setting Servo Gain

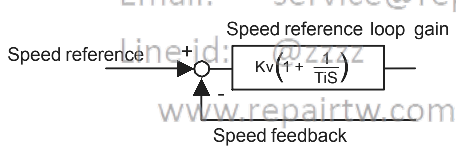
■ Setting Speed Loop Gain

Set the following speed-loop-related parameters as required.

Pn100	Speed Loop Gain (Kv)	Unit: Hz	Setting Range: 1 to 2000	Factory Setting: 40	Speed/Torque Control, Position Control
Pn101	Speed Loop Integral Time Constant (Ti)	Unit: 0.01 ms	Setting Range: 15 to 51200	Factory Setting: 2000	Speed/Torque Control, Position Control

The above constants are the SERVOPACK's speed loop gain and integral time constant respectively.

The higher the speed loop gain, or the smaller the speed loop integral time constant value, the faster the speed control response will be. There is, however, a certain limit depending on machine characteristics.



Speed loop gain Kv is adjusted in 1-Hz increments provided that the following parameter is set correctly.

Pn103	Inertia Ratio	Unit: %	Setting Range: 0 to 10000 (0 to 20000)*	Factory Setting: 0	Speed/Torque Control, Position Control

* The setting range when the software version 32 or later is used.

$$\text{Inertia ratio} = \frac{\text{Motor axis conversion load moment of inertia } (J_L)}{\text{Servomotor rotor moment of inertia } (J_M)} \times 100\ (\%)$$

The load moment of inertia of the SERVOPACK converted on the basis of the motor shaft is factory-set to the rotor moment of inertia of the servomotor. Therefore, obtain the inertia ratio from the above formula and set parameter Pn103 properly.

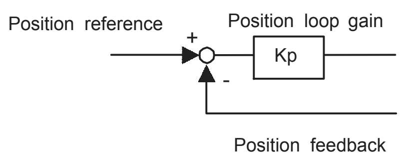
■ Setting Position Loop Gain

Set the following position loop-related parameter as required.

Pn102	Position Loop Gain (Kp)	Unit: 1/s	Setting Range: 1 to 2000	Factory Setting: 40	Speed Control, Position Control

The above constant is the position loop gain for the SERVOPACK.

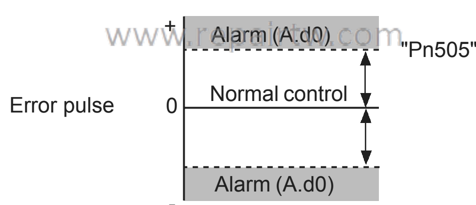
The higher the position loop gain, the smaller the position control error will be. There is, however, a certain limit depending on machine characteristics.



This gain setting is also valid for zero clamp operation.

Pn505	Overflow level	Unit: 256 reference units	Setting Range: 1 to 32767	Factory Setting: 1024	Position Control

Set in this parameter the error pulse level at which a position error pulse overflow alarm (A.d0) is detected.



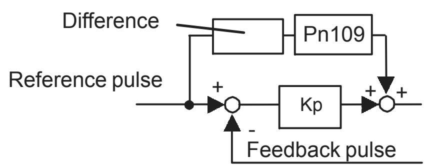
If the machine permits only a small position loop gain value to be set in Pn102, an overflow alarm may arise during high-speed operation. In this case, increase the value set in this parameter to suppress alarm detection.

5.2.2 Using Feed-forward Control

The time required for positioning can be shortened with feed-forward control[1] by setting the following parameter.

Pn109	Feed-forward	Unit: %	Setting Range: 0 to 100	Factory Setting: 0	Position Control

This parameter is set to apply feed-forward frequency compensation to position control inside the SERVOPACK. Use this parameter to shorten positioning time. Too high a value may cause the machine to vibrate. For ordinary machines, set 80% or less in this constant.

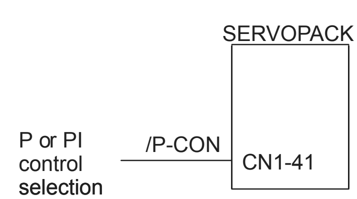


5.2.3 Using Proportional Control

If parameter Pn000.1 is set to 0 or 1 as shown below, input signal /P-CON serves as a PI/P control changeover switch.

- PI control: Proportional/integral control.
- P control: Proportional Control

Pn000.1	Control Method Selection	Factory Setting: 0	Speed/Position Control

<table>
<tr><th>Pn000.1 Setting</th><th colspan="3">Control Mode</th></tr>
<tr><td>0</td><td>Speed Control</td><td>Usual speed control or position control is selected.
Input signal /P-CON (CN1-41) is used to select PI control or P control.</td><td rowspan="2"></td></tr>
<tr><td>1</td><td>Position Control</td><td><table><tr><td>CN1-41 is open.</td><td>PI control</td></tr><tr><td>CN1-41 is 0 V.</td><td>P control</td></tr></table></td></tr>
</table>

TERMS

[1] Feed-forward control

Feed-forward control is a type of control in which necessary control connections are made in advance before the control system is affected by external disturbance. Feed-forward control increases the effective servo gain, thus making it possible to improve the response performance of the system.

■ Methods for Using Proportional Control

Proportional control can be used in the following two ways.

- When operation is performed by sending speed references from the host controller to the SERVOPACK, the host controller can selectively use P control mode for particular conditions only. This method can suppress overshooting and shorten setting time. Refer to *5.2.5 Using Mode Switch* for particular conditions.
- If PI control mode is used when the speed reference has a reference offset, the motor may rotate at a very slow speed and fail to stop even if 0 is specified as a speed reference. In this case, use P control mode to stop the motor.

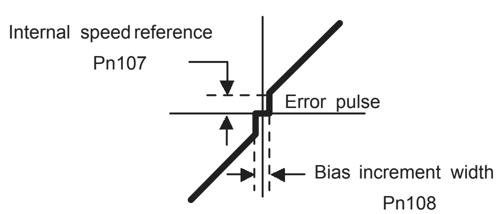
5.2.4 Setting Speed Bias

The setting time for positioning can be reduced by assigning bias to the speed reference block in the SERVOPACK. To assign bias, use the following parameters.

Pn107	Bias	Unit: min^{-1}	Setting Range: 0 to 450	Factory Setting: 0	Position Control
Pn108	Bias Addition Width	Unit: reference units	Setting Range: 0 to 250	Factory Setting: 7	Position Control

Set the parameters to shorten the time required for positioning according to the application.

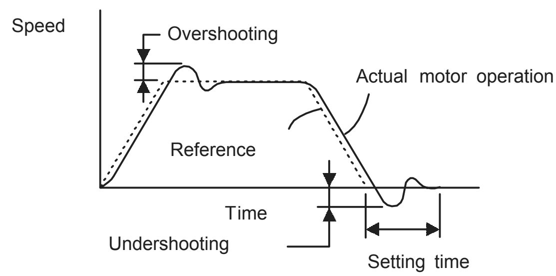
The bias increment width (Pn108) is expressed by an error pulse width that determine the timing of giving bias input (Pn107). The bias input is ON if the error pulse width exceeds the value set in Pn108.



5.2.5 Using Mode Switch

Use the mode switch function for the following purposes.

- To suppress overshooting during acceleration or deceleration (for speed control).
- To suppress undershooting during positioning and to shorten the setting time (for position control).



The mode switch function makes it possible to automatically switch over the SERVOPACK's internal speed control mode from PI to P control[1] mode and vice versa when specified conditions are satisfied.

IMPORTANT

1. The mode switch is used to fully utilize performance of a servodrive to achieve very high-speed positioning. The speed response waveform must be observed to adjust the mode switch.
2. The overshooting or undershooting can be suppressed by setting the acceleration/deceleration time constant for the host controller, the soft start time constants (Pn305 and Pn306), or position reference acceleration/deceleration constant (Pn204) for the SERVOPACK.

TERMS

[1] From PI control to P control

PI control means proportional/integral control and P control means proportional control. In short, switching "from PI control to P control" reduces effective servo gain, making the servo system more stable.

■ Selecting Mode Switch Setting

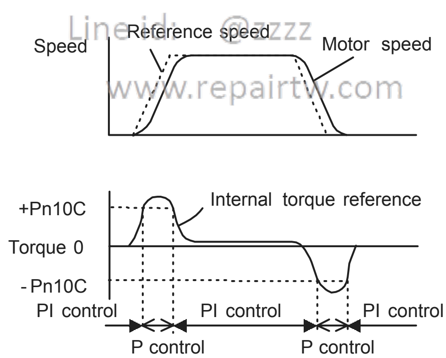
The SERVOPACK incorporates four mode switch settings (0 to 3). Select a mode switch with the following parameter (Pn10B.0).

Pn10B.0 Setting	Selecting Mode Switch Setting	Parameter to Set Detective Point	Set Unit
0	Uses torque reference as the detection point. (Standard setting)	Pn10C	Percentage of rated torque: %
1	Uses speed reference input as the detection point.	Pn10D	Motor speed: min^{-1}
2	Uses acceleration as the detection point.	Pn10E	Motor acceleration:10 min^{-1}/s
3	Uses error pulse input as the detection point.	Pn10F	Reference units
4	Mode switch function is not used.	-	-

Torque Reference Input Used as Detection Point (Standard Setting)

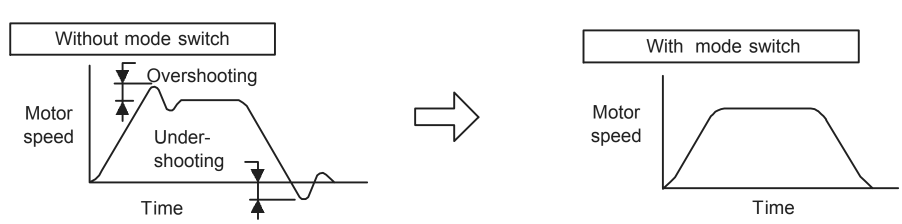
With this setting, if the value of torque reference input exceeds the torque set in parameter Pn10C, the speed loop switches to P control.

The SERVOPACK is factory-set to this standard mode. (Pn10C = 200)



◀ EXAMPLE ▶ Operating Example

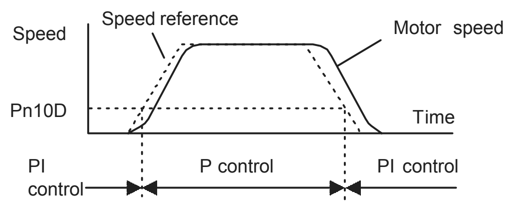
If the system is always in PI control without using the mode switch function, the speed of the motor may overshoot or undershoot due to torque saturation at the time of the acceleration or deceleration of the motor. The mode switch function suppresses torque saturation and eliminates the overshooting or undershooting of the speed of the motor.



5

Speed Reference Used as Detection Point

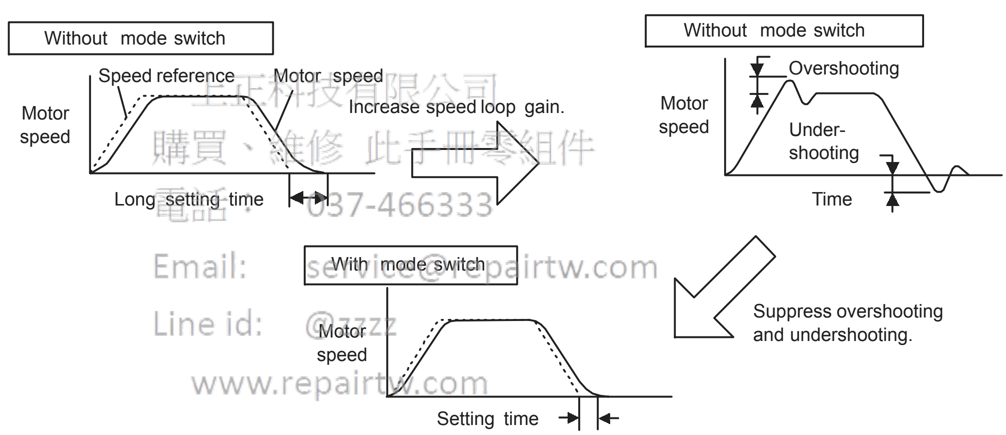
With this setting, if a speed reference exceeds the value set in parameter Pn10D, the speed loop switches to P control.



◀ EXAMPLE ▶

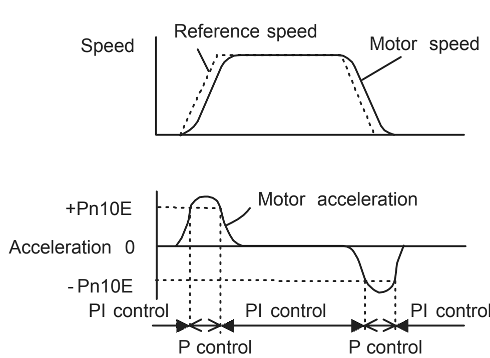
Operating Example

In this example, the mode switch is used to reduce setting time. Generally, speed loop gain must be increased to reduce setting time. Using the mode switch suppresses the occurrence of overshooting and undershooting when speed loop gain is increased.



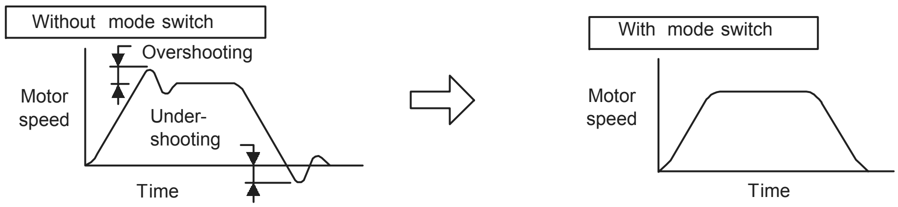
Acceleration Used as Detection Point

If motor acceleration exceeds the value set in parameter Pn10E, the speed loop switches to P control.



◀ EXAMPLE ▶ Operating Example

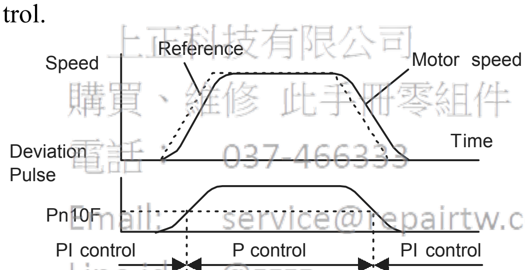
If the system is always in PI control without using the mode switch function, the speed of the motor may overshoot or undershoot due to torque saturation at the time of the acceleration or deceleration of the motor. The mode switch function suppresses torque saturation and eliminates the overshooting or undershooting of the speed of the motor.



Error Pulse Used as Detection Point

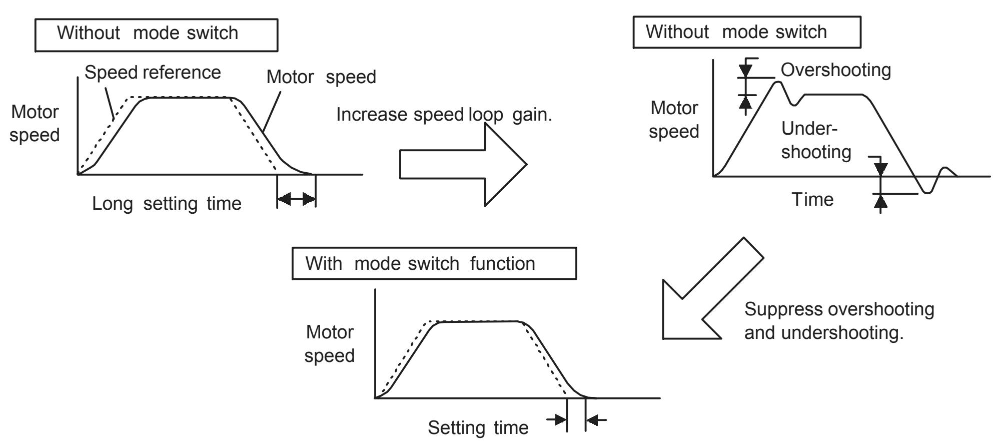
This setting is enabled for position control operation only.

If an error pulse exceeds the value set in parameter Pn10F, the speed loop switches to P control.



◀ EXAMPLE ▶ Operating Example

In this example, the mode switch is used to reduce setting time. Generally, speed loop gain must be increased to reduce setting time. Using the mode switch suppresses the occurrence of overshooting and undershooting when speed loop gain is increased.



5.2.6 Speed Feedback Compensation

Speed-feedback compensation is not available in a SERVOPACK with a capacity of 22 kW or more.

5.3 Autotuning

Autotuning is not available in a SERVOPACK with a capacity of 22 kW or more.

5.4 Servo Gain Adjustments

This section describes information on the basic rules of gain adjustments in the SERVOPACK, adjustment methods in a variety of cases, and reference set values.

5.4.1 Servo Gain Parameters

The following parameters must be set properly for servo gain adjustments.

- Pn100: Speed loop gain
- Pn101: Speed loop integral time constant
- Pn102: Position loop gain
- Pn401: Torque reference filter time constant

If the SERVOPACK is used in the speed control mode with the analog voltage reference, the position loop is controlled by the host device. Therefore, position loop gain is adjusted through the host device.

If the host is not available for adjustments of position loop gain, set the speed reference input gain in parameter Pn300. If the set value is improper, the servomotor may not run at top speed.

5.4.2 Basic Rules of Gain Adjustment

The servo system consists of three feedback loops (i.e., position loop, speed loop, and current loop). The innermost loop must have the highest response speed and the middle loop must have higher response speed than the outermost. If this principle is not followed, it will result in vibration or poor responsiveness.

The SERVOPACK is designed to ensure that the current loop has good response performance. The user need only adjust position loop and speed loop gain.

The servo system block diagram consists of the position, speed, and current loops, as shown below.

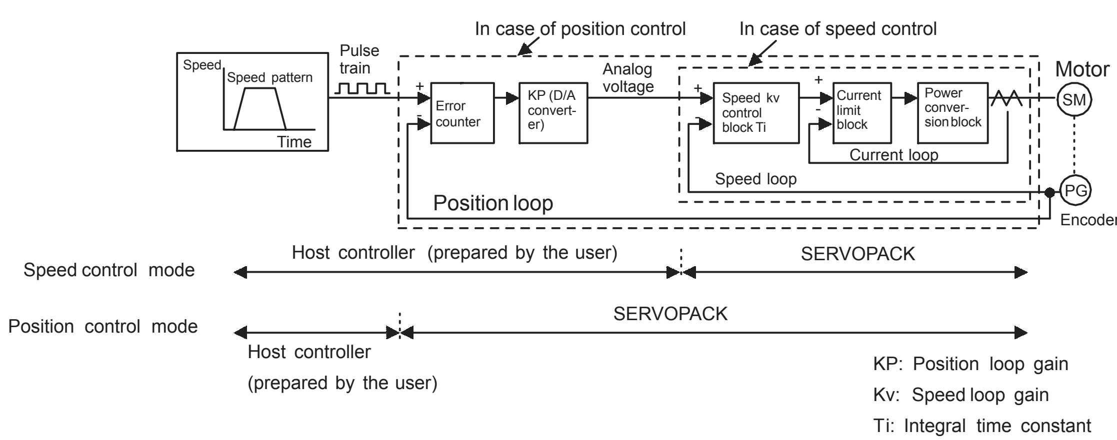


Fig. 5.1 Servo System Block Diagram

Generally speaking, the responsiveness of the position loop cannot be higher than that of the speed loop. Therefore, to increase the position loop gain, you must first increase the speed loop gain. If only the position loop gain is increased, oscillation will result in the speed reference and positioning time will increase, not decrease.

Position loop gain can be increased only to the point where oscillation begins in the mechanical system.

- If the position loop response is faster than the speed loop response, speed reference output from the position loop cannot follow the position loop response due to the slow speed loop response. Therefore, smooth linear acceleration or deceleration will not be possible and the position loop will keep accumulating errors, thus increasing the amount of speed reference output.

  As a result, the motor speed will be excessive and the position loop will try decreasing the amount of speed reference output. The speed loop responsiveness will be poor, however, and the motor will not be able to catch up with the speed reference. As a result, the speed reference will oscillate as shown in the following graph.

  If this happens, reduce the position loop gain or increase the speed loop gain to prevent the speed reference from oscillating.

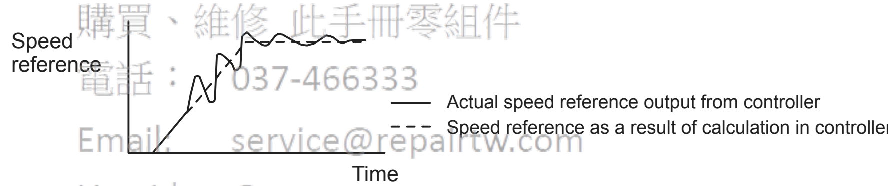


Fig. 5.2 Speed Reference with Position Loop Gain and Speed Loop Responsiveness Not Well-balanced

- The position loop gain must not exceed the natural frequency of the mechanical system. For example, if the mechanical system is an articulated robot, the rigidity of the machinery mechanism is very low because the mechanism incorporates a wave reduction gear and the natural frequency of the mechanical system is 10 to 20 Hz. In this case, the position loop gain can be set to 10 to 20 (1/s).

  If the mechanical system is a chip mounting machine, IC bonding machine, or high-precision machining tool, the natural frequency of the system is 70 Hz or more. Therefore, the position loop gain can be set to 70 (1/s) or higher.

- When high responsiveness is required, it is not only important to ensure the responsiveness of the servo system that is employed (the controller, SERVOPACK, motor, and encoder), but it is also necessary to ensure that the mechanical system have high rigidity.

5.4.3 Making Manual Adjustments

■ Speed Control

Required Parameters

The following parameters are used.

- Speed Loop Gain (Pn100)

  This parameter is used for determining the response speed of the speed loop. The response speed increases if the constant is set to a large value provided that the mechanical system does not vibrate. The value of speed loop gain is the same as the set value of Pn100 if the inertia ratio set in Pn103 is correct.

  Speed loop gain Kv = Set value of Pn100 (Hz)

  Set Pn103 to the following value.

$$\text{Pn103 set value} = \frac{\text{Motor axis conversion load moment of inertia } (J_L)}{\text{Servomotor rotor moment of inertia } (J_M)} \times 100\ (\%)$$

- Speed Loop Integral Time Constant (Pn101)

  The speed loop has an integral element so that the speed loop can respond to minute inputs. This integral element delays the operation of the servo system, so a longer positioning setting time is required with slower response speed as the value of the time constant increases.

  If the load moment of inertia is large or the mechanical system is likely to vibrate, make sure that the speed loop integral time constant is large enough; otherwise the mechanical system will vibrate. The following formula is the standard.

$$\mathrm{Ti} \geq 2.3 \times \frac{1}{2\pi \times \mathrm{Kv}}$$

  Ti: Integral time constant [s]

  Kv: Speed loop gain (calculated from the above) [Hz]

- Torque Reference Filter Time Constant (Pn401)

  If the mechanical system uses ball screws, torsion resonance may result, in which case the oscillation noise will be a high-pitched tone. The oscillation may be stopped by increasing the time constant of the torque reference filter. Like the integral time constant, this filter causes a delay in the operation of the servo system. Therefore, this constant must not be set to an excessively large value.

- Speed Reference Input Gain (Pn300)

  Changing the speed reference input gain set in Pn300 is equivalent to changing the position loop gain. In other words, an increase in the speed reference input gain set in Pn300 is equivalent to a decrease in the position loop gain and vice versa. Use this parameter in the following cases.

- When the host controller does not have a function for adjusting the position loop gain.

  (The host incorporates a D/A converter to change the number of bits but cannot make fine adjustments of position loop gain.)

- When it is necessary to clamp the full range of the speed reference output of the host device to a specified rotation speed.

In normal operation, the factory-set value can be used as it is.

INFO

If the SERVOPACK is used for speed control, the position loop gain set in Pn102 is enabled in zero-clamp mode only. In normal control operation, change the position loop gain through the host or change the speed reference input gain in Pn300 in the SERVOPACK. The position loop gain remains the same if the setting in Pn102 is changed.

Adjustment Procedure

1. Set the position loop gain to a comparatively low value in the host device. Then increase the speed loop gain set in Pn100 to within a range where there is no noise or oscillation resulting.

   If the position loop gain cannot be changed through the host device, increase the speed reference input gain set in Pn300 to a larger value.

2. Decrease the speed loop gain a little from the value set in step 1. Then increase the position loop gain through the host controller to within a range where there is no noise or oscillation resulting.

   As in step 1., decrease the set value of Pn300 if the position loop gain cannot be changed through the host device.

3. Set the speed loop integral time constant in Pn101 while observing the positioning setting time and the vibration of the mechanical system. If the constant is too large, positioning setting time will be long.

4. Set the torque reference filter to a small value in Pn401 if the mechanical system does not have shaft torsion resonance. If the mechanical system generates oscillation noise in a high-pitched tone, shaft torsion resonance may be occurring. In that case, set Pn401 to a larger value.

5. Finally, progressively make fine adjustments to parameters such as the position loop gain, speed loop gain, and integral time constant to find the optimal points.

■ Position Control

Required Parameters

The following parameters are used.

- Speed Loop Gain (Pn100)

  This parameter is used for determining the response speed of the speed loop. The response speed increases if the constant is set to a large value provided that the mechanical system does not vibrate. The value of speed loop gain is the same as the set value of Pn100 if the inertia ratio set in Pn103 is correct.

  Speed loop gain Kv = Set value of Pn100 (Hz)

  Set Pn103 to the following value.

$$\text{Pn103 set value} = \frac{\text{Motor axis conversion load moment of inertia } (J_L)}{\text{Servomotor rotor moment of inertia } (J_M)} \times 100\ (\%)$$

- Speed Loop Integral Time Constant (Pn101)

  The speed loop has an integral element so that the speed loop can respond to minute inputs. This integral element delays the operation of the servo system, so a longer positioning setting time is required with slower response speed as the value of the time constant increases.

  If the load moment of inertia is large or the mechanical system is likely to vibrate, make sure that the speed loop integral time constant is large enough; otherwise the mechanical system will vibrate. The following formula is the standard.

$$Ti \geq 2.3 \times \frac{1}{2\pi \times Kv}$$

  Ti: Integral time constant [s]

  Kv: Speed loop gain (calculated from the above) [Hz]

- Torque Reference Filter Time Constant (Pn401)

  If the mechanical system uses ball screws, torsion resonance may result, in which case the oscillation noise will be a high-pitched tone. The oscillation may be stopped by increasing the time constant of the torque reference filter. Like the integral time constant, this filter causes a delay in the operation of the servo system. Therefore, this constant must not be set to an excessively large value.

- Position Loop Gain (Pn102)

  The responsiveness of the servo system is determined by the position loop gain. The response speed increases if the position loop gain is set to a high value, so the time required for positioning will be shortened. In order to set the position loop gain to a high value, the rigidity and natural frequency of the mechanical system must be high.

  The responsiveness of the whole servo system may become unstable if only the position loop gain is increased, because the speed reference as output from the position loop is likely to become unstable. Increase the speed loop gain while observing the response.

Adjustment Procedure

1. Set the position loop gain to a comparatively low value. Then increase the speed loop gain set in Pn100 to within a range where there is no noise or oscillation resulting.
2. Decrease the speed loop gain a little from the value set in step 1. Then increase the position loop gain to within a range where there is no overshooting or oscillation resulting.
3. Set the speed loop integral time constant in Pn101 while observing the positioning setting time and the vibration of the mechanical system. If the constant is too large, positioning setting time will be long.
4. Set the torque reference filter to a small value in Pn401 if the mechanical system does not have shaft torsion resonance. If the mechanical system generates oscillation noise in a high-pitched tone, shaft torsion resonance may be resulting. In that case, set Pn401 to a larger value.
5. Finally, progressively make fine adjustments to parameters such as the position loop gain, speed loop gain, and integral time constant to find the optimal points.

■ Function to Improve Response Characteristics

The mode switch, feed-forward, and bias functions can improve the response characteristics of the servo system only if they are used properly. If they are used improperly, they will worsen the response characteristics. Refer to the following instructions and make adjustments to these functions while observing the change in the actual response characteristics.

Mode Switch

Use the mode switch function in order to improve the saturation characteristics of the servo system if there is torque reference saturation at the time of acceleration or deceleration of the servomotor. If an appropriate value is set with this function, the speed loop in PI (proportional and integral) control is switched over to P (proportional) control when the operation speed exceeds the set value.

Feed-forward Functions

The responsiveness is increased by using one of the feed-forward functions. A feed-forward function is not so effective, however, if the position loop gain is set to a high enough value. Adjust the feed-forward set value of Pn109 as described below.

1. Adjust the speed loop and position loop according to the method described on *page 5-20*.

2. Gradually increase the set value of Pn109 so that the positioning completion signal (/COIN) will be output quickly.

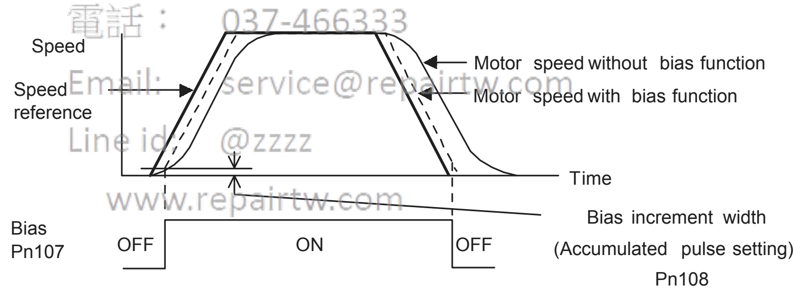
   Make sure that the positioning completion signal (/COIN) is not broken (i.e., turned ON and OFF repeatedly within a short period) and that speed overshooting does not result. These are likely to occur if the feed-forward value is too high.

   It is possible to add a primary delay filter (to be set in Pn10A) to the feed-forward function. The primary delay filter may prevent the positioning completion signal from breaking and the system speed from overshooting.

Bias Function

This function adds the bias set in Pn107 to the output (i.e., speed reference) of the error counter if the number of accumulated pulses of the error counter exceeds the bias increment width set in Pn108 and stops adding the bias if the output is within the bias increment width. As a result, the number of accumulated pulses of the error counter decreases and the time required for positioning can be shortened.

If the bias set value of Pn107 is too large, the motor rotation will be unstable. The optimum bias value varies with the load, gain, and bias increment width. Make bias adjustments while observing the response. When not using this function, set Pn107 to 0.



5.4.4 Gain Setting Reference Values

This section describes information on servo gain values as reference for making gain adjustments.

Refer to the following for standards for gain adjustments according to the rigidity of the mechanical system. Refer to these values and use the previously mentioned methods to make gain adjustments. These values are for reference only and do not mean that the mechanical system has good response characteristics or is free from oscillation in the specified ranges.

Observe the response by monitoring the response waveform and make the optimum gain adjustments. If the rigidity of the machinery is high, further gain increments exceeding the described ranges are possible.

■ Machines with High Rigidity

These machines are directly connected to ball screws.

Example: Chip mounting machine, bonding machine, high-precision machine tool

Position Loop Gain (Pn102) [1/s]	Speed Loop Gain (Pn100) [Hz]	Speed Loop Integral Time Constant (Pn101) [ms]
50 to 70	50 to 70	5 to 20

■ Machines with Medium Rigidity

These machines are driven by ball screws through speed reducers or long-length machines directly driven by screws.

Examples: General machining tool, transverse robot, and conveyor

Position Loop Gain (Pn102) [1/s]	Speed Loop Gain (Pn100) [Hz]	Speed Loop Integral Time Constant (Pn101) [ms]
30 to 50	30 to 50	10 to 40

■ Machines with Low Rigidity

These machines are driven by timing belts or chains or machines with wave reduction gears.

Example: Conveyor and articulated robot

Position Loop Gain (Pn102) [1/s]	Speed Loop Gain (Pn100) [Hz]	Speed Loop Integral Time Constant (Pn101) [ms]
10 to 20	10 to 20	50 to 120

IMPORTANT

If the inertia ratio is a little larger than 10 times its rated value, start gain adjustments with the position and speed loop gains slightly below the above corresponding ranges and the speed loop integral constant slightly exceeding the above corresponding range. If the inertia ratio is much larger, start the gain adjustments with the position and speed loop gains set to the smallest values and the speed loop integral constant to the largest value in the above corresponding ranges.

In speed control operation, the position loop gain is set through the host device. If that is not possible, adjust the position loop gain with the speed reference input gain in Pn300 in the SERVOPACK. In speed control operation, the position loop gain set in Pn102 is enabled in zero-clamp mode only. Position loop gain K_P is obtainable from the following.

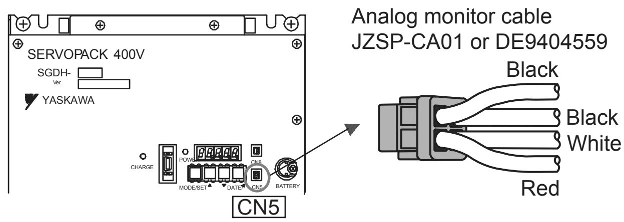
$$Kp \geq \frac{Vs}{\varepsilon}$$

- Kp (1/S): Position Loop Gain
- Vs (PPS): Constant Speed Reference
- ε (Pulse): Constant error: The number of accumulated pulses of the error counter at the above constant speed.

5.5 Analog Monitor

The analog monitor can observe a variety of signals through analog voltages.

Analog monitor signals must be observed through the CN5 connector using JZSP-CA01 or DE9404559 dedicated cable.



Cable Color	Signal Name	Description
White	Analog monitor 1	Torque reference: 1 V/100% rated torque
Red	Analog monitor 2	Motor speed: 1 V/1000 min^{-1}
Black (two wires)	GND (0 V)	-

Analog monitor signals can be selected with parameters Pn003.0 and Pn003.1.

Pn003.0	Analog Monitor 1	Factory Setting: 2	Speed/Torque Control, Position Control
Pn003.1	Analog Monitor 2	Factory Setting: 0	Speed/Torque Control, Position Control

The following monitor signals can be observed.

Setting in Pn003.0 and Pn003.1	Contents	
	Monitor signal	Observation gain
0	Motor speed	1 V/1000 min^{-1}
1	Speed reference	1 V/1000 min^{-1}
2	Torque reference	1 V/100% rated torque
3	Position error	0.05 V/1 reference unit
4	Position error	0.05 V/100 reference units
5	Reference pulse speed frequency (converted to min^{-1})	1 V/1000 min^{-1}
6	Motor speed	1 V/250 min^{-1}
7	Motor speed	1 V/125 min^{-1}
8 to E	Reserved monitor signal	-

Note: In the case of torque control or speed control, the monitor signal of position error monitor signal is indefinite.

INFO

The output voltage of the analog monitor is ±8 V max. The output voltage will be reversed if ±8 V is exceeded.

6

Using the Digital Operator

This chapter describes the basic operation of the Digital Operator and the features it offers. All constant settings and motor operations can be executed by simple, convenient operations. Operate the Digital Operator as you read through this chapter.

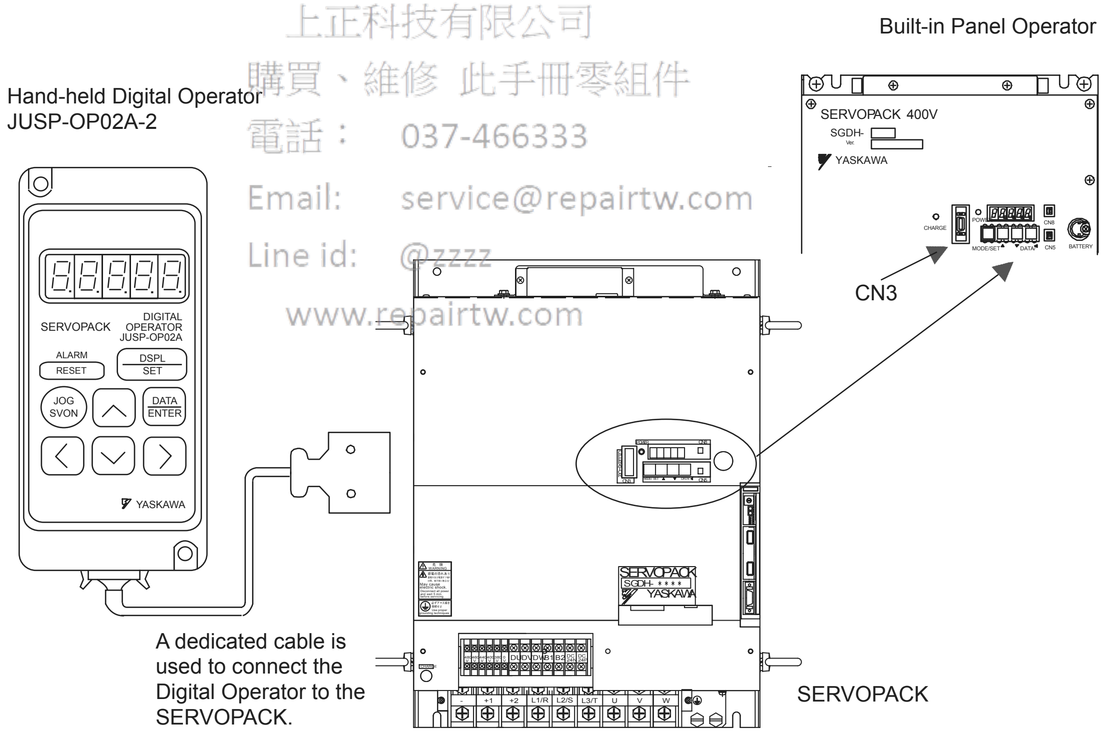
6.1 Basic Operation

This section provides information on the basic operation of the Digital Operator for setting operating conditions.

6.1.1 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 SERVOPACK. This type of Digital Operator is also called a Panel Operator. The other one is a Hand-held Operator (i.e., the JUSP-OP02A-2 Digital Operator), which can be connected to the SERVOPACK through connector CN3 of the SERVOPACK.

Refer to the following illustrations to connect the Hand-held Digital Operator to the SERVOPACK. There is no need to turn OFF the SERVOPACK to connect this Hand-held Operator to the SERVOPACK.



IMPORTANT

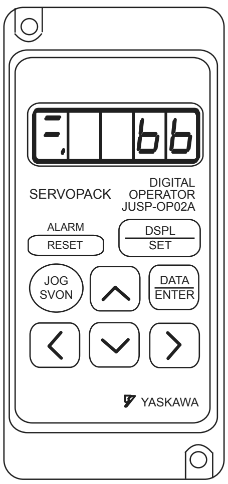
If the Hand-held Digital Operator is connected to the SERVOPACK, the built-in Panel Operator does not display anything.

6.1.2 Functions

The Digital Operator can be used parameter settings, operating references, and status displays.

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

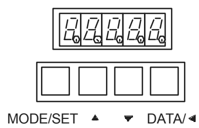
Hand-held Digital Operator



Key	Name		Function
ALARM RESET	RESET Key		Press this key to reset the servo alarm.
DSPL SET	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	DATA/ENTER Key		Press this key to set each parameter or display the set value of each parameter.
	Value Change/JOG Key	Up Cursor Key	Press this key to increase the set value. This key is used as a forward start key in JOG operation.
		Down Cursor 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 Cursor Key	• Press this key to select the digit to be changed. The selected digit flashes. • Press the Right Cursor Key to shift to the next digit on the right. • Press the Left Cursor Key to shift to the next digit on the left.
		Left Cursor Key	
JOG SVON	SVON Key		Press this key to perform the JOG operation with the Digital Operator.

6

Built-in
Panel Operator



Key	Name	Function
▲	Up Cursor Key	• Press this key to set parameters or display the set values of parameters. • Press the Up Cursor Key to increase the set value. • Press the Down Cursor Key to decrease the set value. • Press the Up and Down Cursor Keys together to reset a servo alarm.
▼	Down Cursor Key	
MODE/SET	MODE/SET Key	Press this key to select the status display mode, auxiliary function mode, parameter setting mode, or monitor mode.
DATA/◄	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.

6.1.3 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.

■ Using the Built-in Panel Operator

Press the Up and Down Cursor Keys together in status display mode.

The alarm can be reset with CN1-44, or /ALM-RST signal input. Refer to *4.5.1 Using Servo Alarm and Alarm Code Outputs*.

The servo alarm need not be reset if the control power supply is turned OFF.

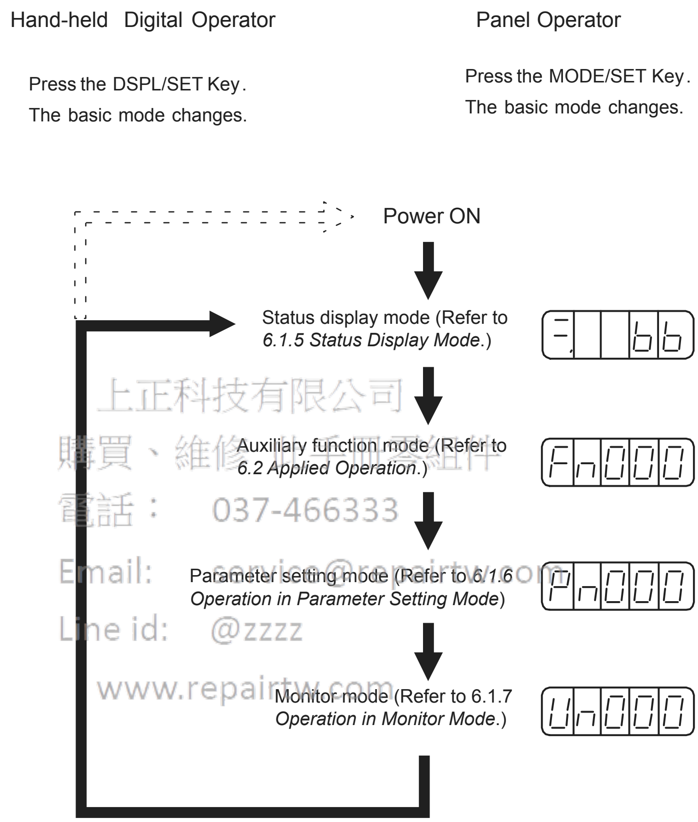
IMPORTANT

If an alarm is ON, reset the alarm after eliminating the cause of the alarm. Refer to *8.2 Troubleshooting*.

6.1.4 Basic Mode Selection

The basic mode selection of the Digital Operator is used for indicating the status of the SERVOPACK in operation and setting a variety of parameters and operation references.

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



6

6.1.5 Status Display Mode

In status display mode, bit data and codes are displayed to indicate the status of the SERVOPACK.

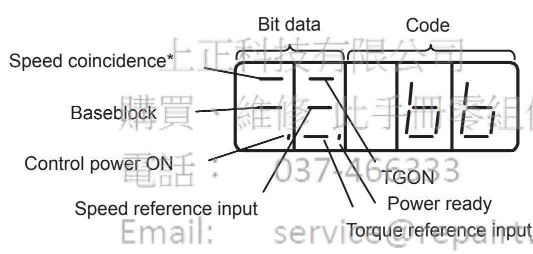
■ Selecting Status Display Mode

The Digital Operator goes into status display mode when the Digital Operation is turned ON.

■ Items Indicated in Status Display Mode

The displayed contents in the status display mode are different for the speed and torque control mode and the position control mode.

Speed and Torque Control Mode



* This indicator is always lit when the SERVOPACK is in torque control mode.

The following tables list bit data items, codes, and their meanings.

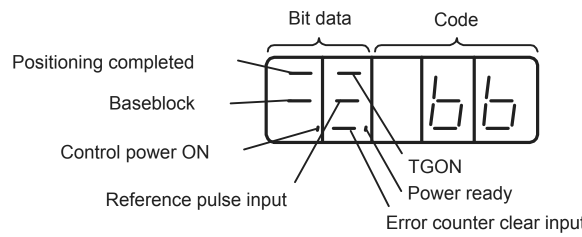
Table 6.1 Bit Data and Meanings in Speed and Torque Control Mode

Bit Data	Meaning
Control Power ON	Lit when the SERVOPACK control power is ON.
Baseblock	Lit for baseblock. Not lit when servo is ON.
Speed Coincidence	Lit when the difference between the motor speed and reference speed is the same as or less than the value set. Preset value: Set in Pn503 (10 min^{-1} is standard setting)
/TGON	Lit if motor speed exceeds preset value. Not lit if motor speed is below preset value. Preset value: Set in Pn502 (20 min^{-1} is standard setting)
Speed Reference Input	Lit if input speed reference exceeds preset value. Not lit if input speed reference is below preset value. Preset value: Set in Pn502 (20 min^{-1} is standard setting)
Torque Reference Input	Lit if input torque reference exceeds preset value. Not lit if input torque reference is below preset value. Preset value: 10% rated torque is standard setting.
Power Ready	Lit when main power supply circuit is normal. Not lit when power is OFF.

Table 6.2 Codes and Meanings in Speed and Torque Control Mode

Code	Meaning
bb	Baseblock Servo OFF (motor power OFF)
run	Run Servo ON (motor power ON)
Pot	Forward Run Prohibited CN1-42 (P-OT) is OFF. Refer to *4.1.2 Setting the Overtravel Limit Function*.
not	Reverse Run Prohibited CN1-43 (N-OT) is OFF. Refer to *4.1.2 Setting the Overtravel Limit Function*.
A.02	Alarm Status Displays the alarm number. Refer to *8.2 Troubleshooting*.
A.03 :	

Position Control Mode



The following tables list bit data items, codes, and their meanings.

Table 6.3 Bit Data and Meanings in Position Control Mode

Bit Data	Meaning
Control Power ON	Lit when the SERVOPACK control power is ON.
Baseblock	Lit for baseblock. Not lit when servo is ON.
Positioning Completed	Lit if error between position reference and actual motor position is below preset value. Not lit if error between position reference and actual motor position exceeds preset value. Preset value: Set in Pn500 (7 pulses are standard setting)
/TGON	Lit if motor speed exceeds preset value. Not lit if motor speed is below preset value. Preset value: Set in Pn502 (20 min^{-1} is standard setting)
Reference Pulse Input	Lit if reference pulse is input. Not lit if no reference pulse is input.
Error Counter Clear Input	Lit when error counter clear signal is input. Not lit when error counter clear signal is not input.
Power Ready	Lit when main power supply circuit is normal. Not lit when power is OFF.

Table 6.4 Codes and Meanings in Position Control Mode

Code	Meaning
bb	Baseblock Servo OFF (motor power OFF)
run	Run Servo ON (motor power ON)
Pot	Forward Run Prohibited CN1-42 (P-OT) is OFF. Refer to *4.1.2 Setting the Overtravel Limit Function*.
not	Reverse Run Prohibited CN1-43 (N-OT) is OFF. Refer to *4.1.2 Setting the Overtravel Limit Function*.
A.02	Alarm Status Displays the alarm number. Refer to *8.2 Troubleshooting*.
A.03 :	

6.1.6 Operation in Parameter Setting Mode

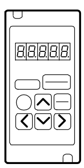
Functions can be selected or adjusted by setting parameters. There are two types of parameters. One type requires value setting and the other requires function selection. These two types use different setting methods.

With value setting, a parameter is set to a value within the specified range of the parameter. With function selection, the functions allocated to each digit of the seven-segment LED panel indicator (five digits) can be selected. Refer to *Appendix A List of Parameters*.

■ Changing Parameter Settings

The parameter settings can be used for changing parameter data. Check the permitted range of the parameters in *Appendix A List of Parameters*, before changing the data.

The example below shows how to change parameter Pn507 from 100 to 85.



Using the Hand-held Digital Operator

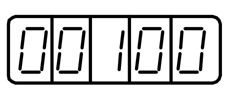
1. Press DSPL/SET Key to select the parameter setting mode.

2. Select the parameter number to be set. (Pn507 is selected in this example.)

   Press the Left or Right Cursor Key to select the digit. The selected digit will flash.

   Press the Up or Down Cursor Key to change the value.

3. Press the DATA/ENTER Key to display the current data for the parameter selected at step 2.



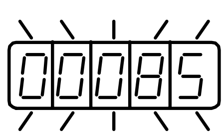
4. Change to the required data.

   Press the Left or Right Cursor Key to select the digit. The selected digit will flash.

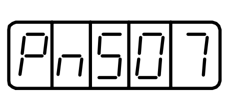
   Press the Up or Down Cursor Key to change the value.

   Continue pressing the key until “00085” is displayed.

5. Press the DATA/ENTER Key to store the data. The display will flash.

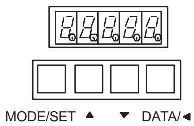


6. Press the DATA/ENTER Key once more to return to the parameter number display.



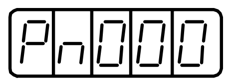
This has changed the setting of the parameter Pn507 from 100 to 85.

Repeat steps 2. to 6. as often as required.

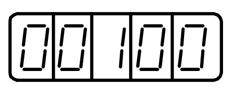


Using the Panel Operator

1. Press the MODE/SET Key to select the parameter setting mode.

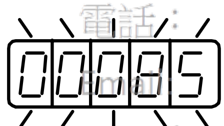


2. Press the Up or Down Cursor Key to select the parameter number to set. (Pn507 is selected in this example.)
3. Press the DATA/SHIFT Key for a minimum of one second to display the current data for the parameter selected at step2.



4. Press the Up or Down Cursor Key to change to the desired value of “00085.”

   As you keep pressing the Up or Down Cursor Key, and the display changes faster.
5. Press the DATA/SHIFT Key for a minimum of one second to save the data. The display will flash.



6. Press the DATA/SHIFT Key once more for a minimum of one second to return to the parameter number display.

This has changed the setting of the parameter Pn507 from 100 to 85.

Repeat steps 2. to 6. as often as required.

IMPORTANT

Press the DATA/SHIFT Key for a maximum of one second to shift to a higher (left) digit.

INFO

Parameter numbers that are not defined are skipped during Operator operations.

■ Function Selection Parameters

Types of Function Selection Parameters

The following table shows the parameters used for selecting SERVOPACK functions.

Category	Parameter No.	Name	Factory Setting	Remarks
Function Selection Constants	Pn000	Function Selection Basic Switches	0000	(See 1.)
	Pn001	Function Selection Application Switches 1	0000	(See 1.)
	Pn002	Function Selection Application Switches 2	0000	(See 1.)
	Pn003	Function Selection Application Switches 3	0002	
Gain-related Constants	Pn10B	Gain-related Application Switches	0000	(See 2.)
Position Control-related Constant	Pn200	Position Control Reference Selection Switches	0000	(See 1.)
Sequence-related Constants	Pn50A	Input Signal Selections 1	2100	(See 1.)
	Pn50B	Input Signal Selections 2	6543	(See 1.)
	Pn50C	Input Signal Selections 3	8888	(See 1.)
	Pn50D	Input Signal Selections 4	8888	(See 1.)
	Pn50E	Output Signal Selections 1	3211	(See 1.)
	Pn50F	Output Signal Selections 2	0000	(See 1.)
	Pn510	Output Signal Selections 3	0000	(See 1.)

6

IMPORTANT

1. After changing these parameters, turn OFF the main circuit and control power supplies and then turn them ON again to enable the new settings.
2. Pn10B.1 require the power to be reset as mentioned above.

Parameter settings are displayed in two patterns as shown below.

Parameters for function selection	n.0000	Hexadecimal display for each digit
Parameters for constant settings	00100	Decimal display in five digits

Since each digit in the function selection parameters has a significant meaning, the value can only be changed for each individual digit. Each digit displays a value within its own setting range.

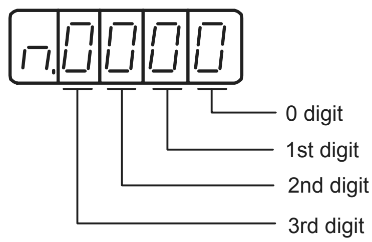
Definition of Display for Function Selection Parameters

Each digit of the function selection parameters has a unique meaning.

For example, the rightmost digit of parameter Pn000 is expressed as “Pn000.0”.

IMPORTANT

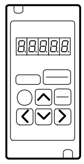
Each digit of the function selection parameters is defined as shown below. The parameter display example shows how parameters are displayed in digits for set values.



How to Display Parameters

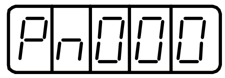
Pn000.0	:	Indicates the value for the 0 digit of parameter Pn000
Pn000.1	:	Indicates the value for the 1st digit of parameter Pn000
Pn000.2	:	Indicates the value for the 2nd digit of parameter Pn000
Pn000.3	:	Indicates the value for the 3rd digit of parameter Pn000

■ Changing Function Selection Parameter Settings



Using the Hand-held Digital Operator

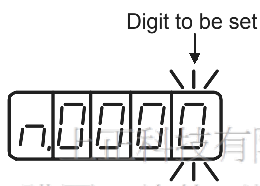
1. Press DSPL/SET Key to select the parameter setting mode.



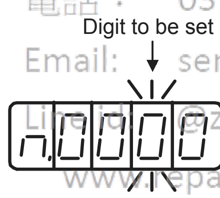
2. Select the parameter number to be set.

   Press the Left or Right Cursor Key to select the digit. The selected digit will flash. Press the Up or Down Key to change the value. (Pn000 is selected in this example.)

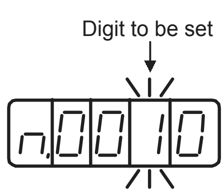
3. Press the DATA/ENTER Key to display the current data of the parameter selected in the above step 2.



4. Press the Left or Right Cursor Key to select the digit.

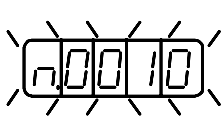


5. Press the Up or Down Cursor Key to select the value defined as a function setting for the selected digit.

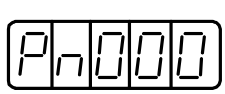


   Repeat the above steps 4. and 5. for changing the data as required.

6. Press the DATA/ENTER Key to save the data. The display will flash.

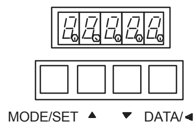


7. Press the DATA/ENTER Key once more to return to the parameter number display.



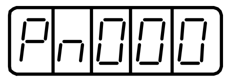
   This has changed the 1st digit of parameter Pn000 to “1.”

6

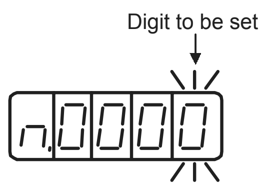


Using the Panel Operator

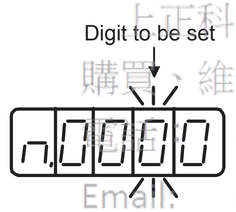
1. Press the MODE/SET Key to select the parameter setting mode.



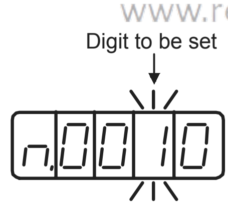
2. Press the Up or Down Cursor Key to select the parameter number to set. (Pn000 is selected in this example.)
3. Press the DATA/SHIFT Key for a minimum of one second to display the current data for the selected parameter.



4. Press the DATA/SHIFT Key to select the digit to be set.

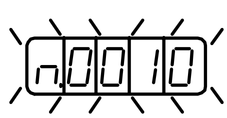


5. Press the Up or Down Cursor Key to select the value defined as a function setting for the selected digit.



Repeat the above steps 4. and 5. for changing the data as required.

6. Press the DATA/SHIFT Key for a minimum of one second to save the data. The display will flash.



7. Press the DATA/SHIFT Key once more for a minimum of one second to return to the parameter number display.

This has changed the 1st digit of parameter Pn000 to "1."

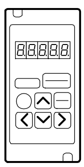
6.1.7 Operation in Monitor Mode

The monitor mode can be used for monitoring the reference values, I/O signal status, and SERVOPACK internal status.

The monitor mode can be set during motor operation.

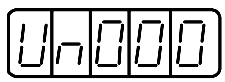
■ Using the Monitor Mode

The example below shows how to display 1500, the contents of monitor number Un000 when the servomotor rotates at 1500 min^{-1}.

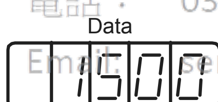


With the Hand-held Digital Operator

1. Press the DSPL/SET Key to select the monitor mode.

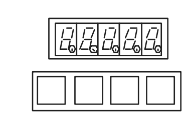


2. Press the Up or Down Cursor Key to select the monitor number to be displayed.
3. Press the DATA/ENTER Key to display the data for the monitor number selected in the above step 2.



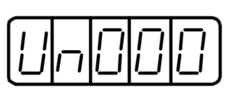
4. Press the DATA/ENTER Key once more to return to the monitor number display.

This completes the example procedure for displaying 1500, the contents of monitor number Un000.

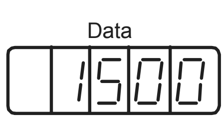


Using the Panel Operator

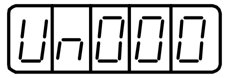
1. Press the MODE/SET Key to select the monitor mode.



2. Press the Up or Down Cursor Key to select the monitor number to be displayed.
3. Press the DATA/SHIFT Key for a minimum of one second to display the data for the monitor number selected in the above step2.



4. Press the DATA/SHIFT Key once more for a minimum of one second to return to the monitor number display.



This completes the example procedure for displaying 1500, the contents of monitor number Un000.

■ Contents of Monitor Mode Display

The following table shows contents of the monitor mode display.

Monitor Number	Monitor Display	Unit	Remarks
Un000	Actual motor speed	min^{-1}	
Un001	Input speed reference	min^{-1}	*3
Un002	Internal torque reference	%	Value for rated torque
Un003	Rotation angle 1	pulses	Number of pulses from the origin
Un004	Rotation angle 2	deg	Angle (electrical angle) from the origin
Un005	Input signal monitor	-	*1
Un006	Output signal monitor	-	*1
Un007	Input reference pulse speed	min^{-1}	*4
Un008	Error counter value	reference units	Positional error*4
Un009	Accumulated load rate	%	Value for the rated torque as 100%. Displays effective torque in 10-s cycle.
Un00A	Regenerative load rate	%	Value for the processable regenerative power as 100%. Displays regenerative consumption power in 10-s cycle.
Un00B	Power consumed by DB resistance	%	Value for the processable power when dynamic brake is applied as 100%. Displays DB power consumption in 10-s cycle.
Un00C	Input reference pulse counter	-	In hexadecimal*2, *4
Un00D	Feedback pulse counter	-	In hexadecimal

* 1. Refer to *Sequence I/O Signal Monitor Display* on the next page.
* 2. Refer to *Reference Pulse/Feedback Pulse Counter Monitor Display*.
* 3. Displayed only in speed control mode.
* 4. Displayed only in position control mode.

■ Sequence I/O Signal Monitor Display

The following section describes the monitor display for sequence I/O signals.

Input Signal Monitor Display

Top: OFF ("H" level)
Bottom: ON ("L" level)

8 7 6 5 4 3 2 1 Number

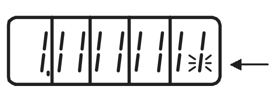
LED Number	Input Terminal Name	Factory Setting
1	SI0 (CN1-40)	/S-ON
2	SI1 (CN1-41)	/P-CON
3	SI2 (CN1-42)	P-OT
4	SI3 (CN1-43)	N-OT
5	SI4 (CN1-44)	/ALM -RST
6	SI5 (CN1-45)	/P-CL
7	SI6 (CN1-46)	/N-CL
8	(CN1-4)	SEN

Note: Refer to *4.3.3 Input Circuit Signal Allocation* for details on input terminals.

Input signals are allocated as shown above and displayed on the panel display of the SERVOPACK or the Digital Operator. They are indicated by ON/OFF display of seven-segment LEDs in top and bottom rows. These segments turn ON depending on the input signals (ON for “L” level and OFF for “H” level).

◀ EXAMPLE ▶

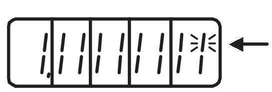
- When /S-ON signal is ON (Servo ON at “L” signal)



8 7 6 5 4 3 2 1

The bottom segment of number 1 is lit.

- When /S-ON signal is OFF

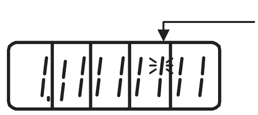


8 7 6 5 4 3 2 1

The top segment of number 1 is lit.

- When P-OT signal operates (Operates at “H” signal)

The top segment of number 3 is lit.



8 7 6 5 4 3 2 1

6

Output Signal Monitor Display

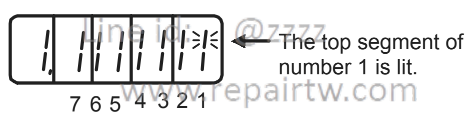
LED Number	Output Terminal Name	Factory Setting
1	(CN1-31, -32)	ALM
2	SO1 (CN1-25, -26)	/COIN or /V-CMP
3	SO2 (CN1-27, -28)	/TGON
4	SO3 (CN1-29, -30)	/S-RDY
5	(CN1-37)	AL01
6	(CN1-38)	AL02
7	(CN1-39)	AL03

Note: Refer to *4.3.4 Output Circuit Signal Allocation* for details on output terminals.

Output signals are allocated as shown above and displayed on the panel display of the SERVOPACK or the Digital Operator. They are indicated by ON/OFF display of seven-segment LEDs in top and bottom rows. These segments turn ON depending on the output signals (ON for “L” level and OFF for “H” level).

◀ EXAMPLE ▶

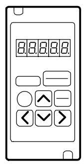
- When ALM signal operates (alarm at “H”)



■ Reference Pulse/Feedback Pulse Counter Monitor Display

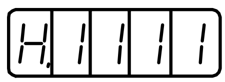
The monitor display of reference pulse counter and feedback pulse counter is expressed in 32-bit hexadecimal.

The display procedure is as follows:

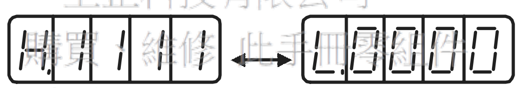


Using the Hand-held Digital Operator

1. Press the DSPL/SET Key to select the monitor mode.
2. Press the Up or Down Cursor Key to select “Un00C” or “Un00D.”
3. Press the DATA/ENTER Key to display the data for the monitor number selected in the above step 2.

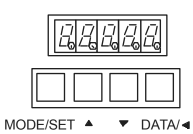


4. Press the Up or Down Cursor Key to alternately display the leftmost 16-bit data and rightmost 16-bit data.



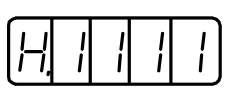
Leftmost 16-bit Data　Rightmost 16-bit Data

5. Press both the Up and Down Cursor Keys simultaneously to clear the 32-bit counter data.
6. Press the DATA/ENTER Key once more to return to the monitor number display.

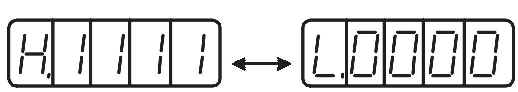


Using the Panel Operator

1. Press the MODE/SET Key to select the monitor mode.
2. Press the Up or Down Cursor Key to select “Un00C” or “Un00D.”
3. Press the DATA/SHIFT Key for a minimum of one second to display the data for the monitor number selected in the above step 2.



4. Press the Up or Down Cursor Key to alternately display the leftmost 16-bit data and rightmost 16-bit data.



Leftmost 16-bit Data　Rightmost 16-bit Data

5. Press both the Up and Down Cursor Keys simultaneously to clear the 32-bit counter data.
6. Press the DATA/SHIFT Key once more for a minimum of one second to return to the monitor number display.

6

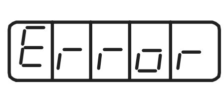
6.2 Applied Operation

This section describes how to apply the basic operations using the Digital Operator to run and adjust the motor. Read the basic operations described in *6.1 Basic Operation* before proceeding to this section.

Parameters for applied operation can be set in the auxiliary function mode. The following table shows the parameters in the auxiliary function mode.

Parameter No.	Function	Remarks
Fn000	Alarm traceback data display	
Fn001	Not available for SERVOPACKs with a capacity greater than 22 kW.	(See note.)
Fn002	JOG mode operation	
Fn003	Zero-point search mode	
Fn004	(Reserved constant)	
Fn005	Parameter settings initialization	(See note.)
Fn006	Alarm traceback data clear	(See note.)
Fn007	Not available for SERVOPACKs with a capacity greater than 22 kW.	
Fn008	Absolute encoder multiturn reset and encoder alarm reset	(See note.)
Fn009	Automatic tuning of analog (speed, torque) reference offset	(See note.)
Fn00A	Manual adjustment of speed reference offset	(See note.)
Fn00B	Manual adjustment of torque reference offset	(See note.)
Fn00C	Manual zero-adjustment of analog monitor output	(See note.)
Fn00D	Manual gain-adjustment of analog monitor output	(See note.)
Fn00E	Automatic offset-adjustment of motor current detection signal	(See note.)
Fn00F	Manual offset-adjustment of motor current detection signal	(See note.)
Fn010	Password setting (protects from parameter changes)	
Fn011	Motor models display	
Fn012	SERVOPACK software version display	
Fn013	Multiturn limit value setting change when a Multiturn Limit Disagreement alarm occurs	(See note.)
Fn014	Clear of option unit detection results	

Note: These parameters and those indicated as Pn□□□ are displayed as shown below if their passwords are set (Fn010). These parameters cannot be changed.



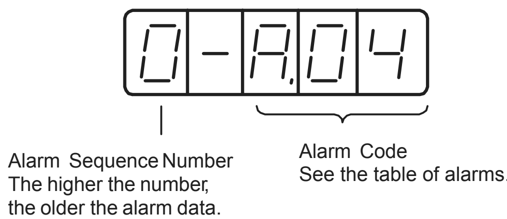
Flashing for one second

6.2.1 Operation in Alarm Traceback Mode

The alarm traceback mode can display up to ten alarms that have occurred, thus making it possible to check what kind of alarms have been generated.

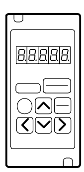
The alarm traceback data is not cleared on alarm reset. The alarm traceback data is not cleared when the SERVOPACK power is turned OFF. This does not adversely affect operation.

The data can be cleared using the special “clear alarm traceback mode.” Refer to *6.2.5 Clearing Alarm Traceback Data*.



■ Checking Alarms

Follow the procedure below to determine which alarms have been generated.

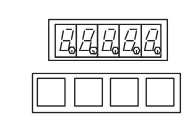


Using the Hand-held Digital Operator

1. Press the DSPL/SET Key to select the “Displaying alarm traceback data (Fn000)” in the auxiliary function mode.

2. Press the DATA/ENTER Key and the alarm traceback data will be displayed.
3. Press the Up or Down Cursor Key to scroll the alarm sequence numbers up or down and display information on previous alarms.

The higher the left-hand digit (alarm sequence number), the older the alarm data.



Using the Panel Operator

1. Press the MODE/SET Key to select the “Displaying alarm traceback data (Fn000)” in the auxiliary function mode.

2. Press the DATA/SHIFT Key for a minimum of one second to display the alarm traceback data.
3. Press the Up or Down Cursor Key to scroll the alarm sequence numbers up or down.

The higher the left-hand digit (alarm sequence number), the older the alarm data.

6

For descriptions of each alarm code, refer to *8.2 Troubleshooting*.

The following are Operator-related alarms which are not recorded in the traceback data.

CPF00	Digital Operator transmission error 1
CPF01	Digital Operator transmission error 2

The display will be as shown below while no alarm is detected.

0-A.--

INFO

Alarm traceback data will not be updated when the same alarm occurs repetitively.

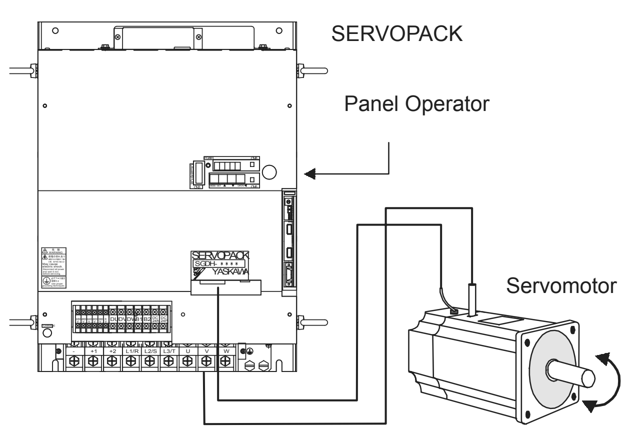
6.2.2 Controlling Operation Through the Digital Operator

⚠ CAUTION

- Forward run prohibited (P-OT) and reverse run prohibited (N-OT) signals are not effective during jog operations using parameter Fn002.

Controlling operation through the Digital Operator allows the SERVOPACK to run the motor. This allows rapid checking of motor's rotation direction and speed setting during machine set-up and testing, without the trouble of connecting a host controller.

For motor speed setting procedure, refer to *6.1.6 Operation in Parameter Setting Mode* and *4.3.2 JOG Speed*.

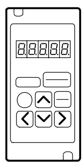


INFO

The following conditions must be satisfied to perform JOG mode operation.

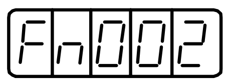
1. If the Servo-ON input signal (/S-ON) is ON, turn it OFF.
2. Release the Servo-ON signal mask if parameter Pn50A.1 is set to 7 and the Servo has been set to always be ON.

Operation procedure using the Digital Operator is described on the following pages.



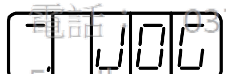
Using the Hand-held Digital Operator

1. Press the DSPL/SET Key to select Fn002 in the auxiliary function mode.

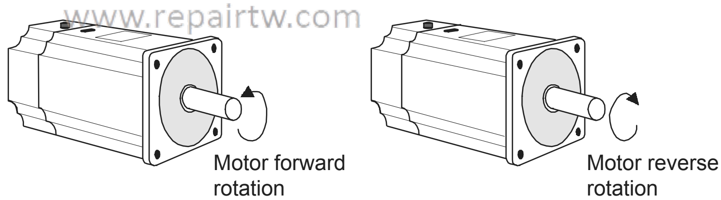


2. Press the DATA/ENTER Key to select the Digital Operator operation mode. Operation is now possible using the Digital Operator.

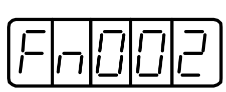
3. Press the SVON Key to set to the servo ON state (with motor power turned ON).



4. Press the Up Cursor Key or Down Cursor Key to operate the motor. The motor keeps operating while the key is pressed.

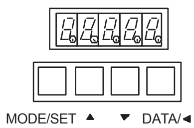


5. Press the DSPL/SET Key and the display will revert to Fn002. This sets to the servo OFF state (with motor power turned OFF). Alternatively, press the SVON Key to set to the servo OFF state.



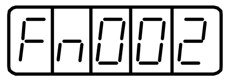
This disables operation under Digital Operator control.

6

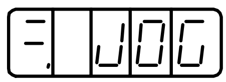


Using the Panel Operator

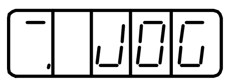
1. Press the MODE/SET Key to select Fn002 in the auxiliary function mode.



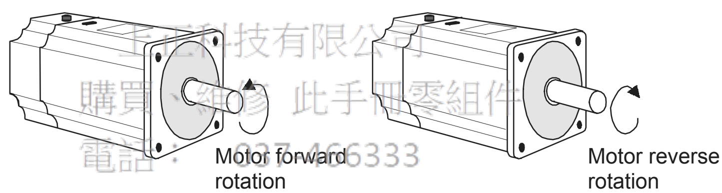
2. Press the DATA/SHIFT Key for a minimum of one second to select the Panel Operator operation mode. Operation is now possible using the Panel Operator.



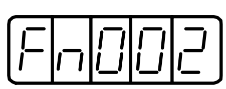
3. Press the MODE/SET Key to set to the servo ON state (with motor power turned ON).



4. Press the Up Cursor Key or Down Cursor Key to operate the motor. The motor keeps operating while the key is pressed.



5. 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.
6. 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 control using Digital Operator or Panel Operator can be changed with a parameter:

Parameter: Pn304, Unit: min^{-1}, Standard setting: 500

INFO

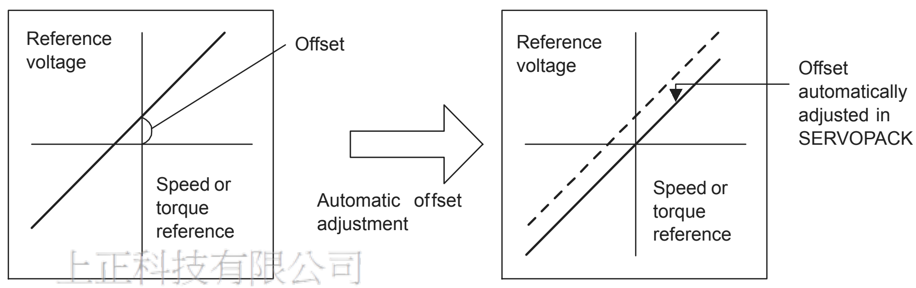
The rotation direction of the servomotor depends on the setting of parameter Pn000.0 “Rotation Direction.” The above example shows a case where Pn000.0 is set to “0” as a factory setting.

6.2.3 Automatic Adjustment of the Speed and Torque Reference Offset

When speed and torque control are used, the motor may rotate slowly even when 0 V is specified as the analog reference voltage. This occurs when the host controller or external circuit has a small offset (measured in mV) in the reference voltage.

The reference offset automatic adjustment mode automatically measures the offset and adjusts the reference voltage. It adjusts both the speed and torque references.

The following diagram illustrates automatic adjustment of an offset in the reference voltage by the SERVOPACK.



After completion of offset automatic adjustment, the amount of offset is stored in the SERVOPACK.

The amount of offset can be checked in the speed reference offset manual adjustment mode. Refer to *6.2.4 Manual Adjustment of the Speed and Torque Reference Offset*.

The reference offset automatic adjustment mode cannot be used for setting the error pulses to zero for a stopped SERVOPACK when a position loop is formed with a host controller.

In such cases, use the reference offset manual adjustment mode. Refer to *6.2.4 Manual Adjustment of the Speed and Torque Reference Offset*.

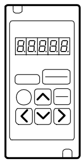
The zero-clamp speed control function is available to force the motor to stop while the zero speed reference is given. Refer to *4.4.3 Using the Zero Clamp Function*.

IMPORTANT

Automatic adjustment of the speed/torque reference offset must be performed under the servo OFF state.

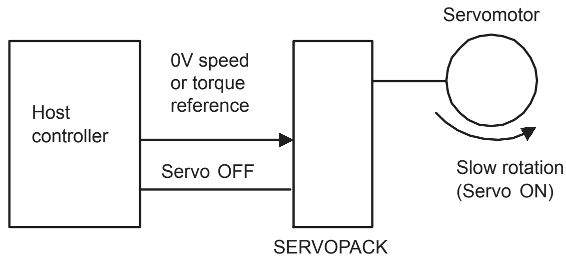
Follow the procedure below to automatically adjust the speed/torque reference offset.

6

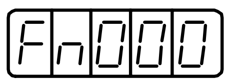


Using the Hand-held Digital Operator

1. Input the (intended) 0 V reference voltage from the host controller or external circuit.



2. Press the DSPL/SET Key to select the auxiliary function mode.

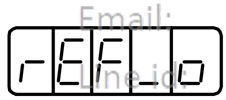


3. Select the parameter Fn009.

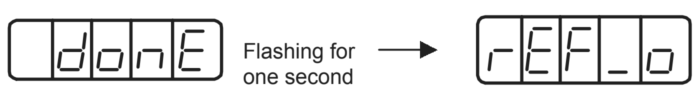
   Press the Left or Right Cursor Key to select the digit.

   Press the Up or Down Cursor Key to change the number.

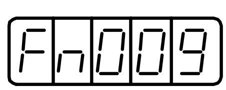
4. Press the DATA/ENTER Key. The following display will appear.



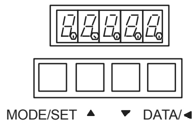
5. Press the DSPL/SET Key, and the following display will flash for one second. The reference offset will be automatically adjusted.



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

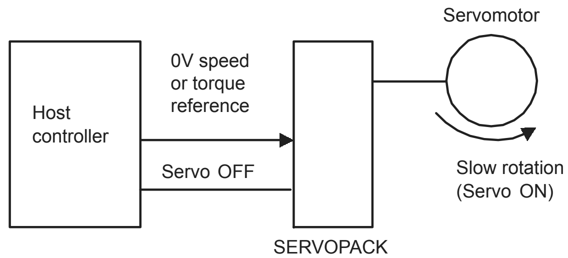


This completes the speed/torque reference offset automatic adjustment.

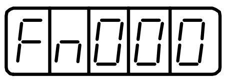


Using the Panel Operator

1. Input the (intended) 0 V reference voltage from the host controller or external circuit.

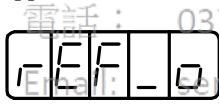


2. Press the MODE/SET Key to select the auxiliary function mode.

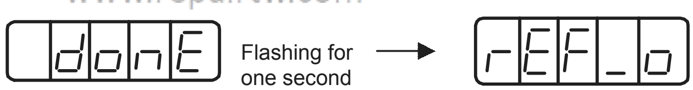


3. Press the Up or Down Cursor Key to select the parameter Fn009.

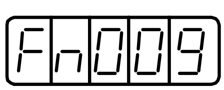
4. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



5. Press the MODE/SET Key and the following display will flash for one second. The reference offset will be automatically adjusted.



6. Press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.



This completes the speed/torque reference offset automatic adjustment.

6

6.2.4 Manual Adjustment of the Speed and Torque Reference Offset

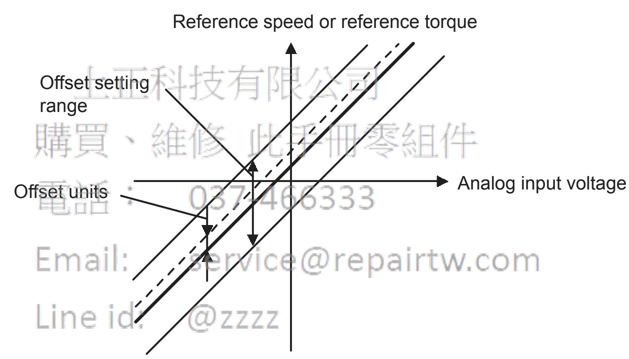
Speed/torque reference offset manual adjustment is very convenient in the following situations:

- If a loop is formed with the host controller and the error is zeroed when servo lock is stopped.
- To deliberately set the offset to some value.

This mode can also be used to check the data set in the reference offset automatic adjustment mode.

In principle, this mode operates in the same way as the reference offset automatic adjustment mode, except that the amount of offset is directly input during the adjustment. The offset amount can be set in the speed reference or torque reference.

The offset setting range and setting units are as follows:

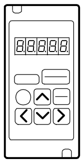


Offset Setting Range
Speed Reference: -9999 to +9999
Torque Reference: -128 to +127

Offset Setting Range
Speed Reference: 0.058 mV/LSB
Torque Reference: 14.7 mV/LSB

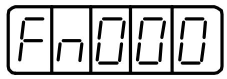
■ Speed Reference Offset Manual Adjustment

Follow the procedure below to manually adjust the speed reference offset.



Using the Hand-held Digital Operator

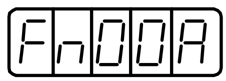
1. Press the DSPL/SET Key to select the auxiliary function mode.



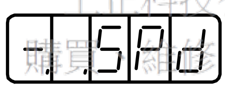
2. Select the parameter Fn00A.

   Press the Left or Right Cursor Key to select the digit.

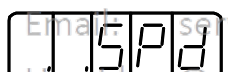
   Press the Up or Down Cursor Key to change the number.



3. Press the DATA/ENTER Key, and the display will be as shown below. The manual adjustment mode for the speed reference offset will be entered.

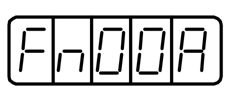


4. Turn ON the Servo ON (/S-ON) signal. The display will be as shown below.



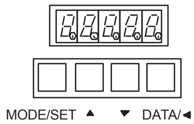
5. Press the Left or Right Cursor Key, to display the speed reference offset amount.

6. Press the Up or Down Cursor Key to adjust the amount of offset (adjustment of the speed reference offset).
7. Press the Left or Right Cursor Key to return to the display in the above step 4.
8. Press the DATA/ENTER Key to return to the auxiliary function mode display.



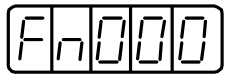
This completes the speed reference offset manual adjustment.

6

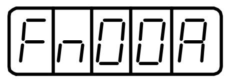


Using the Panel Operator

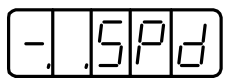
1. Press the MODE/SET Key to select the auxiliary function mode.



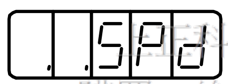
2. Press the Up or Down Cursor Key to select the parameter Fn00A.



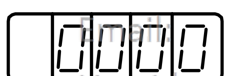
3. Press the DATA/SHIFT Key for a minimum of one second. The display will be as shown below. The manual adjustment mode for the speed reference offset will be entered.



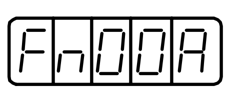
4. Turn ON the Servo ON (/S-ON) signal. The display will be as shown below.



5. Press the DATA/SHIFT Key for less than one second to display the speed reference offset amount.



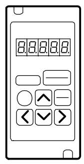
6. Press the Up or Down Cursor Key to adjust the amount of offset (adjustment of the speed reference offset).
7. Press the DATA/SHIFT Key for a minimum of one second to return to the display in the above step 4.
8. Press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.



This completes the speed reference offset manual adjustment.

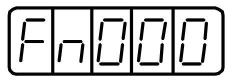
■ Torque Reference Offset Manual Adjustment

Follow the procedure below to manually adjust the torque reference offset.



Using the Hand-held Digital Operator

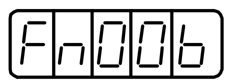
1. Press the DSPL/SET Key to select the auxiliary function mode.



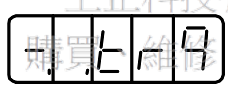
2. Select the parameter Fn00B.

   Press the Left or Right Cursor Key to select the digit.

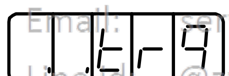
   Press the Up or Down Cursor Key to change the number.



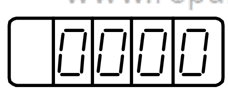
3. Press the DATA/ENTER Key, and the display will be as shown below. The manual adjustment mode for the torque reference offset will be entered.



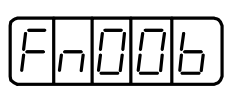
4. Turn ON the Servo ON (/S-ON) signal. The display will be as shown below.



5. Press the Left or Right Cursor Key to display the torque reference offset amount.

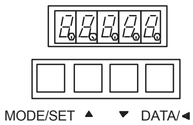


6. Press the Up or Down Cursor Key to adjust the offset amount (adjustment of torque reference offset).
7. Press the Left or Right Cursor Key to return to the display in the above step 4.
8. Press the DATA/ENTER Key to return to the auxiliary function mode display.



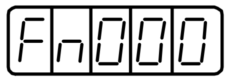
This completes the torque reference offset manual adjustment.

6

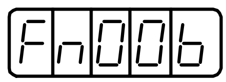


Using the Panel Operator

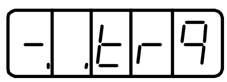
1. Press the MODE/SET Key to select the auxiliary function mode.



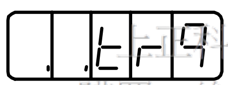
2. Press the Up or Down Cursor Key to select the parameter Fn00B.



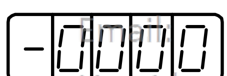
3. Press the DATA/SHIFT Key for a minimum of one second. The display will be as shown below. The manual adjustment mode for the torque reference offset will be entered.



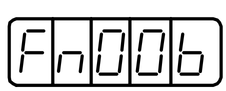
4. Turn ON the Servo ON (/S-ON) signal. The display will be as shown below.



5. Press the DATA/SHIFT Key for less than one second, to display the torque reference offset amount.



6. Press the Up or Down Cursor Key to adjust the offset amount. (Adjustment of torque reference offset).
7. Press the DATA/SHIFT Key for a minimum of one second to return to the display in the above step 4.
8. Press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.

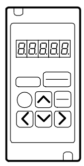


This completes the torque reference offset manual adjustment.

6.2.5 Clearing Alarm Traceback Data

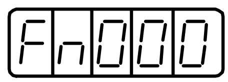
This procedure clears the alarm history, which stores the alarms generated in the SERVOPACK. Each alarm in the alarm history is set to A.- -, which is not an alarm code. Refer to *6.2.1 Operation in Alarm Traceback Mode*.

Follow the procedure below to clear the alarm traceback data.



Using the Hand-held Digital Operator

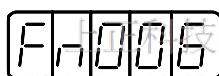
1. Press the DSPL/SET Key to select the auxiliary function mode.



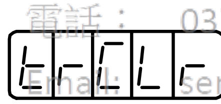
2. Select the parameter Fn006.

   Press the Left or Right Cursor Key to select the digit.

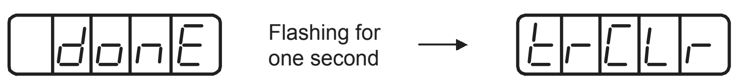
   Press the Up or Down Cursor Key to change the number.



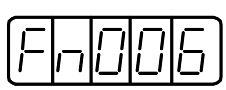
3. Press the DATA/ENTER Key. The following display will appear.



4. Press the DSPL/SET Key to clear the alarm traceback data. The following display will flash for one second, and, after the alarm traceback data is cleared, the display will return to the one in the above step 3.

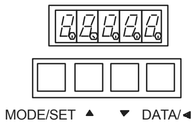


5. Press the DATA/ENTER Key to return to the parameter number display.



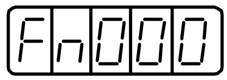
This completes the alarm traceback data clearing procedure.

6

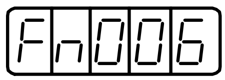


Using the Panel Operator

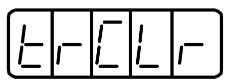
1. Press the MODE/SET Key to select the auxiliary function mode.



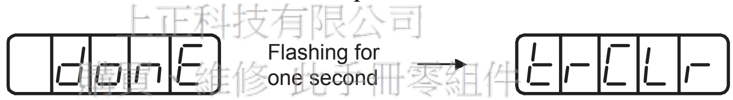
2. Press the Up or Down Cursor Key to select the parameter Fn006.



3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



4. Press the MODE/SET Key to clear the alarm tracebcak data. The following display will flash for one second, and, after the alarm traceback data is cleared, the display will return to the one in the above step 3.



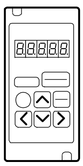
5. Press the DATA/SHIFT Key for a minimum of one second to return to the parameter number display.

This completes the alarm traceback data clearing procedure.

6.2.6 Checking the Motor Model

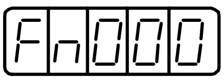
Set the parameter Fn011 to select the motor model check mode. This mode is used for the motor maintenance, and can also be used to check the specification codes of SERVOPACKs made with special specifications.

Follow the procedure below to check the motor model.

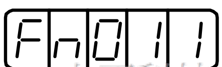


Using the Hand-held Digital Operator

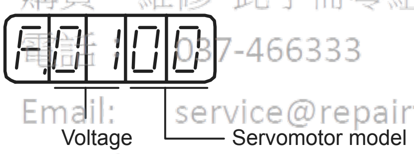
1. Press the DSPL/SET Key to select the auxiliary function mode.



2. Select the parameter Fn011. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.



3. Press the DATA/ENTER Key to display the servomotor model and voltage code.



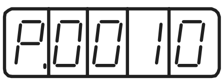
Voltage

Code	Voltage
00	100 VAC or 140 VDC
01	200 VAC or 280 VDC
02	400 VAC or 560 VDC

Servomotor Model

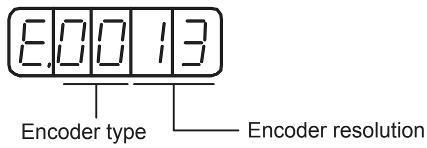
Code	Servomotor Model
00	SGMAH
01	SGMPH
02	SGMSH
03	SGMGH-□A (1500 min^{-1})
04	SGMGH-□B (1000 min^{-1})
05	SGMDH
06	SGMUH
0B	SGMBH

4. Press the DSPL/SET Key to display servomotor capacity.



Capacity: Displayed value × 10 (W)
In this example, the capacity is 100 W.

5. Press the DSPL/SET Key to display the encoder type and resolution code.



Encoder Type

Code	Type
00	Incremental encoder
01	Absolute encoder

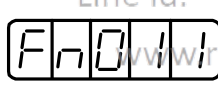
Encoder Resolution

Code	Resolution
13	13 bits
16	16 bits
17	17 bits
20	20 bits

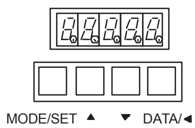
6. Press the DSPL/SET Key to display the SERVOPACK's specification code (Y Specification code).

This example shows specification code "Y10" (Indicated in decimal).

7. Press the DATA/ENTER Key to return to the auxiliary function mode display. Pressing the DATA/ENTER Key after the above display 3. to 5. will also return to the auxiliary function mode display.

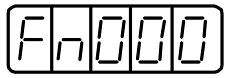


This completes the checking motor type procedure.

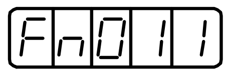


Using the Panel Operator

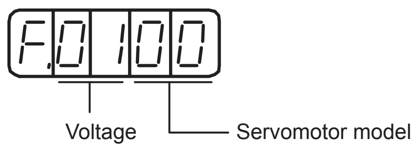
1. Press the MODE/SET Key to select the auxiliary function mode.



2. Press the Up or Down Cursor Key to select the parameter Fn011.



3. Press the DATA/SHIFT Key for a minimum of one second to display the servomotor model and voltage code.



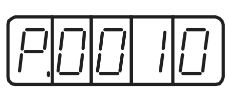
Voltage

Code	Voltage
00	100 VAC or 140 VDC
01	200 VAC or 280 VDC
02	400 VAC or 560 VDC

Servomotor Model

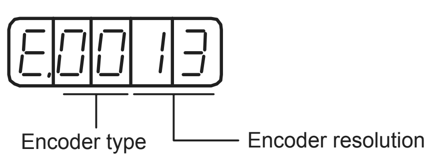
Code	Servomotor Model
00	SGMAH
01	SGMPH
02	SGMSH
03	SGMGH-□A (1500 min^{-1})
04	SGMGH-□B (1000 min^{-1})
05	SGMDH
06	SGMUH
0B	SGMBH

4. Press the MODE/SET Key to display servomotor capacity.



Capacity: Displayed value × 10 (W)
In this example, the capacity is 100 W.

5. Press the MODE/SET Key to display the encoder type and resolution code.



Encoder Type

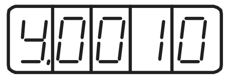
Code	Type
00	Incremental encoder
01	Absolute encoder

Encoder Resolution

Code	Resolution
13	13 bits
16	16 bits
17	17 bits
20	20 bits

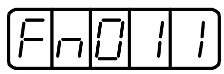
6

6. Press the MODE/SET Key to display the SERVOPACK's specification code (Y Specification code).



This example shows specification code "Y10" (Indicated in decimal).

7. Press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display. Pressing the DATA/SHIFT Key after the above display 3. to 5. will also return to the auxiliary function mode display.



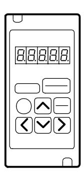
This completes the checking motor type procedure.

6.2.7 Checking the Software Version

This mode is used for the motor maintenance.

Set Fn012 to select the software-version check mode.

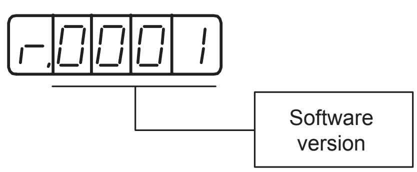
Follow the procedure below to check the software version.



Using the Hand-held Digital Operator

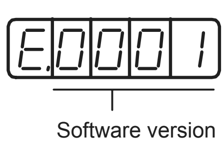
1. Select the parameter Fn012.
2. Press the DATA/ENTER Key and the SERVOPACK's Software version will be displayed.

Software Version Display

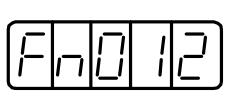


3. Press the DSPL/SET Key and the software version of the encoder mounted on the motor will be displayed.

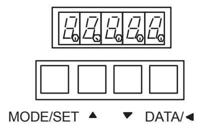
Software Version Display



4. Press the DATA/ENTER Key to return to the parameter number display.



This completes the checking software version procedure.



Using the Panel Operator

1. Select the parameter Fn012.
2. Press the DATA/SHIFT Key for a minimum of one second to display the SERVOPACK's Software version.
3. Press the MODE/SET Key to display the encoder software version.
4. Press the DATA/SHIFT Key for a minimum of one second to return to the parameter number display.

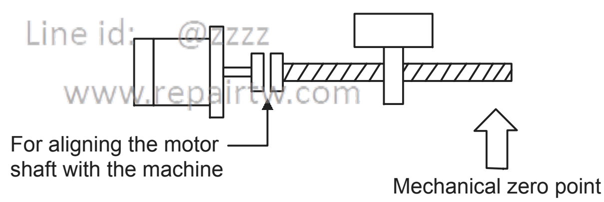
6.2.8 Zero-point Search Mode

⚠ CAUTION

- Forward run prohibited (P-OT) and reverse run prohibited (N-OT) signals are not effective during zero-point search mode operations using parameter Fn003.

The zero-point search mode is designed to position the zero-point pulse position of the encoder and to clamp at the position. This mode is used when the motor shaft needs to be aligned to the machine. Execute the zero-point search without connecting the couplings.

The speed for executing the zero-point search is 60 min^{-1}.

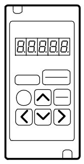


INFO

The following conditions must be met to perform the zero-point search operation.

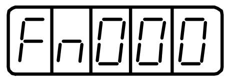
1. If the Servo-ON input signal (/S-ON) is ON, turn it OFF.
2. Release the Servo-ON signal mask if parameter Pn50A.1 is set to 7 and the Servo has been set to always be ON.

Follow the procedure below to execute the zero-point search.

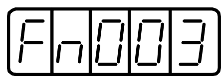


Using the Hand-held Digital Operator

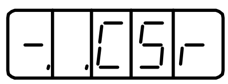
1. Press the DSPL/SET Key to select the auxiliary function mode.



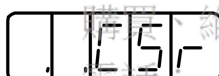
2. Select the parameter Fn003. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.



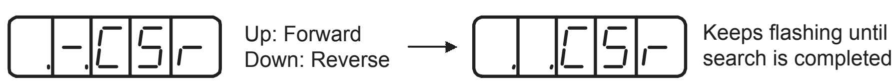
3. Press the DATA/ENTER Key. The following display will appear.



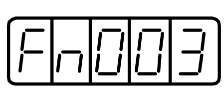
4. Press the SVON Key and the display is as shown below. Now it is ready for executing the zero-point search mode.



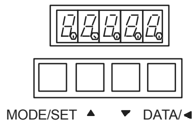
5. Hold down the Up or Down Cursor Key to execute the zero-point search.
   When the parameter is set to Pn000.0 = 0 (default), pressing the Up Cursor Key will rotate the motor in the forward direction. Pressing the Down Cursor Key will rotate the motor in the reverse direction. When the parameter is set to Pn000.0 = 1, the rotation of the motor is reversed.



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

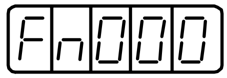


This completes the zero-point search execution.

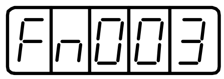


Using the Panel Operator

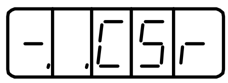
1. Press the MODE/SET Key to select the auxiliary function mode.



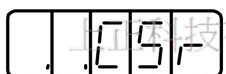
2. Press the Up or Down Cursor Key to select the parameter Fn003.



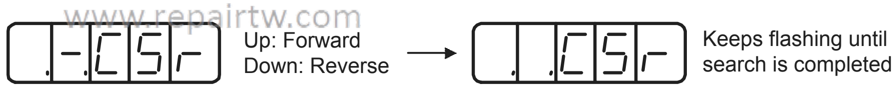
3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



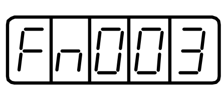
4. Press the MODE/SET Key and the display is as shown below. Now it is ready for executing the zero-point search mode.



5. Hold down the Up or Down Cursor Key to execute the zero-point search.
   When the parameter is set to Pn000.0 = 0 (default), pressing the Up Cursor Key will rotate the motor in the forward direction. Pressing the Down Cursor Key will rotate the motor in the reverse direction. When the parameter is set to Pn000.0 = 1, the rotation of the motor is reversed.



6. Press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.



This completes the zero-point search execution.

6

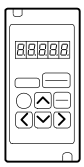
6.2.9 Initializing Parameter Settings

This function is used when returning to the standard settings (factory settings) after changing parameter settings.

IMPORTANT

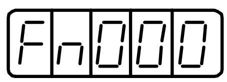
Initialize the parameter settings with the servo OFF.

Follow the procedure below to initialize parameter settings.

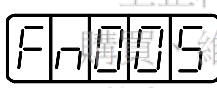


Using the Hand-held Digital Operator

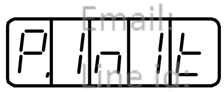
1. Press the DSPL/SET Key to select the auxiliary function mode.



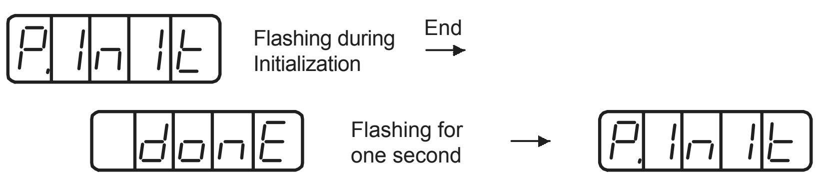
2. Select the parameter Fn005. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.



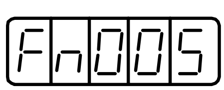
3. Press the DATA/ENTER Key. The following display will appear.



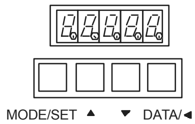
4. Press the DSPL/SET Key and the display will change as shown below. The parameter will be initialized.



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

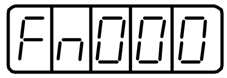


This completes the initialization of parameter settings.

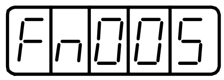


Using the Panel Operator

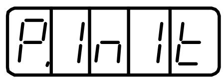
1. Press the MODE/SET Key to select the auxiliary function mode.



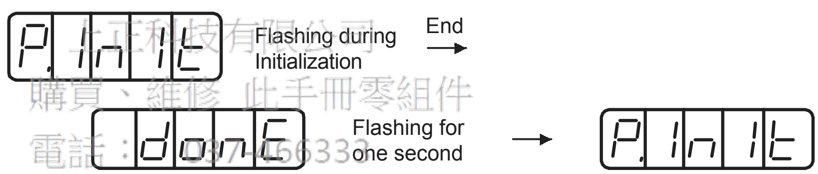
2. Press the Up or Down Cursor Key to select the parameter Fn005.



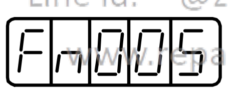
3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



4. Press the MODE/SET Key and the display will change as shown below. The parameter will be initialized.



5. Press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.



This completes the initialization of parameter settings.

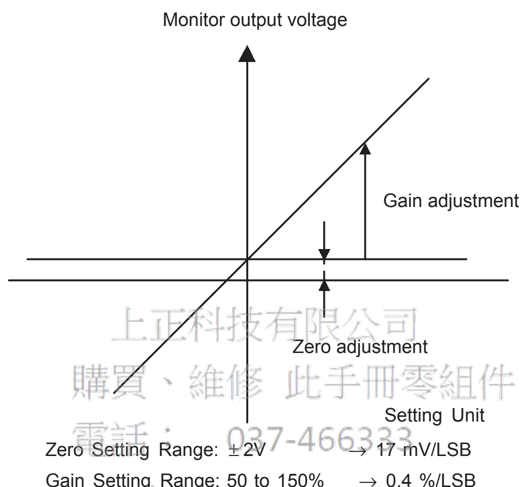
INFO

Parameters will not be initialized by pressing the DSPL/SET or MODE/SET Key with the servo ON. Turn the power OFF and then back ON after initialization.

6.2.10 Manual Zero Adjustment and Gain Adjustment of Analog Monitor Output

Motor speed, torque reference, and position error can be monitored through the analog monitor output. Refer to *5.5 Analog Monitor*.

Use the manual zero adjustment function to compensate for the output voltage drift or the zero point drift caused by noise entering the monitor system. The gain adjustment function can be changed to match the sensitivity of the measuring system.

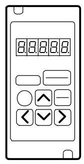


INFO

The output voltage of the analog monitor is ±8 V max. The output voltage will be reversed if ±8 V is exceeded.

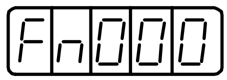
■ Manual Zero Adjustment of Analog Monitor Output

Follow the procedure below to execute the manual zero adjustment of analog monitor output.

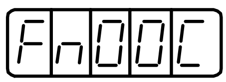


Using the Hand-held Digital Operator

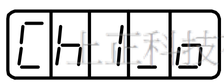
1. Press the DSPL/SET Key to select the auxiliary function mode.



2. Select the parameter Fn00C. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.

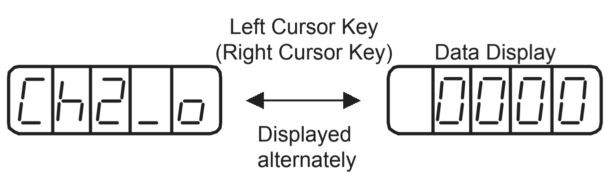


3. Press the DATA/ENTER Key. The following display will appear.

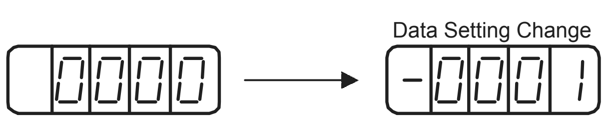


4. Press the DSPL/SET Key, and the monitor output for the two channels will be displayed alternately as shown below.

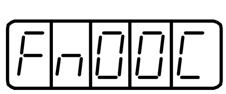
5. Press the Left or Right Cursor Key to display the analog monitor output data. Pressing the Left or Right Cursor Key again will return to the display shown in the above step 3. or 4.



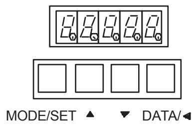
6. Press the Up or Down Cursor Key to perform zero adjustment of the analog monitor output.



7. When zero adjustment has been completed for the two channels, press the DATA/ENTER Key to return to the auxiliary function mode display.

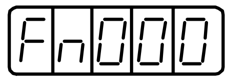


This completes the manual zero adjustment of the analog monitor output.

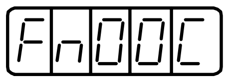


Using the Panel Operator

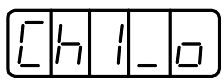
1. Press the MODE/SET Key to select the auxiliary function mode.



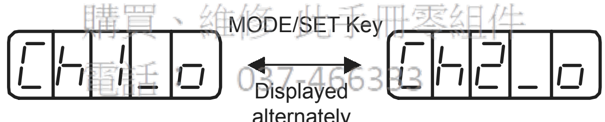
2. Press the Up or Down Cursor Key to select the parameter Fn00C.



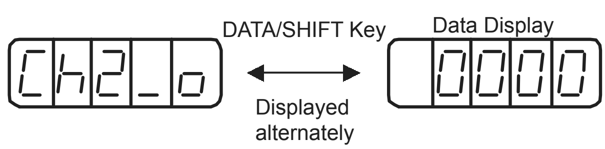
3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



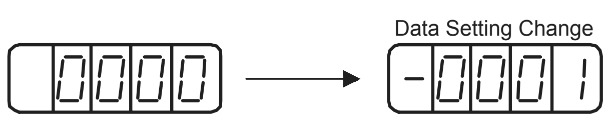
4. Press the MODE/SET Key, and the monitor output for the two channels will be displayed alternately as shown below.



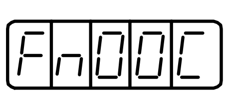
5. Press the DATA/SHIFT Key for less than one second, and the analog monitor gain constant will be displayed. Pressing the DATA/SHIFT Key again for less than one second will return to the display shown in the above step 3. or 4.



6. Press the Up or Down Cursor Key to perform zero adjustment of the analog monitor output.



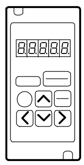
7. When zero adjustment has been completed for the two channels, press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.



This completes the manual zero adjustment of the analog monitor output.

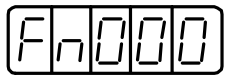
■ Manual Gain Adjustment of Analog Monitor Output

Follow the procedure below to execute the manual gain adjustment of analog monitor output.

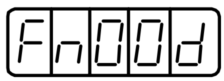


Using the Hand-held Digital Operator

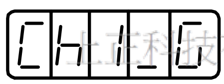
1. Press the DSPL/SET Key to select the auxiliary function mode.



2. Select the parameter Fn00D. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.

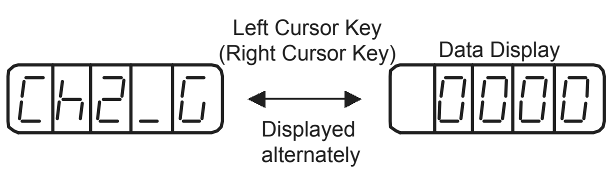


3. Press the DATA/ENTER Key. The following display will appear.

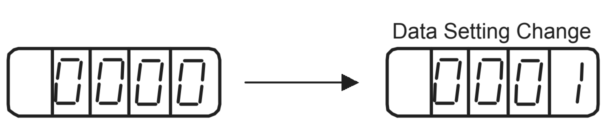


4. Press the DSPL/SET Key, and the monitor output for the two channels will be displayed alternately as shown below.

5. Press the Left or Right Cursor Key to display the analog monitor gain constant. Pressing the Left or Right Cursor Key again will return to the display shown in the above step 3. or 4.

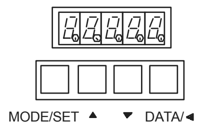


6. Press the Up or Down Cursor Key to adjust the gain for the analog monitor output.



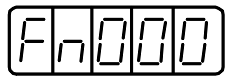
7. When the gain adjustment has been completed for the two channels, press the DATA/ENTER Key to return to the auxiliary function mode display.

This completes the manual gain adjustment of the analog monitor output.

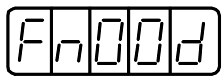


Using the Panel Operator

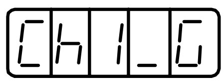
1. Press the MODE/SET Key to select the auxiliary function mode.



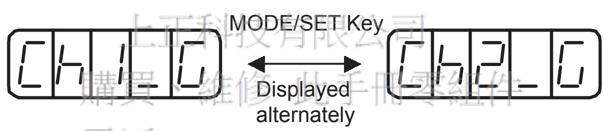
2. Press the Up or Down Cursor Key to select the parameter Fn00D.



3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.

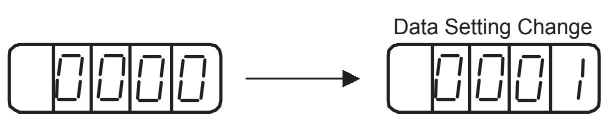


4. Press the MODE/SET Key, and the monitor output for the two channels will be displayed alternately as shown below.

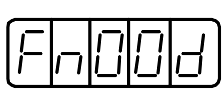


5. Press the DATA/SHIFT Key for less than one second, and the analog monitor gain constant will be displayed. Pressing the DATA/SHIFT Key again for less than one second will return to the display shown in the above step 3. or 4.

6. Press the Up or Down Cursor Key to adjust the gain for the analog monitor output.



7. When the gain adjustment has been completed for the two channels, press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.



This completes the manual gain adjustment of the analog monitor output.

6.2.11 Adjusting the Motor Current Detection Offset

Motor current detection offset adjustment is performed at Yaskawa before shipping. Basically, the user need not perform this adjustment. Perform this adjustment only if highly accurate adjustment is required for reducing torque ripple caused by current offset.

The following sections describe automatic and manual adjustment of the current detection offset.

IMPORTANT

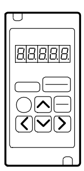
If this function, particularly manual adjustment, is executed carelessly, it may worsen the characteristics.

■ Automatic Adjustment of the Motor Current Detection Offset

Follow the procedure below to perform automatic adjustment of the current detection offset.

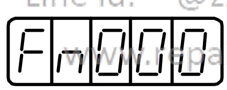
INFO

Automatic adjustment is possible only with power supplied to the main circuits and with the servo OFF.

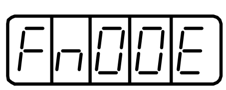


Using the Hand-held Digital Operator

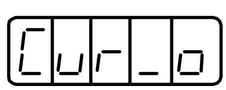
1. Press the DSPL/SET Key to select the auxiliary function mode.



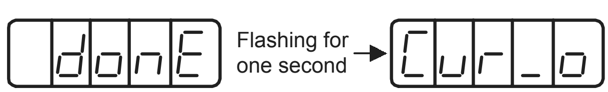
2. Select the parameter Fn00E. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.



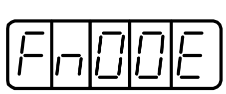
3. Press the DATA/ENTER Key. The following display will appear.



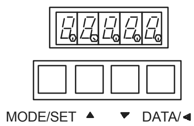
4. Press the DSPL/SET Key. The display will change as shown below and offset will be automatically adjusted.



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

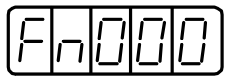


This completes the automatic adjustment of the motor current detection offset.

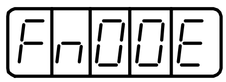


Using the Panel Operator

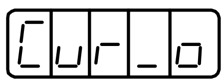
1. Press the MODE/SET Key to select the auxiliary function mode.



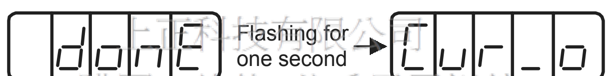
2. Press the Up or Down Cursor Key to select the parameter Fn00E.



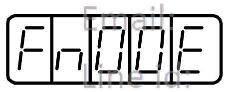
3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



4. Press the MODE/SET Key. The display will change as shown below and offset will be automatically adjusted.



5. Press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.



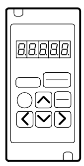
This completes the automatic adjustment of the motor current detection offset.

■ Manually Adjusting the Motor Current Offset

Follow the procedure below to manually adjust the current detection offset.

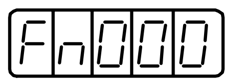
IMPORTANT

When making manual adjustments, run the motor at a speed of approximately 100 min^{-1}, and adjust the Operator until the torque monitor ripple is minimized. (Refer to Section *5.5 Analog Monitor*.) Adjust the phase-U and phase-V offsets alternately several times until these offsets are well balanced.

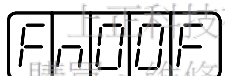


Using the Hand-held Digital Operator

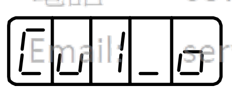
1. Press the DSPL/SET Key to select the auxiliary function mode.



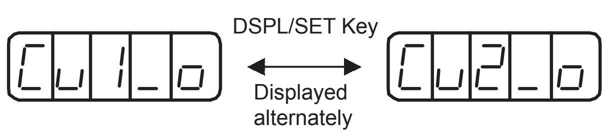
2. Select the parameter Fn00F. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.



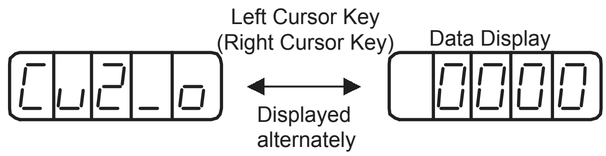
3. Press the DATA/ENTER Key. The following display will appear.



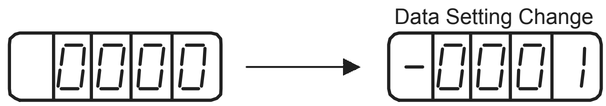
4. Press the DSPL/SET Key to switch between the phase-U (Cu1_0) and phase-V (Cu2_0) current detection offset adjustment mode.



5. Press the Left or Right Cursor Key to display the current detection data. Pressing the Left or Right Cursor Key again will return to the display shown in the above step 3. or 4.

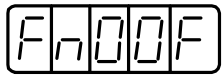


6. Press the Up or Down Cursor Key to adjust the offset. Carefully adjust the offset while monitoring the torque reference monitor signal.

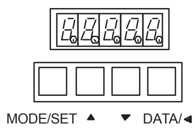


7. When the current offset adjustment has been completed for the phase U (Cu1_0) and phase V (Cu2_0), press the DATA/ENTER Key to return to the auxiliary function mode display.

6

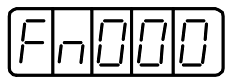


This completes the manual adjustment of the motor current detection offset.

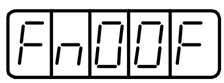


Using the Panel Operator

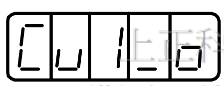
1. Press the MODE/SET Key to select the auxiliary function mode.



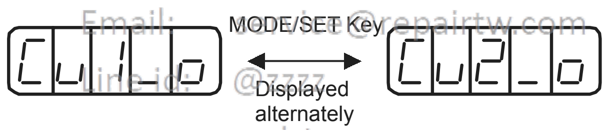
2. Press the Up or Down Cursor Key to select the parameter Fn00F.



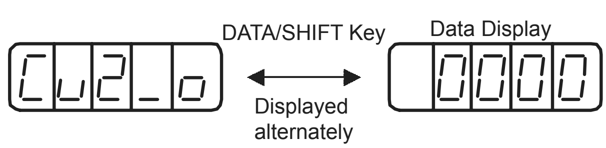
3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



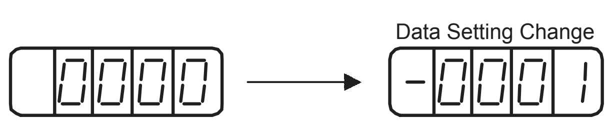
4. Press the MODE/SET Key to switch between phase-U (Cu1_0) and phase-V (Cu2_0) current detection offset adjustment mode.



5. Press the DATA/SHIFT Key for less than one second to display the current detection data. Pressing the DATA/SHIFT Key again for less than one second will return to the display shown in the above step 3. or 4.



6. Press the Up or Down Cursor Key to adjust the offset. Carefully adjust the offset while monitoring the torque reference monitor signal.



7. When the current offset adjustment has been completed for the phase U (Cu1_0) and phase V (Cu2_0), press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.

This completes the manual adjustment of the motor current detection offset.

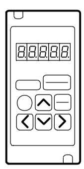
6.2.12 Password Setting (Write Prohibited Setting)

The password setting is used for preventing careless changes of the parameter. Parameters Pn□□□ and some of Fn□□□ become write prohibited by setting the password.

Password setting values are as follows:

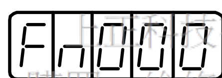
- “0000”: Write enabled (Releases write prohibited mode.)
- “0001”: Write prohibited (Parameters become write disabled from the next power ON.)

Follow the procedure below to set the password.

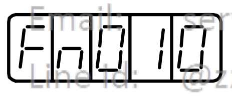


Using the Hand-held Digital Operator

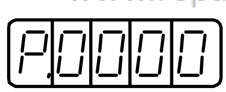
1. Press the DSPL/SET Key to select the auxiliary function mode.



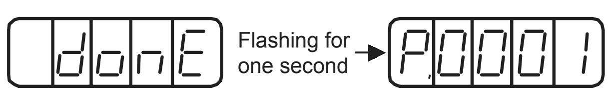
2. Select the parameter Fn010. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.



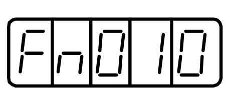
3. Press the DATA/ENTER Key. The following display will appear.



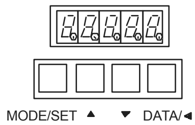
4. Input the password (0001) and press the DSPL/SET Key. The display will change as shown below and the password will be registered.



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

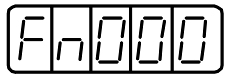


This completes the procedure for setting the password. The newly set password will become valid from the next power ON.

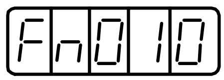


Using the Panel Operator

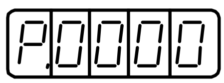
1. Press the MODE/SET Key to select the auxiliary function mode.



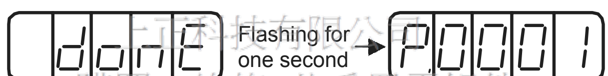
2. Press the Up or Down Cursor Key to select the parameter Fn010.



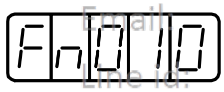
3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



4. Input the password (0001) and press the MODE/SET Key. The display will change to one shown below and the password will be registered.



5. Press the DATA/SHIFT Key for a minimum of one second to return to the auxiliary function mode display.



This completes the procedure for setting the password. The newly set password will become valid from the next power ON.

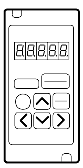
6.2.13 Clearing Option Unit Detection Results

The alarm A.E7 (option unit detection fail) occurs when turning ON the power for the first time when the SGDH is used without option unit after the SGDH has been used with option unit.

The following operation does not permanently reset the alarm A.E7. Restarting again after performing the following operation will clear and reset the alarm A.E7. Then, the operation of SGDH without option unit is enabled.

IMPORTANT

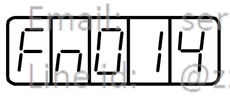
Because the parameter is set for the SGDH with an option unit, change the setting or initialize the parameter value (Fn005 of auxiliary function mode) as required.



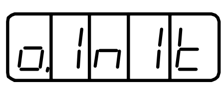
Using the Hand-held Digital Operator

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

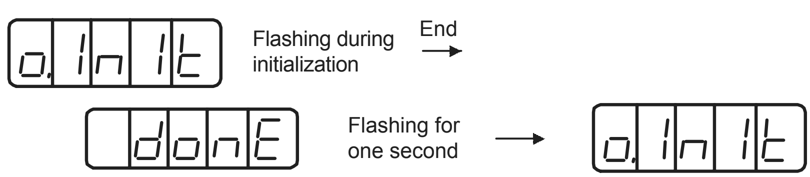
2. Select the parameter Fn014. Press the Left or Right Cursor Key to select the digit. Press the Up or Down Cursor Key to change the number.



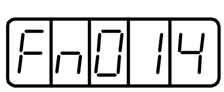
3. Press the DATA/ENTER Key. The following display will appear.



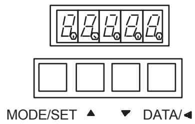
4. Press the DSPL/SET Key. The display will change as shown below and the option unit detection result will be cleared.



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

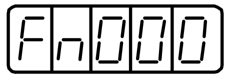


This completes the clear of the option unit detection results.

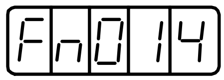


Using the Panel Operator

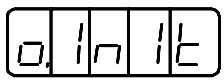
1. Press the MODE/SET Key to select the auxiliary function mode.



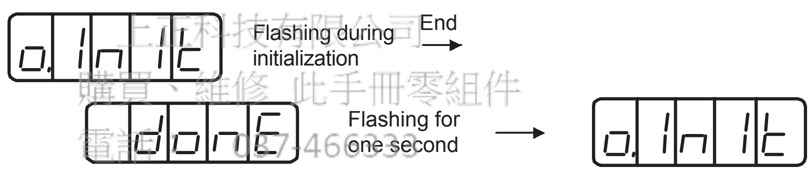
2. Press the Up or Down Cursor Key to select the parameter Fn014.



3. Press the DATA/SHIFT Key for a minimum of one second. The following display will appear.



4. Press the MODE/SET Key. The display will change as shown below and the option unit detection result will be cleared.



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

This completes the clear of the option unit detection results.

7

Servo Selection and Data Sheets

This chapter describes how to select Σ-II Series servodrives and peripheral devices. The chapter also presents the specifications and dimensional drawings required for selection and design. Refer to this chapter for selecting or designing an appropriate servodrive.

7.1 Selecting a Σ-II Series Servodrives

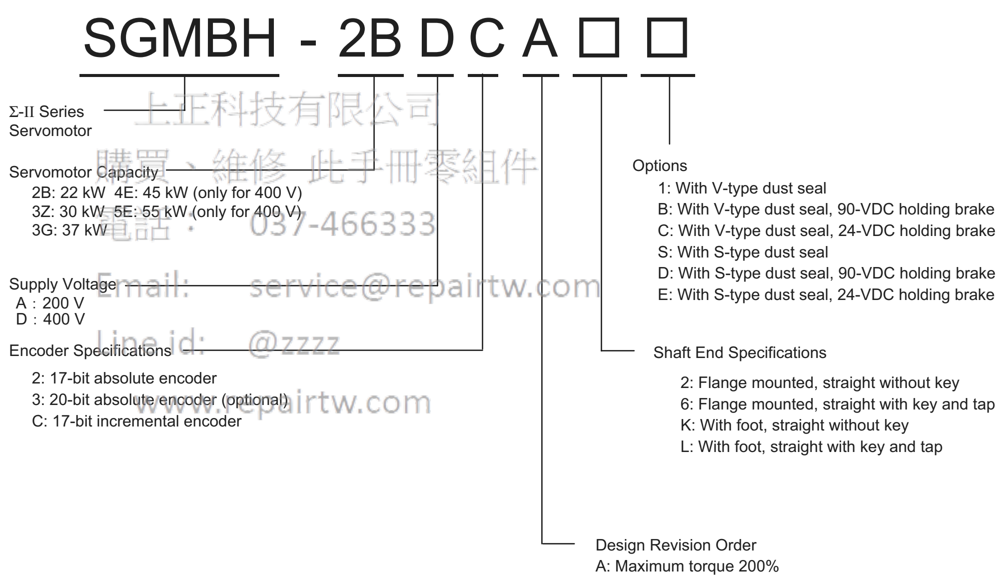
This section describes how to select the Σ-II Series servomotor, SERVOPACK, and Digital Operator.

7.1.1 Selecting Servomotors

This section describes the available models and provides flowcharts for selecting servomotors.

Model Designations

A servomotor can be selected based on the seven-digit alphanumeric characters after SGMBH.

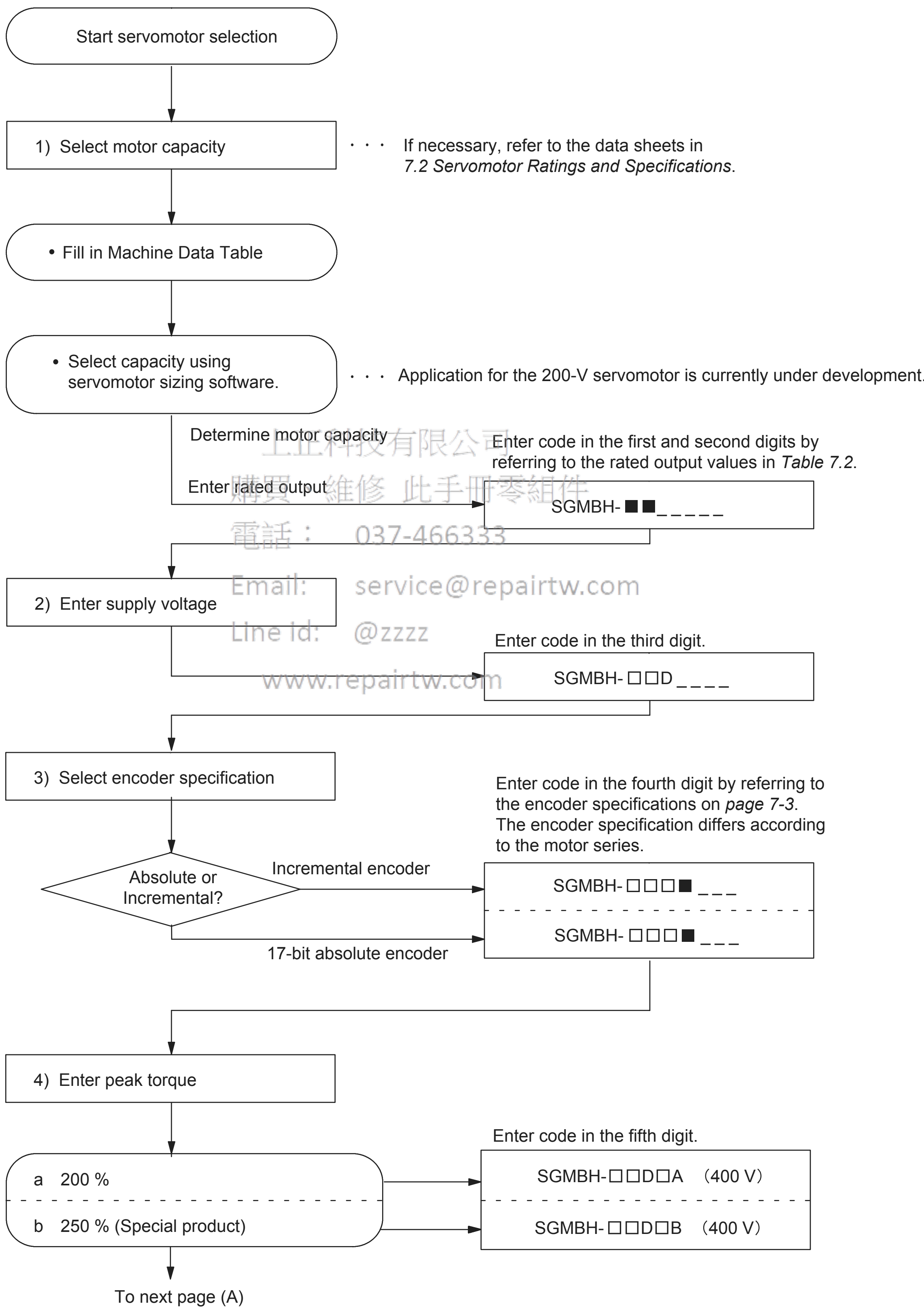


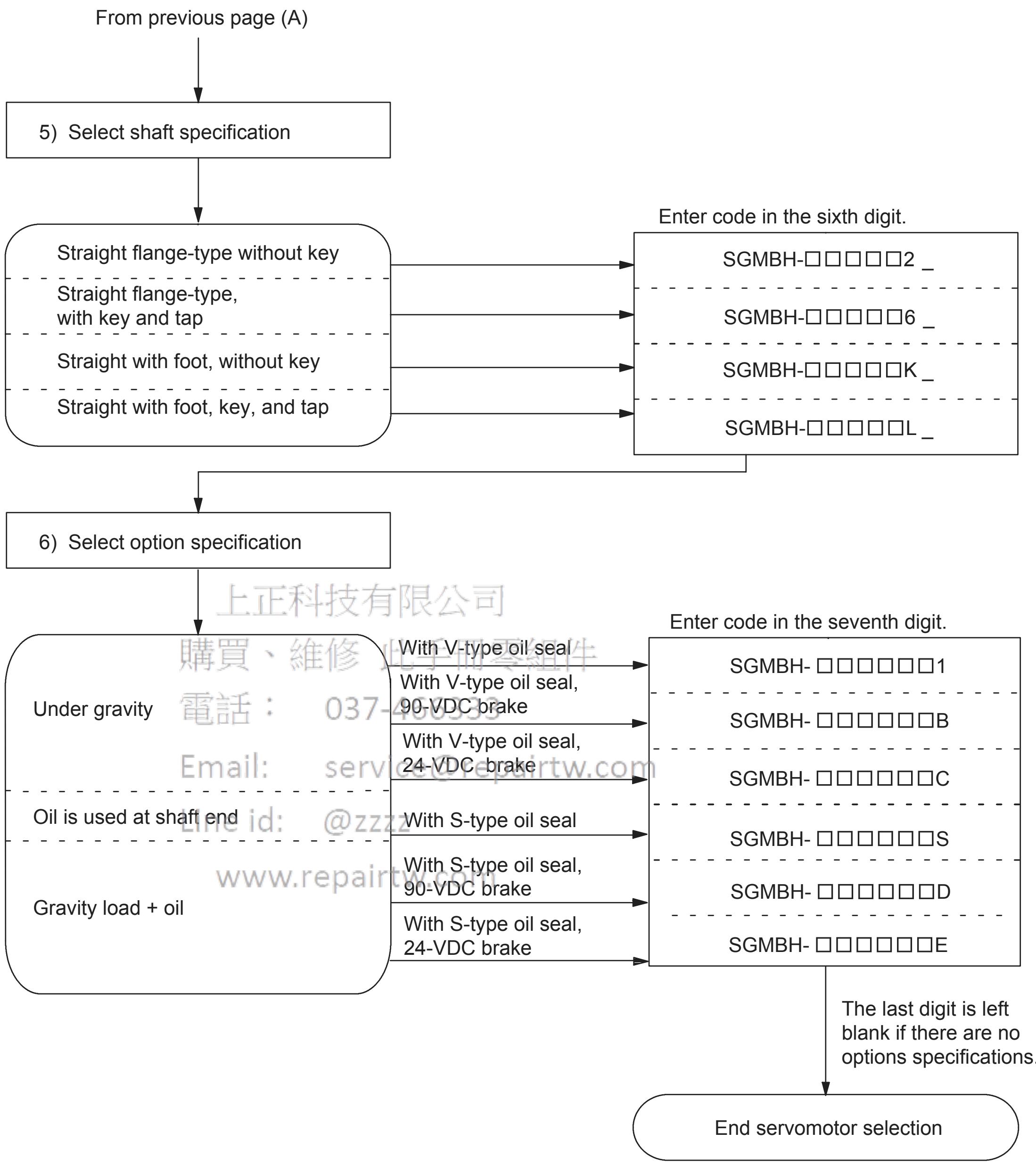
Flowchart for servomotor selection

	Selected Motor Model
Example	SGMBH- 2 B D C A □ □
Axis 1	SGMBH- □ □ □ □ □ □ □
Axis 2	SGMBH- □ □ □ □ □ □ □
· · ·	· · · · · · Blank for standard specification

Servomotor Selection Flowchart

Use the following flowchart to select a servomotor.




From previous page (A)
5) Select shaft specification
Enter code in the sixth digit.
Straight flange-type without key
Straight flange-type, with key and tap
Straight with foot, without key
Straight with foot, key, and tap
SGMBH-□□□□□2 _
SGMBH-□□□□□6 _
SGMBH-□□□□□K _
SGMBH-□□□□□L _
6) Select option specification
Enter code in the seventh digit.
Under gravity
Oil is used at shaft end
Gravity load + oil
With V-type oil seal
With V-type oil seal, 90-VDC brake
With V-type oil seal, 24-VDC brake
With S-type oil seal
With S-type oil seal, 90-VDC brake
With S-type oil seal, 24-VDC brake
SGMBH- □□□□□□1
SGMBH- □□□□□□B
SGMBH- □□□□□□C
SGMBH- □□□□□□S
SGMBH- □□□□□□D
SGMBH- □□□□□□E
The last digit is left blank if there are no options specifications.
End servomotor selection

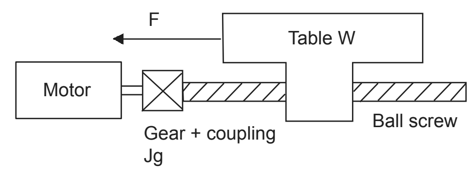
7

Selecting Capacity Based on Machine Specifications

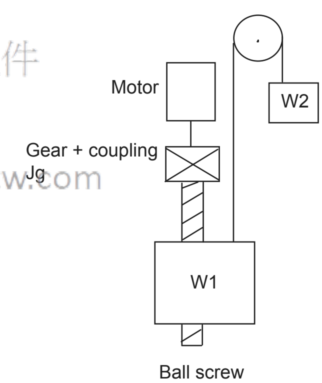
Fill out the data table below as an aid in selecting a drive system. When the machine data table is complete, use the Servomotor Sizing Software to select motor capacity.

Table 7.1 Machine Data Table

Ball Screw Horizontal Axis			Device Configuration
Load mass*1	W	kg	
Thrust	F	N	
Friction coefficient	μ		
Overall efficiency	η		
Gear ratio*2	R (=N_M/N_L)		
Gear + coupling*3	Jg	kg • cm^2	
Ball screw pitch	P	mm	
Ball screw diameter	D	mm	
Ball screw length	L	mm	



Ball Screw Vertical Axis		
Load mass	W1	kg
Counterweight	W2	kg
Friction coefficient	μ	
Overall efficiency	η	
Deceleration ratio	R (=N_M/N_L)	
Gear + coupling	Jg	kg • cm^2
Ball screw pitch	P	mm
Ball screw diameter	D	mm
Ball screw length	L	mm



Timing Belt		
Load mass	W	kg
Thrust	F	N
Friction coefficient	μ	
Overall efficiency	η	
Deceleration ratio	R (=N_M/N_L)	
Gear + coupling	Jg	kg • cm^2
Pulley moment of inertia	J_P	kg • cm^2
Pulley diameter	D	mm

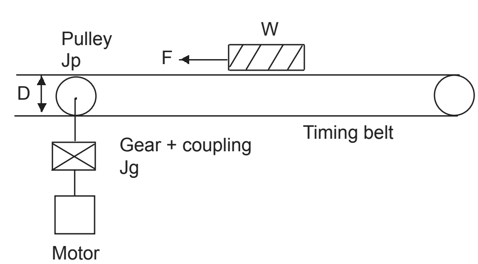
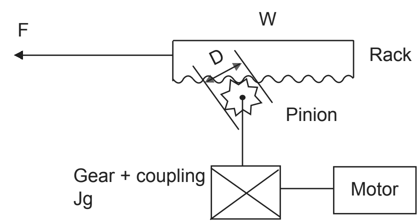


Table 7.1 Machine Data Table (cont'd)

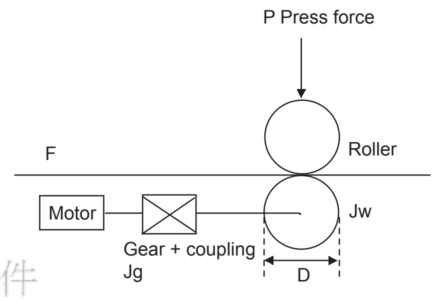
Rack and Pinion

Load mass	W	kg
Thrust	F	N
Friction coefficient	μ	
Overall efficiency	η	
Deceleration ratio	R (=N_M/N_L)	
Gear + coupling	Jg	kg • cm^2
Pinion diameter	D	mm
Pinion thickness	t	mm



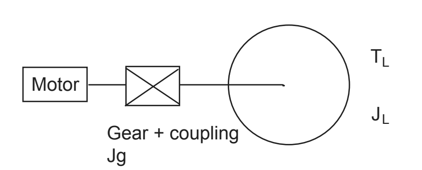
Roll Feeder

Load moment of inertia	J_W	kg • cm^2
Tension	F	N
Press force	P	N
Roller diameter	D	mm
Friction coefficient	μ	
Overall efficiency	η	
Deceleration ratio	R (=N_M/N_L)	
Gear + coupling	Jg	kg • cm^2



Rotor

Load moment of inertia	J_L	kg • cm^2
Load torque	T_L	kg • cm
Overall efficiency	η	
Deceleration ratio	R (=N_M/N_L)	
Gear + coupling	Jg	kg • cm^2



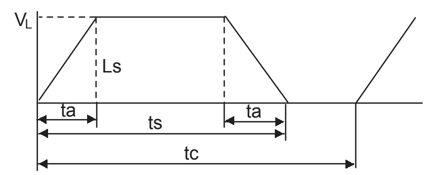
Others

Load moment of inertia	J_L	kg • cm^2
Load torque	T_L	N • m
Motor speed	N_M	min^{-1}
Duty	t c	s
Positioning time	t s	s
Accel/decel time	t a	s

7

Table 7.1 Machine Data Table (cont'd)

Duty Cycle		
Duty	t c	s
Positioning distance	Ls	mm
Slide speed	V_L	m/min
Positioning time	t s	s
Accel/decel time	t a	s
Enter either V_L or ts. Specify the priority if both are entered.		
Operating environment		
Ambient temperature		
Others		



* 1. Moment of inertia J for table W (load mass) can be calculated with the Sizing Software. Moment of inertia J for the servomotor is calculated automatically with the Sizing Software.
* 2. Gear ratio $R = N_M/N_L$ = Motor speed/load-end speed
* 3. Gear + coupling Jg: Gear or coupling moment of inertia. This is the moment of inertia for coupling between the servomotor and the load (machine).

7.1.2 Selecting SERVOPACKs

The following section describes SERVOPACK models and applicable servomotors.

■ SGDM SERVOPACK Model Designations

SGDM - 2B A D A

Σ-II Series
SGDM SERVOPACK

Rated Output (motor capacity)
2B : 22 kW
3Z : 30 kW
3G : 37 kW

Supply Voltage
A: 200 V

Model
D: For speed, torque, and position control

Design Revision Order

■ SGDH SERVOPACK Model Designations

SGDH - 2B D E

Σ-II Series
SGDH SERVOPACK

Rated Output (motor capacity)
- 2B : 22 kW 4E : 45 kW (Only for 400 V)
- 3Z : 30 kW 5E : 55 kW (Only for 400 V)
- 3G : 37 kW

Supply Voltage
A: 200 V
D: 400 V

Model
- E: For speed/torque control and position control

Flowchart for SERVOPACK selection

	Selected SERVOPACK Model
Example	SGDH- 2 B D E
Axis 1	SGDH- □□□□
Axis 2	SGDH- □□□□
. . .	. . . . . .

7.2 Servomotor Ratings and Specifications

This section provides the ratings, specifications, and mechanical characteristics of the SGMBH servomotors.

7.2.1 Ratings and Specifications

The following sections provide the ratings and specifications of the servomotors by model.

■ SGMBH Servomotors

- Time Rating: Continuous
- Thermal Class: F
- Vibration Class: 15μm or below
- Withstand Voltage: 1800 VAC
- Insulation Resistance: 500 VDC, 10 MΩ min.
- Enclosure: Totally enclosed, cooled separately, IP44
- Ambient Temperature: 0 to 40°C
- Ambient Humidity: 20% to 80% (with no condensation)
- Excitation: Permanent magnet
- Drive Method: Direct drive
- Mounting: Foot and flange-mounted type

Table 7.2 SGMBH Standard Servomotor Ratings and Specifications

Servomotor Model SGMBH-		200V			400 V				
		2BA□A	3ZA□A	3GA□A	2BD□A	3ZD□A	3GD□A	4ED□A	5ED□A
Rated Output*1	kW	22	30	37	22	30	37	45	55
Rated Torque*1	N • m	140	191	236	140	191	236	286	350
	lb • in*2				1240	1690	2090	2530	3100
Instantaneous Peak Torque*1	N • m	280	382	471	280	382	471	572	700
	lb • in*2				2480	3380	4170	5060	6120
Rated Current *1	A (rms)	116	160	200	58	80	100	127	150
Instantaneous Max. Current *1	A (rms)	240	340	420	120	170	210	260	310
Rated Speed *1	min^{-1}	1500							
Max. Speed *1	min^{-1}	2000							
Rotor Moment of Inertia *J*	$\times 10^{-4}$ kg • m^2	592	773	1390	592	773	1390	1510	1970
	$\times 10^{-3}$ lb • in • s^2*2				525	685	1230	1490	1750
Rated Power Rate *1	kW/s	331	472	401	331	472	401	542	622
Rated Angular Acceleration*1	rad/s^2	2360	2470	1700	2360	2470	1700	1890	1780

* 1. These items and torque-motor speed characteristics quoted in combination with an SGDM/SGDH SERVOPACKs are at an armature winding temperature of 20°C (68°F).

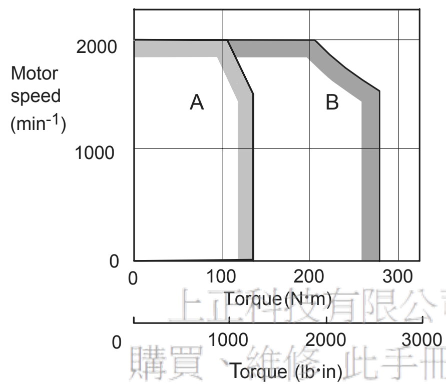
* 2. These values are reference values.

Note: These characteristics are values with the following heat sinks attached for cooling.
SGMBH-2B, -3Z: 650 × 650 × 35 (mm) [26 × 26 × 1.38 (in.)]
SGMBH-3G, -4E, -5E: 750 × 750 × 45 (mm) [30 × 30 × 1.77 (in.)]

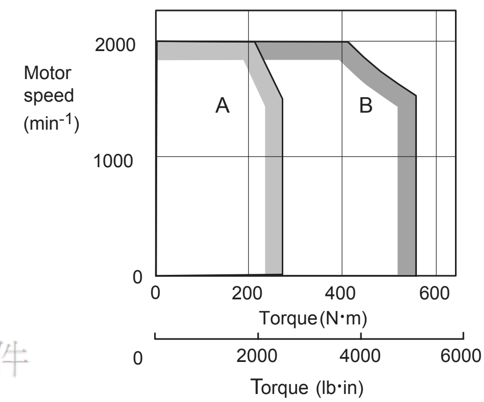
Torque-Motor Speed Characteristics

The following diagrams show the torque-motor speed characteristics for the SGMBH servomotor (rated motor speed: 1500 min^{-1}).

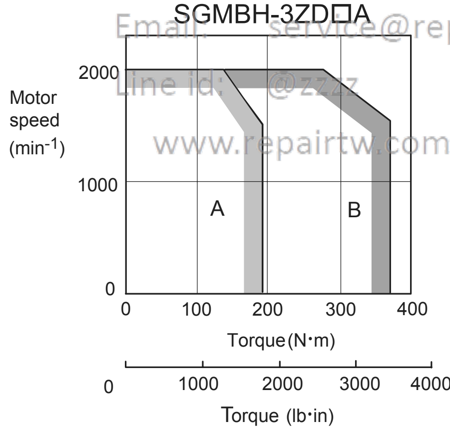
SGMBH-2BA□A
SGMBH-2BD□A



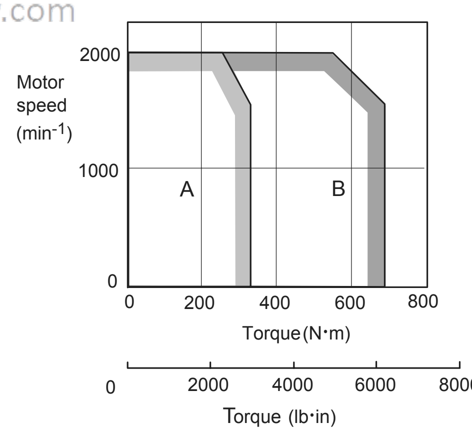
SGMBH-4ED□A



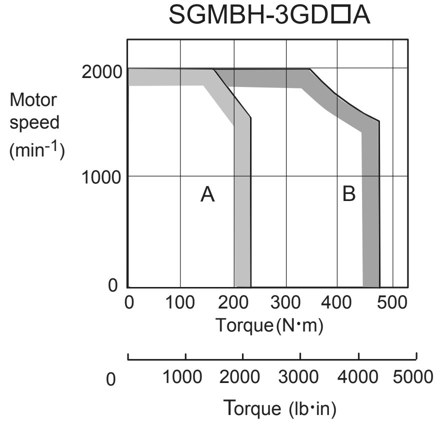
SGMBH-3ZA□A
SGMBH-3ZD□A



SGMBH-5ED□A



SGMBH-3GA□A
SGMBH-3GD□A



7.2.2 Mechanical Characteristics

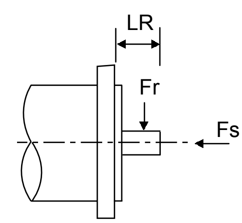
The following sections provide the mechanical characteristics of the SGMBH servomotors.

■ Allowable Radial and Thrust Loads

The following table shows the allowable loads on the output shafts of the SGMBH servomotors.

Conduct mechanical design such that the radial loads and thrust loads do not exceed the values shown in *Table7.3*.

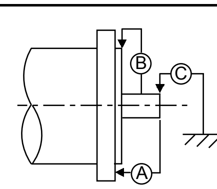
Table 7.3 Allowable Radial and Thrust Loads for the Servomotor

Servomotor Model SGMBH-	Allowable Radial Load Fr [N (lbf)]	Allowable Thrust Load Fs [N (lbf)]	LR mm (inch)	Reference Diagram
2BA☐A 2BD☐A	5880 (1323)	2156 (485)	100 (3.94)	
3ZA☐A 3ZD☐A	6272 (1412)	2156 (485)	100 (3.94)	
3GA☐A 3GD☐A	7448 (1676)	2156 (485)	100 (3.94)	
4ED☐A	7840 (1764)	2156 (485)	100 (3.94)	
5ED☐A	8428 (1897)	2156 (485)	110 (4.33)	

Note: Allowable radial and thrust loads shown above are the maximum values that could be applied to the shaft end from motor torque or other loads.

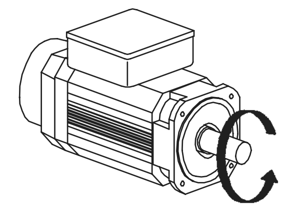
■ Mechanical Tolerance

The following table shows tolerances for SGMBH servomotor output shaft and installation area. See the dimensional drawing of the individual servomotor for more details on tolerances.

Tolerance T. I. R. (Total Indicator Reading)		Reference Diagram
Perpendicularity between the flange face and output shaft Ⓐ	0.05	
Mating concentricity of the flange O.D. Ⓑ	0.05	
Run-out at the end of the shaft Ⓒ	0.03	

■ Direction of Servomotor Rotation

Positive rotation of the servomotor is counterclockwise when viewed from the load.

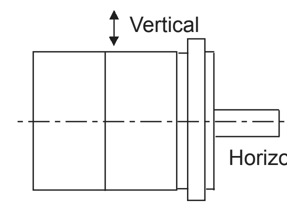


Positive direction

■ Impact Resistance

Mount the servomotor with the axis horizontal. The servomotor will withstand the following vertical impacts:

- Impact Acceleration: 490 m/s^2
- Number of Impacts: 2



Impact applied to the servomotor

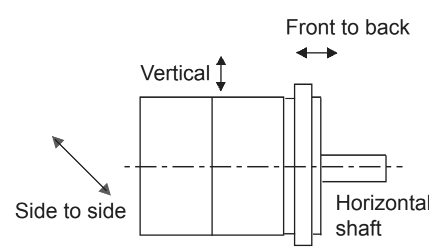
IMPORTANT

SGMBH servomotors have a precision detector attached to the end of the shaft opposite the load. Avoid direct impact on the shaft because it may damage the detector.

■ Vibration Resistance

Mount the servomotor with the axis horizontal. The servomotor will withstand the following vibration acceleration in three directions: Vertical, side to side, and front to back. The amount of vibration the servomotor endures will vary depending on the application. Check the vibration acceleration being applied to your servomotor for each application.

- Vibration Acceleration: 24.5 m/s^2

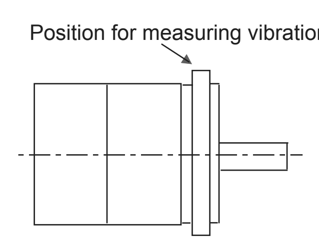


Impact applied to the servomotor

■ Vibration Class

The vibration class for the SGMBH servomotors at rated motor speed is as follows:

- Vibration Class: 15 µm or below



7.3 SERVOPACK Ratings and Specifications

This section provides the ratings, specifications, and mechanical characteristics of the SGDM/ SGDH SERVOPACKs.

7.3.1 Combined Specifications

The following table shows the specifications obtained when the SGDM/SGDH SERVOPACKs are combined with the SGMBH servomotors:

■ Three-phase, 200 to 230 VAC

Table 7.4 SERVOPACK and Servomotor Combination Specifications

SERVOPACK Model SGDM- SGDH-		2BADA 2BAE	3ZADA 3ZAE	3GADA 3GAE
Applicable Servomotor	Model SGMBH-	2BA	3ZA	3GA
	Capacity (kW)	22	30	37
	Motor Speed min^{-1}	Rated 1500/maximam 2000		
Applicable Encoder		Standard: 17-bit incremental encoder or 17-bit absolute encoder		
Continuous Output Current A (rms)		116	160	200
Max. Output Current A (rms)		240	340	420
Allowable Load Moment of Inertia J $\times 10^{-4}$ kg • m^2 ($\times 10^{-3}$oz • in • s^2)		2960	3865	6950

■ Three-phase, 380 to 480 VAC

Table 7.5 SERVOPACK and Servomotor Combination Specifications

SERVOPACK Model SGDH-		2BDE	3ZDE	3GDE	4EDE	5EDE
Applicable Servomotor	Model SGMBH-	2BD	3ZD	3GD	4ED	5ED
	Capacity (kW)	22	30	37	45	55
	Motor Speed min^{-1}	Rated 1500/maximam 2000				
Applicable Encoder		Standard: 17-bit incremental encoder or 17-bit absolute encoder				
Continuous Output Current A (rms)		58	80	100	127	150
Max. Output Current A (rms)		120	170	210	260	310
Allowable Load Moment of Inertia J $\times 10^{-4}$ kg • m^2 ($\times 10^{-3}$oz • in • s^2)		2960 (2621)	3865 (3422)	6950 (6153)	7550 (6684)	9850 (8721)

7.3.2 Ratings and Specifications

The following table shows ratings and specifications for the SGDM/SGDH SERVOPACKs. Refer to them as required when selecting a SERVOPACK.

Table 7.6 SERVOPACK Ratings and Specifications

SERVOPACK Model			200-V Series			400-V Series				
		SGDM-	2BADA	3ZADA	3GADA	-				
		SGDH-	2BAE	3ZAE	3GAE	2BDE	3ZDE	3GDE	4EDE	5EDE
Applicable Servomotor Model SGMBH-			2BA	3ZA	3GA	2BD	3ZD	3GD	4ED	5ED
Continuous Output (kW)			22	30	37	22	30	37	45	55
Allowable Load Moment of Inertia *J* $\times 10^{-4}$ kg • m^2 ($\times 10^{-3}$oz • in • s^2)			2960 (2621)	3865 (3422)	6950 (6153)	2960 (2621)	3865 (3422)	6950 (6153)	7550 (6684)	9850 (8721)
Basic Specifications	Input Power Supply *1	Main Circuit	Three-phase 200 to 230 VAC +10 to -15%, 50/60 Hz			Three-phase 380 to 480 VAC +10 to -15%, 50/60 Hz				
		Main Circuit Power Supply Capacity (kVA)	36.7	50.1	61.8	36.7	50.1	61.8	75.2	91.9
		Control Circuit	Single-phase 200 to 220 VAC +10 to -15%, 50 Hz Single-phase 200 to 230 VAC +10 to -15%, 60 Hz			24 VDC ±15%				
		Control Circuit Power Supply Capacity (VA)	150							
	Control Mode		Three-phase full-wave rectification IGBT-PWM (sine-wave driven)							
	Feedback		Incremental encoder, absolute encoder							
	Operating Conditions:	Ambient/Storage Temperature *2	0 to + 55 °C / -20 to + 85 °C (32 to 131 °F / -4 to 185 °F)							
		Ambient/Storage Humidity	90% RH or less (with no condensation)							
		Vibration/Shock Resistance	4.9 m/s^2 / 19.6 m/s^2							
	Configuration		Base-mounted							
	Approx. Mass kg (lb)		55 (121)		60 (132)	40 (88)		60 (132)	65 (144)	

* 1. Supply voltage must not exceed the following values. Otherwise, the SERVOPACK may malfunction. If the voltage exceeds these values, use a step-down transformer so that the voltage will be within the specified range.
SERVOPACK for 200 V: 253 Vrms (max.)
SERVOPACK for 400 V: 528 Vrms (max.)

* 2. Use the SERVOPACK within the ambient temperature range. When enclosed in a box, internal temperatures must not exceed the ambient temperature range.

7

Table 7.6 SERVOPACK Ratings and Specifications (cont'd)

SERVOPACK Model				200-V Series			400-V Series				
		SGDM-		2BADA	3ZADA	3GADA	-				
		SGDH-		2BAE	3ZAE	3GAE	2BDE	3ZDE	3GDE	4EDE	5EDE
Speed and Torque Control Mode	Performance	Speed Control Range		1:5000 (The lowest speed of the speed control range is the speed at which the servomotor will not stop with a rated torque load.)							
		Speed Regulation *3	Load Regulation	0 to 100% load: ±0.01% max. (at rated speed)							
			Voltage Regulation	Rated Voltage ±10%: 0% (at rated speed)							
			Temperature Regulation	25 ± 25 °C (77 ± 77 °F) : ±0.1% max. (at rated speed)							
		Frequency Characteristics		100 Hz (at $J_L = J_M$)							
		Torque Control Tolerance (Repeatability)		±2 %							
		Soft Start Time Setting		0 to 10 s (Can be set individually for acceleration and deceleration.)							
	Input Signal	Speed Reference Input	Reference Voltage *4	±6 VDC (Variable setting range: ±2 to ±10 VDC) at rated speed (positive rotation with positive reference), input voltage: ±12 V (max.)							
			Input Impedance	Approx. 14 kΩ							
			Circuit Time Constant	Approx. 47 µs							
		Torque Reference Input	Reference Voltage *4	±3 VDC (Variable setting range: ±1 to ±10 VDC) at rated torque (positive torque reference with positive reference), input voltage: ±12 V (max.)							
			Input Impedance	Approx. 14 kΩ							
			Circuit Time Constant	Approx. 47 µs							
		Contact Speed Reference	Rotation Direction Selection	With P control signal							
			Speed Selection	With forward/reverse current limit signal (speed 1 to 3 selection), servomotor stops or another control method is used when both are OFF.							

* 3. Speed regulation is defined as follows:

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

The motor speed may change due to voltage variations or amplifier drift and changes in processing resistance due to temperature variation. The ratio of speed changes to the rated speed represent speed regulation due to voltage and temperature variations.

* 4. Forward is clockwise viewed from the non-load side of the servomotor. (Counterclockwise viewed from the load and shaft end.)

Table 7.6 SERVOPACK Ratings and Specifications (cont'd)

<table>
<tr><td colspan="4">SERVOPACK Model</td><td colspan="3">200-V Series</td><td colspan="5">400-V Series</td></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">SGDM-</td><td>2BADA</td><td>3ZADA</td><td>3GADA</td><td colspan="5">-</td></tr>
<tr><td colspan="2">SGDH-</td><td>2BAE</td><td>3ZAE</td><td>3GAE</td><td>2BDE</td><td>3ZDE</td><td>3GDE</td><td>4EDE</td><td>5EDE</td></tr>
<tr><td rowspan="8">Position Control Mode</td><td rowspan="3">Performance</td><td colspan="2">Bias Setting</td><td colspan="8">0 to 450 min^{-1} (setting resolution: 1 min^{-1})</td></tr>
<tr><td colspan="2">Feed-forward Compensation</td><td colspan="8">0 to 100% (setting resolution: 1%)</td></tr>
<tr><td colspan="2">Positioning Completed Width Setting</td><td colspan="8">0 to 250 reference units (setting resolution: 1 reference unit)</td></tr>
<tr><td rowspan="5">Input Signals</td><td rowspan="3">Reference Pulse</td><td>Type</td><td colspan="8">Sign + pulse train, 90 ° phase difference 2-phase pulse (phase A + phase B), or CCW + CW pulse train</td></tr>
<tr><td>Form</td><td colspan="8">Line driver (+5 V level), open collector (+5 V or +12 V level)</td></tr>
<tr><td>Frequency</td><td colspan="8">500/200 kpps max. (line driver/open collector)</td></tr>
<tr><td colspan="2">Control Signal</td><td colspan="8">Clear signal (input pulse form identical to reference pulse)</td></tr>
<tr><td colspan="2">Built-in Open Collector Power Supply*5</td><td colspan="8">+12 V (1-kΩ resistor built-in)</td></tr>
<tr><td rowspan="5">I/O Signals</td><td colspan="2" rowspan="2">Position Output</td><td>Form</td><td colspan="8">Phase-A, -B, and -C line driver
Phase-S line driver (only with an absolute encoder)</td></tr>
<tr><td>Frequency Dividing Ratio</td><td colspan="8">Any</td></tr>
<tr><td colspan="2">Sequence Input</td><td>Signal allocation can be modified.</td><td colspan="8">Servo ON, P control (or Control Mode switching, forward/reverse motor rotation by internal speed setting, zero clamping, reference pulse prohibited), forward run prohibited (P-OT), reverse run prohibited (N-OT), alarm reset, forward current limit and reverse current limit (or internal speed selection)</td></tr>
<tr><td colspan="2" rowspan="2">Sequence Output</td><td>Fixed Output</td><td colspan="8">Servo alarm, 3-bit alarm codes</td></tr>
<tr><td>Signal allocation can be modified.</td><td colspan="8">Select three signals among the following: positioning complete (speed agree), servomotor rotation, servo ready, current limit, speed limit, brake release, warning, and NEAR signals.</td></tr>
</table>

* 5. The built-in open collector power supply is not electrically insulated from the control circuit in the SERVOPACK.

7

Table 7.6 SERVOPACK Ratings and Specifications (cont'd)

SERVOPACK Model			200-V Series			400-V Series				
	SGDM-		2BADA	3ZADA	3GADA	-				
	SGDH-		2BAE	3ZAE	3GAE	2BDE	3ZDE	3GDE	4EDE	5EDE
Built-in Functions	Dynamic Brake (DB)		Operated at main power OFF, servo alarm, servo OFF or overtravel.							
	Regenerative Processing		Incorporated. External regenerative resistor must be mounted.							
	Overtravel Prevention (OT)		Dynamic brake stop at P-OT or N-OT, deceleration to a stop, or free run to a stop							
	Electronic Gear		$0.01 \leq B/A \leq 100$							
	Protection		Overcurrent, overvoltage, low voltage, overload, regeneration error, main circuit voltage error, heat sink overheated, no power supply, overflow, overspeed, encoder error, overrun, CPU error, parameter error, etc.							
	LED Display		Charge, Power, five 7-segment LEDs (built-in Digital Operator functions)							
	Analog Monitor (CN5)		Analog monitor connector built in for monitoring speed, torque and other reference signals. Speed: 1 V/1000 min^{-1} Torque: 1 V/rated torque Pulses remaining: 0.05 V/1 reference unit or 0.05 V/100 reference units							
	Communications	Interface	Digital Operator (hand-held model), RS-422A port such as for a personal computer (RS-232C ports under certain conditions)							
		1:N Communications	Up to N = 14 for RS-422A ports							
		Axis Address Setting	Set with parameters.							
		Functions	Status display, parameter setting, monitor display, alarm trace-back display, JOG and auto-tuning operations, speed, torque reference signal and other drawing functions.							
	Others		Reverse rotation connection, zero point search, automatic servomotor ID, DC reactor connection terminal for high power supply frequency control							

7.3.3 Overload Characteristics

SERVOPACKs have a built-in overload protective function that protects the SERVOPACKs and servomotors from overload. Allowable power for the SERVOPACKs is limited by the overload protective function as shown in the figure below.

The overload detection level is set under hot start[1] conditions at a servomotor ambient temperature of 40 °C (104 °F).

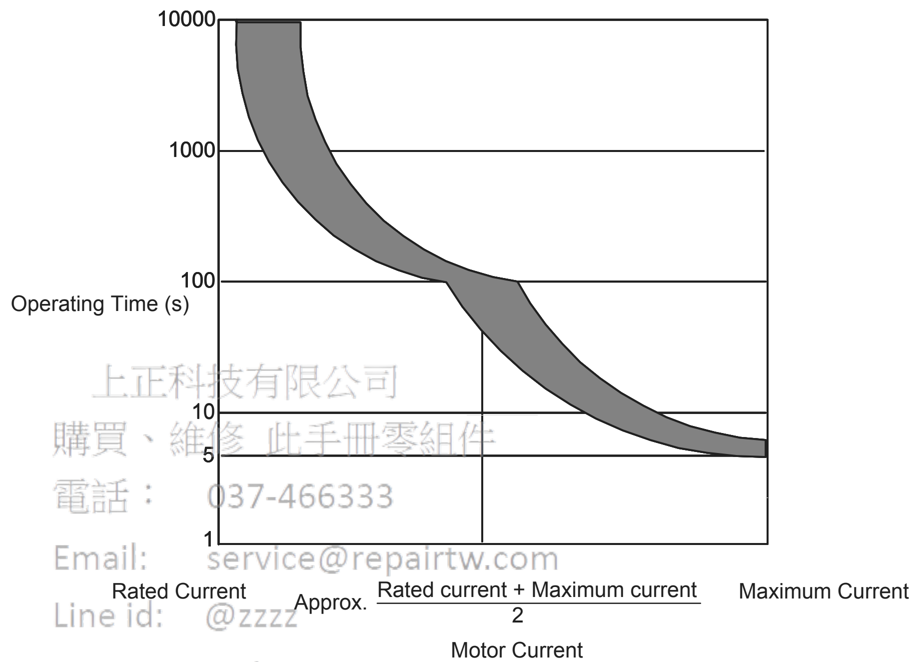


Fig. 7.1 Overload Characteristics

TERMS

[1] Hot Start

A hot start indicates that both the SERVOPACK and the servomotor have run long enough at the rated load to be thermally saturated.

7.3.4 Starting and Stopping Time

The motor starting time (tr) and stopping time (tf) under a constant load are calculated using the following formulas. Motor viscous torque and friction torque are ignored.

$$\text{Starting time:}\quad tr = \frac{2\pi \cdot N_M (J_M + J_L)}{60 \cdot (T_{PM} - T_L)} \; [s]$$

$$\text{Stopping time:}\quad tf = \frac{2\pi \cdot N_M (J_M + J_L)}{60 \cdot (T_{PM} - T_L)} \; [s]$$

N_M: Rated motor speed (min^{-1})

J_M: Motor rotor moment of inertia ($kg{\cdot}m^2$)

J_L: Load converted to shaft moment of inertia ($kg{\cdot}m^2$)

T_{PM}: Instantaneous peak motor torque when combined with a SERVOPACK (N·m)

T_L: Load torque (N·m)

Calculate the torque from the motor current using servomotor torque constant × motor current (effective value).

Fig7.2 shows the motor torque and motor speed timing chart.

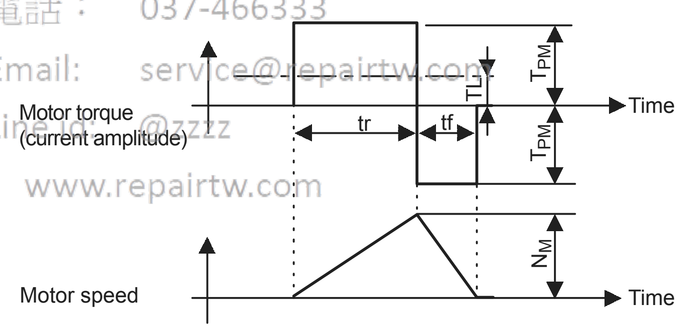


Fig. 7.2 Motor Torque (Current Amplitude) and Motor Speed Timing Chart

7.3.5 Load Moment of Inertia

The larger the load moment of inertia, the worse the movement response of the load. The size of the load moment of inertia (J_L) allowable when using a servomotor is limited to within 5 times the moment of inertia (J_M).

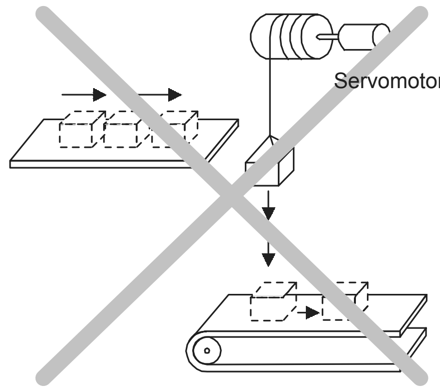
If the load moment of inertia exceeds five times the motor moment of inertia, an overvoltage alarm may arise during deceleration. Take one of the steps below if this occurs.

- Reduce the torque limit.
- Reduce the deceleration rate.
- Reduce the maximum motor speed.
- Consult your Yaskawa representative if the alarm cannot be cleared.

7.3.6 Overhanging Load

A servomotor may not be operated with an overhanging load, i.e., a load which tends to continuously rotate the motor. *Fig7.3* shows a typical example of such a load.

• Vertical Axis Motor Drive without Counterweight



• Feeding Motor Drive

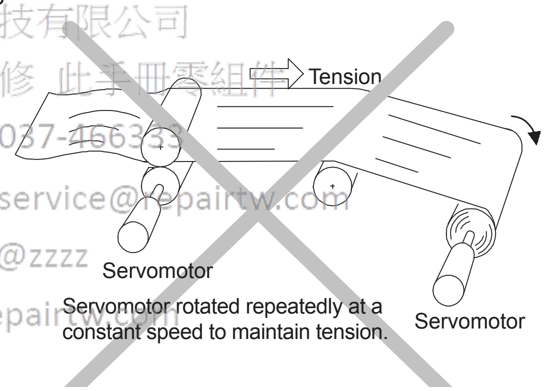


Fig. 7.3 Examples of Overhanging Loads

IMPORTANT

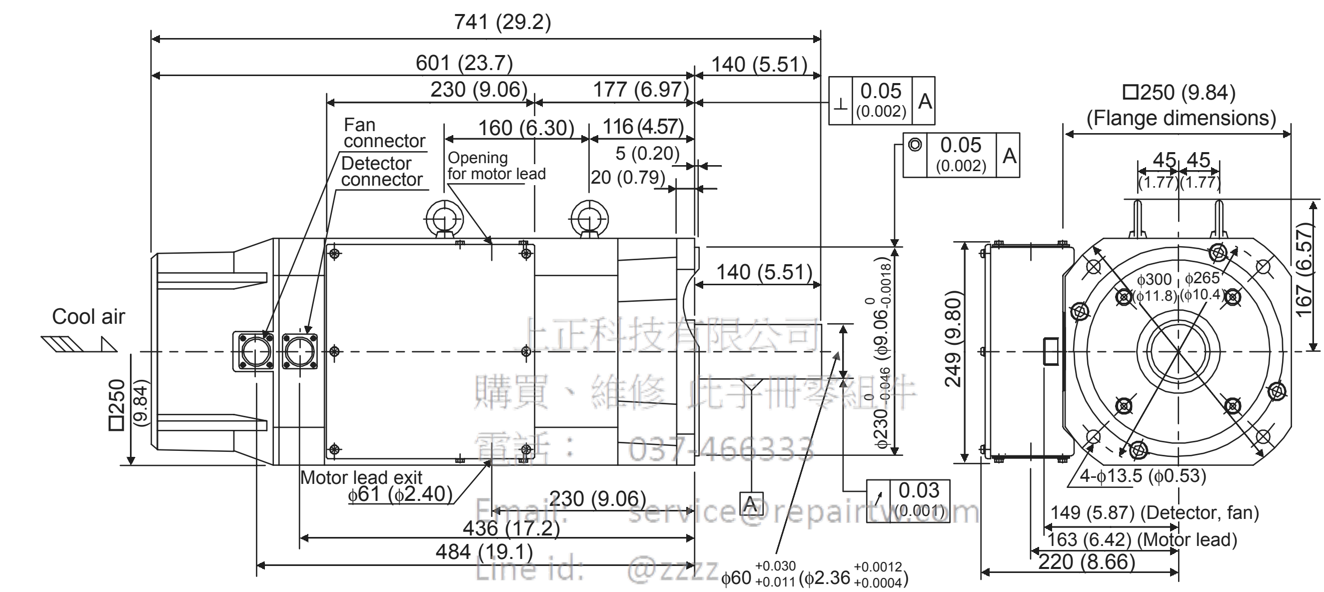
Doing so will cause the SERVOPACK's regenerative brake to be applied continuously and the regenerative energy of the load may exceed the allowable range causing damage to the SERVOPACK. The regenerative brake capacity of the SGDM/SGDH SERVOPACKs is rated for short-term operation approximately equivalent to the time it takes to decelerate to a stop.

7.4 Servodrive Dimensional Drawings

This section provides dimensional drawings for the servomotor and SERVOPACK.

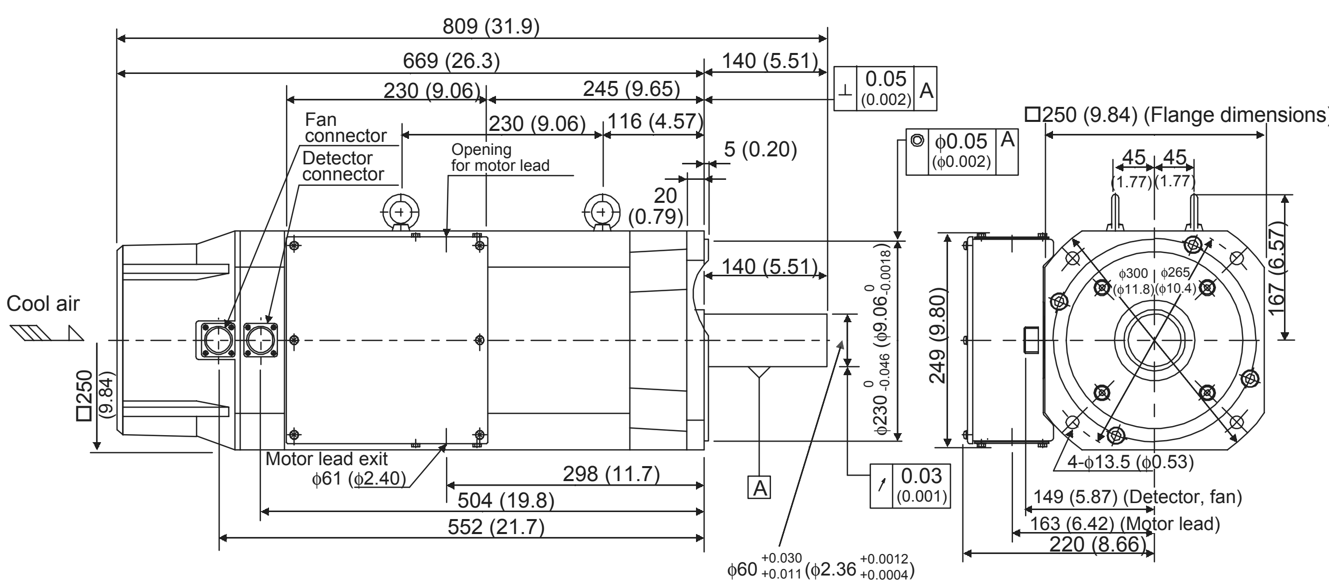
7.4.1 Servomotors

■ SGMBH-2BA□A and SGMBH-2BD□A Servomotors



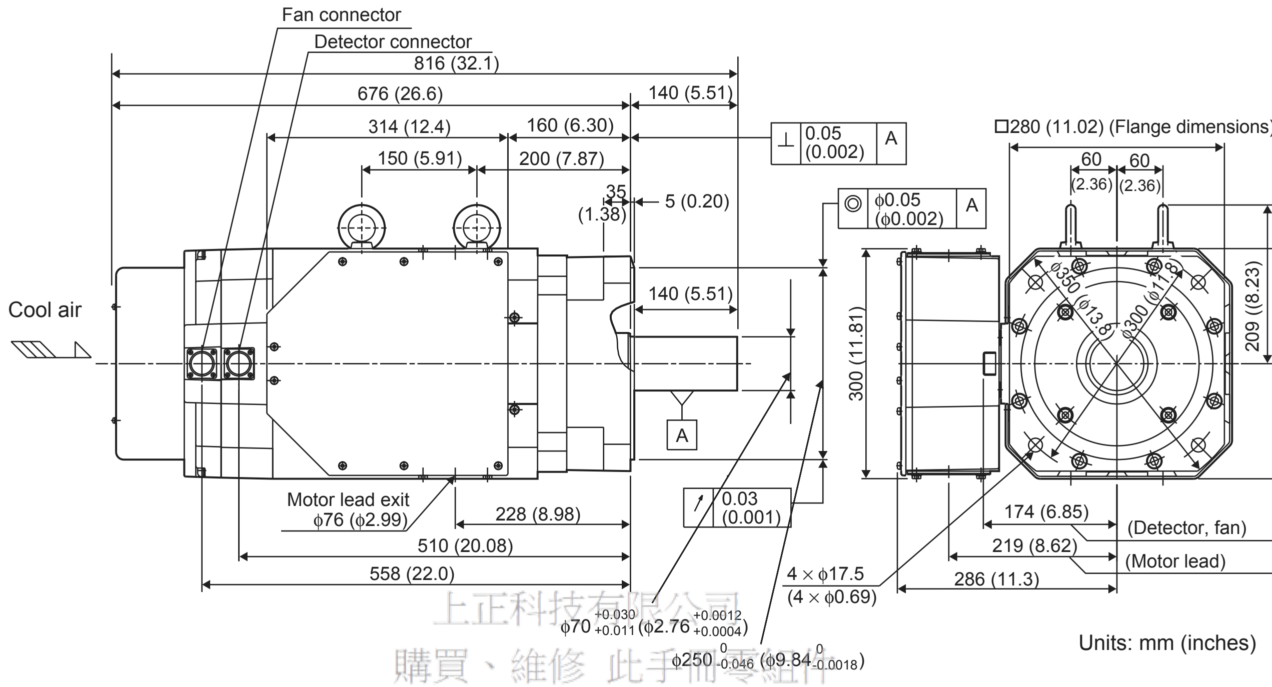
Units: mm (inches)

■ SGMBH-3ZA□A and SGMBH-3ZD□A Servomotors



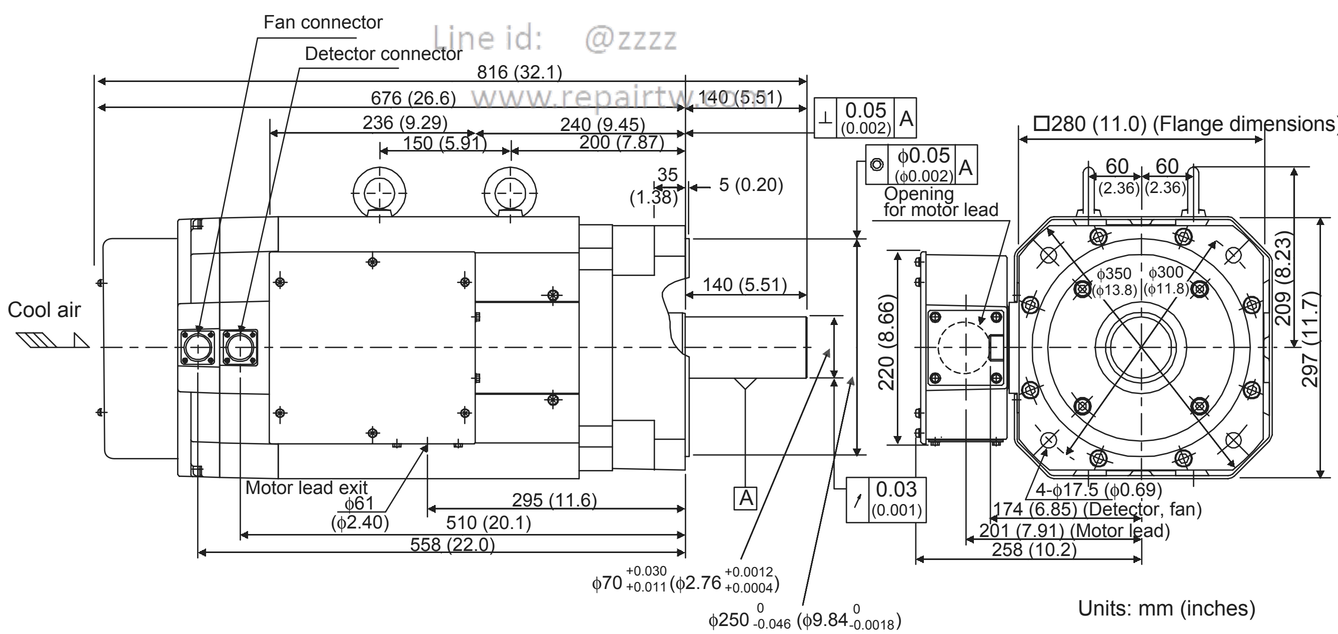
Units: mm (inches)

■ SGMBH-3GA□A Servomotors



Units: mm (inches)

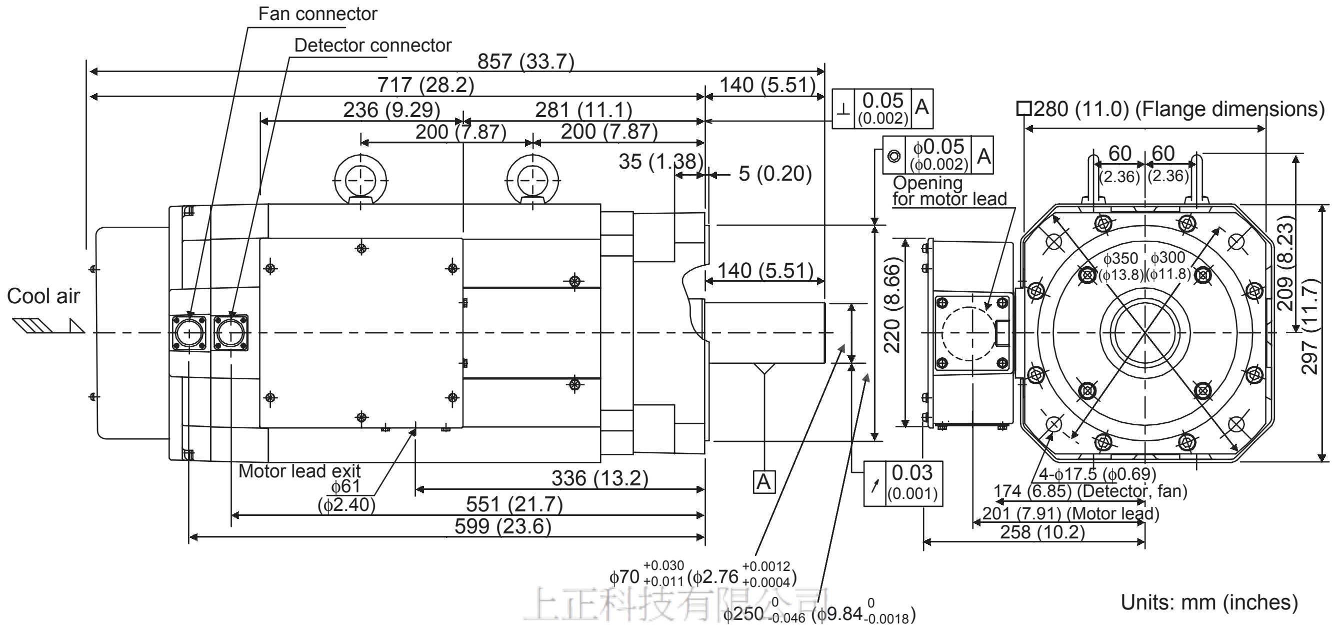
■ SGMBH-3GD□A Servomotors



Units: mm (inches)

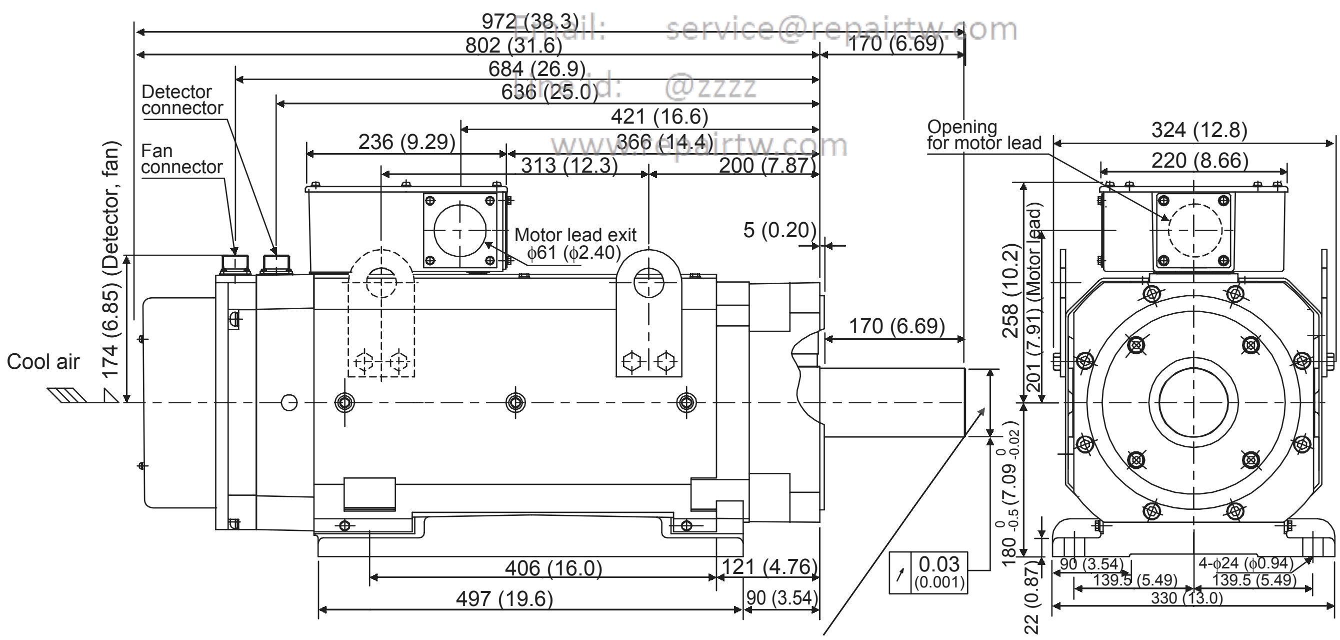
7

■ SGMBH-4ED□A Servomotors



Units: mm (inches)

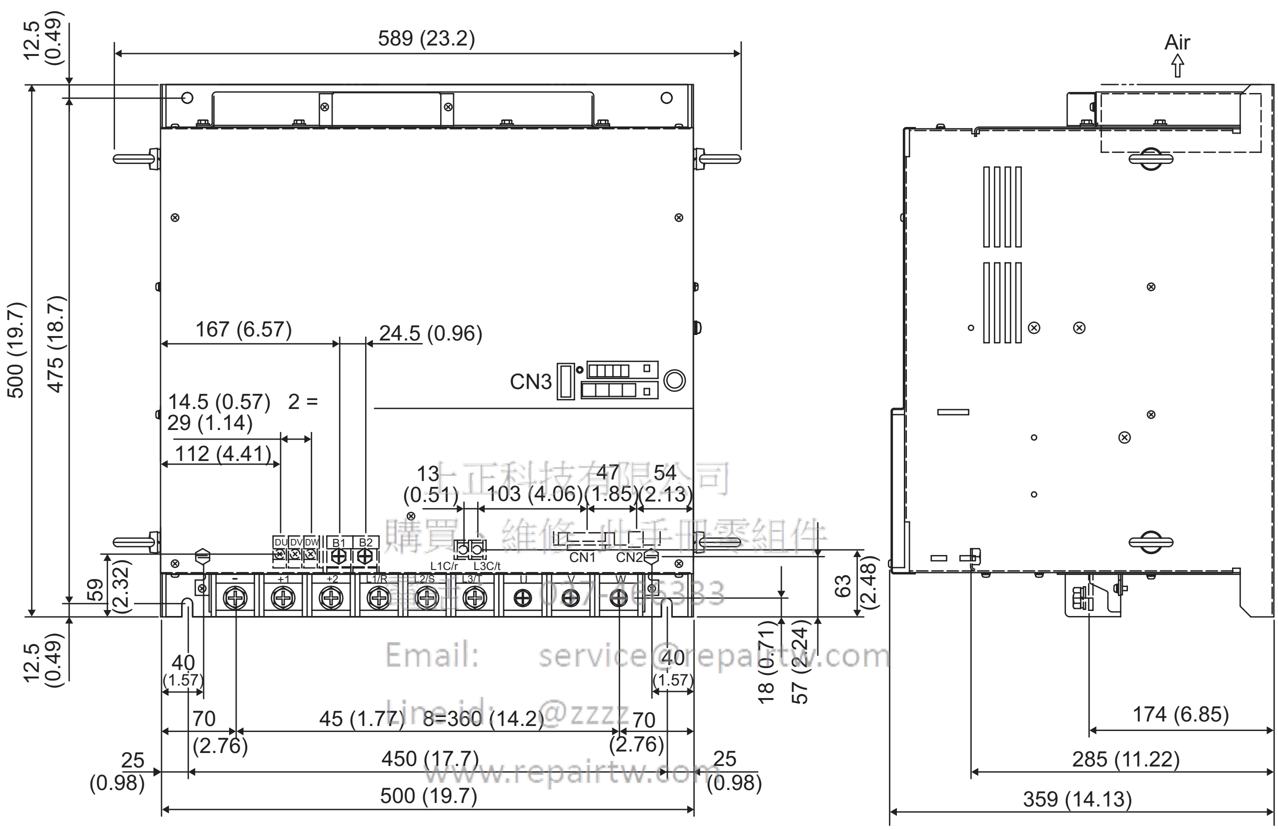
■ SGMBH-5ED□A Servomotors



Units: mm (inches)

7.4.2 SERVOPACKs

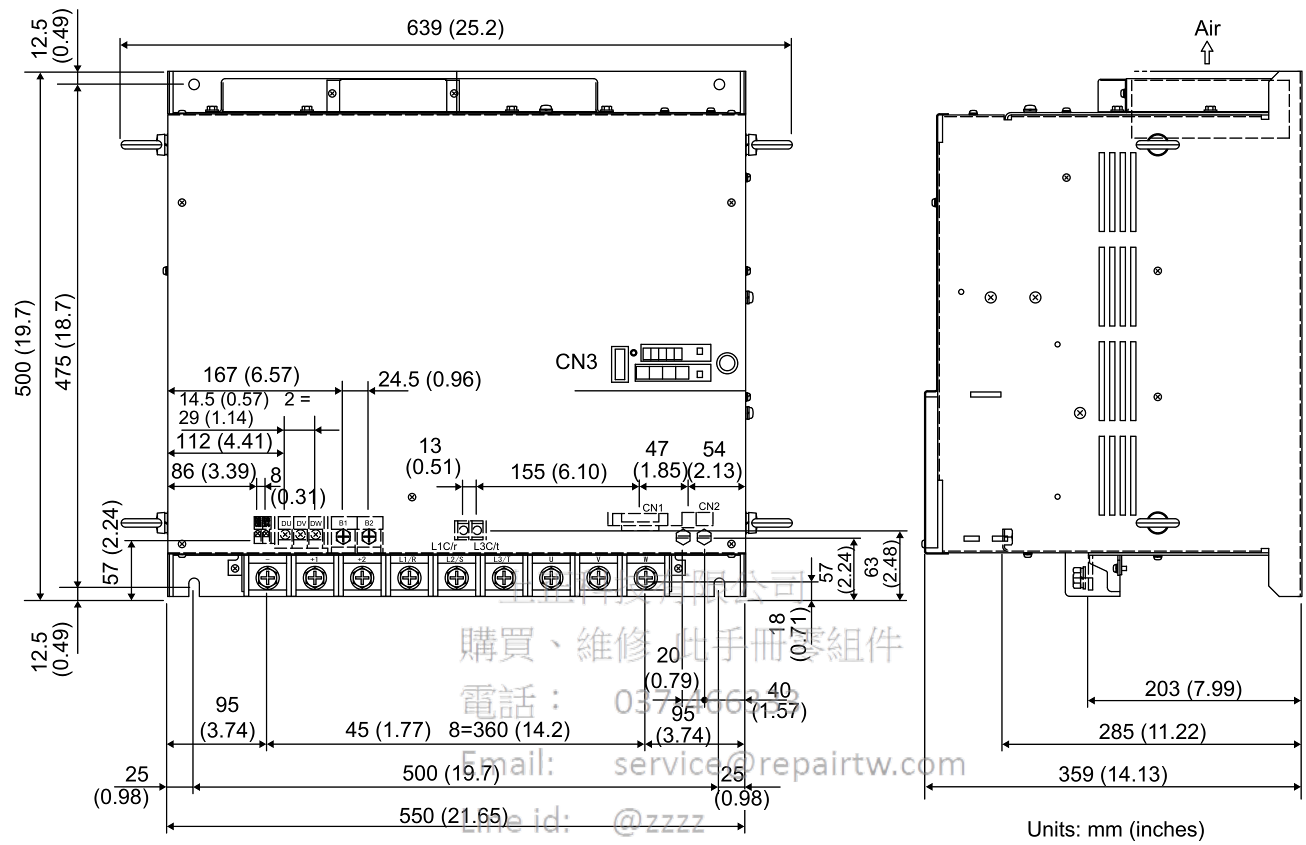
■ SGDM-2BADA (Three-phase 200 V, 22 kW)
SGDM-3ZADA (Three-phase 200 V, 30 kW)



Units: mm (inches)
Approx. mass: 55 kg (121.25 lbs)

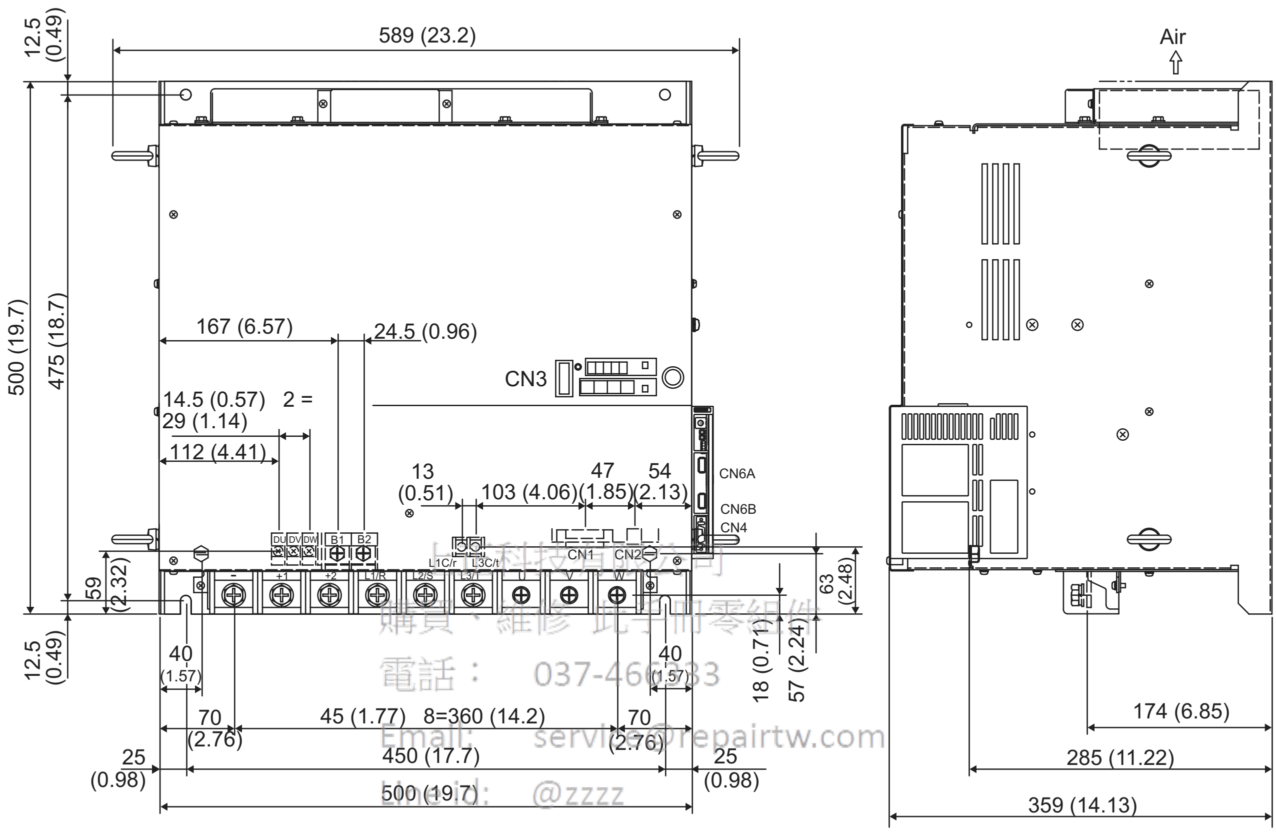
7

■ SGDM-3GADA (Three-phase 200 V, 37 kW)



Units: mm (inches)
Approx. mass: 60 kg (132 lbs)

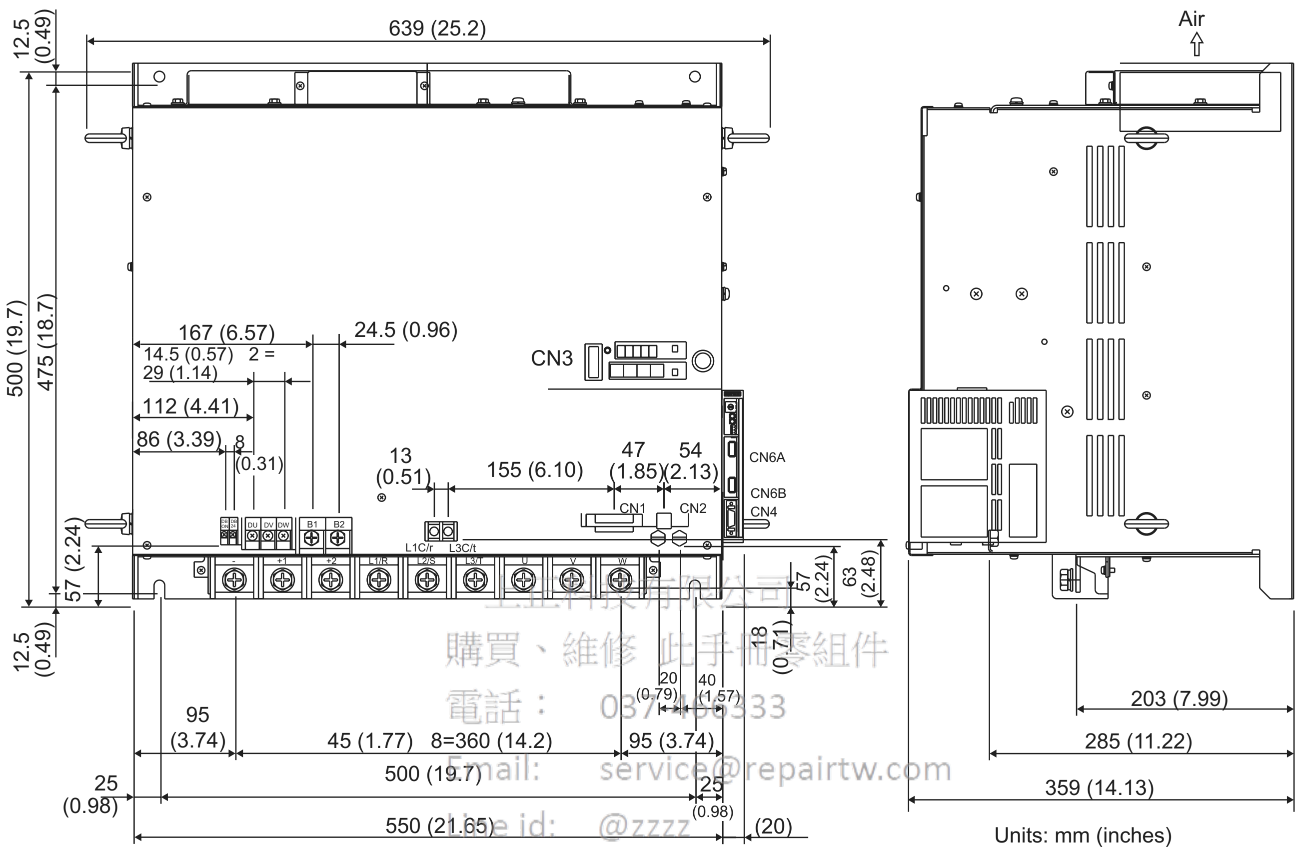
■ SGDH-2BAE (Three-phase 200 V, 22 kW)
SGDH-3ZAE (Three-phase 200 V, 30 kW)



Units: mm (inches)
Approx. mass: 55 kg (121.25 lbs)

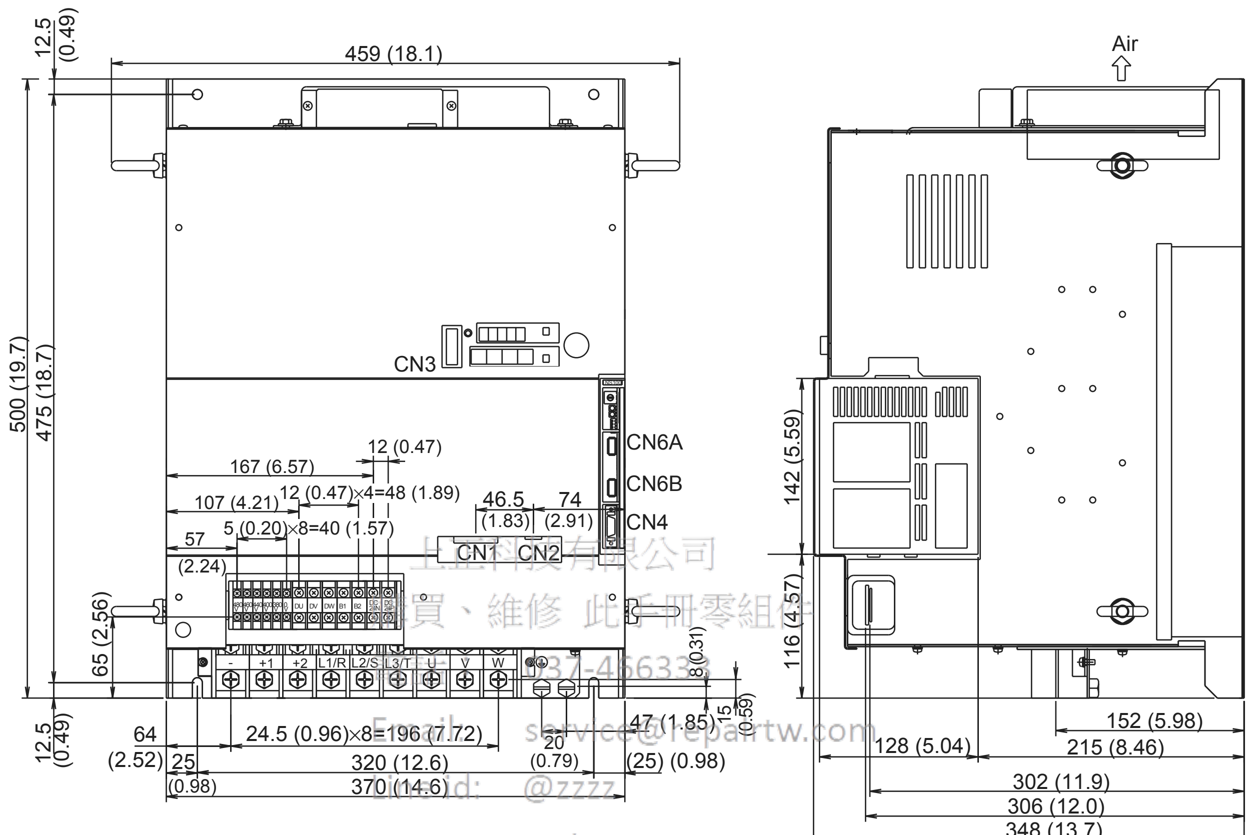
7

■ SGDH-3GAE (Three-phase 200 V, 37 kW)



Units: mm (inches)
Approx. mass: 60 kg (132 lbs)

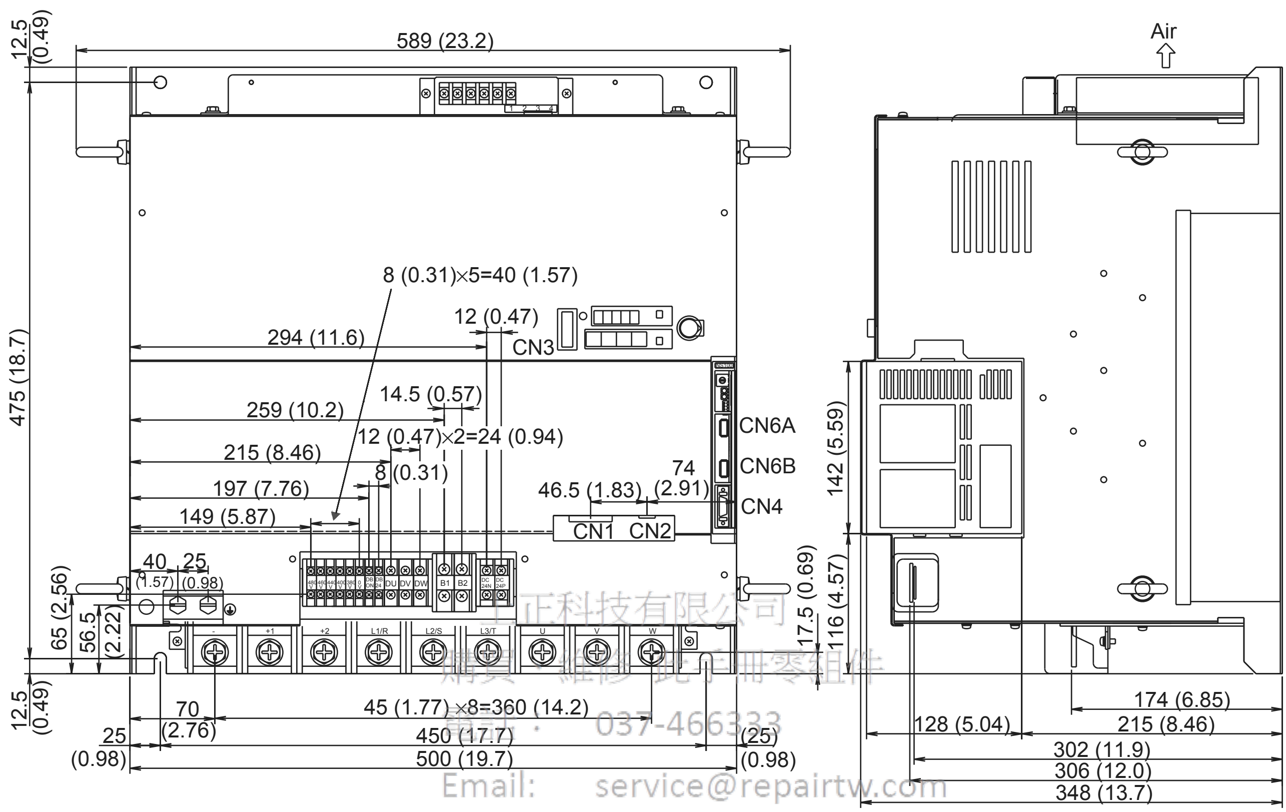
■ SGDH-2BDE (Three-phase 400 V, 22 kW),
SGDH-3ZDE (Three-phase 400 V, 30 kW)



Units: mm (inches)
Approx. mass: 40 kg (88.2 lbs)

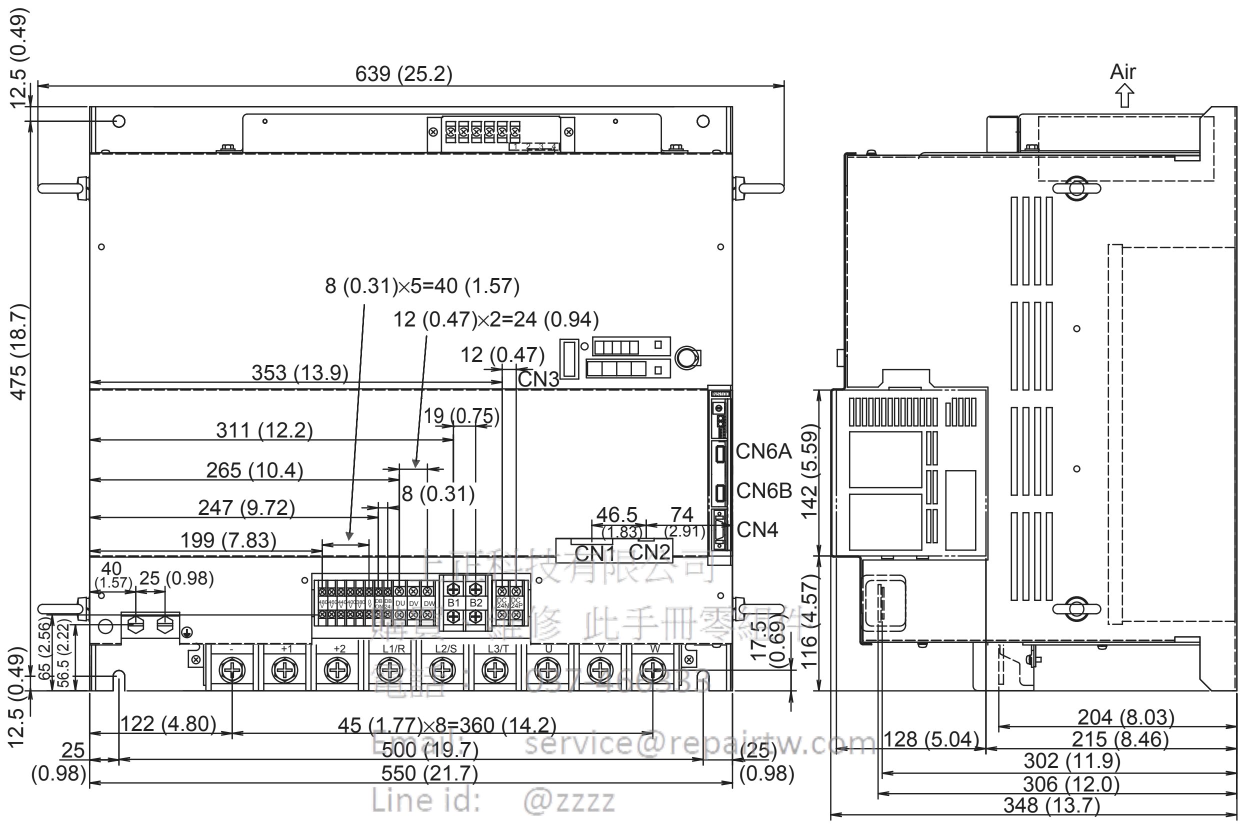
7

■ SGDH-3GDE (Three-phase 400 V, 37 kW)



Units: mm (inches)
Approx. mass: 60 kg (132 lbs)

■ SGDH-4EDE (Three-phase 400 V, 45 kW),
SGDH-5EDE (Three-phase 400 V, 55 kW)



Units: mm (inches)
Approx. mass: 65 kg (143 lbs)

7

7.5 Specifications and Dimensional Drawings for Peripheral Devices

This section provides specifications and dimensional drawings for peripheral devices required in a Σ-II Series Servo System.

7.5.1 Cable Specifications and Peripheral Devices

Ratings and specifications for peripheral devices as well as cable specifications for SERVOPACKs are summarized in *Table7.7* to *Table7.9*.

⚠ CAUTION

Wiring Precautions

- Do not bundle or run power and signal lines together in the same duct.
  Keep power and signal lines at least 30 cm (11.81 in) apart.
- Use twisted-pair wires or multi-core shielded-pair wires for signal and encoder (PG) feedback lines.
- The Maximum lengths for signal lines are as follows:
  - Maximum of 3 m (9.84 ft) for reference input lines.
  - Maximum of 20 m (65.6 ft) for PG feedback lines.

■ Cable Specifications

Table7.7 and *Table7.8* provide wire size specifications for servomotors and SERVOPACKs.

Table 7.7 SERVOPACK Wire Sizes

External Terminal Name		Terminal Symbol	Wire Size Examples [mm² (in²)]							
			SGDM-□□ADA SGDH-□□AE			SGDH-□□DE				
			2B	3Z	3G	2B	3Z	3G	4E	5E
Online Terminals	Main Power Input Terminals	L1/R, L2/S, L3/T, ⏚	HIV 30 (0.047) min.	HIV 50 (0.078) min.	HIV 60 (0.093) min.	HIV 14 (0.022) min.	HIV 14 (0.022) min.	HIV 22 (0.034) min.	HIV 30 (0.047) min.	HIV 38 (0.059) min.
	Servomotor Connection Terminals	U, V, W, ⏚	HIV 38 (0.059) min.	HIV 60 (0.093) min.	HIV 80 (0.124) min.	HIV 14 (0.022) min.	HIV 22 (0.034) min.	HIV 30 (0.047) min.	HIV 38 (0.059) min.	HIV 50 (0.078) min.
	Control Power Input Terminal	DC24P, DC24V	No terminals			HIV 1.25 (0.002) min.				
		L1C/r, L3C/t	HIV 1.25 (0.002) min.			No terminals				
	Regenerative Resistor Terminal	B1, B2	HIV 22 (0.034) min.	HIV 38 (0.059) min.		HIV 22 (0.034) min.				HIV 38 (0.059) min.
	Input Terminals for Actuator Control	0 V, 380 V, 400 V, 440 V, 460 V, 480V	No terminals			HIV 1.25 (0.002) min.				
	Dynamic Brake Unit Connection Terminal	DU, DV, DW	HIV 2.0 (0.003) min.	HIV 3.5 (0.0054) min.		HIV 2.0 (0.003) min.				HIV 3.5 (0.0054) min.
		DBON, DB24	HIV 1.25 (0.002) min.							
Offline Terminals	Control I/O Signal Connector	1CN	Twisted-pair or shielded twisted-pair wires Core wire at least 0.12 mm² (0.0002 in²), tinned, annealed copper twisted wires. Finished cable dimension: max.ϕ16mm (0.63 in) for CN1 and max. ϕ11 (0.43 in) for CN2.							
	PG Signal Connector	2CN								

7

Table 7.8 Servomotor Wire Sizes

External Terminal Name		Terminal Symbol	Wire Size Examples [mm² (in²)]							
			SGDM-□□ADA SGDH-□□AE			SGDH-□□DE				
			2B	3Z	3G	2B	3Z	3G	4E	5E
Offline Termi-nals	Fan Terminals	U (A), V (B), W (C)	HIV 1.25 (0.002) min.							
	Brake Power Supply Connection Terminals (for servomotor with brake only)	A, B								
	Thermal Protector Terminals	1, 1b								

Note: 1. Wire sizes were selected for three cables per bundle at 40°C ambient temperature with the rated current.
2. Use cable with a minimum withstand voltage of 600 V for main circuits.
3. If cables are bundled in PVC or metal ducts, consider the reduction ratio of the allowable current.
4. Use heat-resistant cable under high ambient or panel temperatures where normal vinyl cable will rapidly deteriorate.

The following table shows types of cables and must be used in conjunction with *Table7.7* and *Table7.8*.

Cable Types		Allowable Conductor Temperature °C
Symbol	Name	
PVC	Normal vinyl cable	-
IV	600-V vinyl cable	60
HIV	Temperature-resistant vinyl cable	75

Note: 1. Use cable with a minimum withstand voltage of 600 V for main circuits.
2. If cables are bundled in PVC or metal ducts, consider the reduction ratio of the allowable current.
3. Use heat-resistant cable under high ambient or panel temperatures where normal vinyl cable will rapidly deteriorate.

■ Peripheral Device Types and Capacities

The following table shows SERVOPACK peripheral device types and capacities.

Table 7.9 Peripheral Device Types and Capacities

SERVOPACK Model	Applicable Servomotor Model SGMBH-	Power Supply Capacity*4 kVA	Molded-case Circuit Breaker (MCCB) or Fuse Capacity *1 A	Main Power Inrush Current (peak value) A	Recommended Line Filter*2	Magnetic Contactor*3
SGDM-2BADA SGDH-2BAE	2BA□A	36.7 kVA	150A	325A	FN258L-130-35	HI-65E2 (135 A)
SGDM-3ZADA SGDH-3ZAE	3ZA□A	50.1 kVA	200A	325A	FN258L-180-07	HI-100E2 (180 A)
SGDM-3GADA SGDH-3GAE	3GA□A	61.8 kVA	225A	650A	FN359P-250-99	HI-125E2 (220 A)
SGDH-2BDE	2BD□A	36.7 kVA	100A	162A	FN258-180-07	HI-65J (65 A)
SGDH-3ZDE	3ZD□A	50.1 kVA	150A	650A	FN258-180-07	HI-80J (80 A)
SGDH-3GDE	3GD□A	61.8 kVA	150A	650A	FN258-180-07	HI-80J (80 A)
SGDH-4EDE	4ED□A	75.2 kVA	225A	1300A	FN359-250-99	HI-125J (125 A)
SGDH-5EDE	5ED□A	91.9 kVA	225A	1300A	FN359-250-99	HI-125J (125 A)

* 1. Braking characteristics at 25°C: 200% for 2 s min., 700% for 0.01 s min.
* 2. Manufactured by SCHAFFNER. (Available from Yaskawa Controls Co., Ltd.)
* 3. Manufactured by Yaskawa Controls Co., Ltd.
* 4. The supply voltage capacity shown is the value for a rated load.

The following table shows appropriate cables for CN1 and CN2 SERVOPACK connectors.

Wire sizes were selected for three cables per bundle at 40°C ambient temperature with the rated current.

Table 7.10 Cables for CN1 and CN2 Connectors

Control I/O Signal Connector	CN1	Cable	Use twisted-pair or shielded twisted-pair wire.
		Applicable wire	AWG24, 26, 28, 30
		Finished cable dimension	ϕ16.0 mm (0.63 in) max.
PG Signal Connector	CN2	Cable	Use Yaskawa cable, or shielded twisted-pair wire if Yaskawa cable is not used.
		Applicable wire	AWG24, 26, 28, 30 Use AWG22 (0.33 mm^2 (0.001 in^2)) for the encoder power supply and FG line, and AWG26 (0.12 mm^2 (0.0002 in^2)) for other signals. These conditions permit wiring distances up to 20 m (65.6 ft).
		Finished cable dimension	ϕ11.6 mm (0.46 in) max.

7

7.5.2 Digital Operator

The SGDM/SGDH SERVOPACKs have Digital Operator functions built in, but a hand-held Digital Operator can be connected to the SERVOPACK just as with conventional Σ-Series SERVOPACKs.

The cable section specifications are different from those of conventional hand-held Digital Operators (JUSP-OP02A-1). A conventional unit can be used simply by replacing the cable section.

Fig7.4 shows the Digital Operator (unit + cable) and cable configuration.

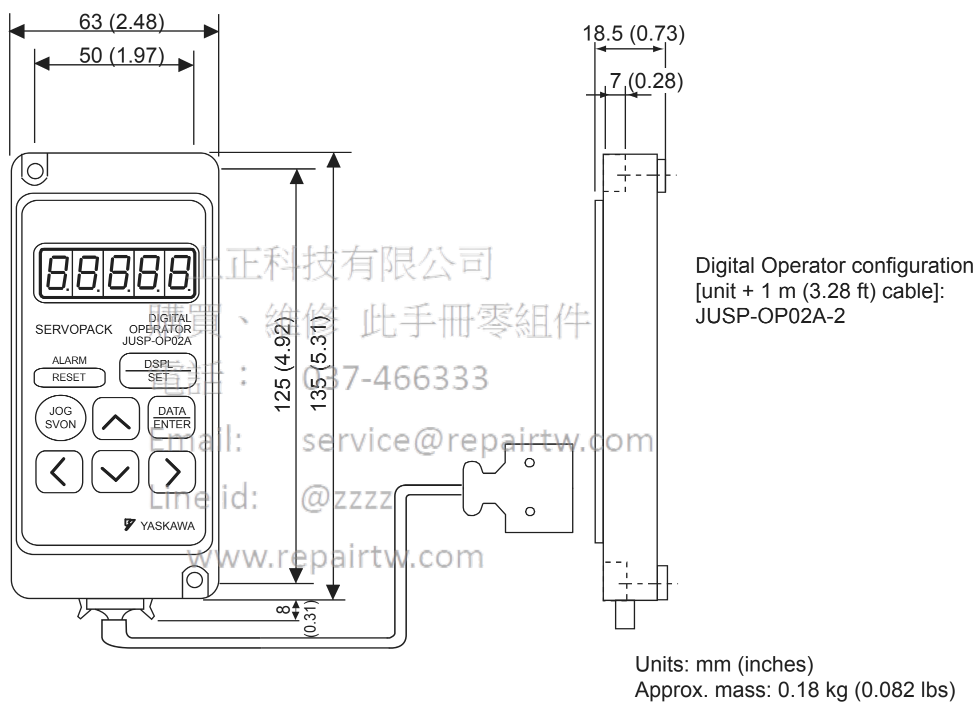


Fig. 7.4 Digital Operator

7.5.3 CN1 Connector

CN1 connectors are required to connect the host controller to CN1 of the SERVOPACK. CN1 connectors are comprised of a connector and a case.

The following section provides types and dimensional drawings for CN1.

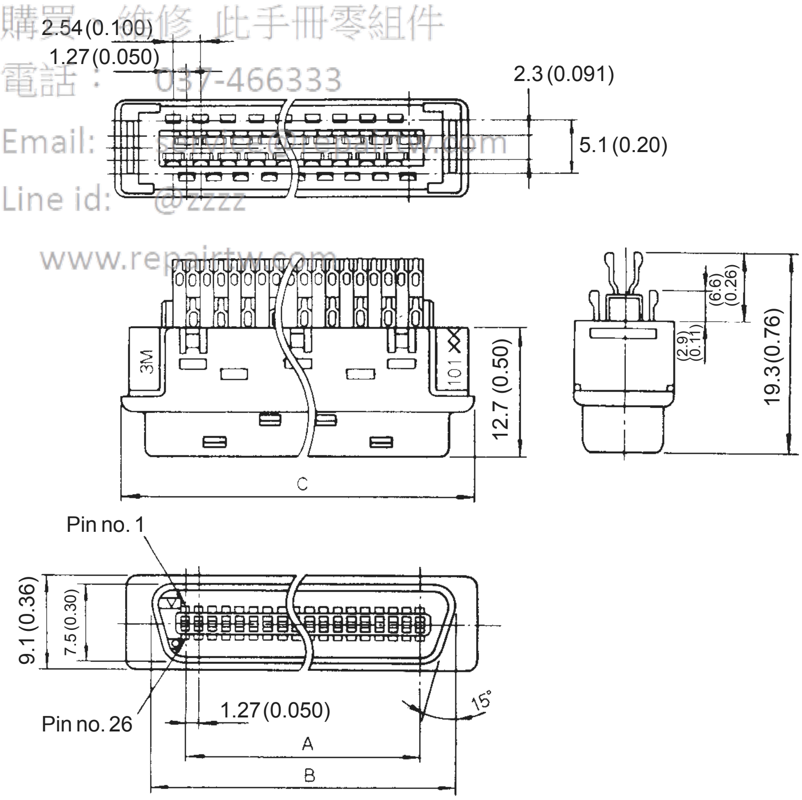
■ Configuration

Connector Model	Application	Connector Part List			
		Connector		Case	
		Model	Qty	Model	Qty
JZSP-CKI9	I/O connector for CN1	10150-3000VE*	1	10350-52A0-008*	1

* Manufactured by Sumitomo 3M Co.

■ Dimensional Drawings

Connector

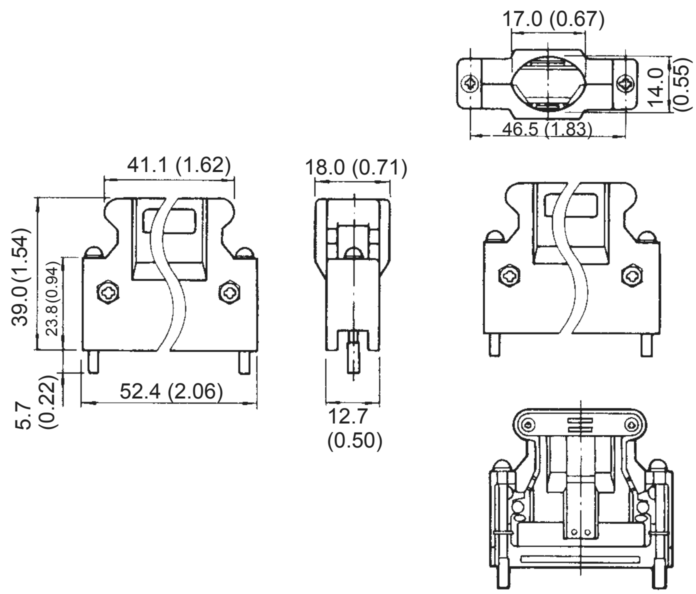


Unit: mm (in)

Connector Model	A	B	C
10150-3000VE	30.48 (1.20)	36.7 (1.44)	41.1 (1.62)

Manufactured by Sumitomo 3M Co.

Case



Assembly Diagram

Unit: mm (in)

■ Wire Size

Item	Specifications
Cable	Use twisted-pair or twisted-pair shielded wire.
Applicable Wires	AWG24, 26, 28, 30
Finished Dimension	ϕ16 mm (ϕ0.63 in) or less

7.5.4 Connector Terminal Block Converter Unit

The Connector Terminal Block Converter Unit is comprised of a CN1 connector and cable. The terminal block numbers match CN1 connector numbers on the SERVOPACK-end connector.

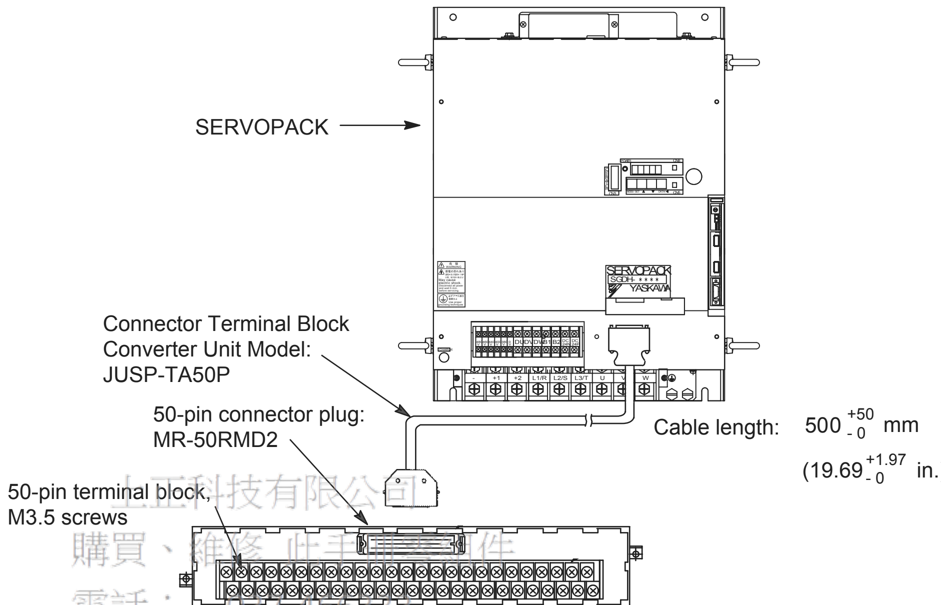


Fig. 7.5 Connector Terminal Block Converter Unit Connected to a SERVOPACK

■ Terminal Block Pin Numbers and Signal Names

Fig7.6 shows terminal block pin numbers and signal names.

SGDM/SGDH SERVOPACKs Signal Name	1CN Pin No.	Terminal Block Unit JUSP-TA50P Connector No.	Terminal Block No.
SG	1	A1	1
SG	2	B1	2
PL1	3	A2	3
SEN	4	B2	4
V-REF	5	A3	5
SG	6	B3	6
PULS	7	A4	7
/PULS	8	B4	8
T-REF	9	A5	9
SG	10	B5	10
SIGN	11	A6	11
/SIGN	12	B6	12
PL2	13	A7	13
/CLR	14	B7	14
CLR	15	A8	15
TQR-M	16	B8	16
VTG-M	17	A9	17
PL3	18	B9	18
PCO	19	A10	19
/PCO	20	B10	20
BAT+	21	A11	21
BAT-	22	B11	22
+12V	23	A12	23
-12V	24	B12	24
/V-CMP+	25	A13	25
/V-CMP-	26	B13	26
/TGON+	27	A14	27
/TGON-	28	B14	28
/S-RDY+	29	A15	29
/S-RDY-	30	B15	30
ALM+	31	A16	31
ALM-	32	B16	32
PAO	33	A17	33
/PAO	34	B17	34
PBO	35	A18	35
/PBO	36	B18	36
ALO1	37	A19	37
ALO2	38	B19	38
ALO3	39	A20	39
/S-ON	40	B20	40
/P-CON	41	A21	41
P-OT	42	B21	42
N-OT	43	A22	43
/ALM-RST	44	B22	44
/P-CL	45	A23	45
/N-CL	46	B23	46
+24V IN	47	A24	47
PSO	48	B24	48
/PSO	49	A25	49
	50	B25	50
Connector Case			

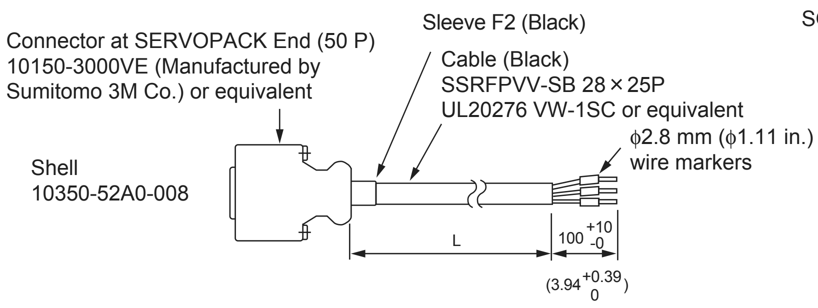
Cable: Supplied with terminal block.

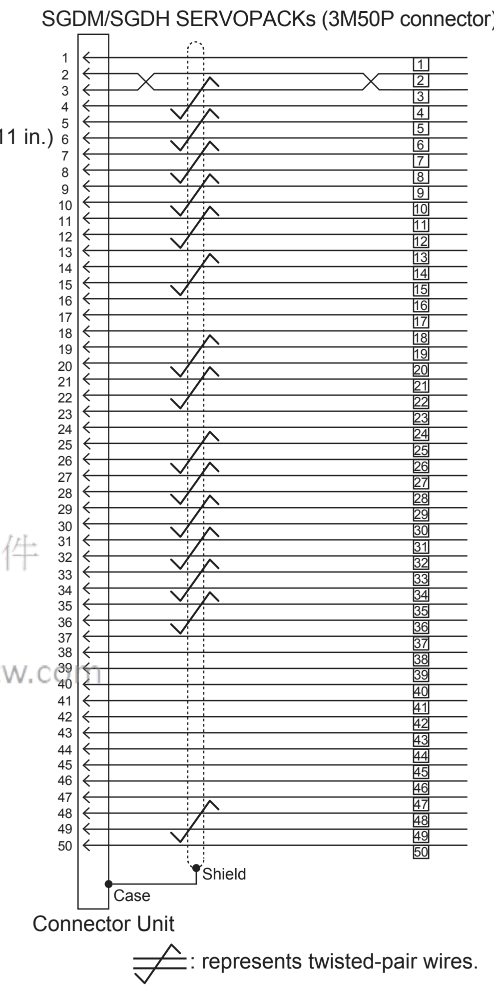
: represents twisted-pair wires.

Fig. 7.6 Terminal Block Pin Numbers and Signal Names

7.5.5 Cable With CN1 Connector and One End Without Connector

These cables do not have a host controller connector. The loose leads are labeled with terminal numbers.





Cable Length

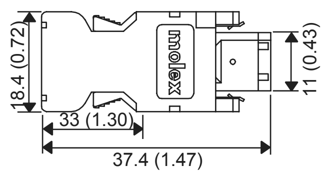
Model	L in mm (feet)
JZSP-CKI01-1	1 m (3.28 ft)
JZSP-CKI01-2	2 m (6.56 ft)
JZSP-CKI01-3	3 m (9.84 ft)

7

7.5.6 CN2 Encoder Connector at SERVOPACK

Only one type of CN2 encoder connector is available for the SERVOPACK end of the cable.

- Encoder Connector at SERVOPACK

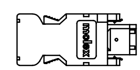


Units: mm (inches)

- Connector Kit

  A connector kit is comprised of an encoder connector (soldered) for the servomotor and SERVOPACK ends of the cable. *Table7.11* shows cable kit models and appearance.

Table 7.11 Connector Kit Types

Type	Connector Kit Model	List of Connector Kit Parts
Plug for a SERVOPACK CN2 encoder connector	JZSP-CMP9-1	

7.5.7 Encoder Cables

Encoder cables are used to connect the SERVOPACK to the encoder mounted to the servomotor.

The following section shows encoder cable models and appearance. Specify the cable model when ordering.

Cables With SERVOPACK and Servomotor Connectors

Table7.12 shows cable models.

Table 7.12 Cables With SERVOPACK and Servomotor Connectors

Applicable Servomotors		Cable Model	Length (L)
SGMBH Servomotors	With straight plug	JZSP-CMP21-03	3 m (9.84 ft)
		JZSP-CMP21-05	5 m (16.4ft)
		JZSP-CMP21-10	10 m (32.8 ft)
		JZSP-CMP21-15	15 m (49.2 ft)
		JZSP-CMP21-20	20 m (65.6 ft)
	With L–shape plug	JZSP-CMP22-03	3 m (9.84 ft)
		JZSP-CMP22-05	5 m (16.4 ft)
		JZSP-CMP22-10	10 m (32.8 ft)
		JZSP-CMP22-15	15 m (49.2 ft)
		JZSP-CMP22-20	20 m (65.6 ft)

Fig7.7 and *Fig7.8* show cable dimensions.

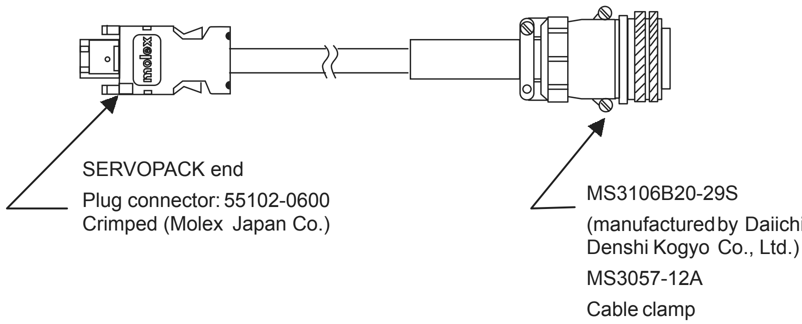


Fig. 7.7 SGMBH Servomotor Cables With Straight Plugs

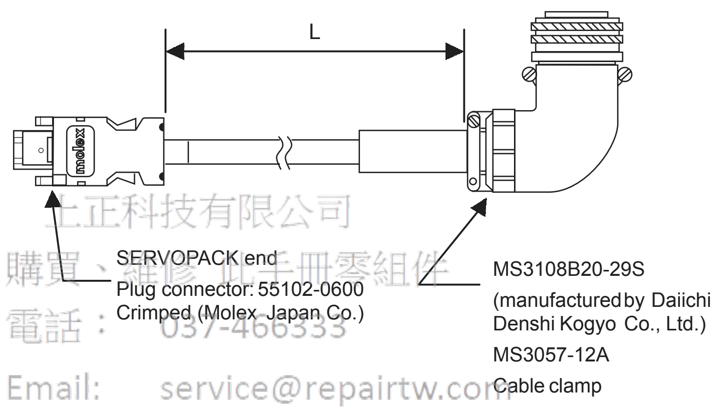


Fig. 7.8 SGMBH Servomotor Cables With L-shaped Plugs

Cables With a SERVOPACK Connector and Encoder Loose Leads

Table7.13 shows cable models.

Table 7.13 Cables With a SERVOPACK Connector and Encoder Loose Leads

Cable Model	Length (L)
JZSP-CMP23-03	3 m (9.84 ft)
JZSP-CMP23-05	5 m (16.4ft)
JZSP-CMP23-10	10 m (32.8 ft)
JZSP-CMP23-15	15 m (49.2 ft)
JZSP-CMP23-20	20 m (65.6 ft)

Fig7.9 shows cable dimensions.

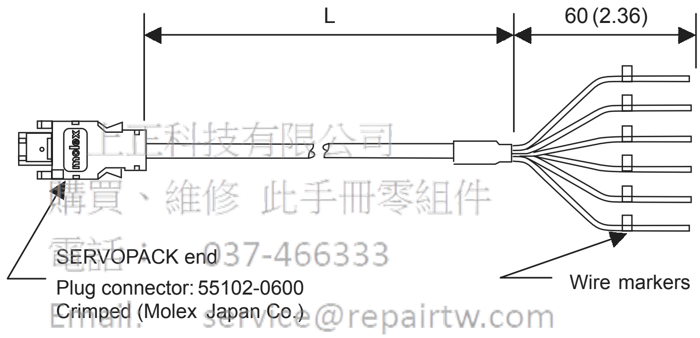


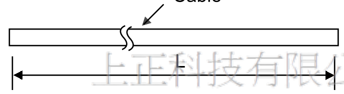
Fig. 7.9 Cables With a SERVOPACK Connector and Encoder Loose Leads

Cable Lines

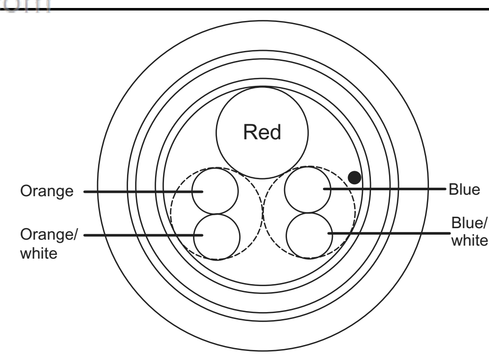
The following describes models and specifications for encoder cables without connectors. *Table7.14* shows cable models and lengths.

Table 7.14 Cables Without Connectors

Cable Model	Length (L)
JZSP-CMP29-05	5 m (16.4 ft)
JZSP-CMP29-10	10 m (32.8 ft)
JZSP-CMP29-15	15 m (49.2 ft)
JZSP-CMP29-20	20 m (65.6 ft)
JZSP-CMP29-30	30 m (98.4 ft)
JZSP-CMP29-40	40 m (131 ft)
JZSP-CMP29-50	50 m (164 ft)



The following table shows specifications for encoder cables without connectors. These cables are not SERVOPACK or servomotor accessories and must be purchased separately.

Basic Specifications	T/20276-SP（SP） AWG26×2P，AWG16×1P
Finished Dimensions	ϕ7.0 mm (ϕ0.28 in)
Internal Configuration and Lead Colors	
Yaskawa Standard Specifications	5 m (16.4 ft), 10 m (32.8 ft), 15 m (49.2 ft), 20 m (65.6 ft), 30 m (98.4 ft), 40 m (131 ft), 50 m (164 ft)

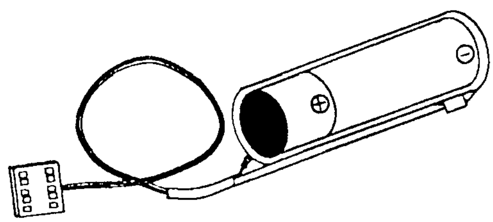
7

7.5.8 Absolute Encoder Battery

When the power supply of an absolute encoder is OFF, a data backup battery is required. Customers must purchase one of the absolute encoder batteries below.

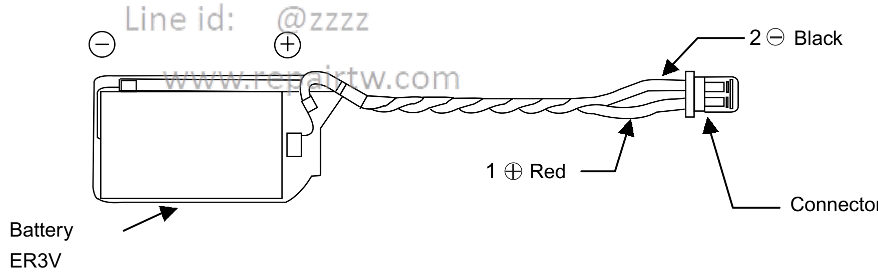
■ Installing the Battery at the Host Device

Model: ER6VC3 (lithium battery)
3.6 V 2000 mAh
Manufactured by Toshiba Battery Co., Ltd.



■ Battery Provided for the SERVOPACK

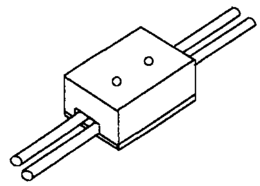
Model: JZSP-BA01-1 (lithium battery)
(Battery: ER 3 V battery made by Toshiba Battery Co., Ltd.)
3.6 V 1000 mAh



7.5.9 Brake Power Supplies

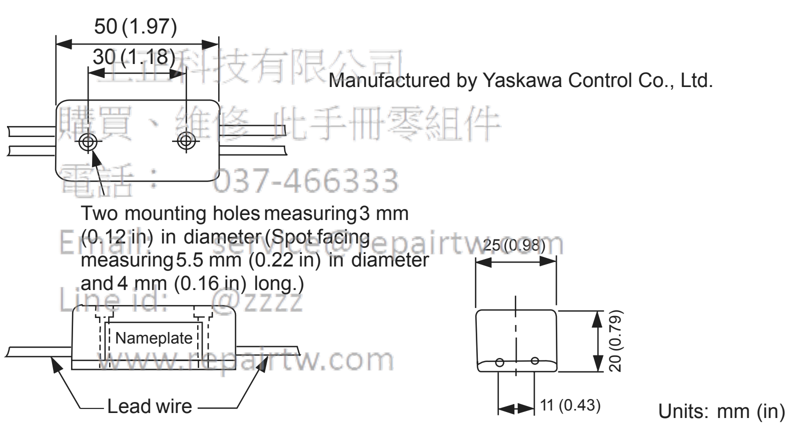
Brake power supplies are available for 200-V and 100-V inputs for servomotors with brakes.

200 V input: LPSE-2H01 (90 VDC output)
100 V input: LPDE-1H01 (90 VDC output)



Note: The 24-VDC brake power supply is not provided by Yaskawa. The customer must provide a 24-VDC brake power supply when using the servomotor with a 24-VDC brake.

■ Dimensional Drawings



■ Specifications

- Rated output voltage: 90 VDC
- Maximum output current: 1.0 ADC
- Lead wire length: About 500 mm (19.69 in) each
- Max. ambient temperature: 60°C
- Lead wires: Color coded

AC Input		Brake End
100 V	200 V	
Blue/White	Yellow/White	Red/Black

■ Internal Circuits

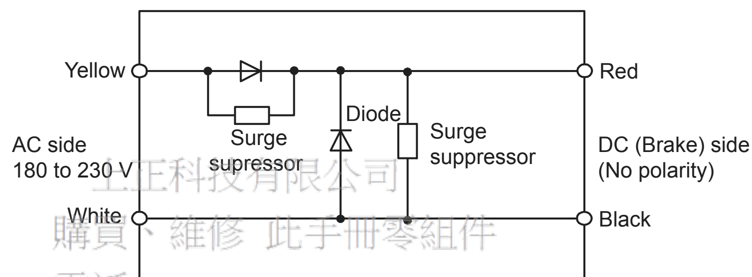
The following shows internal circuits for brake power supplies. While it is possible to switch either the AC or the DC side of the power supplies, it is normally safer to switch the AC side.

IMPORTANT

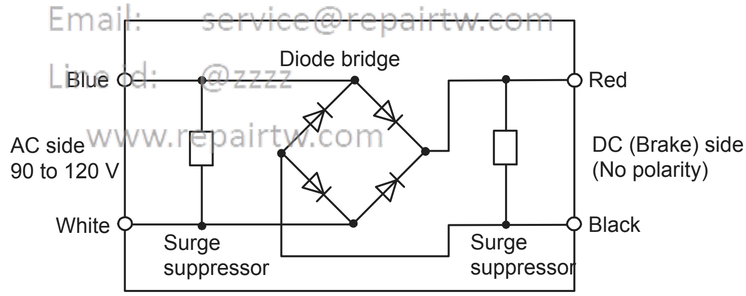
When switching on the DC side, install a surge suppressor near the brake coil to prevent damage to the coil from voltage surges due to DC-side switching.

Brake operation time delay occurs during brake power supply ON/OFF operation. Set output timing of servo OFF operation (motor output stop), referring to *4.4.4 Using the Holding Brake*. Especially, if the AC side of the brake power supply is to be switched, brake operation time is extended.

- Internal Circuit for 200 VAC Input (LPSE-2H01)



- Internal Circuit for 100 VAC Input (LPDE-1H01)



7.5.10 Molded-case Circuit Breaker (MCCB)

A molded-case circuit breaker is used to protect the power supply line. The customer must provide a molded-case circuit breaker with an appropriate capacity.

SERVOPACK Model	Power Supply Capacity per SERVOPACK (kVA)	Power Supply Capacity per MCCB or Fuse (A)	Inrash Current (A0-p)	
			Main Circuit Power Supply	Control Circuit Power Supply
SGDM-2BADA SGDH-2BAE	36.7	150	300	30
SGDM-3ZADA SGDH-3ZAE	50.1	200	300	30
SGDM-3GADA SGDH-3GAE	61.8	225	600	30
SGDH-2BDE	36.7	100	140	(10) *
SGDH-3ZDE	50.1	150	565	
SGDH-3GDE	61.8	150	565	
SGDH-4EDE	75.2	225	1130	
SGDH-5EDE	91.9	225	1130	

* This values will differ depending on the 24-V power supply that is used.

If selecting a molded-case circuit breaker, observe the following precautions.

IMPORTANT

■ Ground Fault Detector

- Select ground fault detectors for inverters.
- High-frequency current leaks from the servomotor armature because of switching operation inside the SERVOPACK.

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■ Maximum Input Current

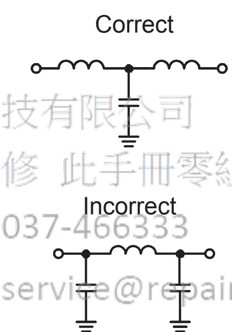
- The instantaneous maximum output of the SERVOPACK is approximately three times of the rated output for maximum for three seconds. Accordingly, select a molded-case circuit breaker whose breaking time is five seconds or more at 300% of SERVOPACK rated current.
  The general-purpose low-speed acting molded-case circuit breakers are applicable.
- The power supply capacity per SERVOPACK when using a servomotor is described in the above table. Select a molded-case circuit breaker with the capacity larger than the effective load current (when using more than multiple SERVOPACKs) calculated from the total power supply capacity.
- The consumption of other controllers must be considered when selecting a molded-case circuit breaker.

■ Inrush Current

- Refer to the table on the page 7-49 for SERVOPACK inrush current.
- The allowable inrush current for a low-speed acting molded-case circuit breaker is approximately 10 times of the rated current for 0.02 seconds.
- When turning ON multiple SERVOPACKs simultaneously, select a molded-case circuit breaker with the allowable current for 20 ms larger than the total inrush current shown in the table on the page 7-49.

7.5.11 Noise Filter

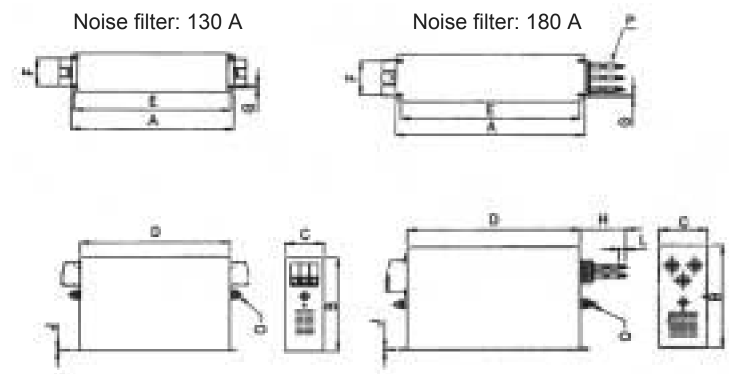
A noise filter is installed to eliminate external noise from the power supply line. Select one of the following noise filters based on SERVOPACK capacity.

SERVOPACK Model	Noise Filter Reference Diagram	Recommended Noise Filter*
SGDM-2BADA SGDH-2BAE		FN258L-130-35
SGDM-3ZADA SGDH-3ZAE		FN258L-180-07
SGDM-3GADA SGDH-3GAE		FN359P-250-99
SGDH-2BDE		FN258-180-07
SGDH-3ZDE		FN258-180-07
SGDH-3GDE		FN258-180-07
SGDH-4EDE		FN359-250-99
SGDH-5EDE		FN359-250-99

* Manufactured by SCHAFFNER. (Available from Yaskawa Controls Co., Ltd.)

■ Dimensional Drawing

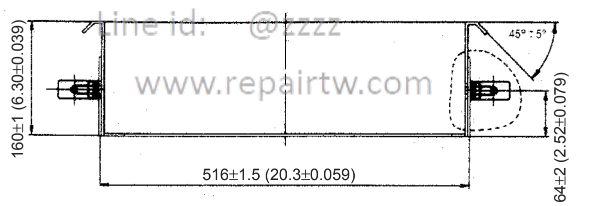
FN258 and FN258L

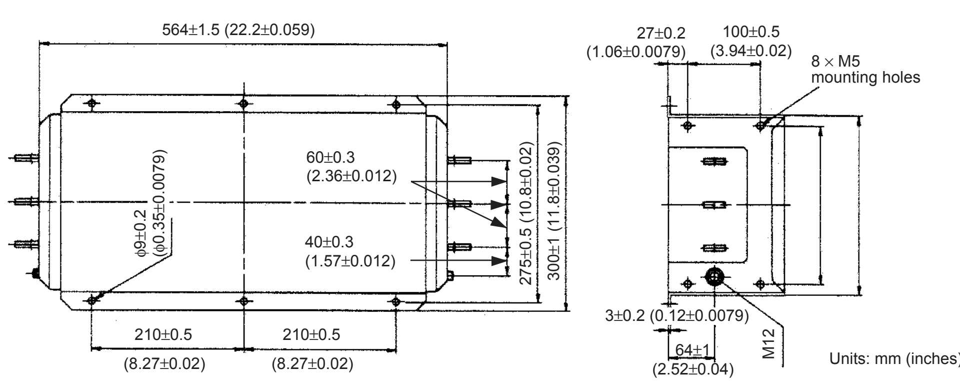


Unit: mm (in)

Noise Filter Model	A	B	C	D	E	F	G	H	J	L	O	P
FN258L-130-35	439 ± 1.5 (17.3 ± 0.059)	240 (9.44)	110± 0.8 (4.33 ± 0.031)	400± 1.2 (15.7 ± 0.047)	414 (16.3)	80 (3.15)	6.5 (0.26)	-	3 (0.12)	-	M10	-
FN258L-180-07 FN258-180-07	438± 1.5 (17.2 ± 0.059)	240 (9.44)	110± 0.8 (4.33 ± 0.031)	400± 1.2 (15.7 ± 0.047)	413 (16.3)	80 (3.15)	6.5 (0.26)	500 (19.7)	4 (0.16)	15 (0.59)	M10	50 (mm^2)

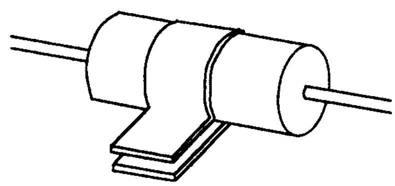
FN359-250-99





7.5.12 Surge Suppressor

Attach a surge suppressor to the magnetic contactor to prevent power supply noise and protect contacts.



- Recommended Product

Spark Killer manufactured by Okaya electric Industries Co., Ltd.
Model: CR50500BA (250 VAC)
Capacitance: 0.5 µF± 20%
Resistance: 50 Ω (1/2W) ± 30%
(Available from Yaskawa Controls Co., Ltd.)

7.5.13 Regenerative Resistor Unit

Regenerative resistors for processing regenerative energy are externally mounted on SERVOPACKs.

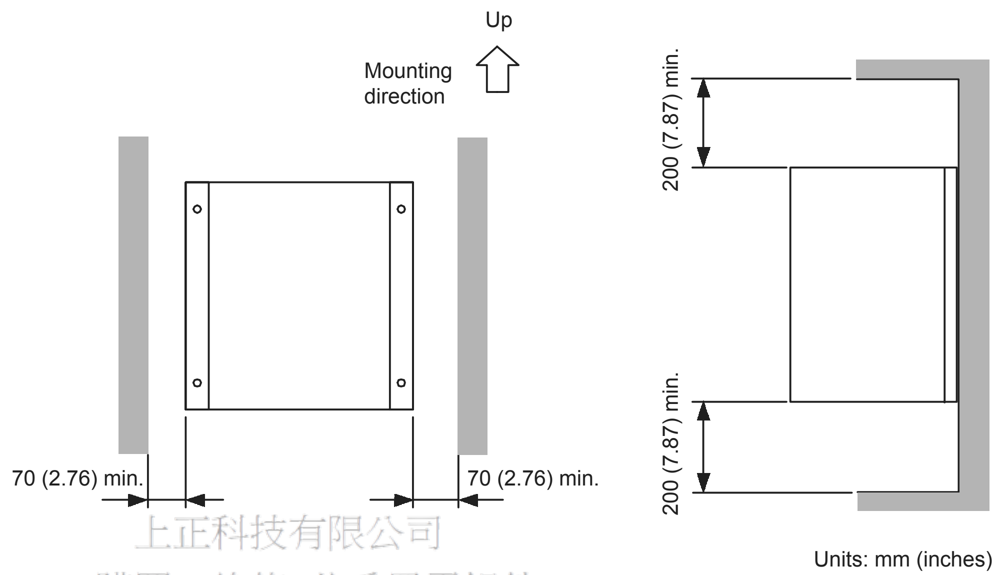
■ Specifications

The following Regenerative Resistor Units are required according to the SERVOPACK model.

SERVOPACK Model	SGDM-	2BADA	3ZADA	3GADA	–				
	SGDH-	2BAE	3ZAE	3GAE	2BDE	3ZDE	3GDE	4EDE	5EDE
Regenerative Resistor Unit	JUSP-	RA08	RA09	RA11	RA12	RA13	RA14	RA15	RA16
Resistance		2.4 Ω	1.8 Ω	1.6 Ω	9 Ω	6.7 Ω	5 Ω	4 Ω	3.8 Ω
Resistance Capacity		2400 W	4800 W	4800 W	3600 W	3600 W	4800 W	6000 W	7200 W
Allowable Load Moment of Inertia		5 times the load moment of inertia							
Allowable Duty		2 % ED at maximum speed ad torque deceleration.							

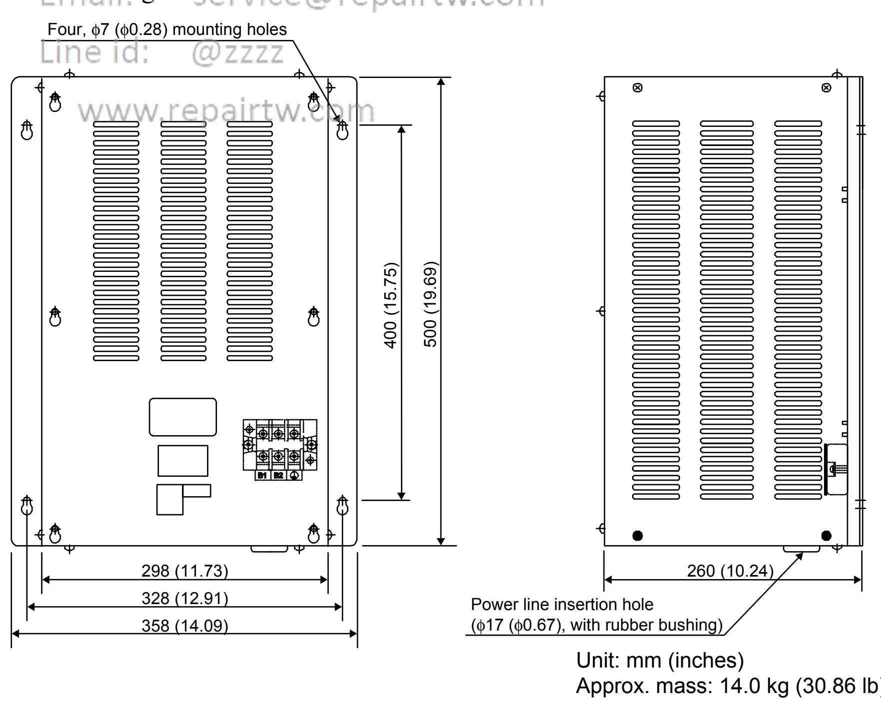
■ Mounting

When mounting the Unit, provide sufficient space between the Unit and any devices beside it, as shown in the following diagram.

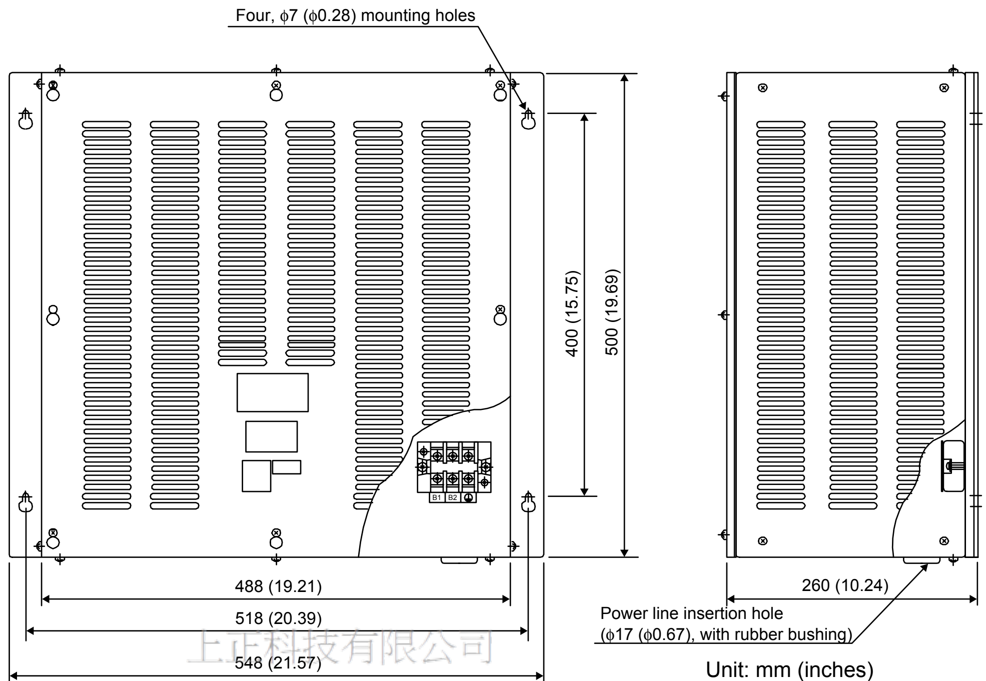


■ Dimensional Drawings

JUSP-RA08 Regenerative Resistor Unit

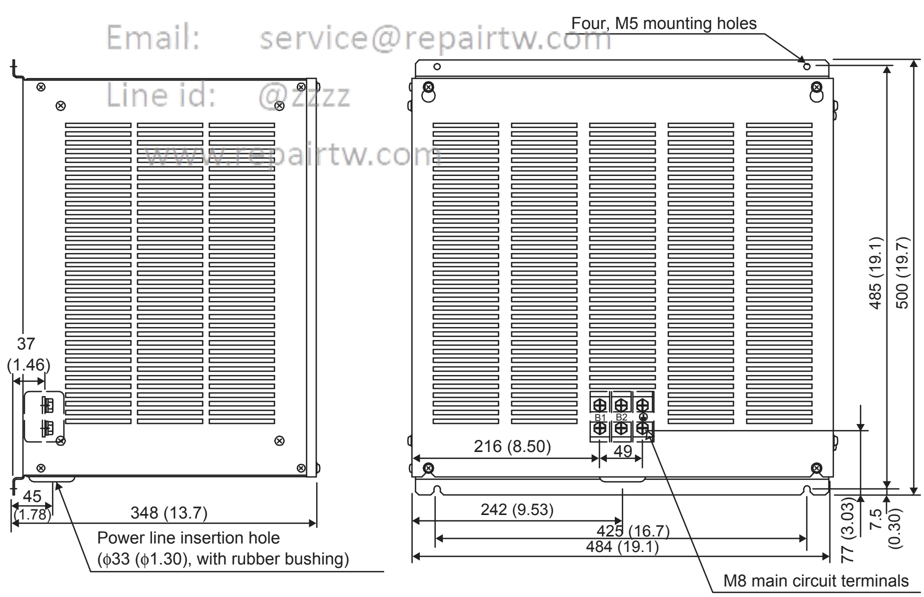


JUSP-RA09 Regenerative Resistor Unit



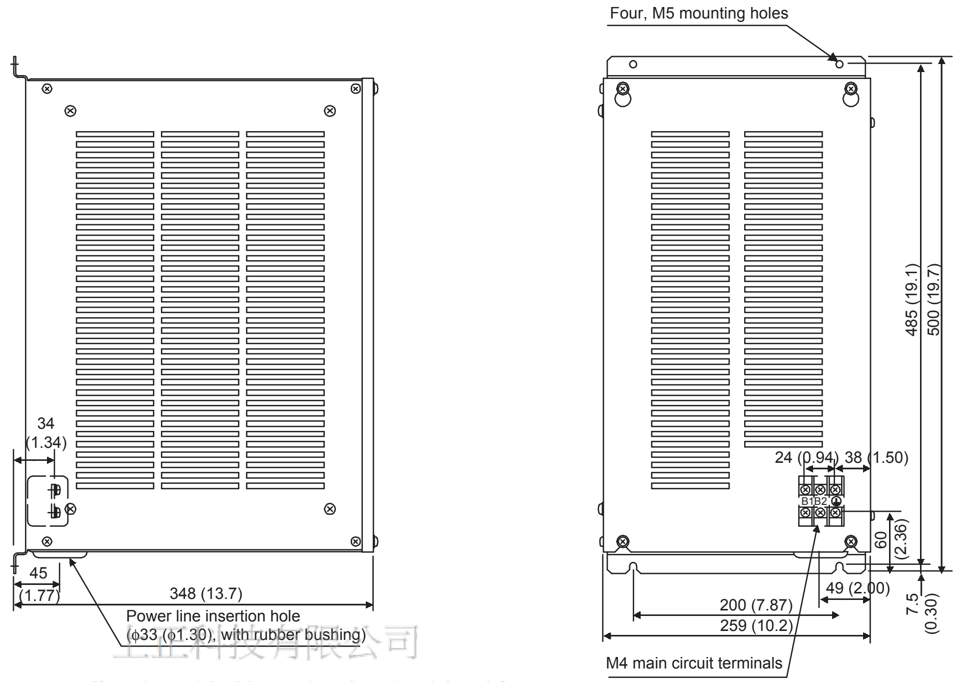
Unit: mm (inches)
Approx. mass: 21.0 kg (46.30 lb)

JUSP-RA11 Regenerative Resistor Unit



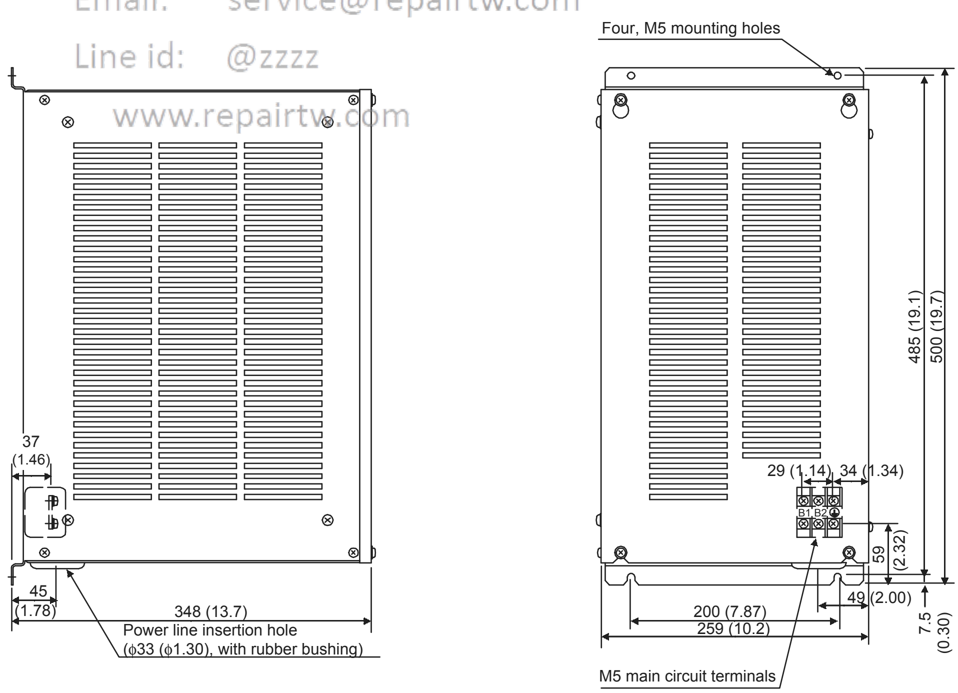
Unit: mm (inches)
Approx. mass: 20.5 kg (45.19 lb)

JUSP-RA12 Regenerative Resistor Unit



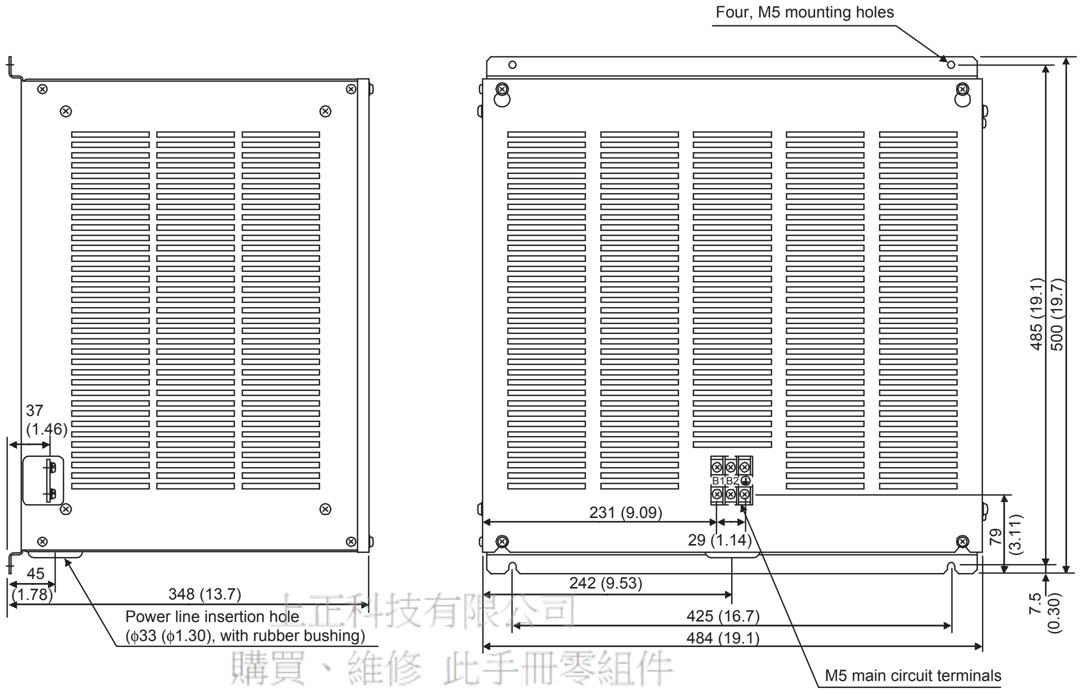
Unit: mm (inches)
Approx. mass: 14 kg (30.9 lb)

JUSP-RA13 Regenerative Resistor Unit



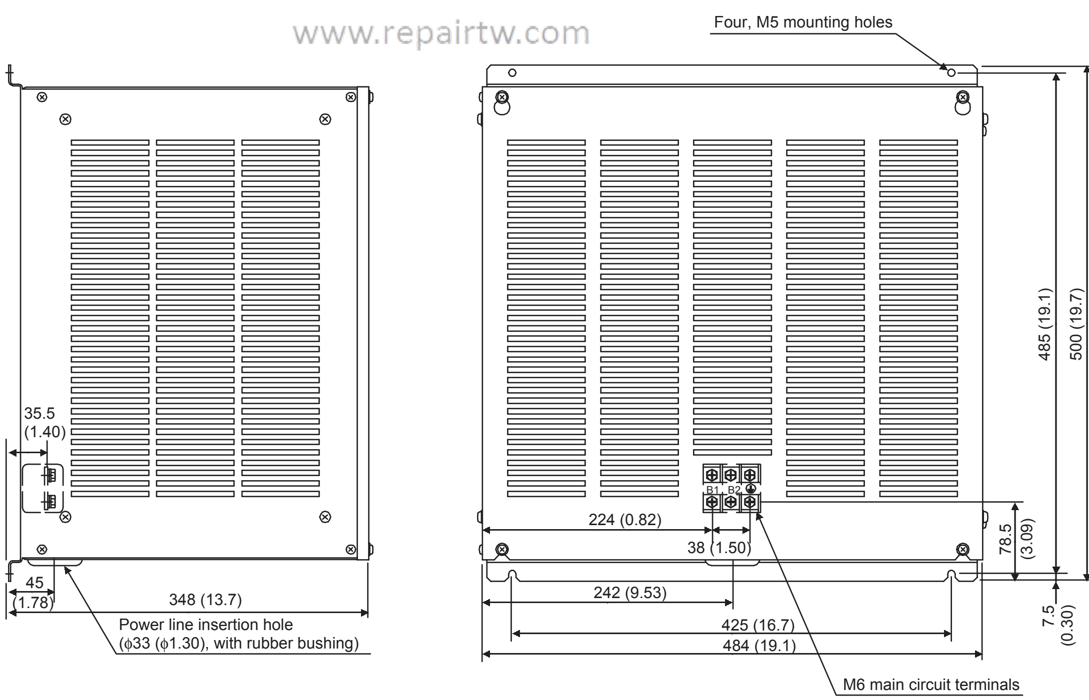
Unit: mm (inches)
Approx. mass: 14 kg (30.9 lb)

JUSP-RA14 Regenerative Resistor Unit



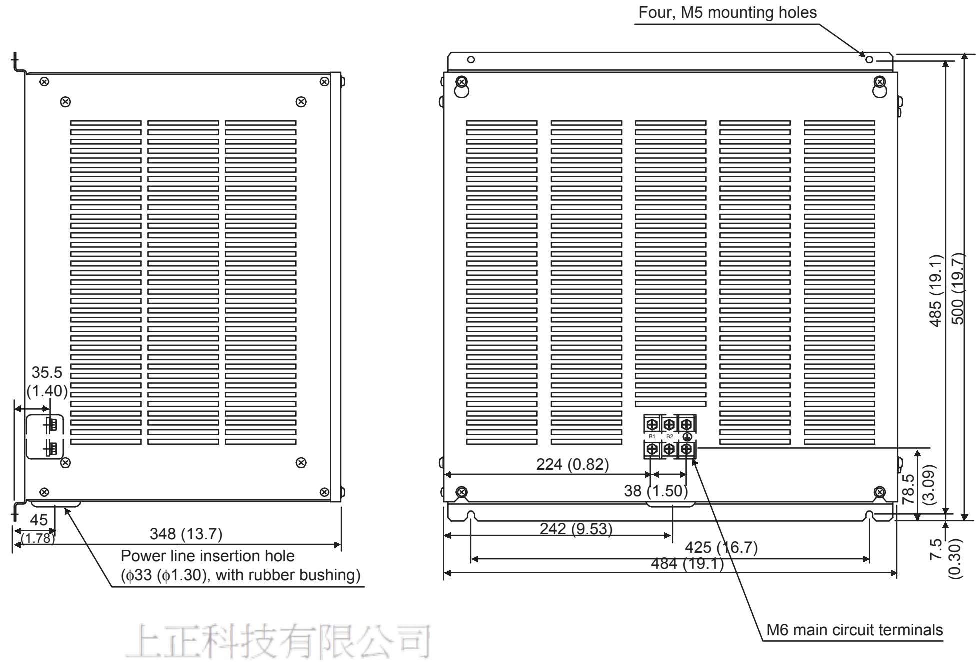
Unit: mm (inches)
Approx. mass: 20 kg (44.1 lb)

JUSP-RA15 Regenerative Resistor Unit



Unit: mm (inches)
Approx. mass: 21.5 kg (47.4 lb)

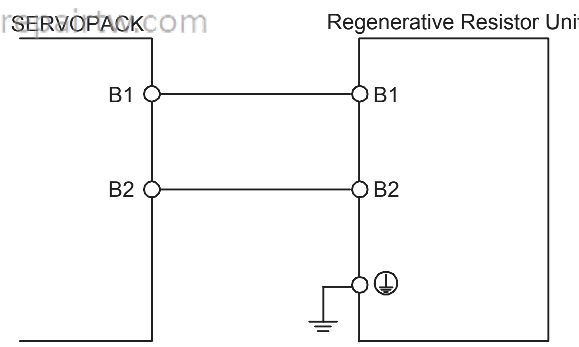
JUSP-RA16 Regenerative Resistor Unit



Unit: mm (inches)
Approx. mass: 23.5kg (51.8 lb)

■ Connections

Connect the Regenerative Resister Unit to the SGDM/SGDH SERVOPACKs as shown in the following diagram.



7

7.5.14 Dynamic Brake (DB) Unit

Externally attach a dynamic brake resistor to the SERVOPACK to dissipate regenerative energy when using the dynamic brake function. The dynamic brake resistor does not need to be installed if the dynamic brake function is not required.

■ Specifications

The following Dynamic Brake Units are required according to the SERVOPACK model.

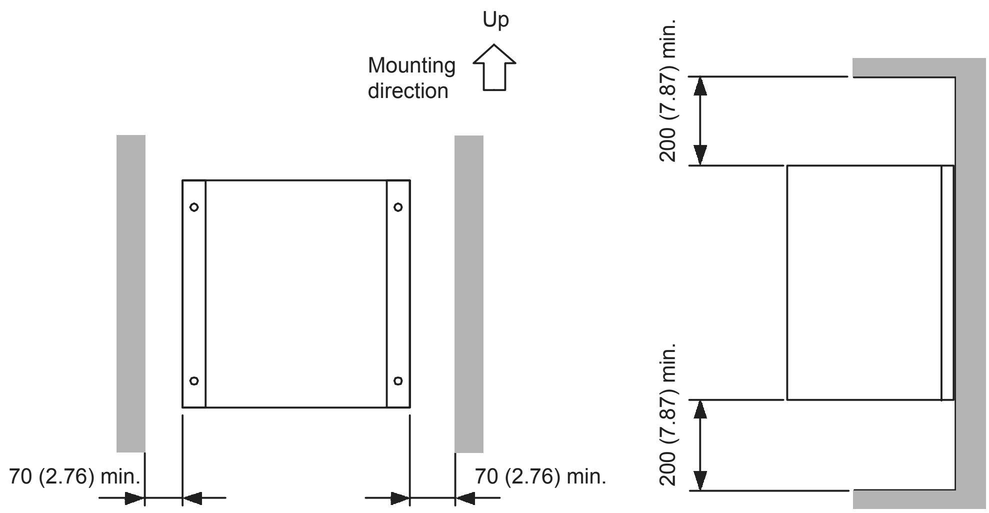
Dynamic Brake (DB) Unit Model	SERVOPACK Model		Resistance Specifications (Star Wiring 人)	DB Contactor and Surge Absorption Unit
	SGDM-	SGDH-		
JUSP–DB01	2BADA, 3ZADA	2BAE, 3ZAE	180 W, 0.3 Ω	Built into the SERVOPACK
JUSP–DB02	3GADA	3GAE	180 W, 0.3 Ω	Built into Dynamic Brake Unit
JUSP–DB03	–	2BDE, 3ZDE	180 W, 0.8 Ω	Built into the SERVOPACK
JUSP–DB04	–	3GDE	180 W, 0.8 Ω	Built into Dynamic Brake Unit
JUSP–DB05	–	4EDE	180 W, 0.8 Ω	Built into Dynamic Brake Unit
JUSP–DB06	–	5EDE	300 W, 0.8 Ω	Built into Dynamic Brake Unit

Use the Dynamic Brake Unit under the following conditions. Contact your Yaskawa representative before using the Unit under conditions more severe than those specified below.

Allowable load moment of inertia: 5 times the load moment of inertia
Frequency of Dynamic Brake (DB) application: Less than one DB stop per hour at maximum rotation speed

■ Mounting

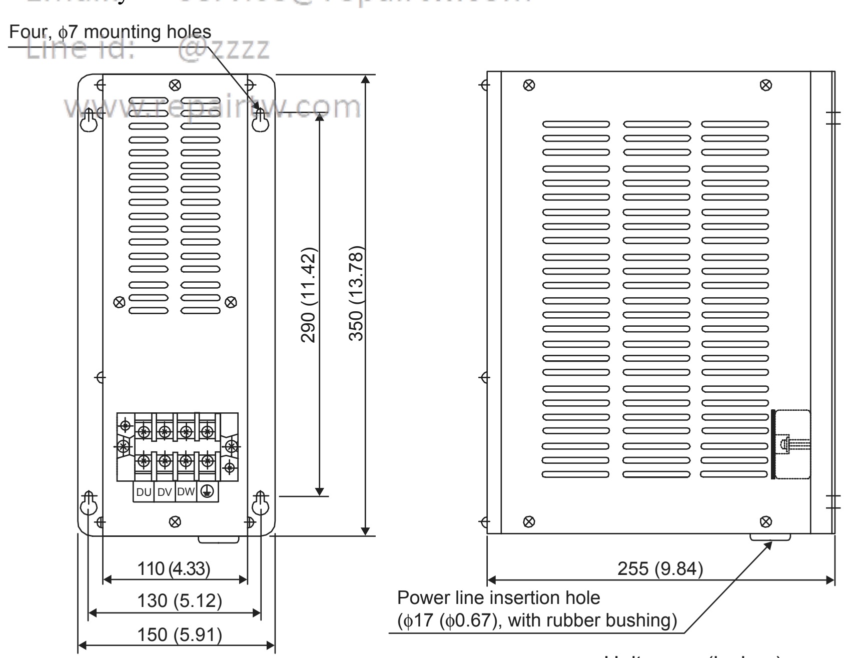
When mounting the Unit, provide sufficient space between the Unit and any devices beside it, as shown in the following diagram.



Units: mm (inches)

■ Dimensional Drawings

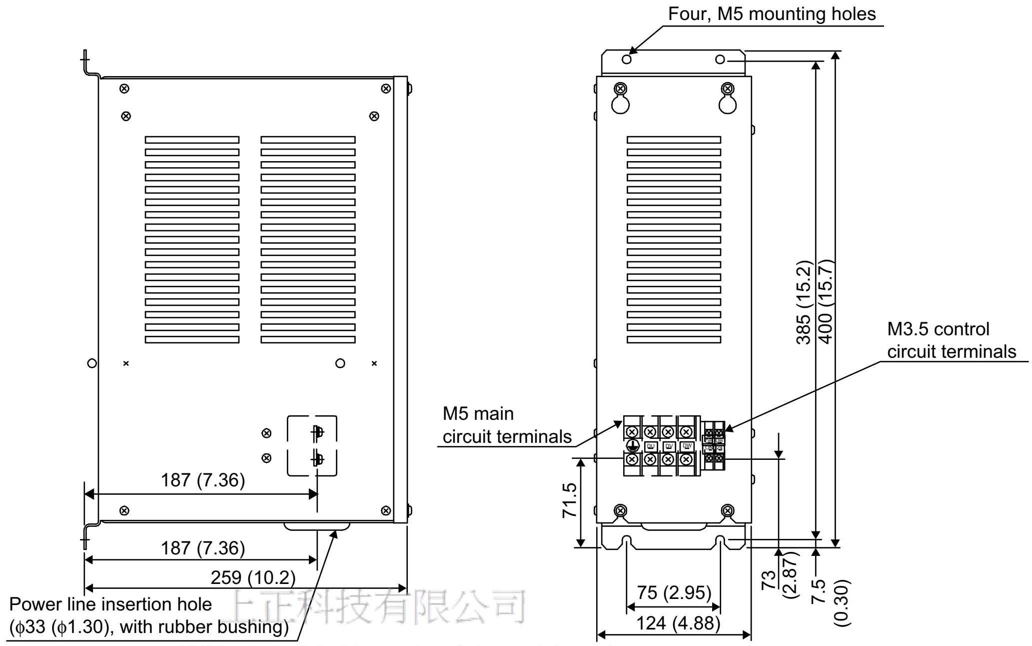
JUSP-DB01 Dynamic Brake Unit



Units: mm (inches)
Approx. mass: 5.0 kg (11 lb)

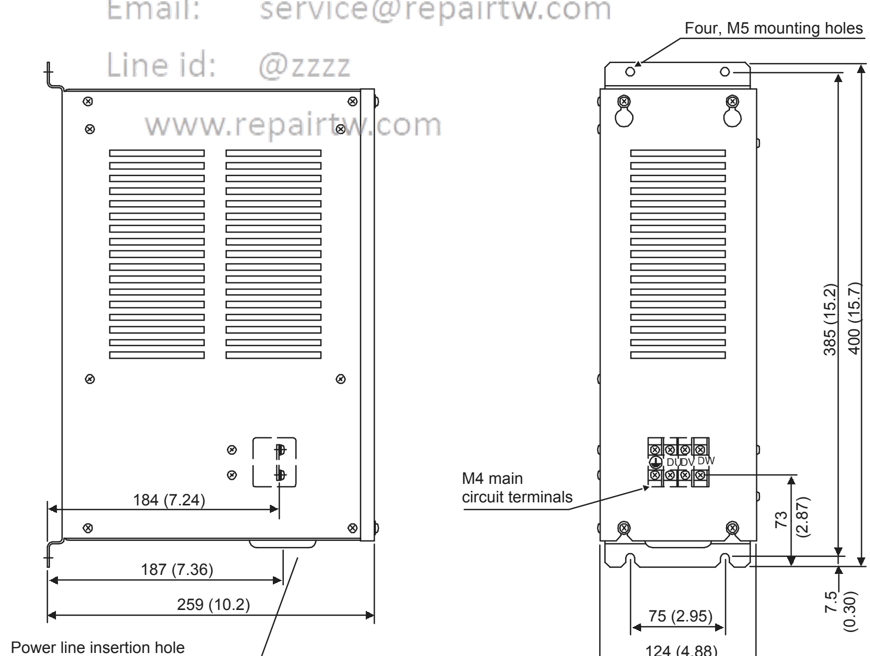
7

JUSP-DB02 Dynamic Brake Unit



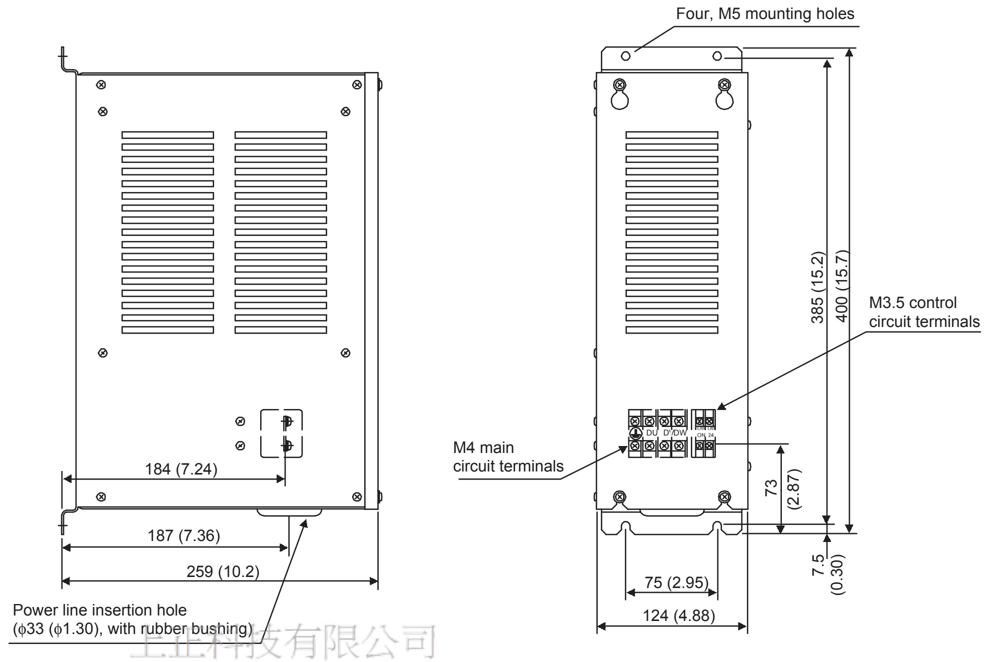
Units: mm (inches)
Approx. mass: 6.0 kg (13.28 lb)

JUSP-DB03 Dynamic Brake Unit



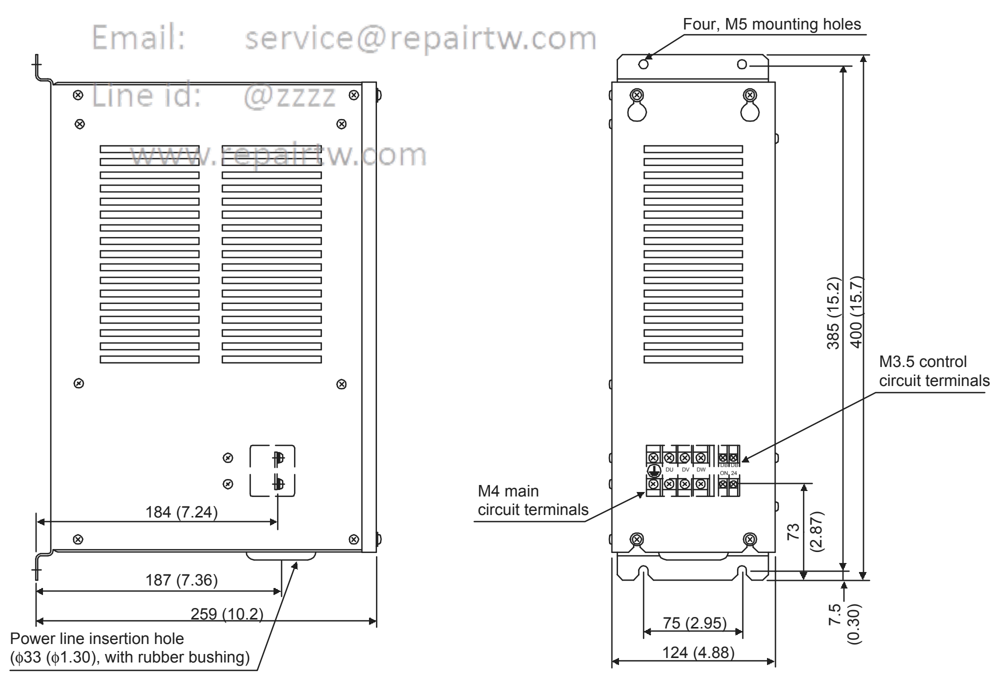
Units: mm (inches)
Approx. mass: 5.0 kg (11 lb)

JUSP-DB04 Dynamic Brake Unit



Units: mm (inches)
Approx. mass: 6.0 kg (13.2 lb)

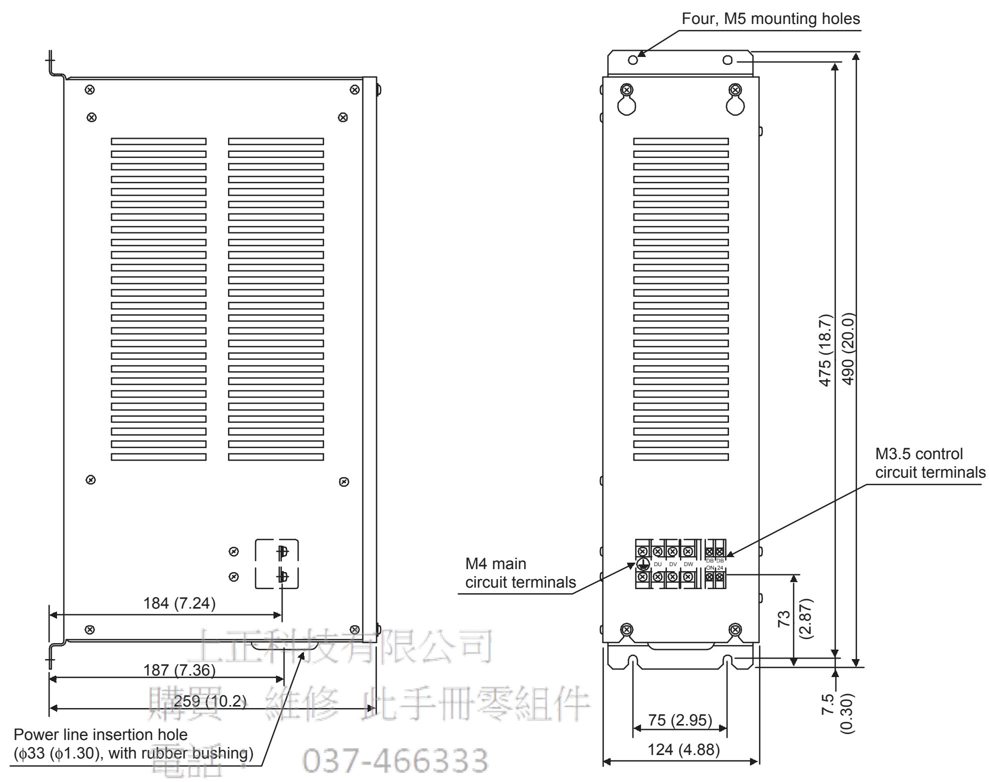
JUSP-DB05 Dynamic Brake Unit



Units: mm (inches)
Approx. mass: 6.0 kg (13.2 lb)

7

JUSP-DB06 Dynamic Brake Unit



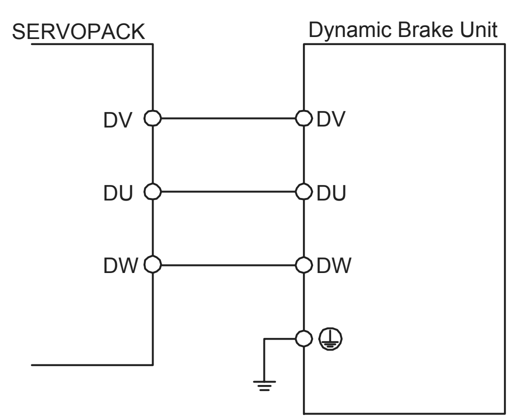
Units: mm (inches)
Approx. mass: 7.0 kg (15.4 lb)

■ Connections

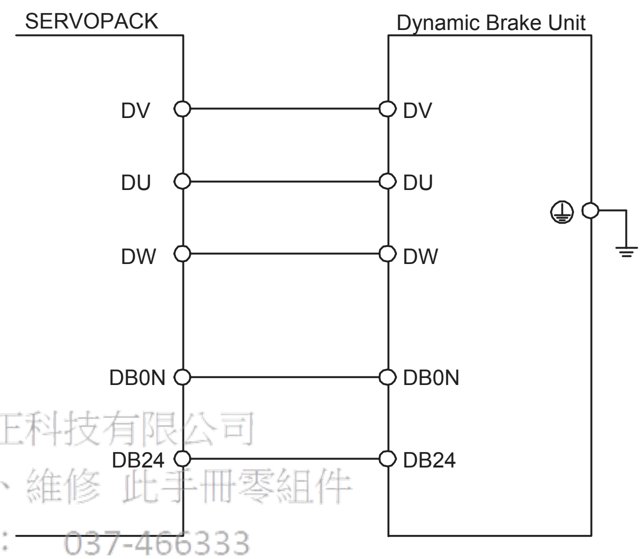
Using a Yaskawa Dynamic Brake Unit

- SGDM-2BADA, 3ZADA SERVOPACKs
  SGDH-2BAE, 2BDE, 3ZAE, 3ZDE SERVOPACKs

  The dynamic brake contactor and Surge Absorption Unit are built into the SERVOPACK. Connect the DU, DV, and DW terminals and the Frame Ground (⏚) on the Dynamic Brake Unit, as sown in the following diagram.

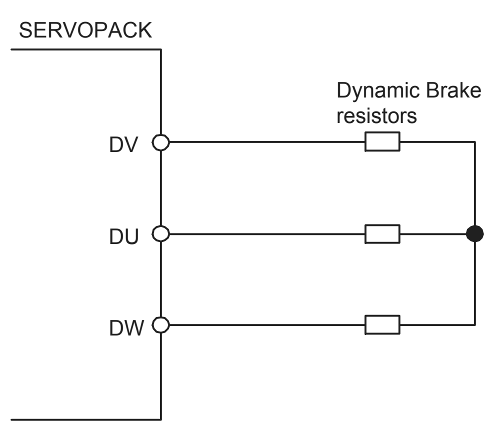


- SGDM-3GADA SERVOPACK
  SGDH-3GAE, 3GDE, 4EDE, 5EDE SERVOPACKs
  The dynamic brake contactor and Surge Absorption Unit are built into the Dynamic Brake Unit. Connect the DU, DV, and DW terminals and the Frame Ground (⏚) on the Dynamic Brake Unit, and also connect the terminals DBON and DB24 for dynamic brake contactor control, as shown in the following diagram.



Using Dynamic Brake Resistors Prepared by the Customer

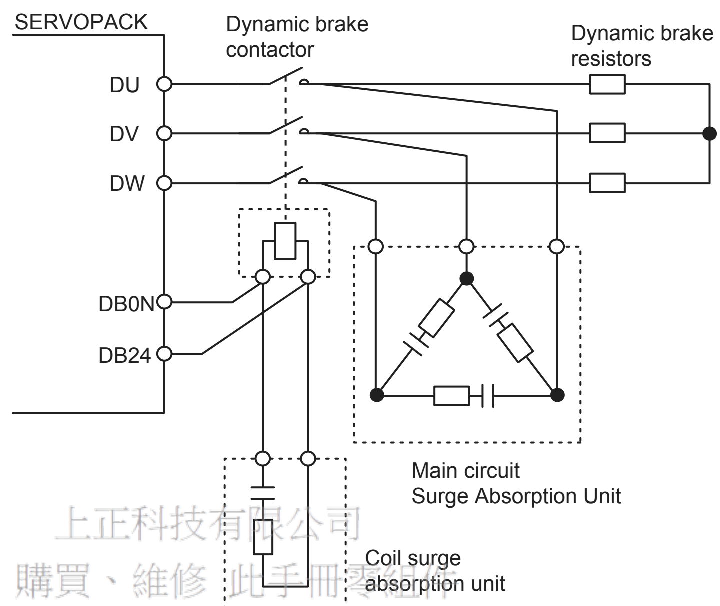
- SGDM-2BADA, 3ZADA SERVOPACKs
  SGDH-2BAE, 2BDE, 3ZAE, 3ZDE SERVOPACKs
  The dynamic brake contactor and Surge Absorption Unit are built into the SERVOPACK. Connect the dynamic brake resistors only, as shown in the following diagram.



Note: Connect dynamic brake resistors with the following resistance specifications.
200-V SERVOPACKs: Higher than 0.3 Ω
400-V SERVOPACKs: Higher than 0.8 Ω

- SGDM-3GADA SERVOPACK
  SGDH-3GAE, 3GDE, 4EDE, 5EDE SERVOPACKs

  Connect a dynamic brake contactor and Surge Absorption Unit, as shown in the following diagram.



Note: Connect dynamic brake resistors with the following resistance specifications.
200-V SERVOPACKs: Higher than 0.3 Ω
400-V SERVOPACKs: Higher than 0.8 Ω

Use the following dynamic brake contactor and Surge Absorption Unit. The main circuit Surge Absorption Unit is available as a side-connection type or a front-connection type.

Name		Model	Manufacturer
Contactor		SC-4-1/G 24-VDC coil	Fuji Electric Co., Ltd.
Main Circuit Surge Absorption Unit	Front Connection	SZ-ZM1	
	Side Connection	SZ-ZM2	
Coil Surge Absorption Unit		SZ-Z4	

7.5.15 Thermal Relays

Connect a thermal relay to the SERVOPACK to protect the regenerative resistor and dynamic brake resistor from heat damage when operating under extreme conditions.

■ Recommended Thermal Relay Models

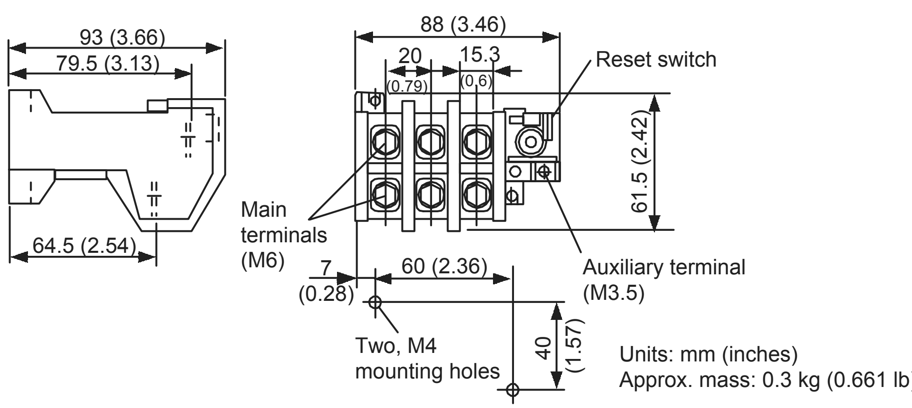
Select the appropriate thermal relay from the following list when using Yaskawa Regenerative Resistor Units and Dynamic Brake Units.

Dynamic Brake (DB) Unit and Regenerative Resistor Unit Model	Thermal Relay Model	Thermal Relay Current Range	Thermal Relay Current	Manufacturer
JUSP-DB01 JUSP-DB02	TR-3N/3 9 A	9 to 13 A	10 A	Fuji Electric Co., Ltd.
JUSP-DB03 JUSP-DB04 JUSP-DB05	TR-3N/3 7 A	7 to 11 A	7 A	
JUSP-DB06	TR-3N/3 7 A	7 to 11 A	9 A	
JUSP-RA08	TR-3N/3 12 A	12 to 18 A	14 A	
JUSP-RA09	TR-3N/3 18 A	18 to 26 A	23 A	
JUSP-RA11	TR-3N/3 18 A	18 to 26 A	24 A	
JUSP-RA12	TR-3N/3 7 A	7 to 11 A	9 A	
JUSP-RA13	TR-3N/3 9 A	9 to 13 A	10 A	
JUSP-RA14	TR-3N/3 12 A	12 to 18 A	14 A	
JUSP-RA15	TR-3N/3 12 A	12 to 18 A	17 A	
JUSP-RA16	TR-3N/3 18 A	18 to 26 A	19 A	

7

■ Dimensional Drawings

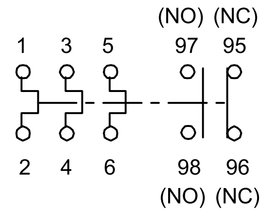
The following dimensional drawing is for a TR-3N Thermal Relay.



Mounting Hole Dimensions

■ Internal Connection Diagram

The following connection diagram is for a TR-3N Thermal Relay.

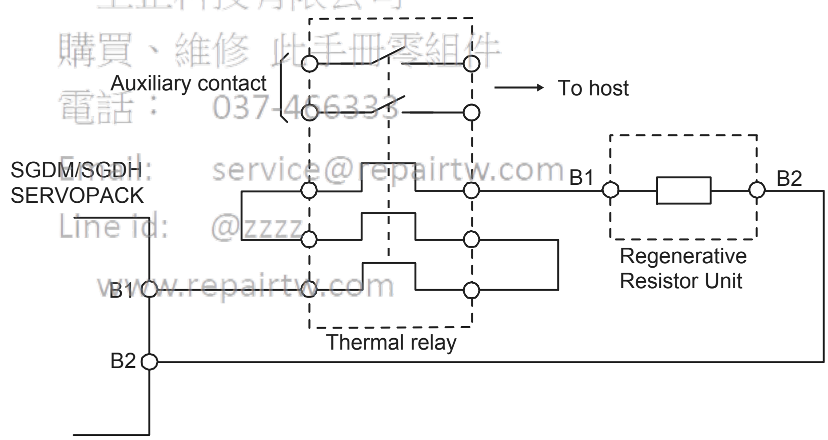


■ Connections

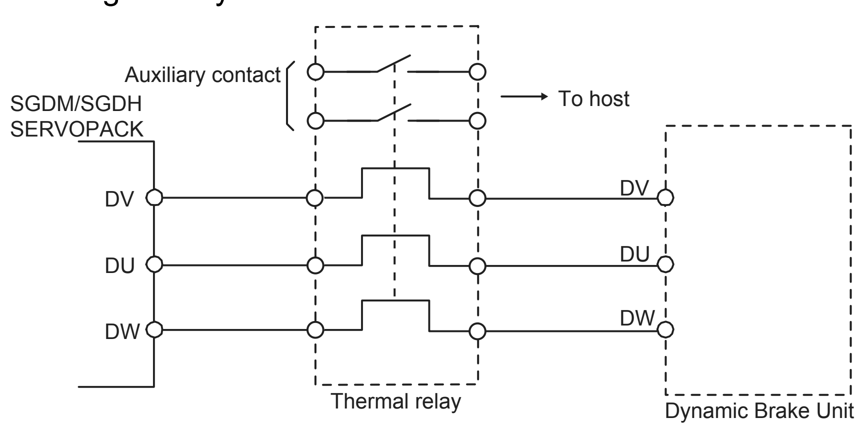
Connect the thermal relay as shown in the following diagram.

When the thermal relay operates, the auxiliary contact turns OFF (or ON). Therefore, configure a sequence so that the main power supply or the servomotor turns OFF when the auxiliary contact turns OFF (or ON).

Connecting to a Regenerative Resistor Unit



Connecting to a Dynamic Brake Unit



■ Selecting a Thermal Relay

When preparing the dynamic brake resistor and regenerative resistor separately, select a thermal relay by calculating the setting current of the thermal relay according to the value and capacity of the resistor being used, as shown in the following equation.

$$\text{Setting current} = \sqrt{\frac{\text{Resistance capacity (W)} \times 0.2}{\text{Resistance value } (\Omega)}}$$

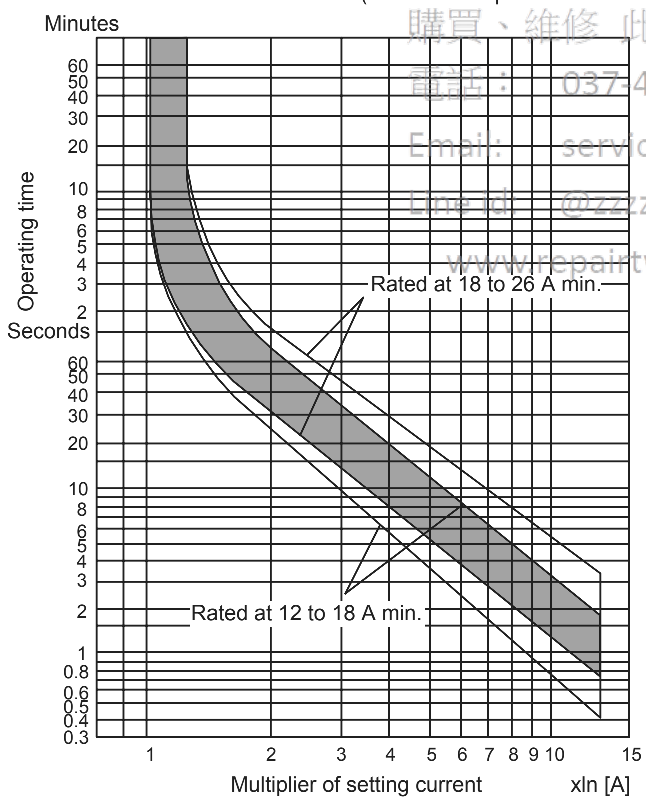
Example for a JUSP-RA08

$$\text{Setting current} = \sqrt{\frac{2000\ (\text{W}) \times 0.2}{2.4\ (\Omega)}} \fallingdotseq 14\ \text{A}$$

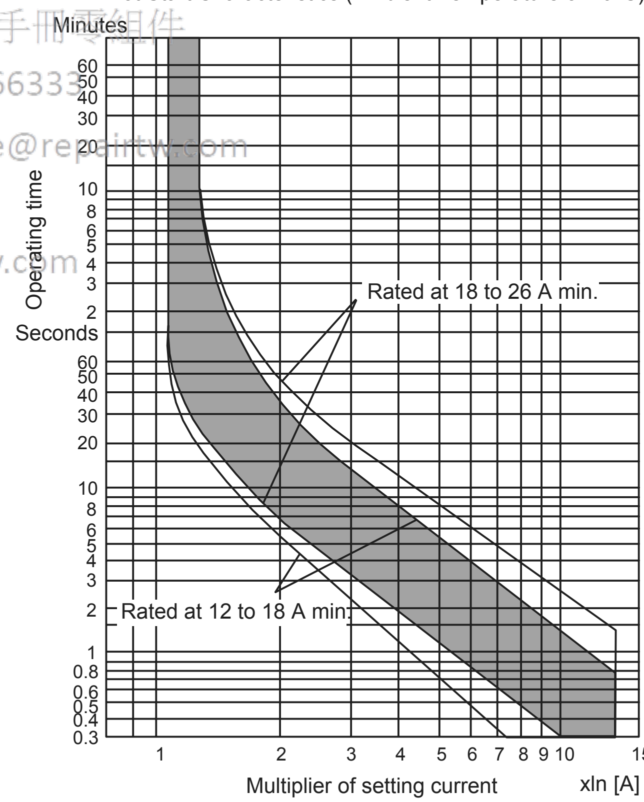
Select a thermal relay that has operating characteristics equivalent to those of the recommended product.

Refer to the following diagrams for the operating characteristics of the recommended thermal relays.

Cold Start Characteristics (Ambient Temperature of 20°C)



Hot Start Characteristics (Ambient Temperature of 20°C)



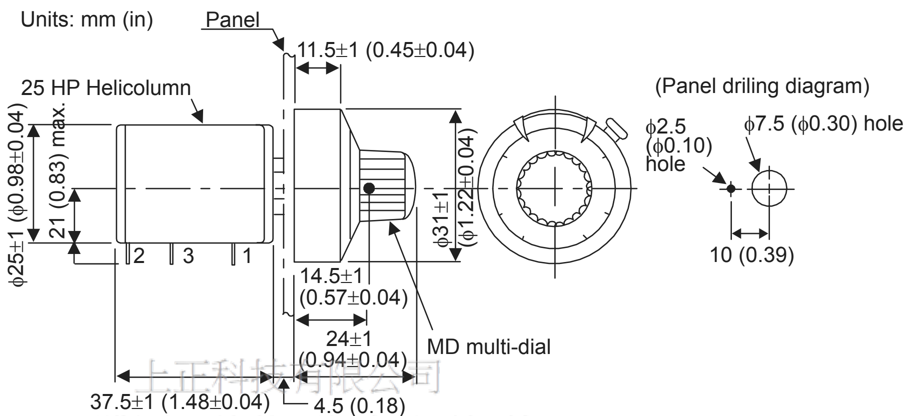
7

7.5.16 Variable Resistor for Speed and Torque Setting

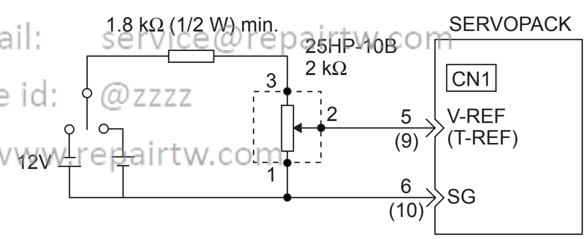
■ Model: 25HP-10B

The multiturn type winding variable resistors with dial MD10-30B4 are manufactured by Sakae Tsushin Kogyo Co., Ltd. Contact Yaskawa Controls Co., Ltd.

■ Dimensional Drawings



■ Example of Connection to an External Power Supply



7.5.17 Encoder Signal Converter Unit

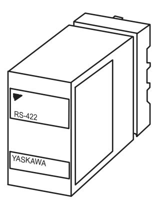
The encoder signal converter unit (the trade name “Receiver Unit”) converts encoder signal output from the line driver to open-collector or voltage-pulse output.

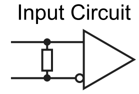
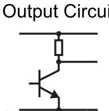
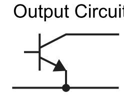
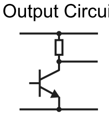
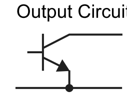
A socket model 11PFA is required to use a Receiver Unit.

■ Model: LRX-01 / A□

Contact Yaskawa Controls Co., Ltd.

■ Specifications



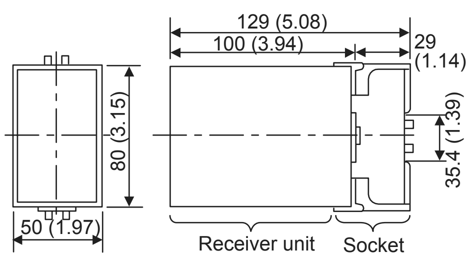
Specifications	Receiver Unit			
	LRX-01/A1	LRX-01/A2	LRX-01/A3	LRX-01/A4
Power Supply	12 VDC ±10 %, 100 mA		5 VDC ±5 %, 100 mA	
Input Signals	Balanced line driver input (RS-422) Input Circuit 			
Output Signals	Voltage pulse output Output Circuit 	Open collector output Output Circuit 	Voltage pulse output Output Circuit 	Open collector output Output Circuit 
Input Signal Level	Differential voltage ≥ 0.3 V, built-in terminator 100 Ω			
Output Signal Level	H: 10 V min. (1 mA) L: 0.5 V max. (30 mA)	L: 0.5 V min. (30 mA) Withstand voltage: 50 V	H: 3 V min. (1 mA) L: 0.5 V max. (30 mA)	L: 0.5 V min. (30 mA) Withstand voltage: 50 V
Ambient Temperature	0 (32 °F) to + 60 °C (140 °F)			
IC Used	Receiver IC: AM26LS32C or the equivalent			
Response Frequency	100 kHz			

■ Dimensional Drawings

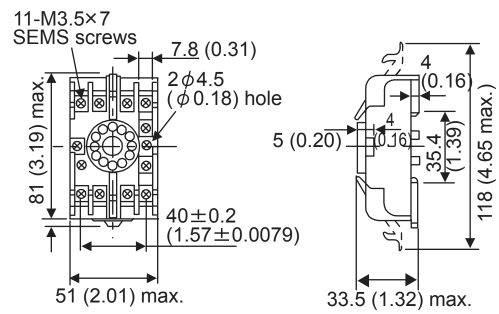
The socket is optional.

Units: mm (in)

Receiver unit and socket



Socket Type 11PFA



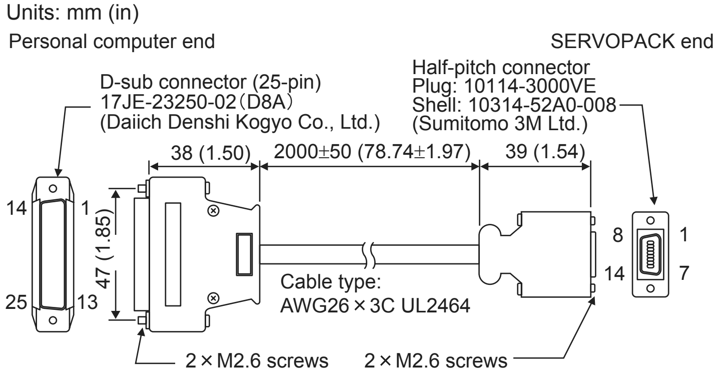
7

7.5.18 Cables for Connecting PCs to a SERVOPACK

■ For 25-pin Connector Cable for NEC PC-98 Series PC

- Cable Type: JZSP-CMS01
- Dimensional Drawing

Units: mm (in)



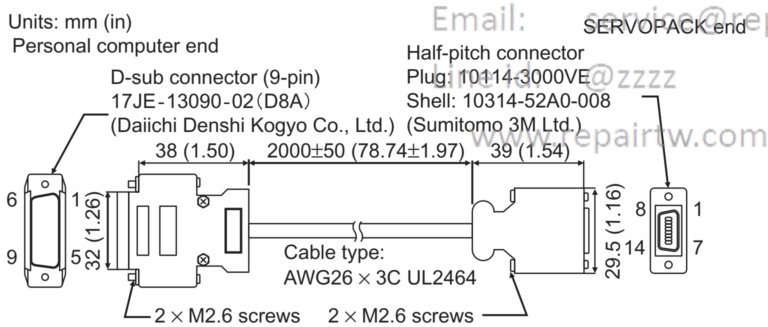
Personal computer end Signal	Pin No.	SERVOPACK end Pin No.	Signal
RXD	3	2	/TXD
TXD	2	4	/RXD
0 V	7	14	0 V
RTS	4	–	–
CTS	5	–	–
FG	1	Case	FG

Shield wire

■ D-sub, 9-pin Connector Cable for IBM PC Compatible

- Cable Type: JZSP-CMS02
- Dimensional Drawing

Units: mm (in)



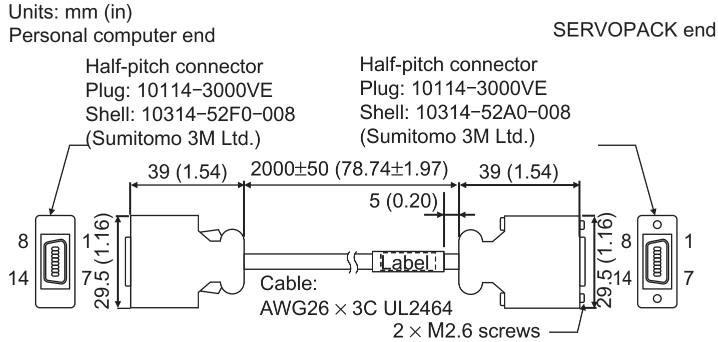
Personal computer end Signal	Pin No.	SERVOPACK end Pin No.	Signal
RXD	2	2	/TXD
TXD	3	4	/RXD
0 V	5	14	0 V
RTS	7	–	–
CTS	8	–	–
FG	Case	Case	FG

Shield wire

■ 14-pin Half-pitch Connector Cable for NEC PC-98 Series PC

- Cable Type: JZSP-CMS03
- Dimensional Drawing

Units: mm (in)



Personal computer end Signal	Pin No.	SERVOPACK end Pin No.	Signal
RXD	1	2	TXD
TXD	9	4	RXD
RTS	10	–	–
CTS	4	–	–
GND	14	14	GND
FG	12	Case	FG
FG	Case		

Shield wire

8

Inspection, Maintenance, and Troubleshooting

This chapter describes the basic inspection and maintenance to be carried out by the user. In addition, troubleshooting procedures are described for problems which cause an alarm display and for problems which result in no alarm display.

8.1 Servodrive Inspection and Maintenance

This section describes the basic inspections and maintenance of servomotors and SERVOPACKs and the procedures for replacing the battery for absolute encoders.

8.1.1 Servomotor Inspection

For inspection and maintenance of servomotors, follow the simple, daily inspection procedures in the following table. The AC servomotors are brushless. Simple, daily inspection is sufficient. The inspection and maintenance frequencies in the table are only guidelines. Increase or decrease the frequency to suit the operating conditions and environment.

IMPORTANT

During inspection and maintenance, do not disassemble the servomotor. If disassembly of the servomotor is required, contact your Yaskawa representative.

Table 8.1 Servomotor Inspections

Item	Frequency	Procedure	Comments
Vibration and Noise	Daily	Touch and listen.	Levels higher than normal?
Exterior	According to degree of contamination	Clean with cloth or compressed air.	-
Insulation Resistance Measurement	At least once a year	Disconnect the SERVOPACK and test insulation resistance at 500 V. Must exceed 10 MΩ. *	Contact your Yaskawa representative if the insulation resistance is below 10 MΩ.
Replacing Oil Seal	At least once every 5000 hours	Remove servomotor from machine and replace oil seal.	Applies only to motors with oil seals.
Overhaul	At least once every 20000 hours or 5 years	Contact your Yaskawa representative.	The user should not disassemble and clean the servomotor.

* Measure across the servomotor FG and the phase-U, phase-V, or phase-W power line.

8.1.2 SERVOPACK Inspection

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

Table 8.2 SERVOPACK Inspections

Item	Frequency	Procedure	Comments
Clean Interior and Circuit Boards	At least once a year	Check for dust, dirt, and oil on the surfaces.	Clean with compressed air or cloth.
Loose Screws	At least once a year	Check for loose terminal block and connector screws.	Tighten any loose screws.
Defective Parts in Unit or on Circuit Boards	At least once a year	Check for discoloration, damage or discontinuities due to heating.	Contact your Yaskawa representative.

■ Part Replacement Schedule

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

The parameters of any SERVOPACKs overhauled by Yaskawa are reset to the standard settings before shipping. Be sure to confirm that the parameters are properly set before starting operation.

Table 8.3 Periodical Part Replacement

Part	Standard Replacement Period	Replacement Method
Cooling Fan	4 to 5 years	Replace with new part.
Smoothing Capacitor	7 to 8 years	Test. Replace with new part.
Relays	-	Test. Replace if necessary.
Fuse	10 years	Replace with new part.
Aluminum Electrolytic Capacitor on Circuit Board	5 years	Test. Replace with new circuit board if necessary.

Operating Conditions:

- Ambient Temperature: Annual average of 30°C
- Load Factor: 80% max.
- Operation Rate: 20 hours/day max.

8.1.3 Replacing Battery for Absolute Encoder

If the voltage of the battery for an absolute encoder drops to approx. 2.7 V or less, an Absolute Encoder Battery Alarm (A. 83) will occur in the SERVOPACK. This alarm occurs when the SERVOPACK receives a signal from the absolute encoder when the power to the SERVOPACK is turned ON. Therefore, the SERVOPACK will not give an alarm when the battery voltage drops below the minimum voltage level while the power is being supplied to the SERVOPACK.

Refer to *4.7.3 Handling Batteries* for the battery type recommended for absolute encoders. Replace the battery using the following procedure if the battery voltage drops below the minimum required battery voltage.

■ Battery Replacement Procedure

1. Replace the battery while the control power to the SERVOPACK is ON.
2. After replacement, turn OFF the power to the SERVOPACK in order to clear the Absolute Encoder Battery Alarm (A. 83).
3. Turn ON the power to the SERVOPACK again and confirm that it operates properly to complete battery replacement.

IMPORTANT

The absolute encoder data will be lost when the control power to the SERVOPACK is turned OFF and when the encoder cable is disconnected from the battery. If the data is lost, refer to *4.7.4 Absolute Encoder Setup* and initialize the absolute encoder.

8.2 Troubleshooting

This section describes causes and remedies for problems which cause an alarm display and for problems which result in no alarm display.

8.2.1 Troubleshooting Problems with Alarm Displays

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

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

■ A.02

A.02: Parameters Breakdown

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

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

■ A.03

A.03: Main Circuit Detector Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

	Cause	Remedy
A	Circuit board (1PWB or 2PWB) defective.	Replace the SERVOPACK.

■ A.04

A.04: Parameter Setting Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

	Cause	Remedy
A	An out-of-range parameter was previously set or loaded.	• Reset all parameters in range. • Otherwise, re-load correct parameter.
B	Circuit board (1PWB) defective.	Replace the SERVOPACK.

■ A.05

A.05: Combination Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON	A, B

	Cause	Remedy
A	The range of servomotor capacities that can be combined has been exceeded.	Replace the servomotor so that a suitable combination is achieved.
B	Encoder parameters have not been written properly.	Replace the servomotor.

8

■ A.09

A.09: Dividing Ratio Setting Error

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when the control power was turned ON. — A, B

	Cause	Remedy
A	If Pn207.2 = 1, the value of Pn212 (PG Dividing Pulse) is outside the allowable setting range or the resolution of the connected encoder.	Correct the setting of Pn212. Turn the power OFF and then ON again.
B	The EEPROM of the SERVOPACK or peripheral circuit failed.	Replace the SERVOPACK.

■ A.0A

A.0A: Encoder Model Unmatched

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when the control power was turned ON. — A, B

	Cause	Remedy
A	Serial encoder does not support the SGDM/ SGDH SERVOPACKs.	Replace the serial encoder with one that supports the SGDM/SGDH SERVOPACK.
B	Circuit board of the SERVOPACK failed.	Replace the SERVOPACKs.

■ A.10

A.10: Overcurrent or Heat Sink Overheated

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B, D, E, F, G, H

When SERVO ON (/S-ON) signal turned ON — C, D

At power ON — C

	Cause	Remedy
A	Wiring shorted between the SERVOPACK and servomotor.	Check and correct wiring.
B	Servomotor phase U, V, or W shorted.	Replace the servomotor.
C	• Circuit board (1PWB) defective. • Power transistor defective.	Replace the SERVOPACK.
D	Current feedback circuit, power transistor, DB circuit, or circuit board defective.	Replace the SERVOPACK.
E	The ambient temperature of the SERVOPACK exceeded 55°C.	Alter conditions so that the ambient temperature goes below 55°C.
F	The air flow around the heat sink is bad.	Follow the installation method and provide sufficient space as specified.
G	Fan stopped.	Replace the SERVOPACK.
H	The SERVOPACK is operating under an overload.	Reduce load.

Note: E to H can occur with a SERVOPACK with a capacity of all models (400 V) and 1.5 kW to 5 kW (200 V).

■ A.30

A.30: Regenerative Error Detected

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B

Occurred when the control power turned ON — D

Occurred approximately 1 second after the main circuit power ON. — A, B, C

	Cause	Remedy
A	Regenerative transistor is abnormal.	Replace the SERVOPACK.
B	Disconnection of the regenerative resistor.	Replace the SERVOPACK or regenerative resistor.
C	Regenerative Unit disconnected (for an external regenerative resistor).	Check wiring of the external regenerative resistor.
D	SERVOPACK defective.	Replace the SERVOPACK.

8

■ A.32

A.32: Regenerative Overload

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B

	Cause	Remedy
A	Regenerative power exceeds the allowable value.	Use an external regenerative resistor that matches the regenerative power capacity.
B	Alarm occurs although an external regenerative resistor is used and the temperature rise of the regenerative resistor is small.	Correct parameter Pn600.

■ A.33

A.33: Main-circuit Power Supply Wiring Error

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when the control power was turned ON. — A, B

Occurred when main circuit power was turned ON. — C, D

	Cause	Remedy
A	Circuit board of the SERVOPACK failed.	Replace the SERVOPACK.
B	Voltage remains in the main circuit.	Check and correct the resistance value of the regenerative resistor.
C	AC power is supplied between L1, L2, and L3 in the DC power input mode.	Set Pn001.2 to zero if the AC power supply input is used. Set Pn001.2 to 1 if the DC power supply input is used.
D	DC power is supplied between +1 and the negative terminal in the AC power input mode.	

8

■ A.40

A.40: Main Circuit DC Voltage Error Detected: Overvoltage

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B, C, D

Occurred when the control power turned ON. — E

Occurred when main circuit power turned ON. — A, D

	Cause	Remedy
A	The power supply voltage is not within the range of specifications.	Check power supply.
B	Load exceeds capacity of the Regenerative Unit.	Check specifications of load moment of inertia and overhanging load.
C	Regenerative transistor is abnormal.	Replace the SERVOPACK.
D	Rectifying diode defective.	
E	SERVOPACK defective.	

■ A.41

A.41: Main Circuit DC Voltage Error Detected: Undervoltage

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B, C

Occurred when the control power turned ON. — D

Occurred when main circuit power turned ON. — A, B, C

	Cause	Remedy
A	The power supply voltage is not within the range of specifications.	Check power supply voltage.
B	Fuse blown.	Replace the SERVOPACK.
C	Rectifying diode defective.	
D	SERVOPACK defective.	

8

■ A.51

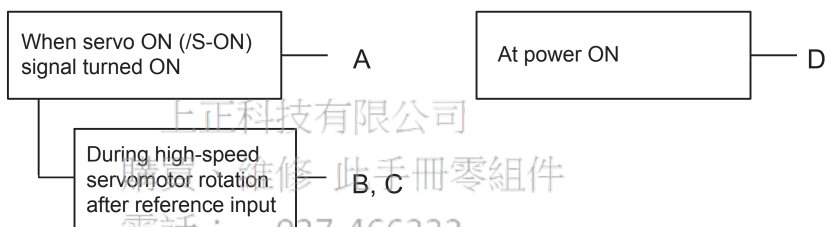
A.51: Overspeed

Display and Outputs

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

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

Status and Remedy for Alarm



	Cause	Remedy
A	Servomotor wiring incorrect.	Check and correct wiring. (Check for phase-U, -V, and -W wiring errors.)
B	Position or speed reference input is too large.	Lower the reference input values.
C	Incorrect reference input gain settings.	Check and correct parameter settings.
D	Circuit board (1PWB) defective.	Replace the SERVOPACK.

■ A.71

A.71: Overload: High Load

The alarm output, status, and remedy for A.71 are the same as for A.72.

■ A.72

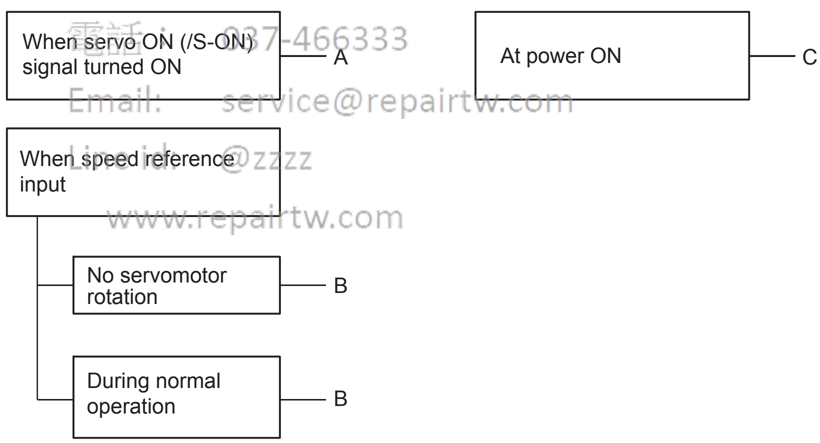
A.72: Overload: Low Load

Display and Outputs

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

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

Status and Remedy for Alarm



Cause		Remedy
A	Servomotor wiring incorrect or disconnected.	Check wiring and connectors at servomotor.
B	Load greatly exceeds rated torque.	Reduce load torque and moment of inertia. Otherwise, replace with larger capacity servomotor.
C	Circuit board (1PWB) defective.	Replace the SERVOPACK.

■ A.73

A.73: Dynamic Brake Overload

Display and Outputs

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

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

Status and Remedy for Alarm

When servo OFF signal turned ON — A

At power ON — B

	Cause	Remedy
A	The product of the square of rotational motor speed and the combined moment of inertia of the motor and load (rotation energy) exceeds the capacity of the dynamic brake resistor built into the SERVOPACK.	• Lower the rotational speed. • Lower the load moment of inertia. • Minimize the use of the dynamic brake.
B	Circuit board (1PWB) defective.	Replace the SERVOPACK.

■ A.74

A.74: Overload of Surge Current Limit Resistor

Display and Outputs

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

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

Status and Remedy for Alarm

When main circuit power turned ON or OFF — A

At power ON — B

	Cause	Remedy
A	Frequently turning the main circuit power ON/OFF.	Do not repeatedly turn ON/OFF the main circuit power.
B	Circuit board (1PWB) defective.	Replace the SERVOPACK.

8

■ A.7A

A.7A: Heat Sink Overheated

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B, C, D

When control power turned ON — E

	Cause	Remedy
A	The ambient temperature of the SERVOPACK exceeded 55°C.	Alter conditions so that the ambient temperature goes below 55°C.
B	The air flow around the heat sink is bad.	Follow the installation method and provide sufficient space as specified.
C	Fan stopped.	Replace the SERVOPACK.
D	The SERVOPACK is operating under an overload.	Reduce load.
E	SERVOPACK defective.	Replace the SERVOPACK.

■ A.81

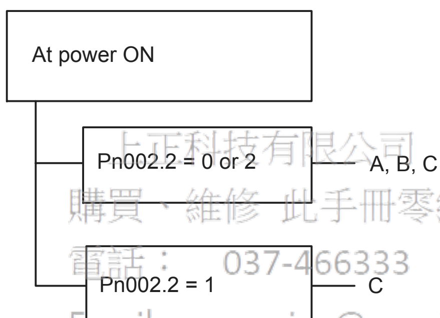
A.81: Absolute Encoder Backup Error

Display and Outputs

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

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

Status and Remedy for Alarm



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

■ A.82

A.82: Encoder Checksum Error

Display and Outputs

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

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

Status and Remedy for Alarm

Status	Cause
At power ON	A, B
When SEN signal turned ON; Pn002.2 = 0 or 2	A
During operation	A, B

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

■ A.83

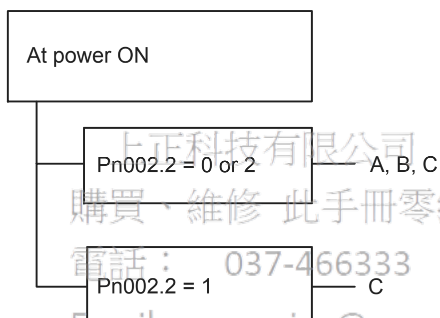
A.83: Absolute Encoder Battery Error

Display and Outputs

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

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

Status and Remedy for Alarm



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

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

8

■ A.84

A.84: Absolute Encoder Data Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

During operation — B

	Cause	Remedy
A	Encoder defective.	Replace the servomotor if the problem occurs often.
B	Operational error in encoder caused by external noise.	Check and correct wiring around the encoder (grounding of the servomotor, separation between the encoder cable and the servomotor power cable, insertion of toroidal cores onto cables, etc.).

■ A.85

A.85: Absolute Encoder Overspeed

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

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

8

■ A.86

A.86: Encoder Overheated

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B

Occurred when the control power turned ON. — C, D

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

■ A.b1

A.b1: Reference Speed Input Read Error

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B

At power ON — C

	Cause	Remedy
A	Error in reference read-in unit (A/D Converter, etc.).	Reset alarm and restart operation.
B	Reference read-in unit faulty. (A/D Converter, etc.).	Replace the SERVOPACK.
C	Circuit board (1PWB) defective.	Replace the SERVOPACK.

8

■ A.b2

A.b2: Reference Torque Input Read Error

Display and Outputs

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

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

Status and Remedy for Alarm

Status	Cause
During servomotor operation	A, B
At power ON	C

Cause		Remedy
A	Error in reference read-in unit (A/D Converter, etc.).	Reset alarm and restart operation.
B	Reference read-in unit faulty. (A/D Converter, etc.).	Replace the SERVOPACK.
C	Circuit board (1PWB) defective.	Replace the SERVOPACK.

■ A.b3

A.b3: Current Detection Error

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when the control power was turned ON. — A

Occurred during normal operation. — A, B

Occurred when the servo ON (/S-ON) signal turned ON. — A, B

	Cause	Remedy
A	Sensor for current detection in the SERVOPACK failed.	Replace the SERVOPACK.
B	Power line of servomotor is disconnected.	Reconnect the power line of the servomotor.

■ A.bF

A.bF: System Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when the control power was turned ON. — A

Occured during normal operation. — B, C

	Cause	Remedy
A	Control circuit of the SERVOPACK failed.	Replace the SERVOPACK.
B	Program failed.	Replace the SERVOPACK. Contact your Yaskawa representative.
C	Control circuit of the SERVOPACK failed.	Replace the SERVOPACK.

■ A.C1

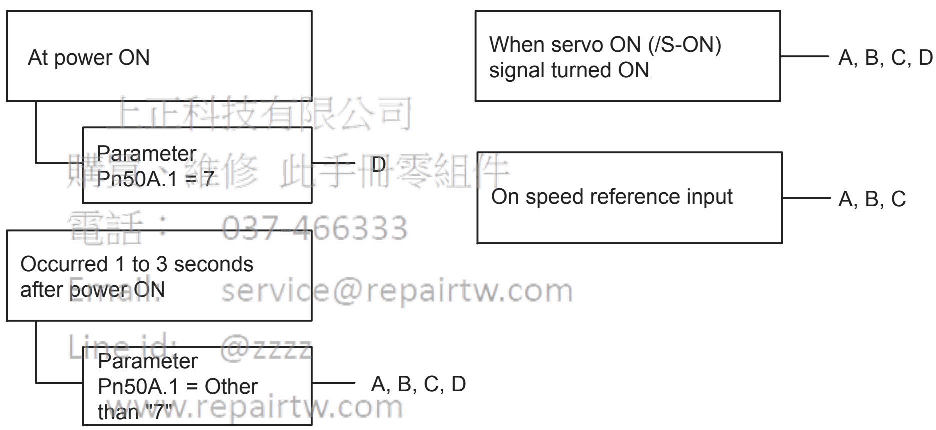
A.C1: Servo Overrun

Display and Outputs

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

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

Status and Remedy for Alarm



Cause		Remedy
A	Servomotor wiring incorrect or disconnected.	Check wiring and connectors at servomotor.
B	Encoder wiring incorrect or disconnected.	Check wiring and connectors at encoder.
C	Encoder defective.	Replace the servomotor.
D	Circuit board (1PWB) defective.	Replace the SERVOPACK.

■ A.C8

A.C8: Absolute Encoder Clear Error and Multiturn Limit Setting Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

When resetting multiturn clear encoder alarm — A, B

	Cause	Remedy
A	Encoder defective.	Replace the servomotor.
B	SERVOPACK defective.	Replace the SERVOPACK.

■ A.C9

A.C9: Encoder Communications Error

Display and Outputs

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

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

Status and Remedy for Alarm

During servomotor operation — A, B, C

At power ON — A, B, C

	Cause	Remedy
A	Encoder wiring incorrect or disconnected	Check wiring and connectors at encoder.
B	Encoder defective.	Replace the servomotor.
C	SERVOPACK defective.	Replace the SERVOPACK.

■ A.CA

A.CA: Encoder Parameter Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

	Cause	Remedy
A	Encoder defective.	Replace the servomotor.
B	SERVOPACK defective.	Replace the SERVOPACK.

■ A.Cb

A.Cb: Encoder Echoback Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

	Cause	Remedy
A	Encoder wiring incorrect or disconnected	Check wiring and connectors at encoder.
B	Encoder defective.	Replace the servomotor.
C	SERVOPACK defective.	Replace the SERVOPACK.

■ A.CC

A.CC: Multiturn Limit Disagreement Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

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

■ A.d0

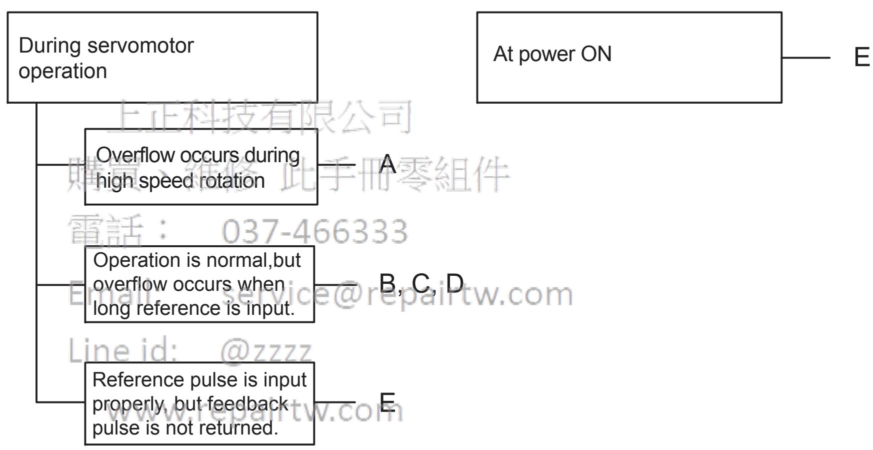
A.d0: Position Error Pulse Overflow

Display and Outputs

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

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

Status and Remedy for Alarm



	Cause	Remedy
A	Servomotor wiring incorrect.	Check and correct wiring.
B	The SERVOPACK was not correctly adjusted.	Increase speed loop gain (Pn100) and position loop gain (Pn102).
C	Motor load was excessive.	Reduce load torque and moment of inertia. Otherwise, replace with larger capacity servomotor.
D	Position reference pulse frequency was too high.	• Increase or decrease reference pulse frequency. • Add smoothing function. • Correct electronic gear ratio.
E	Circuit board (1PWB) defective.	Replace the SERVOPACK.

8

■ A.E7

A.E7: Option Unit Detection Error

A.E7 occurs when the SGDH is used without option unit after it has been used with option unit.

This alarm cannot be cleared by alarm reset.

Clear the alarm by Fn014 (option unit detection result clear) of auxiliary function mode.

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred without option unit when the control power turned ON. — A

Occurred with option unit when the control power turned ON. — B, C, D

	Cause	Remedy
A	The SGDH is used without option unit after it has been used with option unit.	To continue using the SGDH without option unit, execute Fn014 (option unit detection result clear) of the auxiliary function mode and restart the power.
B	Option unit connection defective.	Check and correct the connection.
C	Option unit defective.	Replace option unit.
D	Connector Cn10 of the SERVOPACK defective.	Replace the SERVOPACK.

■ A.F1

A.F1: Power Line Open Phase

Display and Outputs

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

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

Status and Remedy for Alarm

At main circuit power supply ON. — A, B

Occurred when the control power turned ON. — C

	Cause	Remedy
A	One phase (L1, L2, or L3) of the main circuit power supply is disconnected.	• Check power supply. • Check wiring of the main circuit power supply. • Check QF, noise filter, magnetic contactor.
B	There is one phase where the line voltage is low.	Check power supply.
C	SERVOPACK defective.	Replace the SERVOPACK.

8

■ A.F5, A.F6

A.F5 and A.F6: Servomotor Disconnection Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when the control power was turned ON. — A

Occurred when the servo ON (/S-ON) signal was turned ON. — A, B

	Cause	Remedy
A	Circuit board of the SERVOPACK failed.	Replace the SERVOPACK.
B	Power line of servomotor is disconnected.	Reconnect the power line of the servomotor.

■ CPF00

CPF00: Digital Operator Transmission Error 1
This alarm is not stored in the alarm trace-back function memory.

This alarm is also temporarily displayed when an option unit and the Digital Operator are used at the same time and communications between the option unit and the SERVOPACK last for more than one second. Operation with the Digital Operator is disabled during this period.

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
Not specified			

Status and Remedy for Alarm

Status	Cause
At power ON. Digital Operator connected before SERVOPACK power turned ON.	A, B, C, D
Digital Operator connected to SERVOPACK after power turned ON.	A, B, C, D

	Cause	Remedy
A	Cable defective or poor contact between Digital Operator and the SERVOPACK.	• Check connector connections. • Replace cable.
B	Malfunction due to external noise.	Separate Digital Operator and cable from noise source.
C	Digital Operator defective.	Replace Digital Operator.
D	SERVOPACK defective.	Replace the SERVOPACK.

8

■ CPF01

CPF01: Digital Operator Transmission Error 2

This alarm is not stored in the alarm trace-back function memory.

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
Not specified			

Status and Remedy for Alarm

During operation — A, B, C, D

	Cause	Remedy
A	Cable defective or poor contact between Digital Operator and the SERVOPACK.	• Check connector connections. • Replace cable.
B	Malfunction due to external noise.	Separate Digital Operator and cable from noise source.
C	Digital Operator defective.	Replace Digital Operator.
D	SERVOPACK defective.	Replace the SERVOPACK.

■ A.- -

A.- -: Normal Operation

This is not an alarm display.

Display and Outputs

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

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

8.2.2 Troubleshooting Problems with No Alarm Display

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

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

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

Table 8.4 Troubleshooting Table of No Alarm Display

Symptom	Cause	Inspection	Remedy
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).	Tighten any loose parts.
	Connector (CN1) external wiring incorrect	Check connector (CN1) external wiring.	Refer to connection diagram and correct wiring.
	Servomotor or encoder wiring disconnected.		Reconnect wiring.
	Overloaded	Run under no load.	Reduce load or replace with larger capacity servomotor.
	Speed/position references not input	Check reference input pins.	Correctly input speed/position references.
	/S-ON is turned OFF	Check settings of parameters Pn50A.0 and Pn50A.1.	Turn /S-ON input ON.
	/P-CON input function setting incorrect	Check parameter Pn000.1.	Refer to section *4.3.5* and set parameters to match application.
	Reference pulse mode selection incorrect.	Refer to section *4.2.2*.	Correct setting of parameter Pn200.0.
	Encoder type differs from parameter setting.	Incremental or absolute encoder?	Set parameter Pn002.2 to the encoder type being used.
	P-OT and N-OT inputs are turned OFF.	Refer to section *4.1.2*.	Turn P-OT and N-OT input signals ON.
	CLR input is turned ON.	Check status of error counter clear input.	Turn CLR input OFF.
	SEN input is turned OFF.	When absolute encoder is used.	Turn SEN input ON.
Servomotor Moves Instantaneously, then Stops	Servomotor or encoder wiring incorrect.		Refer to section *2.3* and correct wiring.
Suddenly Stops during Operation and will Not Restart	Alarm reset signal (/ALM-RST) is turned ON because an alarm occurred.		Remove cause of alarm. Turn alarm reset signal (/ALM-RST) from ON to OFF.
Servomotor Speed Unstable	Wiring connection to motor defective	Check connection of power lead (phases U, V, and W) and encoder connectors.	Tighten any loose terminals or connectors.

Table 8.4 Troubleshooting Table of No Alarm Display (cont'd)

Symptom	Cause	Inspection	Remedy
Servomotor Vibrates at Approximately 200 to 400 Hz.	Speed loop gain value too high.		Reduce speed loop gain (Pn100) preset value.
	Speed/position reference input lead too long.		Minimize length of speed/position reference input lead, with impedance not exceeding several hundred ohms.
	Speed/position reference input lead is bundled with power cables.		Separate reference input lead at least 30 cm from power cables.
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 speed loop gain (Pn100) preset value. Reduce the integration time constant (Pn101).
Servomotor Overheated	Ambient temperature too high	Measure servomotor ambient temperature.	Reduce ambient temperature to 40°C max.
	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	Mechanical mounting incorrect	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 representative if defective.
	Machine causing vibrations	Foreign object intrusion, damage or deformation of sliding parts of machine.	Consult with machine manufacturer.
Speed Reference 0 V but Servomotor Rotates.	Speed reference voltage offset applied		Adjust reference offset. Refer to sections *6.2.4* and *6.2.5*.

8.2.3 Alarm Display Table

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

Table 8.5 Alarm Display Table

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Meaning
	ALO1	ALO2	ALO3			
A.02	OFF	OFF	OFF	OFF	Parameter Breakdown*	EEPROM data of the SERVOPACK 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					Combination Error	SERVOPACK and servomotor capacities do not match each other.
A.09					Dividing Ratio Setting Error	The setting of dividing ratio (Pn212) is not acceptable (out of fixed increments) or exceeds the value for the connected encoder resolution.
A.0A					Encoder Model Unmatched	The mounted serial encoder is not supported by Σ-II Series SERVOPACK.
A.10	ON	OFF	OFF	OFF	Overcurrent or Heat Sink Overheated*	An overcurrent flowed through the IGBT. Heat sink of the SERVOPACK 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.33					Main-circuit Power Supply Wiring Error	The power supply to the main circuit does not match the parameter Pn001 setting.
A.40	OFF	OFF	ON	OFF	Overvoltage	Main circuit DC voltage is excessively high.
					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 the SERVOPACK overheated.

Table 8.5 Alarm Display Table (cont'd)

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Meaning
	ALO1	ALO2	ALO3			
A.81	OFF	OFF	OFF	OFF	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					Encoder Data Error*	Data in the encoder is abnormal.
A.85					Encoder Overspeed	The encoder was rotating at high speed when the power was turned ON.
A.86					Encoder Overheated	The internal temperature of encoder is too high.
A.b1					Reference Speed Input Read Error	The A/D converter for reference speed input is faulty.
A.b2					Reference Torque Input Read Error	The A/D converter for reference torque input is faulty.
A.b3					Current Detection Error	The current sensor is faulty, or the servomotor is disconnected.
A.bF					System Alarm*	A system error occurred in the SERVOPACK.
A.C1	ON	OFF	ON	OFF	Servo Overrun Detected	The servomotor ran out of control.
A.C8					Absolute Encoder Clear Error and Multiturn Limit Setting Error*	The multiturn for the absolute encoder was not properly cleared or set.
A.C9					Encoder Communications Error*	Communications between the SERVOPACK 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					Multiturn Limit Disagreement	Different multiturn limits have been set in the encoder and SERVOPACK.
A.d0	ON	ON	OFF	OFF	Position Error Pulse Overflow	Position error pulse exceeded parameter (Pn505).
A.E7	OFF	ON	ON	OFF	Option Unit Detection Error	Option unit detection fails.
A.F1	OFF	ON	OFF	OFF	Power Line Open Phase	One phase is not connected in the main power supply.
A.F5					Servomotor Disconnection Alarm	The power is not supplied to the servomotor though the SERVOPACK received the Servo ON command.
A.F6						
CPF00	Not specified				Digital Operator Transmission Error	Digital Operator (JUSP-OP02A-2) fails to communicate with the SERVOPACK (e.g., CPU error).
CPF01						
A.- -	OFF	OFF	OFF	ON	Not an error	Normal operation status

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

* These alarms are not reset for the alarm reset signal (/ALM-RST). Eliminate the cause of the alarm and then turn OFF the power supply to reset the alarms.

8.2.4 Warning Displays

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

Table 8.6 Warning Displays and Outputs

Warning Display	Warning Code Outputs			Warning Name	Meaning of Warning
	ALO1	ALO2	ALO3		
A.90	OFF	OFF	OFF	Excessive Position Error Warning	The position errors exceed the setting in Pn51E.
A.91	ON	OFF	OFF	Overload	This warning occurs before the overload alarms (A.71 or A.72) occur. If the warning is ignored and operation continues, an overload alarm may occur.
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, a regenerative overload alarm may occur.
A.93	ON	ON	OFF	Absolute Encoder Battery Warning	This warning occurs when battery voltage for the absolute encoder has dropped. If the warning is ignored and operation continues, a regenerative overload alarm may occur.

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

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8.2.5 Internal Connection Diagram and Instrument Connection Examples

The following diagrams show the SGDH SERVOPACK internal connection and instrument connection examples. Refer to these diagrams during inspection and maintenance.

■ Internal Connection Diagram

22 kW or 30 kW for 200 V

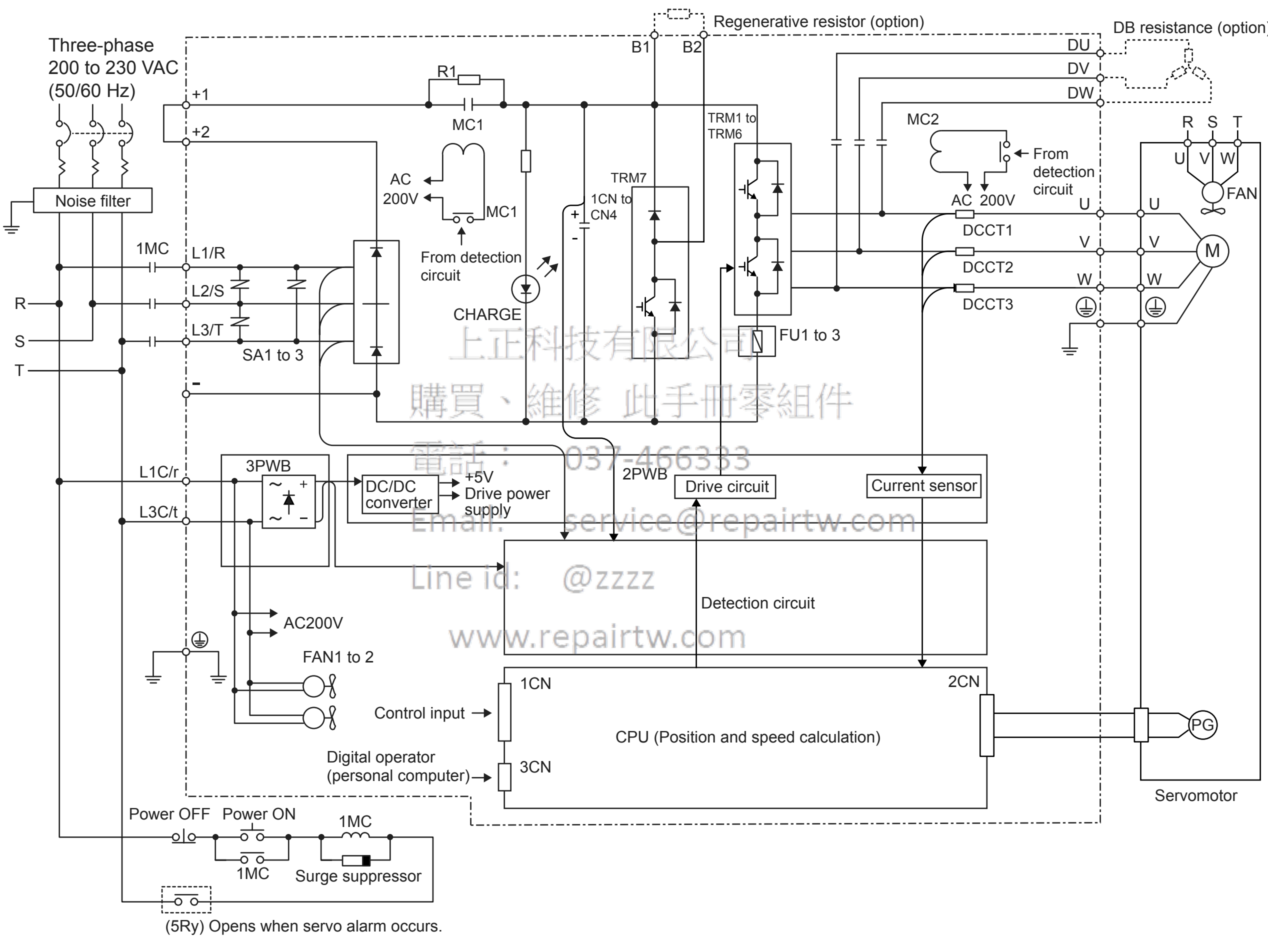


Fig. 8.1 SERVOPACK Internal Connection Diagram of 22 kW or 30 kW for 200 V

37 kW for 200 V

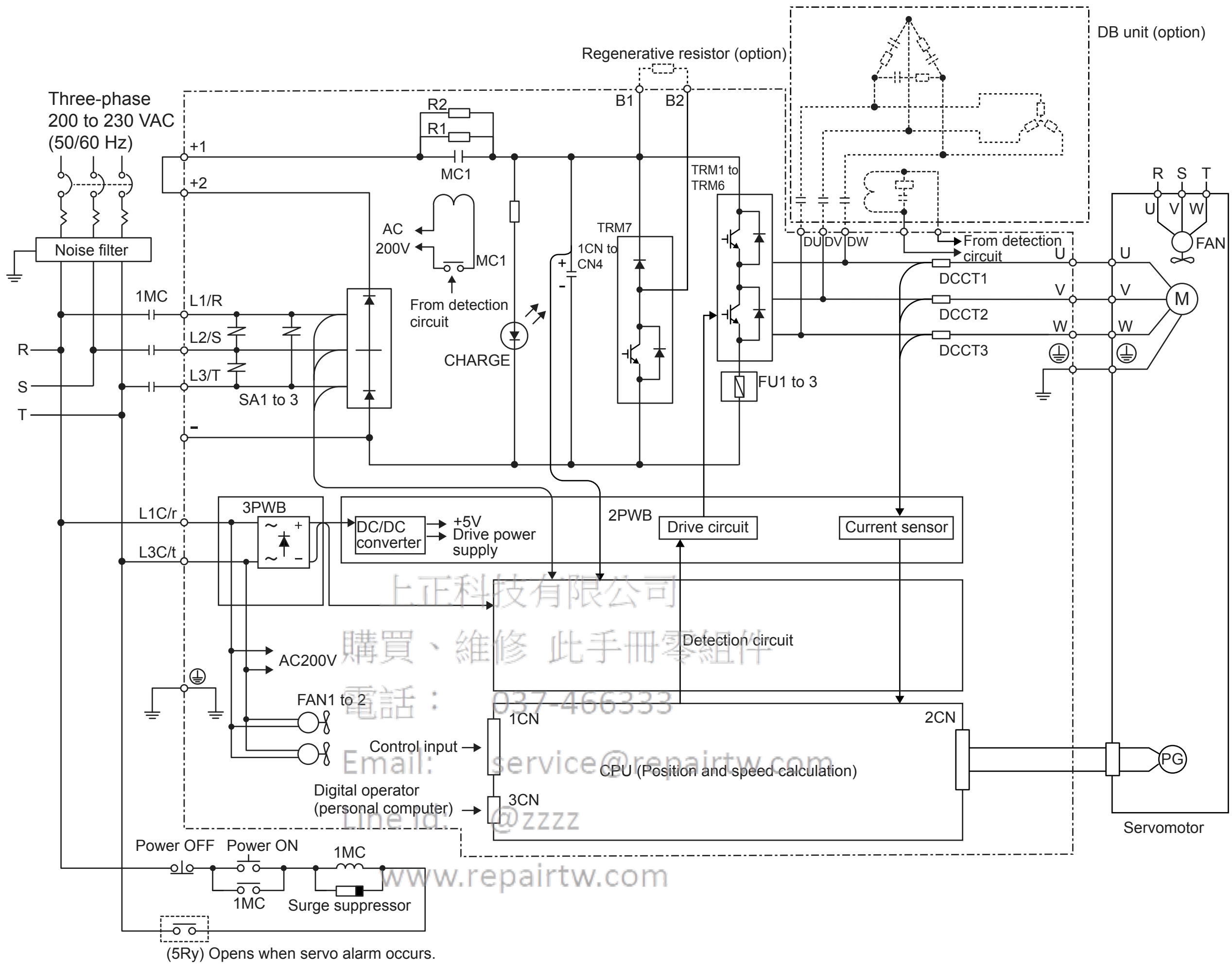


Fig. 8.2 SERVOPACK Internal Connection Diagram of 37 kW for 200 V

22 kW or 30 kW for 400 V

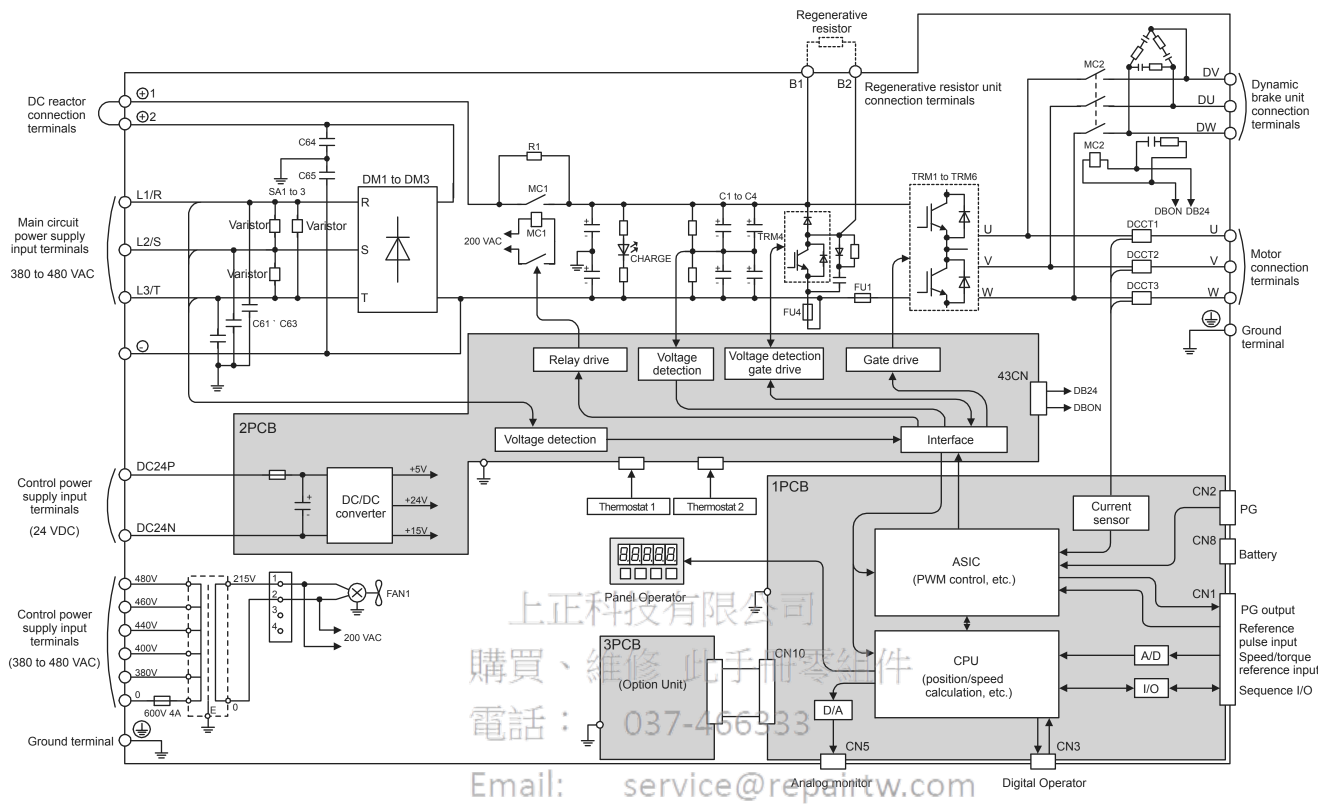


Fig. 8.3 SERVOPACK Internal Connection Diagram of 22 kW or 30 kW for 400 V

37 kW for 400 V

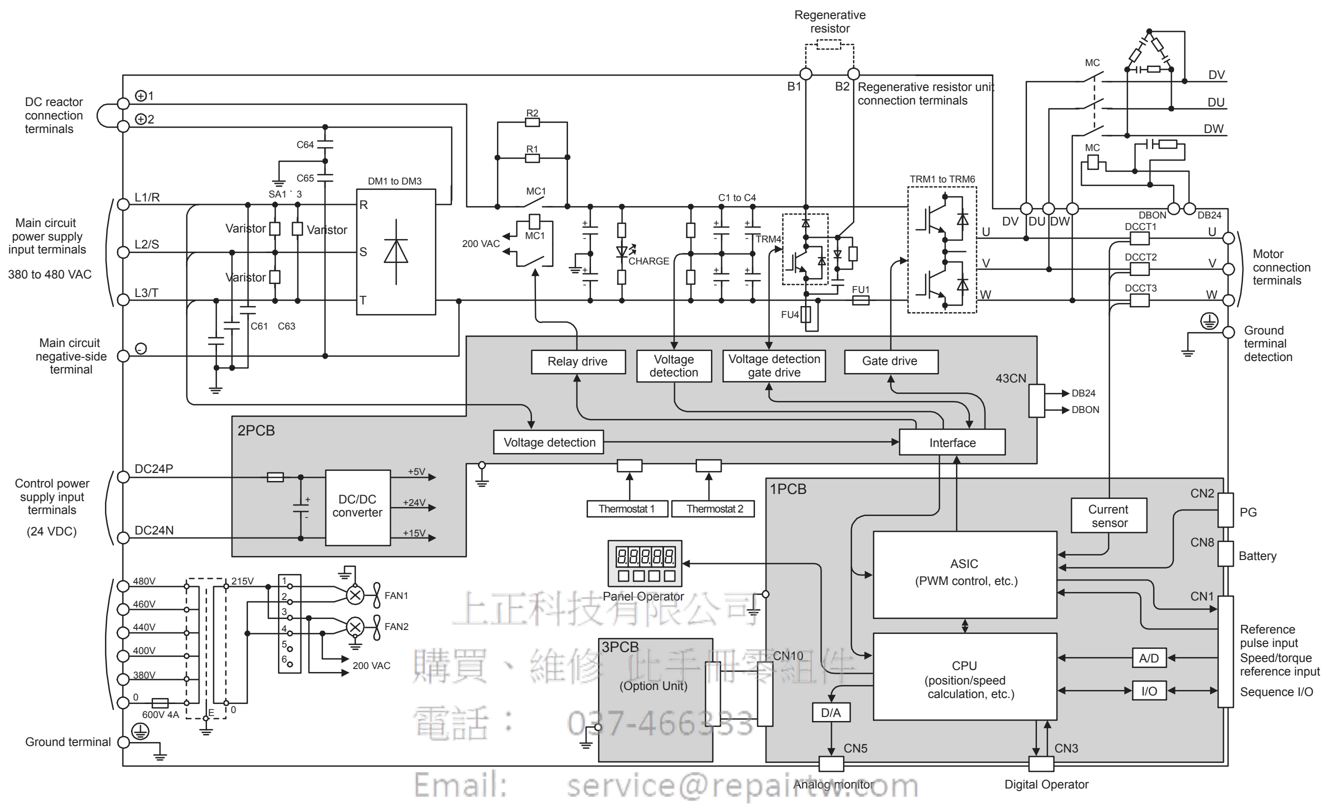


Fig. 8.4 SERVOPACK Internal Connection Diagram of 37 kW for 400 V

8

45 kW or 55 kW for 400 V

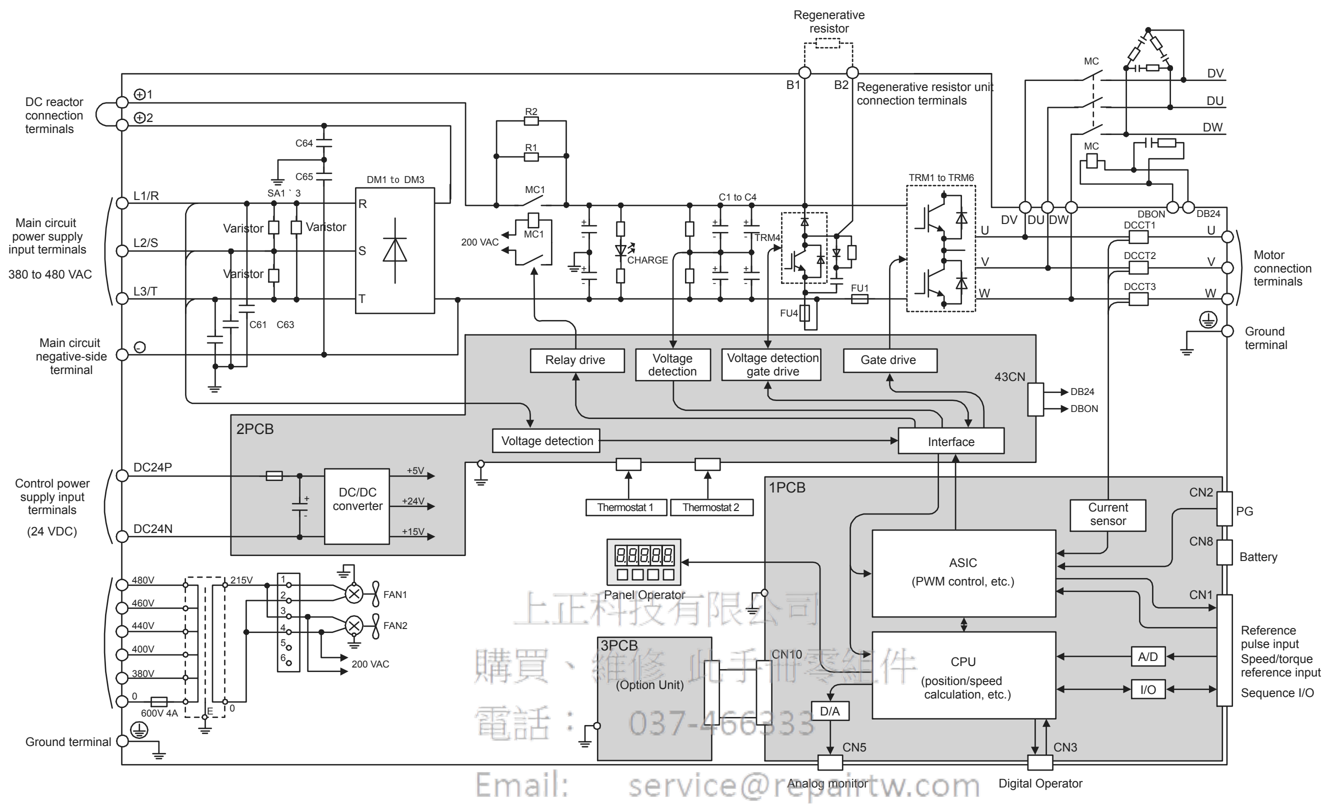
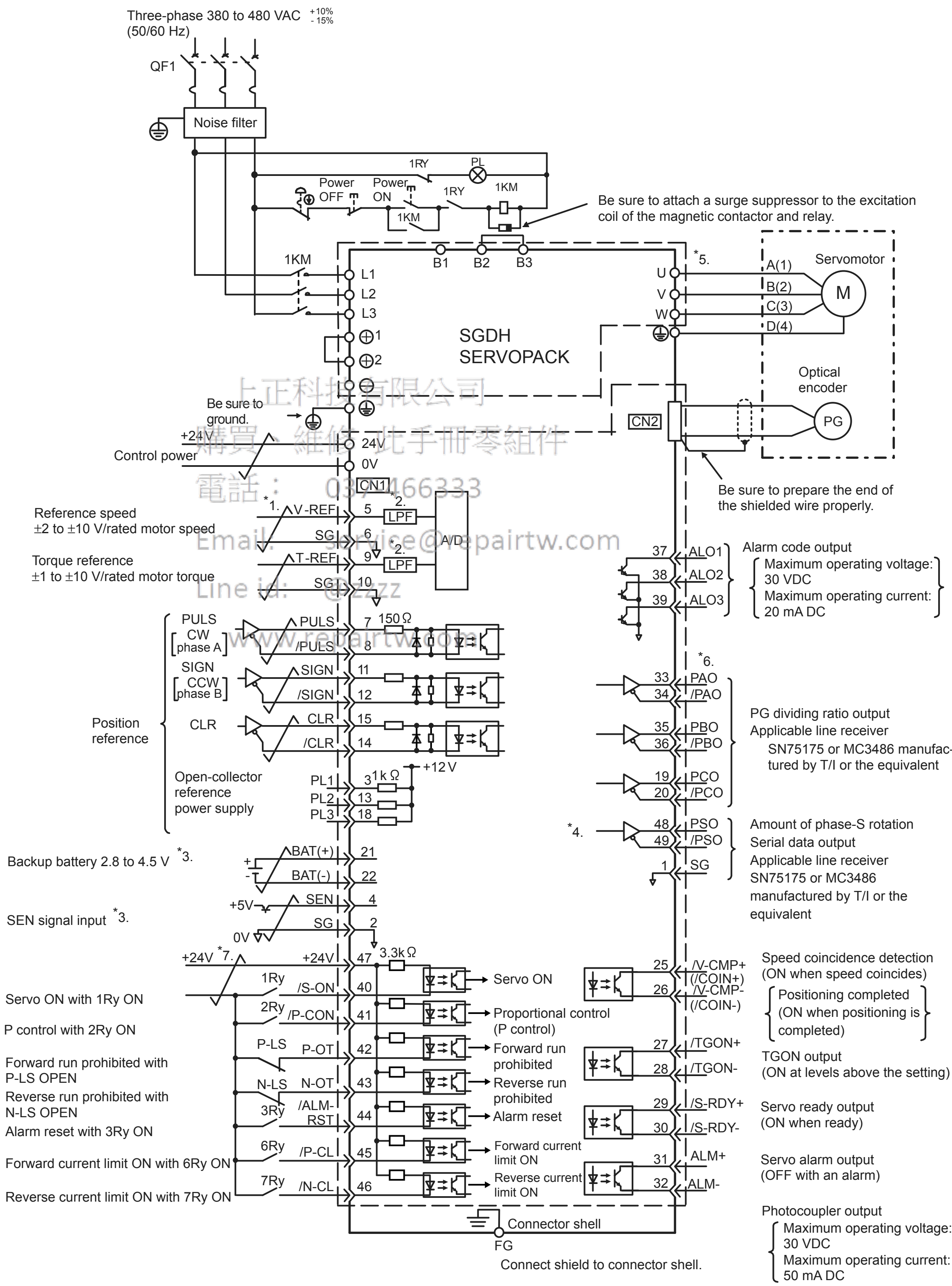


Fig. 8.5 SERVOPACK Internal Connection Diagram of 45 kW or 55 kW for 400 V

■ Instrument Connection Examples

The following diagram shows a connection example of reference and control I/O.

Wiring with 400-V SERVOPACK



* 1. represents twisted-pair wires.
* 2. The time constant for the primary filter is 47 μs.
* 3. Connect when using an absolute encoder.
* 4. Used only with an absolute encoder.
* 5. These circuits are hazardous and therefore, are separated by protecting separator.
* 6. These circuits are SELV circuits and are separated from all other circuits by double and reinforced insulation.
* 7. A double-insulated 24-VDC power supply must be supplied by the user.

Appendix A

A

List of Parameters

This appendix lists the parameters, switches, input signal selections, output signal selections, auxiliary functions, and monitor modes for SGDH SERVOPACKs.

A.1 Parameters

The following list shows parameters and their settings.

Table A.1 List of Parameters

Category	Parameter No.	Name	Unit	Setting Range	Factory Setting	Reference
Function Selection Constants	Pn000	Function Selection Basic Switches[*1]	-	-	0000	4.1.1, 4.3.5
	Pn001	Function Selection Application Switches 1[*1]	-	-	0000	4.1.2, 4.4.2, 4.5.7
	Pn002	Function Selection Application Switches 2[*1]	-	-	0000	4.2.8, 4.2.10, 4.7.2
	Pn003	Function Selection Application Switches 3	-	-	0002	5.5
	Pn004	Fixed Parameters (Do not change.)	-	-	0000	-
	Pn005		-	-	0000	-
Gain Related Constants	Pn100	Speed Loop Gain	Hz	1 to 2000	40	5.2.1
	Pn101	Speed Loop Integral Time Constant	0.01 ms	15 to 51200	2000	5.2.1
	Pn102	Position Loop Gain	1/s	1 to 2000	40	5.2.1
	Pn103	Inertia Ratio	%	0 to 10000 (0 to 20000)[*2]	0	5.2.1
	Pn104	2nd Speed Loop Gain	Hz	1 to 2000	40	-
	Pn105	2nd Speed Loop Integral Time Constant	0.01 ms	15 to 51200	2000	-
	Pn106	2nd Position Loop Gain	1/s	1 to 2000	40	-
	Pn107	Bias	min^{-1}	0 to 450	0	5.2.4
	Pn108	Bias Addition Width	reference units	0 to 250	7	5.2.4
	Pn109	Feed-forward	%	0 to 100	0	5.2.2
	Pn10A	Feed-forward Filter Time Constant	0.01 ms	0 to 6400	0	4.2.5
	Pn10B	Gain-related Application Switches[*1]	-	-	0000	5.2.5
	Pn10C	Mode Switch Torque Reference	%	0 to 800	200	5.2.5
	Pn10D	Mode Switch Speed Reference	min^{-1}	0 to 10000	0	5.2.5
	Pn10E	Mode Switch Acceleration	10 min^{-1}/s	0 to 3000	0	5.2.5
	Pn10F	Mode Switch Error Pulse	reference units	0 to 10000	0	5.2.5
	Pn110	Online Autotuning Switches[*3] (Not available for SERVOPACKs with a capacity of 22 kW or more.)	-	-	0012	-
	Pn111	Speed Feedback Compensation[*3] (Not available for SERVOPACKs with a capacity of 22 kW or more.)	%	1 to 500	100	5.2.6

* 1. After changing these parameters, turn OFF the main circuit and control power supplies and then turn them ON again to enable the new settings.

* 2. Available with software version 32 or later.

* 3. These parameters are not available.

Table A.1 List of Parameters (cont'd)

Category	Parameter No.	Name	Unit	Setting Range	Factory Setting	Reference
Gain Related Constants (cont'd)	Pn112	Fixed Parameters (Do not change.)	%	0 to 1000	100	-
	Pn113		-	0 to 1000	1000	-
	Pn114		-	0 to 1000	200	-
	Pn115		-	0 to 65535	32	-
	Pn116		-	0 to 65535	16	-
	Pn117		%	20 to 100	100	-
	Pn118		%	50 to 100	100	-
	Pn119		1/s	1 to 2000	50	-
	Pn11A		0.1%	1 to 2000	1000	-
	Pn11B		Hz	1 to 150	50	-
	Pn11C		Hz	1 to 150	70	-
	Pn11D		%	0 to 150	100	-
	Pn11E		%	0 to 150	100	-
	Pn11F		ms	0 to 2000	0	-
	Pn120		0.01 ms	0 to 51200	0	-
	Pn121		Hz	10 to 250	50	-
	Pn122		Hz	0 to 250	0	-
	Pn123		%	0 to 100	0	-
	Pn124	Automatic Gain Switching Timer[*1]	ms	1 to 10000	100	-
	Pn125	Automatic Gain Switching Width[*1]	Reference unit	1 to 250	7	-
Position Related Constants	Pn200	Position Control Reference Selection Switches[*2]	-	-	0000	4.2.2
	Pn201	PG Divider[*2]	P/r	16 to 16384	16384	4.2.3
	Pn202	Electronic Gear Ratio (Numerator) [*2]	-	1 to 65535	4	4.2.5
	Pn203	Electronic Gear Ratio (Denominator) [*2]	-	1 to 65535	1	4.2.5
	Pn204	Position Reference Accel/ Decel Time Constant	0.01 ms	0 to 6400	0	5.1.2
	Pn205	Multiturn Limit Setting[*2, *3]	rev	0 to 65535	65535	4.7.6
	Pn206	Fixed Parameter (Do not change.)	P/rev	513 to 65535	16384	-
	Pn207	Position Control Function Switches[*2]	-	-	0000	4.2.9, 5.1.2
	Pn208	Position Reference Movement Averaging Time[*2]	0.01 ms	0 to 6400	0	5.1.2
	Pn212	PG Dividing Pulse (17 bits or more)[*1]	P/rev	16 to 1073741824	2048	-
	Pn217	Reference Pulse Input[*1]	×1	1 to 99	1	-
	Pn218	Reference Pulse Function Selection[*1]	-	-	0000	-

* 1. Available with software version 32 or later.

* 2. After changing these parameters, turn OFF the main circuit and control power supplies and then turn them ON again to enable the new settings.

* 3. The multiturn limit value must be changed only for special applications. Changing it inappropriately or unintentionally can be dangerous.

Table A.1 List of Parameters (cont'd)

Category	Parameter No.	Name	Unit	Setting Range	Factory Setting	Reference
Speed Related Constants	Pn300	Speed Reference Input Gain	0.01V/ rated speed	150 to 3000	600	4.2.1
	Pn301	Speed 1	min^{-1}	0 to 10000	100	4.2.6
	Pn302	Speed 2	min^{-1}	0 to 10000	200	4.2.6
	Pn303	Speed 3	min^{-1}	0 to 10000	300	4.2.6
	Pn304	Jog Speed	min^{-1}	0 to 10000	500	4.3.2
	Pn305	Soft Start Acceleration Time	ms	0 to 10000	0	5.1.1
	Pn306	Soft Start Deceleration Time	ms	0 to 10000	0	5.1.1
	Pn307	Speed Reference Filter Time Constant	0.01 ms	0 to 65535	40	-
	Pn308	Speed Feed-forward Filter Time Constant	0.01 ms	0 to 65535	0	-
	Pn309	Fixed Parameter (Do not change.)*	min^{-1}	0 to 500	60	-
Torque Related Constants	Pn400	Torque Reference Input Gain	0.1 V/rated torque	10 to 100	30	4.2.7
	Pn401	Torque Reference Filter Time Constant	0.01 ms	0 to 65535	100	5.1.5
	Pn402	Forward Torque Limit	%	0 to 800	800	4.1.3
	Pn403	Reverse Torque Limit	%	0 to 800	800	4.1.3
	Pn404	Forward External Torque Limit	%	0 to 800	100	4.1.3
	Pn405	Reverse External Torque Limit	%	0 to 800	100	4.1.3
	Pn406	Emergency Stop Torque	%	0 to 800	800	4.1.2
	Pn407	Speed Limit during Torque Control	min^{-1}	0 to 10000	10000	4.2.7
	Pn408	Torque Function Switches	-	-	0000	5.1.6
	Pn409	Notch Filter Frequency	Hz	50 to 2000	2000	5.1.6
	Pn40A	1st-stage Notch Filter Q Value*	×0.01	50 to 400	70	-
	Pn40B	2nd-stage Notch Filter Frequency*	Hz	50 to 2000	2000	-
	Pn40C	2nd-stage Notch Filter Q Value*	×0.01	50 to 400	70	-

* Available with software version 32 or later.

Table A.1 List of Parameters (cont'd)

Category	Parameter No.	Name	Unit	Setting Range	Factory Setting	Reference
Sequence Related Constants	Pn500	Positioning Completed Width	reference units	0 to 250	7	4.5.3
	Pn501	Zero Clamp Level	min^{-1}	0 to 10000	10	4.4.3
	Pn502	Rotation Detection Level	min^{-1}	1 to 10000	20	4.5.5
	Pn503	Speed Coincidence Signal Output Width	min^{-1}	0 to 100	10	4.5.4
	Pn504	NEAR Signal Width	reference units	1 to 250	7	4.5.8
	Pn505	Overflow Level	256 reference units	1 to 32767	1024	5.2.1
	Pn506	Brake Reference Servo OFF Delay Time	10 ms	0 to 50	0	4.4.4
	Pn507	Brake Reference Output Speed Level	min^{-1}	0 to 10000	100	4.4.4
	Pn508	Timing for Brake Reference Output during Motor Operation	10 ms	10 to 100	50	4.4.4
	Pn509	Momentary Hold Time	ms	20 to 1000	20	4.5.9
	Pn50A	Input Signal Selections 1[*1]	-	-	2100	4.3.3
	Pn50B	Input Signal Selections 2[*1]	-	-	6543	4.3.3
	Pn50C	Input Signal Selections 3[*1]	-	-	8888	4.3.3
	Pn50D	Input Signal Selections 4[*1]	-	-	8888	4.3.3
	Pn50E	Output Signal Selections 1[*1]	-	-	3211	4.3.4
	Pn50F	Output Signal Selections 2[*1]	-	-	0000	4.3.4
	Pn510	Output Signal Selections 3[*1]	-	-	0000	4.3.4
	Pn511	Fixed Parameter (Do not change.)	-	-	8888	-
	Pn512	Output Signal Reversal Settings[*1]	-	-	0000	4.3.4
	Pn51A	Position Error Level between Motor and Load [*2]	Reference unit	0 to 32767	0	-
	Pn51B	Fixed Parameter (Do not change.)[*2]	256 Reference unit	1 to 32767	100	-
	Pn51C	Fixed Parameter (Do not change.)[*2]	min^{-1}	0 to 10000	450	-
	Pn51E	Excessive Position Error Warning Level[*2]	%	0 to 100	0	-
Other Constants	Pn600	Regenerative Resistor Capacity[*3]	10 W	0 to capacity[*4]	0	4.6
	Pn601	Fixed Parameter (Do not change.)	-	0 to capacity[*4]	0	-

* 1. After changing these parameters, turn OFF the main circuit and control power supplies and then turn them ON again to enable the new settings.

* 2. Available with software version 32 or later.

* 3. Normally set to "0." When installing an external regenerative resistor, set the regenerative resistors capacity (W).

* 4. The upper limit is the maximum output capacity (W) of the SERVOPACK.

A.2 Switches

The following list shows the switches and their factory settings.

Table A.2 List of Switches

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn000 Function Selection Basic Switches	0	Rotation Direction Selection	0	Sets CCW as forward direction.	0
			1	Sets CW as forward direction (reverse rotation mode).	
	1	Control Method Selection	0	Speed control (analog reference)	0
			1	Position control (pulse train reference)	
			2	Torque control (analog reference)	
			3	Internal set speed control (contact reference)	
			4	Internal set speed control (contact reference)/Speed control (analog reference)	
			5	Internal set speed control (contact reference)/Position control (pulse train reference)	
			6	Internal set speed control (contact reference)/Torque control (analog reference)	
			7	Position control (pulse train reference)/Speed control (analog reference)	
			8	Position control (pulse train reference)/Torque control (analog reference)	
			9	Torque control (analog reference)/Speed control (analog reference)	
			A	Speed control (analog reference)/Zero clamp	
			B	Position control (pulse train reference)/Position control (Inhibit)	
	2	Axis Address	0 to F	Sets SERVOPACK axis address.	0
	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	Overtravel Stop Mode	0	Same setting as Pn001.0 (Stops the motor by applying DB or by coasting.)	0
			1	Sets the torque of Pn406 to the maximum value, decelerates the motor to a stop, and then sets it to servolock state.	
			2	Sets the torque of Pn406 to the maximum value, decelerates the motor to a stop, and then sets it to coasting state.	
	2	AC/DC Power Input Selection	0	Not applicable to DC power input: Input AC power supply through L1, L2, and (L3) terminals.	0
			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).	

Table A.2 List of Switches (cont'd)

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn002 Function Selection Application Switches	0	Speed, Position Control Option (T-REF Terminal Allocation)	0	None	0
			1	Uses T-REF as an external torque limit input.	
			2	Uses T-REF as a torque feed-forward input.	
			3	Uses T-REF as an external torque limit input when P-CL and N-CL are ON.	
	1	Torque Control Option (V-REF Terminal Allocation)	0	None	0
			1	Uses V-REF as an external speed limit input.	
	2	Absolute Encoder Usage	0	Uses absolute encoder as an absolute encoder.	0
			1	Uses absolute encoder as an incremental encoder.	
	3	Fixed Parameter (Do not change.)	0 to 4	-	0
Pn003 Function Selection Application Switches	0	Analog Monitor 1 Torque Reference Monitor	0	Motor speed: 1 V/1000 min^{-1}	2
	1	Analog Monitor 2 Speed Reference Monitor	1	Speed reference: 1 V/1000 min^{-1}	0
			2	Torque reference: 1 V/100%	
			3	Position error: 0.05 V/1 reference unit	
			4	Position error: 0.05 V/100 reference unit	
			5	Reference pulse frequency (converted to min^{-1}): 1 V/1000 min^{-1}	
			6	Motor speed × 4: 1 V/250 min^{-1}	
			7	Motor speed × 8: 1 V/125 min^{-1}	
			8	Fixed Parameters (Do not change.)	
			9		
			A		
			B		
			C		
			D		
			E		
			F		
	2	Reserved		-	0
	3	Reserved		-	0

Table A.2 List of Switches (cont'd)

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn10B	0	Mode Switch Selection	0	Uses internal torque reference as the condition (Level setting: Pn10C)	0
			1	Uses speed reference as the condition (Level setting: Pn10D)	
			2	Uses acceleration as the condition (Level setting: Pn10E)	
			3	Uses error pulse as the condition (Level setting: Pn10F)	
			4	No mode switch function available	
	1	Speed Loop Control Method	0	PI control	0
			1	IP control	
	2	Automatic Gain Switching Conditions*	0	Automatic gain switch is not executed.	0
			1	Switches the gain only according to the position reference condition.	
			2	Switches the gain only according to the position error condition.	
			3	Switches the gain according to the position reference condition and the position error condition.	
	3	Fixed Parameter (Do not change.)	0 to 2	-	0
Pn110 Online Autotuning Switches	0	Online Autotuning Method	2	Does not perform autotuning. Only 2 can be set.	2
	1	Speed Feedback Compensation Selection	0	Not available if a SERVOPACK with a capacity of 22 kW or more is used.	1
			1		
	2	Friction Compensation Selection	0	Friction compensation: Disabled	0
			1	Friction compensation: Small	
			2	Friction compensation: Large	
	3	Fixed Parameter (Do not change.)	0 to 3	-	0

* Available with software version 32 or later.

Table A.2 List of Switches (cont'd)

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn200 Position Control References Selection Switches	0	Reference Pulse Form	0	Sign + pulse, positive logic	0
			1	CW + CCW, positive logic	
			2	Phase A + phase B (×1), positive logic	
			3	Phase A + phase B (×2), positive logic	
			4	Phase A + phase B (×4), positive logic	
			5	Sign + pulse, negative logic	
			6	CW + CCW, negative logic	
			7	Phase A + phase B (×1), negative logic	
			8	Phase A + phase B (×2), negative logic	
			9	Phase A + phase B (×4), negative logic	
	1	Error Counter Clear Signal Form	0	Clears error counter when the signal goes high.	0
			1	Clears error counter at the rising edge of the signal.	
			2	Clears error counter when the signal goes low.	
			3	Clears error counter at the falling edge of the signal.	
	2	Clear Operation	0	Clears error counter at the baseblock.	0
			1	Does not clear error counter. (Possible to clear error counter only with CLR signal.)	
			2	Clears error counter when an alarm occurs.	
	3	Filter Selection	0	Reference input filter for line driver signals	0
			1	Reference input filter for open collector signals	
Pn207 Position Control Function Switches	0	Position Reference Filter Selection	0	Acceleration/deceleration filter	0
			1	Average movement filter	
	1	Position Control Option	0	Disabled.	0
			1	Uses V-REF as a speed feed-forward input.	
	2	Dividing Ratio Output Range *	0	Uses Pn201 (16 bits or less) as the dividing ratio.	0
			1	Uses Pn212 (17 bits or more) as the dividing ratio.	
	3	Not used.		-	0
Pn218 Reference Pulse Multiplication Range Switching Function	0	Reference Pulse Input Multiplication Range Switching Function *	0	Disabled.	0
			1	Enabled.	
	1	Reserved	-	Do not change.	0
	2	Reserved	-	Do not change.	
	3	Reserved	-	Do not change.	
Pn408 Torque Function Switches	0	Notch Filter Selection *	0	Disabled.	0
			1	Uses a notch filter for torque reference.	
	1	Not used.		-	0
	2	Notch Filter Selection 2 *	0	2nd-stage notch filter disabled.	0
			1	2nd-stage notch filter enabled.	
	3	Not used.		-	0

* Available with software version 32 or later.

A.3 Input Signal Selections

The following list shows input signal selections and their factory settings.

Table A.3 Input Signal Selections

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn50A	0	Input Signal Allocation Mode	0	Sets the input signal allocation for the sequence to the same one as for the SGDB SERVOPACK. *	0
			1	Possible to freely allocate the input signals.	
	1	/S-ON Signal Mapping (Servo ON when low.)	0	Inputs from the SI0 (CN1-40) input terminal.	0: SI0
			1	Inputs from the SI1 (CN1-41) input terminal.	
			2	Inputs from the SI2 (CN1-42) input terminal.	
			3	Inputs from the SI3 (CN1-43) input terminal.	
			4	Inputs from the SI4 (CN1-44) input terminal.	
			5	Inputs from the SI5 (CN1-45) input terminal.	
			6	Inputs from the SI6 (CN1-46) input terminal.	
			7	Sets signal ON.	
			8	Sets signal OFF.	
			9	Inputs the reverse signal from the SI0 (CN1-40) input terminal.	
			A	Inputs the reverse signal from the SI1 (CN1-41) input terminal.	
			B	Inputs the reverse signal from the SI2 (CN1-42) input terminal.	
			C	Inputs the reverse signal from the SI3 (CN1-43) input terminal.	
			D	Inputs the reverse signal from the SI4 (CN1-44) input terminal.	
			E	Inputs the reverse signal from the SI5 (CN1-45) input terminal.	
			F	Inputs the reverse signal from the SI6 (CN1-46) input terminal.	
	2	/P-CON Signal Mapping (P control when low.)	0 to F	Same as above.	1: SI1
	3	P-OT Signal Mapping (Overtravel when high.)	0 to F	Same as above.	2: SI2
Pn50B	0	N-OT Signal Mapping (Overtravel when high.)	0 to F	Same as above.	3: SI3
	1	/ALM-RST Signal Mapping (Alarm reset when low.)	0 to F	Same as above.	4: SI4
	2	/P-CL Signal Mapping (Torque control when low.)	0 to F	Same as above.	5: SI5
	3	/N-CL Signal Mapping (Torque control when low.)	0 to F	Same as above.	6: SI6

* If Pn50A.0 is set to zero for the SGDB SERVOPACK, the following settings are compatible: Pn50A.1=7, Pn50A.3=8, and Pn50B.0=8.

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Table A.3 Input Signal Selections (cont'd)

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn50C	0	/SPD-D Signal Mapping (Internal Set Speed Selection)	0 to F	Same as above.	8: OFF
	1	/SPD-A Signal Mapping (Internal Set Speed Selection)	0 to F	Same as above.	8: OFF
	2	/SPD-B Signal Mapping (Internal Set Speed Selection)	0 to F	Same as above.	8: OFF
	3	/C-SEL Signal Mapping (Control Mode Switching)	0 to F	Same as above.	8: OFF
Pn50D	0	/ZCLAMP Signal Mapping (Zero Clamping)	0 to F	Same as above.	8: OFF
	1	/INHIBIT Signal Mapping (Disabling Reference Pulse)	0 to F	Same as above.	8: OFF
	2	/G-SEL Signal Mapping (Gain Switching)	0 to F	Same as above.	8: OFF
	3	(Reserved)	0 to F	Same as above.	8: OFF

A.4 Output Signal Selections

The following list shows output signal selections and their factory settings.

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn50E	0	/COIN Signal Mapping	0	Disabled.	1: SO1
			1	Outputs from the SO1 (CN1-25, 26) output terminal.	
			2	Outputs from the SO2 (CN1-27, 28) output terminal.	
			3	Outputs from the SO3 (CN1-29, 30) output terminal.	
	1	/V-CMP Signal Mapping	0 to 3	Same as above.	1: SO1
	2	/TGON Signal Mapping	0 to 3	Same as above.	2: SO2
	3	/S-RDY Signal Mapping	0 to 3	Same as above.	3: SO3
Pn50F	0	/CLT Signal Mapping	0 to 3	Same as above.	0: Not used
	1	/VLT Signal Mapping	0 to 3	Same as above.	0: Not used
	2	/BK Signal Mapping	0 to 3	Same as above.	0: Not used
	3	/WARN Signal Mapping	0 to 3	Same as above.	0: Not used
Pn510	0	/NEAR Signal Mapping	0 to 3	Same as above.	0: Not used
	1	Reserved	0 to 3	Same as above.	0: Not used
	2	Switching Output Signal Allocation for Reference Pulse Input (/PSELA) *	0 to 3	Same as above.	0: Not used
	3	Not used.	0	-	0
Pn512	0	Output Signal Reversal for SO1 (CN1-25 and 26)	0	Output signal not reversed.	0: Not reversed
			1	Output signal reversed.	
	1	Output Signal Reversal for SO2 (CN1-27 and 28)	0	Output signal not reversed.	0: Not reversed
			1	Output signal reversed.	
	2	Output Signal Reversal for SO3 (CN1-29 and 30)	0	Output signal not reversed.	0: Not reversed
			1	Output signal reversed.	
	3	Not used.	-	-	0

* Available with software version 32 or later.

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(cont'd)

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn513	0	Reference Pulse Input Switching*	0	Enabled when CN1-40 input signal is ON (L-level)	8
			1	Enabled when CN1-41 input signal is ON (L-level)	
			2	Enabled when CN1-42 input signal is ON (L-level)	
			3	Enabled when CN1-43 input signal is ON (L-level)	
			4	Enabled when CN1-44 input signal is ON (L-level)	
			5	Enabled when CN1-45 input signal is ON (L-level)	
			6	Enabled when CN1-46 input signal is ON (L-level)	
			7	Always sets the signal ON.	
			8	Always sets the signal OFF.	
			9	Enabled when CN1-40 input signal is OFF (H-level)	
			A	Enabled when CN1-41 input signal is OFF (H-level)	
			B	Enabled when CN1-42 input signal is OFF (H-level)	
			C	Enabled when CN1-43 input signal is OFF (H-level)	
			D	Enabled when CN1-44 input signal is OFF (H-level)	
			E	Enabled when CN1-45 input signal is OFF (H-level)	
			F	Enabled when CN1-46 input signal is OFF (H-level)	
	1	Fixed Parameter	-	Do not change.	8
	2	Fixed Parameter	-	Do not change.	0
	3	Fixed Parameter	-	Do not change.	0

* Available with software version 32 or later.

Note: 1. When more than one signal is allocated to the same output circuit, data is output using OR logic.

2. Depending on the control mode, undetected signals are treated as OFF. For example, in the speed control mode, the /COIN signal is treated as OFF.

3. Types of /WARN signals: Overload and regenerative overload.

A.5 Auxiliary Functions

The following list shows the available auxiliary functions.

Parameter	Function
Fn000	Alarm traceback data display
Fn001	Not available if a SERVOPACK with a capacity of 22 kW or more is used.
Fn002	JOG mode operation
Fn003	Zero-point search mode
Fn004	(Fixed parameter)
Fn005	Parameter settings initialization
Fn006	Alarm traceback data clear
Fn007	Not available if a SERVOPACK with a capacity of 22 kW or more is used.
Fn008	Absolute encoder multiturn reset and encoder alarm reset.
Fn009	Automatic tuning of analog (speed, torque) reference offset
Fn00A	Manual adjustment of speed reference offset
Fn00B	Manual adjustment of torque reference offset
Fn00C	Manual zero-adjustment of analog monitor output
Fn00D	Manual gain-adjustment of analog monitor output
Fn00E	Automatic offset-adjustment of motor current detection signal
Fn00F	Manual offset-adjustment of motor current detection signal
Fn010	Password setting (protects parameters from being changed)
Fn011	Motor models display
Fn012	SERVOPACK Software version display
Fn013	Multiturn limit value setting change when a Multiturn Limit Disagreement Alarm (A.CC) occurs
Fn014	Option unit detection results clear

A.6 Monitor Modes

The following list shows monitor modes available.

Parameter	Content of Display	Unit	Remarks
Un000	Actual motor speed	min^{-1}	-
Un001	Input speed reference	min^{-1}	-
Un002	Internal torque reference	%	Value for rated torque
Un003	Rotation angle 1	pulse	Number of pulses from the origin
Un004	Rotation angle 2	deg	Angle (electrical angle) from the origin
Un005	Input signal monitor	-	-
Un006	Output signal monitor	-	-
Un007	Input reference pulse speed	min^{-1}	-
Un008	Error counter value	reference units	Amount of position error
Un009	Accumulated load rate	%	Value for the rated torque as 100%. Displays effective torque in 10-s cycle.
Un00A	Regenerative load rate	%	Value for the processable regenerative power as 100%. Displays regenerative consumption power in 10-s cycle.
Un00B	Power consumed by DB resistance	%	Value for the processable power when dynamic brake is applied as 100%. Displays DB power consumption in 10-s cycle.
Un00C	Input reference pulse counter	-	Displayed in hexadecimal.
Un00D	Feedback pulse counter	-	Displayed in hexadecimal.

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Symbols

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Revision History

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

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		Back cover	Revision: Address
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		Back cover	Revision: Address

Σ-Ⅱ Series SGMBH/SGDM/SGDH
USER'S MANUAL

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YASKAWA

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

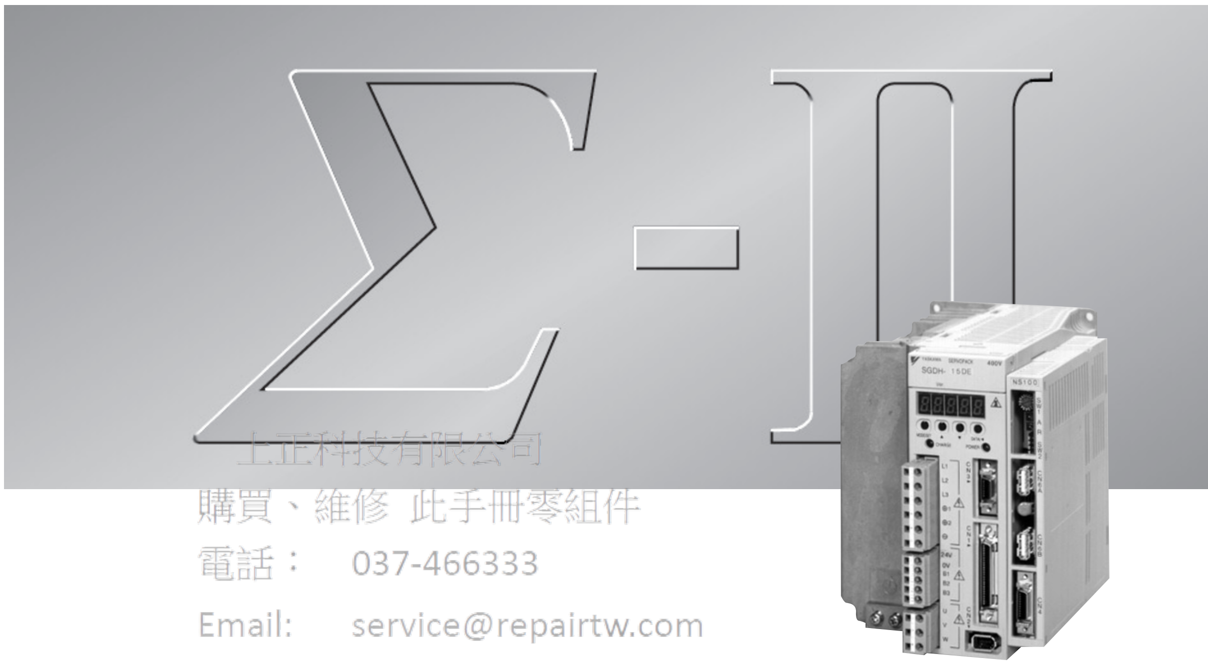
Specifications are subject to change without notice for ongoing product modifications and improvements.

MANUAL NO. SIE-S800-32.4B
Published in Japan September 2008 02-3 ⑥-0
08-5-10 98-23066, 01-71055

Σ-Ⅱ SERIES SGDH

MECHATROLINK INTERFACE UNIT
USER'S MANUAL

MODEL: JUSP-NS100



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MANUAL NO. SIE-C718-4B

Overview

■ About this Manual

This manual provides the following information for the Σ-II Series SGM□H/SGDH-□E Servodrives with a JUSP-NS100 MECHATROLINK Interface Unit mounted.

- Procedures for installing and wiring the SERVOPACK and Option Unit.
- Procedures for trial operation of the Servodrive.
- Procedures for using functions and adjusting the Servodrives.
- Precautions for using the built-in Panel Operator and the Hand-held Digital Operator.
- Ratings and specifications for standard models.
- Procedures for maintenance and inspection.
- SERVOPACK MECHATROLINK communications specifications.

■ Intended Audience

This manual is intended for the following users.

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

■ Description of Technical Terms

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

- **Option Unit** = JUSP-NS100
- **Servomotor** = Σ-II Series SGMAH, SGMPH, SGMGH, SGMSH, or SGMDH Servomotor.
- **SERVOPACK** = Σ-II Series SGDH-□□□E SERVOPACK.
- **Servodrive** = A set including a Servomotor and Servo Amplifier.
- **Servo System** = A servo control system that includes the combination of a Servodrive with a host 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 examples:

- /S-ON
- /P-CON

Visual Aids

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

◀ EXAMPLE ▶ Indicates application examples.

INFO Indicates supplemental information.

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

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

■ Related Manuals

Refer to the following manuals as required.

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

Manual Name	Manual Number	Contents
Σ-II Series SGM□H/SGDH User's Manual Servo Selection and Data Sheets	SIE-S800-32.1	Describes the procedure used to select Σ-II Series Servodrives and capacities.
Σ-II Series SGM□H/SGDH User's Manual Design and Maintenance	SIE-S800-32.2	Provides detailed information on SGDH SERVOPACKs.
Σ-II Series Servopack Personal Computer Monitoring Software Operation Manual	SIE-S800-35	Describes the applications and operation of software for the Σ-II Series Servodrive monitoring devices for use on personal computers.
Σ-II Series SGM□H/SGDM Digital Operator Operation Manual	TOE-S800-34	Provides detailed information on the operation of the JUSP-OP02A-2 Digital Operator, which is an optional product.
High-speed Field Network MECHATROLINK System User's Manual	SIE-S800-26.1	Provides detailed information on the MECHATROLINK system.
High-speed Field Network MECHATROLINK Servo Command User's Manual	SIE-S800-26.2	Describes the Servo commands for use in a MECHATROLINK system.

Safety Information

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

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

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

⃠ PROHIBITED Indicates actions that must never be taken.

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

ISO	JIS

The ISO symbol is used in this manual.

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

Safety Precautions

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

■ Checking Products upon Delivery

⚠ CAUTION

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

  Not doing so may cause fire or malfunction.

■ Installation

⚠ CAUTION

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

  Doing so may result in electric shock or fire.

■ Wiring

⚠ WARNING

- Connect the SERVOPACK ground terminal effectively to a system grounding conductor or grounding electrode (100 Ω or less).

  Improper grounding may result in electric shock or fire.

⚠ CAUTION

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

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

  Not doing so may result in fire.

■ Operation

⚠ WARNING

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

  Doing so may result in injury.

⚠ CAUTION

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

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

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

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

  Doing so may result in burns due to high temperatures.

■ Maintenance and Inspection

⚠ WARNING

- Never touch the inside of the SERVOPACKs.

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

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

  Residual voltage may cause electric shock.

⚠ CAUTION

- Do not disassemble the Servomotor.

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

  Doing so may result in electric shock or injury.

■ General Precautions

Note the following to ensure safe application.
• The drawings presented in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual. • The drawings presented in this manual are typical examples and may not match the product you received. • This manual is subject to change due to product improvement, specification modification, and manual improvement. When this manual is revised, the manual code is updated and the new manual is published as a next edition. The edition number appears on the front and back covers. • If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual. • Yaskawa will not take responsibility for the results of unauthorized modifications of this product. Yaskawa shall not be liable for any damages or troubles resulting from unauthorized modification.

CONTENTS

4 MECHATROLINK Communications

1

1 Checking Products and Part Names

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

1.1 Checking Products on Delivery

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

Check Items	Comments
Are the delivered products the ones that were ordered?	Check the model numbers marked on the nameplates of the Option Unit. (Refer to the descriptions of model numbers on following pages.)
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Can the Option Unit be installed on the SERVOPACK used?	Check the model number given on the SERVOPACK nameplate. The model number must contain “SGDH” and “E” as shown below to support the Option Unit. SGDH-□□□E-□

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

■ External Appearance and Nameplate Examples

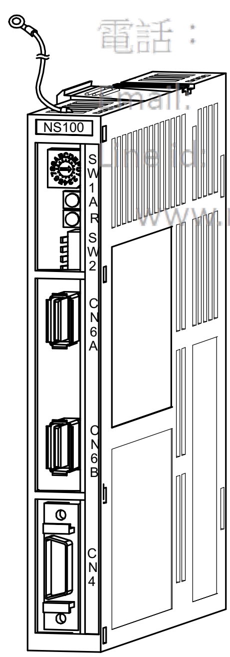


Fig. 1.1 External Appearance of the Option Unit

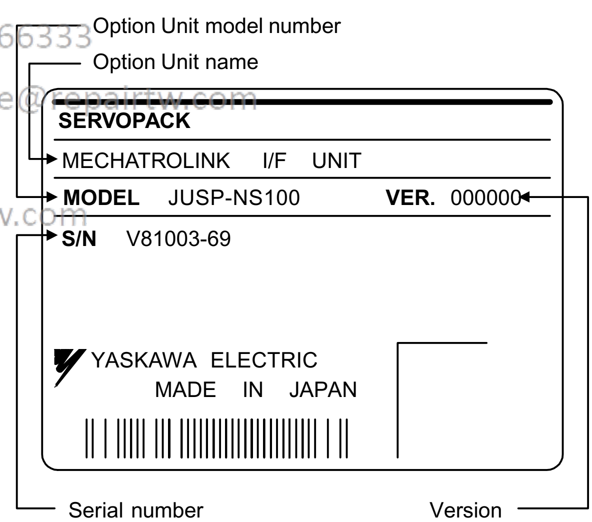


Fig. 1.2 Nameplate

■ Model Numbers

Option Unit

JUSP - NS10 0

- JUSP: SERVOPACK peripheral device
- NS10: Type of device: NS10 MECHATROLINK Interface Unit
- 0: Design Revision Order

1.2 Product Part Names

The following diagram illustrates the product part names of the Option Unit.

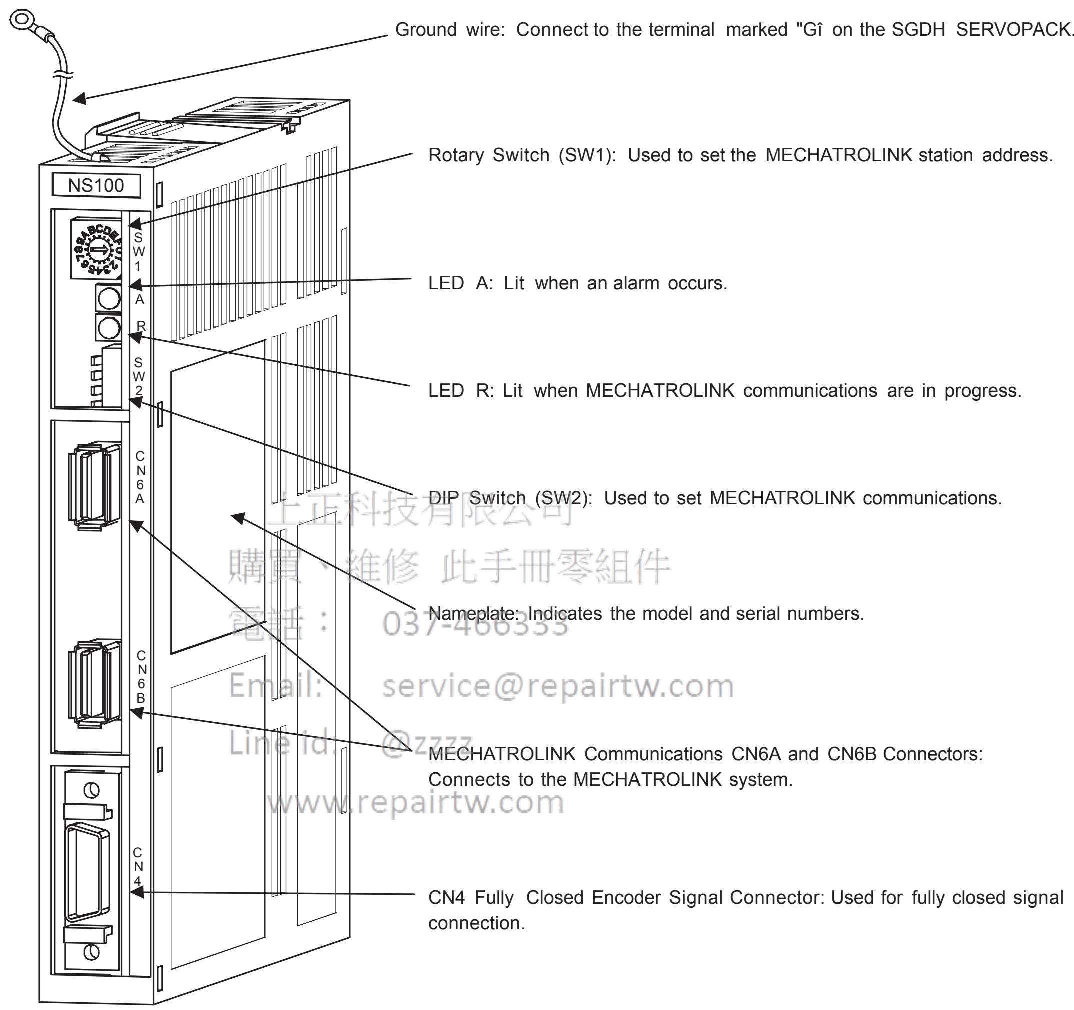


Fig. 1.3 Option Unit

1.3 Mounting the Option Unit

This section describes how to mount a JUSP-NS100 MECHATROLINK Interface Unit (Option Unit) on the SGDH SERVOPACK.

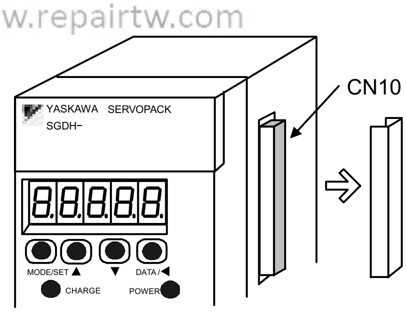
Prepare the screws for connecting the ground wire as shown in the following table:

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

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

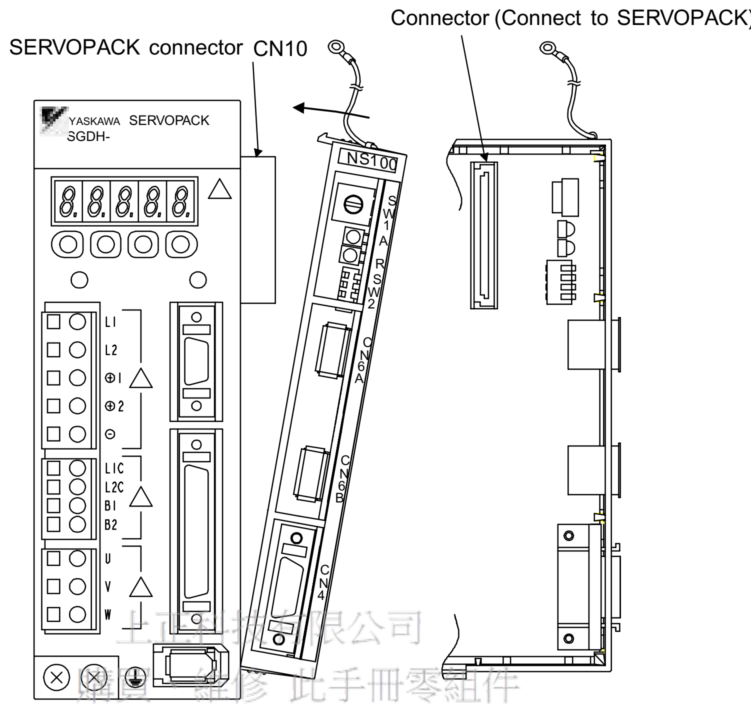
By mounting an Option Unit, the SGDH SERVOPACK can be used in a MECHATROLINK system. Use the following procedure to ensure Option Units are mounted correctly.

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

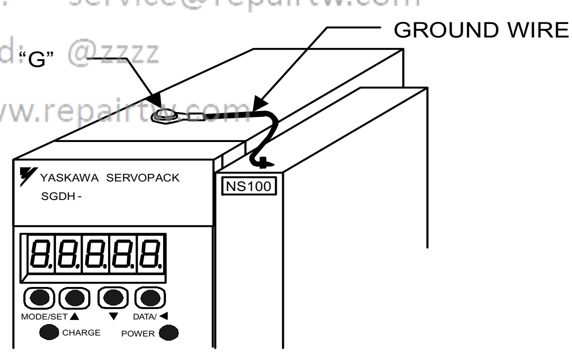


1

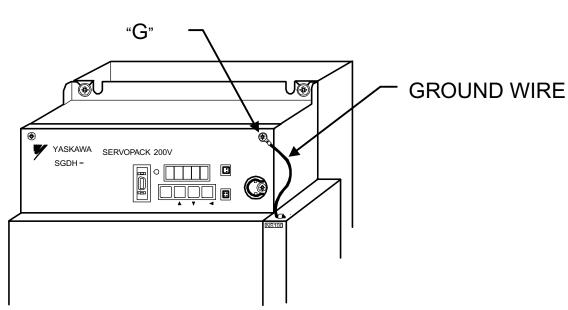
2. Mount the Option Unit on the SERVOPACK.



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

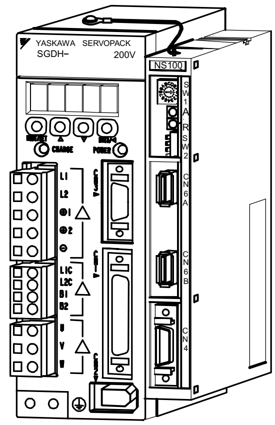


For SERVOPACK (30 W to 5.0 kW)



For SERVOPACK (6.0 kW to 7.5 kW)

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



2

Installation

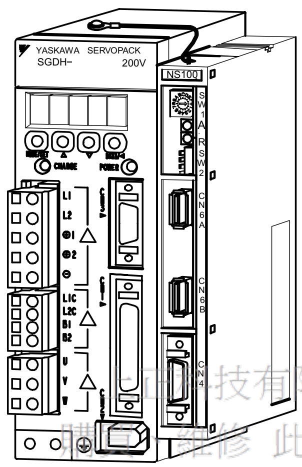
This chapter describes precautions for Σ-II Series product installation.

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

2.1 Storage Conditions

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

-20 to 85°C



Σ-II Series SGDH SERVOPACK
with Option Unit mounted

2.2 Installation Site

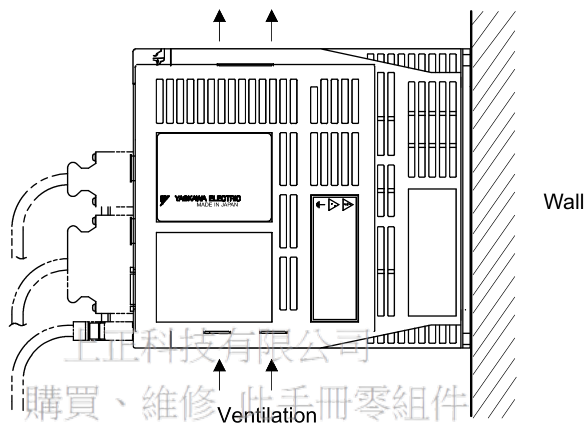
Take the following precautions at the installation site.

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

2.3 Orientation

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

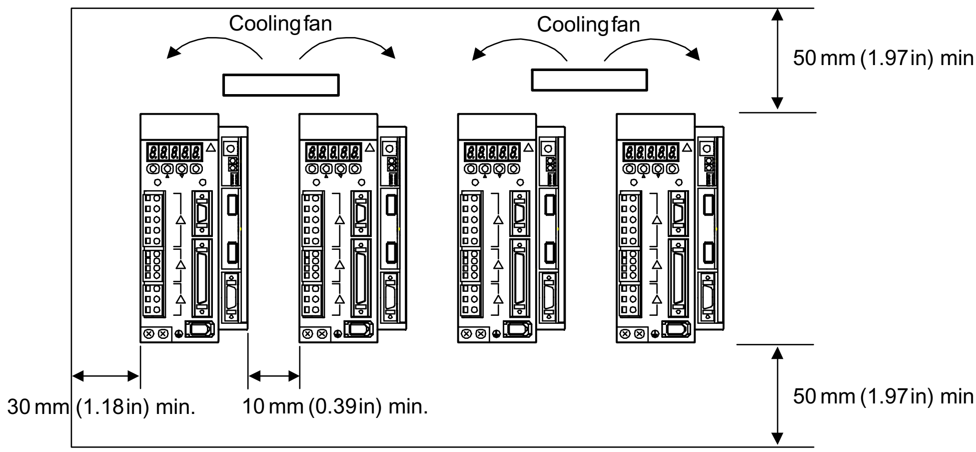
Secure the SERVOPACK using 2 to 4 mounting holes. The number of holes depends on the SERVOPACK capacity.



2

2.4 Installation

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



■ SERVOPACK Orientation

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

■ Cooling

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

■ Side-by-side Installation

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

■ Environmental Conditions in the Control Panel

- Ambient Temperature: 0 to 55°C
- Humidity: 90% RH or less
- Vibration: 0.5 G (4.9 m/s^2)
- Condensation and Freezing: None
- Ambient Temperature for Long-term Reliability: 45°C max.

3

Connectors

3

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

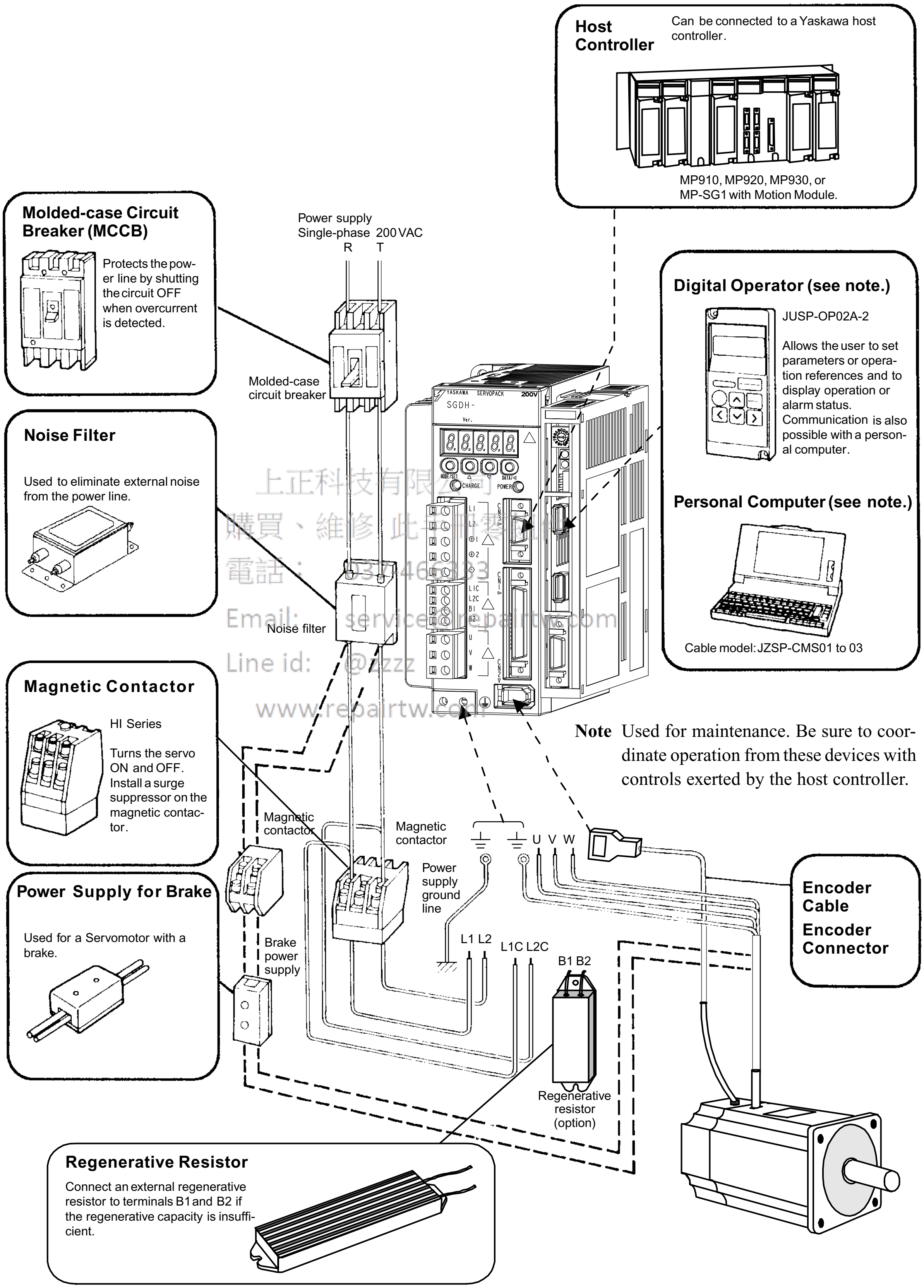
3.1 Connecting to Peripheral Devices

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

It also briefly explains how to connect each peripheral device.

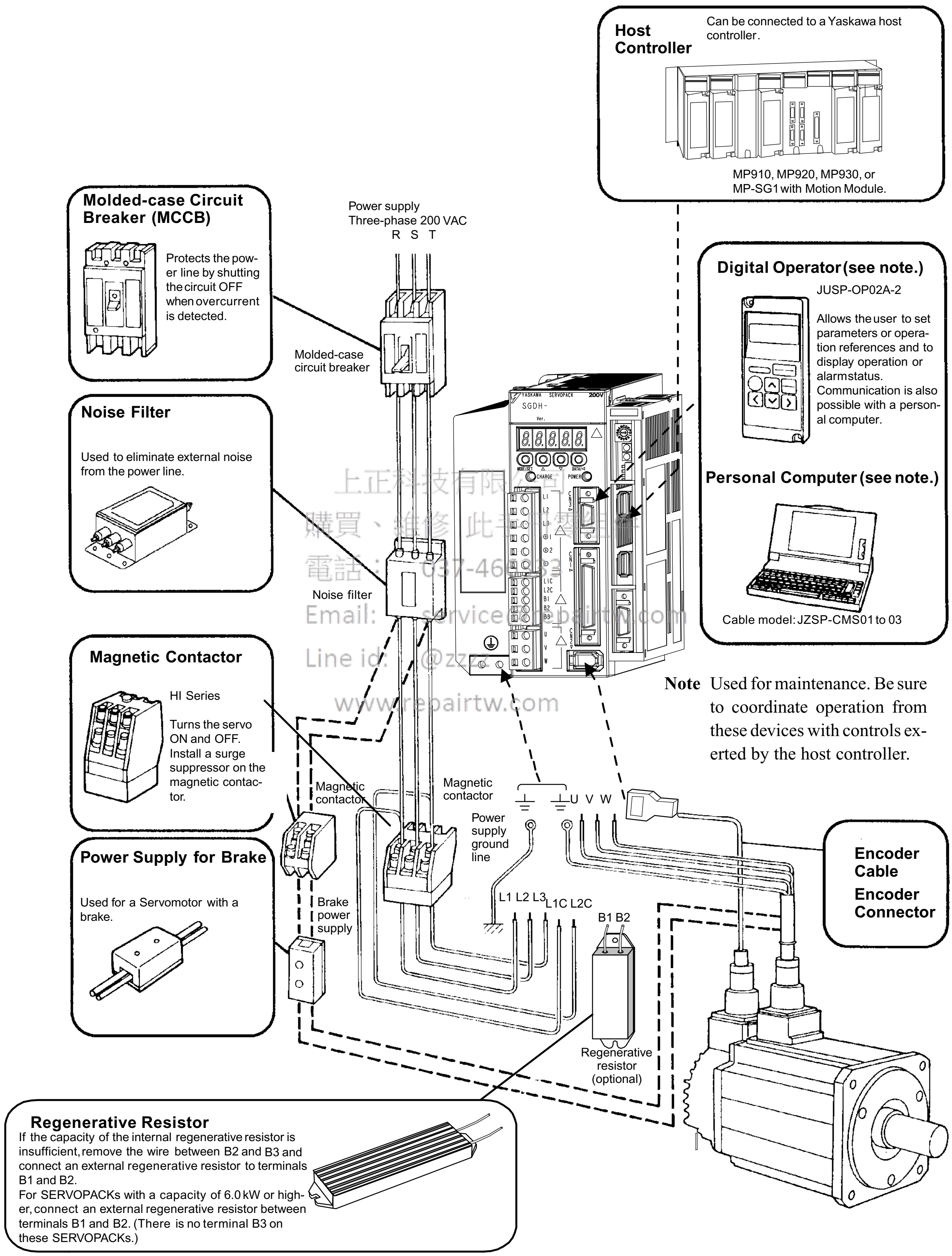
3

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



Note Used for maintenance. Be sure to coordinate operation from these devices with controls exerted by the host controller.

3.1.2 Three-phase (200 V) Main Circuit Specifications



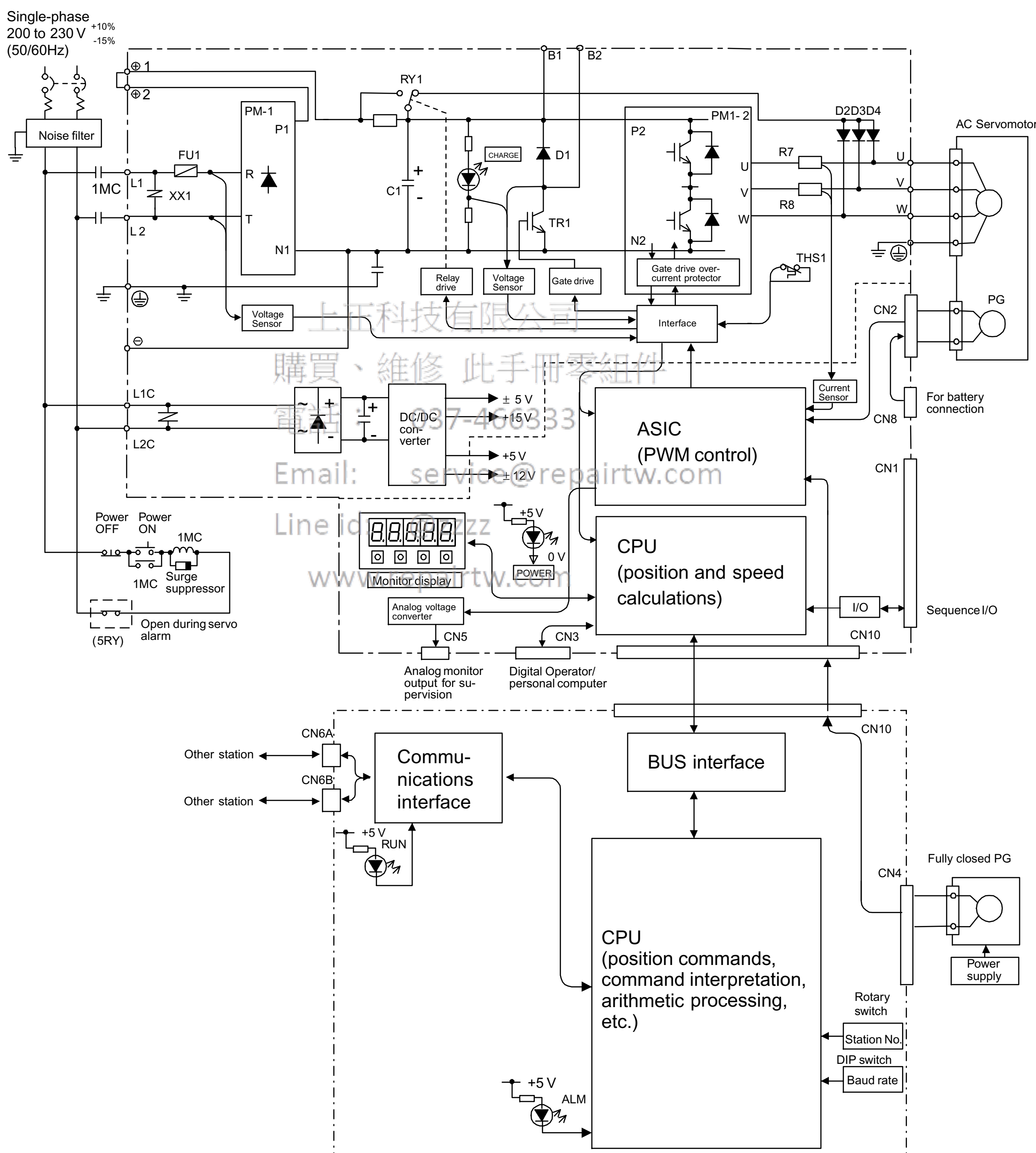
Note Used for maintenance. Be sure to coordinate operation from these devices with controls exerted by the host controller.

3

3.2 SERVOPACK Internal Block Diagrams

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

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

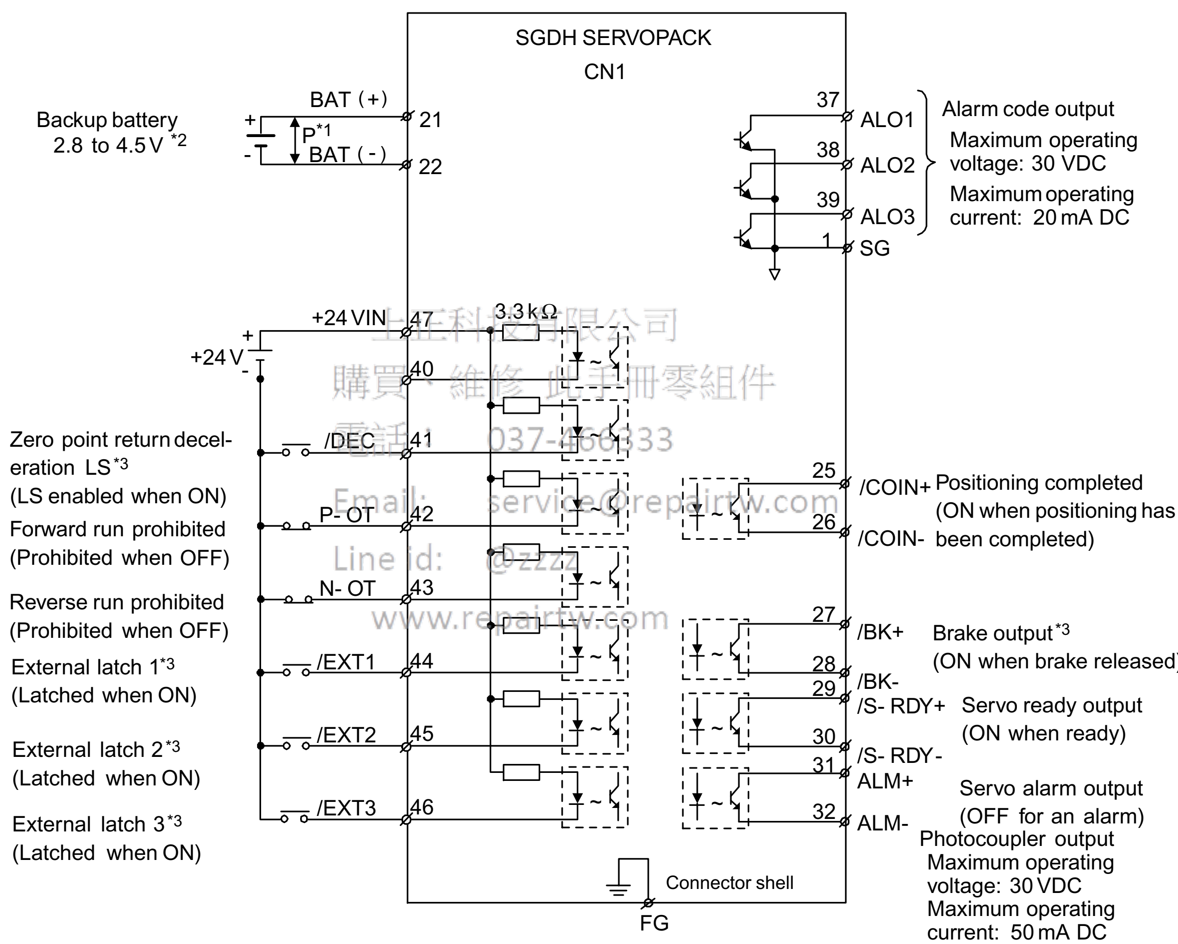


3.3 I/O Signals

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

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

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



Connect shield to connector shell.

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

Fig. 3.1 I/O Signal Connections for CN1 Connectors

3.3.2 I/O Signals Connector (CN1)

The following diagram shows the layout of CN1 terminals.

■ CN1 Terminal Layout

1	SG	GND
2	SG	GND
3	-	-
4	-	-
5	-	-
6	SG	GND
7	-	-
8	-	-
9	-	-
10	SG	GND
11	-	-
12	-	-
13		
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	BAT (+)	Battery (+)
22	BAT (-)	Battery (-)
23	-	-
24	-	-
25	/COIN +	Positioning complete output
26	/COIN-	Positioning complete output
27	/BK+ (Note 3)	Brake interlock output
28	/BK- (Note 3)	Brake interlock output
29	/S-RDY+	Servo ready output
30	/S-RDY-	Servo ready output
31	ALM+	Servo alarm output
32	ALM-	Servo alarm output
33	-	-
34	-	-
35	-	-
36	-	-
37	ALO1	Alarm code output (open-collector output)
38	ALO2	Alarm code output
39	ALO3	
40	-	-
41	/DEC (Note 3)	Zero point return deceleration LS input
42	P-OT	Forward drive prohibited input
43	N-OT	Reverse run prohibited input
44	/EXT1 (Note 3)	External latch signal 1 input
45	/EXT2 (Note 3)	External latch signal 2 input
46	/EXT3 (Note 3)	External latch signal 3 input
47	+24VIN	External power supply input
48	-	-
49	-	-
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 SERVOPACK-end connector.
3. Make signal allocations using parameters. (Refer to *6.1.2 Standard Settings for CN1 I/O Signals.)*

■ CN1 Specifications

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

3.3.3 I/O Signal Names and Functions

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

■ Input Signals

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

Note: The functions allocated to /DEC, P-OT, N-OT, /EXT1, /EXT2, /EXT3, P-CL, and N-CL input signals can be changed via parameters.

■ Output Signals

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

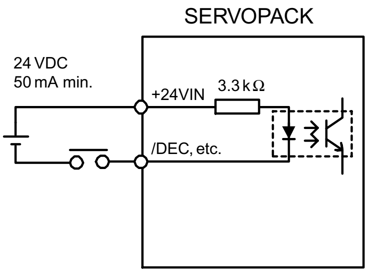
Note: 1. Pin numbers in parenthesis () indicate signal grounds.
2. The functions allocated to /BK, /S-RDY, and /COIN can be changed via parameters. The /BK, /S-RDY, and /COIN output signals can be changed to /CLT, /VCT, /TGON, /WARN, or /NEAR signals.

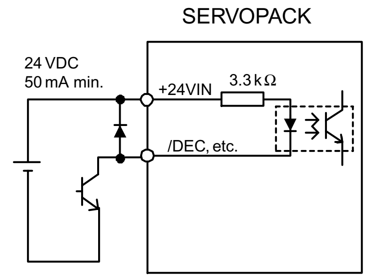
3.3.4 Interface Circuits

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

■ Sequence Input Circuit Interface

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





3

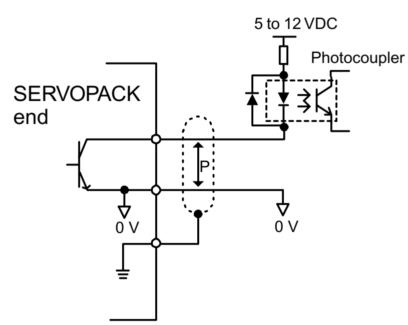
■ Output Circuit Interfaces

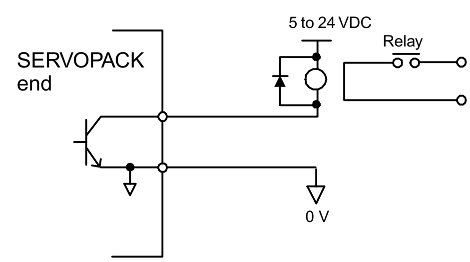
Any of the following two types of SERVOPACK output circuits can be used. Form an input circuit at the host controller that matches one of two types.

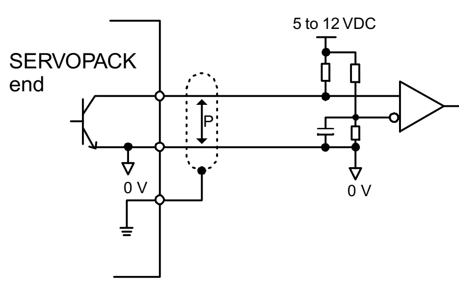
- Connecting to an Open-collector Output Circuit

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

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





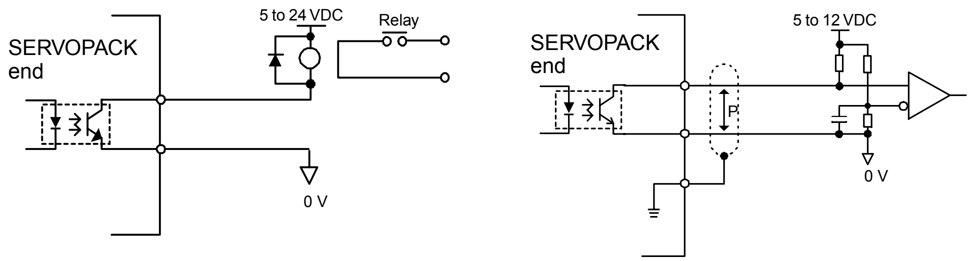


Note The maximum allowable voltage and current capacities for open-collector output circuits are as follows:
- Voltage: 30 VDC max.
- Current: 20 mA DC max.

- Connecting to a Photocoupler Output Circuit

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

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



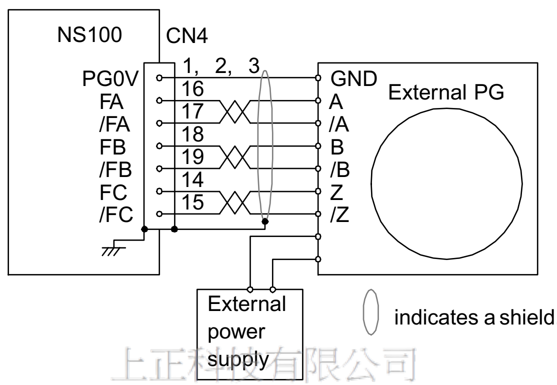
Note The maximum allowable voltage and current capacities for photocoupler output circuits are as follows:
- Voltage: 30 VDC max.
- Current: 50 mA DC max.

3.4 Fully Closed Encoder Signals Connector (CN4)

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

3.4.1 Fully Closed Encoder Connection Example

The following diagram shows an example of CN4 connections.



3.4.2 CN4 Connector Terminal Layout

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

■ CN4 Connector Terminal Layout

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

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

■ CN4 Specifications

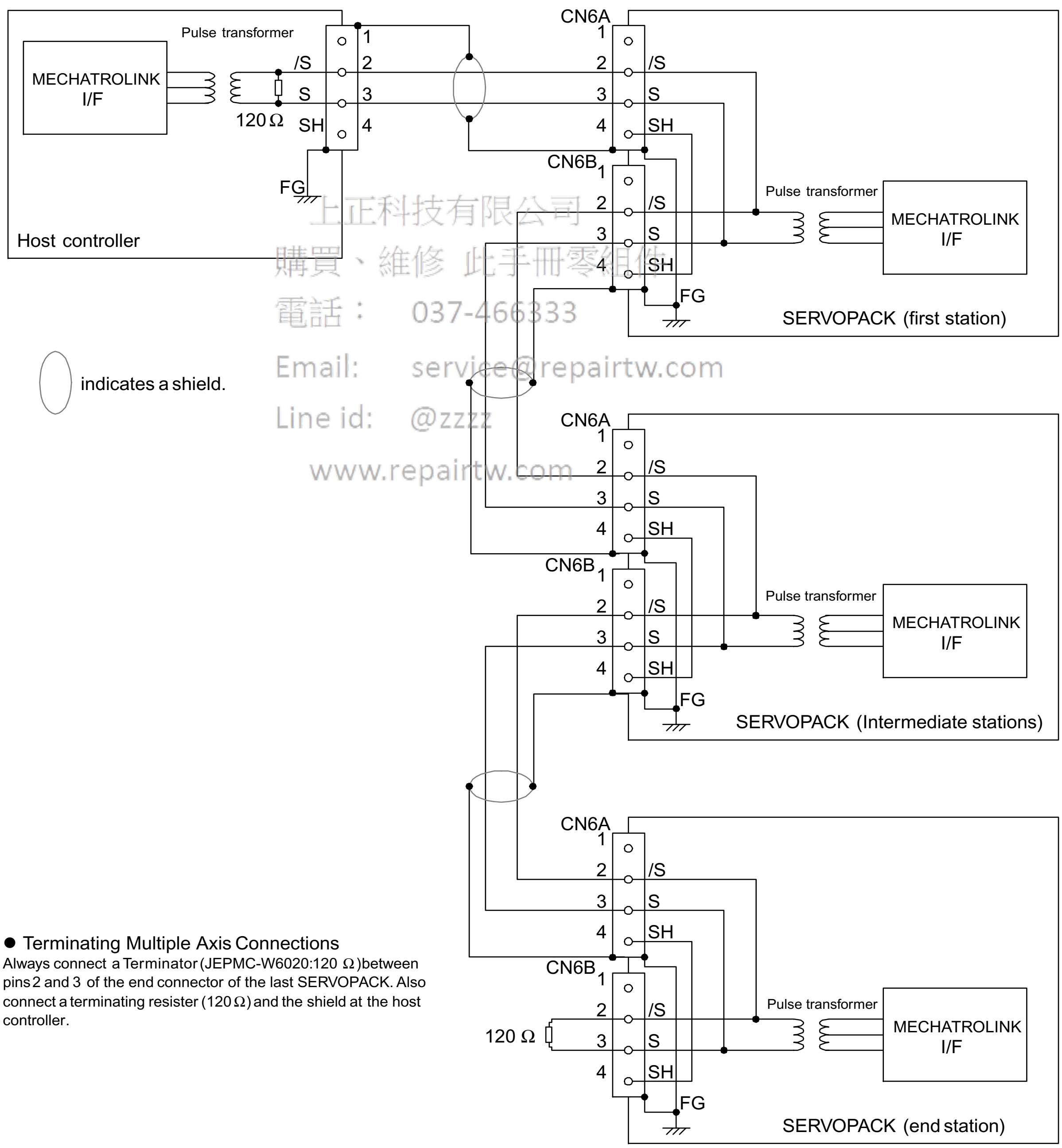
Specifications for SERVOPACK Connectors	Applicable Receptacles		
	Soldered	Case	Manufacturer
10220-52A2JL 20-pin Right Angle Plug	10120-3000VE	10320-52A0-008	SUMITOMO 3M LTD.

3.5 Connections for MECHATROLINK Communications

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

3.5.1 MECHATROLINK Communications Connection Example

The following diagram shows an example of connections between a host controller and a SERVOPACK using MECHATROLINK communications cables (CN6A, CN6B).



● Terminating Multiple Axis Connections
Always connect a Terminator (JEPMC-W6020:120 Ω) between pins 2 and 3 of the end connector of the last SERVOPACK. Also connect a terminating resister (120 Ω) and the shield at the host controller.

3.5.2 MECHATROLINK Communications Connectors (CN6A, CN6B)

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

■ CN6A and CN6B Connectors Terminal Layout

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

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

■ CN6A and CN6B Specifications

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

3.5.3 Precautions for Wiring MECHATROLINK Cables

Observe the following precautions when wiring MECHATROLINK cables.

■ Number of Stations

A maximum of 15 slave stations can be connected.

■ Cables

Be sure to use the specified cables.

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

■ Cable Length

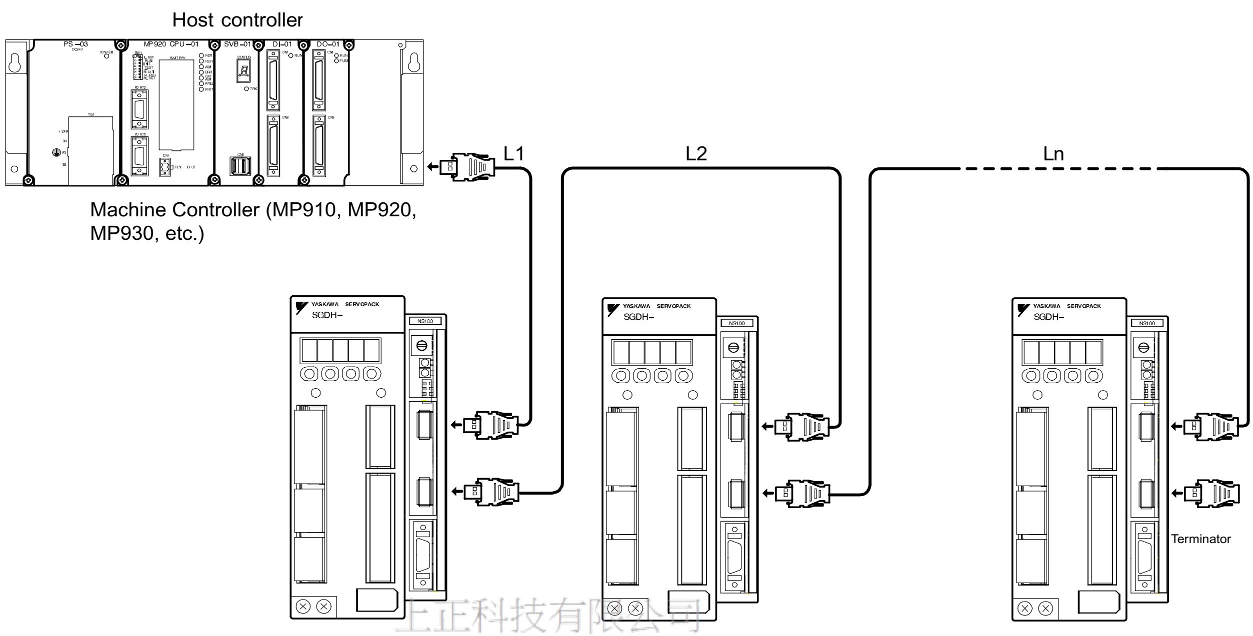
The total cable length must be 50 m or less.
(Station 1 + Station 2 + ... Station n $\leq$ 50 m)

■ Terminal Processing

Install a Terminator on the last SERVOPACK.

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

A MECHATROLINK wiring diagram is shown below.

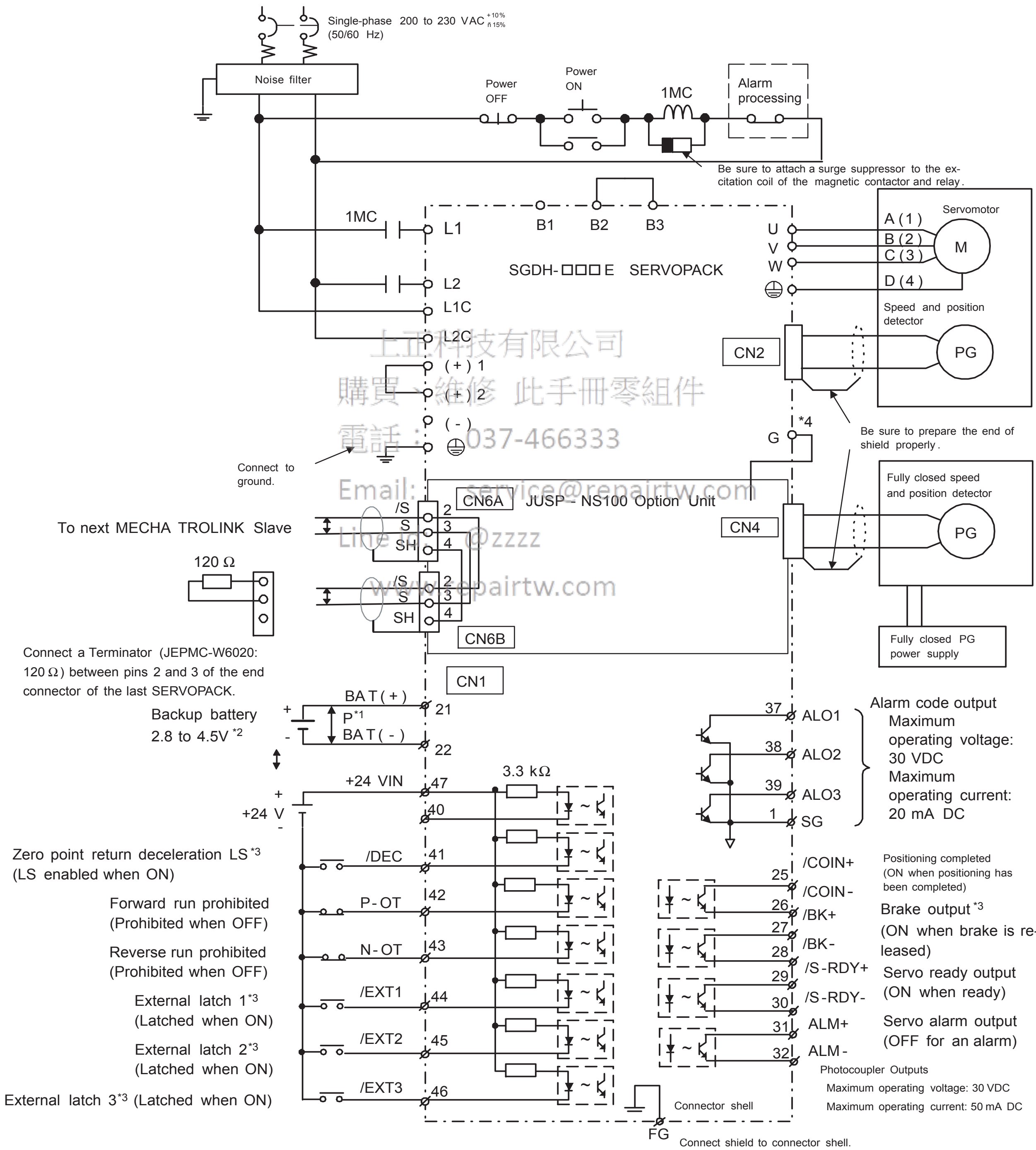


Note: L + L2 ... + Ln must be 50 m or less. A maximum of 15 stations can be connected.

3.6 Examples of Combined Connections (for Fully Closed Encoders)

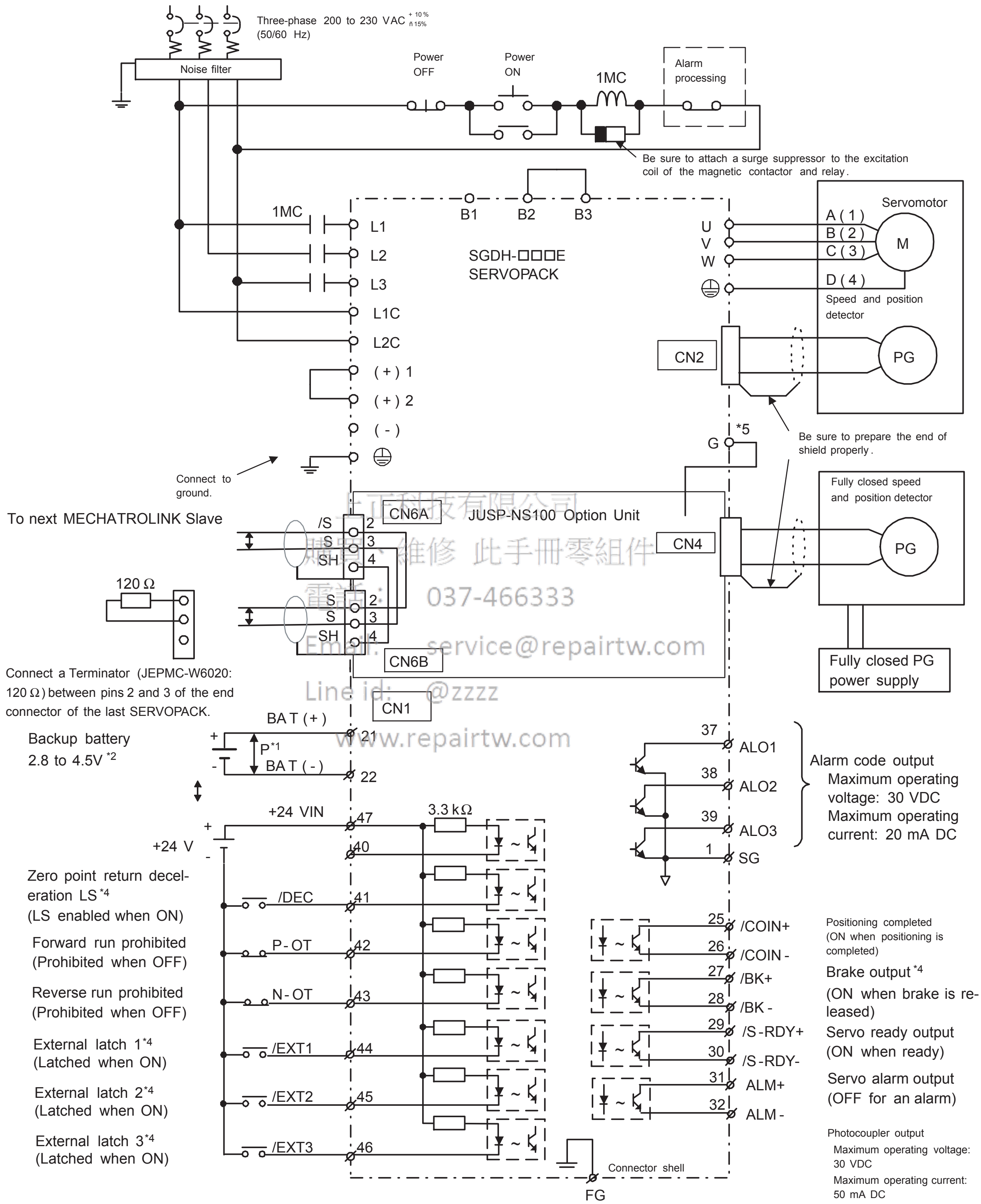
The following diagrams show examples of combined connections.

3.6.1 Single-phase Power Supply Specifications



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

3.6.2 Three-phase Power Supply Specifications



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

4

MECHATROLINK Communications

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

4

4.1 Specifications and Configuration

4.1.1 Specifications

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

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

4.1.2 Control Configuration

The following illustration shows control configuration. A maximum of 15 axes can be connected.

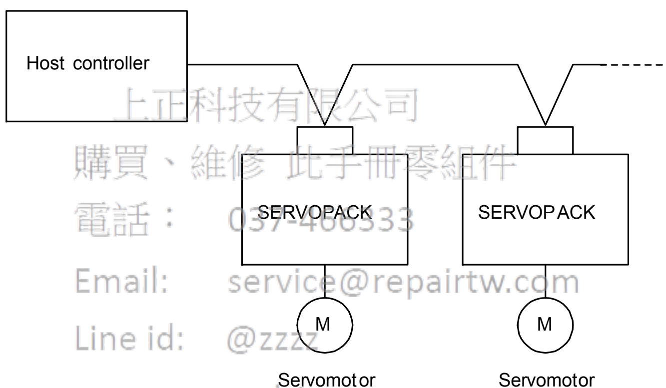


Fig. 4.1 Control Configuration

4.2 Switches for MECHATROLINK Communications Settings

This section describes the switch settings necessary for MECHATROLINK communications.

4.2.1 Rotary Switch (SW1) for MECHATROLINK Station Address Setting

The SW1 switch sets the MECHATROLINK station address. This setting is enabled when the power is turned OFF and ON again after making the setting.

The SW1 setting is used to select one of the following addresses for the JUSP-NS100 Option Unit.

Table 4.1 SW1 Settings

SW1	Station Address
0	Not used*
1	41H
2	42H
3	43H
4	44H
5	45H
6	46H
7	47H
8	48H
9	49H
A	4AH
B	4BH
C	4CH
D	4DH
E	4EH
F	4FH

Note: Do not set.

4.2.2 DIP Switch (SW2) for Communications Settings

The SW2 switch sets the MECHATROLINK communications settings.

Settings that have been changed are enabled when the power is turned OFF and ON.

Table 4.2 SW2 Settings

SW2 Bit	Item	Setting	Setting Format (see note)
Bit 1	Communications settings	Ver. 1.0 (Baud rate: 4 Mbps Transmission cycle: 2 ms)	0: Ver. 1.0
Bit 2	Not used.	Do not set. Set to OFF.	
Bit 3			
Bit 4	Cn number mode		

Note: 0: OFF (Bit switch OFF)
1: ON (Bit switch ON)

■ Setting Bit 1

Set according to the specifications of the MECHATROLINK physical layer used. The Option Unit is compatible with MECHATROLINK Ver. 1.0. Set bit 1 to OFF.

Ver. 1.0: Bit switch OFF (baud rate: 4 Mbps, transmission cycle: 2 ms)

■ Setting Bit 4

Bit 4 can be turned ON to use the same Cn numbers as the Σ Series (SGDB-N, SGD-N) for MECHATROLINK communications parameters.

Refer to *Appendix D.3 Parameters Comparison*.

4.3 Special Command Descriptions

The following sections describes specific items unique to the JUSP-NS100 Option Unit.

4.3.1 No Operation (NOP: 00H)

Byte	Command	Response	Description
1	NOP	NOP	• Returns the status of the ALM and CMDRDY in STATUS bytes only. All other bits are not used. The NOP command will be returned from when the power is turned ON until processing has been completed, and during this time, the following status will be returned: CMDRDY: 0. • Can be used during any phase.
2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.2 Read Parameter (PRM_RD: 01H)

Byte	Command	Response	Description
1	PRM_RD	PRM_RD	• Reads current operating parameters. The latest setting value, however, is read for offline parameters. • If NO is not within range, a parameter setting warning (A.94) will be generated and the command will be ignored. • If SIZE does not match, a parameter setting warning (A.94) will be generated and the command will be ignored. • For details on NO and SIZE, refer to the parameters list. • If A.94 is generated, PARAMETER will not be dependable. • If communications are in progress with either a Digital Operator or personal computer, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • Can be used during any phase.
2		ALARM	
3		STATUS	
4			
5	NO	NO	
6			
7	SIZE	SIZE	
8		PARAMETER	
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.3 Write Parameter (PRM_WR: 02H)

Byte	Command	Response	Description
1	PRM_WR	PRM_WR	• Temporarily writes parameters and stores them in EEPROM memory. • If NO is not within range, a parameter setting warning (A.94) will be generated and the command will be ignored. • If SIZE does not match, a parameter setting warning (A.94) will be generated and the command will be ignored. • If PARAMETER is not within range or would result in a calculation overflow, a parameter setting warning (A.94) will be generated and the command will be ignored. • For details on NO, SIZE, and data setting ranges, refer to the parameters list. • If a parameter setting warning (A.94) is generated, the write will not be executed and the command will be ignored. (Parameters will not be changed.) • If communications are in progress with either a Digital Operator or personal computer, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5	NO	NO	
6			
7	SIZE	SIZE	
8	PARAMETER	PARAMETER	
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.4 Read ID (ID_RD: 03H)

Byte	Command	Response	Description
1	ID_RD	ID_RD	• ID_RD reads the corresponding DEVICE_CODE for each type of hardware; 00H: Main device/Product type, 12H: Encoder, 20H: Motor, and 50H: Option Unit. • The following list shows IDs that can be read. • Can be used during any phase.
2		ALARM	
3		STATUS	
4			
5	DEVICE_CODE	DEVICE_CODE	
6	OFFSET	OFFSET	
7	SIZE	SIZE	
8		ID	
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

	DEVICE_CODE	ID Description																
		00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10
SERVOPACK	00H	S	G	D	H	-	*1	*1	*2	E	*5	*5	*5	00				
	02H	Ver.																
Encoder	12H	Ver.																
Motor	20H	S	G	M	*3	H	-	*1	*1	*2	*4	00						
Option Unit	50H	J	U	S	P	-	N	S	1	0	0	*5	*5	*5	00			
	52H	Ver.																

Note: 1. The contents of IDs that can be read are as follows:

- Model numbers appear in ASCII code, with the last section as “00”.
- The software version is binary data.
- *1: Capacity, *2: Power supply voltage, *3: Type of motor, *4: Type of serial encoder, *5: Y specifications number, e.g.: Y123. The standard is “00”.
- Spaces indicate unspecified data.
- Installation options (-R, -P) are not displayed.

2. If the SGDH is not operating (when an alarm (E0, E1, E2, EA, EB, EC) is generated at power ON), the data is as follows:
   - *1: Capacity, *2: Power supply voltage, *3: Type of motor, *4: All serial encoder types will become “?”, *5: 00.
3. If a new type of motor is connected, the data will be as follows:
   - *1: Capacity, *2: Power supply voltage, *3: Type of motor, *4: All serial encoder types will become “?”.

4.3.5 Set Up Device (CONFIG: 04H)

Byte	Command	Response	Description
1	CONFIG	CONFIG	• Recalculates all currently set parameters and initializes positions, signals, etc. This operation takes approximately 4 s to execute, during which time the status is as shown in the table below. • The Servo will be turned OFF if this command is received when the Servo is ON. • If communications are in progress with either a Digital Operator or personal computer, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • CMDRDY will remain at 0 until the operation has been completed. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

■ CONFIG Operation

Status, I/O, etc.	Before CONFIG	During CONFIG	After CONFIG
ALM (status)	Alarms currently generated	Alarms currently generated	Current alarms
CMDRDY (status)	1	0	1
Other status	Current status	Not used	Current status
ALARM (code)	Alarms currently generated	Alarms currently generated	Current alarms
ALM (output signal)	Status currently generated	Status currently generated	Current alarms
/S-RDY (output signal)	Current status	OFF	Current status
Other output signals	Current status	Not used	Current status

4.3.6 Read Alarm or Warning (ALM_RD: 05H)

Byte	Command	Response	Description
1	ALM_RD	ALM_RD	• Reads the alarm or warning specified by the ALM_RD_MODE at byte 5 of ALM_RD (read alarm/warning). Specifications can be made for individual products. • The ALM_RD_MODE specifications are shown in the following table. If values other than these set values are used, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • The latest error and warning information is contained from byte 6 onwards of the ALM_DATA. When there are no errors or warnings, the remaining bytes are normal (A.99). • Reading alarm history occurrences takes 2 s or less. CMDRDY will be set to 0 during this time. • If communications are in progress with either a Digital Operator or personal computer, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • Can be used during any phase.
2		ALARM	
3		STATUS	
4			
5	ALM_RD_MODE	ALM_RD_MODE	
6		ALM_DATA	
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

■ ALM_RD_MODE

ALM_RD_MODE	Description
0	Read current alarm/warning status 10 items max. (sixth to fifteenth byte)
1	Read alarm status history (Warning history is not preserved) 10 items max. (sixth to fifteenth byte)

Note: Alarm history occurrences are saved on EEPROM, and will not be lost if power goes OFF.

4.3.7 Clear Alarm/Warning (ALM_CLR: 06H)

Byte	Command	Response	Description
1	ALM_CLR	ALM_CLR	• The ALM_CLR_MODE at the fifth byte of ALM_CLR (clear alarm/warning status) is the field used to select objects that will be cleared. Specifications can be made for individual products. • The ALM_CLR_MODE specifications are shown in the following table. If values other than these set values are used, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • It takes approximately 100 ms to execute the clear current alarm/warning status command. During this time, CMDRDY is set to 0. • It takes approximately 2 s to execute the clear alarm status history command. During this time, CMDRDY is set to 0. • If communications are in progress with either a Digital Operator or personal computer, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5	ALM_CLR_MODE	ALM_CLR_MODE	
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

■ ALM_CLR_MODE

ALM_CLR_MODE	Description
0	Clear current alarm/warning status
1	Clear alarm status history

4.3.8 Start Synchronous Communications (SYNC_SET: 0DH)

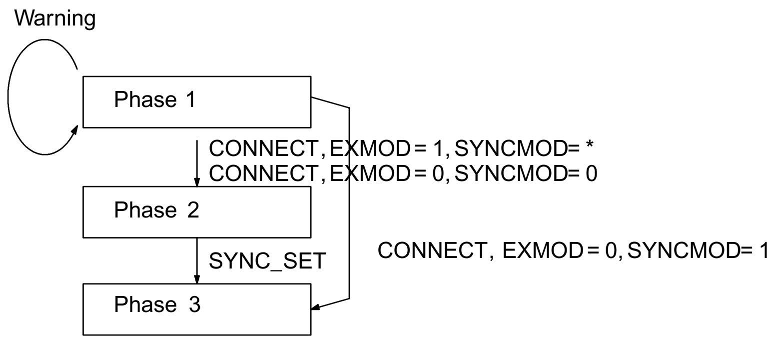
Byte	Command	Response	Description
1	SYNC_SET	SYNC_SET	• Switches from phase 2 to phase 3. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 3, the command will be ignored (without a warning).
2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.9 Connection (CONNECT: 0EH)

Byte	Command	Response	Description
1	CONNECT	CONNECT	• VER: Version Set VER to 10H (Ver. 1.0). If any other data is set, a parameter setting warning (A.94) will be generated and the command will be ignored. • COM_MODE: Refer to the following table. • COM_TIME: Communications cycle Ver. 1.0: 2 ≤COM_TIME ≤ 32. Set to an even number. If any other data is set, a parameter setting warning (A.94) will be generated and the command will be ignored. • The command will be ignored in all phases except phase 1 (without a warning).
2		ALARM	
3		STATUS	
4			
5	VER	VER	
6	COM_MODE	COM_MODE	
7	COM_TIME	COM_TIME	
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

■ COM_MODE

D7	D6	D5	D4	D3	D2	D1	D0
				DTMOD		SYNCMOD	EXMOD



- EXMOD:
  0: Standard connection
  1: Extended connection
- SYNCMOD:
  0: Asynchronous (Phase 2 will be entered.)
  1: Start synchronous (Phase 3 will be entered.)
  * Ignores the SYNCMOD setting and switches to phase 2 when EXMOD = 1.
- DTMOD: Data transfer method
  00: Single transfer
  01: Consecutive transfer
  10: Multiple transfers are not supported. If it is selected, a parameter setting warning (A.94) will be generated.
  If any other data is set, a parameter setting warning (A.94) will be generated and the command will be ignored.
- Set all other bits to 0.

4.3.10 Disconnection (DISCONNECT: 0FH)

Byte	Command	Response	Description

1	DISCONNECT	DISCONNECT	• This command can be received at any time.
			• When this command is received, the following operations will be performed.
			  • Phase 1 will be entered.
			  • The Servo will be turned OFF.
			  • The reference point setting will become invalid.
			• Can be used during any phase.

2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.11 Read EEPROM Parameters (PPRM_RD: 1BH)

Byte	Command	Response	Description
1	PPRM_RD	PPRM_RD	• This command is not supported. • When this command is received, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5	NO		
6			
7	SIZE		
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.12 Write EEPROM Parameters (PPRM_WR: 1CH)

Byte	Command	Response	Description
1	PPRM_WR	PPRM_WR	• Saves data in EEPROM. If parameters are for online parameters, those parameters will become effective. • If NO is not within range, a parameter setting warning (A.94) will be generated and the command will be ignored. • If SIZE does not match, a parameter setting warning (A.94) will be generated and the command will be ignored. • If PARAMETER is not within range or would result in a calculation overflow, a parameter setting warning (A.94) will be generated and the command will be ignored. • For details on NO and SIZE, refer to the parameters list. • If a parameter setting warning (A.94) is generated, the write will not be executed and the command will be ignored. • If communications are in progress with either a Digital Operator or personal computer, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5	NO	NO	
6			
7	SIZE	SIZE	
8	PARAMETER	PARAMETER	
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.13 Set Coordinates (POS_SET: 20H)

Byte	Command	Response	Description
1	POS_SET	POS_SET	• Sets coordinates as follows: POS_SET: 0:POS 3: APOS If any other setting is used, a parameter setting warning (A.94) will be generated and the command will be ignored. REFE: 0: Reference point disabled 1: Reference point enabled • Set all other bits to 0. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5	PS_SUBCMD	PS_SUBCMD	
6	POS_DATA	POS_DATA	
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

■ PS_SUBCMD

D7	D6	D5	D4	D3	D2	D1	D0
REFE				POS_SEL			

4.3.14 Apply Brake (BRK_ON: 21H)

Byte	Command	Response	Description
1	BRK_ON	BRK_ON	• Effective when the parameter is set for the activated BRK-ON/OFF command (Pn005.0 = 1). In all other cases, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. The brake interlock at the Servo will no longer be used. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.15 Release Brake (BRK_OFF: 22H)

Byte	Command	Response	Description
1	BRK_OFF	BRK_OFF	• Effective when the parameter is set for the activated BRK-ON/OFF command (Pn005.0 = 1). In all other cases, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. The brake interlock on the Servo side will no longer be used. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.16 Turn Sensor ON (SENS_ON: 23H)

Byte	Command	Response	Description
1	SENS_ON	SENS_ON	• Obtains the initial position data when an absolute encoder is used. • Multi-turn data is received from the encoder and the current position is created. • The reference point will be effective when an absolute encoder is used. • If communications are in progress with either a Digital Operator or personal computer, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • If a parameter is masking SENS_ON (Pn802.1 = 1), the command will be ignored (without a warning). • If an incremental encoder is being used, the command will be ignored (without a warning). • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.17 Turn Sensor OFF (SENS_OFF: 24H)

Byte	Command	Response	Description
1	SENS_OFF	SENS_OFF	• Makes the encoder ineffective without turning OFF the power. After the SENS_OFF command has been issued, position data is not used. • If the Servo is ON, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • If a parameter is masking SENS_ON (Pn802.1 = 1), a MECHATROLINK command warning (A.95) will be generated and the command will be ignored (without a warning). • If an incremental encoder is being used, the command will be ignored (without a warning). • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

4.3.18 Stop Motion (HOLD: 25H)

Byte	Command	Response	Description
1	HOLD	HOLD	• From current motion status, performs a deceleration stop and positioning according to the deceleration value set in the parameters. • The acceleration/deceleration filter and P/PI control can be specified using OPTION, but be sure that the acceleration/deceleration filter is set the same as for the previous command. (The acceleration/deceleration filter will be changed for DEN = 1.) • Latch processing, which is dependent on LATCH, EX_POSING, and SVCTRL will be cancelled. • ZRET latch processing and ZRET zero point alignment will be canceled. • A warning is not issued even when the Servo is OFF (not operating). • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3	OPTION	STATUS	
4			
5		MONITOR1	
6			
7			
8			
9		MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

4.3.19 Status Monitoring (SMON: 30H)

Byte	Command	Response	Description
1	SMON	SMON	• Reads the current status of the Servo. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5		MONITOR1	
6			
7			
8			
9		MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

4.3.20 Servo ON (SV_ON: 31H)

Byte	Command	Response	Description
1	SV_ON	SV_ON	• Turns ON the Servo when the following conditions are met. • The main power supply is ON (PON = 1 in STATUS) • There are no alarms (ALM = 0 in STATUS) • If an absolute encoder is being used, SENS_ON is effective. If the above conditions are not met, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • CMDRDY will be 0 during the time it takes for the command to be received until the Servo is turned ON. • P/PI control is possible using OPTION. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4	OPTION		
5		MONITOR1	
6			
7			
8			
9		MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

4.3.21 Servo OFF (SV_OFF: 32H)

Byte	Command	Response	Description
1	SV_OFF	SV_OFF	• Turns OFF the Servo. If SV_ON is being masked by parameter (Pn802.0 = 1), a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3		STATUS	
4			
5		MONITOR1	
6			
7			
8			
9		MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

4.3.22 Interpolation Feed (INTERPOLATE: 34H)

Byte	Command	Response	Description
1	INTERPOLATE	INTERPOLATE	• The target position (TPOS) is distributed each transmission cycle. • The acceleration/deceleration filter and P/PI control can be specified using OPTION. • FF (feed forward) can be executed. • If the interpolation feed speed for the INTERPOLATE command exceeds 131068000 reference units/s, a parameter setting warning (A.94) will be generated and the command will be ignored. Processing will stop at the previous target position (TPOS). • If the Servo is OFF, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • In all other phases except phase 3, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3	OPTION	STATUS	
4			
5	TPOS	MONITOR1	
6			
7			
8			
9	FF	MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

4.3.23 Positioning (POSING: 35 H)

Byte	Command	Response	Description
1	POSING	POSING	• Accelerates towards the target position (TPOS) up to the target speed (TSPD) and continues to move at the target speed until deceleration starts, when it decelerates towards the target position and stops there. • Acceleration and deceleration are controlled by the parameter settings or the acceleration/deceleration filter. • The acceleration/deceleration filter and P/PI control can be specified using OPTION. • Changes can be made to the target position and speed during movement. • The target speed (TSPD) is an unsigned 4 bytes. • If the target speed (TSPD) for the POSING command exceeds 131068000 reference units/s, a parameter setting warning (A.94) will be generated and the command will be ignored. • If the Servo is OFF, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3	OPTION	STATUS	
4			
5	TPOS	MONITOR1	
6			
7			
8			
9	TSPD	MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

4.3.24 Constant Speed Feed (FEED: 36H)

Byte	Command	Response	Description
1	FEED	FEED	• Accelerates to the target speed in the direction indicated by the target speed (TSPD) and continues to move at the target speed. • Acceleration and deceleration are controlled by the parameter settings or the acceleration/deceleration filter. • Changes can be made to both direction and speed. • The acceleration/deceleration filter and P/PI control can be specified using OPTION. • Stop is performed using HOLD. • The FEED target speed (TSPD) is a signed 4 bytes. The direction is determined by the sign. • If the target speed (TSPD) for the FEED command exceeds 131068000 reference units/s, a parameter setting warning (A.94) will be generated and the command will be ignored. • If the Servo is OFF, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2		ALARM	
3	OPTION	STATUS	
4			
5		MONITOR1	
6			
7			
8			
9	TSPD	MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

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

Byte	Command	Response	Description
1	LATCH	LATCH	• Starts the latch operation and the target position (TPOS) is distributed each transmission cycle. • If the latch signal is input, the position when the input is received is recorded as the counter latch position (LPOS) and LPOS will be indicated as the MONITOR 2 value for one communications cycle. • The acceleration/deceleration filter and P/PI control can be specified using OPTION. • FF (feed forward) can be executed. • A latch signal can be selected using LT_SGNL. • If the target speed (TSPD) for the LATCH command exceeds 131068000 reference units/s, a parameter setting warning (A.94) will be generated and the command will be ignored. Processing will stop at the previous target position (TPOS). • If the Servo is OFF, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • In all other phases except phase 3, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2	LT_SGNL	ALARM	
3	OPTION	STATUS	
4			
5	TPOS	MONITOR1	
6			
7			
8			
9	FF	MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

4.3.26 External Input Positioning (EX_POSING: 35H)

Byte	Command	Response	Description
1	EX_POSING	EX_POSING	• Starts the latch operation and accelerates at the target speed (TSPD) towards the target position (TPOS). • Once the latch signal has been input, positioning is performed according to the travel distance specified in the parameters. • When no latch signal is input, positioning is performed for the target position. • Acceleration and deceleration are controlled by the parameter settings or the acceleration/deceleration filter. • The acceleration/deceleration filter and P/PI control switching can be specified using OPTION. • Once the latch operation has been completed, changes can be made to the target position during motion, but these changes will be ignored. • The target speed (TSPD) is an unsigned 4 bytes. • If the target speed (TSPD) for the EX_POSING command exceeds 131068000 reference units/s, a parameter setting warning (A.94) will be generated and the command will be ignored. • If the Servo is OFF, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2	LT_SGNL	ALARM	
3	OPTION	STATUS	
4			
5	TPOS	MONITOR1	
6			
7			
8			
9	TSPD	MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

4.3.27 Zero point return (ZRET: 3AH)

Byte	Command	Response	Description
1	ZRET	ZRET	• Accelerates to the target speed (TSPD) in the direction specified in the parameters and continues to move at the target speed. • Decelerates to approach speed 1 at the first DEC* = 1. • DEC* will be 0, and when the signal has been latched, approach speed 2 is used and positioning is performed from the latched position for the travel distance specified in the parameters. That position is the zero point. • Acceleration and deceleration are controlled by the parameter settings or the acceleration/deceleration filter. DEC* = 1: Operation is started at approach speed 2. Until DEC* = 1 is reached, the speed can be changed. • The acceleration/deceleration filter and P/PI control can be specified using OPTION. • The target speed (TSPD) is an unsigned 4 bytes. • If the target speed (TSPD) for the ZRET command exceeds 131068000 reference units/s, a parameter setting warning (A.94) will be generated and the command will be ignored. • If the Servo is OFF, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2	LT_SGNL	ALARM	
3	OPTION	STATUS	
4			
5		MONITOR1	
6			
7			
8			
9	TSPD	MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14		I/O	
15			
16	WDT	RWDT	

* DEC is zero point return deceleration LS.

4.3.28 Adjusting (ADJ: 3EH)

Byte	Command	Response	Description

1	ADJ	ADJ	• If SUBCMD = 00H, the following processes are performed. For details on processing, refer to *Appendix C Using the Adjusting Command (ADJ: 3EH)*.
			  • Autotuning
			  • Absolute encoder setup
			  • Multi-turn limit settings
			• The basic settings and references for field data are shown in the following tables.
			• During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.

2	SUBCMD	ALARM	
3		STATUS	
4			
5	CMD	ANS	
6	ADDRESS	ADDRESS	
7			
8	DATA	DATA	
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

■ Basic Procedure

Data references and settings are made when the following commands are sent. Commands will not be processed when the response is not normal. If this occurs, set the ADDRESS and DATA correctly and resend.

Table 4.3 Data References

	Command	Response
CMD/ANS	CMD = 00H (data reference)	ANS: 00H: Normal, 08H: Address error
ADDRESS	Reference address	Reference address
DATA	(Not used)	Reference data

Table 4.4 Data Settings

	Command	Response
CMD/ANS	CMD = 01H (data settings)	ANS: 01H: Normal, 09H: Address error, 05H: Data error
ADDRESS	Set address	Set address
DATA	Set data	Set data

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

Byte	Command	Response	Description
1	SVCTRL	SVCTRL	• Latch Processing: Supported. Select the latch signal using L_SGN in the sub-command (SUB-CMD) and set SET_L to 1. When the selected latch signal is input, L_CMP in STATUS will become 1. To perform latch processing again, set SET_L to 0 once more and start again. The latch signal cannot be changed while SET_L is set to 1. If it is changed, there will be no warning. • Motion: Any of the motions listed in the following table can be selected. Refer to each item for operating specifications. • Sequence Signals: Refer to each sequence item for operating specifications. A warning may not be generated, however, depending on the ON/OFF status of the signals. For example, even if PON in STATUS is ON, if SON = 1 in SQ_CMD, a warning will not be given. • During phase 1, a MECHATROLINK command warning (A.95) will be generated and the command will be ignored.
2	SUBCMD	ALARM	
3	OPTION	STATUS	
4			
5	TPOS	MONITOR1	
6			
7			
8			
9	TSPD or FF	MONITOR2	
10			
11			
12			
13	MON_SEL	MON_SEL	
14	SQ_CMD	I/O	
15			
16	WDT	RWDT	

■ Sub-command: SUBCMD

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

Select Latch Signal: L_SGN

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

Motion: MOTION

D6	D5	D4	Motion	
0	0	0	HOLD	• During phase 1, a parameter setting warning (A.94) will be generated for POSING and FEED, and the commands will be ignored. • For INTERPOLATE, in all other phases except phase 3, a parameter setting warning (A.94) will be generated and the command will be ignored. • A warning may not be given depending on the sequence signal status.
0	0	1	INTERPOLATE	
0	1	0	FEED	
0	1	1	POSING	

Sequence Signals: SQ_CMD

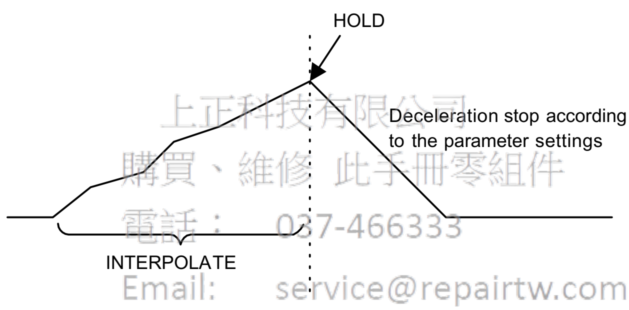
D7	D6	D5	D4	D3	D2	D1	D0
RESERVE 0				ACLR Alarm clear	SEN Sensor ON	BRK Brake ON	SON Servo ON

4.3.30 Motion Command Specifications

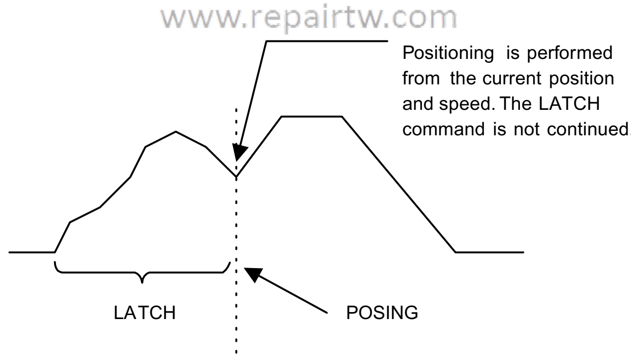
After a change is made during a motion, the new command becomes effective and the previous command is cancelled.

After a change has been made, movement will continue from the new position and speed.

■ Example 1



■ Example 2



4.4 Field Special Descriptions

The following describes specific items unique to the Option Unit.

4.4.1 Latch Signal Field Specifications: LT_SGNL

1	Command	Description

2	LT_SGNL	• The second byte of the reference data field for motion commands is reserved as a latch signal field and used to select latch signals for position data.
		• The applicable commands for latch signals are:
		  • LATCH
		  • EX_POSING
		  • ZRET
		• Signals that can be selected are shown in the following table.

3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16	WDT	

■ Latch Signal Field

D7	D6	D5	D4	D3	D2	D1	D0
						Latch signal*	

* Latch Signal Selection (0 to 3)

Latch Signal Selection

Name	Code	Contents
CPHAS	0	Phase-C encoder
EXT1	1	First external signal
EXT2	2	Second external signal
EXT3	3	Third external signal

4.4.2 Option Field Specifications

1	Command	Description
2		• The third and fourth bytes of the reference data field for motion commands are reserved as an option field used to add motion command functions for individual products. • Option fields are used for speed loop P/PI control switching and acceleration/deceleration filter selection. • Appropriate commands for options are: • SV_ON • INTERPOLATE • POSING • FEED • LATCH • EX_POSING • ZRET • SVCTRL Acceleration/deceleration filter selection cannot be used with SV_ON.
3	OPTION	
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16	WDT	

■ Option Fields

Option fields are as shown in the table below. The third byte is used for acceleration/deceleration filter type selection and the fourth byte is used for speed loop P/PI control.

3	Acceleration/deceleration filter type selection
4	Speed loop P/PI control switching

■ Acceleration/Deceleration Filter Selection

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

* Acceleration/deceleration selection (0 to 2)

Acceleration/Deceleration Selection (D3 and D4)

Three types of acceleration and deceleration can be selected.

Type	Acceleration/Deceleration Type	Related Parameters
0	Linear acceleration/deceleration (no filter)	-
1	Exponential acceleration/deceleration	Pn810, Pn811
2	Simple S-curve acceleration/deceleration (running average)	Pn812

IMPORTANT

1. All bits except D3 and D4 must be set to 0.
2. Acceleration/deceleration types can only be switched when DEN (output complete) is set to 1. Never switch acceleration/deceleration types when DEN is set to 0. Yaskawa cannot guarantee how the SERVOPACK will act if the two items above are not followed exactly.

■ Speed Loop P/PI Control Switching

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

* Speed loop P/PI control switching (0: PI control, 1: P control)

Speed Loop P/PI Control Switching (D4)

Speed loop can be switched between PI and P control in real time.

D4	Speed Loop Control
0	PI control (switches to P control via mode switch settings)
1	P control

This function suppresses undershooting and shortens positioning adjustment time when the Servomotor is stopped.

IMPORTANT

All bits except D4 must be set to 0, otherwise Yaskawa cannot guarantee how the SERVOPACK will act.

4.4.3 Speed Feed Forward (FF) Field Specifications

1	Command	Description

2		• The ninth to twelfth bytes of the reference data field for motion commands are reserved as a speed feed forward field and used to control the extent of speed feed forward.
		• Speed feed forward is set using 4-byte signed data. Unit: Reference units/s
		• The applicable commands for speed feed forward are:
		  • INTERPOLATE
		  • LATCH

3		
4		
5		
6		
7		
8		
9	FF	
10		
11		
12		
13		
14		
15		
16	WDT	

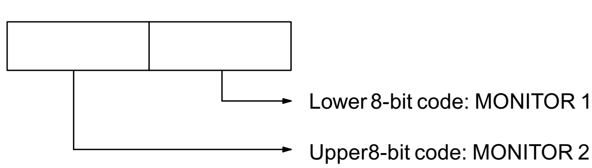
4.4.4 Monitor 1/2 Type Field Specifications

1	Command	Response	Description

2			• The thirteenth byte of the reference data field of commands is reserved for monitor 1/2 used to select monitor data that will be returned.
			• The applicable commands for monitor 1/2 type are:
			  • SMON
			  • SV_ON
			  • SV_OFF
			  • INTERPOLATE
			  • POSING
			  • FEED
			  • LATCH
			  • EX_POSING
			  • ZRET
			  • SVCTRL
			  • HOLD

3			
4			
5		MONITOR1	
6			
7			
8			
9		MONITOR2	
10			
11			
12			
13	MON_SEL*	MON_SEL*	
14			
15			
16	WDT	WDT	

* The selection options are as shown below.



■ Monitor 1/2 Selection Modes

Name	Code	Description	Units
POS	0	Position in the reference coordinate system	Reference units
MPOS	1	Position in the mechanical coordinate system	Reference units
PERR	2	Position error	Reference units
APOS	3	Absolute position	Reference units
LPOS	4	Counter latch position	Reference units
IPOS	5	Internal position in the reference coordinate system	Reference units
TPOS	6	Final target position	Reference units
-	7	-	-
FSPD	8	Feedback speed	Reference units/s
CSPD	9	Reference speed	Reference units/s
TSPD	A	Final target reference speed	Reference units/s
TRQ	B	Torque reference	%
-	C	-	-
-	D	-	-
OMN1	E	Option monitor 1*	-
OMN2	F	Option monitor 2*	-

* Monitor data is selected using parameter Pn813.

Note: The minus (-) sign indicates unused bits. Do not use them.

4.5 Power ON Sequence

This section describes the recommended power ON sequence.

4.5.1 Typical Power ON Sequence

The following is a typical power ON sequence.

1. Turn ON the power supply.
   ↓
2. Make communications connection (CONNECT command).
   ↓
3. Check equipment ID, etc. (ID_RD command).
   ↓
4. Write required parameters with PRM_WR command.
   ↓
5. Set up the equipment (CONFIG command).
   ↓
6. Turn encoder (sensor) power ON (SENS_ON command).
   ↓
7. Main circuits ON (SV_ON command).
   ↓
8. Operation starts.
   :
9. Main circuits OFF (SV_OFF command).
   ↓
10. Communications disconnected (DISCONNECT command)
   ↓
11. Turn power supply OFF.

The controller always maintains required parameters and transfers the parameters at power ON. We recommend using this method at all times because the controller can then manage operation even if the SERVOPACK or motor is replaced.

4.5.2 Alternative Power ON Sequence

When the SERVOPACK maintains all parameters (non-volatile parameters), the power ON sequence is as shown on the following page. Non-volatile parameters are saved on EEPROM and the number of times they can be changed is limited (10,000 times maximum). Also ,when absolute encoder is being used, the encoder cannot be changed to an incremental encoder without turning power OFF and ON again.

■ Writing Parameters

First write parameters to the SERVOPACK offline.

1. Turn power ON.
   ↓
2. Communications connection (CONNECT command)
   ↓
3. Check equipment ID, etc. (ID_RD command).
   ↓
4. Write required non-volatile parameters with PPRM_WR command.
   ↓
5. Communications disconnected (DISCONNECT command)
   ↓
6. Turn OFF power.

■ Typical Sequence

The following is a typical example sequence (no parameters transferred).

1. Turn ON power supply.
   ↓
2. Communications connection (CONNECT command)
   ↓
3. Check equipment ID, etc. (ID_RD command).
   ↓
4. Turn ON encoder (sensor) power (SENS_ON command).
   ↓
5. Main circuits ON (SV_ON command).
   ↓
6. Operation starts.
   :
7. Turn OFF the main circuit (SV_OFF command).
   ↓
8. Communications disconnected (DISCONNECT command)
   ↓
9. Turn OFF power supply.

5

Trial Operation

This chapter describes the procedure for trial operation of the Option Unit.

5.1 Check Items before Trial Operation

Conduct trial operation after wiring has been completed.

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

5.1.1 Servomotors

Inspect the following items before conducting trial operation. Also conduct the inspections according to *Chapter 9 Inspection, Maintenance, and Troubleshooting* in the Σ-*II Series SGM□H/SGDH User's Manual for Design and Maintenance (SIE-S800-32.2)* if conducting trial operation on Servomotors that have been stored for a long period of time.

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

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

5.1.2 SERVOPACKs

Inspect the following items before conducting trial operation.

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

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

5

5.2 Trial Operation for MECHATROLINK Communications

This section describes the trial operation procedure for MECHATROLINK communications.

5.2.1 Preparations for Trial Operation

IMPORTANT

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

Prepare for operation using the following procedure.

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

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

   If the R indicator on the Option Unit does not light, check to make sure the switches on the Option Unit (SW1 and SW2) are set correctly and then turn the power OFF then ON again. For information on switch settings, refer to *4.2 Switches for MECHATROLINK Communications Settings*.
3. Execute the CONNECT (start connection) command to start communications.

   The status of the SERVOPACK can be checked using the SMON (Status Monitor) command. The response data from the SERVOPACK will be alarm code 99 (normal).
4. Confirm the model number using the ID_RD (Read ID) command.

   “SGDH-***E” will be returned from the SERVOPACK.

   Alternatively, for the Option Unit, “JUSP-NS100” will be returned.
5. Write the parameters necessary for trial operation using the PRM_WR (parameter write) command.

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

5.2.2 Operating the Servomotor

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

■ Command Transmission Example

POSING (rapid traverse positioning) command

Option = 0

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

Rapid traverse speed = 400

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

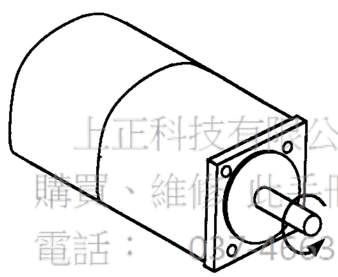


Fig. 5.1 Motor Forward Rotation

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

5.3 Trial Operation Inspection

Inspect the following items during the trial operation.

- Unusual vibration
- Abnormal noise
- Excessive temperature rise

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

5.4 Supplementary Information on Trial Operation

5.4.1 Minimum Parameters and Input Signals

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

■ Parameters

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

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

Changing Servomotor Rotation Direction

Use the following parameter to reverse the direction of rotation.

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

■ Input Signals

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

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

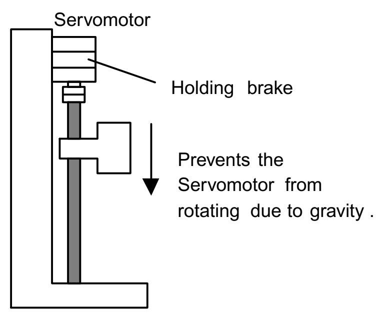
Signal Name		Pin Number	Description
P-OT	Forward run prohibited	CN1-42	The Overtravel Limit Switch Refer to 6.2.2
N-OT	Reverse run prohibited	CN1-43	

5.4.2 Servomotors with Brakes

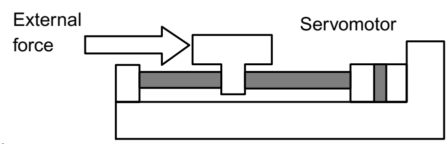
Use Servomotors with brakes for vertical shaft applications or when external force is applied to the shaft to prevent the shaft from rotating due to gravity or external force when power is lost.

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

- Vertical Shaft



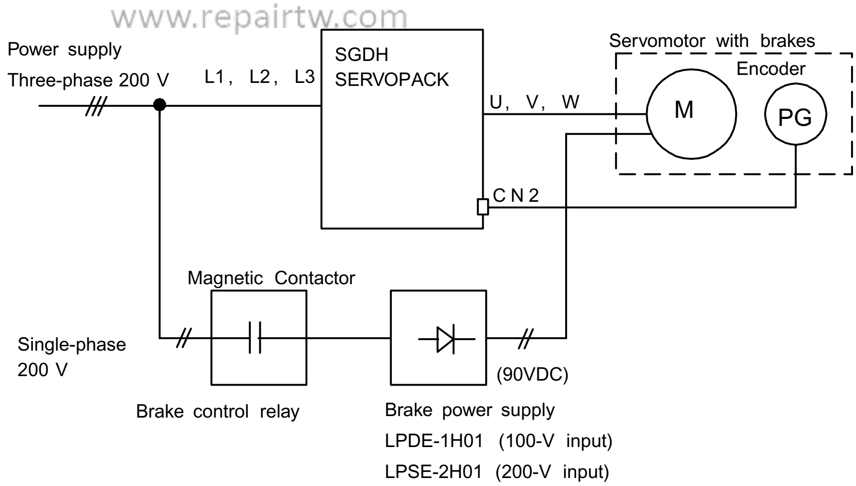
- Shaft with External Force Applied



IMPORTANT

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

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



6

Parameter Settings and Functions

This chapter describes the procedure for setting and applying parameters.

6

■ Before Reading this Chapter

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

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

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

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

■ Parameter Configurations

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

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

6.1 Parameter Limits and Standard Settings with Option Unit

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

6.1.1 Parameter Limits

When an Option Unit is mounted on an SGDH SERVOPACK and it is used for MECHATROLINK communications, the following parameters are automatically set. The following parameters will be treated as “reserved for system use,” so do not change them. The SGDH SERVOPACK 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 6.1 List of Parameters for System Use with the JUSP-NS100

Pn No.	Digit	Parameter Name	Set Value	Contents
Pn000	1	Select control method	1	Position control
Pn004	1	Reserved	0	-
Pn200	2	Clear signal status	1	Deviation counter is not cleared.
Pn204	-	Position command acceleration/deceleration parameter	0	Time constant = 0
Pn207	1	Select position command filter	0	Uses the position command acceleration/deceleration filter.
Pn50A	0	Input signal allocation mode	1	User set
	1	/S-ON signal mapping	8	Not used
	2	/P-CON signal mapping	8	Not used
Pn50B	1	/ALM-RST signal mapping	8	Not used
Pn50C	-	Select input signal 3	8888	Not used
Pn50D	-	Select input signal 4	8888	Not used

INFO

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

6.1.2 Standard Settings for CN1 I/O Signals

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

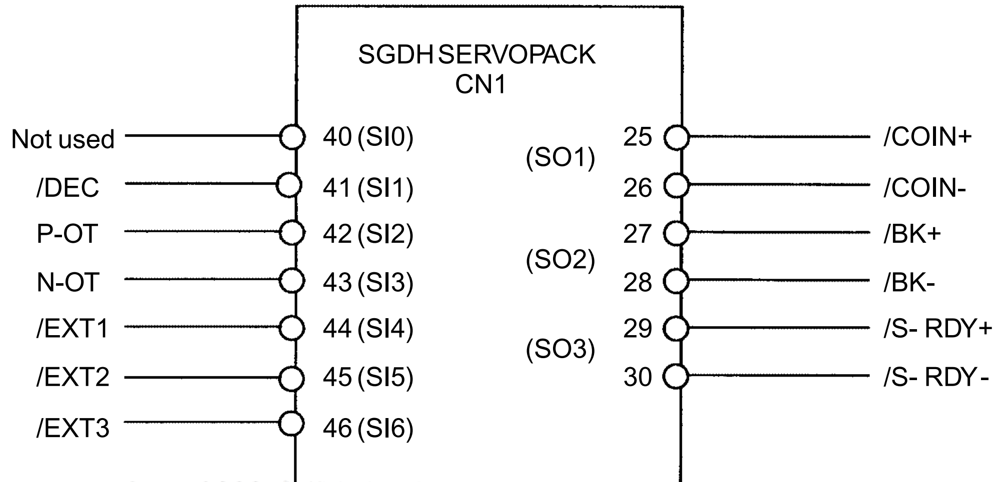


Fig. 6.1 Standard CN1 I/O Signal Settings

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

Parameter	Description	Factory Setting	Standard Setting
Pn50A	Input signal selections 1	2881	Same as left
Pn50B	Input signal selections 2	6583	8883
Pn511	Input signal selections 5	8888	6541
Pn50E	Output signal selections 1	3211	3001
Pn50F	Output signal selections 2	0000	0200
Pn510	Output signal selections 3	0000	Same as left

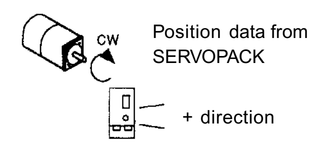
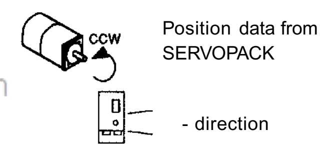
6.2 Settings According to Device Characteristics

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

6.2.1 Switching Servomotor Rotation Direction

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

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

	Standard Setting	Reverse Rotation Mode
Forward Reference		
Reverse Reference		

■ Setting Reverse Rotation Mode

Use parameter Pn000.0.

Pn000.0	Direction Selection	Factory Setting: 0	Position Control

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

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

6.2.2 Setting the Overtravel Limit Function

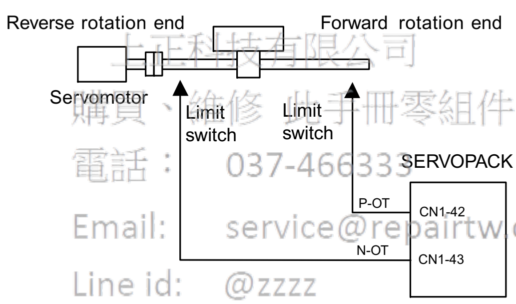
The overtravel limit function forces movable equipment parts to stop if they exceed the allowable range of motion.

■ Using the Overtravel Function

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

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

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



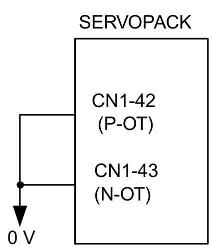
Drive status with an input signal ON or OFF is shown in the following table.

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

■ Enabling/Disabling Input Signals

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

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



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

Parameter	Setting	Item
Pn50A.3	2 (Factory setting)	Uses the P-OT input signal for prohibiting forward rotation. (Forward rotation is prohibited when CN1-42 is open and is allowed when CN1-42 is at 0 V.)
	8	Does not use the P-OT input signal for prohibiting forward rotation. (Forward rotation is always allowed and has the same effect as shorting CN1-42 to 0 V.)
Pn50B.0	3 (Factory setting)	Uses the N-OT input signal for prohibiting reverse rotation. (Reverse rotation is prohibited when CN1-43 is open and is allowed when CN1-43 is at 0 V.)
	8	Does not use the N-OT input signal for prohibiting reverse rotation. (Reverse rotation is always allowed and has the same effect as shorting CN1-43 to 0 V.)

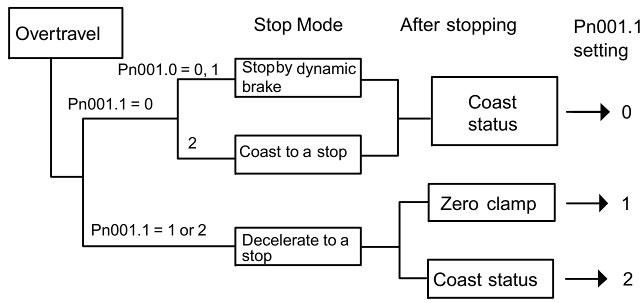
■ Servomotor Stop Mode for P-OT and N-OT Input Signals

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

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

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

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

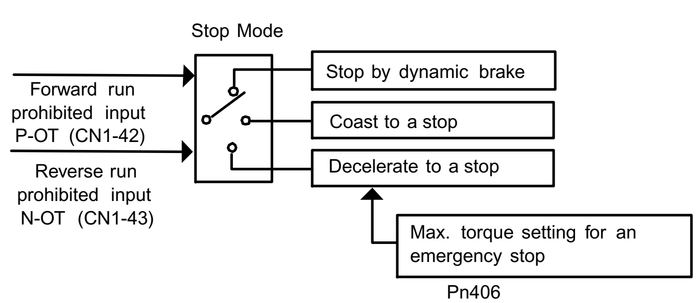


Parameter	Setting	Item
Pn001.1	0	Stops the Servomotor the same way as turning the servo OFF (according to Pn001.0).
	1	Decelerates the Servomotor to a stop at the preset torque, and then locks the Servomotor in Zero Clamp Mode. Torque setting: Pn406 emergency stop torque
	2	Decelerates the Servomotor to a stop at the preset torque, and puts the Servomotor in coast status. Torque setting: Pn406 emergency stop torque

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

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

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



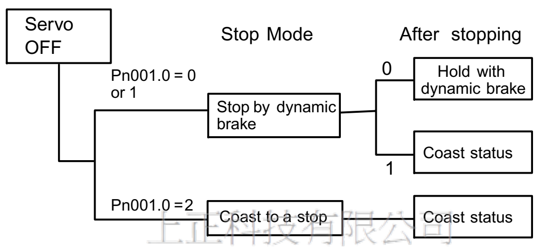
■ Servo OFF Stop Mode Selection

The SGDH SERVOPACK turns OFF under the following conditions:

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

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

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



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

Refer to *6.5.1 Using the Dynamic Brake.*

Parameter	Setting	Item
Pn001.0	0 (Factory setting)	Uses the dynamic brake to stop the Servomotor, and maintains dynamic brake status after stopping.
	1	Uses the dynamic brake to stop the Servomotor, and cancels dynamic brake status after stopping to go into coast status.
	2	Coasts the Servomotor to a stop. The Servomotor is turned OFF and stops due to equipment friction.

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

6.2.3 Software Limit Settings

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

■ Software Limit Function

The software limits can be enabled or disabled.

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

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

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

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

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

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

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

■ Selecting Software Limit Operation

Software limit operation is selected by setting the following parameter.

Pn801.1	Software Limit Operation Selection	Factory Setting: 0	Position Control

Select the operation using one of the following settings.

Pn801.1 Setting	Meaning
0 (Factory setting)	Operation from the machine coordinate system absolute position (APOS)
1	Operation from the absolute position (APOS) converted according to the reference coordinate system.

■ Software Limit Check using Commands

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

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

6

Pn801.2 Setting	Meaning
0 (Factory setting)	No software limit check for commands.
1	Software limit check for commands. The checking method for a software limit check using input target position commands is determined by the Pn801.1 setting. When Pn801.1 = 0, a software limit check is performed on the target position for the machine coordinate system. When Pn801.1 = 1, a software limit check is performed on the target position for the reference coordinate system.

■ Software Limit Setting

Set software limits in the positive and negative directions.

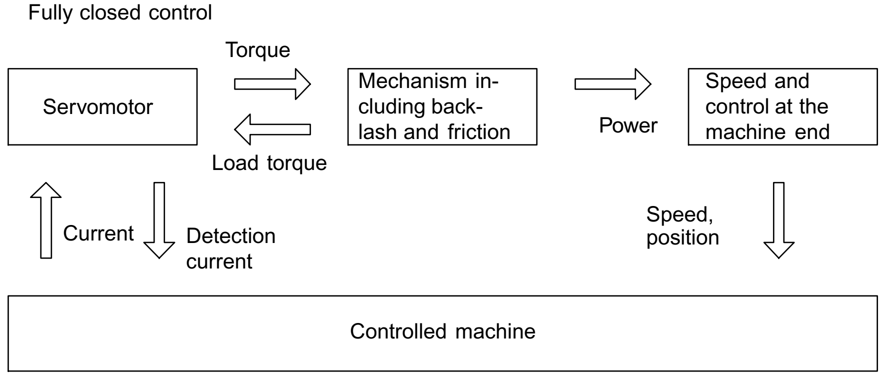
Pn804	Forward Software Limit	Unit	Setting Range: -1073741823 to 1073741823	Factory Setting: 81911808	Position Control
Pn806	Reverse Software Limit	Unit	Setting Range: -1073741823 to 1073741823	Factory Setting: -81911808	Position Control

The negative limit must be less than the positive limit.

6.2.4 Fully Closed Control

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

Fully closed control



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

6.2.5 Fully Closed System Specifications

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

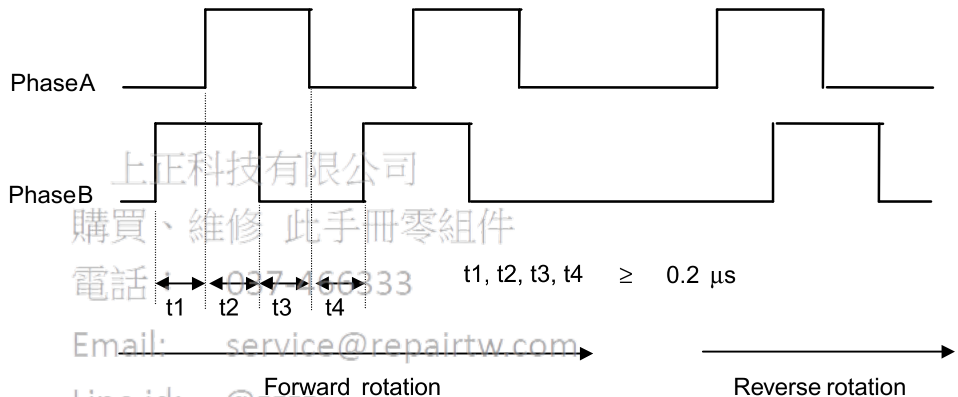
■ Fully Closed Encoder Pulse Output Form

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

■ Fully Closed Encoder Pulse Signal Form

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

Maximum receivable frequency for SERVOPACK: 1 Mbps



6.2.6 Parameter Settings

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

■ Overflow Level

For information on parameter contents, refer to *6.2.1 Servo Gain Settings* of the *Σ-II Series SGM□H/SGDH User's Manual : Design and Maintenance* (SIE-S800-32.2). The factory setting is made to minimize the chance of the motor going out of control due to wiring errors or other causes. After performing a trial operation at a low speed, change the setting to a higher value if necessary.

■ Fully Closed Encoder

Set the method for using the fully closed encoder.

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

The setting details are as follows:

Parameter	Setting	Meaning
Pn002.3	0 (Factory setting)	Fully closed encoder is not used.
	1	Fully closed encoder is used without phase C.
	2	Fully closed encoder is used with phase C.
	3	Fully closed encoder is used in Reverse Rotation Mode without phase C.
	4	Fully closed encoder is used in Reverse Rotation Mode with phase C.

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

■ Number of Fully Closed Encoder Pulses

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

When the number of fully closed encoder pulses per motor rotation is not an integer, set the closest integer.

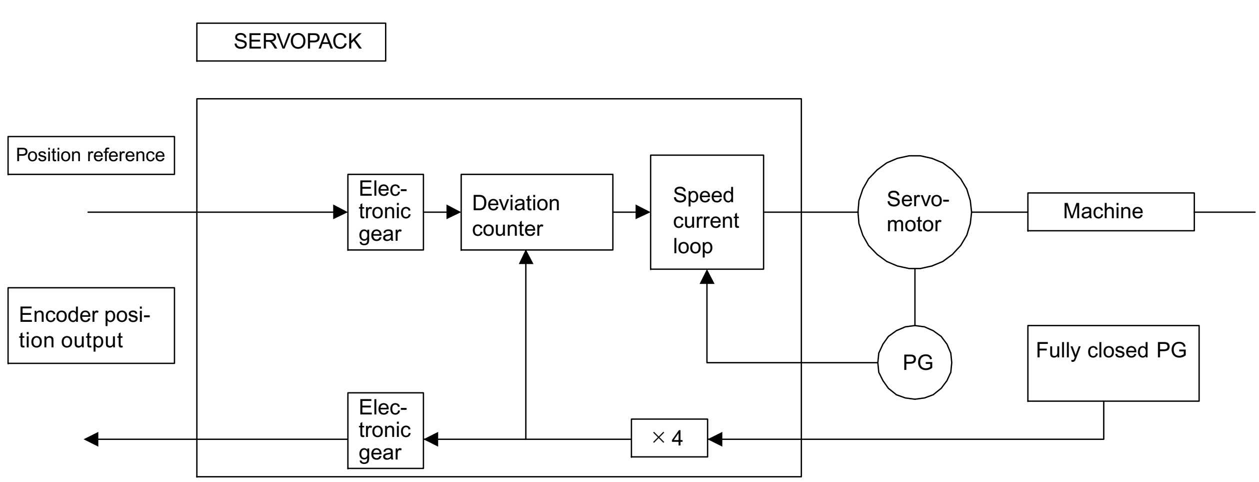
Error will occur in the speed monitor for position loop gain, feed forward, and reference pulse, but no position displacement will occur. Set the number of pulses with a multiplication factor of 1.

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

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

■ Electronic Gears

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



■ Reverse Rotation Settings

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

Making the settings carefully. Errors may cause the motor to run out of control.

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

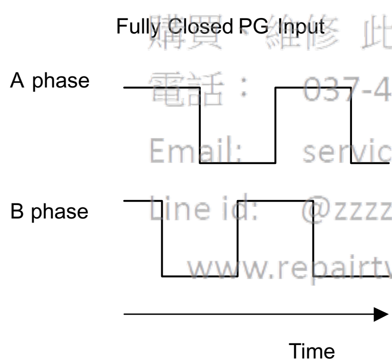


Fig. 6.2

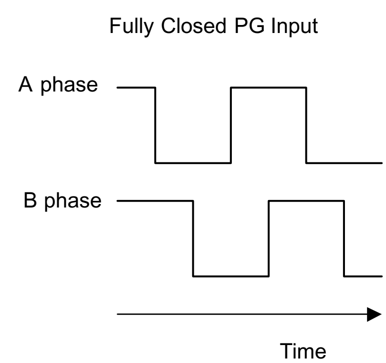


Fig. 6.3

Both Pn000.0 and Pn002.3 can be used to change the rotational direction during normal operation. If the motor runs out of control, change either Pn000.0 or Pn002.3.

6.3 Settings According to Host Controller

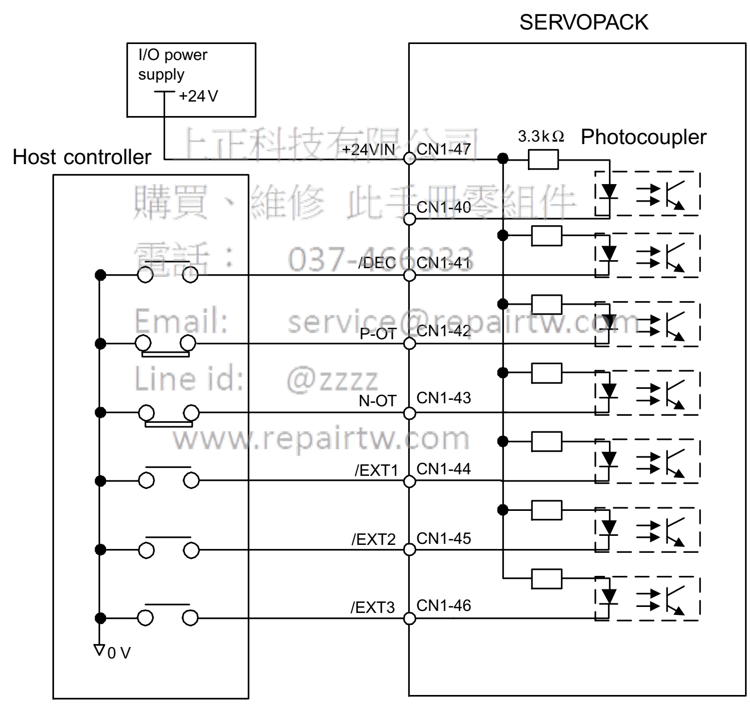
This section describes the procedure for connecting a Σ-II Series Servo to a host controller, including the procedure for setting related parameters.

6.3.1 Sequence I/O Signals

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

■ Input Signal Connections

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



IMPORTANT

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

- External power supply specifications: 24 ± 1 VDC, 50 mA min.

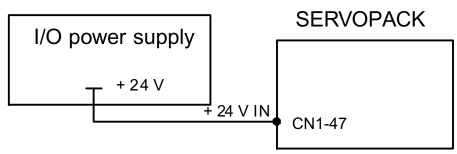
Yaskawa recommends using the same external power supply as that used for output circuits. The allowable voltage range for the 24-V sequence input circuit power supply is 11 to 25 V. Although a 12-V power supply can be used, contact faults can easily occur for relays and other mechanical contacts under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

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

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

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

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

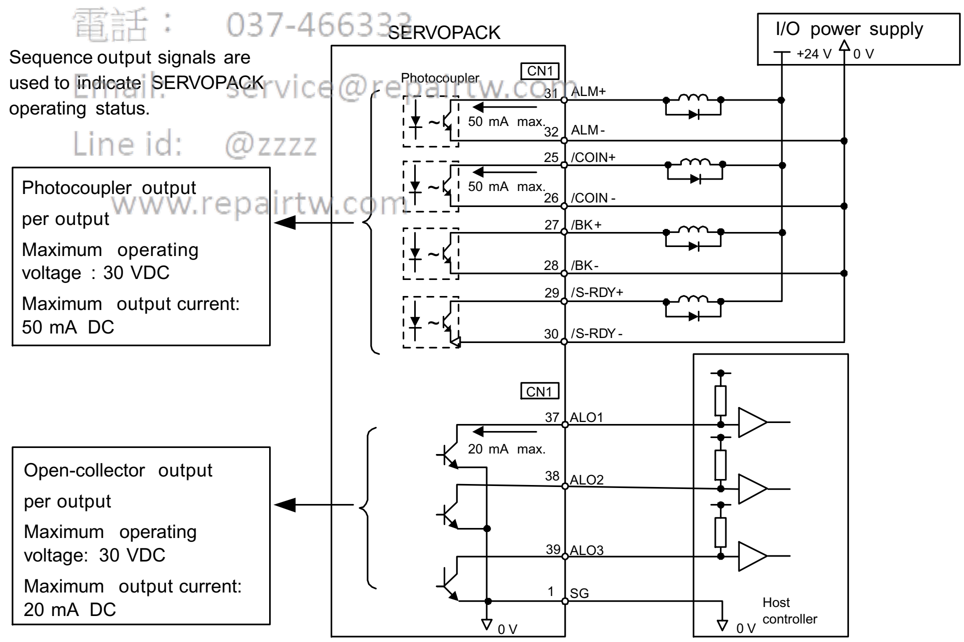


Connect an external I/O power supply.

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

■ Output Signal Connections

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



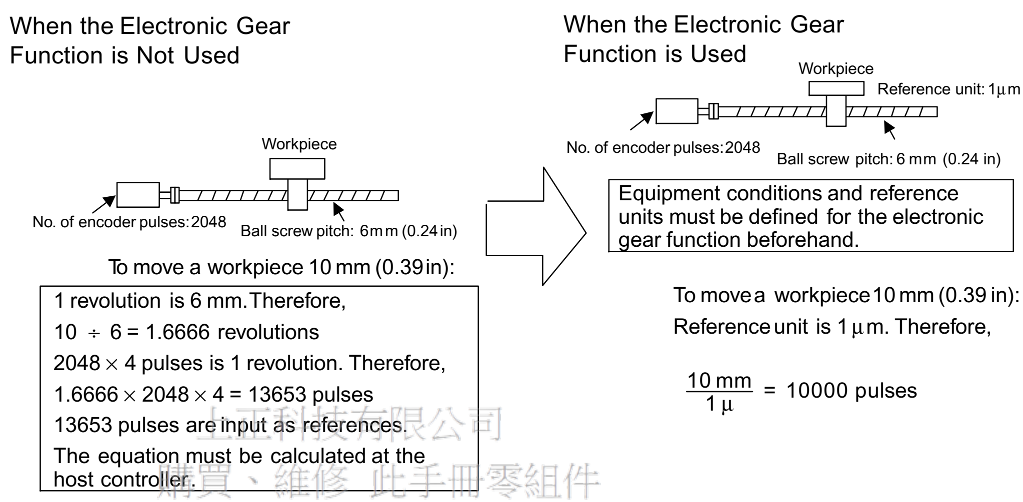
IMPORTANT	Provide a separate external I/O power supply; the SERVOPACK does not have an internal 24-V power supply. Yaskawa recommends using the same type of external power supply as that used for input circuits.

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

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

6.3.2 Using the Electronic Gear Function

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



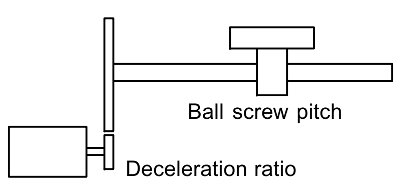
■ Setting the Electronic Gear

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

1. Check equipment specifications.

   Items related to the electronic gear:

   - Deceleration ratio
   - Ball screw pitch
   - Pulley diameter

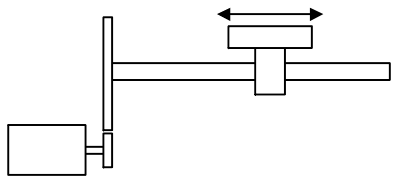


2. Check the number of encoder pulses for the SGM☐H Servomotor.

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

3. Determine the reference unit used.

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



Determine the reference unit according to equipment specifications and positioning accuracy.

◀ EXAMPLE ▶

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

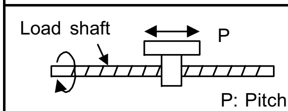
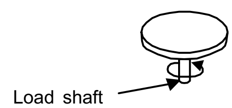
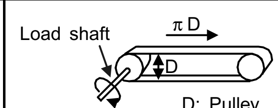
4. Determine the load travel distance per load shaft revolution in reference units.

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

◀ EXAMPLE ▶

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

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

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

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

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

   where m is the rotation of the motor and n is the rotation of the load shaft,

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

IMPORTANT

Make sure the electronic gear ratio satisfies the following condition:

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

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

6. Set the parameters.

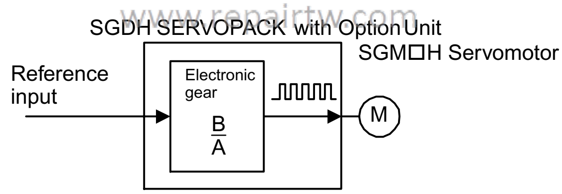
Reduce the electronic gear ratio $\left(\frac{B}{A}\right)$ to the lower terms so that both A and B are integers smaller than 65535, then set A and B in the respective parameters.

$\left(\frac{B}{A}\right)$	Parameter	Name
B →	Pn202	Electronic Gear Ratio (Numerator)
A →	Pn203	Electronic Gear Ratio (Denominator)

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

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

Set the electronic gear ratio according to equipment specifications.



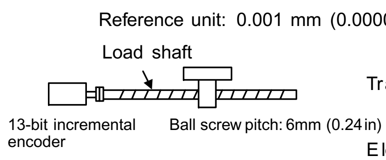
$$\text{Electronic gear ratio}\left(\frac{B}{A}\right) = \frac{Pn202}{Pn203}$$

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

■ Electronic Gear Setting Examples

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

Ball Screws

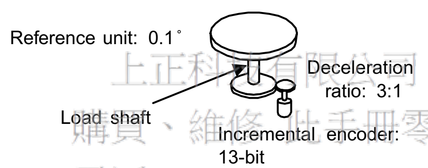


$$\text{Travel distance per load shaft revolution} = \frac{6\text{ mm}}{0.001\text{ mm}} = 6000$$

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

Preset Values	Pn202	8192
	Pn203	6000

Circular Tables

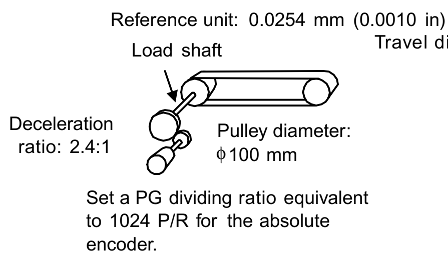


$$\text{Travel distance per load shaft revolution} = \frac{360^\circ}{0.1^\circ} = 3600$$

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

Preset Values	Pn202	24576
	Pn203	3600

Belts and Pulleys



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

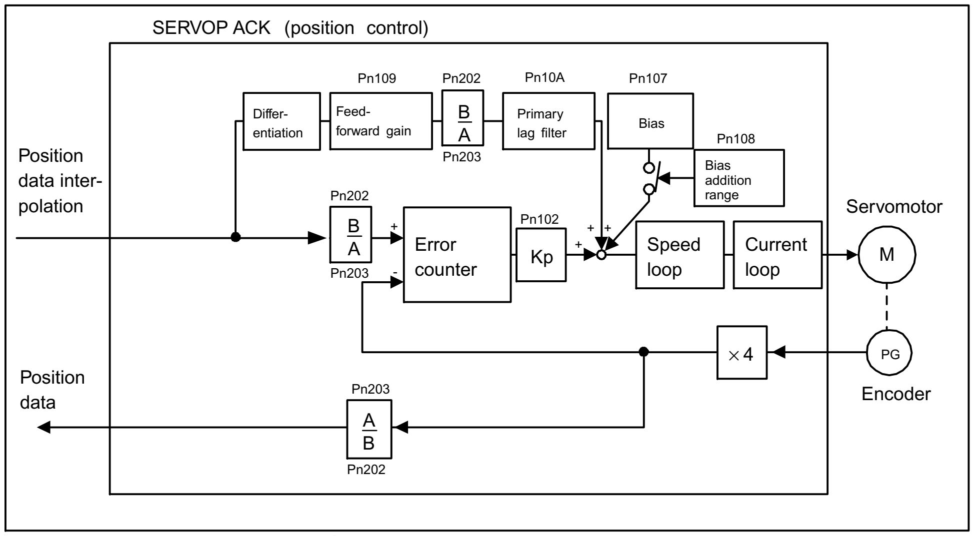
$$\text{Electronic gear ratio}\left(\frac{B}{A}\right) = \frac{1024 \times 4 \times 2.4}{12362 \times 1} = \frac{Pn202}{Pn203}$$

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

Preset Values	Pn202	49152
	Pn203	61810

■ Control Block Diagram

The following diagram illustrates a control block for position control.



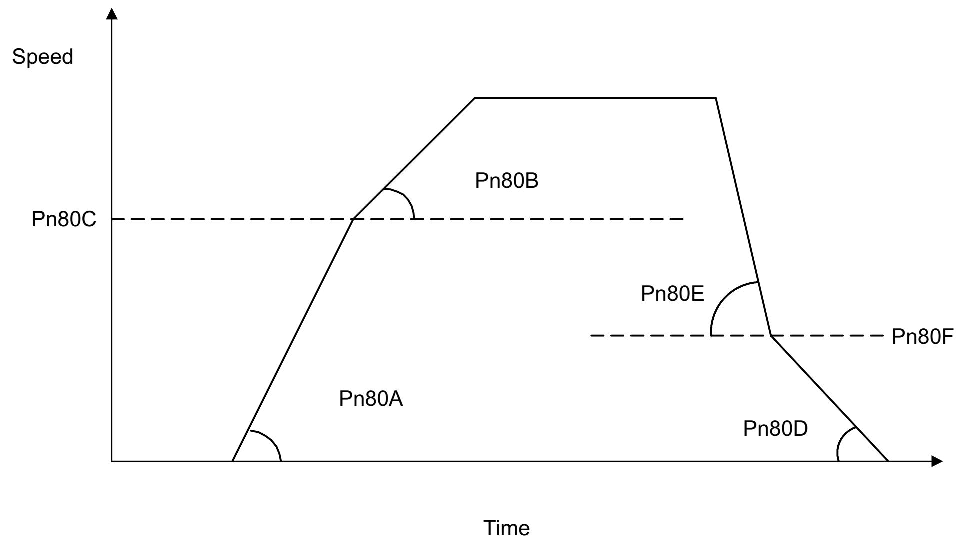
6.3.3 Acceleration/Deceleration Function

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

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

Related parameters

Type	Parameter Number	Outline
Acceleration/deceleration	Pn80A	First-step linear acceleration parameter
	Pn80B	Second-step linear acceleration parameter
	Pn80C	Acceleration switching speed
	Pn80D	First-step linear deceleration parameter
	Pn80E	Second-step linear deceleration parameter
	Pn80F	Deceleration switching speed
Acceleration/deceleration filter	Pn810	Exponential acceleration/deceleration bias
	Pn811	Exponential acceleration/deceleration time parameter
	Pn812	Movement average time



■ First-step Linear Acceleration Parameter

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

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

■ Second-step Linear Acceleration Parameter

Set the second-step linear acceleration.

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

■ Acceleration Switching Speed

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

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

6

First-step Linear Deceleration Parameter

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

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

Second-step Linear Deceleration Parameter

Set the second-step deceleration.

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

Deceleration Switching Speed

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

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

Exponential Acceleration/Deceleration Bias

Set the bias speed for exponential acceleration/deceleration.

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

Exponential Acceleration/Deceleration Time Parameter

Set the time constant for exponential acceleration/deceleration.

Pn811	Exponential Acceleration/ Deceleration Time Constant	Unit 0.1 ms	Setting Range: 0 to 5100	Factory Setting: 0	Position Control

■ Movement Average Time

Set the time over which to average movement when using S-curve acceleration/deceleration by applying a movement average to the acceleration/deceleration.

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

6.3.4 Motion Settings

Motion settings are performed using the following parameters.

Set them according to the machine system.

■ Positioning Completed Width

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

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

INFO

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

■ Positioning Proximity Width

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

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

INFO

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

■ Zero Point Width

Set the zero point position detection (ZPOINT) width.

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

■ Final Travel Distance for External Positioning

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

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

■ Zero point Return Direction

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

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

The setting details are as show below.

Pn816.0 Setting	Meaning
0	Forward direction
1	Reverse direction

■ Zero point Return Approach Speed 1

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

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

■ Zero point Return Approach Speed 2

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

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

■ Final Travel Distance to Return to Zero Point

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

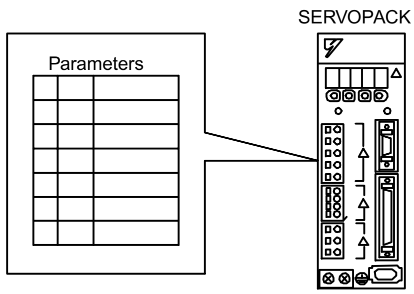
Pn819	Final Travel Distance to Return to Zero Point	Unit Reference unit	Setting Range: -1073741823 to 1073741823	Factory Setting: 100	Position Control

6.4 Setting Up the SERVOPACK

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

6.4.1 Parameters

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



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

Parameters are divided into the following three groups.

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

Refer to *Appendix B List of Parameters*.

6.4.2 Input Circuit Signal Allocation

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

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

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

CN1 Connector Terminal Numbers	Input Terminal Name	Factory Setting		Standard Setting	
		Symbol	Name	Symbol	Name
46	SI6	/N-CL	Reverse run external torque control	/EXT3	External latch signal 3

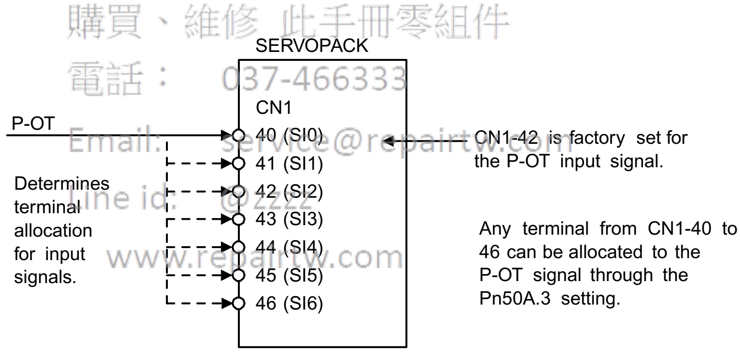
The following parameter is used to enable input signal allocations. Usually this parameter is set to 1. Do not change this setting.

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

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

■ Input Signal Allocation

The following signals can be allocated.



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

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

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

- Examples of Input Signal Allocation

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

Pn50A.3 Setting	Description	Remarks
0	Inputs the P-OT signal from the SI0 (CN1-40) input terminal.	Signal Polarity: Normal Example: Forward run prohibited signal (P-OT) is valid when high (OFF).
1	Inputs the P-OT signal from the SI1 (CN1-41) input terminal.	
2	Inputs the P-OT signal from the SI2 (CN1-42) input terminal.	
3	Inputs the P-OT signal from the SI3 (CN1-43) input terminal.	
4	Inputs the P-OT signal from the SI4 (CN1-44) input terminal.	
5	Inputs the P-OT signal from the SI5 (CN1-45) input terminal.	
6	Inputs the P-OT signal from the SI6 (CN1-46) input terminal.	
7	Sets P-OT signal so that it is always valid.	Set the Forward run prohibited signal (P-OT) so that it is always valid or always invalid.
8	Sets P-OT signal so that it is always invalid.	
9	Inputs the P-OT signal from the SI0 (CN1-40) input terminal.	Signal Polarity: Reversed (See note.) Example: Forward run prohibited signal (P-OT) is valid when low (ON).
A	Inputs the P-OT signal from the SI1 (CN1-41) input terminal.	
B	Inputs the P-OT signal from the SI2 (CN1-42) input terminal.	
C	Inputs the P-OT signal from the SI3 (CN1-43) input terminal.	
D	Inputs the P-OT signal from the SI4 (CN1-44) input terminal.	
E	Inputs the P-OT signal from the SI5 (CN1-45) input terminal.	
F	Inputs the P-OT signal from the SI6 (CN1-46) input terminal.	

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

IMPORTANT

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

As shown in the table above, the P-OT signal can be allocated to any input terminal from SI0 to SI6. P-OT is always input when Pn50A.3 is set to 7, and so the SERVOPACK will always be in forward run prohibited status.

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

- When the factory set input signals are to be replaced by another input signal.
- When the forward run prohibited (P-OT) and the reverse run prohibited (N-OT) input signals are not required in the system configuration for trial or normal operation.

  The forward run prohibited (P-OT) and the reverse run prohibited (N-OT) input signals are valid when OFF (high level). The input terminals must therefore be wired so that these signals remain ON (low level) in systems where they are not required. The need to wiring these terminals can be eliminated by setting the parameters to 8.

INFO

Signals are input with OR logic when multiple signals are allocated to the same input circuit.

- Allocating Other Input Signals

  Input signal allocation can be changed as shown below.

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

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

6

6.4.3 Output Circuit Signal Allocation

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

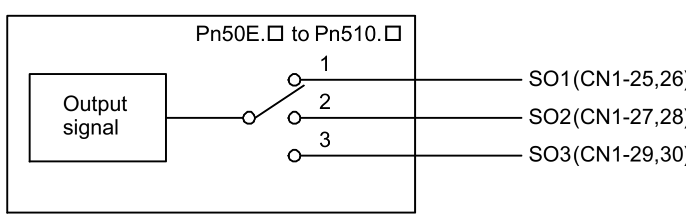
In general, allocate signals according to the standard settings in the following table.

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

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

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

Select the CN1 connector terminals that will output the signals.



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

* Always OFF when an Option Unit is mounted.

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

INFO

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

■ Output Signal Reversal

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

Pn512	Output Signal Reversal Settings	Factory Setting: 0000	Position Control

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

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

6.4.4 Command Masking Function

The command mask setting (Pn802) can be used to mask SV_ON and SENS_ON MECHATROLINK communications commands.

■ SV_ON Command Mask

Set to 1 to disable the SV_ON command.

Pn802.0	SV_ON Command Mask	Factory Setting: 0	Position Control

Settings are shown in the following table.

Pn802.0 Setting	Description
0 (Factory setting)	SV_ON, SV_OFF commands enabled.
1	The Servo is always ON.

■ SENS_ON Command Mask

Set to 1 to disable the SENS_ON command.

Pn802.1	SENS_ON Command Mask	Factory Setting: 0	Position Control

Settings are shown in the following table.

Pn802.1 Setting	Description
0 (Factory setting)	SENS_ON, SENS_OFF commands enabled.
1	Absolute PG is always ON.

6.4.5 Debug Function

The following parameter is used for the debug function.

■ Communications Control Function

Used to perform MECHATROLINK communications without using the communications check for debugging.

For normal operating conditions, set to 0 (with check).

Pn800.0	MECHATROLINK Communications Check Mask	Factory Setting: 0	Position Control

Settings are shown in the following table.

Pn800.0 Setting	Description
0 (Factory setting)	Check performed.
1	Ignore communications errors. When a communications error occurs, data will be discarded.
2	Ignore WDT errors. Data will be received even if a WDT error occurs.
3	Ignore both communications and WDT errors.

6.4.6 Monitoring

6

The monitoring function allows monitor data to be read using the MECHATROLINK communications monitoring function and the results displayed on a host controller for adjustment.

■ Option Monitor

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

Use the following parameter settings.

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

Settings are as shown in the following table.

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

■ Analog Monitor

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

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

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

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

INFO

Refer to *6.5 Analog Monitor* of the *Σ-II Series SGM□H/SGDH User's Manual : Design and Maintenance* (SIE-S800-32.2) for information on the analog monitor.

6.5 Setting Stop Functions

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

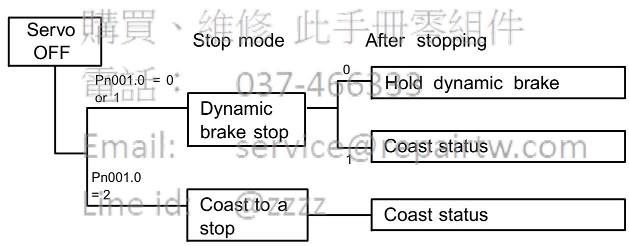
6.5.1 Using the Dynamic Brake

To stop the Servomotor by applying the dynamic brake (DB)[1], set the desired mode in the following parameter. The Servomotor will stop due to equipment friction if the dynamic brake is not applied.

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

The SERVOPACK turns OFF under the following conditions:

- When the SV_OFF command is issued.
- A Servo alarm occurs.
- Power is turned OFF.



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

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

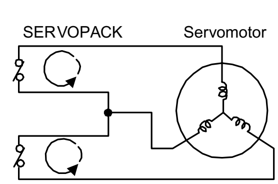
* 1. If the Servomotor is stopped or moving at extremely low speed, it will coast to a stop.

* 2. A dynamic brake is used when the control power and main power are turned OFF.

TERMS

[1] Dynamic brake (DB)

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

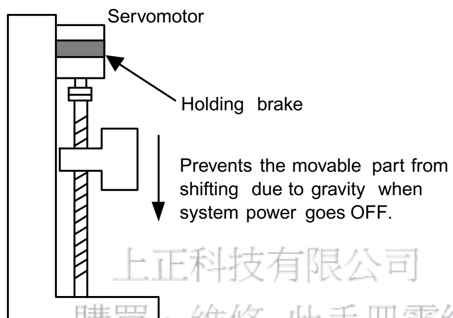


IMPORTANT

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

6.5.2 Using the Holding Brake

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

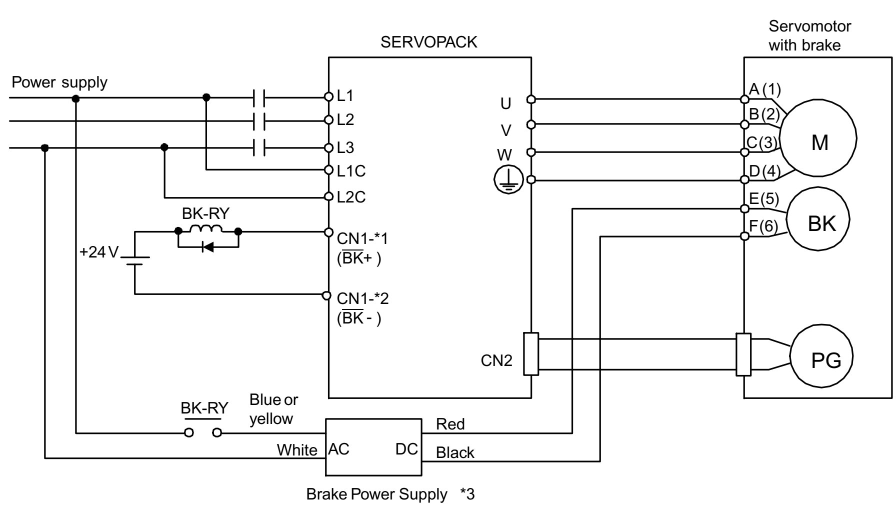


IMPORTANT

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

■ Wiring Example

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



BK-RY: Brake control relay

*1, *2: The output terminal allocated with Pn50F.2

*3: Brake power supplies are available in 200-V and 100-V models.

Output → /BK	Brake Interlock Output	Position Control

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

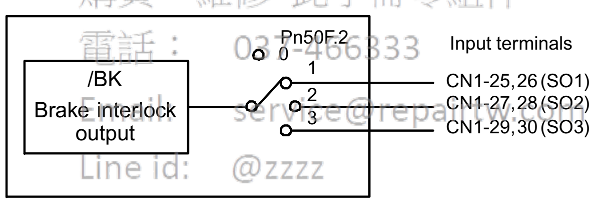
ON:	Closed or low level	Releases the brake.
OFF:	Open or high level	Applies the brake.

Related Parameters

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

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

Pn50F	Output Signal Selections 2	Factory Setting: 0000	Position Control



Select the /BK output terminal.

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

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

■ Brake Operation

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

Pn005.0	Brake Operation	Factory Setting: 0	Position Control

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

IMPORTANT

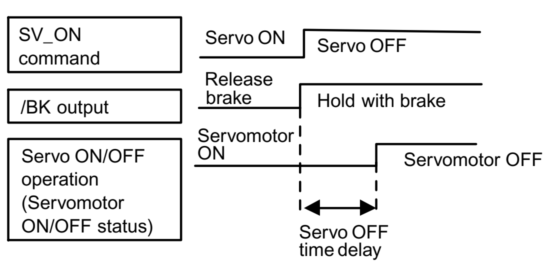
When brake operation is controlled using the controller's BRK_ON/BRK_OFF commands, the SERVOPACK's parameters (Pn506, Pn507, Pn508) settings will be ignored.

■ Brake ON Timing

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

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

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



With the standard setting, the servo is turned OFF when the /BK signal (brake operation) is output. 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.

IMPORTANT

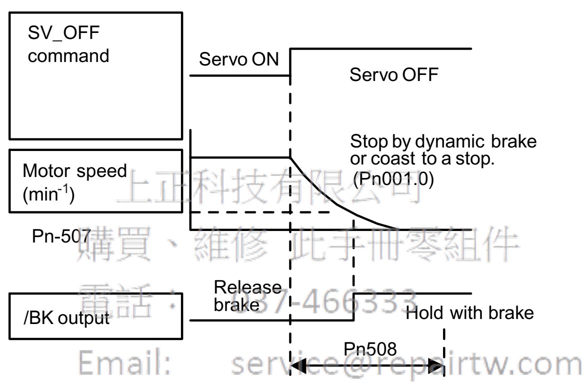
The Servomotor will turn OFF immediately if an alarm occurs. The equipment may move due to gravity in the time it takes for the brake to operate.

■ Holding Brake Setting

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

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

Set the brake timing used when the servo is turned OFF by the SV_OFF command or when an alarm occurs during Servomotor with brake operation.



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

/BK Signal Output Conditions During Servomotor Operation

The circuit is open under either of the following conditions:

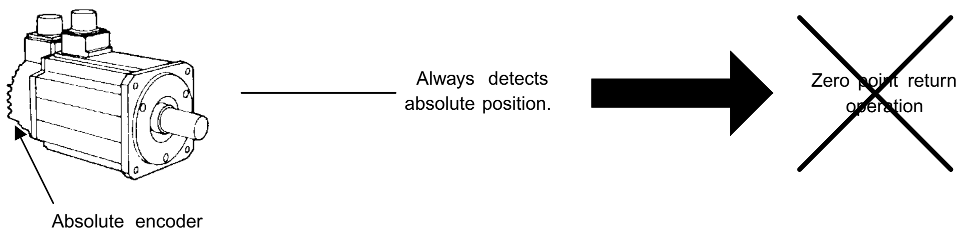
1	Motor speed drops below the setting at Pn507 after servo OFF.
2	The time set at Pn508 has elapsed since servo OFF.

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

6.6 Absolute Encoders

If a motor with an absolute encoder is used, a system to detect the absolute position can be made in the host controller. Consequently, operation can be performed without zero point return operation immediately after the power is turned ON.

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



6.6.1 Selecting an Absolute Encoder

Select the absolute encoder usage with the following parameter.

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

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

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

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

6.6.2 Absolute Encoder Setup

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

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

Perform the setup operation in one of the following ways.

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

Setup can also be performed using personal computer monitor software.

INFO

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

IMPORTANT

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

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

6.6.3 Multiturn Limit Setting

⚠ WARNING

- The multiturn limit value must be changed only for special applications. Changing it inappropriately or unintentionally can be dangerous.
- If the Multiturn Limit Disagreement alarm occurs, check the setting of parameter Pn205 in the SERVOPACK to be sure that it is correct.

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

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

Select the absolute encoder usage with the following parameter.

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

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

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

*Σ-II Series SGM□H/SGDH User’s Manual : Design and Maintenance (*SIE-S800-32.2*)*The multiturn limit is set in the SERVOPACK using the following parameter.

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

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

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

TERMS

1 Multiturn limit

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

INFO

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

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

Alarm Name: Multiturn Limit Disagreement

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

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

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

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

Setup can also be performed using the personal computer monitor software.

INFO

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

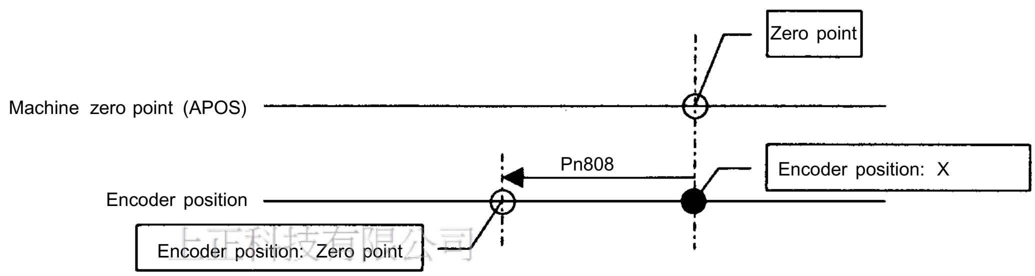
6

6.6.4 Absolute Encoder Zero Point Position Offset

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

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

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



6

7

Digital Operator

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

7.1 Connecting the Digital Operator

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

There is no need to turn OFF the SERVOPACK to connect the Hand-held Digital Operator to the SERVOPACK. For details on how to use the Hand-held Digital Operator, refer to the Σ-*II Series SGM□H/SGDH User's Manual : Design and Maintenance (*SIE-S800-32.2*)*.

7.2 Limitations in Using a Hand-held Digital Operator

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

INFO

Disconnect the Hand-held Digital Operator during normal operation.

Do not perform communications with a personal computer during normal operation

Normal Operation

When a Hand-held Digital Operator is connected or communications with a personal computer started during normal operation, the following commands are not supported (command warning A.95).

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

PRM_RD, PRM_WR

PPRM_WR

CONFIG

ALM_RD, ALM_CLR

SENS_ON

ADJ

7

7.3 Panel Operator Indicators

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

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

   Note: The indicator will be lit when the ADJ command has been executed to enable the Panel Operator. Refer to *Appendix C.5 Enabling the Panel Operator* for details.

8

Ratings, Specifications, and Dimensional Drawings

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

8

8.1 Ratings and Specifications

The following table shows ratings and specifications for the Option Unit.

Table 8.1 Option Unit Ratings and Specifications

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

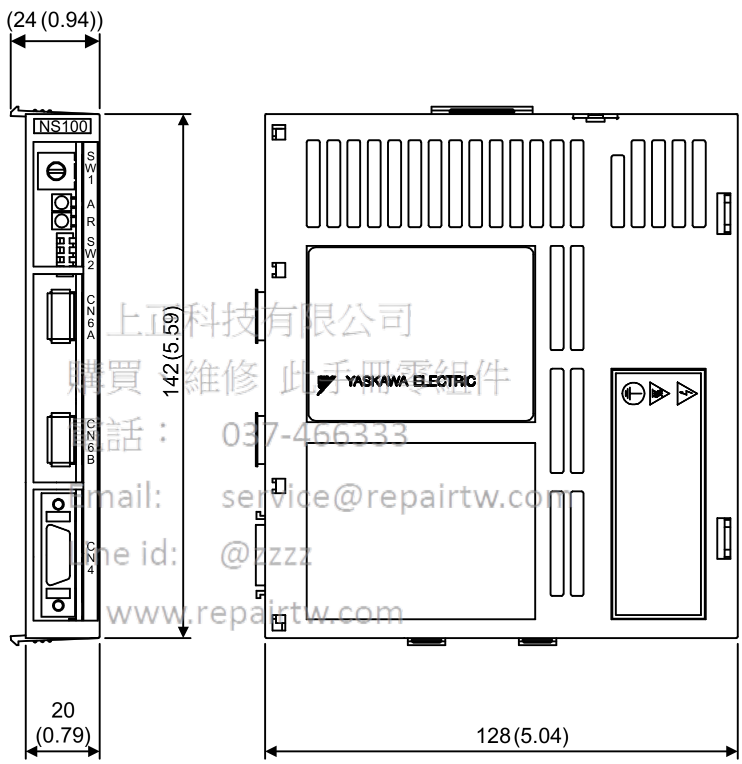
8.2 Dimensional Drawings

Dimensional drawings of the Option Unit and SERVOPACKs are shown below.

8.2.1 Option Unit

Dimensions of the Option Unit are shown below.

Unit: mm (in)



Approx. mass: 0.2 kg (0.44 lb)

8

8.2.2 SERVOPACKs

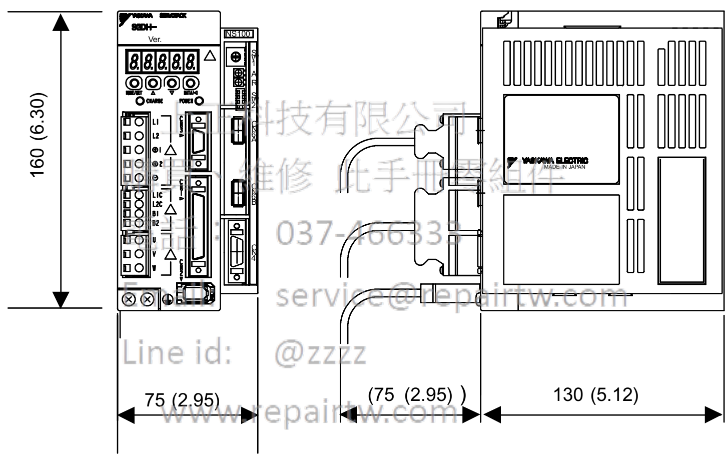
Dimensional drawings of the Base-mounted Standard SERVOPACKs (with Option Unit mounted) are shown below. For detailed dimensional drawings, refer to Σ-*II Series SGM□H/SGDH User's Manual : Servo Selection and Data Sheets (*SIE-S800-32.1*).*

For details of the Rack-mounted and Duct-ventilated SERVOPACKs, refer also to Σ-*II Series SGM□H/SGDH User's Manual : Servo Selection and Data Sheets (*SIE-S800-32.1*).*

■ Base-Mounted Models

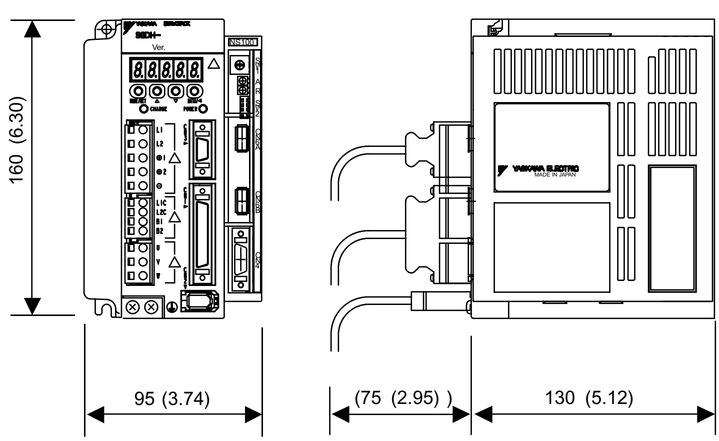
Unit: mm (in)

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



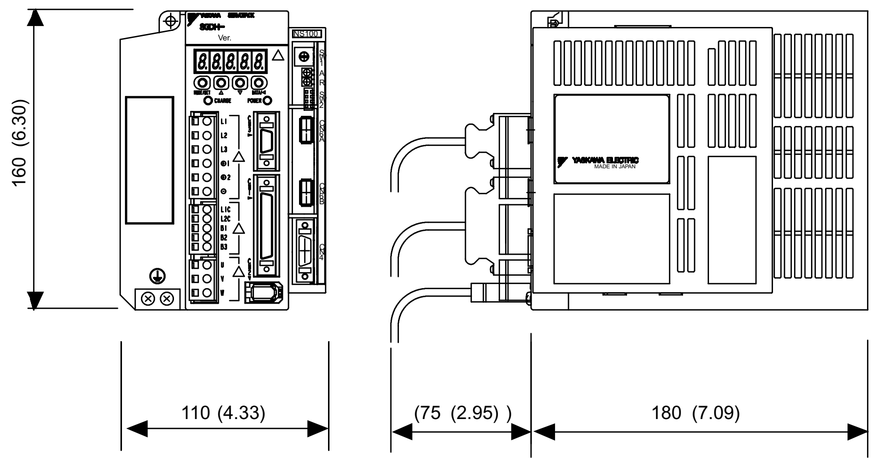
Approx. mass: 1.0 kg (2.21 lb)

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



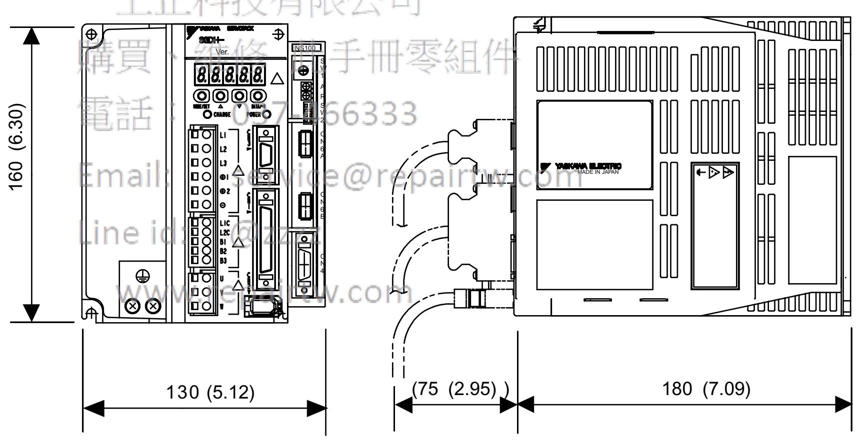
Approx. mass: 1.3 kg (2.87 lb)

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



Approx. mass: 1.9 kg (4.19 lb)

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



Approx. mass: 3.0 kg (6.61 lb)

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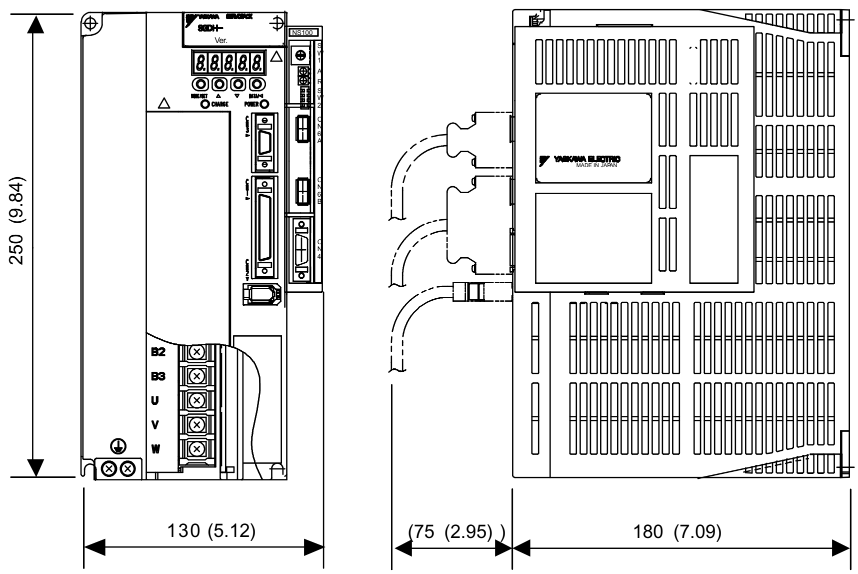
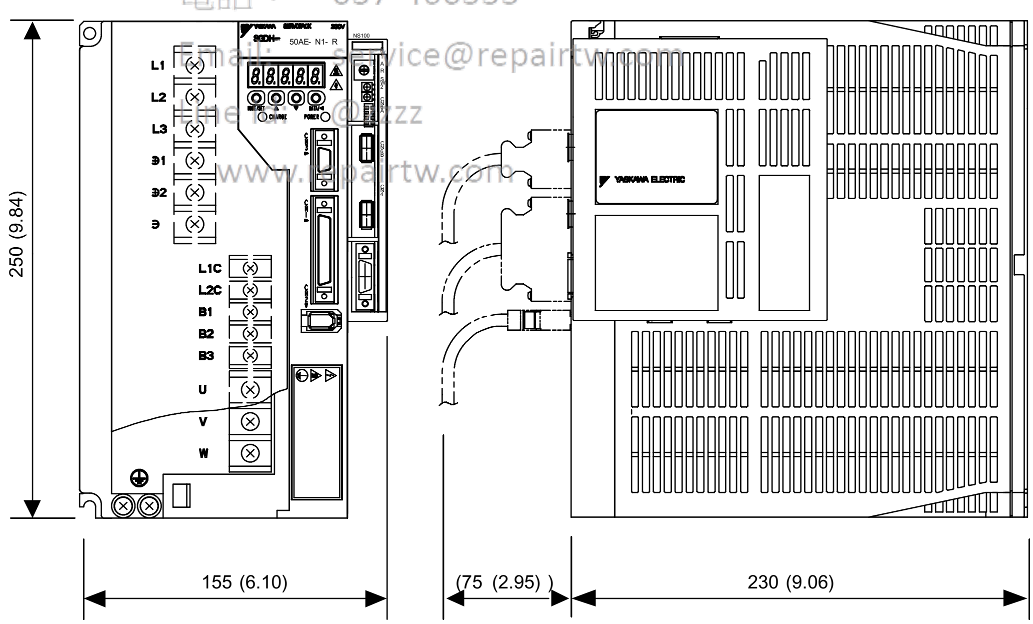
SGDH-20AE, -30AE (Three-phase, 200 V, 2.0 kW, 3.0 kW)



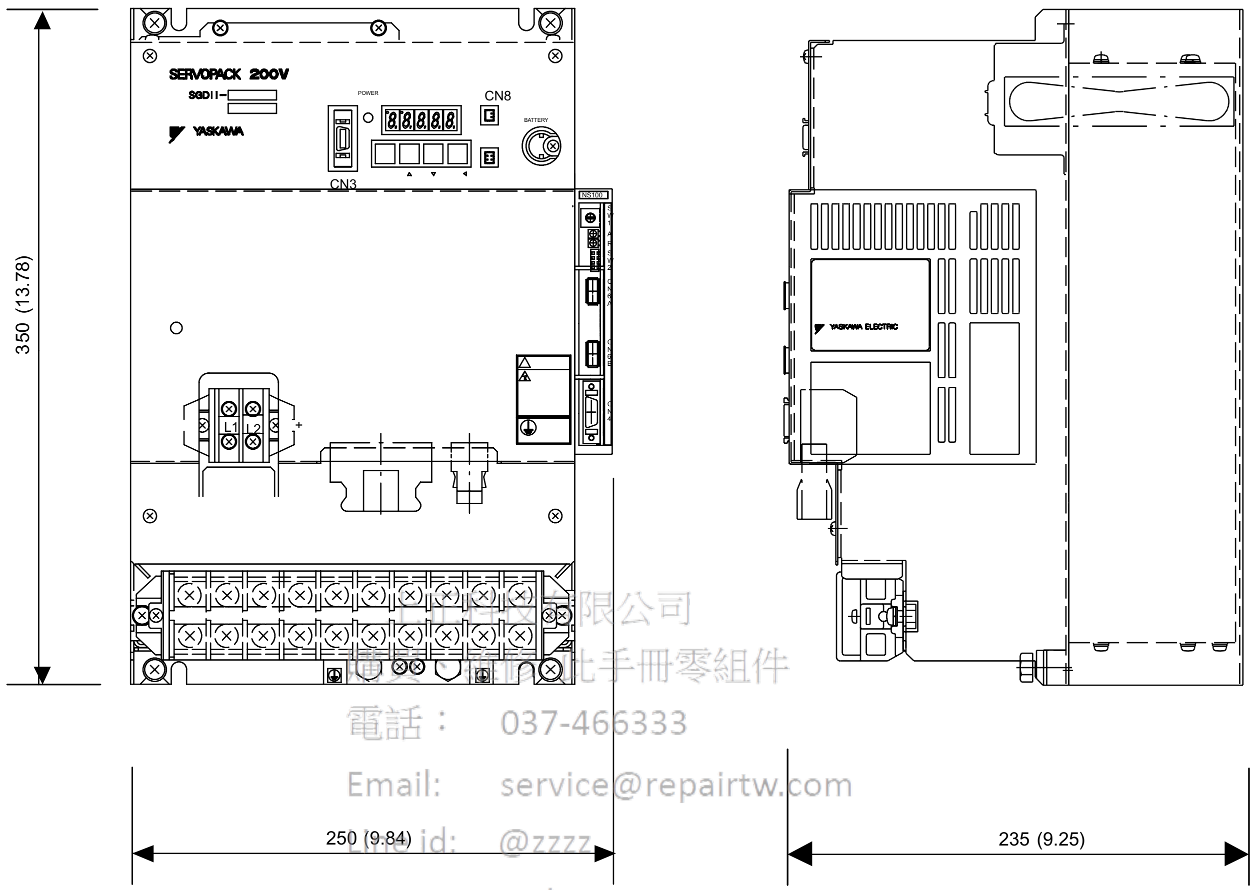
Approx. mass: 4.0 kg (8.82 lb)

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



Approx. mass: 5.7 kg (12.57 lb)

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



Approx. mass: 15.0 kg (33.07 lb)

8

9

Troubleshooting

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

9.1 Troubleshooting Problems with Alarm Displays

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

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

■ A.02

A.02: Parameters Breakdown

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B, C

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

■ A.04

A.04: Parameter Setting Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B, C

	Cause	Remedy
A	An out-of-range parameter was previously set or loaded.	• Reset all parameters in range. • Otherwise, re-load correct parameter.
B	Circuit board (1PWB) is defective.	Replace SERVOPACK.
C	Option Unit is defective.	Replace Option Unit.

9

■ A.81

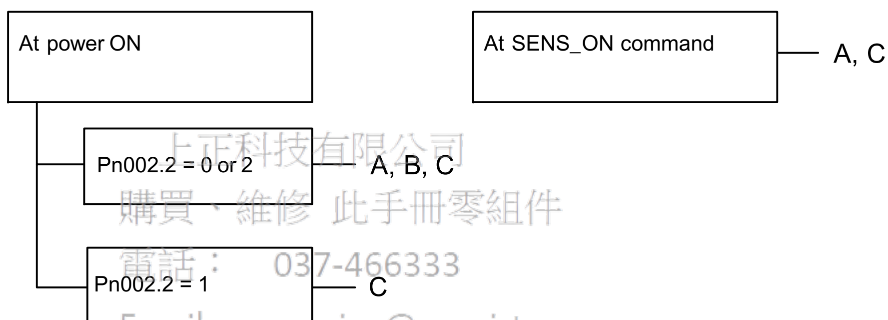
A.81: Absolute Encoder Backup Error

Display and Outputs

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

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

Status and Remedy for Alarm



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

9

■ A.82

A.82: Encoder Checksum Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

At SENS_ON command — B

During operation — A, B

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

9

■ A.83

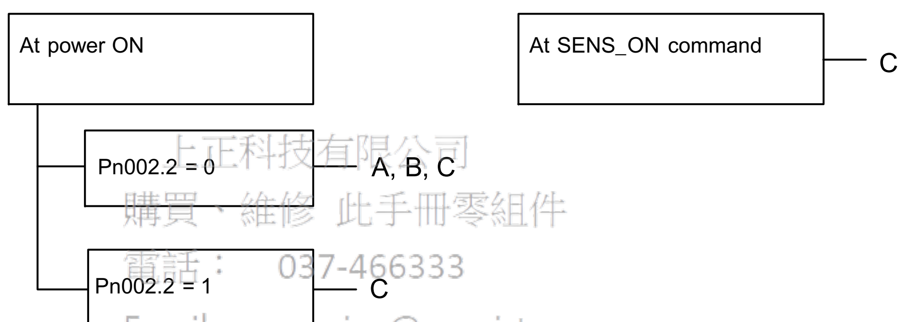
A.83: Absolute Encoder Battery Error

Display and Outputs

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

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

Status and Remedy for Alarm



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

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

9

■ A.84

A.84: Absolute Encoder Data Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

During operation — B

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

9

■ A.85

A.85: Absolute Encoder Overspeed

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

At SENS_ON command — C, D

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

■ A.86

A.86: Encoder Overheated

Display and Outputs

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

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

Status and Remedy for Alarm

During Servomotor operation — A, B

At power ON — C, D

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

■ A.94

A.94: Parameter Setting Warning

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when the command was issued — A

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

■ A.95

A.95: MECHATROLINK Command Warning

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when the command was issued — A, B

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

■ A.96

A.96: MECHATROLINK Communications Warning.

Display and Outputs

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

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

Status and Remedy for Alarm

During MECHATROLINK communications — A, B

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

■ A.b6

A.b6: Communications LSI Error Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

	Cause	Remedy
A	Option Unit is defective.	Replace Option Unit.

■ A.C6

A.C6: Fully-closed Encoder A-, B-phase Disconnection Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

1 to 3 seconds after power ON — A, B, C, D

During Servomotor operation — A, B, C, D

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

9

■ A.C7

A.C7: Fully-closed Encoder C-phase Disconnection Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

1 to 3 seconds after power ON — A, B, C, D

During Servomotor operation — A, B, C, D

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

■ A.CC

A.CC: Multiturn Limit Disagreement Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A, B

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

9

■ A.d0

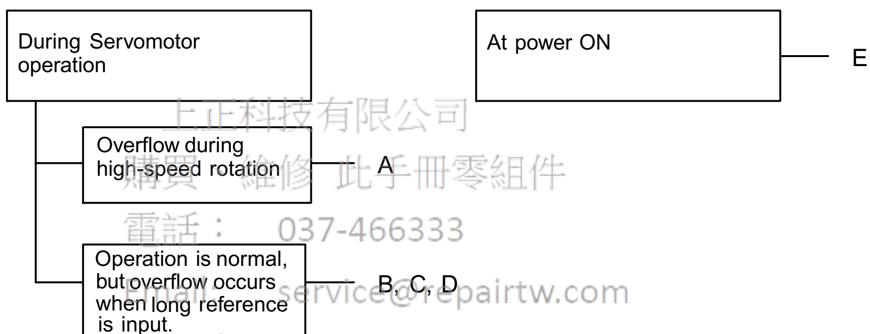
A.d0: Position Error Pulse Overflow

Display and Outputs

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

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

Status and Remedy for Alarm



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

9

■ A.E0

A.E0: Option Unit No Response Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

	Cause	Remedy
A	Option Unit is defective.	Replace Option Unit.

■ A.E1

A.E1: Option Unit Time Out Alarm

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

	Cause	Remedy
A	Option Unit is defective.	Replace Option Unit.

■ A.E2

A.E2: Option Unit WDC Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

During MECHATROLINK communications — B

	Cause	Remedy
A	Option Unit is defective.	Replace Option Unit
B	MECHATROLINK communications interrupted.	Turn the power ON again.

■ A.E5

A.E5: MECHATROLINK Synchronization Error

Display and Outputs

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

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

Status and Remedy for Alarm

Occurred when command was issued — A

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

9

■ A.E6

A.E6: MECHATROLINK Communications Error (Twice Consecutively)

Display and Outputs

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

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

Status and Remedy for Alarm

At control power supply power ON — A, B

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

■ A.EA

A.EA: SERVOPACK Malfunction

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

	Cause	Remedy
A	SERVOPACK is defective.	Replace SERVOPACK.

■ A.EB

A.EB: SERVOPACK Initial Access Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

	Cause	Remedy
A	SERVOPACK is defective.	Replace SERVOPACK.

■ A.EC

A.EC: SERVOPACK WDC Error

Display and Outputs

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

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

Status and Remedy for Alarm

At power ON — A

During MECHATROLINK communications — B

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

■ A.ED

A.ED: Command Execution Incomplete

Display and Outputs

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

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

Status and Remedy for Alarm

During MECHATROLINK communications — A

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

9.2 Troubleshooting Problems with No Alarm Display

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

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

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

Table 9.1 Troubleshooting Table No Alarm Display

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

Table 9.1 Troubleshooting Table No Alarm Display

Symptom	Cause	Inspection	Remedy
Servomotor Overheated	Ambient temperature too high	Measure Servomotor ambient temperature.	Reduce ambient temperature to 40°C max.
	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	Mechanical mounting incorrect	Check Servomotor mounting screws.	Tighten mounting screws.
		Check couplings not centered.	Center coupling.
		Check coupling balance.	Balance coupling.
	Bearing defective	Check noise and vibration near bearing.	Consult your Yaskawa representative if defective.
	Machine causing vibrations	Check foreign object intrusion, damage or deformation of sliding parts of machine.	Consult with machine manufacturer.

9

9.3 Alarm Display Table

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

Table 9.2 Alarm Display Table

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO1	ALO2	ALO3			
A.02	OFF	OFF	OFF	OFF	Parameter Breakdown[*3]	EEPROM data of SERVOPACK is abnormal.
A.03					Main Circuit Encoder Error	Detection data for power circuit is abnormal.
A.04					Parameter Setting Error[*3]	The parameter setting is outside the allowable setting range.
A.05					Combination Error	SERVOPACK and Servomotor capacities do no match each other.
A.10	ON	OFF	OFF	OFF	Overcurrent or Heat Sink Overheated[*3]	An overcurrent flowed through the IGBT. Heat sink of SERVOPACK 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[*4]	Main circuit DC voltage is excessively high.
A.41					Undervoltage[*4]	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 [*2]	The heat sink of SERVOPACK is overheated.

9

Table 9.2 Alarm Display Table

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO1	ALO2	ALO3			
A.81	OFF	OFF	OFF	OFF	Encoder Backup Error*3	All the power supplies for the absolute encoder have failed and position data was cleared.
A.82					Encoder Checksum Error*3	The checksum results of encoder memory is abnormal.
A.83					Absolute Encoder Battery Error	Battery voltage for the absolute encoder has dropped.
A.84					Encoder Data Error*3	Data in the encoder is abnormal.
A.85					Encoder Overspeed	The encoder was rotating at high speed when the power was turned ON.
A.86					Encoder Overheated	The internal temperature of encoder is too high.
A.b1					Reference Speed Input Read Error	The A/D converter for reference speed input is faulty.
A.b2					Reference Torque Input Read Error	The A/D converter for reference torque input is faulty.
A.b6					Gate array error	Communications LSI error
A.bF					System Alarm*3	A system error occurred in the SERVOPACK.
A.C1	ON	OFF	ON	OFF	Servo Overrun Detected	The Servomotor ran out of control.
A.C6					Fully closed loop phase A/B disconnected.	The phase A/B of the fully closed encoder was disconnected.
A.C7					Fully closed loop phase C disconnected	The phase C of the fully closed encoder was disconnected.
A.C8					Absolute Encoder Clear Error and Multiturn Limit Setting Error*3	The multiturn for the absolute encoder was not properly cleared or set.
A.C9					Encoder Communications Error*3	Communications between SERVOPACK and encoder is not possible.
A.CA					Encoder Parameter Error*3	Encoder parameters are faulty.
A.Cb					Encoder Echoback Error*3	Contents of communications with encoder is incorrect.
A.CC					Multiturn Limit Disagreement	Different multiturn limits have been set in the encoder and SERVOPACK.
A.d0	ON	ON	OFF	OFF	Position Error Pulse Overflow	Position error pulse exceeded parameter (Pn505).

Table 9.2 Alarm Display Table

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO1	ALO2	ALO3			
A.E0	OFF	ON	ON	OFF	No option *3.	No Option Unit installed.
A.E1					Option time out *3.	No response from the board in the Option Unit.
A.E2					Option WDC error *3.	WDC error in the board in the Option Unit
A.E5					WDT error	MECHATROLINK synchronization error
A.E6					Communications error	MECHATROLINK communications error
A.EA					SERVOPACK damaged *3.	SERVOPACK is defective.
A.EB					SERVOPACK initial access error *3.	Initial processing failed.
A.EC					SERVOPACK WDC error	SERVOPACK WDC error
A.ED					Command execution incom-plete	Command was interrupted.
A.F1	OFF	ON	OFF	OFF	Power Line Open Phase	One phase is not connected in the main power supply.
CPF00	Not specified				Hand-held Digital Operator Transmission Error	The Hand-held Digital Operator (JUSP-OP02A-2) fails to communicate with SERVO-PACK (e.g., CPU error).
CPF01						
A.– –	OFF	OFF	OFF	ON	Not an error	Normal operation status

Note: 1. OFF: Output transistor is OFF (high). ON: Output transistor is ON (low).
2. This alarm display appears only within the range of 30 W to 1000 W.
3. These alarms are not reset for the alarm clear (ALM-CLR) command. Eliminate the cause of the alarm and then turn OFF the power supply to reset the alarms.
4. For SERVOPACKs with a capacity of 6.0 kw or more, A.40 indicates a main circuit voltage error alarm. This means that either an overvoltage or an undervoltage has occurred at some stage.

9.4 Warning Displays

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

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

Table 9.3 Warning Displays and Outputs

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

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

9

10

Option Unit Peripheral Devices

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

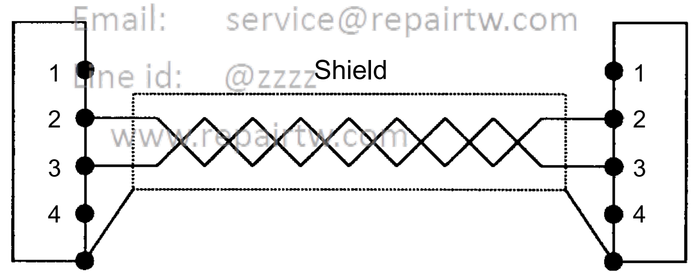
10.1 Fully Closed Encoder Connector Kit

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

10.2 MECHATROLINK Communications Cables and Terminator

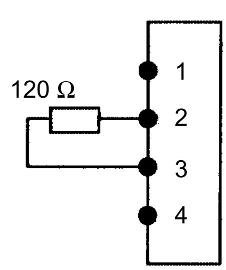
■ Communications Cables (With Connectors on both Ends)

Name	Model Number	Cable Length
MECHATROLINK Communi-cations Cables	JEPMC-W6000-A3	0.3 m
	JEPMC-W6000-A5	0.5 m
	JEPMC-W6000-01	1.0 m



■ Terminator

Name	Model Number
MECHATROLINK Communi-cations Terminator	JEPMC-W6020



Appendix A

List of MECHATROLINK Commands and Command Formats

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

A.1 MECHATROLINK Command List

MECHATROLINK common commands, motion common commands, and servo standard commands are shown in the following tables.

■ MECHATROLINK Common Command List

Code	Command	Function	Processing Classification*2	Synchronization Classification*2	Remarks
00	NOP	No Operation	N	A	-
01	PRM_RD	Read parameters	D	A	*1
02	PRM_WR	Write parameters	D	A	*1
03	ID_RD	Read ID	D	A	*1
04	CONFIG	Set up devices	D	A	*1
05	ALM_RD	Read alarm or warning	D	A	*1
06	ALM_CLR	Clear alarm or warning	C	A	*1
07	-	-	-	-	-
08	-	-	-	-	-
09	-	-	-	-	-
0A	-	-	-	-	-
0B	-	-	-	-	-
0C	-	-	-	-	-
0D	SYNC_SET	Start synchronous communications	N	A	
0E	CONNECT	Establish connection	N	A	*1
0F	DISCONNECT	Release connection	N	A	-
10	-	-	-	-	-
11	-	-	-	-	-
12	-	-	-	-	-
13	-	-	-	-	-
14	-	-	-	-	-
15	-	-	-	-	-
16	-	-	-	-	-
17	-	-	-	-	-
18	-	-	-	-	-
19	-	-	-	-	-
1A	-	-	-	-	-
1B	PPRM_RD	Read EEPROM parameters	D	A	Not supported.
1C	PPRM_WR	Write EEPROM parameters	D	A	-
1D	-	-	-	-	-
1E	-	-	-	-	-
1F	-	-	-	-	-

* 1. For details, refer to *4.3 Special Command Descriptions*.
* 2. The following abbreviations are used for processing and synchronization classifications.

Processing Classifications		Synchronization Classifications	
N	Network command	A	Asynchronous command
D	Data communications command	S	Synchronous command
C	Control command		
M	Motion command		
X	Compound command		

■ MECHATROLINK Common Motion Command List

Code	Command	Function	Processing Classification *2	Synchronization Classification *2	Remarks
20	POS_SET	Set coordinates	D	A	*1
21	BRK_ON	Apply brake	C	A	*1
22	BRK_OFF	Release brake	C	A	*1
23	SENS_ON	Turn ON sensor	C	A	*1
24	SENS_OFF	Turn OFF sensor	C	A	*1
25	HOLD	Stop motion	M	A	-
26	-	-	-	-	-
27	-	-	-	-	-
28	-	-	-	-	-
29	-	-	-	-	-
2A	-	-	-	-	-
2B	-	-	-	-	-
2C	-	-	-	-	-
2D	-	-	-	-	-
2E	-	-	-	-	-
2F	-	-	-	-	-

* 1. For details, refer to *4.3 Special Command Descriptions*.
* 2. The following abbreviations are used for processing and synchronization classifications.

Processing Classifications		Synchronization Classifications	
N	Network command	A	Asynchronous command
D	Data communications command	S	Synchronous command
C	Control command		
M	Motion command		
X	Compound command		

■ MECHATROLINK Servo Standard Command List

Code	Command	Function	Processing Classification*2	Synchronization Classification*2	Remarks
30	SMON	Status monitoring	D	A	-
31	SV_ON	Servo ON	C	A	-
32	SV_OFF	Servo OFF	C	A	-
33	-	-	-	-	-
34	INTERPOLATE	Interpolation feed	M	S	-
35	POSING	Positioning	M	A	-
36	FEED	Constant speed feed	M	A	-
37	-	-	-	-	-
38	LATCH	Interpolation feeding with position detection	M	S	-
39	EX_POSING	External input positioning	M	A	-
3A	ZRET	Parameter return	M	A	-
3B	-	-	-	-	-
3C	-	-	-	-	-
3D	-	-	-	-	-
3E	ADJ	Adjusting	X	A	*1
3F	SVCTRL	General-purpose servo control	X	A, S	-

* 1. For details see *Chapter 4.3 Special Command Descriptions*.
* 2. The following abbreviations are used for processing and synchronization classifications.

Processing Classifications		Synchronization Classifications	
N	Network command	A	Asynchronous command
D	Data communications command	S	Synchronous command
C	Control command		
M	Motion command		
X	Compound command		

A.2 MECHATROLINK Command Format List

The command formats for MECHATROLINK commands are shown in the following list.

■ Common Commands: Command/Response Format

Table A.1 Common Commands: Command Format 1

1	NOP (00H)	CONNECT (0EH)	DISCONNECT (0FH)	SYNC_SET (0DH)	ID_RD (03H)	CONFIG (04H)
2						
3						
4						
5		VER			DEVICE_CODE	
6		COM_MOD			OFFSET	
7		COM_TIME			SIZE	
8						
9						
10						
11						
12						
13						
14						
15						
16	WDT	WDT		WDT	WDT	WDT

Table A.2 Common Commands: Response Format 1

1	NOP	CONNECT	DISCONNECT	SYNC_SET	ID_RD	CONFIG
2	ALARM	ALARM		ALARM	ALARM	ALARM
3	STATUS	STATUS		STATUS	STATUS	STATUS
4						
5		VER			DEVICE_CODE	
6		COM_MOD			OFFSET	
7		COM_TIME			SIZE	
8					ID	
9						
10						
11						
12						
13						
14						
15						
16	RWDT	RWDT		RWDT	RWDT	RWDT

Table A.3 Common Commands: Command Format 2

1	PRM_RD (01H)	PRM_WR (02H)	ALM_RD (05H)	ALM_CLR (06H)	PPRM_RD (1BH)	PPRM_WR (1CH)
2						
3						
4						
5	NO	NO	ALM_RD_MOD	ALM_CLR_MOD	NO	NO
6						
7	SIZE	SIZE			SIZE	SIZE
8		PARAMETER				PARAMETER
9						
10						
11						
12						
13						
14						
15						
16	WDT	WDT	WDT	WDT	WDT	WDT

Table A.4 Common Commands: Response Format 2

1	PRM_RD	PRM_WR	ALM_RD	ALM_CLR	PPRM_RD	PPRM_WR
2	ALARM	ALARM	ALARM	ALARM	ALARM	ALARM
3	STATUS	STATUS	STATUS	STATUS	STATUS	STATUS
4						
5	NO	NO	ALM_RD_MOD	ALM_CLR_MOD		NO
6			ALM_DATA			
7	SIZE	SIZE				SIZE
8	PARAMETER	PARAMETER				PARAMETER
9						
10						
11						
12						
13						
14						
15						
16	RWDT	RWDT	RWDT	RWDT	RWDT	RWDT

■ Common Motion Commands: Command/Response Format

Table A.5 Common Motion Commands: Command Format 1

1	HOLD (25H)	POS_SET (20H)	SENS_ON (23H)	SENS_OFF (24H)	BRK_ON (21H)	BRK_OFF (22H)
2						
3	OPTION					
4						
5		PS_SUBCMD				
6		POS_DATA				
7						
8						
9						
10						
11						
12						
13	MON_SEL					
14						
15						
16	WDT	WDT	WDT	WDT	WDT	WDT

Table A.6 Common Motion Commands: Response Format 1

1	HOLD	POS_SET	SENS_ON	SENS_OFF	BRK_ON	BRK_OFF
2	ALARM	ALARM	ALARM	ALARM	ALARM	ALARM
3	STATUS	STATUS	STATUS	STATUS	STATUS	STATUS
4						
5	MONITOR1	PS_SUBCMD				
6		POS_DATA				
7						
8						
9	MONITOR2					
10						
11						
12						
13	MON_SEL					
14	I/O					
15						
16	RWDT	RWDT	RWDT	RWDT	RWDT	RWDT

A

■ Standard Servo Commands: Command/Response Format

Table A.7 Servo Standard Commands: Command Format 1

1	SMON (30H)	SV_ON (31H)	SV_OFF (32H)		INTERPOLATE (34H)	POSING (35H)
2						
3		OPTION			OPTION	OPTION
4						
5					TPOS	TPOS
6						
7						
8						
9					FF	TSPD
10						
11						
12						
13	MON_SEL	MON_SEL	MON_SEL		MON_SEL	MON_SEL
14						
15						
16	WDT	WDT	WDT		WDT	WDT

Table A.8 Servo Standard Commands: Response Format 1

1	SMON	SV_ON	SV_OFF		INTERPOLATE	POSING
2	ALARM	ALARM	ALARM		ALARM	ALARM
3	STATUS	STATUS	STATUS		STATUS	STATUS
4						
5	MONITOR1	MONITOR1	MONITOR1		MONITOR1	MONITOR1
6						
7						
8						
9	MONITOR2	MONITOR2	MONITOR2		MONITOR2	MONITOR2
10						
11						
12						
13	MON_SEL	MON_SEL	MON_SEL		MON_SEL	MON_SEL
14	I/O	I/O	I/O		I/O	I/O
15						
16	RWDT	RWDT	RWDT		RWDT	RWDT

Table A.9 Servo Standard Commands: Command Format 2

1	FEED (36H)		LATCH (38H)	EX_POSING (39H)	ZRET (3AH)	
2			LT_SGNL	LT_SGNL	LT_SGNL	
3	OPTION		OPTION	OPTION	OPTION	
4						
5			TPOS	TPOS		
6						
7						
8						
9	TSPD		FF	TSPD	TSPD	
10						
11						
12						
13	MON_SEL		MON_SEL	MON_SEL	MON_SEL	
14						
15						
16	WDT		WDT	WDT	WDT	

Table A.10 Servo Standard Commands: Response Format 2

1	FEED		LATCH	EX_POSING	ZRET	
2	ALARM		ALARM	ALARM	ALARM	
3	STATUS		STATUS	STATUS	STATUS	
4						
5	MONITOR1		MONITOR1	MONITOR1	MONITOR1	
6						
7						
8						
9	MONITOR2		MONITOR2	MONITOR2	MONITOR2	
10						
11						
12						
13	MON_SEL		MON_SEL	MON_SEL	MON_SEL	
14	I/O		I/O	I/O	I/O	
15						
16	RWDT		WDT	WDT	WDT	

Table A.11 Servo Standard Commands: Command Format 3

1			ADJ (3EH)	SVCTRL (3FH)		
2			00	SUBCMD		
3				OPTION		
4						
5			CMD	TPOS		
6			ADDRESS			
7						
8			DATA			
9				TSPD or FF		
10						
11						
12						
13				MON_SEL		
14				SQ_CMD		
15						
16			WDT	WDT		

Table A.12 Servo Standard Commands: Response Format 3

1			ADJ	SVCTRL		
2			ALARM	ALARM		
3			STATUS	STATUS		
4						
5			ANS	MONITOR1		
6			ADDRESS			
7						
8			DATA			
9				MONITOR2		
10						
11						
12						
13				MON_SEL		
14				I/O		
15						
16			RWDT	RWDT		

Appendix B

List of Parameters

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

B.1 Parameters

The following list shows parameters and their settings.

IMPORTANT

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

B

Table B.1 Parameters List

Category	Parameter No.	Name	Size	Unit	Setting Range	Factory Setting	Reference
Function Selection Parameters	Pn000	Function Selection Basic Switches (See note 3.)	2	-	-	0010	6.2.1
	Pn001	Function Selection Application Switches 1 (See notes 1 and 3.)	2	-	-	0000	6.2.2, 6.5.1
	Pn002	Function Selection Application Switches 2 (See note 3.)	2	-	-	0000	6.2.4, 6.6.1
	Pn003	Function Selection Application Switches 3	2	-	-	0002	6.4.6, H-6.5
	Pn004	Reserved parameters (Do not change.)	2	-	-	0000	-
	Pn005	Function Selection Application Switches 5 (See note 3.)	2	-	-	0000	6.5.2
Gain-related Parameters	Pn100	Speed Loop Gain	2	Hz	1 to 2000	40	H-6.2.1
	Pn101	Speed Loop Integral Time Constant	2	0.01 ms	15 to 51200	2000	H-6.2.1
	Pn102	Position Loop Gain	2	1/s	1 to 2000	40	H-6.2.1
	Pn103	Inertia Ratio	2	%	0 to 10000	0	H-6.2.1, H-6.3.3
	Pn104	Reserved parameters (Do not change.)	2	Hz	1 to 2000	40	-
	Pn105		2	0.01 ms	15 to 51200	2000	-
	Pn106		2	1/s	1 to 2000	40	-
	Pn107	Bias	2	min^{-1}	0 to 10000	0	H-6.2.4
	Pn108	Bias Width Addition	2	Reference units	0 to 250	7	H-6.2.4
	Pn109	Feed-forward	2	%	0 to 100	0	H-6.2.2
	Pn10A	Feed-forward Filter Time Constant	2	0.01 ms	0 to 6400	0	H-5.2.5
	Pn10B	Gain-related Application Switches	2	-	-	0000	H-6.2.5
	Pn10C	Mode Switch Torque Reference	2	%	0 to 800	200	H-6.2.5

Note: The prefix “H-” of the section number in the reference column refers to the Σ-*II Series SGM□H/SGDH User’s Manual: Design and Maintenance (SIE-S800-32.2)*.

Category	Parameter No.	Name	Size	Unit	Setting Range	Factory Setting	Reference
Gain-related Parameters	Pn10D	Mode Switch Speed Reference	2	min^{-1}	0 to 10000	0	H-6.2.5
	Pn10E	Mode Switch Acceleration	2	10 min^{-1}/s	0 to 3000	0	H-6.2.5
	Pn10F	Mode Switch Error Pulse	2	Reference units	0 to 10000	0	H-6.2.5
	Pn110	Online Autotuning Switches	2	-	-	0010	H-6.3.4
	Pn111	Speed Feedback Compensation (See note 2.)	2	-	1 to 100	100	H-6.2.6
	Pn112	Reserved parameters (Do not change.)	2	%	0 to 1000	100	-
	Pn113		2	-	0 to 10000	1000	-
	Pn114		2	-	0 to 400	200	-
	Pn115		2	-	0 to 1000	32	-
	Pn116		2	-	0 to 1000	16	-
	Pn117		2	%	20 to 100	100	-
	Pn118		2	%	50 to 100	100	-
	Pn119		2	1/S	1 to 2000	50	-
	Pn11A		2	0.1%	1 to 2000	1000	-
	Pn11B		2	Hz	1 to 150	50	-
	Pn11C		2	Hz	1 to 150	70	-
	Pn11D		2	%	0 to 150	100	-
	Pn11E		2	%	0 to 150	100	-
	Pn11F		2	ms	0 to 2000	0	-
	Pn120		2	0.01 ms	0 to 51200	0	-
	Pn121		2	Hz	10 to 250	50	-
	Pn122		2	Hz	0 to 250	0	-
	Pn123		2	%	0 to 100	0	-
Position-related Parameters	Pn200	Reserved parameters (Do not change.)	2	-	-	0100	-
	Pn201		2	P/R	16 to 16384	16384	-
	Pn202	Electronic Gear Ratio (Numerator) (See note 3.)	2	-	1 to 65535	4	6.3.2
	Pn203	Electronic Gear Ratio (Denominator) (See note 3.)	2	-	1 to 65535	1	6.3.2
	Pn204	Reserved parameters (Do not change.)	2	0.01 ms	0 to 6400	0	-
	Pn205	Multi-turn Limit Setting (See notes 1 and 3.)	2	rev	0 to 65535	65535	6.6.3
	Pn206	Number of Fully Closed Encoder Pulses	2	P/R	513 to 65535	16384	6.2.4
	Pn207	Reserved parameters (Do not change.)	2	-	-	0010	-
	Pn208		2	0.01 ms	0 to 6400	0	-

Note: The prefix "H-" of the section number in the reference column refers to the Σ-*II Series SGM□H/SGDH User's Manual : Design and Maintenance (SIE-S800-32.2)*.

B

Category	Parameter No.	Name	Size	Unit	Setting Range	Factory Setting	Reference
Speed-related Parameters	Pn300	Reserved parameters (Do not change.)	2	0.01 V/ rated speed	150 to 3000	600	-
	Pn301		2	min^{-1}	0 to 10000	100	-
	Pn302		2	min^{-1}	0 to 10000	200	-
	Pn303		2	min^{-1}	0 to 10000	300	-
	Pn304	Jog Speed	2	min^{-1}	0 to 10000	500	H-5.3.2
	Pn305	Soft Start Acceleration Time	2	ms	0 to 10000	0	H-6.1.1
	Pn306	Soft Start Deceleration Time	2	ms	0 to 10000	0	H-6.1.1
	Pn307	Reserved parameters (Do not change.)	2	0.01 ms	0 to 65535	40	-
	Pn308	Speed F/B Filter Time Constant	2	0.01 ms	0 to 65535	0	-
Torque-related Parameters	Pn400	Reserved parameters (Do not change.)	2	0.1 V/rated torque	10 to 100	30	-
	Pn401	Torque Reference Filter Time Constant	2	0.01 ms	0 to 65535	100	H-6.1.5
	Pn402	Forward Torque Limit	2	%	0 to 800	800	H-5.1.3
	Pn403	Reverse Torque Limit	2	%	0 to 800	800	H-5.1.3
	Pn404	External Input Forward Torque Limit	2	%	0 to 800	100	H-5.1.3
	Pn405	External Input Reverse Torque Limit	2	%	0 to 800	100	H-5.1.3
	Pn406	Emergency Stop Torque	2	%	0 to 800	800	6.2.2
	Pn407	Reserved parameters (Do not change.)	2	min^{-1}	0 to 10000	10000	-
	Pn408	Torque Control Function Switches	2	-	-	0000	H-6.1.6
	Pn409	Notch Filter Frequency	2	Hz	50 to 2000	2000	H-6.1.6

Note: The prefix “H-” of the section number in the reference column refers to the Σ-*II Series SGM□H/SGDH User’s Manual : Design and Maintenance (SIE-S800-32.2)*.

Category	Parameter No.	Name	Size	Unit	Setting Range	Factory Setting	Reference
Sequence-related Parameters	Pn500	Positioning Completed Width	2	Reference units	0 to 250	7	H-6.3.4
	Pn501	Reserved parameters (Do not change.)	2	min^{-1}	0 to 10000	10	-
	Pn502	Rotation Detection Level	2	min^{-1}	1 to 10000	20	H-5.5.5
	Pn503	Reserved parameters (Do not change.)	2	min^{-1}	0 to 100	10	-
	Pn504	NEAR Signal Width	2	Reference units	1 to 250	7	H-6.3.4
	Pn505	Overflow Level	2	256 reference units	1 to 32767	1024	H-6.2.1
	Pn506	Brake Reference Servo OFF Delay Time	2	10 ms	0 to 50	0	6.5.2
	Pn507	Brake Reference Output Speed Level	2	min^{-1}	0 to 10000	100	6.5.2
	Pn508	Timing for Brake Reference Output during Motor Operation	2	10 ms	10 to 100	50	6.5.2
	Pn509	Momentary Hold Time	2	ms	20 to 1000	20	H-5.5.9
	Pn50A	Input Signal Selections 1 (See note 3.)	2	-	-	2881	6.2.2, 6.4.2
	Pn50B	Input Signal Selections 2 (See note 3.)	2	-	-	6583	6.4.2
	Pn50C	Reserved parameters (Do not change.)	2	-	-	8888	-
	Pn50D		2	-	-	8888	-
	Pn50E	Output Signal Selections 1	2	-	-	3211	6.4.3
	Pn50F	Output Signal Selections 2	2	-	-	0000	6.4.3
	Pn510	Output Signal Selections 3	2	-	-	0000	6.4.3
	Pn511	Input Signal Selections 5 (See note 3.)	2	-	-	8888	6.4.2
	Pn512	Output Signal Reversal	2	-	-	0000	6.4.3
Other Parameters	Pn600	Regenerative Resistor Capacity (See note 4.)	2	10 W	0 to capacity (See note 5.)	0	H-5.6.1
	Pn601	Reserved parameter (Do not change.)	2	-	0 to capacity (See note 5.)	0	-
MECHATROLINK Parameters	Pn800	Communications Control	2	-	-	0000	6.4.5
Sequence-related Parameters	Pn801	Function Selection Application (Software Limits)	2	-	-	0000	6.2.3
	Pn802	Command Mask	2	-	-	0000	6.4.4
	Pn803	Zero Point Width	2	Reference units	0 to 250	10	6.3.4

Note: The prefix “H-” of the section number in the reference column refers to the *Σ-II Series SGM□H/SGDH User’s Manual : Design and Maintenance (SIE-S800-32.2)*.

Category	Parameter No.	Name	Size	Unit	Setting Range	Factory Setting	Reference
Position-related Parameters	Pn804	Forward software limit	4	Reference units	$-2^{30}+1$ to $2^{30}-1$	8192 ×99999	6.2.3
	Pn806	Reverse software limit	4	Reference units	$-2^{30}+1$ to $2^{30}-1$	-8192 ×99999	6.2.3
	Pn808	Absolute encoder zero point position offset	4	Reference units	$-2^{30}+1$ to $2^{30}-1$	0	6.6.4
Acceleration/ Deceleration	Pn80A	First-step linear acceleration parameter	2	10000 reference units/s^2	0 to 65535	100	6.3.3
	Pn80B	Second-step linear acceleration parameter	2	10000 reference units/s^2	0 to 65535	100	6.3.3
	Pn80C	Acceleration parameter switching speed	2	100 reference units/s	0 to 65535	0	6.3.3
	Pn80D	First-step linear deceleration parameter	2	10000 reference units/s^2	0 to 65535	100	6.3.3
	Pn80E	Second-step linear deceleration parameter	2	10000 reference units/s^2	0 to 65535	100	6.3.3
	Pn80F	Deceleration parameter switching speed	2	100 reference units/s	0 to 65535	0	6.3.3
Acceleration/ Deceleration Filter	Pn810	Exponential acceleration/ deceleration bias	2	100 reference units/s	0 to 65535	0	6.3.3
	Pn811	Exponential acceleration/ deceleration time constant	2	0.1 ms	0 to 5100	0	6.3.3
	Pn812	Running average time	2	0.1 ms	0 to 5100	0	6.3.3
Monitor	Pn813	Option monitor	2	-	-	0000	6.4.6
Supplementary Commands	Pn814	Final travel distance for external positioning	4	Reference units	$-2^{30}+1$ to $2^{30}-1$	100	6.3.4
	Pn816	Zero point return direction	2	-	-	0000	6.3.4
	Pn817	Zero point return approach speed 1	2	100 reference units/s	0 to 65535	50	6.3.4
	Pn818	Zero point return approach speed 2	2	100 reference units/s	0 to 65535	5	6.3.4
	Pn819	Final travel distance to return to zero point	4	Reference units	$-2^{30}+1$ to $2^{30}-1$	100	6.3.4

Note: The prefix “H-” of the section number in the reference column refers to the Σ-*II Series SGM□H/SGDH User’s Manual : Design and Maintenance (SIE-S800-32.2)*.

* 1. The multiturn limit must be changed only for special applications. Changing this limit inappropriately or unintentionally can be dangerous.

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

* 3. After changing these parameters, turn OFF the main circuit and control power supplies and then turn them ON again 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 SERVOPACK.

B.2 Memory Switches

The following list shows the memory switches and their factory settings.

Table B.2 Memory Switches List

Parameter	Digit Place	Name	Setting	Contents	Factory 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	Reserved (Do not change.)	0 to B	-	1
	2	Axis Address	0 to F	-	0
	3	Not used.	-	-	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	Overtravel Stop Mode	0	Same setting as Pn001.0 (Stops the motor by applying DB or by coasting.)	0
			1	Sets the torque of Pn406 to the maximum value, decelerates the motor to a stop, and then sets it to servolock state.	
			2	Sets the torque of Pn406 to the maximum value, decelerates the motor to a stop, and then sets it to coasting state.	
	2	DC Power Applications	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	Reserved (Do not change.)	0 to 2	-	0
	1	Reserved (Do not change.)	0, 1	-	0
	2	Absolute Encoder Usage	0	Uses absolute encoder as an absolute encoder.	0
			1	Uses absolute encoder as an incremental encoder.	
	3	Fully Closed Encoder Usage	0	Do not use.	0
			1	For use without phase C	
			2	For use with phase C	
			3	For use in Reverse Rotation Mode without phase C.	
			4	For use in Reverse Rotation Mode with phase C.	

B

Table B.2 Memory Switches List

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn003 Function Selection Application Switches	0, 1	Analog Monitor 1 Torque Reference Monitor Analog Monitor 2 Speed Reference Monitor	0	Motor speed: 1 V/1000 min^{-1}.	0, 2
			1	Speed reference: 1 V/1000 min^{-1}.	
			2	Torque reference: 1 V/100%	
			3	Position error: 0.05 V/1 pulse	
			4	Position error: 0.05 V/100 pulse	
			5	Reference pulse frequency (converted to min^{-1}): 1 V/1000 min^{-1}.	
			6	Motor speed × 4: 1 V/250 min^{-1}.	
			7	Motor speed × 8: 1 V/125 min^{-1}.	
			8	Reserved parameters (Do not change.)	
			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	I-P Control	0	Performs speed loop using PI control.	0
			1	Performs speed loop using I-P control.	
	2	Not used.	0	-	0
	3	Not used.	0	-	0

Table B.2 Memory Switches List

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
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 parameters (Do not change.)	0 to 3	-	0
Pn200 Position Control References Selection Switches	0	Reserved (Do not change.)	0 to 9	-	0
	1	Reserved (Do not change.)	0 to 3	-	0
	2	Reserved (Do not change.)	0 to 2	-	1
	3	Reserved (Do not change.)	0, 1	-	0
Pn408 Torque Function Switches	0	Notch Filter Selection	0	Disabled.	0
			1	Uses a notch filter for torque reference.	
	1	Not used.	-	-	0
	2	Not used.	-	-	0
	3	Not used.	-	-	0

B

B

B.3 Input Signal Selections

The following list shows input signal selections and their factory settings.

Table B.3 Input Signal Selections List

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn50A	0	Reserved (Do not change.)	0, 1	-	1
	1	Reserved (Do not change.)	0 to F	-	8: OFF
	2	Reserved (Do not change.)	0 to F	-	8: OFF
	3	P-OT Signal Mapping (Overtravel when high.)	0	Inputs from the SI0 (CN1-40) input terminal.	2: SI2
			1	Inputs from the SI1 (CN1-41) input terminal.	
			2	Inputs from the SI2 (CN1-42) input terminal.	
			3	Inputs from the SI3 (CN1-43) input terminal.	
			4	Inputs from the SI4 (CN1-44) input terminal.	
			5	Inputs from the SI5 (CN1-45) input terminal.	
			6	Inputs from the SI6 (CN1-46) input terminal.	
			7	Sets signal ON.	
			8	Sets signal OFF.	
			9	Inputs the reverse signal from the SI0 (CN1-40) input terminal.	
			A	Inputs the reverse signal from the SI1 (CN1-41) input terminal.	
			B	Inputs the reverse signal from the SI2 (CN1-42) input terminal.	
			C	Inputs the reverse signal from the SI3 (CN1-43) input terminal.	
			D	Inputs the reverse signal from the SI4 (CN1-44) input terminal.	
			E	Inputs the reverse signal from the SI5 (CN1-45) input terminal.	
			F	Inputs the reverse signal from the SI6 (CN1-46) input terminal.	
Pn50B	0	N-OT Signal Mapping (Overtravel when high.)	0 to F	Same as above.	3: SI3
	1	Reserved parameters (Do not change.)	0 to F	Same as above.	8: OFF
	2	/P-CL Signal Mapping (Torque control when low.)	0 to F	Same as above.	5: SI5
	3	/N-CL Signal Mapping (Torque control when low.)	0 to F	Same as above.	6: SI6

Table B.3 Input Signal Selections List

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn50C	0	Reserved (Do not change.)	0 to F	-	8: OFF
	1	Reserved (Do not change.)	0 to F	-	8: OFF
	2	Reserved (Do not change.)	0 to F	-	8: OFF
	3	Reserved (Do not change.)	0 to F	-	8: OFF
Pn50D	0	Reserved (Do not change.)	0 to F	-	8: OFF
	1	Reserved (Do not change.)	0 to F	-	8: OFF
	2	Reserved (Do not change.)	0 to F	-	8: OFF
	3	Reserved (Do not change.)	0 to F	-	8: OFF

Table B.3 Input Signal Selections List

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn511	0	/DEC Signal Mapping (Deceleration when low.)	1	Inputs from the SI1 (CN1-41) input terminal.	8: OFF
			2	Inputs from the SI2 (CN1-42) input terminal.	
			3	Inputs from the SI3 (CN1-43) input terminal.	
			4	Inputs from the SI4 (CN1-44) input terminal.	
			5	Inputs from the SI5 (CN1-45) input terminal.	
			6	Inputs from the SI6 (CN1-46) input terminal.	
			7	Sets signal ON.	
			8	Sets signal OFF.	
			9	Inputs the reverse signal from the SI0 (CN1-40) input terminal.	
			A	Inputs the reverse signal from the SI1 (CN1-41) input terminal.	
			B	Inputs the reverse signal from the SI2 (CN1-42) input terminal.	
			C	Inputs the reverse signal from the SI3 (CN1-43) input terminal.	
			D	Inputs the reverse signal from the SI4 (CN1-44) input terminal.	
			E	Inputs the reverse signal from the SI5 (CN1-45) input terminal.	
			F	Inputs the reverse signal from the SI6 (CN1-46) input terminal.	
	1	/EXT1 Signal Mapping (EXT1 when low.)	0 to 3	Sets signal OFF.	8: OFF
			4	Inputs from the SI4 (CN1-44) input terminal.	
			5	Inputs from the SI5 (CN1-45) input terminal.	
			6	Inputs from the SI6 (CN1-46) input terminal.	
			7	Sets signal ON.	
			8	Sets signal OFF.	
			D	Inputs the reverse signal from the SI4 (CN1-44) input terminal.	
			E	Inputs the reverse signal from the SI5 (CN1-45) input terminal.	
			F	Inputs the reverse signal from the SI6 (CN1-46) input terminal.	
			9 to F	Sets signal OFF.	
	2	/EXT2 Signal Mapping (EXT2 when low.)	0 to F	Same as above.	8: OFF
	3	/EXT3 Signal Mapping (EXT3 when low.)	0 to F	Same as above.	8: OFF

B.4 Output Signal Selections

The following list shows output signal selections and their factory settings.

Table B.4 Output Signal Selections List

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn50E	0	/COIN Signal Mapping	0	Disabled.	1: SO1
			1	Outputs from the SO1 output terminal.	
			2	Outputs from the SO2 output terminal.	
			3	Outputs from the SO3 output terminal.	
	1	Reserved (Do not change.)	0 to 3	-	1: SO1
	2	/TGON Signal Mapping	0	Disabled.	2: SO2
			1	Outputs from the SO1 output terminal.	
			2	Outputs from the SO2 output terminal.	
			3	Outputs from the SO3 output terminal.	
	3	/S-RDY Signal Mapping	0 to 3	Same as above.	3: SO3
Pn50F	0	/CLT Signal Mapping	0 to 3	Same as above.	0: Not used
	1	/VLT Signal Mapping	0 to 3	Same as above.	0: Not used
	2	/BK Signal Mapping	0 to 3	Same as above.	0: Not used
	3	/WARN Signal Mapping	0 to 3	Same as above.	0: Not used
Pn510	0	/NEAR Signal Mapping	0 to 3	Same as above.	0: Not used
	1	/C-PULS Signal Mapping	0 to 3	Same as above.	0: Not used
	2	Reserved (Do not change.)	-	-	0
	3	Reserved (Do not change.)	-	-	0
Pn512	0	Output Signal Reversal for SO1	0	Output signal is not reversed.	0: Not reversed
			1	Output signal is reversed.	
	1	Output Signal Reversal for SO2	0	Output signal is not reversed.	0: Not reversed
			1	Output signal is reversed.	
	2	Output Signal Reversal for SO3	0	Output signal is not reversed.	0: Not reversed
			1	Output signal is reversed.	
	3	Reserved (Do not change.)	-	-	0

Note: 1. When more than one signal is allocated to the same output circuit, data is output using OR logic.
2. Depending on the control mode, undetected signals are treated as OFF. For example, in the speed control mode, the /COIN signal is treated as OFF.
3. Types of /WARN signals: Overload, regenerative overload, communications warnings, data settings warnings, and command warnings.

B.5 MECHATROLINK Communications Setting Parameters

The following table is a list of parameters for MECHATROLINK communications settings.

Table B.5 MECHATROLINK Communications Settings Parameters List

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn800	0	MECHATROLINK Communications Check Mask	0	Normal.	0
			1	Ignore communications error.	
			2	Ignore WDT error.	
			3	Ignore both communications and WDT errors.	
	1	Not used.	-	-	0
	2	Not used.	-	-	0
	3	Not used.	-	-	0
Pn801	0	Soft Limit Function	0	Soft limit enabled.	0
			1	Forward soft limit disabled.	
			2	Reverse soft limit disabled.	
			3	Soft limit disabled in both directions.	
	1	Soft Limit Operation Selection	0	Operation from the machine coordinate system absolute position (APOS)	0
			1	Operation from the reference coordinate system absolute position (APOS)	
	2	Soft Limit Check Using Commands	0	No soft limit check using commands.	0
			1	Soft limit check using commands.	
	3	Not used.	-	-	0
Pn802	0	SV_ON Command Mask	0	SV_ON/SV_OFF commands enabled.	0
			1	Servo always ON.	
	1	SENS_ON Command Mask	0	SENS_ON/SENS_OFF commands enabled.	0
			1	Servo always ON.	
	2	Not used.	-	-	0
	3	Not used.	-	-	0
Pn813	0	Option Monitor 1	0	As for Analog Monitor 1. (Pn003.0)	0
			1	As for Analog Monitor 2. (Pn003.1)	
			2	Monitors initial multi-rotation data. (IMTDATA)	
			3	Monitors the encoder count value. (PGCNT)	
	1	Option Monitor 2	0 to 3	Same as above.	1
	2	Not used.	-	-	0
	3	Not used.	-	-	0
Pn816	0	Return to Zero point Direction	0	Forward.	0
			1	Reverse.	
	1	Not used.	-	-	0
	2	Not used.	-	-	0
	3	Not used.	-	-	0

Appendix C

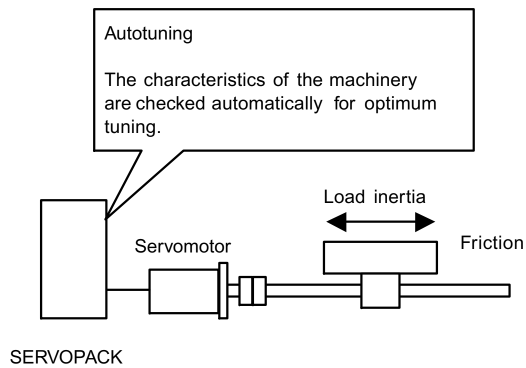
Using the Adjusting Command (ADJ: 3EH)

C

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

C.1 Autotuning

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



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

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

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

C.1.1 Online Autotuning

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

Online autotuning may not work well in the following cases.

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

Disable the online autotuning function if tuning is not possible. Refer to 6.4.3 Making Manual Adjustments of the Σ-*II Series SGM□H/SGDH User's Manual : Design and Maintenance (SIE-S800-32.2)*.

IMPORTANT

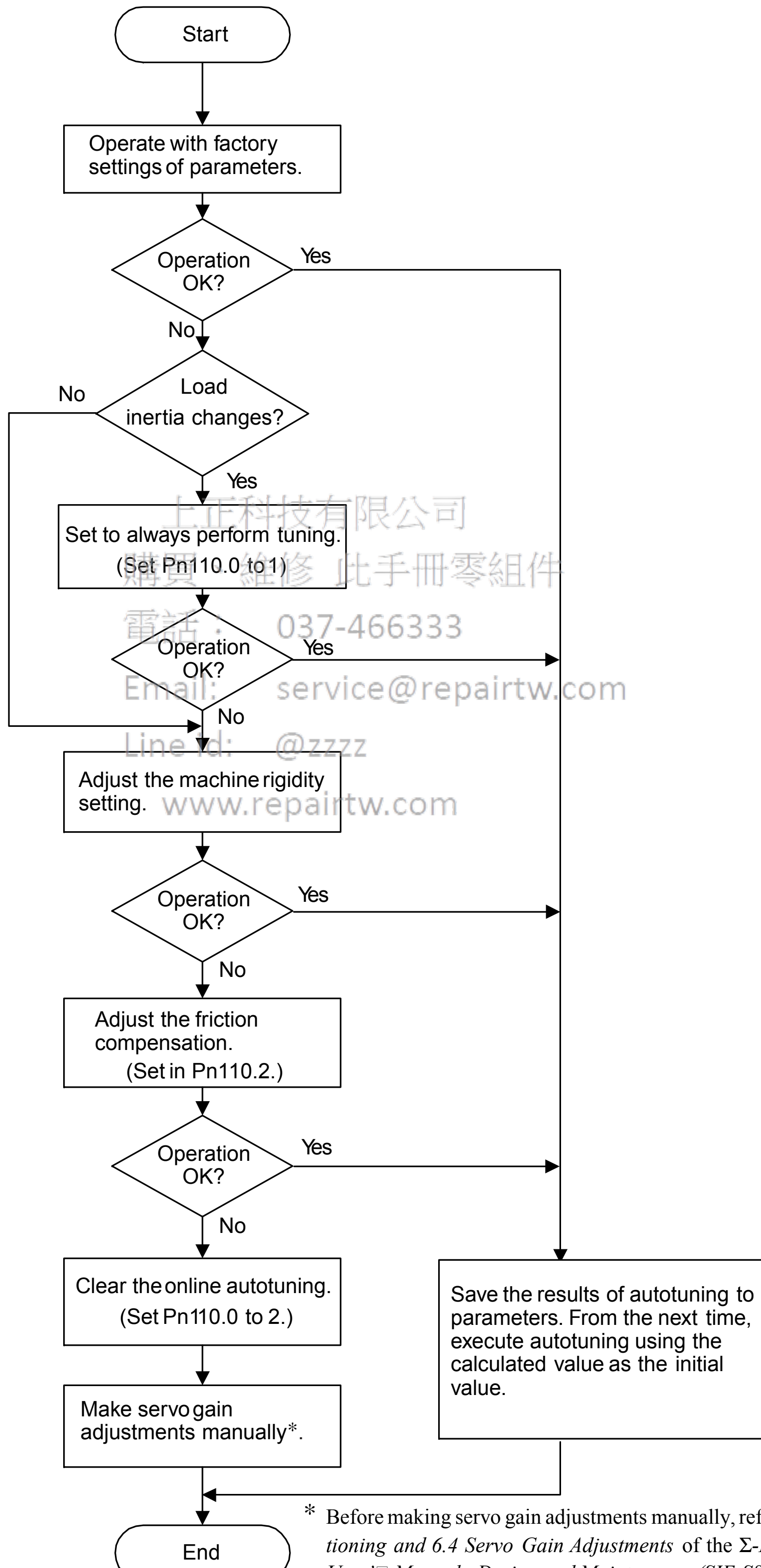
Do not use online autotuning in the following cases.

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

C

■ Setting Parameters for Online Autotuning

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



* Before making servo gain adjustments manually, refer to *6.2 High-speed Positioning* and *6.4 Servo Gain Adjustments* of the *Σ-II Series SGM□H/SGDH User's Manual : Design and Maintenance (SIE-S800-32.2).*

C.1.2 Machine Rigidity Settings for Online Autotuning

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

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

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

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

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

INFO

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

■ Changing the Machine Rigidity Setting

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

The procedure for making changes is shown below.

INFO

It is also possible to use a Digital Operator to change settings. Refer to the Σ-*II Series SGM□H/SGDH User's Manual : Design and Maintenance (SIE-S800-32.2)*.

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

	Command	Response	
5	CMD	ANS	CMD: Command ANS: Answer ADDRESS: Setting/reference address DATA: Setting/reference data
6	ADDRESS	ADDRESS	
7			
8	DATA	DATA	
9			

2. Send the following data in each command field.

   Set "01H" (Data setting) in the CMD field.

   Set "2003H" in the ADDRESS field.

   Set 1 to 10 in the DATA field.

3. After setting the data, send the command.

   It takes approximately 1 second after sending for setting to be completed.

   Continue to send the same command during this time.

4. Use the following data reference command to check when settings have been completed.

   Set "00H" (Data reference) in the CMD field.

   Set "2003H" in the ADDRESS field.

5. After setting the data, send the command.

   If a response is returned with the rigidity setting that is being made, the rigidity setting has been completed.

This completes changing the machine rigidity setting using online autotuning.

C.1.3 Saving Results of Online Autotuning

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

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

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

Pn103	Inertia Ratio	Unit: %	Setting Range: 0 to 10000	Factory Setting: 100	Position Control

$$\text{Inertia ratio} = \frac{\text{Motor axis conversion load inertia } (J_L)}{\text{Servomotor rotor of inertia } (J_M)} \times 100(\%)$$

The inertia ratio is factory-set to 0%.

IMPORTANT

Before making servo gain adjustments manually, be sure to set the inertia ratio in Pn103. If the inertia ratio is incorrect, the speed loop gain (in 1-Hz increments) set in Pn100 will be wrong.

■ Procedure for Saving Results of Online Autotuning

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

The procedure for saving results is shown below.

INFO

It is also possible to use a Digital Operator to save settings. Refer to the *Σ-II Series SGM□H/SGDH User's Manual : Design and Maintenance (SIE-S800-32.2)*.

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

	Command	Response	
5	CMD	ANS	CMD: Command ANS: Answer ADDRESS: Setting/reference address DATA: Setting/reference data
6	ADDRESS	ADDRESS	
7			
8	DATA	DATA	
9			

2. Send the following data in each command field.

   Set “01H” (Data setting) in the CMD field.

   Set “2000H” in the ADDRESS field.

   Set “1007H” in the DATA field.

3. After setting the data, send the command.

   The Online Autotuning Results Write Mode will be entered.

4. Continue by using the following data setting command.

   Set “01H” (Data setting) in the CMD field.

   Set “2001H” in the ADDRESS field.

   Set “01H” (Execute) in the DATA field.

5. After setting the data, send the command.

   It takes approximately 1 second to save settings.

   Continue to send the same command during this time.

This completes saving the online autotuning results.

C.1.4 Parameters Related to Online Autotuning

This section provides information on a variety of parameters related to online autotuning.

■ Online Autotuning Method

The following parameter is used to set the autotuning conditions.

Pn110.0	Online Autotuning Method	Factory Setting: 0	Position Control

Pn110.0 Setting	Description
0	Autotuning is performed only when the system runs for the first time after the power is turned ON. After the load inertia is calculated, the calculated data is not refreshed.
1	Autotuning is continuously performed (inertia value calculation).
2	The online autotuning function is not used.

C

This parameter is factory-set to "0." If the load inertia change is minimal or if the application makes few changes, there is no need to continue calculating the inertia while the system is in operation. Instead, continue to use the value that was calculated when the system was first started up.

Set this parameter to "1" if the load inertia always fluctuates due to the load conditions. Then the response characteristics can be kept stable by continuously refreshing the inertia calculation data and reflecting them in the servo gain.

If the load inertia fluctuation results within 200 ms, the inertia calculation data may not be refreshed properly. If that happens, set Pn110.0 to "0" or "2."

Set Pn110.0 to "2" if autotuning is not available or if the online autotuning function is not used because the load inertia is already known and the SERVOPACK is manually adjusted by setting the inertia ratio data in Pn103.

■ Speed Feedback Compensation Selection

Use the following parameter to enable or disable speed feedback compensation. Refer to *6.2.6 Speed Feedback Compensation* of the *Σ-II Series SGM☐H/SGDH User's Manual : Design and Maintenance (SIE-S800-32.2)*.

This parameter can be left as it is if online autotuning is performed. If this parameter is set manually, however, the setting is reflected to the operational setting made during online autotuning.

Pn110.1	Speed Feedback Compensation Selection	Factory Setting: 1	Position Control

Pn110.1 Setting	Description
0	Enabled
1	Disabled

■ Friction Compensation Selection

Use the following parameter to enable or disable friction compensation to determine whether or not the friction of the servo system is to be taken into consideration for the calculation of load inertia.

If this compensation function is enabled, select small or large friction compensation according to the extent of friction in order to ensure highly precise load inertia calculation.

Pn110.2	Friction Compensation Selection	Factory Setting: 1	Position Control

Pn110.2 Setting	Description
0	Friction compensation: Disabled
1	Friction compensation: Small
2	Friction compensation: Large

INFO

1. Do not set friction compensation for loads with low friction (10% rated torque/speed or less).
2. Autotuning will be performed as if the load inertia was 30 times the motor inertia when the load inertia exceeds 30 times the motor inertia.

C.2 Absolute Encoder Setup (Initialization)

The Adjusting (ADJ: 3EH) command can be used to setup (initialize) the absolute encoder.

The setup procedure is outline below.

INFO

It is also possible to use a Digital Operator to change settings. Refer to *5.7.4 Absolute Encoder Setup* of the Σ-*II Series SGM□H/SGDH User's Manual : Design and Maintenance (SIE-S800-32.2)*.

1. By setting byte 1 of the MECHATROLINK command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CMD	ANS	CMD: Serial communications command ANS: Serial communications answer ADDRESS: Setting/reference address DATA: Setting/reference data
6	ADDRESS	ADDRESS	
7			
8	DATA	DATA	
9			

2. Send the following data in each command field.
   Set "01H" (Data setting) in the CMD field.
   Set "2000H" in the ADDRESS field.
   Set "1008H" in the DATA field.
3. After setting the data, send the command.
   The absolute encoder will enter the Setup Mode.
4. Continue by using the following data setting command to save the settings.
   Set "01H" (Data setting) in the CMD field.
   Set "2001H" in the ADDRESS field.
   Set "02H" (Save) in the DATA field.
5. After setting the data, send the command.
6. Send the following command to execute.
   Set "01H" (Data reference) in the CMD field.
   Set "2001H" in the ADDRESS field.
   Set "01H" (Execute) in the DATA field.
7. After setting the data, send the command.
   It approximately 2 seconds after sending for setting to be completed.
   Continue to send the same command during this time.

This completes setting up the absolute encoder.

C.3 Multiturn Limit Setting

The Adjusting command (ADJ: 3EH) can be used to set the multiturn limit.

Use the following setting procedure.

INFO

It is also possible to use a Digital Operator to make settings. Refer to *5.7.6 Multiturn Limit Setting* of the *SGM□H/SGDH User's Manual : Design and Maintenance (SIE-S800-32.2)*.

C

1. By setting byte 1 of the MECHATROLINK command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CMD	ANS	CMD: Command ANS: Answer ADDRESS: Setting/reference address DATA: Setting/reference data
6	ADDRESS	ADDRESS	
7			
8	DATA	DATA	
9			

2. Send the following data in each command field.
   Set "01H" (Data setting) in the CMD field.
   Set "2000H" in the ADDRESS field.
   Set "1013H" in the DATA field.
3. After setting the data, send the command.
   The Multiturn Limit Setting Mode will be entered.
4. Continue by using the following data setting commands to save the settings.
   Set "01H" (Data setting) in the CMD field.
   Set "2001H" in the ADDRESS field.
   Set "02H" (Save) in the DATA field.
5. After setting the data, send the command.
6. Send the following command to execute.
   Set "01H" (Data reference) in the CMD field.
   Set "2001H" in the ADDRESS field.
   Set "01H" (Execute) in the DATA field.
7. After setting the data, send the command.
   It takes approximately 2 seconds after sending for setting to be completed.
   Continue to send the same command during this time.

This completes setting the multiturn limit.

C.4 Automatic Offset Adjustment of Motor Current Detection Signals

The offset adjustment of the motor current detection signals has already been made before shipping the product. Therefore, it is not necessary for the users to make any adjustment. Use the automatic offset adjustment only if the torque ripple due to current offset is considered abnormally high or the torque ripple needs to be reduced to achieve higher accuracy.

The adjustment procedure is outlined below.

INFO

The automatic adjustment is possible only when the Servo is set to OFF with the main circuit power turned ON.

C

1. By setting byte 1 of the MECHATROLINK command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CMD	ANS	CMD: Command ANS: Answer ADDRESS: Setting/reference address DATA: Setting/reference data
6	ADDRESS	ADDRESS	
7			
8	DATA	DATA	
9			

2. Send the following data in each command field.

   Set “01H” (Data setting) in the CMD field.

   Set “2000H” in the ADDRESS field.

   Set “100EH” in the DATA field.

3. After setting the data, send the command.

   The automatic offset adjustment of motor current detection signals will be enabled.

4. Continue by using the following data setting command to execute the settings.

   Set “01H” (Data setting) in the CMD field.

   Set “2001H” in the ADDRESS field.

   Set “01H” (Execute) in the DATA field.

5. After setting the data, send the command.

   It takes approximately 2 seconds after sending for setting to be completed.

   Continue to send the same command during this time.

This completes setting up the automatic offset adjustment of the motor current detection signals.

C

C.5 Enabling the Panel Operator

If the Panel Operator indicator (LED) is turned OFF (refer to *7.3 Panel Operator Indicators*) by receiving a MECHATROLINK command, it can be lit by using an adjustment command (ADJ: 3EH) provided that no Hand-held Digital Operator is connected or no communications is taking place with personal computers.

Use the following setting procedure.

1. By setting byte 1 of the MECHATROLINK command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CMD	ANS	CMD: Command ANS: Answer ADDRESS: Setting/reference addresses DATA: Setting/reference data
6	ADDRESS	ADDRESS	
7			
8	DATA	DATA	
9			

2. Send the following data to each command field.

   Set “01H” (Data setting) in the CMD field.

   Set “2002H” in the ADDRESS field.

   Set “Desired data” in the DATA field.

3. When the settings are completed, send the command to enable the Panel Operator.

Appendix D

Σ-II Series Command Compatibility

This appendix describes the differences between the Σ-II Series and Σ Series products. Here, the Σ-II Series refers to the SGDH-□□□E + JUSTP-NS100 (referred to as simply the "SGDH"). The Σ Series refers to the SGDB-□□□N (referred to as simple the "SGDB-N") and the SGD-□□□N (referred to as simple the "SGD-N").

D.1 Command Comparison

Command specifications vary as shown in the following table.

Table D.1 Command Comparison

Command or Command Data	SGDB-N, SGD-N	SGDH
PRM_RD RPM_WR	Processing time: 2 ms	Processing time for SGDH parameters (Pn000 to Pn601): 2 to 6 ms (typ: 4ms) CMRDY in STATUS will become 0. Processing time for NS100 parameters (Pn8□□): 2 ms
ID_RD	Main unit only. DEVICE_CODE 00H SGDN-□□□N □: No capacity, voltage (SGDB-N) SGD-□□□N □: No capacity, voltage (SGD-N)	Specifications differ for the SGDH (Main unit) and the NS100 Option Unit. DEVICE_CODE: 00H: SDGH-□□□E □: Capacity, no voltage 50H: JUSP-NS100
CONFIG	CMDRDY stays at 1.	CMDRDY becomes 0 for approximately 4 s.
PPRM_RD	Supported.	Not supported. MECHATROLINK command warning (A.95) will be generated.
INTERPOLATE LATCH	Without feedforward.	With feedforward.
ADJ	Not supported.	Supported. See *Appendix C*.
SVCTRL	Not supported.	Supported.
External Latch Signal	EXT1 only. EXT1 monitoring is not possible with the SGD-N.	EXT2 and EXT 3 also supported.
Latch Processing Time	500 µs max.	3 ms max.
Option Monitor 1/2 Type	Option Monitor 1, 2 cannot be set.	Option Monitor 1, 2 can be set.
I/O Monitor	P-OT and N-OT use soft limit and logical OR.	P-OT and N-OT do not use soft limit and logical OR.
Status during Phase 1	ALARM in STATUS: 1 ALARM: 99H ALM output signal in CN1: Open	STATUS ALARM: 0 ALARM: 99H CN1 ALM output signal: Closed
Motion Command Activation Time (Start Distribution)	After 750 µs	After 1 ms
Motion Command Resolution (Same Command Method)	Speed resolution: 1.953 (reference units/s) Acceleration/deceleration: 15,625 (reference units/s^2)	Speed resolution: 0.488 (reference units/s) Acceleration/deceleration: 244 (reference units/s^2)

D.2 Absolute Encoder Comparison

Absolute encoder multiturn values differ as shown in the following table.

Table D.2 Multiturn Values Comparison

Item	SGDB-N, SGD-N	SGDH
Number of multiturns	0 to +99999 -99999 to 0	-32768 to +32767 (When Pn205 = 65535)
Multiturn limit function	None	Setting possible using Pn205 between 0 and 65534.

D

D.3 Parameters Comparison

The standard setting is for parameters to be expressed as Pn numbers, but by setting pin 4 ON the DIP switch (SW2) of the JUSP-NS100, parameters can be expressed as Cn numbers in the same manner as SGDB-N (SGD-N) SERVOPACKs. This is called Cn Number Mode.

■ Cn Number Mode

- Cn numbers are used as the parameter numbers.
- Units of the Cn numbers are used.

  Because the units differ, there may be some discrepancies in reading/writing values. Set to a number that can be divided by units of the Pn numbers when writing.
- The data setting ranges are the same as for Pn numbers.
- The conditions under which parameters are enabled are the same as for Pn numbers.
- Some Pn numbers may not have corresponding Cn numbers.

  If these numbers are written, a parameter setting warning (A.94) will not be generated but read data will be returned as 0.
- Only Pn numbers can be used with the Digital Operator.

■ Pn Numbers with Corresponding Cn Numbers

Appendix D.3 provides a comparative list of Cn numbers and their Pn number equivalents.

Using the List

If the parameter No. column is blank, there is no corresponding parameter.

If columns other than the Pn number are blank, they are the same as for the Cn number. Only differences are listed.

Cn/Pn sizes are the same.

1. Characters on the upper-right of the Pn number.

   S: Reserved for system use (Do not change). (These numbers are used for the MECHATROLINK SERVOPACK.)

   N: Not used (Do not change). (Not used by MECHATROLINK)
2. Validity

   ◎: Can be changed during operation

   ○: Can be changed when DEN = 1. (Do not change while DEN = 0. Operation cannot be guaranteed if changes are made.)

   ●: Can be changed while the Servo is OFF. (Do not change while the Servo is ON. Operation can not be guaranteed if changes are made during Servo ON.)

   Δ: Enabled once the power is turned OFF then ON again or after the CONFIG command is executed.

×: Read-only (A warning will not be generated if a write is attempted and the data written will not be read. The currently set data will be read.)

R: 0 when read.

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Dig-it	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for correspond-ing Cn number
Cn001		Memory Switch 1	2	-	-	-	0080H	-									
	0	SV_ON Mask			0	1	0	●	Pn802	0						Δ	
	1	SENS_ON Mask			0	1	0	●		1						Δ	
	2	P-OT Mask			0	1	0	●	Pn50A	3	P-OT Signal Mapping		0	F	2	Δ	
	3	N-OT Mask			0	1	0	●	Pn50B	0	N-OT Signal Mapping		0	F	3	Δ	
	4	-			-	-	0	-									
	5	-			-	-	0	-									
	6	Stop Method for Base Block			0	1	0	●	Pn001	0	Servo OFF or Alarm Stop Mode		0	2	0	Δ	
	7	Status After DB Stop			0	1	1	●									
	8	Operation During OT			0	1	0	●		1	Overtravel Stop Mode		0	2	0	Δ	
	9	Operation after Deceleration Stop with OT Emergency Stop Torque			0	1	0	●									
	A	-			-	-	0	-									
	B	Mode Switch Function			0	1	0	●	Pn10B	0	Mode Switch Selection		0	4	0	Δ	
	C	Mode Switch Selection			0	1	0	●									
	D	Mode Switch Selection			0	1	0	●									
	E	Encoder Selection			0	1	0	Δ	Fn011 → E*		Encoder Type		0	1	Depends on machine type	×	
	F	Power Generation Unit			0	1	0	Δ	Pn001	2	DC Power Applications						

* Refer to *7.2.6 Checking the Motor Model* in the *Σ-II Series SGM□H/SGDH User's Manual for Design and Maintenance (SIE-S800-32.2)*.

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Dig-it	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
Cn002		Memory Switch 2	2	-	-	-	0000H	-									
	0	Reverse Rotation Mode			0	1	0	●	Pn000	0	Direction Selection					Δ	
	1	Zero point Error Detection Mask			0	1	0	●									
	2	-			-	-	0	-									
	3	-			-	-	0	-									
	4	-			-	-	0	-									
	5	-			-	-	0	-									
	6	Software Limit Check using Reference Target Position			0	1	0	●	Pn801	2	Software Limit Reference Range						
	7	-			-	-	0	-									
	8	-			-	-	0	-									
	9	-			-	-	0	-									
	A	-			-	-	0	-									
	B	-			-	-	0	-									
	C	-			-	-	0	-									
	D	-			-	-	0	-									
	E	-			-	-	0	-									
	F	-			-	-	0	-									
Cn003		Load Inertia	2	%	0	65535	100	◎	Pn103		Inertia Ratio			10000	0		
Cn004		Speed Loop Gain	2	0.1 Hz	0	20000	400	◎	Pn100			Hz	1	2000	40		Differs for Read or Write
Cn005		Differential Speed Loop Parameter	2	0.01 ms	100	65535	2000	◎	Pn101				15	51200			

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
Cn006		Emergency Stop Torque	2	%	0	MAX	MAX	◎	Pn406					800	800		
Cn007		Positioning Proximity Width	2	Reference unit	1	10000	10	◎	Pn504		NEAR Signal Width			250	7		
Cn008		Forward Torque Limit	2	%	0	MAX	MAX	◎	Pn402					800	800		
Cn009		Reverse Torque Limit	2	%	0	MAX	MAX	◎	Pn403					800	800		
Cn00A		Reserved	2	-	-	-	0	-									When read:0
Cn00B		Reserved	2	-	-	-	0	-									When read:0
Cn00C		Mode Switch (Torque reference)	2	%	0	32767	200	◎	Pn10C					800			
Cn00D		Reserved	2	-	-	-	0	◎									
Cn00E		Mode Switch (Acceleration)	2	10 min^{-1}/s	0	3000	0	◎	Pn10E								
Cn00F		Mode Switch (Error Pulse)	2	Pulse	0	10000	0	◎	Pn10F			Reference unit					As reference unit
Cn010		Reserved	2	-	-	-	0										When read:0
Cn011		Number of Encoder Pulses	2	-	513	32767	-	●	Fn011→E*		Encoder Resolution	Bits/R	13	20	Depends on machine type	×	
Cn012		Servo OFF Delay Time for Brake Reference	2	10 ms	0	50	0	●	Pn506								

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
Cn013		Memory Switch 3	2	-	-	-	0000H	-									
	0	-			-	-	0	-									
	1	-			-	-	0	-									
	2	-			-	-	0	-									
	3	-			-	-	0	-									
	4	-			-	-	0	-									
	5	-			-	-	0	-									
	6	-			-	-	0	-									
	7	-			-	-	0	-									
	8	-			-	-	0	-									
	9	-			-	-	0	-									
	A	MECHATROLINK Communications Error Mask			0	1	0	◎	Pn800	0	Communications Controls		0	3	0		
	B	MECHATROLINK WDT Error Mask			0	1	0	◎									
	C	-			-	-	0	-									
	D	-			-	-	0	-									
	E	-			-	-	0	-									
	F	-			-	-	0	-									

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Dig-it	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for correspond-ing Cn number
Cn014		Memory Switch 4	2	-	-	-	0000H	-									
	0	-			-	-	0	-									
	1	Return to Zero point Direction			0	1	0	○	Pn816	0							
	2	P-SOT Mask			0	1	0	●	Pn801	0	Software Limit Operation		0	3	0		
	3	N-SOT Mask			0	1	0	●									
	4	-			-	-	0	-									
	5	DEC Signal Mask			0	1	0	●	Pn511	0	DEC Signal Mapping		0	F	1	Δ	
	6	EXT Signal Mask			0	1	0	●	Pn511	1	EXT1 Signal Mapping		0	F	4	Δ	
	7	-			-	-	0	-									
	8	-			-	-	0	-									
	9	Brake Operation			0	1	0	●	Pn005	0						Δ	Factory setting Servo operation
	A	P-OT Logic Return			0	1	0	●	Pn50A	3	P-OT Signal Mapping		0	F	2	Δ	
	B	N-OT Logic Return			0	1	0	●	Pn50B	0	N-OT Signal Mapping		0	F	3	Δ	
	C	DEC Logic Return			0	1	0	●	Pn511	0	DEC Signal Mapping		0	F	1	Δ	
	D	-			-	-	0	-									
	E	-			-	-	0	-									
	F	-			-	-	0	-									
Cn015		Brake Reference Output Speed Level	2	min^{-1}	0	MAX	100	●	Pn507					10000			
Cn016		Reference Wait Time after Servo OFF	2	10 ms	10	100	50	●	Pn508								
Cn017		Torque Reference Filter Parameter	2	0.001 ms	0	25000	400	◎	Pn401			0.01 ms		65535	100		Differs for Read or Write

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
Cn018		Torque Reference Filter Parameter(2nd)	2	-	-	-	0	◎									
Cn019		Reserved	2	-	-	-	0	-									When read:0
Cn01A		Position Loop Gain	2	0.01/s	1	50000	4000	◎	Pn102			1/s	1	2000	40		
Cn01B		Positioning Completed Width	2	Reference unit	0	250	7	◎	Pn500								
Cn01C		Bias	2	100 reference units/s	0	MAX	0	◎	Pn107			min^{-1}		10000			Differs for Read or Write
Cn01D		Feed forward	2	%	0	100	0	◎	Pn109								
Cn01E		Position Error Overflow Value	2	Reference unit or 128 reference units	1	65535	65535	◎	Pn505		Overflow level	256 Reference units		32767	1024		Differs for Read or Write
Cn01F		First-step Linear Acceleration/ Deceleration Parameter	2	10000 reference units/s^2	0	65535	0	○	Pn80A		First-step Linear Acceleration Parameter		1		100		
									Pn80D		First-step Linear Deceleration Parameter		1		100		
Cn020		Second-step Linear Acceleration/ Deceleration Parameter	2	10000 reference units/s^2	0	65535	100	○	Pn80B		Second-step Linear Acceleration Parameter		1		100		
									Pn80E		Second-step Linear Deceleration Parameter		1		100		
Cn021		Acceleration/ Deceleration Parameter Switching Speed	2	100 reference units/s	0	65535	0	○	Pn80C		Acceleration Parameter Switching Speed		0		0		
									Pn80F		Deceleration Parameter Switching Speed		0		0		

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
Cn022		Zero point Return Approach Speed 1	2	100 Reference units/s	0	65535	50	○	Pn817								
Cn023		Zero point Return Approach Speed 2	2	100 Reference units/s	0	65535	5	○	Pn818								
Cn024		Electronic Gear Ratio (Numerator)	2	-	1	32768	4	●	Pn202					65535		Δ	
Cn025		Electronic Gear Ratio (Denominator)	2	-	1	32768	1	●	Pn203					65535		Δ	
Cn026		Movement Average Time	2	0.1 ms	0	5100	0	○	Pn812								
Cn027		Feed Forward Filter Time Constant	2	0.001 ms	0	64000	0	◎	Pn10A			0.01 ms		6400			
Cn028		Final Travel Distance to Return to Zero point	4	Reference unit	-2^{31}	$2^{31}-1$	100	○	Pn819				$-2^{30}+1$	$2^{30}-1$			
Cn02A		Zero Point Range	2	Reference unit	0	65535	10	◎	Pn803					250			
Cn02B		Final Travel Distance for External Positioning	4	Reference unit	-2^{31}	$2^{31}-1$	100	○	Pn814				$-2^{30}+1$	$2^{30}-1$			
Cn02D		Exponential Acceleration/ Deceleration Bias	2	500 Reference units/s	0	32767	0	○	Pn810			100 Reference units/s					
Cn02E		Exponential Acceleration/ Deceleration Time Constant	2	0.1 ms	0	5100	0	○	Pn811								

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers								SGDH Pn Numbers							
Parameter No. / Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No. / Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
Cn02F	Forward Software Limit	4	Reference unit	-2^{31}	$2^{31}-1$	8192 ×99999	●	Pn804			$-2^{30}+1$	$2^{30}-1$			
Cn031	Reverse Software Limit	4	Reference unit	-2^{31}	$2^{31}-1$	- 8192 ×99999	●	Pn806			$-2^{30}+1$	$2^{30}-1$			
Cn033	Absolute Encoder Zero Point Positioning Offset	4	Reference unit	-2^{31}	$2^{31}-1$	0	Δ	Pn808			$-2^{30}+1$	$2^{30}-1$			
Cn035	Speed Loop Interpolation Parameter	2	-	0	100	0	●								
Cn036	Reserved	2	-	-	-	0	-								When read:0
Cn037	Motor Selection	2	-	0	255	Capacity	●								When read:0
Cn038	PG Power Supply/Voltage Adjustment	2	-	52000	58000	52500	●								When read:0
Cn039	Reserved	2	-	-	-	0	-								When read:0
Cn03A	Reserved	2	-	-	-	0	-								When read:0
Cn03B	Reserved	2	-	-	-	0	-								When read:0
Cn03C	Reserved	2	-	-	-	0	-								When read:0
Cn03D	Reserved	2	-	-	-	0	-								When read:0
Cn03E	Reserved	2	-	-	-	0	-								When read:0
Cn03F	Reserved	2	-	-	-	0	-								When read:0

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
									Pn000		Function Selection Basic Switches 1	-	-	-	0010	Δ	
										1 [S]	Control Method (Reserved)		-	-	1	Δ	
										2	Axis Address		0	F	0	Δ	
										3	Reserved		-	-	0	Δ	
									Pn001		Function Selection Application Switches	-	-	-	0000	Δ	
										3	Warning Code Output Selection		0	1	0	Δ	
									Pn002		Function Selection Application Switches 2	-	-	-	0000	Δ	
										0	Speed Control Option (Reserved)		-	-	0	Δ	
										1	Torque Control Option [N]		-	-	0	Δ	
										2	Absolute Encoder Usage		0	2	0	Δ	
										3	Position Control		-	-	1	Δ	
									Pn003		Function Selection Application Switches 3	-	-	-	0002	◎	
									Pn004 [S]		Function Selection Application Switches 4	-	-	-	0001	Δ	
									Pn104 [N]		Second Speed Loop Gain	Hz	1	2000	40	◎	
									Pn105 [N]		Second Speed Loop Integer Parameter	0.01ms	15	51200	2000	◎	
									Pn106 [N]		Second Position Loop Gain	1/s	1	2000	40	◎	

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
									Pn108		Bias Width Addition	Reference unit	0	250	7	◎	
									Pn10D		Mode Switch (Speed Reference)	min^{-1}	0	10000	0	◎	
									Pn110		Online Autotuning Switches	-	-	-	0000	◎	
									Pn111		Speed Feedback Compensation	-	1	100	100	◎	
									Pn112		Reserved parameter (Do not change.)	%	0	1000	100	◎	
									Pn113		Reserved parameter (Do not change.)	0.1 Hz	0	10000	1000	◎	
									Pn114		Reserved parameter (Do not change.)	-	0	400	200	◎	
									Pn115		Reserved parameter (Do not change.)	0.1 ms	0	1000	32	◎	
									Pn116		Reserved parameter (Do not change.)	0.1 ms	0	1000	16	◎	
									Pn117		Reserved parameter (Do not change.)	%	20	100	100	Δ	
									Pn118		Reserved parameter (Do not change.)	%	50	100	100	Δ	
									Pn119		Reserved parameter (Do not change.)	1/s	1	2000	60	◎	
									Pn11A		Reserved parameter (Do not change.)	0.1 %	1	2000	1000	◎	
									Pn11B		Reserved parameter (Do not change.)	Hz	1	150	50	◎	

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
									Pn11C		Reserved parameter (Do not change.)	Hz	1	150	70	◎	
									Pn11D		Reserved parameter (Do not change.)	%	0	150	100	◎	
									Pn11E		Reserved parameter (Do not change.)	%	0	150	100	◎	
									Pn11F		Reserved parameter (Do not change.)	ms	0	2000	0	◎	
									Pn120		Reserved parameter (Do not change.)	0.01ms	0	51200	0	◎	
									Pn121		Reserved parameter (Do not change.)	Hz	1	250	50	◎	
									Pn122		Reserved parameter (Do not change.)	Hz	0	250	0	◎	
									Pn123		Reserved parameter (Do not change.)	%	0	100	0	◎	
									Pn200[S]		Position Control Reference Status Selection Switches	-	-	-	0000	-	
									Pn201[N]		PG Differential Ratio	-	16	16384	16384	Δ	
									Pn204[S]		Position Reference Acceleration/ Deceleration Parameter	0.01ms	0	6400	0	◎	
									Pn205		Multiturn Limit Setting	rev	0	65535	65535	Δ	
									Pn206		Number of Fully Closed Pulses	P/R	513	32768	16384	Δ	
									Pn207[S]		Position Reference Function Switches	-	-	-	0010	Δ	

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
									Pn208[N]		Position Reference S-curve Filter Parameter	0.01 ms	0	6400	0	Δ	
									Pn300[N]		Speed Reference Input Gain	0.01 V/ Rated speed	15	300	30	◎	
									Pn301[N]		Internal Set Speed 1	min^{-1}	0	10000	100	◎	
									Pn302[N]		Internal Set Speed 2	min^{-1}	0	10000	200	◎	
									Pn303[N]		Internal Set Speed 3	min^{-1}	0	10000	300	◎	
									Pn304		Jog Speed	min^{-1}	0	10000	500	◎	
									Pn305		Soft Start Acceleration Time	ms	0	10000	0	◎	
									Pn306		Soft Start Deceleration Time	ms	0	10000	0	◎	
									Pn307[N]		Speed Reference Filter Parameter	0.01 ms	0	65535	40	◎	
									Pn308		Speed Feed-forward Filter Time Constant	0.01 ms	0	65535	0	◎	
									Pn400[N]		Torque Reference Input Gain	0.1 V/ Rated torque	10	100	30	◎	
									Pn404		External Input Forward Torque Limit	%	0	800	100	◎	
									Pn405		External Input Reverse Torque Limit	%	0	800	100	◎	
									Pn407[N]		Torque Control Speed Limit	min^{-1}	0	10000	10000	◎	
									Pn408		Torque Control Function Switches	-	-	-	0000	◎	

Table D.3 SGDB-N, SGD-N, and SGDH Parameters Comparison

SGDB-N and SGD-N Cn Numbers									SGDH Pn Numbers								
Parameter No.	Bit	Name	Size	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Parameter No.	Digit	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Validity	Remarks SGDH operation for corresponding Cn number
									Pn409		Notch Filter Frequency	Hz	50	2000	2000	◎	
									Pn501^{N}		Zero Clamp Level	min^{-1}	0	10000	10	◎	
									Pn502		Rotation Detection Level	min^{-1}	1	10000	20	◎	
									Pn503^{N}		Speed Matching Signal Detection Width	min^{-1}	0	100	10	◎	
									Pn509		Momentary Hold Time	ms	20	1000	20	◎	
									Pn50A^{S}		Input Signal Selections 1	-	-	-	2881	Δ	
									Pn50C^{S}		Input Signal Selections 3	-	-	-	8888	Δ	
									Pn50D^{S}		Input Signal Selections 4	-	-	-	8888	Δ	
									Pn50E		Output Signal Selections 1	-	-	-	3001	Δ	
									Pn50F		Output Signal Selections 2	-	-	-	0200	Δ	
									Pn510		Output Signal Selections 3	-	-	-	0000	Δ	
									Pn511		Input Signal Selections 5	-	-	-	6541	Δ	
									Pn512		Output Signal Reversal	-	-	-	0000	Δ	
									Pn600		Regenerative Resistor Capacity	10 W	0	1000	0	Δ	
									Pn601		Reserved parameter (Do not change.)	-	0	1000	0	Δ	
									Pn801	1	Software Limit Operation Selection	-	0	1	0	●	
									Pn813		Option Monitor	-	-	-	0010	◎	

Index

Symbols

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USER'S MANUAL

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In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

MANUAL NO. SIE-C718-4B

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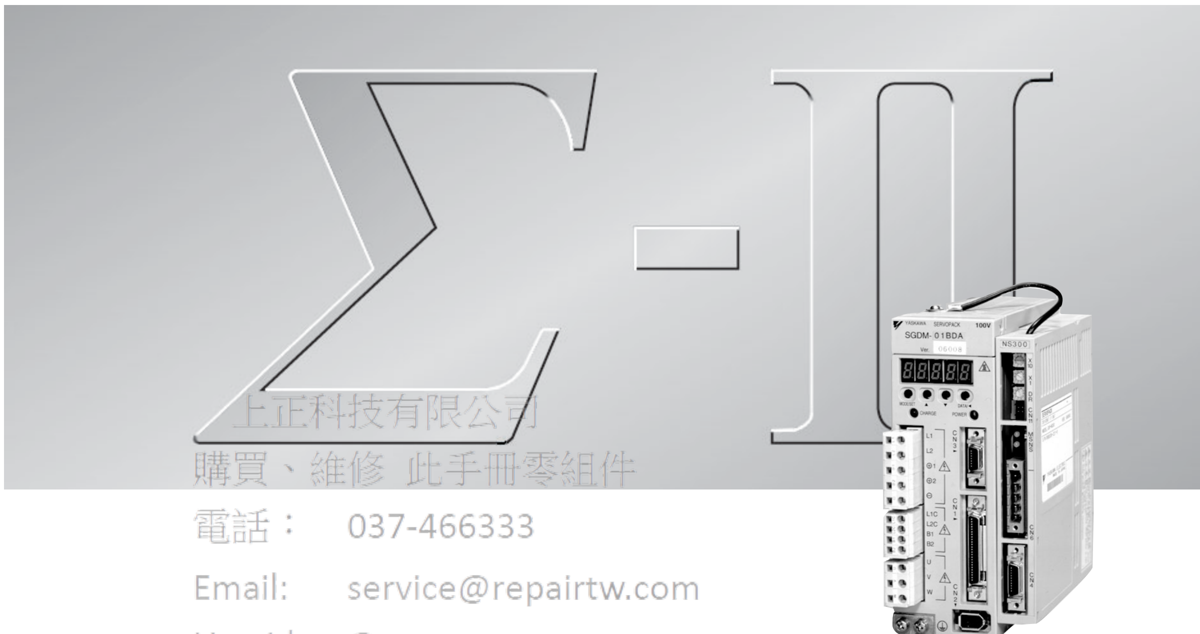
02-5①
98-71115

Σ-Ⅱ Series SGDH

DeviceNet INTERFACE MODULE
USER'S MANUAL

MODEL: JUSP-NS300



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MANUAL NO. SIE-C718-6B

Safety Information

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

⚠ WARNING Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.

⚠ Caution Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

Visual Aids

The following aids are used to indicate certain types of information for easier reference.

◀EXAMPLE▶ Indicates application examples.

INFO Indicates supplemental information.

IMPORTANT Indicates important information that should be memorized.

TERMS

◆ Explains difficult to understand terms and terms that have not been explained before.

OVERVIEW

TABLE OF CONTENTS

4 Parameter Settings

5 DeviceNet Communications

C Alarm and Warning Codes

Overview

■ About this Manual

This manual provides the following information for the Σ-II Series SGM□H/SGDH Servodrives with a JUSP-NS300 DeviceNet Interface Module (hereinafter called the NS300 Module) mounted. The NS300 Module is an Application Module.

- Procedures for installing and wiring the NS300 Module
- Specifications and methods for SERVOPACK DeviceNet communications
- Procedures for setting parameters
- Information on the NSxxx Setup Tool
- Troubleshooting procedures

■ Related Manuals

Refer to the following manuals as required.

Read this manual carefully to ensure the proper use of Σ-II Series Servodrives. Also, keep this manual in a safe place so that it can be referred to whenever necessary.

Manual Name	Manual Number	Contents
Σ-II Series SGM□H/SGDH User's Manual Servo Selection and Data Sheets	SIE-S800-32.1	Describes the procedure used to select Σ-II Series Servodrives and capacities.
Σ-II Series SGM□H/SGDH User's Manual Design and Maintenance	SIE-S800-32.2	Provides detailed information on SGDH SERVOPACKs.

Using This Manual

■ Intended Audience

This manual is intended for the following users.

- Those designing Servodrive systems using DeviceNet.
- Those designing Σ-II Series Servodrive systems.
- Those installing or wiring Σ-II Series Servodrives.
- Those performing trial operation or adjustments of Σ-II Series Servodrives.
- Those maintaining or inspecting Σ-II Series Servodrives.

■ Description of Technical Terms

In this manual, the following terms are defined as follows:

- **NS300 Module** = JUSP-NS300
- **Servomotor** = Σ-II Series SGMAH, SGMPH, SGMGH, or SGMSH servomotor.
- **SERVOPACK** = Σ-II Series SGDH-□□□E SERVOPACK.
- **Servodrive** = A set including a servomotor and Servo Amplifier.
- **Servo System** = A servo control system that includes the combination of a Servodrive with a host 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 examples:

- /S-ON
- /P-CON

Registered Trademark

DeviceNet is a registered trademark of the ODVA (Open DeviceNet Vendor Association, Inc.).

Safety Precautions

The following precautions are for checking products upon delivery, installation, wiring, operation, maintenance and inspections.

■ Checking Products upon Delivery

⚠ CAUTION

- Always use the servomotor and SERVOPACK in one of the specified combinations.
  Not doing so may cause fire or malfunction.

■ Installation

⚠ CAUTION

- Never use the products in an environment subject to water, corrosive gases, inflammable gases, or combustibles.
  Doing so may result in electric shock or fire.

■ Wiring

⚠ WARNING

- Connect the SERVOPACK ground terminal effectively to a system grounding conductor or grounding electrode (100 Ω or less).
  Improper grounding may result in electric shock or fire.

⚠ CAUTION

- Do not connect a three-phase power supply to SERVOPACK U, V, or W output terminals.
  Doing so may result in injury or fire.
- Securely fasten the power supply terminal screws and motor output terminal screws.
  Not doing so may result in fire.

■ Operation

⚠ WARNING

- Never touch any rotating motor parts while the motor is running.

  Doing so may result in injury.

⚠ CAUTION

- Conduct trial operation on the servomotor alone with the motor shaft disconnected from machine to avoid any unexpected accidents.

  Not doing so may result in injury.

- Before starting operation with a machine connected, change the settings to match the parameters of the machine.

  Starting operation without matching the proper settings may cause the machine to run out of control or malfunction.

- Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.

  Not doing so may result in injury.

- Do not touch the heat sinks during operation.

  Doing so may result in burns due to high temperatures.

■ Maintenance and Inspection

⚠ WARNING

- Never touch the inside of the SERVOPACKs.

  Doing so may result in electric shock.

- Do not remove the panel cover while the power is ON.

  Doing so may result in electric shock.

- Do not touch terminals for five minutes after the power is turned OFF.

  Residual voltage may cause electric shock.

⚠ CAUTION

- Do not disassemble the servomotor.

  Doing so may result in electric shock or injury.

- Do not attempt to change wiring while the power is ON.

  Doing so may result in electric shock or injury.

■ General Precautions

Note the following to ensure safe application.
• The drawings presented in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual. • The drawings presented in this manual are typical examples and may not match the product you received. • This manual is subject to change due to product improvement, specification modification, and manual improvement. When this manual is revised, the manual code is updated and the new manual is published as a next edition. The edition number appears on the front and back covers. • If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual. • Yaskawa will not take responsibility for the results of unauthorized modifications of this product. Yaskawa shall not be liable for any damages or troubles resulting from unauthorized modification.

1

Checking Products and Part Names

This chapter describes the procedure for checking Σ-II Series products and the NS300 Module upon delivery. It also describes the names of product parts.

1.1 Checking Products on Delivery

The following procedure is used to check products upon delivery. Check the following items when products are delivered.

Check Items	Comments
Are the delivered products the ones that were ordered?	Check the model numbers marked on the nameplates of the NS300 Module. (Refer to the descriptions of model numbers on following pages)
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Can the NS300 Module be installed on the SERVOPACK used?	Check the model number given on the SERVOPACK nameplate. The model number must contain "SGDH" and "E" as shown below to support the NS300 Module. SGDH-□□□E-□

If any of the above items are faulty or incorrect, contact your Yaskawa sales representative or the dealer from whom you purchased the products.

■ External Appearance and Nameplate Example

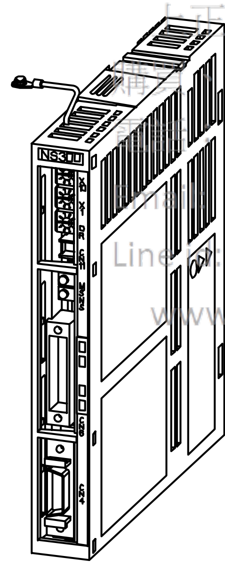


Figure 1.1 External Appearance of the NS300 Module

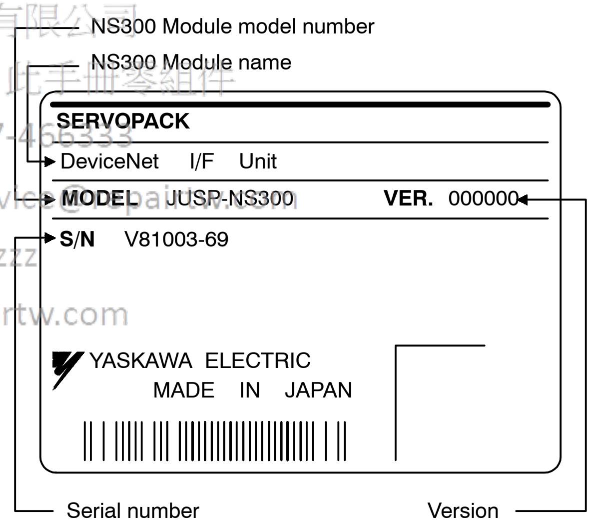


Figure 1.2 Nameplate

■ Model Number

NS300 Module

JUSP – NS30 0

- JUSP: SERVOPACK Peripheral Device
- NS30: Type of device: NS30: DeviceNet Interface Module
- 0: Design Revision Order

1.2 Product Part Names

The following diagram illustrates the part names of the NS300 Module.

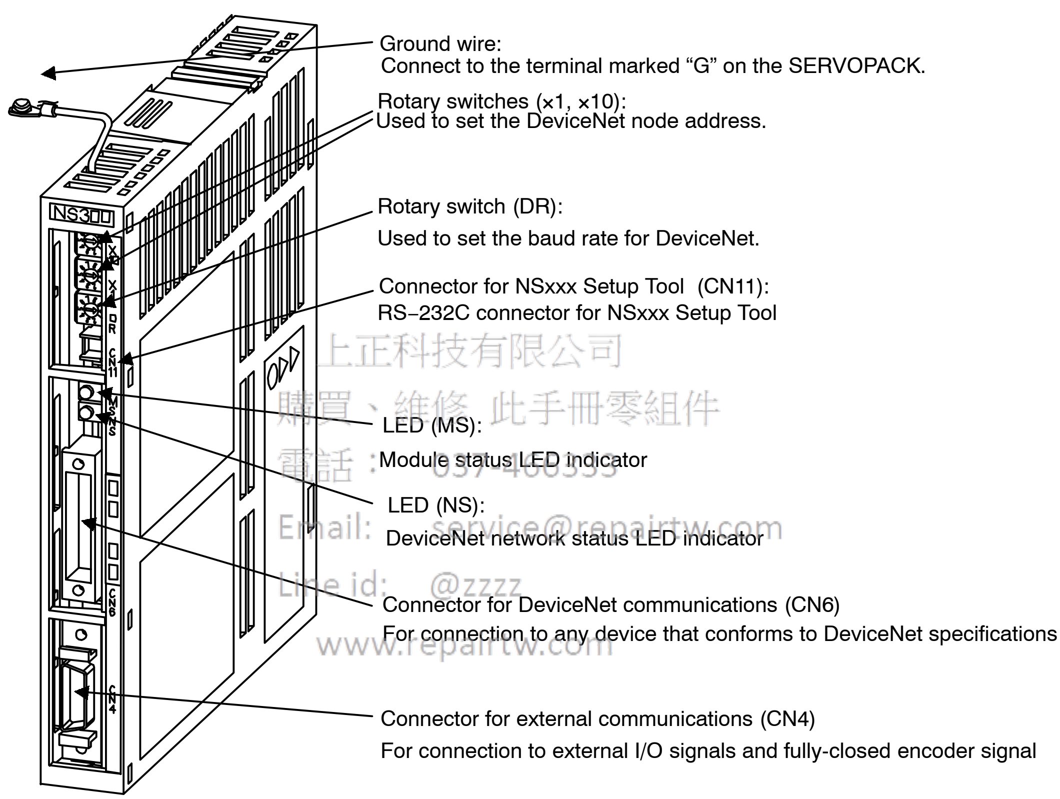


Figure 1.3 NS300 Module

1.3 Mounting the NS300 Module

This section describes how to mount a NS300 Module on the SGDH SERVOPACK.

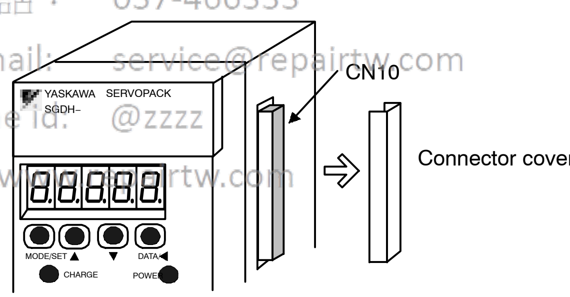
Prepare the screws for connecting the ground wire as shown in the following table:

Mounting Type	SERVOPACK Models	Screw	Remarks
Base Mounted	SGDH-A3 to 02BE SGDH-A3 to 10AE	M3 x 10 round-head screw (spring or flat washer)	Use attached screws on the NS300 Module.
	SGDH-15 to 50AE SGDH-05 to 30DE	M4 x 10 round-head screws (spring or flat washer)	Use attached screws on the NS300 Module.
	SGDH-60/75AE	M4 x 8 round-head screw (spring or flat washer)	Use front panel fixer screws.
Rack Mounted	SGDH-A3 to 02BE-R SGDH-A3 to 50AE-R SGDH-05 to 30DE-R	M4 x 6 round-head screws (spring or flat washer)	Use attached screws on the NS300 Module. (see note)
Duct Vent	SGDH-60/75AE-P	M4 x 8 round-head screw (spring or flat washer)	Use front panel fixer screws

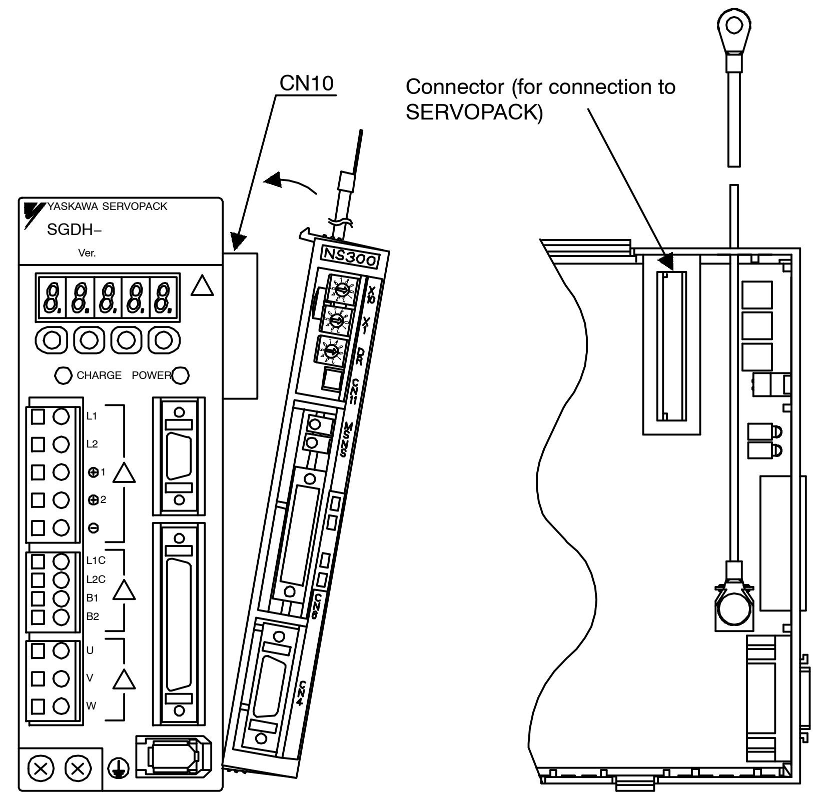
Note: Be sure to use spring washers or flat washers. Failure to do so may result in the screws for connecting the ground wire protruding behind the flange, preventing the SERVOPACK from being mounted.

By mounting NS300 Module, the SGDH SERVOPACK can be used in a DeviceNet network. Use the following procedure to ensure NS300 Modules are mounted correctly.

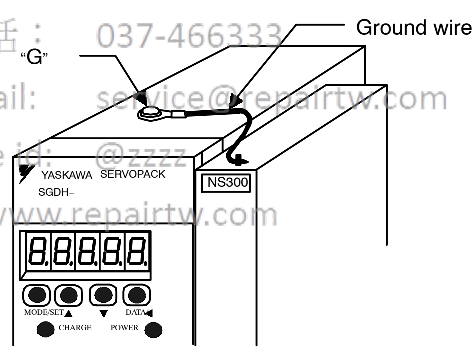
1. Remove the connector cover from the CN10 connector on the SERVOPACK.



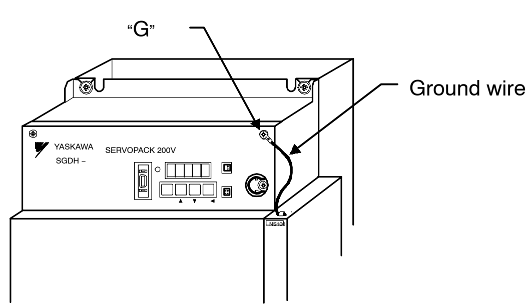
2. Mount the NS300 Module on the SERVOPACK.



3. For grounding, connect a ground wire of the NS300 Module to the point marked "G" on the SERVOPACK.

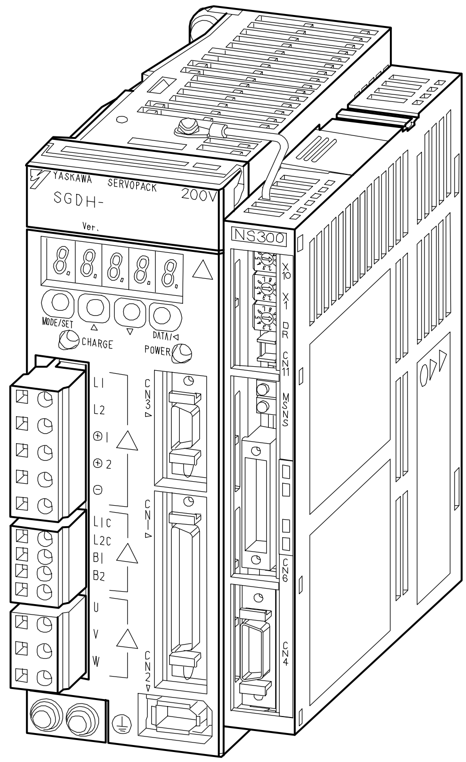


For SERVOPACK 30 W to 5.0 kW



For SERVOPACK 6.0 kW to 7.5 kW

When the NS300 Module has been mounted correctly, the SERVOPACK will appear as shown in the following diagram.



2

Installation

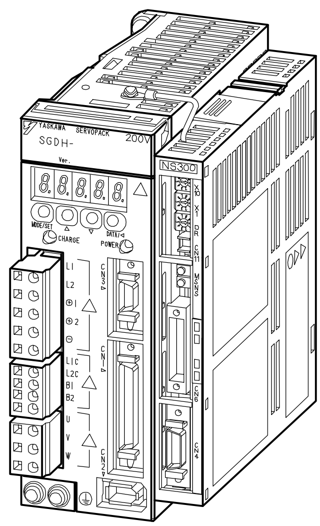
This chapter describes precautions for Σ-II Series product installation.

The SGDH SERVOPACKs are base-mounted servo amplifiers. Incorrect installation will cause problems. Always observe the installation precautions shown in this chapter.

2.1 Storage Conditions

Store the SERVOPACK within the following temperature range when it is stored with the power cable disconnected.

Temperature range: −20 to 85°C



Σ-II Series SGDH SERVOPACK
with NS300 Module mounted

2.2 Installation Site

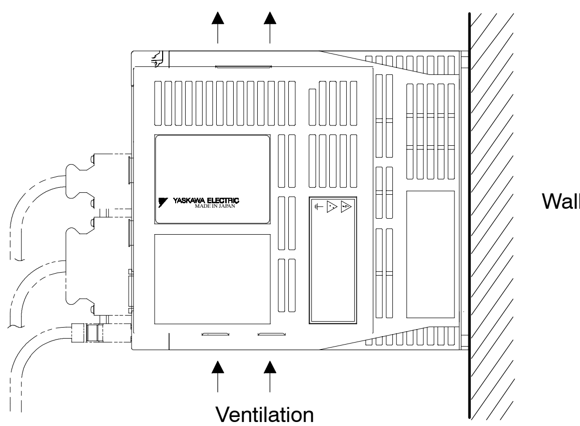
Take the following precautions at the installation site.

Situation	Installation Precaution
Installation in a Control Panel	Design the control panel size, module layout, and cooling method so that the temperature around the SERVOPACK does not exceed 55°C.
Installation Near a Heating Module	Minimize heat radiated from the heating module as well as any temperature rise caused by natural convection so that the temperature around the SERVOPACK does not exceed 55°C.
Installation Near a Source of Vibration	Install a vibration isolator beneath the SERVOPACK to avoid subjecting it to vibration.
Installation at a Site Exposed to Corrosive Gas	Corrosive gas does not have an immediate effect on the SERVOPACK, but will eventually cause electronic components and contactor-related devices to malfunction. Take appropriate action to avoid corrosive gas.
Other Situations	Do not install the SERVOPACK in hot or humid locations, or locations subject to excessive dust or iron powder in the air.

2.3 Orientation

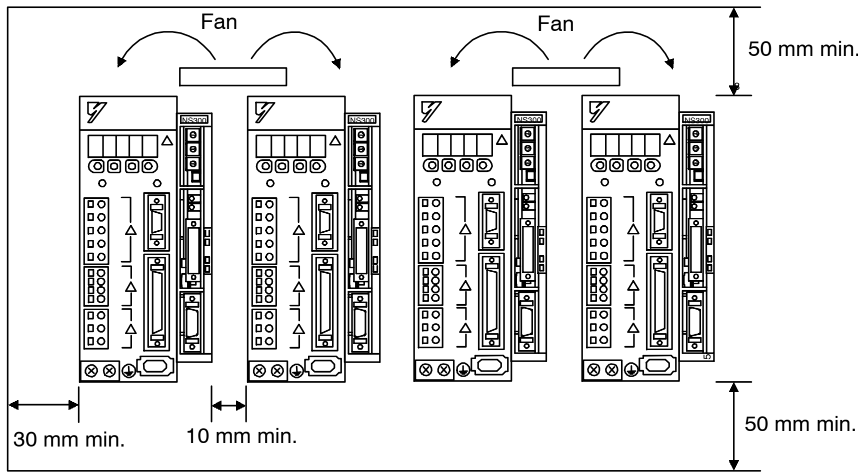
Install the SERVOPACK perpendicular to the wall as shown in the figure. The SERVOPACK must be oriented this way because it is designed to be cooled by natural convection or cooling fan.

Secure the SERVOPACK using 2 to 4 mounting holes. The number of holes depends on the SERVOPACK capacity.



2.4 Installation

Follow the procedure below to install multiple SERVOPACKs side by side in a control panel.



■ SERVOPACK Orientation

Install the SERVOPACK perpendicular to the wall so that the front panel (containing connectors) faces outward.

■ Cooling

As shown in the figure above, provide sufficient space around each SERVOPACK for cooling by cooling fans or natural convection.

■ Side-by-side Installation

When installing SERVOPACKs side by side as shown in the figure above, provide at least 10 mm (0.39 in) between and at least 50 mm (1.97 in) above and below each SERVOPACK. Install cooling fans above the SERVOPACKs to avoid excessive temperature rise and to maintain even temperature inside the control panel.

■ Environmental Conditions in the Control Panel

- Ambient Temperature: 0 to 55°C
- Humidity: 90% or less
- Vibration: 4.9 m/s^2
- Condensation and Freezing: None
- Ambient Temperature for Long-term Reliability: 45°C max.

3

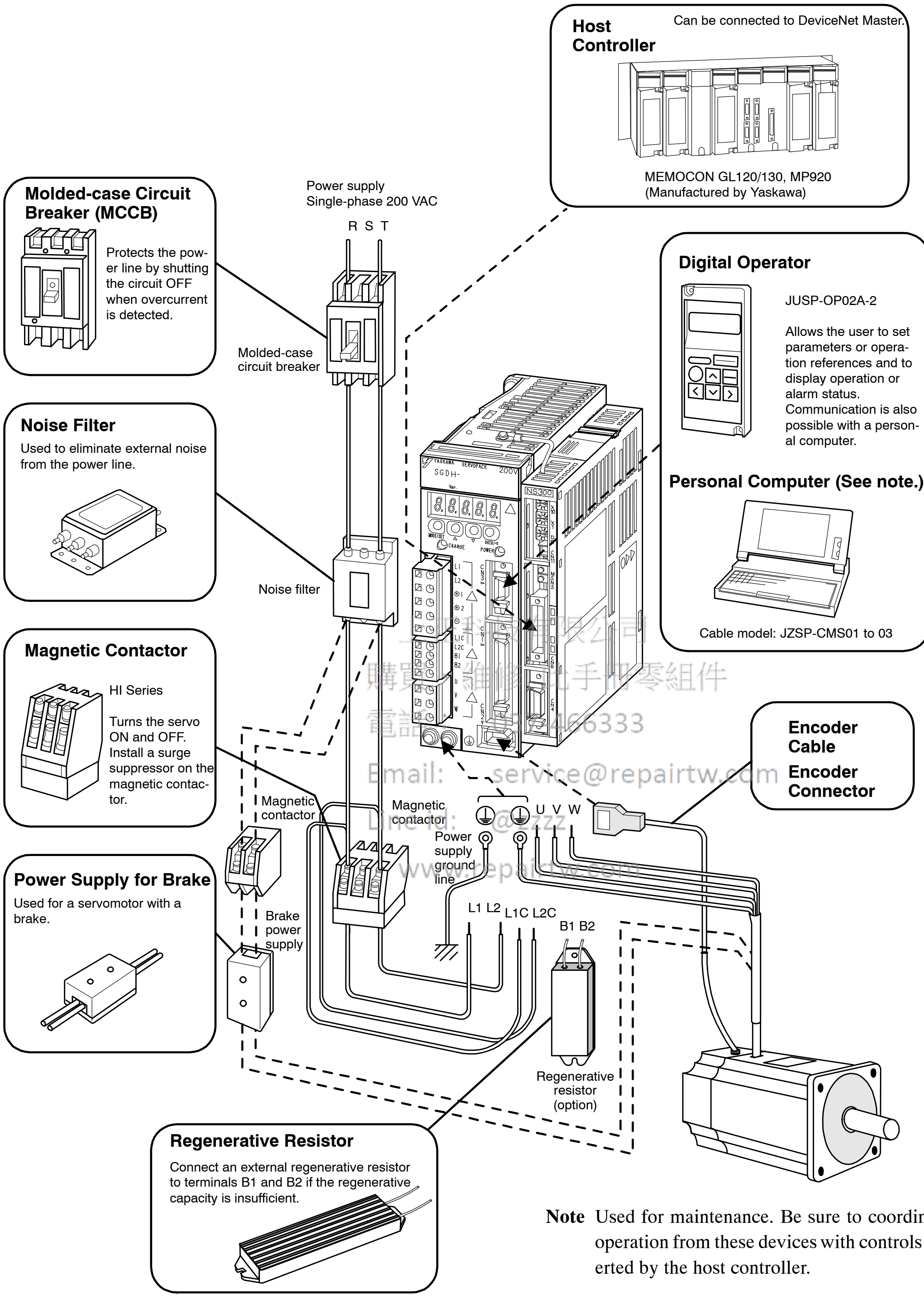
Connectors

This chapter describes the procedure used to connect Σ-II Series products to peripheral devices when NS300 Module is mounted and gives typical examples of I/O signal connections.

3.1 Connecting to Peripheral Devices

This section provides examples of standard Σ-II Series product connections to peripheral devices. It also briefly explains how to connect each peripheral device.

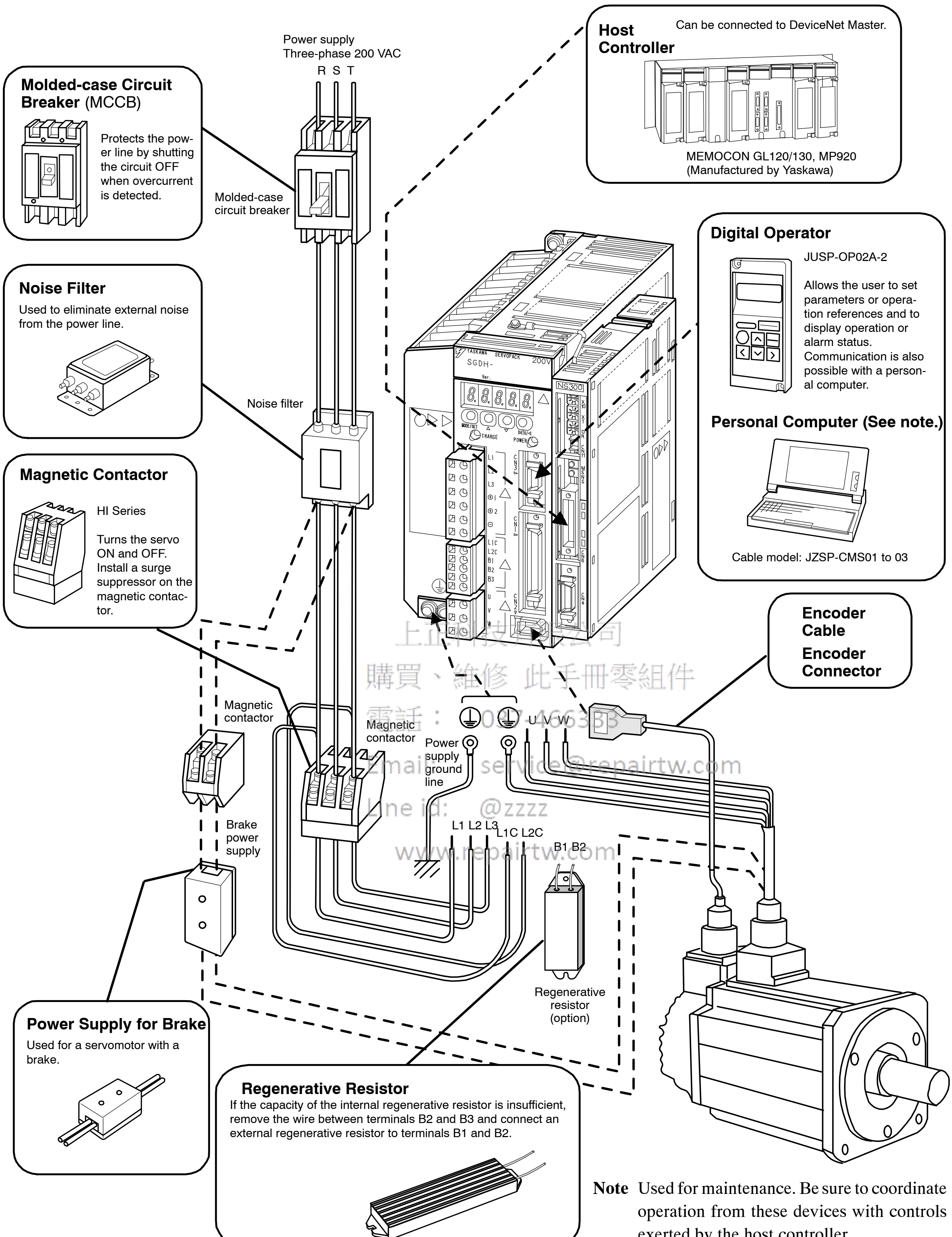
3.1.1 Single-phase (100 V or 200 V) Main Circuit Specifications



Note Used for maintenance. Be sure to coordinate operation from these devices with controls exerted by the host controller.

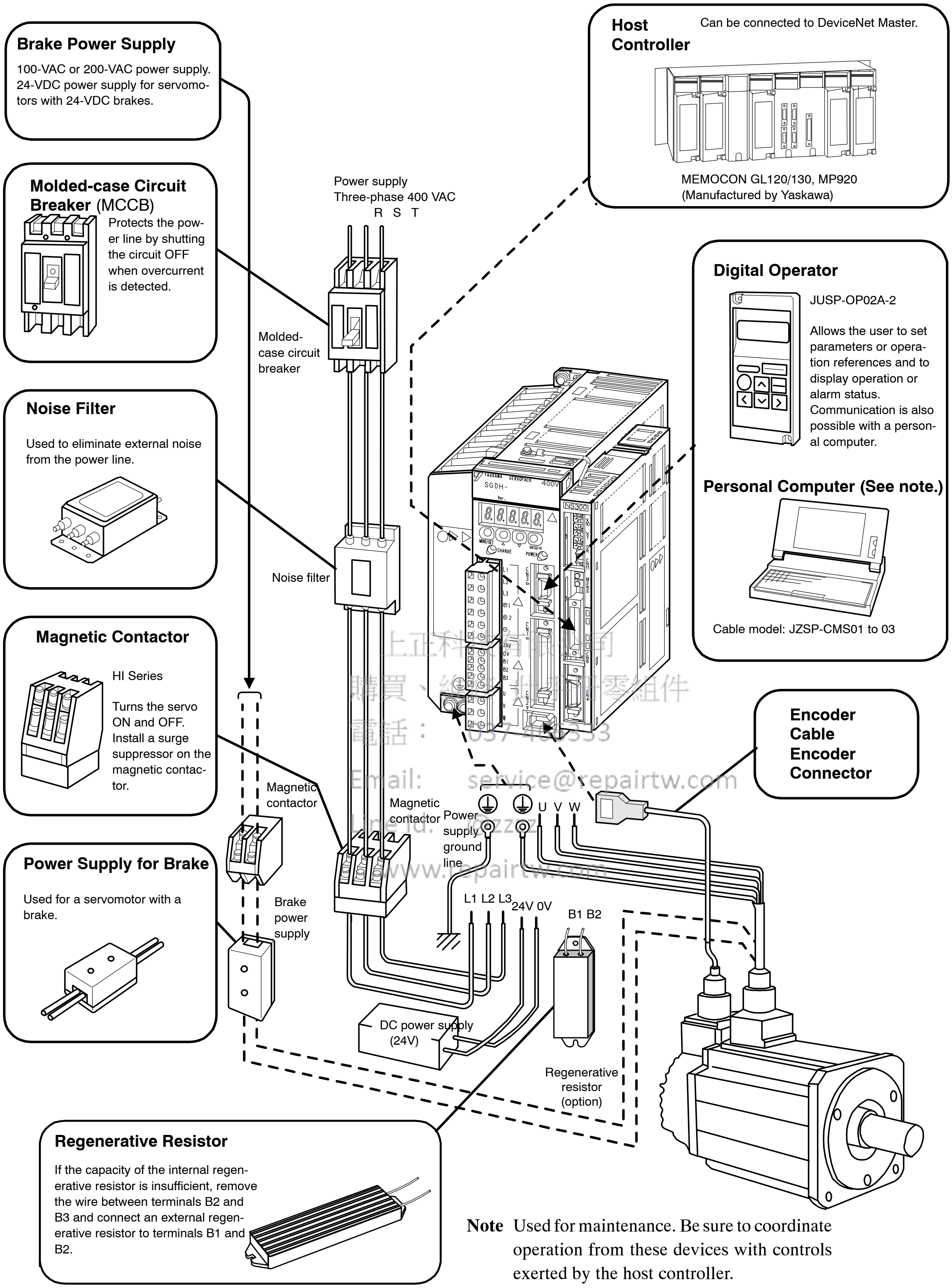
3

3.1.2 Three-phase, 200-V Main Circuit Specifications



Note Used for maintenance. Be sure to coordinate operation from these devices with controls exerted by the host controller.

3.1.3 Three-phase, 400-V Main Circuit Specifications



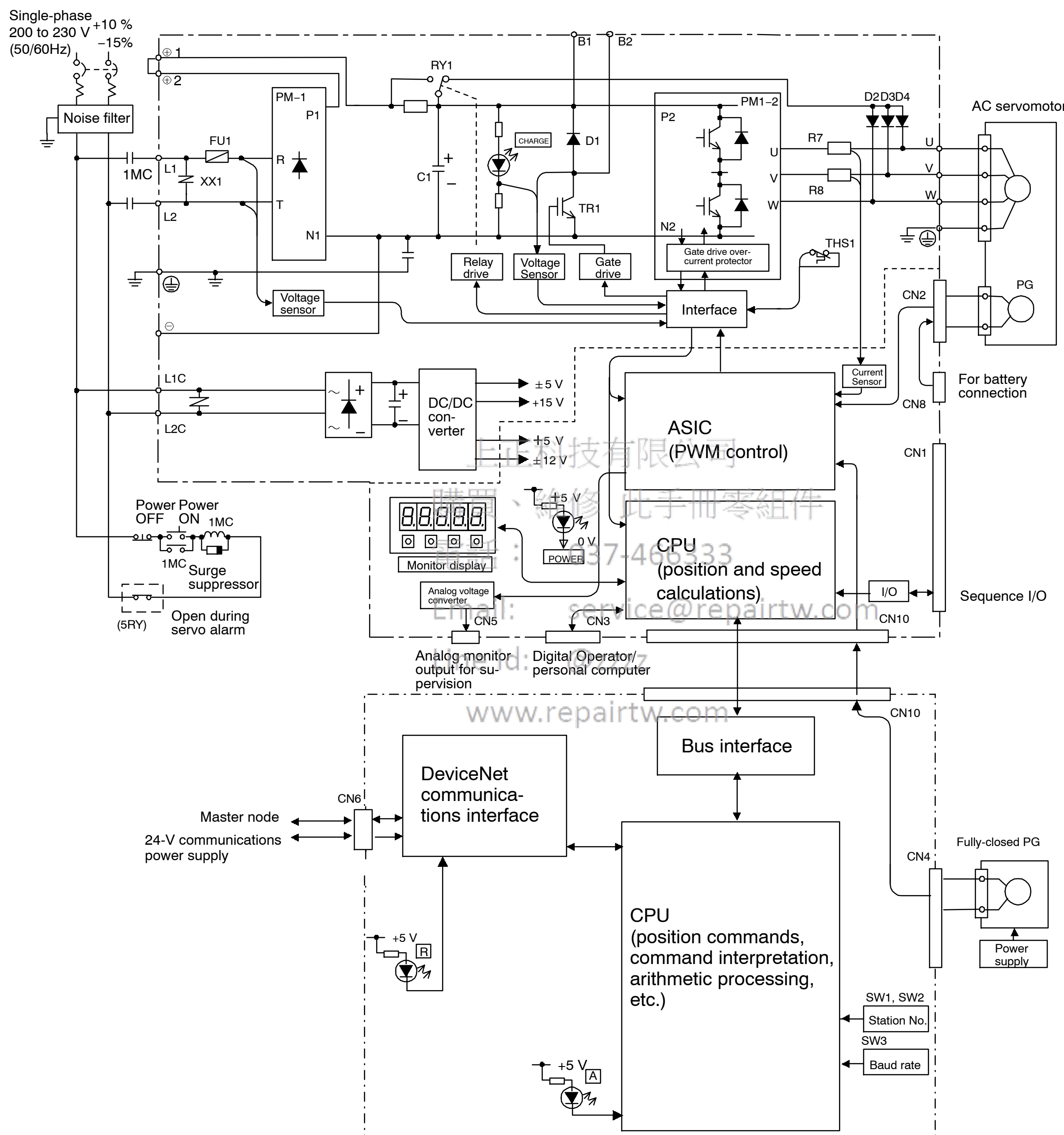
Note Used for maintenance. Be sure to coordinate operation from these devices with controls exerted by the host controller.

3

3.2 SERVOPACK Internal Block Diagrams

The following sections show an internal block diagram for the SERVOPACK with the NS300 Module.

30 to 400 W 200-V and 30 to 200 W 100-V Models

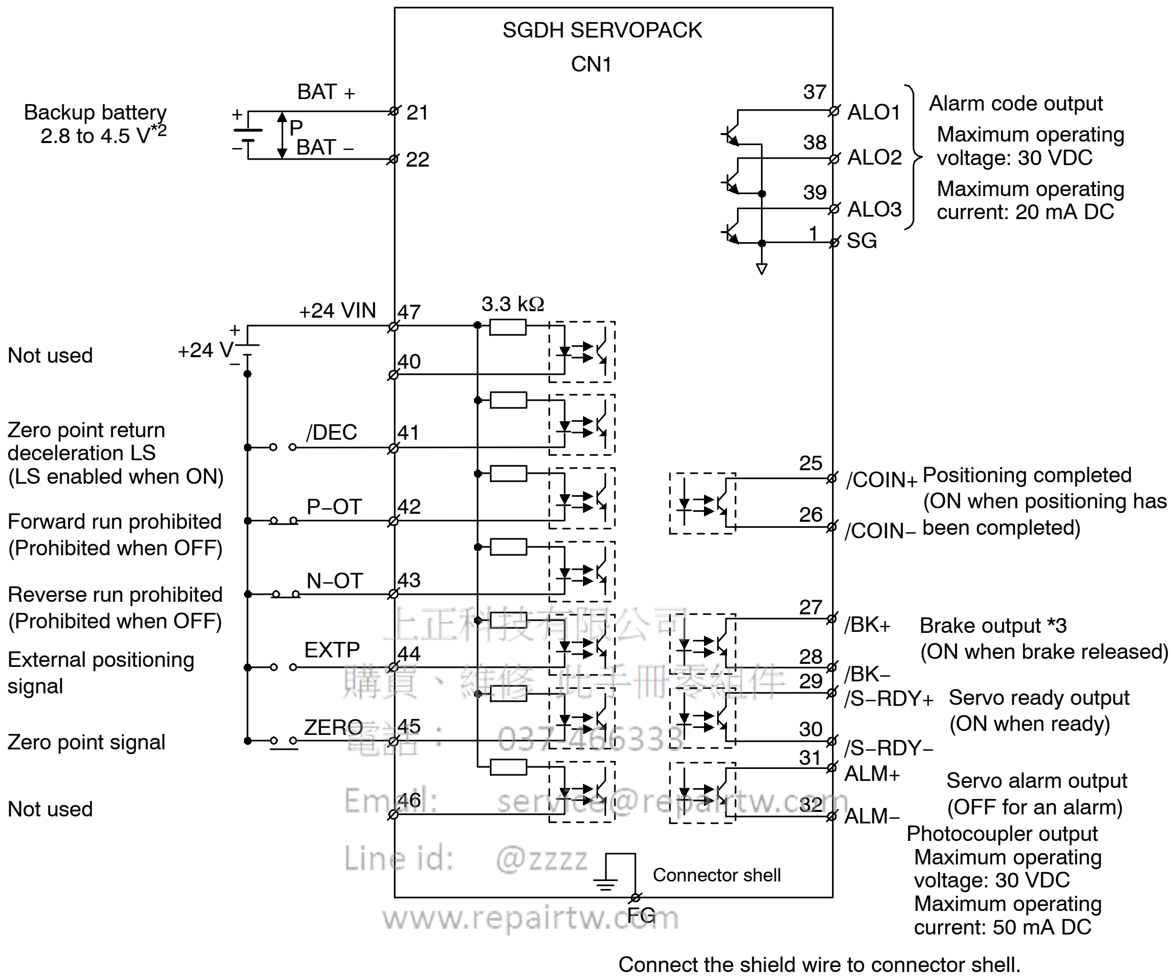


3.3 I/O Signals

This section describes I/O signals for the SERVOPACK with the NS300 Module.

3.3.1 Connection Example of I/O Signal Connector (CN1)

The following diagram shows a typical example of I/O signal connections.



* **1.** ↕P represents twisted-pair wires.

* **2.** When using an absolute encoder, connect a backup battery only when there is no battery connected to the CN8.

* **3.** Make signal allocations using parameters. (Refer to *6.1.2 Standard Settings for CN1 I/O Signals*.)

Figure 3.1 I/O Signal Connections for CN1 Connectors

3.3.2 I/O Signals Connector (CN1)

The following diagram shows the layout of CN1 terminals.

■ CN1 Terminal Layout

Pin	Signal	Function
1	SG	GND
2	SG	GND
3	–	–
4	–	–
5	–	–
6	SG	GND
7	–	–
8	–	–
9	–	–
10	SG	GND
11	–	–
12	–	–
13	–	–
14	–	–
15	–	–
16	–	–
17	–	–
18	–	–
19	–	–
20	–	–
21	BAT (+)	Battery (+)
22	BAT (–)	Battery (–)
23	–	–
24	–	–
25	/COIN +	Positioning complete output
26	/COIN-	Positioning complete output
27	/BK+ (Note 3)	Brake interlock output
28	/BK- (Note 3)	Brake interlock output
29	/S-RDY+	Servo ready output
30	/S-RDY-	Servo ready output
31	ALM+	Servo alarm output
32	ALM-	Servo alarm output
33	–	–
34	–	–
35	–	–
36	–	–
37	AL01	Alarm code output (open-collector output)
38	AL02	Alarm code output
39	AL03	Alarm code output (open-collector output)
40	–	–
41	/DEC	Zero point return deceleration LS input
42	P-OT	Forward drive prohibited input
43	N-OT	Reverse run prohibited input
44	EXTP	External positioning signal
45	ZERO	Zero point signal
46	–	–
47	+24VIN	External power supply input
48	–	–
49	–	–
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 SERVOPACK-end connector.

3. Make signal allocations using parameters. (Refer to *6.1.2 Standard Settings for CN1 I/O Signals.)*

■ CN1 Specifications

Specifications for SERVOPACK Connectors	Applicable Receptacles		
	Soldered	Case	Manufacturer
10250-52A2JL 50-p Right Angle Plug	10150-3000VE	10350-52A0-008	Sumitomo 3M Ltd.

3.3.3 I/O Signal Names and Functions

The following section describes SERVOPACK I/O signal names and functions.

■ Input Signals

Signal Name		Pin No.	Function
Common	**/DEC**	41	Zero point return deceleration NS: Deceleration LS for zero point return connected.
	P-OT **N-OT**	42 43	Forward run prohibited Reverse run prohibited — Overtravel prohibited: Stops servomotor when movable part travels beyond the allowable range of motion.
	EXTP	44	External positioning signal: Signal used for external positioning connected.
	ZERO	45	Zero point
	+24VIN	47	Control power supply input for sequence signals: Users must provide the +24-V power supply. Allowable voltage fluctuation range: 11 to 25 V
	BAT (+) **BAT (–)**	21 22	Connecting pin for the absolute encoder backup battery. Connect to either CN8 or CN1.

■ Output Signals

Signal Name		Pin No.	Function
Common	**ALM+** **ALM–**	31 32	Servo alarm: Turns OFF when an error is detected.
	/BK+ **/BK–**	27 28	Brake interlock: Output that controls the brake. The brake is released when this signal is ON.
	/S-RDY+ **/S-RDY–**	29 30	Servo ready: Turns ON if there is no servo alarm when the control/main circuit power supply is turned ON.
	ALO1 **ALO2** **ALO3**	37 38 39 (1)	Alarm code output: Outputs 3-bit alarm codes. Open-collector: 30 V and 20 mA rating maximum
	FG	Shell	Connected to frame ground if the shield wire of the I/O signal cable is connected to the connector shell.
Position	**/COIN+** **/COIN–**	25 26	Positioning completed (output in Position Control Mode): Turns ON when the number of error pulses reaches the set value. The setting is the number of error pulses set in reference units (input pulse units defined by the electronic gear).

Note 1. Pin numbers in parenthesis () indicate signal grounds.

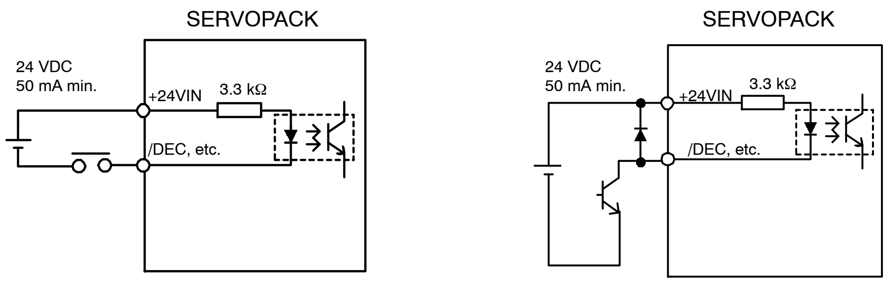
2. The functions allocated to /BK, /S-RDY, and /COIN can be changed via parameters. The /BK, /S-RDY, and /COIN output signals can be changed to /CLT, /VLT, /TGON, /WARN, or /NEAR signals.

3.3.4 Interface Circuits

The following diagram shows an example of connections between a host controller and the I/O signal for a SERVOPACK.

■ 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.



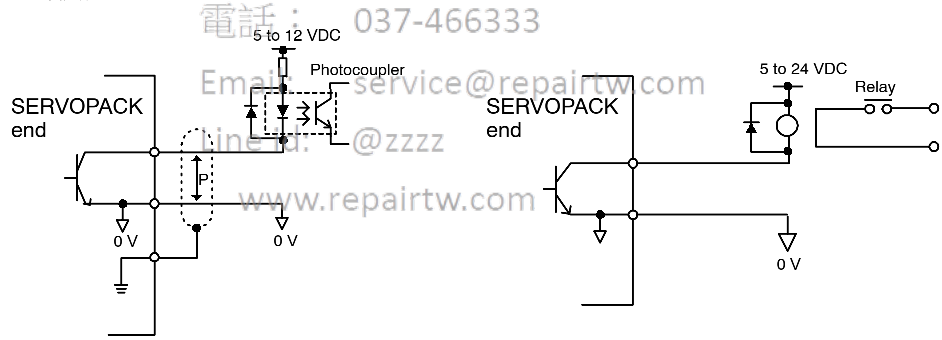
■ Output Circuit Interface

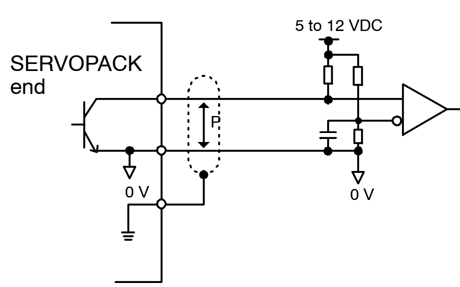
Any of the following three types of SERVOPACK output circuits can be used. Form an input circuit at the host controller that matches one of these types.

- Connecting to an Open-collector Output Circuit

  Alarm code signals are output from open-collector transistor output circuits.

  Connect an open-collector output circuit through a photocoupler, relay, or line receiver circuit.



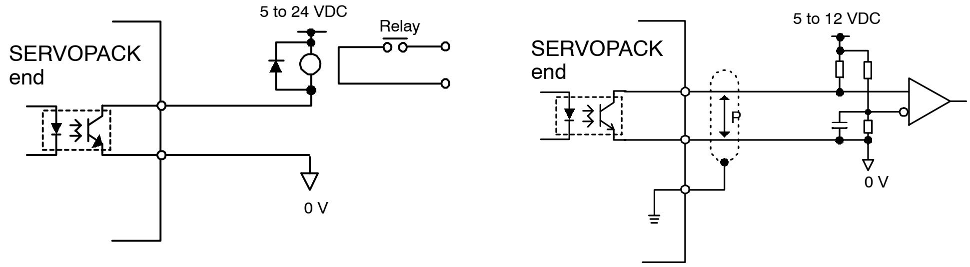


Note The maximum allowable voltage and current capacities for open-collector output circuits are as follows:
·Voltage: 30 VDC max.
·Current: 20 mA DC max.

- Connecting to a Photocoupler Output Circuit

Photocoupler output circuits are used for servo alarm, servo ready, and other sequence output signal circuits.

Connect a photocoupler output circuit through a relay or line receiver circuit.



Note The maximum allowable voltage and current capacities for photocoupler output circuits are as follows:
·Voltage: 30 VDC max.
·Current: 50 mA DC max.

3.4 I/O Signal Connections for NS300 Modules (CN4)

The CN4 on an NS300 Module is used for I/O signal and fully-closed encoder signal connections.

3.4.1 Connection Terminal Layout

The terminal layout and specifications for the CN4 are outlined below.

■ CN4 Terminal Layout

Pin No.	Signal	Description	Pin No.	Signal	Description
1	PG 0V	Signal ground	**11**	+24VIN	24-V common terminal for external input
2	PG 0V	Signal ground	**12**	NOTCH1+	Notch output 1
3	PG 0V	Signal ground	**13**	NOTCH1–	–
4	–	–	**14**	PC	Phase-C input
5	–	–	**15**	/PC	–
6	–	–	**16**	PA	Phase-A input
7	–	–	**17**	/PA	–
8	–	–	**18**	PB	Phase-B input
9	EMSTOP	Emergency stop input	**19**	/PB	–
10	NOTCH2+	Notch output 2	**20**	NOTCH2–	Notch output 2

Note 1. The PG power supply and battery must be supplied externally.

2. The FG is connected to the connector shell.

■ Connector Specifications

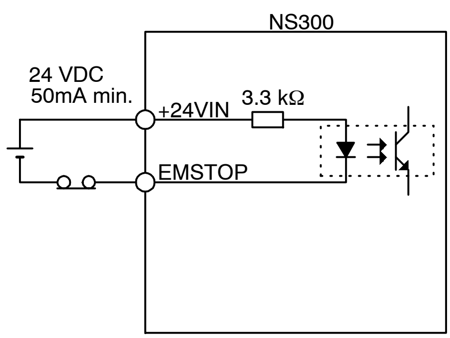
Part	Signal	Manufacturer
Connector	10120–3000VE (20P)	Sumitomo 3M Ltd.
Connector shell	10320–52A0–008	–

3.4.2 I/O Signal Interface Circuits

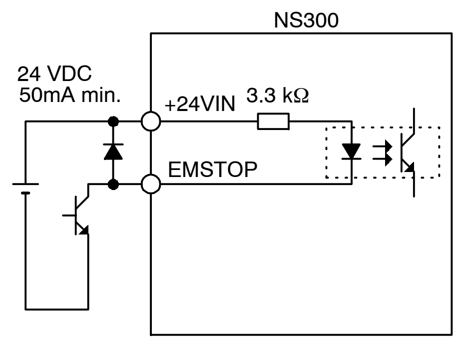
The following diagram shows an example of connections between a host controller and the I/O signals for an NS300 Module.

■ Sequence I/O 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.



Relay

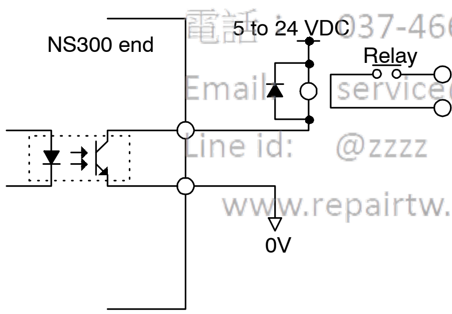


Open Collector

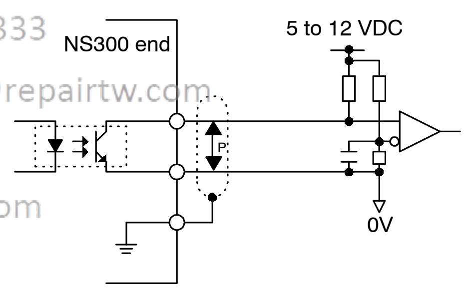
3

■ Output Circuit Interface

Notch output signals are used for photocoupler output circuits. Connect the notch output signals to relays or line receiver circuits.



Relay



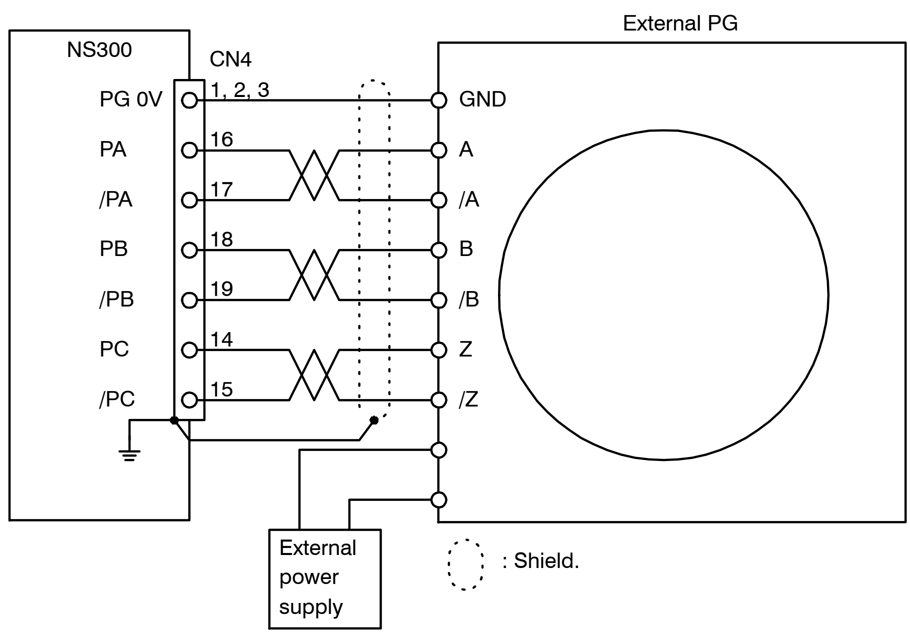
Line Receiver

Note The maximum allowable voltage and current capacity for photocoupler output circuits are as follows:

- Voltage: 30 VDC max.
- Current: 50 mA DC max.

3.4.3 Fully-closed Encoder Connection Example

The following diagram shows a connection example for a fully-closed encoder.



3.5 Connections for DeviceNet Communications

This section describes the connection and wiring of connectors for DeviceNet communications.

3.5.1 DeviceNet Communications Connection Example

The following diagram shows an example of connections between a host controller and an NS300 Module (CN6) using DeviceNet communications cables.

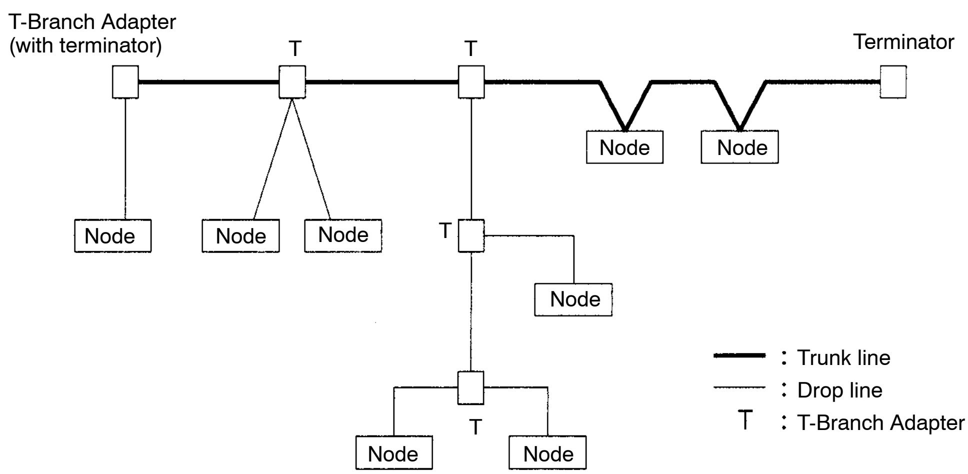


Figure 3.2 Network Connections

■ Configuration Elements

The network is configured from the following elements.

Nodes

A node is either a slave that connects to an NS300 Module or similar Module, or the master that manages the I/O of the slaves. There are no restrictions on the location of the master or slaves. Any node in *Figure 3.2* can be the master or a slave.

Trunk Line and Drop Lines

A cable with a terminator on each end is a trunk line. Any cable branching from the trunk line is a drop line.

Connection Methods

A node is connected using the T-branch method or multi-drop method. A T-Branch Adapter is used to connect a node with the T-branch method. A node is directly connected to the trunk line or a drop line with the multi-drop method. Both T-branch and multi-drop methods can be used together in the same network, as shown in *Figure 3.2*.

Terminator

Both ends of the trunk line must connect to terminating resistance to decrease signal reflection and ensure stable network communications.

Communications Power Supply

The communications connector of each node must be provided with a communications power supply through the communications cable for DeviceNet communications.

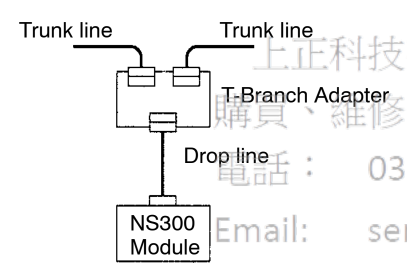
IMPORTANT

1. The communications cable must be a special DeviceNet cable.
2. Both ends of the trunk line must connect to a terminator.
3. Only DeviceNet devices can be connected to the network. Do not connect any other devices, such as a lightning arrester.

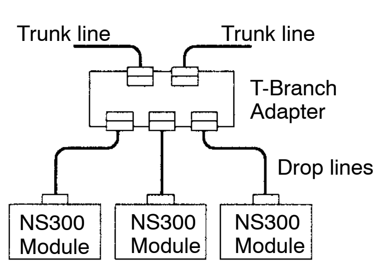
■ Branching from the Trunk Line

There are three methods that can be used to branch from the trunk line.

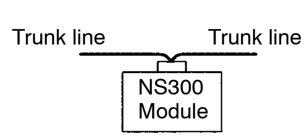
Single Branching



Branching to Three Drop Lines



Direct Node Connection

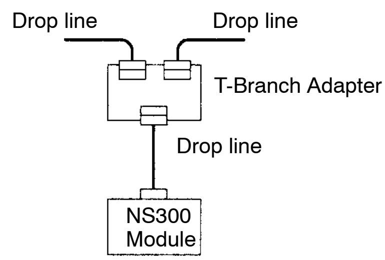


Multi-drop method

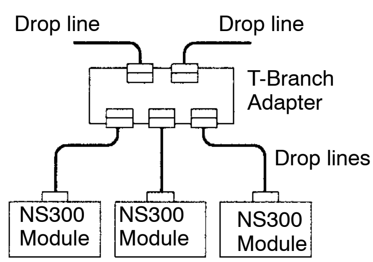
■ Branching from Drop Lines

There are three methods that can be used to branch from drop lines.

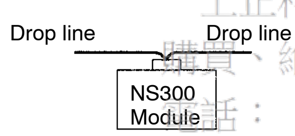
Single Branching



Branching to Three Drop Lines



Direct Node Connection



Multi-drop method

3.5.2 DeviceNet Communications Connectors (CN6)

The terminal layout and specifications of the CN6 connectors are shown below.

■ Connector Specifications

The following table shows the connector specifications. These connectors are metal plated with a flange attached.

Name	Model	Manufacturer
Connector	MSTB2.5/5-STF-5.08AU	PHOENIX CONTACT
Case		

■ Connector Pin Arrangement

The connector pin arrangement is as shown below.

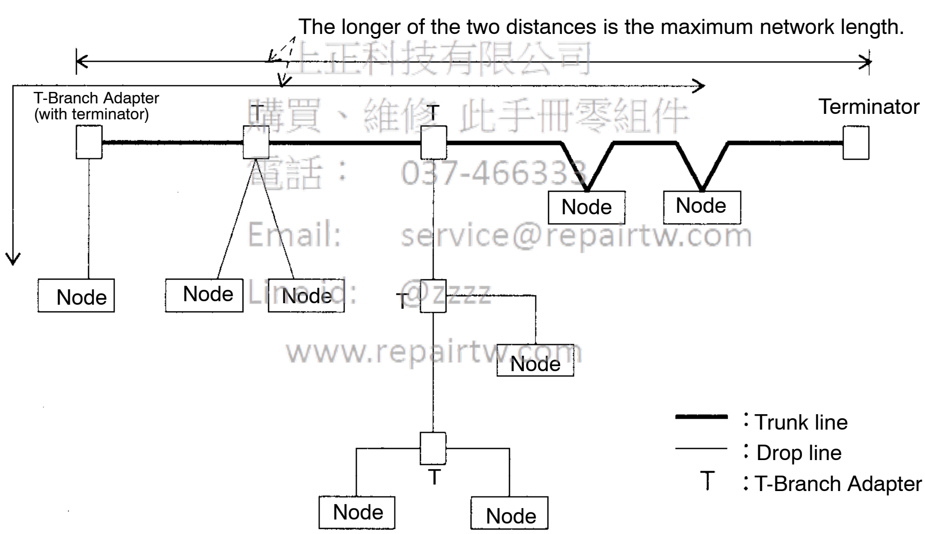
Pin No. and Code	Symbol	Detail
1	0 (24 V)	0 V external communications power supply
2	CAN L	CAN bus line dominant L
3	SHIELD	Shield
4	CAN H	CAN bus line dominant H
5	24 V	24 V external communications power supply

3.5.3 Precautions for Wiring DeviceNet Cables

Observe the following precautions when wiring DeviceNet cables.

■ Maximum Network Length

The maximum network length is either the line length between two nodes located farthest from each other or the line length between the terminators on the ends of the trunk line, whichever is longer.



Special DeviceNet cables can be either thick cables or thin cables. The characteristics of each type are given in the following table.

Item	Cable Type	
	Thick Cable	**Thin Cable**
Signal decay	Slight	Considerable
Communications distance	Long distance	Short distance
Characteristics	Rigid (difficult to bend)	Pliable (bends easily)

The maximum network length is determined by the type of cable, as shown in the following table.

Baud Rate (Kbps)	Maximum Network Length (m)	
	Thick Cable	Thin Cable
500	100	100
250	250	100
125	500	100

INFO

The line connecting two nodes located farthest from each other can use both thick and thin cables provided that the length of each cable satisfies the conditions in the following table.

Baud Rate (Kbps)	Maximum Network Length (m)
500	$L_{THICK} + L_{THIN} \leqq 100$
250	$L_{THICK} + 2.5 \times L_{THIN} \leqq 250$
125	$L_{THICK} + 5.0 \times L_{THIN} \leqq 500$

Note L_{THICK}: Thick cable length L_{THIN}: Thin cable length

■ Drop Line Length

The drop line length is the line length between a branch point on the trunk line to the farthest node that is located on the drop line. The maximum drop line length is 6 m. A drop line can be branched out into other drop lines.

■ Total Drop Line Length

The total drop line length is a total of all drop line lengths.

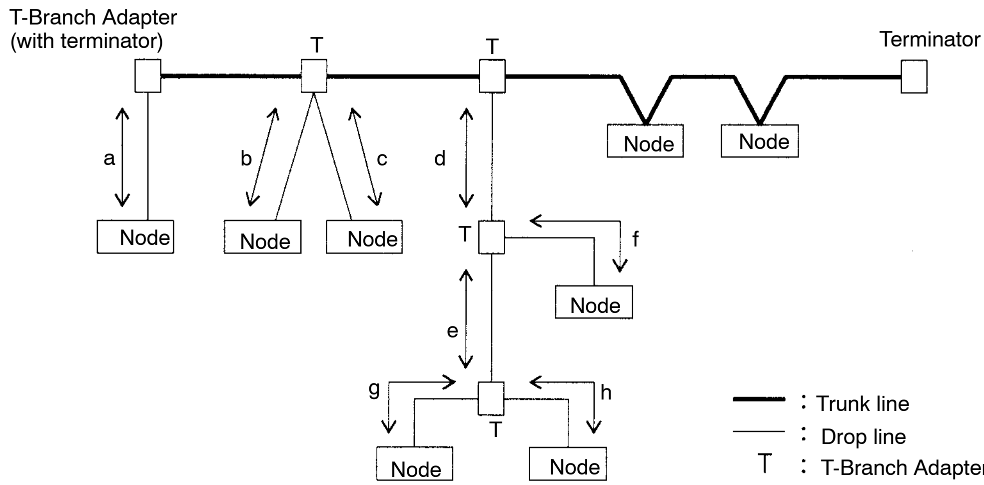
Length Limits

The total drop line length must be within the allowable range and even then, each drop line must be 6 m or less.

The allowable range of total drop line length varies with the baud rate as shown in the following table.

Baud Rate (Kbps)	Total Network Length (m)
500	39 max.
250	78 max.
125	156 max.

The following example is for a baud rate of 500 Kbps.



The above example must satisfy the following conditions.

- a ≦ 6 m
- b ≦ 6 m
- c ≦ 6 m
- d ≦ 6 m
- d+f ≦ 6 m
- d+e+g ≦ 6 m
- d+e+h ≦ 6 m

The total drop line length must satisfy the following condition.

- Total drop line length = a+b+c+d+e+f+g+h ≦ 39 m

■ Basic Precautions

Basic precautions are as follows:

- The communications power supply to the network must be 24 VDC.
- The communications power supply must have a sufficient margin in the capacity.
- Connect the communications power supply to the trunk line.
- If many nodes are provided with power from a single power supply, locate the power supply as close as possible to the middle of the trunk line.
- The allowable current flow in a thick cable is 8 A and that in a thin cable is 3 A.
- The power supply capacity for a drop line varies with the drop line length. The longer a drop line is, the lower the maximum current capacity of the drop line will be regardless of the thickness of the drop line. Obtain the allowable current (I) of the drop line (i.e., the allowable current consumption of the drop line and devices connected to it) from the following equation.

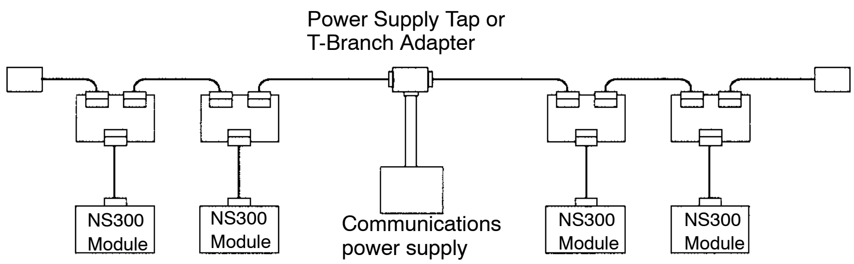
  $I=4.57/L$ I: Allowable current (A)
  L: Drop line length (m)

- If only the communications power supply is turned OFF while the network is operating, errors may occur in the nodes that are communicating at that time.

■ Location of Power Supply

The following two types of configuration are possible for the location of the power supply.

Nodes on Both Sides of the Power Supply



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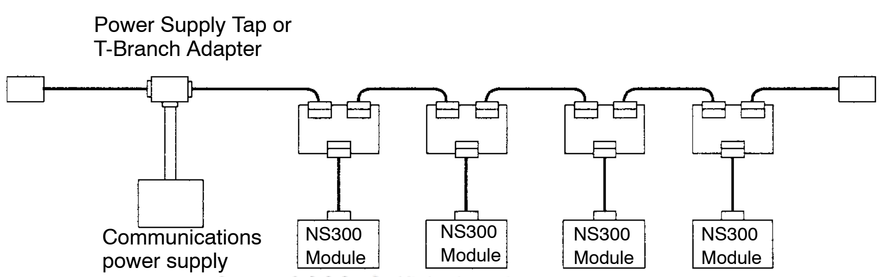
Nodes on One Side of the Power Supply

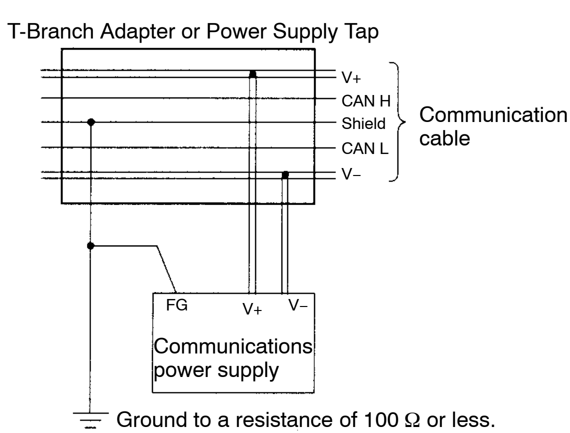


Note The "Nodes on Both Sides of the Power Supply" method is recommended if a single power supply is connected to many nodes.

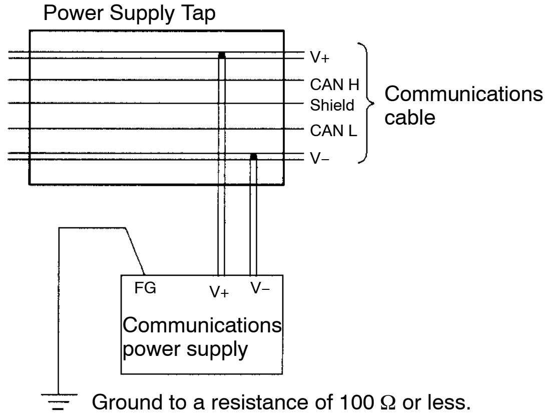
3.5.4 Grounding

As shown below, connect the shield wire of the cable to the FG terminal of the communications power supply and ground the shield wire to a resistance of 100 Ω or less.

■ Power Supply with Single-point Ground



■ Power Supply without Ground



If more than one communications power supply is used, ground only the power supply that is located closest to the middle of the network through the shield wire. Do not ground the power supply through the shield wire at any other point. If more than one communications power supply is connected to the network, connect them using a Power Supply Tap each.

IMPORTANT

1. Power supplies are not counted as nodes.
2. Ground the network to a resistance of 100 Ω or less.
3. Do not ground the network together with servodrivers or inverters.
4. Do not ground the network through the shield wire at more than one point; ground at a single point only.

4

Parameter Settings

This chapter provides an outline and details of NS300 parameters.

4.1 Parameters

4.1.1 Outline of Parameters

Parameters is the name given to the user constants that are required as the settings used to operate the NS300 Module. You must set the optimum values for parameters according to the NS300 Module and the machine to which the SGDH is mounted.

You can edit the NS300 Module parameters using the NSxxx Setup Tool, DeviceNet Configurator, or host controller.

For parameters, refer to *Chapter 6 Parameter Settings* or the Σ-II *Series SGM□H/SGDH User's Manual Design and Maintenance* (SIE-S800-32.2).

4.1.2 Parameter Types

Parameters are classified depending on their purpose as follows:

- Unit parameters
- Zero Point Return parameters
- Machine system and peripheral device parameters
- Speed, acceleration, and deceleration parameters
- Positioning parameters
- Multi-speed positioning parameters
- Notch output positioning parameters

Parameters are further classified according to the priority of the setting, as shown below.

Table 4.1 Parameter Types

Type	Meaning
A	Parameters that must be set even when using the NS300 Module in standard mode.
B	Parameters that must be set when using the NS300 Module in special mode.
C	Parameters whose settings hardly ever need to be changed.

4.1.3 Editing Parameters

You can edit parameters using the following methods.

Table 4.2 Methods of Editing Parameters

Tools	Methods	Remarks
NSxxx Setup Tool	Select ***Option Parameter List*** from the Parameter Menu to read all the NS300 Module parameters. After the parameters have been displayed, select the parameters you want to edit, and click the **Edit** Button to edit the parameters.	All changed parameters are stored in RAM, so they are erased when the power is turned OFF. Use the ***Module Reset*** Command to write the parameter data in RAM to the flash ROM.
Master Device or DeviceNet Configurator	You can edit using ***Explicit Message (Set_Attribute_Single)*** from the Master Device.	All changed parameters are stored in RAM, so they are erased when the power is turned OFF. Execute the **Reset Service** for the Identity Object to write the parameter data in RAM to the flash ROM.

4

IMPORTANT

Parameters changed from each setting device are stored in RAM.
To save parameters in flash ROM after adjustments have been completed, execute the ***Module Reset*** Command in the NSxxx Setup Tool or execute the Reset Service to the Identity Object via DeviceNet.

4.1.4 Effective Timing

Not all parameters edited from the NSxxx Setup Tool or Master Device are effective immediately. Changed parameters are effective at one of the following two times.

Table 4.3 Effective Timing for Parameters

Timing	Control or Processing
Power-up	The values of all parameters are made effective at the following times. 1. When power is turned ON. 2. When the Module is reset from the NSxxx Setup Tool or via a command message.
Immediate	The values of changed parameters are made effective immediately. However, parameters will be stored in the Flash ROM at the following times. 1. When the Module is reset from the NSxxx Setup Tool or via a command message. 2. When the Reset Service to the Identity Object is executed via DeviceNet.

4.2 Parameter Tables

The following tables list the parameters.

If using the NSxxx Setup Tool or reading/writing using a command message, edit parameters using Pn□□□. If editing via DeviceNet explicit messages, edit using the object number and attribute number. Refer to 5.6 *Changing Parameters* or the host controller manual for details.

4.2.1 Unit Parameters

The unit parameter table is shown below.

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#30	Pn810	Electronic Gear Ratio (Numerator)	1 to 10,000,000	---	Power-up	1	B
	#31	Pn811	Electronic Gear Ratio (Denominator)	1 to 10,000,000	---	Power-up	1	B

4.2.2 Zero Point Return Parameters

The table of zero point return parameters are shown below.

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#10	Pn800	Zero Point Return Mode	0 to 3	---	Immediate	0	B
	#11	Pn801	Zero Point Return Function Selection	0 to 7	---	Power-up	1	B
	#12	Pn802	Feed Speed for Zero Point Return	1 to 240,000	1000 reference units/min	Immediate	10,000	B
	#13	Pn803	Approach Speed for Zero Point Return	1 to 240,000	1000 reference units/min	Immediate	1,000	B
	#14	Pn804	Creep Speed for Zero Point Return	1 to 240,000	1000 reference units/min	Immediate	500	B
	#15	Pn805	Final Travel Distance for Zero Point Return	0 to 99,999,999	Reference units	Immediate	0	B
	#16	Pn806	Output Width for Zero Point Return	0 to 32, 767	Reference units	Immediate	100	B

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#17	Pn809	Zero Point Offset	–99,999,999 to 99,999,999	Reference units	Immediate	0	C
	#18	Pn80A	Accel/Decel Time for Zero Point Return	1 to 10,000	ms	Immediate	100	B

Note: 1. For reference unit details, refer to *4.3.1 Unit Parameters*.

2. If you set the reference unit to 0.001 mm, 1,000 reference units/min becomes mm/min.

4.2.3 Machine System and Peripheral Device Parameters

The machine system and peripheral device parameter table is shown below.

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#32	Pn812	Coordinate Type	0, 1	---	Immediate	0	C
	#33	Pn813	Reference units per Machine Rotation	1 to 1,500,000	---	Immediate	360,000	C
	#34	Pn814	Backlash Compensation	0 to 32,767	Reference units	Immediate	0	C
	#35	Pn815	Backlash Direction	0, 1	Reference units	Immediate	0	C
	#36	Pn816	Positive Software Limit	±99,999,999	---	Power-up	99999999	B
	#37	Pn817	Negative Software Limit	±99,999,999	Reference units	Power-up	–99999999	B
	#38	Pn818	Machine Function Selection	0 to 3	---	Immediate	0	B
	#39	Pn819	Hardware Limit Signal Function Selection	0 to 3	---	Immediate	1	B
	#40	Pn81A	Hardware Limit Action Selection	0, 1, 2	---	Immediate	0	B
	#41	Pn81B	Emergency Stop Signal Function Selection	0 to 3	---	Immediate	1	B
	#42	Pn81C	Action Selection on Emergency Stop	0	---	Immediate	0	B

Note: 1. For reference unit details, refer to *4.3.1 Unit Parameters*.

2. If you set the reference unit to 0.001 mm, 1,000 reference units/min becomes mm/min.

4.2.4 Speed, Acceleration, and Deceleration Parameters

A table of speed, acceleration, and deceleration parameters is shown below.

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#51	Pn821	Feed Speed for Positioning	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#52	Pn822	Acceleration Time for Positioning	1 to 10,000	ms	Immediate	100	B
	#53	Pn823	Deceleration Time for Positioning	1 to 10,000	ms	Immediate	100	C
	#54	Pn824	Switch Speed for Second Accel/Decel for Positioning	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#55	Pn825	Accel/Decel Time for Second Accel/Decel for Positioning	1 to 10,000	ms	Immediate	200	B
	#56	Pn826	Accel/Decel Type for Positioning	0 to 3	---	Immediate	0	B
	#57	Pn827	Feed Speed for External Positioning	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#58	Pn829	Filter Selection	0 to 3	---	Immediate	0	B
	#59	Pn830	Constant Feed Reference Module Selection	0, 1	---	Immediate	0	B
	#60	Pn831	Constant Feed Speed	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#61	Pn832	Acceleration Time for Constant Feed	1 to 10,000	ms	Immediate	100	B
	#62	Pn833	Deceleration Time for Constant Feed	1 to 10,000	ms	Immediate	100	C
	#63	Pn834	Switch Speed for Constant Feed Second Accel/Decel	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#64	Pn835	Accel/Decel Time for Constant Feed Second Accel/Decel	1 to 10,000	ms	Immediate	200	C

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#65	Pn836	Accel/Decel Type for Constant Feed	0, 1, 2, 3	---	Immediate	0	B
	#70	Pn840	Time Constant for Exponential Accel/Decel	4 to 1,000	ms	Immediate	25	C
	#71	Pn841	Bias Speed for Exponential Accel/Decel	0 to 240,000	1000 reference units/min	Immediate	0	C
	#72	Pn842	Time Constant of Travelling Average	4 to 1,000	ms	Immediate	25	C
	#73	Pn843	Maximum Feed Speed	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#74	Pn844	Step Distance 1	0 to 99,999,999	Reference units	Immediate	1	B
	#75	Pn845	Step Distance 2	0 to 99,999,999	Reference units	Immediate	10	B
	#76	Pn846	Step Distance 3	0 to 99,999,999	Reference units	Immediate	100	B
	#77	Pn847	Step Distance 4	0 to 99,999,999	Reference units	Immediate	1,000	B

Note: 1. For reference unit details, refer to *4.3.1 Unit Parameters*.

2. If you set the reference unit to 0.001 mm, 1,000 reference units/min becomes mm/min.

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4.2.5 Positioning Parameters

The positioning parameter table is shown below.

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#90	Pn850	Positioning Deadband	0 to 10,000	Reference units	Immediate	5	A
	#91	Pn851	Positioning Timeout	0 to 100,000	ms	Immediate	0	A
	#92	Pn852	Positioning Proximity Detection Width	0 to 32,767	Reference units	Immediate	10	B
	#93	Pn853	Direction for Rotation System	0, 1	---	Immediate	0	B
	#94	Pn854	Approach Speed for External Positioning	1 to 240,000	1,000 reference units/min	Immediate	24,000	B
	#95	Pn855	Travel Distance for External Positioning	-99,999,999 to 99,999,999	Reference units	Immediate	0	B
	#96	Pn856	Function Selection for External Positioning	0 to 1	---	Power-up	1	B
	#100	Pn85A	Number of Stations	1 to 32,767	---	Immediate	1	B

Note: 1. For reference unit details, refer to *4.3.1 Unit Parameters*.

2. If you set the reference unit to 0.001 mm, 1,000 reference units/min becomes mm/min.

4.2.6 Multi-speed Positioning Parameters

A table of multi-speed positioning parameters is shown below.

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#111	Pn861	Number of Points for Speed Switching	0 to 16	–	Immediate	0	C
	#112	Pn862	Initial Feed Speed for Multi-speed Positioning	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#113	Pn863	Speed Switching Position 1	0 to 99,999,999	Reference units	Immediate	0	C
	#114	Pn864	Speed Switching Position 2	0 to 99,999,999	Reference units	Immediate	0	C

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#115	Pn865	Speed Switching Position 3	0 to 99,999,999	Reference units	Immediate	0	C
	#116	Pn866	Speed Switching Position 4	0 to 99,999,999	Reference units	Immediate	0	C
	#117	Pn867	Speed Switching Position 5	0 to 99,999,999	Reference units	Immediate	0	C
	#118	Pn868	Speed Switching Position 6	0 to 99,999,999	Reference units	Immediate	0	C
	#119	Pn869	Speed Switching Position 7	0 to 99,999,999	Reference units	Immediate	0	C
	#120	Pn86A	Speed Switching Position 8	0 to 99,999,999	Reference units	Immediate	0	C
	#121	Pn86B	Speed Switching Position 9	0 to 99,999,999	Reference units	Immediate	0	C
	#122	Pn86C	Speed Switching Position 10	0 to 99,999,999	Reference units	Immediate	0	C
	#123	Pn86D	Speed Switching Position 11	0 to 99,999,999	Reference units	Immediate	0	C
	#124	Pn86E	Speed Switching Position 12	0 to 99,999,999	Reference units	Immediate	0	C
	#125	Pn86F	Speed Switching Position 13	0 to 99,999,999	Reference units	Immediate	0	C
	#126	Pn870	Speed Switching Position 14	0 to 99,999,999	Reference units	Immediate	0	C
	#127	Pn871	Speed Switching Position 15	0 to 99,999,999	Reference units	Immediate	0	C
	#128	Pn872	Speed Switching Position 16	0 to 99,999,999	Reference units	Immediate	0	C
	#129	Pn873	Switching Speed 1	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#130	Pn874	Switching Speed 2	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#131	Pn875	Switching Speed 3	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#132	Pn876	Switching Speed 4	1 to 240,000	1000 reference units/min	Immediate	24,000	C

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#133	Pn877	Switching Speed 5	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#134	Pn878	Switching Speed 6	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#135	Pn879	Switching Speed 7	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#136	Pn87A	Switching Speed 8	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#137	Pn87B	Switching Speed 9	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#138	Pn87C	Switching Speed 10	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#139	Pn87D	Switching Speed 11	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#140	Pn87E	Switching Speed 12	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#141	Pn87F	Switching Speed 13	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#142	Pn880	Switching Speed 14	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#143	Pn881	Switching Speed 15	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#144	Pn882	Switching Speed 16	1 to 240,000	1000 reference units/min	Immediate	24,000	C

Note: 1. For reference unit details, refer to *4.3.1 Unit Parameters*.
2. If you set the reference unit to 0.001 mm, 1,000 reference units/min becomes mm/min.

4.2.7 Notch Output Parameters

The notch output parameter table is shown below.

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#160	Pn890	Notch Signal Output Position Setting	0, 1	–	Immediate	0	C
	#161	Pn891	Notch Signal Output Setting	0 to 3	–	Immediate	0	C
	#162	Pn892	Notch 1 Output Position Lower Limit	±99,999,999	Reference units	Immediate	0	C
	#163	Pn893	Notch 1 Output Position Upper Limit	±99,999,999	Reference units	Immediate	0	C
	#164	Pn894	Notch 2 Output Position Lower Limit	±99,999,999	Reference units	Immediate	0	C
	#165	Pn895	Notch 2 Output Position Upper Limit	±99,999,999	Reference units	Immediate	0	C

Note: 1. For reference unit details, refer to *4.3.1 Unit Parameters*.

2. If you set the reference unit to 0.001 mm, 1,000 reference units/min becomes mm/min.

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4.3 Parameter Details

4.3.1 Unit Parameters

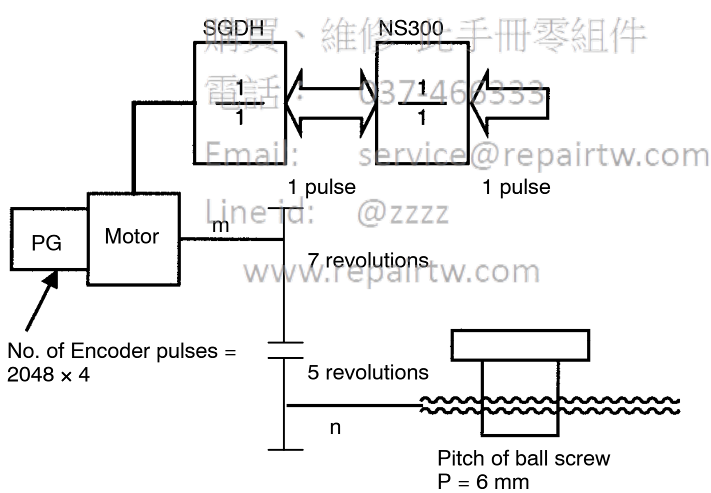
The unit for performing positioning using a NS300 Module is determined by the following two parameters.

Object	Attribute	No.	Name	Range	Units	Effective Timing	Default Value	Type
0x64	#30	Pn810	Electronic gear (numerator)	1 to 10,000,000	---	Power-up	1	B
	#31	Pn811	Electronic gear (denominator)	1 to 10,000,000	---	Power-up	1	B

The electronic gear function can be used to set the position command units equal to the amount of encoder pulses. The host controller can generate position commands in more familiar user-defined units such as millimeters or inches.

■ Not Using the Electronic Gear

If not using the electronic gear, set Pn810 and Pn811 to 1. This will set the reference unit to 1 pulse, so you must calculate the scale position units using the host controller.



IMPORTANT

In this manual, the reference unit explained in *Electronic Gear Settings When Using a Ball Screw* in *4.3.1 Unit Parameters* is based on a unit of 0.001 mm. The speed and other parameters must be interpreted as follows:

- Pn821: Feed Speed for Positioning (mm/min) → (1000 pulses/min)

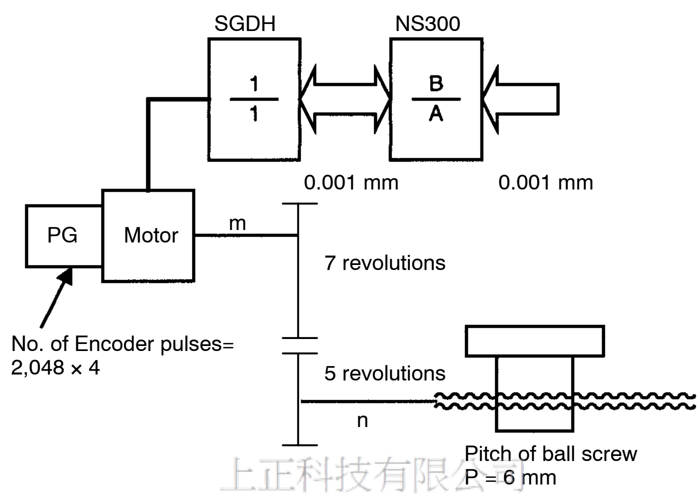
■ Electronic Gear Settings When Using a Ball Screw

If using a ball screw, first check the following specifications.

- Number of Encoder pulses
- Gear ratio
- Ball screw pitch

System Example

The following system example shows the formulas when the reference unit is set to 0.001 mm.



- REV $= \dfrac{\text{Travel distance of load per revolution (mm)}}{\text{Reference unit (mm)}} = \dfrac{6\ \text{mm}}{0.001\ \text{mm}} = 6000$
- A = (REV) × {Gear ratio (load rev.)} = 6000 × 5 = 30000
- B = (Encoder pulses) × (Pulse multiplier) × {Gear ratio (motor rev.)} = 2048 × 4 × 7 = 57344
- B/A = 57344/30000 = 1.911

Data ranges are shown below.

- A ≦ 10,000,000
- B ≦ 10,000,000
- 100 ≧ B/A ≧ 0.01

By storing the value of A in Pn811 and the value of B in Pn810, you can use the Electronic Gear function. These parameters are enabled when the power is turned ON. After you have changed the parameter, execute the Module Reset Command or the Reset Service to the Identity Object.

IMPORTANT

Setting B/A outside the range 0.01 to 100 may result in a misoperation. Make sure to set B and A within this range.

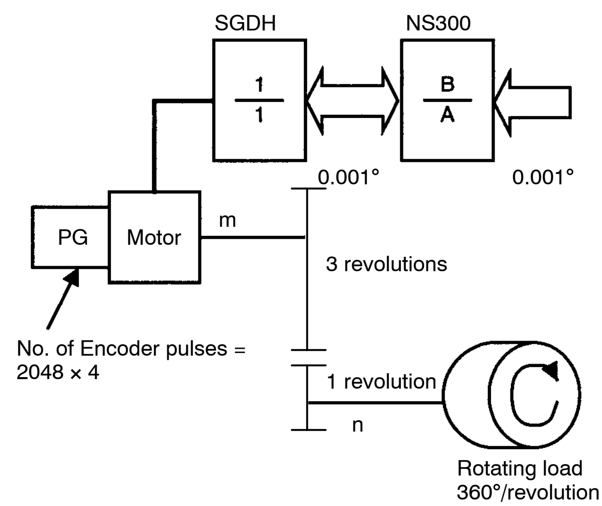
■ Electronic Gear Settings when Using a Rotary Table

If using a rotary table, first check the following specifications.

- Number of Encoder pulses
- Gear ratio

System Example

The following system example shows the formulas when the reference unit is set to 0.001°.



- REV = 360°/0.001° = 36000
- A = REV × {Gear Ratio (load rev.)} = 36000 × 1 = 36000
- B = (Encoder pulses) × (Pulse multiplier) × {Gear ratio (motor rev.)} = 2048 × 4 × 3 = 24576

Data ranges are shown below.

- A ≦ 10,000,000
- B ≦ 10,000,000
- 100 ≧ B/A ≧ 0.01

By storing the value of A in Pn811 and the value of B in Pn810, you can use the Electronic Gear function. These parameters are enabled when the power is turned ON. After you have changed the parameter, execute the Module Reset Command or the Reset Service to the Identity Object.

IMPORTANT

Setting B/A outside the range 0.01 to 100 may result in a misoperation. Make sure to set B and A within this range.

4.3.2 Zero Point Return Parameters

■ Zero Point Return Types

The following four types of zero point return are supported when the incremental detection system is used.

Type 0

This zero point return type returns to the zero point using the deceleration limit switch signal (DEC signal) and the phase C pulse of the encoder. The outline of the operation is as follows:

1. The axis travels in the direction specified as the zero point direction in the Zero Point Return Function Selection (Pn801) at the Zero Point Return Feed Speed (Pn802).
2. When the deceleration limit switch status changes, the axis decelerates and travels at the Zero Point Return Approach Speed (Pn803).
3. When the deceleration limit switch status changes again, the axis decelerates further when the first encoder phase C pulse is detected and then travels at the Zero Point Return Creep Speed (Pn804).
4. The axis travels the Zero Point Return Final Travel Distance (Pn805) from the position where the phase C was detected, and that position becomes the zero point.

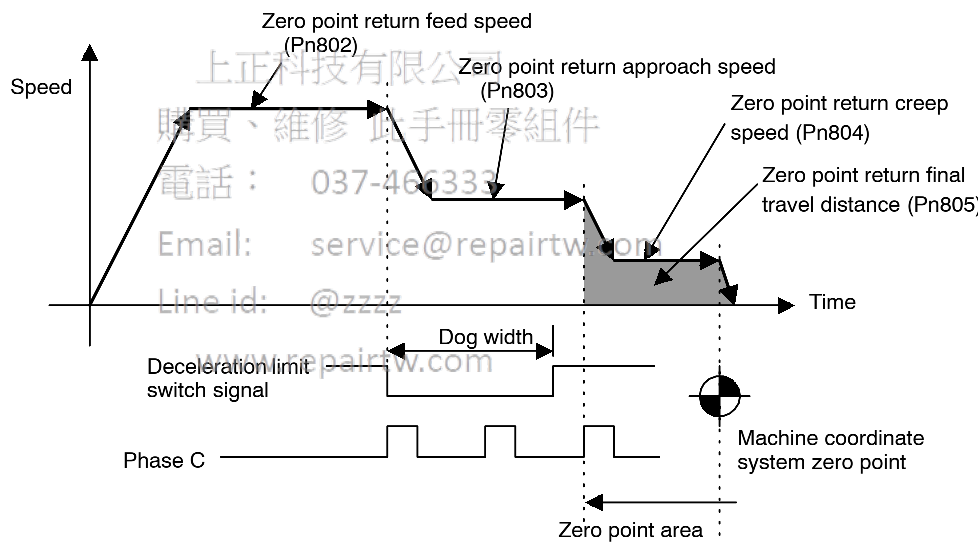


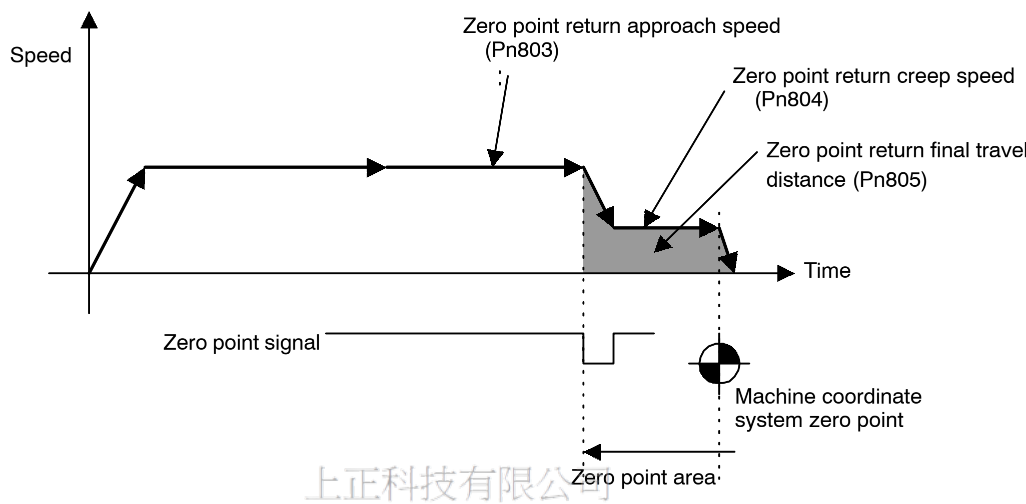
Figure 4.1 Type 0 Zero Point Return

IMPORTANT When an absolute detection system is being used, the zero point return is not performed and positioning will be performed to the zero point in the machine coordinate system at the Feed Speed for Positioning.

Type 1

This zero point return type returns to the zero point using the zero point signal (ZERO signal). The outline of the operation is as follows:

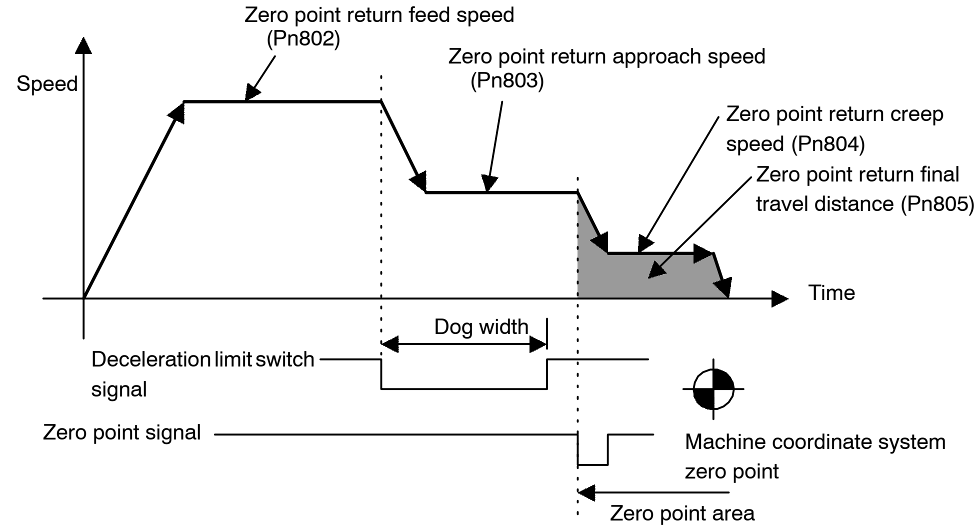
1. The axis travels in the direction specified as the zero point direction in the Zero Point Return Function Selection (Pn801) at the Zero Point Return Approach Speed (Pn803).
2. When the zero point signal status changes, the axis decelerates, and travels at the Zero Point Return Creep Speed (Pn804).
3. The axis travels the Zero Point Return Final Travel Distance (Pn805) from the position that the zero point signal status changed, and that position becomes the zero point.



Type 2

This zero point return type returns to the zero point using the deceleration limit switch (DEC signal) and the zero point signal (ZERO signal). The outline of the operation is as follows:

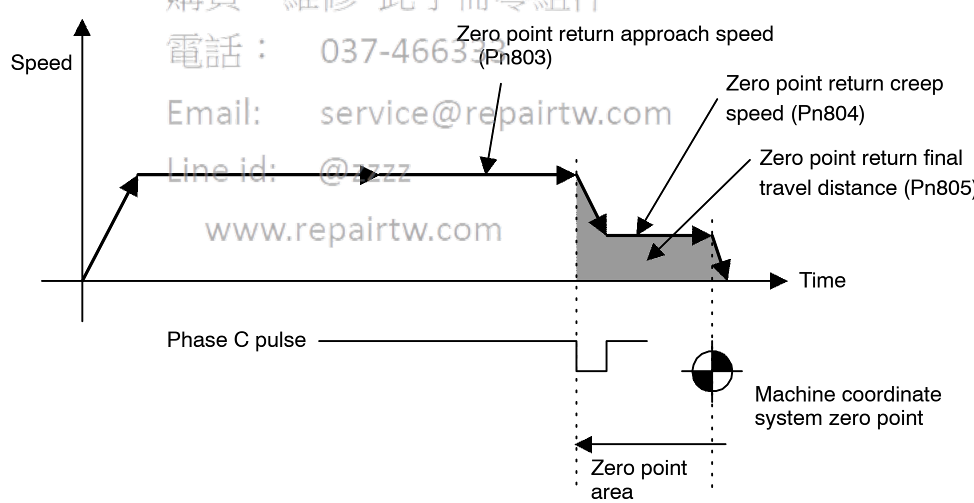
1. The axis travels in the direction specified as zero point direction in the Zero Point Return Function Selection (Pn801) at the Zero Point Return Feed Speed (Pn802).
2. When the deceleration limit switch status changes, the axis decelerates, and travels at the Zero Point Return Approach Speed (Pn803).
3. When the zero point signal changes, the axis decelerates further and travels at the Zero Point Return Creep Speed (Pn804).
4. The axis travels the Zero Point Return Final Travel Distance (Pn805) from the position where the zero point signal changed, and that position becomes the zero point.



Type 3

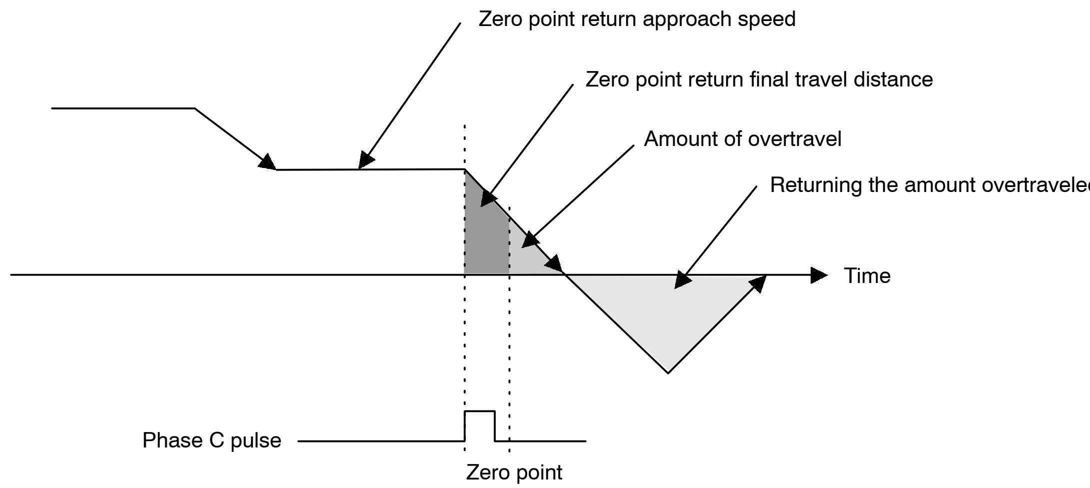
This zero point return type returns to the zero point using the phase C pulse of the encoder only. The outline of the operation is as follows:

1. The axis travels in the direction specified as zero point direction in the Zero Point Return Function Selection (Pn801) at the Zero Point Return Approach Speed (Pn803).
2. When the first phase C pulse of the encoder is detected, the axis decelerates, and travels at the Zero Point Return Creep Speed (Pn804).
3. The axis travels the Zero Point Return Final Travel Distance (Pn805) from the position where the phase C pulse was detected, and that position becomes the zero point.



INFO

When the setting for the Zero Point Return Final Travel Distance (Pn805) is small (when the distance is shorter than the distance required for the deceleration from approach speed), the axis will travel past the zero point and then return to it from the other direction.



■ Parameter Details (Object 0x64)

The details of parameters relating to zero point return are shown below.

Zero Point Return Mode (Object: 0x64, Attribute: #10; Pn800)

The zero point return type is specified in the zero point return mode.

Zero Point Return Mode	Zero Point Return Type
0	3-step deceleration using deceleration limit switch and phase C pulse
1	Double-step deceleration using zero point signal
2	3-step deceleration using deceleration limit switch and zero point signal
3	Double-step deceleration using phase C pulse

Zero Point Return Function Selection (Object: 0x64, Attribute: #11; Pn801)

The zero point return function selection has the following bit settings.

Bit	Name	Description
0	Zero Point Return Direction Setting*	0: Positive direction 1: Negative direction
1	Deceleration Limit Switch Signal Setting	0: Enabled on Low 1: Enabled on High
2	Zero Point Signal Setting	0: Enabled on trailing edge 1: Enabled on leading edge
3 to 15	Reserved	–

Zero Point Return Feed Speed (Object: 0x64, Attribute: #12; Pn802)

Use the Zero Point Return Feed Speed to set the initial feed speed for 3-step deceleration zero point return.

The setting unit is 1,000 reference units/min.

Zero Point Return Approach Speed (Object: 0x64, Attribute: #13; Pn803)

Use the Zero Point Return Approach Speed to set the approach speed for zero point return.
The setting unit is 1,000 reference units/min.

Zero Point Return Creep Speed (Object: 0x64, Attribute: #14; Pn804)

Use the Zero Point Return Creep Speed to set the creep speed for zero point return.
The setting unit is 1,000 reference units/min.

Zero Point Return Final Travel Distance (Object: 0x64, Attribute: #15; Pn805)

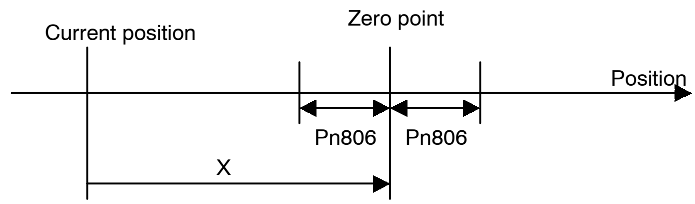
Use the Zero Point Return Final Travel Distance to set the distance from the position where the encoder phase C and zero point signal were detected to the machine zero point.
The setting unit is reference units.

Zero Point Output Width (Object: 0x64, Attribute:#16; Pn806)

Use the Zero Point Output Width to set the area that will be regarded as the zero point.
The setting unit is reference units.

In the following diagram, if the conditions outlined below are met, the Zero Point Flag in the response message will be set to 1.

- X = | Zero point − Current position | ≦ Pn806



Zero Point Offset (Object: 0x64, Attribute: #17; Pn809)

The system automatically writes to the Zero Point Offset the value of the offset from the zero point on the encoder when the zero point setting in the absolute value detection system has been completed. Normally, this parameter does not need to be set.

When using an absolute value detection system, set this value to enable adjustment of the zero point.

Zero Point Return Acceleration/Deceleration Time (Object: 0x64, Attribute: #18; Pn80A)

Use the Zero Point Return Acceleration/Deceleration Time to set the acceleration/declaration time constant used during zero point return. The setting unit is ms. Single-step linear acceleration/deceleration is used for zero point return. Refer to *4.3.4 Speed, Acceleration, and Deceleration* for information on this acceleration/deceleration type.

4.3.3 Machine System and Peripheral Devices

The details of parameters relating to the machine system and peripheral devices are shown below.

Coordinate Type (Object: 0x64, Attribute: #32; Pn812)

Use the Coordinate Type to set whether to use the NS300 Module as a linear axis or rotary axis.

Pn812	Description
0	The linear axis is designated. The unit of current value data: reference units
1	The rotary axis is designated. The unit of current value data: degrees

Reference Units per Machine Rotation (Object: 0x64, Attribute: #33; Pn813)

Use the Reference Units per Machine Rotation to set the reference unit for one machine rotation. This parameter is enabled only when the coordinate type is set to rotary axis. If this parameter is not set correctly, when the machine performs a 360° rotation, the current position will not be reset to 0°, so be careful.

The setting unit is reference units. The initial value is 360,000.

Backlash Compensation (Object: 0x64, Attribute: #34; Pn814)

Use the Backlash Compensation to set the amount of compensation when backlash compensation is used. The setting unit is reference units.

Backlash Compensation Direction (Object: 0x64, Attribute: #35; Pn815)

Use the Backlash Compensation Direction to set the direction of the backlash compensation.

Normally, set this parameter in the opposite direction to the zero point direction.

Pn815	Description
0	Positive Direction
1	Negative Direction

Positive Software Limit (Object: 0x64, Attribute: #36; Pn816)

Use the Positive Software Limit to set the software limit in the positive direction.
The setting unit is reference unit. Make the setting between –99,999,999 and 99,999,999.

Negative Software Limit (Object: 0x64, Attribute: #37; Pn817)

Use the Negative Software Limit to set the software limit in the negative direction.
The setting unit is reference unit. Make the setting between –99,999,999 and 99,999,999.

Machine Function Selection (Object: 0x64, Attribute: #38; Pn818)

Use the Machine Function Selection to set whether or not to use the software limit functions and the backlash compensation functions.

Bit	Description
0	0: Software Limit is disabled. 1: Software Limit is enabled.
1	0: Backlash Compensation is disabled. 1: Backlash Compensation is enabled.

Hardware Limit Signal Function Selection (Object: 0x64, Attribute: #39; Pn819)

Use the Hardware Limit Signal Function Selection to set whether or not to use the hardware limit and to set the signal polarity.

Bit	Name	Description
0	Enable/Disable Hardware Limit	0: Disabled 1: Enabled
1	Hardware Limit Signal Polarity	0: Enabled on Low 1: Enabled on High
2 to 15	Reserved	–

Hardware Limit Action (Object: 0x64, Attribute: #40; Pn81A)

Use the Hardware Limit Action to set the operation of the NS300 Module when a hardware limit is detected.

Pn81A	Description
0	Servo OFF
1	Hard Stop: Stops at the specified maximum torque without acceleration or deceleration.
2 to 255	Reserved

Emergency Stop Signal Function Selection (Object: 0x64, Attribute: #41: Pn81B)

Use the Emergency Stop Signal Function Selection to set whether or not to use the emergency stop function and to set the polarity of the signal.

Bit	Name	Description
0	Enable/disable Emergency Stop	0: Disabled 1: Enabled
1	Emergency Stop Signal Polarity	0: Enabled on Low 1: Enabled on High
2 to 15	Reserved	–

Operation Selection at Emergency Stop (Object: 0x64, Attribute: #42: Pn81C)

Use the Operation Selection at Emergency Stop to set the operation at emergency stop when the emergency stop signal has been enabled. The currently supported setting is 0: Stop immediately and turn OFF Servo.

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4.3.4 Speed, Acceleration, and Deceleration

■ Acceleration and Deceleration Patterns

The following acceleration and deceleration patterns are possible by combining acceleration/deceleration types (Pn826 or Pn836) and filters (Pn829).

–		Acceleration/Deceleration Type (Pn826 or Pn836)			
		0: None	1: Single-step Linear	2: Double-step Linear	3: Asymmetric
Filter Selection (Pn829)	0: None	No acceleration and deceleration	Single-step Linear Accel/Decel Constant Accel/Decel*1	Double-step Linear Accel/Decel Constant Accel/Decel*1	Asymmetric Linear Accel/Decel Constant Accel/Decel*1
	1: Exponent	Exponential Accel/Decel Constant Accel/Decel time*2	---	---	---
	2: Exponent with Bias	Exponential Accel/Decel with Bias Constant Accel/Decel time*2	---	---	---
	3: Travelling Average	Single-step Linear Accel/Decel Constant Accel/Decel time*2	S-curve Accel/Decel Time Constant Accel/Decel*1	---	Asymmetric S-curve Accel/Decel Constant Accel/Decel*1

* 1. With Constant Accel/Decel, the time required for acceleration and deceleration changes with the feed speed changes.
* 2. With Constant Accel/Decel time, the time required for acceleration and deceleration does not change even if the feed speed changes.

Note: Combinations other than those given above may result in incorrect acceleration and deceleration.

Single-step Linear Acceleration/Deceleration with Constant Acceleration/Deceleration

For Single-step Linear Acceleration/Deceleration with Constant Acceleration/Deceleration, the acceleration/deceleration is determined by two parameters: the Maximum Feed Speed and the Acceleration Time for Positioning.

The time T required to reach the Feed Speed for Positioning can be calculated as follows:

T [ms] = Pn822 × (Pn821/Pn843)

If this acceleration/deceleration pattern is used, the acceleration/deceleration will remain constant even if the Feed Speed for Positioning is changed.

Table 4.4 Related Parameters

Object	Attribute	Pn□□□	Name
0x64	#56	Pn826	Acceleration/Deceleration Type for Positioning (= 1)
	#58	Pn829	Filter Selection (= 0)
	#51	Pn821	Feed Speed for Positioning
	#52	Pn822	Acceleration Time for Positioning
	#73	Pn843	Maximum Feed Speed

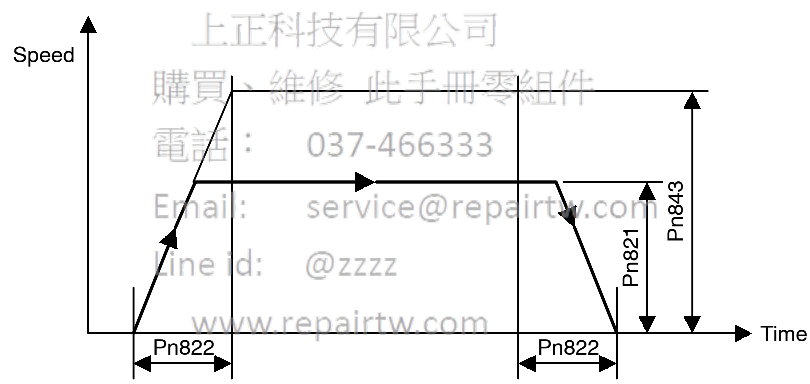


Figure 4.2 Single-step Linear Acceleration/Deceleration with Constant Acceleration/Deceleration

Double-step Linear Acceleration/Deceleration with Constant Acceleration/Deceleration

For Double-step Acceleration/Deceleration, the acceleration/deceleration will change when the Switch Speed for Second Acceleration/Deceleration is reached. The acceleration/deceleration for step 1 is determined by two parameters: the Maximum Feed Speed and the Acceleration Time for Positioning. The acceleration/deceleration for step 2 is determined by three parameters: the Maximum Feed Speed, the Switch Speed for the Second Acceleration/Deceleration, and the Acceleration/Deceleration Time Constant of the Second Acceleration/Deceleration.

The time T required to reach a constant speed for positioning can be calculated as follows:

T1 [ms] = Pn822 $\times$ (Pn824/Pn843)

T2 [ms] = Pn825 $\times$ (Pn821 − Pn824)/(Pn843 − Pn824)

T [ms] = T1 + T2

If this acceleration/deceleration pattern is used, the acceleration/deceleration will remain constant even if the Feed Speed for Positioning is changed.

Table 4.5 Related Parameters

Object	Attribute	Pn□□□	Name
0x64	#56	Pn826	Acceleration/Deceleration Type for Positioning (= 2)
	#58	Pn829	Filter Selection (= 0)
	#51	Pn821	Feed Speed for Positioning
	#52	Pn822	Acceleration Time Constant for Positioning
	#54	Pn824	Switch Speed for Second Accel/Decel
	#55	Pn825	Accel/Decel Time Constant of Second Accel/Decel
	#73	Pn843	Maximum Feed Speed

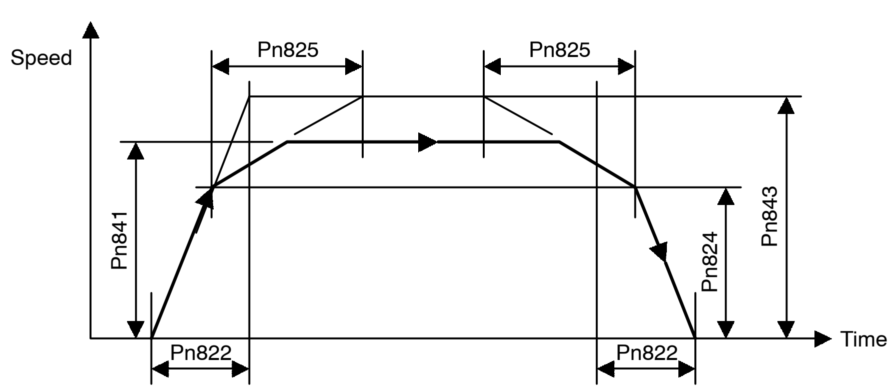


Figure 4.3 Double-step Linear Acceleration/Deceleration with Constant Acceleration/Deceleration

Asymmetric Linear Acceleration/Deceleration with Constant Acceleration/Deceleration

For Asymmetric Linear Acceleration/Deceleration, the acceleration and deceleration can be set separately in Single-step Linear Acceleration/Deceleration.

For example, for deceleration, the time T required to stop from the Feed Speed for Positioning can be calculated as follows:

T [ms] = Pn823 × (Pn821/Pn843)

If this acceleration/deceleration pattern is used, the acceleration/deceleration will remain constant even if the Feed Speed for Positioning is changed.

Table 4.6 Related Parameters

Object	Attribute	Pn□□□	Name
0x64	#56	Pn826	Acceleration/Deceleration Type for Positioning (= 3)
	#58	Pn829	Filter Selection (= 0)
	#51	Pn821	Feed Speed for Positioning
	#52	Pn822	Acceleration Time for Positioning
	#53	Pn823	Deceleration Time for Positioning
	#73	Pn843	Maximum Feed Speed

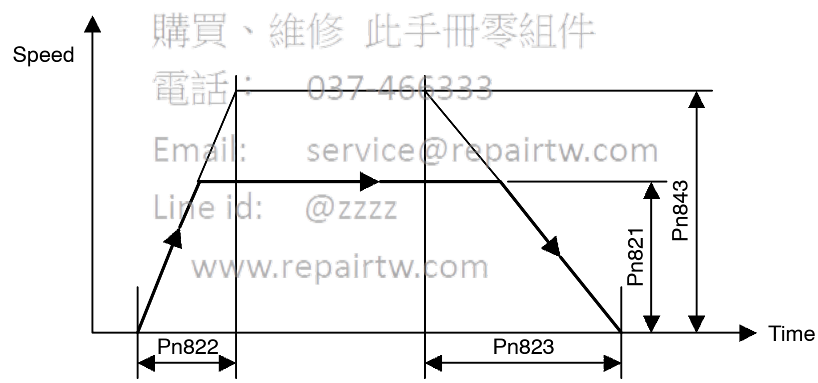


Figure 4.4 Asymmetric Linear Acceleration/Deceleration with Constant Acceleration/Deceleration

Exponential Acceleration/Deceleration with Constant Acceleration/Deceleration Time

For Exponential Acceleration/Deceleration, the acceleration/deceleration is determined by two parameters: the Feed Speed for Positioning and the Time Constant for Exponential Acceleration/Deceleration. Set the time required to reach 63.2% of the Feed Speed for Positioning to Time Constant for Exponential Acceleration/Deceleration. The acceleration/deceleration time will be 3.91 × Pn840 ms.

If this acceleration/deceleration pattern is used, the acceleration/deceleration will remain constant even if the Feed Speed for Positioning is changed.

Table 4.7 Related Parameters

Object	Attribute	Pn□□□	Name
0x64	#56	Pn826	Acceleration/Deceleration Type for Positioning (= 0)
	#58	Pn829	Filter Selection (= 1)
	#51	Pn821	Feed Speed for Positioning
	#70	Pn840	Time Constant for Exponential Acceleration/Deceleration

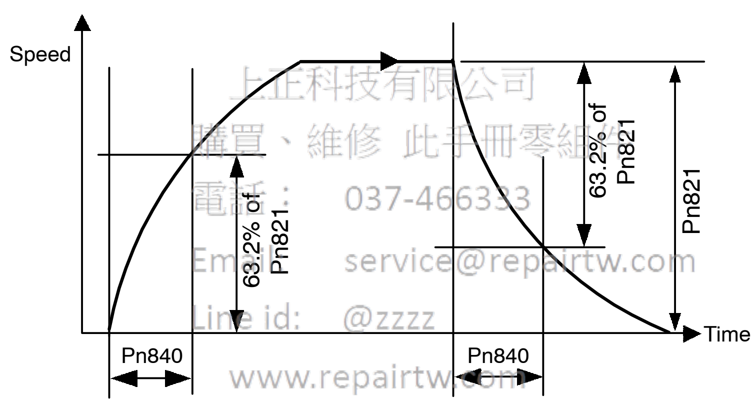


Figure 4.5 Exponential Acceleration/Deceleration with Constant Acceleration/Deceleration Time

Exponential Acceleration/Deceleration with Bias with Constant Acceleration/Deceleration Time

For Exponential Acceleration/Deceleration with Bias, a bias is applied to the Exponential Acceleration/Deceleration.

Feed speed = Bias Speed for Exponential Acceleration/Deceleration +
(Feed Speed for Positioning – Bias Speed for Exponential Acceleration/Deceleration) × 0.632

The acceleration/deceleration time can be calculated as 3.91 × Pn840 ms.

If this acceleration/deceleration pattern is used, the acceleration/deceleration will remain constant even if the Feed Speed for Positioning is changed. If the Bias Speed for Exponential Acceleration/Deceleration is set to 0 (zero), this Acceleration/Deceleration pattern will be the same as the Exponential's pattern.

Table 4.8 Related Parameters

Object	Attribute	Pn□□□	Name
0x64	#56	Pn826	Acceleration/Deceleration Type for Positioning (= 0)
	#58	Pn829	Filter Selection (= 2)
	#51	Pn821	Feed Speed for Positioning
	#70	Pn840	Time Constant for Exponential Acceleration/Deceleration
	#71	Pn841	Bias Speed for Exponential Acceleration/Deceleration

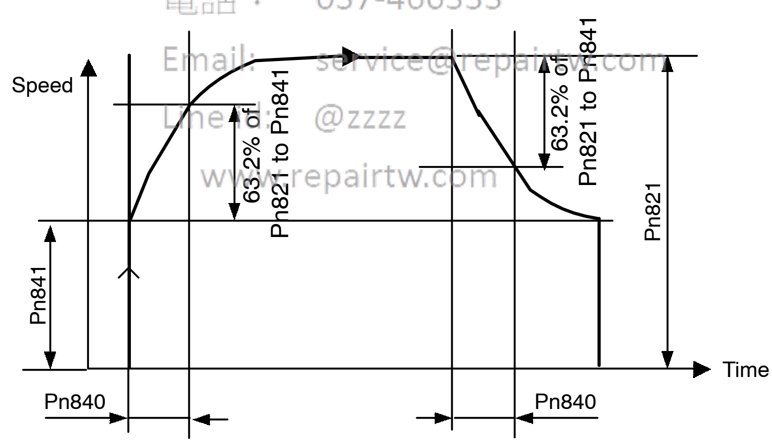


Figure 4.6 Exponential Acceleration/Deceleration with Bias with Constant Acceleration/Deceleration Time

Single-step Linear Acceleration/Deceleration with Constant Acceleration/Deceleration Time

For Single-step Linear Acceleration/Deceleration with Constant Acceleration/Deceleration Time, the acceleration/deceleration is determined by two parameters: the Feed Speed for Positioning and the Time Constant of Travelling Average.

If this acceleration/deceleration pattern is used, the acceleration/deceleration will remain constant even if the Feed Speed for Positioning is changed.

Table 4.9 Related Parameters

Object	Attribute	Pn□□□	Name
0x64	#56	Pn826	Acceleration/Deceleration Type for Positioning (= 0)
	#58	Pn829	Filter Selection (= 3)
	#51	Pn821	Feed Speed for Positioning
	#72	Pn842	Time Constant of Travelling Average

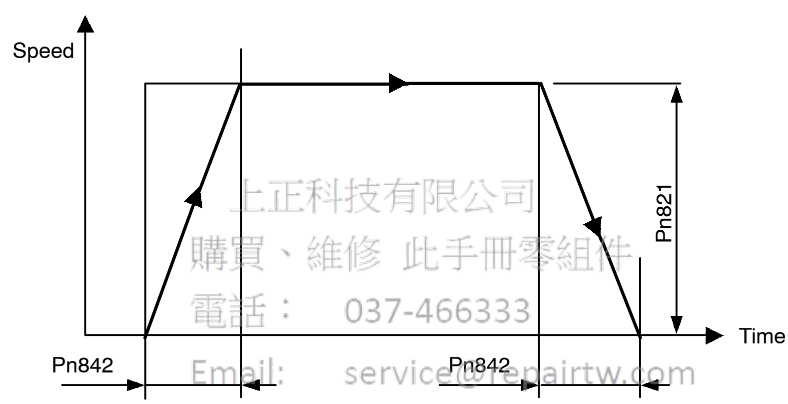


Figure 4.7 Single-step Linear Acceleration/Deceleration with Constant Acceleration/Deceleration Time

S-curve Acceleration/Deceleration with Constant Acceleration/Deceleration

For S-curve Acceleration/Deceleration with Constant Acceleration/Deceleration, the acceleration/deceleration is determined by two parameters as same as Single-step Linear Acceleration/Deceleration: the Maximum Feed Speed and the Acceleration Time for Positioning. For S-curve Acceleration/Deceleration, however, a filter is applied when starting and just before reaching the Feed Speed for Positioning to smooth the corners. The time for rounding the corners is set in the Time Constant of the Travelling Average.

The time T required to reach the Feed Speed for Positioning for positioning can be calculated as follows:

T [ms] = Pn842 + Pn822 × (Pn821/Pn843)

If this acceleration/deceleration pattern is used, the acceleration/deceleration will remain constant even if the Feed Speed for Positioning is changed.

Table 4.10 Related Parameters

Object	Attribute	Pn□□□	Name
0x64	#56	Pn826	Acceleration/Deceleration Type for Positioning (= 1)
	#58	Pn829	Filter Selection (= 3)
	#51	Pn821	Feed Speed for Positioning
	#52	Pn822	Acceleration Time for Positioning
	#72	Pn842	Time Constant of Travelling Average
	#73	Pn843	Maximum Feed Speed

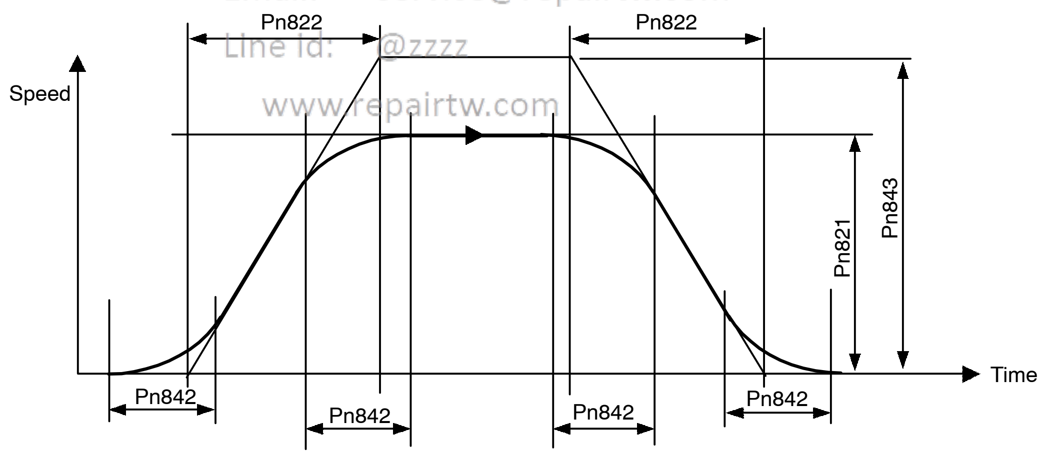


Figure 4.8 S-curve Acceleration/Deceleration with Constant Acceleration/Deceleration

Asymmetric S-curve Acceleration/Deceleration with Constant Acceleration/Deceleration

For Asymmetric S-curve Acceleration/Deceleration with constant Acceleration/Deceleration, the acceleration and deceleration can be set separately to the S-curve Acceleration/Deceleration.

Same as for Asymmetric Linear Acceleration/Deceleration, the acceleration and deceleration are determined by the Maximum Feed Speed, Acceleration Time for Positioning, and Deceleration Time for Positioning. For Asymmetric S-curve Acceleration/Deceleration, however, a filter is applied when starting, ending, and just before reaching the Feed Speed for Positioning to smooth the corners. The time for rounding the corners is set in the Time Constant of the Travelling Average.

The time T required to reach the Feed Speed for Positioning can be calculated as follows:

T [ms] = Pn842 + Pn822 × (Pn821/Pn843)

If this acceleration/deceleration pattern is used, the acceleration/deceleration will remain constant even if the Feed Speed for Positioning is changed.

Table 4.11 Related Parameters

Object	Attribute	Pn□□□	Name
0x64	#56	Pn826	Acceleration/Deceleration Type for Positioning
	#58	Pn829	Filter Selection
	#51	Pn821	Feed Speed for Positioning (mm/min)
	#52	Pn822	Acceleration Time for Positioning
	#53	Pn823	Deceleration Time for Positioning
	#72	Pn842	Time Constant for Travelling Average
	#73	Pn843	Maximum Feed Speed

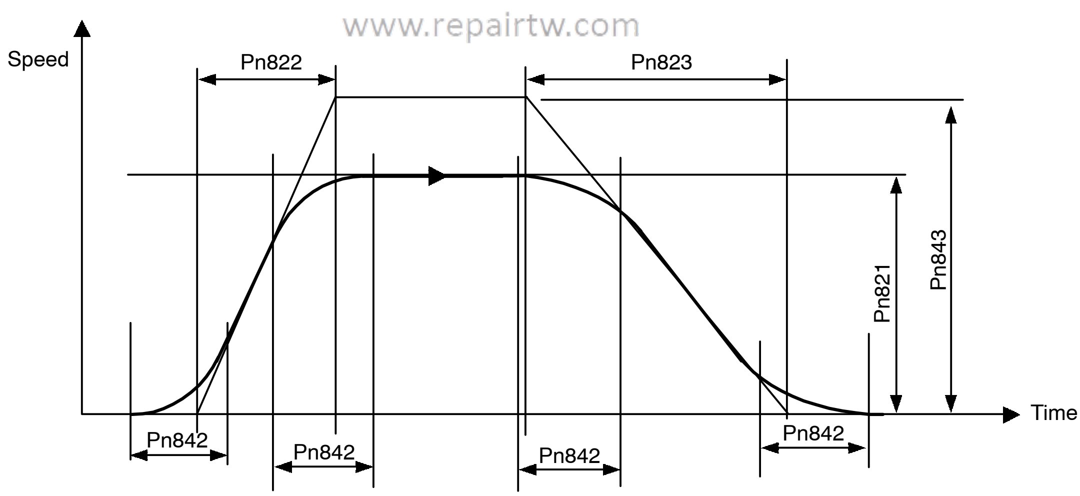


Figure 4.9 Asymmetric S-curve Acceleration/Deceleration with Constant Acceleration/Deceleration

■ Parameter Details

Feed Speed for Positioning (Object: 0x64, Attribute: #51; Pn821)

Use the Feed Speed for Positioning to set the feed speed of the positioning.
The setting unit is 1,000 reference units/min.

Acceleration Time for Positioning (Object: 0x64, Attribute: #52; Pn822)

Use the Acceleration Time for Positioning to set the acceleration time for the positioning.
The setting unit is ms.

Deceleration Time for Positioning (Object: 0x64, Attribute: #53; Pn823)

Use the Deceleration Time for Positioning to set the deceleration time for positioning.
The setting unit is ms.

This parameter is enabled only when the Acceleration/Deceleration Type for Positioning (Object: 0x64, Attribute: #56; Pn826) is set to the asymmetrical linear acceleration and deceleration.

Switch Speed for Second Acceleration/Deceleration for Positioning (Object: 0x64, Attribute: #54; Pn824)

Use the Switch Speed for Second Acceleration/Deceleration for Positioning to set the switching speed to acceleration and deceleration of the second step when using double-step linear acceleration and deceleration. The setting unit is 1,000 reference units/min.

This parameter is enabled only when the Acceleration/Deceleration Type for Positioning (Object: 0x64, Attribute: #56; Pn826) is set to double-step linear acceleration and deceleration.

Acceleration/Deceleration Time for Second Acceleration/Deceleration for Positioning (Object: 0x64, Attribute: #55; Pn825)

Use the Acceleration/Deceleration Time for Second Acceleration/Deceleration for Positioning to set the acceleration and deceleration time for the second step when using double-step linear acceleration and deceleration. The setting unit is ms.

This parameter is enabled only when the Acceleration/Deceleration Type for Positioning (Object: 0x64, Attribute: 56; Pn826) is set to double-step linear acceleration and deceleration.

Acceleration/Deceleration Type for Positioning (Object: 0x64, Attribute: #56; Pn826)

Use the Acceleration/Deceleration Type for Positioning to set the type of acceleration and deceleration for the positioning.

You can set eight different acceleration and deceleration patterns using different combinations of Acceleration/Deceleration Type for Positioning and Filter Selection (Object: 0x64, Attribute: #58; Pn829).

Setting	Description
0	None
1	Single Step Linear
2	Double Step Linear
3	Asymmetric

External Positioning Feed Speed (Object: 0x64, Attribute: #57; Pn827)

Use the External Positioning Feed Speed to set the feed speed for external positioning.

The setting unit is 1,000 reference units/min.

Filter Selection (Object: 0x64, Attribute: #58; Pn829)

Use the Filter Selection to set the acceleration and deceleration filter type. This parameter is used in common by the positioning, constant feeding, and zero point return operations.

Setting	Description
0	None
1	Exponential
2	Exponential with Bias
3	Travelling Average

Constant Feed Reference Module Selection (Object: 0x64, Attribute: #59; Pn830)

Use the Constant Feed Reference Module Selection to set the reference unit for the speed setting for a constant feed Command message.

Setting	Description
0	Sets an override value (%) for the feed speed for FEED (Pn831) in the command message.
1	Speed set directly in the command message. The setting unit is 1,000 reference units/min.

Constant Feed Speed (Object: 0x64, Attribute: #60; Pn831)

Use the Constant Feed Speed to set the feed speed when using the FEED operation.
The setting unit is 1,000 reference units/min.

Acceleration Time for Constant Feed (Object: 0x64, Attribute: #61; Pn832)

Use the Acceleration Time for Constant Feed to set the acceleration time when using the feed operation. The setting unit is ms.

Deceleration Time for Constant Feed (Object: 0x64, Attribute: #62; Pn833)

Use the Deceleration Time for Constant Feed to set the deceleration time when using asymmetrical acceleration and deceleration with the constant feed operation. The setting unit is ms.

This parameter is enabled only when the Acceleration/Deceleration Type for Constant Feed (Object: 0x64, Attribute: #65; Pn836) is set to asymmetrical linear acceleration and deceleration.

Switch Speed for Constant Feed Second Accel/Decel (Object: 0x64, Attribute: #63; Pn834)

Use the Switch Speed for Constant Feed Second Acceleration/Deceleration to set the switching speed to double-step acceleration and deceleration when using double-step linear acceleration and deceleration with the constant feed operation. The setting unit is 1,000 reference units/min.

This parameter is enabled only when the Acceleration/Deceleration Type for Constant Feed (Object: 0x64, Attribute: #65; Pn836) is set to double-step linear acceleration and deceleration.

Accel/Decel Time for Constant Feed Second Accel/Decel (Object: 0x64, Attribute: #64; Pn835)

Use the Acceleration/Deceleration Time for Constant Feed Second Acceleration/Deceleration to set the second acceleration/deceleration time when using double-step linear acceleration and deceleration with the constant feed operation. The setting unit is ms.

This parameter is enabled only when the Acceleration/Deceleration Type for Constant Feed (Object: 0x64, Attribute: #65; Pn836) is set to double-step linear acceleration and deceleration.

Acceleration/Deceleration Type for Constant Feed (Object: 0x64, Attribute: #65; Pn836)

Use the Acceleration/Deceleration Type for Constant Feed to set the acceleration and deceleration type with the constant feed operation.

You can set eight different acceleration and deceleration patterns using different combinations of Acceleration/Deceleration Type for Constant Feed and Filter Selection (Object: 0x64, Attribute: #58; Pn829).

Setting	Description
0	None
1	Single Step Linear
2	Double Step Linear
3	Asymmetric

Time Constant for Exponential Acceleration/Deceleration (Object: 0x64, Attribute: #70; Pn840)

Use the Time Constant for Exponential Acceleration/Deceleration to set the time constant when using exponential acceleration and deceleration. This parameter is used in common by the positioning and the continuous rotary operation. The setting unit is ms.

Bias Speed for Exponential Acceleration/Deceleration (Object: 0x64, Attribute: #71; Pn841)

Use the Bias Speed for Exponential Acceleration/Deceleration to set the bias speed of the exponential acceleration and deceleration. The setting unit is 1,000 reference units/min.

Time Constant of Travelling Average (Object: 0x64, Attribute: #72; Pn842)

Use the Time Constant of Travelling Average to set the time constant of the average travel speed of the acceleration and deceleration. This parameter is used in common by the positioning and the continuous rotary operation. The setting unit is ms.

Maximum Feed Speed (Object: 0x64, Attribute: #73; Pn843)

Use the maximum Feed Speed to set the maximum feed speeds for all speed-related parameters. The acceleration and deceleration data is calculated from this data and the time constants. The setting unit is 1,000 reference units/min.

The speed-related parameters are as follows: Pn802, Pn803, Pn804, Pn821, Pn824, Pn827, Pn831, Pn834, Pn841, Pn854, Pn862, Pn873 to Pn882, and Pn940 to Pn971.

Step Distance 1 (Object: 0x64, Attribute: #74; Pn844)

Use the Step Distance 1 to set the amount of travel when executing step operation. This value is used when the 0 has been specified as the command data in a command message.

The setting unit is reference units.

Step Distance 2 (Object: 0x64, Attribute: #75; Pn845)

Use the Step Distance 2 to set the amount of travel when executing step operation. This value is used when the 1 has been specified as the command data in a command message.

The setting unit is reference units.

Step Distance 3 (Object: 0x64, Attribute: #76; Pn846)

Use the Step Distance 3 to set the amount of travel when executing step operation. This value is used when the 2 has been specified as the command data in a command message.

The setting unit is reference units.

Step Distance 4 (Object: 0x64, Attribute: #77; Pn847)

Use the Step Distance 4 to set the amount of travel when executing step operation. This value is used when the 3 has been specified as the command data in a command message.

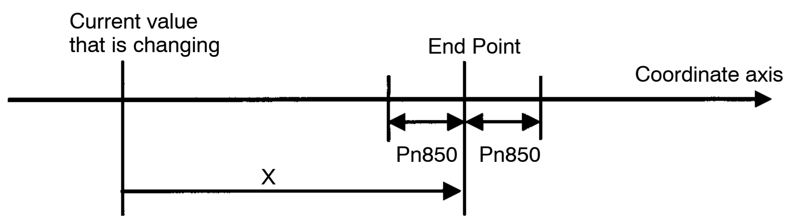
The setting unit is reference units.

4.3.5 Positioning

■ Parameter Details

Positioning Deadband (Object: 0x64, Attribute: #90; Pn850)

Use the Positioning Deadband to set the positioning completed range, i.e., to determine if the axis is on-target position. The setting unit is reference units. When the positioning deadband is set to 0, no on-target position check will be performed.



Positioning Deadband

When the following condition is satisfied in the above figure, the axis is viewed as being at the on-target position and the On-target Flag in the response message will be set to 1.

- X = (End point – Current value) ≤ Pn850

Positioning Timeout (Object: 0x64, Attribute: #91; Pn851)

Use the Positioning Timeout to set the time for performing on-target position check. The setting unit is ms. If, after the move command distribution has been completed, the positioning completed range is not entered within the time set, A.9A positioning a completion timeout warning will be sent.

If this parameter is set to 0, the check time becomes infinite.

Positioning Proximity Detection Width (Object: 0x64, Attribute: #92; Pn852)

Use the Positioning Proximity Detection Width to set the range for positioning area proximity to be detected. If the difference between the current position and the target position are within this parameter range, the proximity signal in the response message will be set to 1. The setting unit is reference units.

Direction for Rotation System (Object: 0x64, Attribute: #93; Pn853)

Use the Direction for Rotation System to set the rotation direction for when Station Commands or rotation commands using absolute values are used.

Setting	Description
0	Uses the rotation direction in command message.
1	Uses the direction for the shortest travel.

Approach Speed for External Positioning (Object: 0x64, Attribute: #94; Pn854)

Use the Approach Speed for External Positioning to set the approach speed after the external signal has reversed status for an external positioning command.

The setting unit is 1,000 reference units/min.

Travel Distance for External Positioning (Object: 0x64, Attribute: #95; Pn855)

Use the Travel Distance for External Positioning to set the travel distance after the external signal has reversed status for an external positioning command.

The setting unit is reference units.

Function Selection for External Positioning (Object: 0x64, Attribute: #96; Pn856)

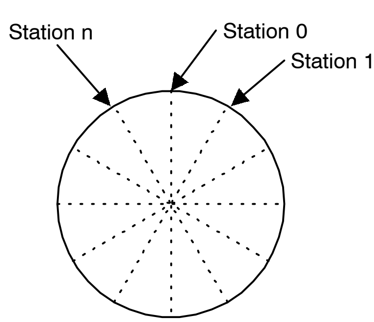
Use the Function Selection for External Positioning to select the polarity of the external signal.

Bit	Name	Description
0	External Signal Polarity	0: Enabled on low 1: Enabled on high
2 to 15	Reserved	–

Number of Stations (Object: 0x64, Attribute: #100; Pn85A)

Use the Number of Stations to set how many stations one revolution of the servomotor will be evenly split into when Station Commands are used.

In Station Commands, equally divided stations are numbered in order from 0 and positioning is performed by specifying a station number.

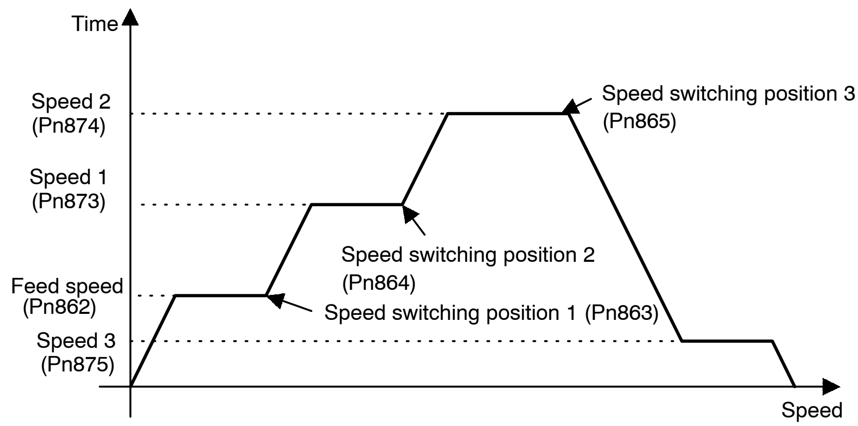


4.3.6 Multi-speed Positioning

By using multi-speed positioning, the speed can be changed in stages during positioning.

Up to 16 speed change stages are possible.

When the axis reaches a specified position, the speed switches to the speed for the next stage and the axis travels to the specified position in that next stage.



■ Parameter Details

Number of Points for Speed Switching (Object: 0x64, Attribute: #111; Pn861)

Use the Number of Points for Speed Switching to set the number of points at which the speed will be switched. If, for example, the parameters for speed switching positions were set from 1 to 16 but this setting for the number of points was set to 3, the speed switching would be enabled for 3 points only.

Initial Feed Speed for Multi-speed Positioning (Object: 0x64, Attribute: #112; Pn862)

Use the Initial Feed Speed for Multi-speed Positioning to set the initial feed speed when performing speed multi-step positioning. This speed will be enabled until the position in the speed switching position 1 parameter is reached.

The setting unit is 1,000 reference units/min.

Speed Switching Positions 1 to 16 (Object: 0x64, Attribute: #113 to #128; Pn863 to Pn872)

Use the Speed Switching Position to set the position at which the speed is to change at a position relative to the start position. The speed switching position xx and switching speed xx are used together. For example, the axis will travel from speed switching position 1 to speed switching position 2 at speed 1.

The setting unit is reference units.

Switching Speeds 1 to 16 (Object: 0x64, Attribute: #129 to #144; Pn873 to Pn882)

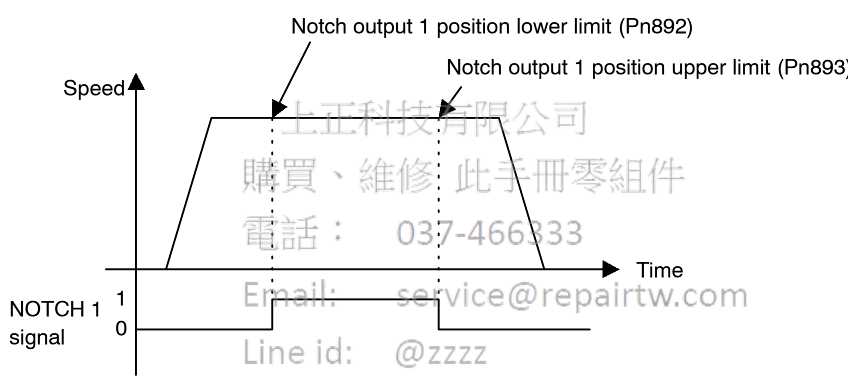
Use the Switching Speed to set the feed speed between specified speed switching positions. For example, the axis will travel at speed 2 between speed switching position 2 and speed switching position 3.

The setting unit is 1,000 reference units/min.

4.3.7 Notch Signal Output Positioning

During the positioning, notch signals (NOTCH 1 and NOTCH 2) are output when specified points are passed.

Two notch signals, NOTCH 1 and NOTCH 2, can be output.



■ Parameter Details

Notch Signal Output Position Setting (Object: 0x64, Attribute: #160; Pn890)

Use the Notch Signal Output Position Setting to set whether absolute or relative positions are set for the notch signal output position parameters.

Setting	Description
0	Setting absolute position.
1	Specifies relative position.

Notch Signal Output Setting (Object: 0x64, Attribute: #161; Pn891)

Use the Notch Signal Output Setting to set the polarity of the notch signal output.

Table 4.12 Notch Signal Output Setting

Setting	Description
0	Sets NOTCH 1 signal.
1	Sets NOTCH 2 signal.

Table 4.13 Bit Meanings

Bit 0/ Bit 1	Description
0	Normally: OFF When passed: ON
1	Normally: ON When passed: OFF

Notch 1 Output Position Lower Limit (Object: 0x64, Attribute: #162; Pn892)
Notch 1 Output Position Upper Limit (Object: 0x64, Attribute: #163; Pn893)

Use the Notch 1 Output Position Upper/Lower Limits to set the output position range for notch signal (NOTCH 1). When the current position is inside this range, the status of the NOTCH 1 signal output is reversed based on the notch signal output setting.

Notch 2 Output Position Lower Limit (Object: 0x64, Attribute: #164; Pn894)
Notch 2 Output Position Upper Limit (Object: 0x64, Attribute: #165; Pn895)

Use the Notch 2 Output Position Upper/Lower Limits to set the output position range for notch signal (NOTCH 2). When the current position is inside this range, the status of the NOTCH 2 signal output is reversed based on the notch signal output setting.

5

DeviceNet Communications

This chapter explains using DeviceNet communications to execute commands and editing parameters for an NS300 Module.

5

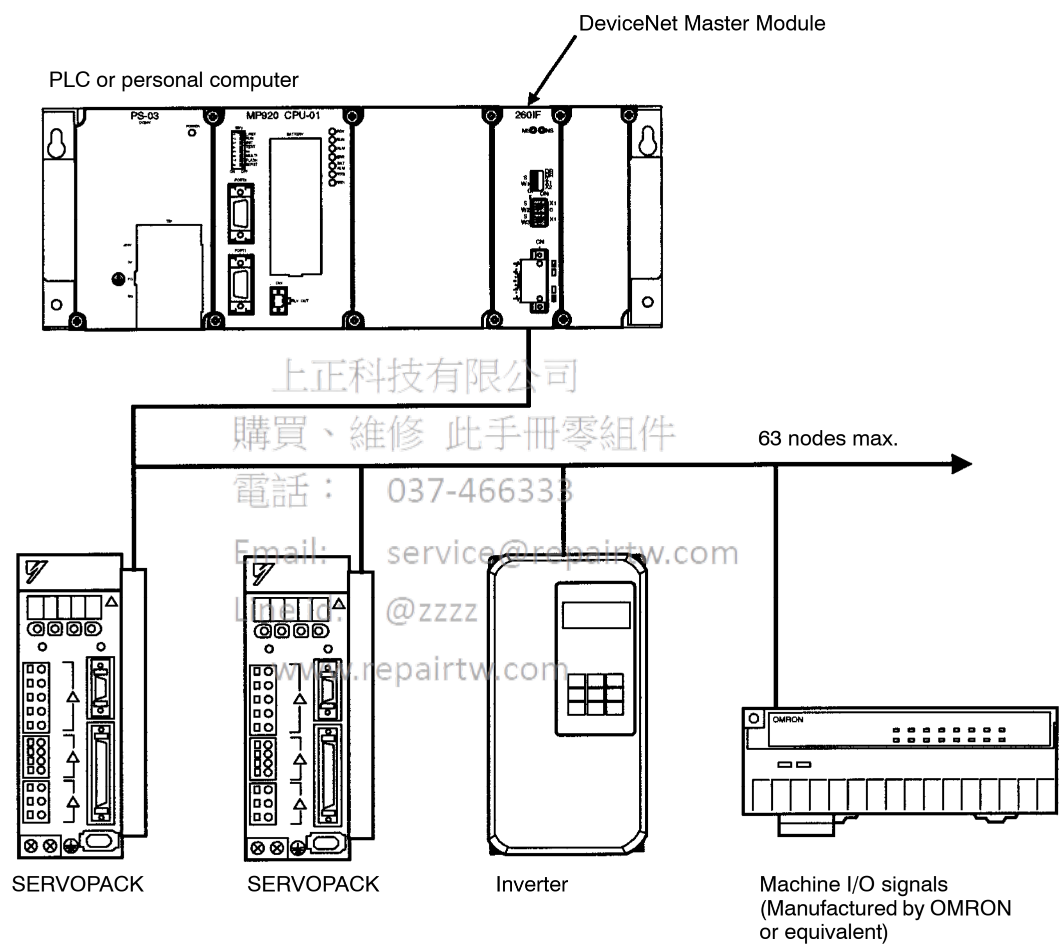
5.1 Specifications and Configuration

5.1.1 Specifications

Refer to *DeviceNet Specification Release 2.0* for details not specified in this manual.

5.1.2 Control Configuration

An outline of the control configuration is shown below. A maximum of 63 NS300 Modules or other slave devices can be connected to one DeviceNet Master.



5.2 DeviceNet Communications Setting Switches

This section explains the switch settings required for DeviceNet communications.

5.2.1 Rotary Switch Settings for Setting Node Address

Use the rotary switches (x1, x10) to set the DeviceNet node address. After making the settings, cycle the communications power to enable the settings.

The node address can be set between 0 and 63. If you make a setting outside this range, a setting error will occur.

Select the node address of the NS300 Module using the switch settings as shown in the following table.

× 10	× 1	Node Address	× 10	× 1	Node Address	× 10	× 1	Node Address
0	0	0	3	4	34	6	8	Setting error
0	1	1	3	5	35	6	9	Setting error
0	2	2	3	6	36	7	0	Setting error
0	3	3	3	7	37	7	1	Setting error
0	4	4	3	8	38	7	2	Setting error
0	5	5	3	9	39	7	3	Setting error
0	6	6	4	0	40	7	4	Setting error
0	7	7	4	1	41	7	5	Setting error
0	8	8	4	2	42	7	6	Setting error
0	9	9	4	3	43	7	7	Setting error
1	0	10	4	4	44	7	8	Setting error
1	1	11	4	5	45	7	9	Setting error
1	2	12	4	6	46	8	0	Setting error
1	3	13	4	7	47	8	1	Setting error
1	4	14	4	8	48	8	2	Setting error
1	5	15	4	9	49	8	3	Setting error
1	6	16	5	0	50	8	4	Setting error
1	7	17	5	1	51	8	5	Setting error
1	8	18	5	2	52	8	6	Setting error
1	9	19	5	3	53	8	7	Setting error
2	0	20	5	4	54	8	8	Setting error
2	1	21	5	5	55	8	9	Setting error
2	2	22	5	6	56	9	0	Setting error
2	3	23	5	7	57	9	1	Setting error
2	4	24	5	8	58	9	2	Setting error
2	5	25	5	9	59	9	3	Setting error
2	6	26	6	0	60	9	4	Setting error
2	7	27	6	1	61	9	5	Setting error
2	8	28	6	2	62	9	6	Setting error
2	9	29	6	3	63	9	7	Setting error
3	0	30	6	4	Setting error	9	8	Setting error
3	1	31	6	5	Setting error	9	9	Setting error
3	2	32	6	6	Setting error	---	---	---
3	3	33	6	7	Setting error	---	---	---

5.2.2 Rotary Switch Settings for Setting Baud Rate

Use the DR rotary switches to set the DeviceNet baud rate. After making the settings, cycle the communications power supply to enable the settings.

Table 5.1 DR Settings

DR	Baud Rate Setting
0	125 Kbps
1	250 Kbps
2	500 Kbps
3 to 9	A setting error will occur.

5.2.3 LED Indicators

NS300 Modules are equipped with two LED indicators, the Module Status indicator to indicate the Module status, and the Network Status indicator to indicate the DeviceNet communications status.

The LED indicator specifications conform to *DeviceNet Specification Release 2.0*.

■ Module Status (MS) Indicator

The MS indicator shows the status of the NS300 Module.

Status	Indicator
SGDH control power supply is turned OFF.	Not lit.
Module is operating normally.	Lit green.
Module is warming up.	Flashes green.
Minor Module failure.	Flashes red.
Major Module failure.	Lit red.
Module is performing self-diagnosis.	Red and green flash alternately.

Refer to the alarm codes in *Appendix C* for details on the malfunction if the the Module Status indicator is either flashing red or lit red.

■ Network Status (NS) Indicator

The NS indicator shows the status of DeviceNet communications.

Status	Indicator
SGDH control power supply is turned OFF or Module is not online.	Not lit.
Module is online, but is not connected to the master device.	Flashes green.
Module is online, and is connected to the master device.	Lit green.
Connection to the master device has timed out.	Flashes red.
A fatal error has occurred in DeviceNet communications.	Lit red.

5.3 Command/Response Format

This section explains command messages sent to an NS300 Module from the master device and the response messages sent from the NS300 Module.

5.3.1 Command Format

This section explains the basic format of command messages sent to an NS300 Module from the master device and the response messages sent from the NS300 Module to the master device. Command and response messages are in an 8-byte data format.

Command

[0]	0/1	General command bits
[1]	Command-dependant data	
[2]		
[3]		
[4]		
[5]		
[6]		
[7]		

Response

[0]	0/1	General status
[1]	Command-dependant data	
[2]		
[3]		
[4]		
[5]		
[6]		
[7]		

Both the command and response data are separated into two sections. Byte 0 is a general area and bytes 1 to 7 make up the command-dependant data area. The command-dependant data area depends on the two types of commands, move commands and set/read commands. The type of command is defined by the most-significant bit of byte 0.

■ Format for Move Commands

Command

[0]	0	General command bits
[1]	Response type	Command code
[2]	Command bit	
[3]		
[4]	Command data	
[5]		
[6]		
[7]		

Response

[0]	0	General status
[1]	Response type	Command code
[2]	Status	
[3]		
[4]	Response data	
[5]		
[6]		
[7]		

■ Format for Set/Read Commands

Command

[0]	1	General command bits
[1]	0	Command code
[2]	Command number	
[3]		
[4]	Command data	
[5]		
[6]		
[7]		

Response

[0]	1	General status
[1]	0	Command code
[2]	Command number	
[3]		
[4]	Response data	
[5]		
[6]		
[7]		

5.3.2 General Command Bits and Status

■ General Command Bits

The general command bit area is detailed below.

Table 5.2 General Command Bits

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	MOD	0	ALRST	ESTP	0	0	SVON	C_STRT

Mode: MOD

Use the MOD bit to specify the data format for bytes 1 to 7.

- 0: Move command format
- 1: Set/read command format

INFO The MOD bit alters the data format for bytes 1 to 7. Set it carefully.

Alarm Reset Command: ALRST

Set the ALRST bit to 1 to reset the current alarm/warning. When an alarm or warning occurs in the NS300 Module or SGDH, remove the cause of the alarm before setting this bit to 1. The alarm/warming will be cleared.

Always make sure this bit is set to 0 during normal operation and after an alarm has been cleared.

Emergency Stop Command: ESTP

When the ESTP bit is changed from 1 to 0, a move command is canceled and the SGDH servo is turned OFF. If the axis is travelling, axis travel is stopped immediately and the SGDH servo is turned OFF as soon as the servomotor stops.

The ESTP Command has negative logic to confirm that DeviceNet communications have been established. Therefore, set the bit to 1 for normal operation and set it to 0 for emergency stops.

The emergency stop status will continue while this bit is set to 0. To release the emergency stop status, set the bit to 1. To turn ON the servo after releasing an emergency stop, set the Servo ON Command bit to 0 and then set it to 1.

Servo ON Command: SVON

Set the SVON bit to 1 to turn ON the SGDH servo. When the leading edge of the bit is detected, the SGDH servo is turned ON and remains ON while the command bit is set to 1. When the command bit setting changes to 0, the servo is turned OFF.

If an alarm turns OFF the SGDH servo, the command bit must be set to 0 and then set to 1 again.

Command Start Command: C_STRT

Set the C_STRT bit to 1 to start execution of the command specified by the command code. Always set the command code and command area data before (or at the same time as) setting the C_STRT bit to 1.

Refer to *5.3.3 Move Command Messages* and *5.3.4 Set/Read Command Messages* for details on using command codes.

■ General Status

Details on the general status area are shown below.

Table 5.3 General Status Bits

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	MOD_R	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R

Mode: MOD_R

The MOD_R bit specifies the data format of bytes 1 to 7.

This bit will be the same as the mode given in the command message.

- 0: Response format for move commands
- 1: Response format for set/read commands

Command Ready: READY

The READY bit will be set to 1 when the NS300 Module is ready to receive commands from the host device. The READY status will be 0 when the Servo ON Command is being executed, when the Parameter Read Command is being executed, when the Parameter Write Command is being executed, when the power is turned ON, when the Module Reset Command in the command message has been received and when the NS300 Module is initializing.

Main Power Supply Status: PWRON

The PWRON bit will be set to 1 when the SGDH main power supply is turned ON. If the main power supply is turned OFF, the bit will be 0 and the Servo ON and other commands cannot be executed.

Emergency Stop: ESTP_R

The ESTP_R bit will be set to 0 when the Emergency Stop Command in the command message has been set to 0 and the NS300 Module is in emergency stop status. Set the Emergency Stop Command in the command message to 1 to clear the emergency stop status, and this bit will change to 1.

This status has negative logic.

Alarm: ALRM

The ALRM bit will be set to 1 when the NS300 Module has detected an alarm. When all alarms have been cleared by the Alarm Reset Command in the command message, this bit will change to 0.

Warning: WARN

The WARN bit will be set to 1 when the NS300 Module has detected a warning. When all warnings have been cleared by the Alarm Reset Command in the command message, this bit will change to 0.

When a warning has occurred, the command that generated the warning and commands other than data setting commands can still be executed normally.

Servo ON: SVON_R

The SVON_R bit will be set to 1 when the Servo ON Command in the command message is set to 1 and the SGDH servo is ON.

The SVON_R bit will be 0 in the following circumstances.

- When the Servo ON Command in the command message has been set to 0
- When the Emergency Stop Command has been set to 0
- When the Module Reset Command has been set to 1
- When an alarm has occurred

Command Start Response: C_STRT_R

The C_STRT_R bit will be set to 1 when the Command Start Command in the command message has been set to 1. The host device can recognize that the NS300 Module has received a command from the host device by checking that this bit is 1.

5.3.3 Move Command Messages

■ Command Messages

Details on command messages for move commands are shown below.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	ALRST	ESTP	0	0	SVON	C_STRT
1	Response type				Command code			
2	HOME	PTBL	STN	STEP	FEED	0	HOLD	CANCEL
3	0	0	0	0	0	0	DIR	INC
4	Command data							
5								
6								
7								

Command Codes

Command codes are used to specify positioning and other commands. To start execution of a command, set the command code and command data first (or at the same time), and then change the Command Start Command from 0 to 1.

Command Codes	Description
0000	No operation
0001	Simple positioning
0010	External positioning
0011	Positioning with notch signal outputs
0100	Multi-speed positioning

Response Types

The response type in the command message specifies the type of data that will be stored as the response data in the response message. The NS300 Module creates response data in the response messages based on the specified response type.

Response Type	Response Data
0000	Command position (reference units)
0001	Current position (reference units)
0010	Position error (reference units)
0011	Command speed (1000 reference units/min)
0100	Current speed (1000 reference units/min)
0101	Torque (%)
1010	Station number
1011	Point table number

Cancel Command: CANCEL

If the Cancel Command is set to 1 during execution of a move command, the execution of the move command will be stopped and the servomotor will decelerate to a stop. The remaining travel distance will be canceled.

Hold Command: HOLD

If the Hold Command is set to 1 during execution of a move command, the execution of the move command will be held and the servomotor will decelerate to a stop. The NS300 Module will wait for command execution to be restarted. Set the Hold Command to 0 again to restart the execution of a move command.

Constant Feed Command: FEED

The NS300 Module will start feeding at a constant speed when it detects the leading edge of the FEED bit. Constant feeding will continue while this bit is set to 1.

When the FEED bit is set to 0, the servomotor will decelerate to a stop. The direction for feeding is determined by the Movement Direction set in the command data area.

An override can be set for this command in the command data area. The override can be from 0% to 200% of the parameter speed or a specific speed can be set in the command data. Which method is used depends on Pn830 (Constant Feed Reference Unit Selection).

Settings Data Area	Description	
Movement direction	0: Forward 1: Reverse	
Command data	When Pn830 = 0	Set an override value (0 to 200). Set to 100 when not using the override function.
	When Pn830 = 1	Set the feed speed.

Step Command: STEP

The NS300 Module will start step operation when it detects the leading edge of the STEP bit. While the STEP bit is set to 1, the axis will travel only the distance set in the specified parameter. If the STEP bit is set to 0 during step operation, the servomotor will decelerate to a stop and the step operation will end. The remaining travel distance will be canceled.

The direction of movement for step operations is determined by the Movement Direction set in the command data area. The number of the step travel distance (0 to 3) is also set in the command data area. The parameter data set in Pn844 to Pn847 will be used for the step travel distance.

Settings Data Area	Description
Movement direction	0: Forward 1: Reverse
Command data	Set the selection number for step travel distance. 0: Uses Pn844 data. 1: Uses Pn845 data. 2: Uses Pn846 data. 3: Uses Pn847 data.

Station Command: STN

The NS300 Module will start station operation when it detects the leading edge of the STN bit. If this command is set to 0 while the axis is travelling, the servomotor will decelerate to a stop and the station operation will end. The remaining travel distance will be cancelled.

Settings Data Area	Description
Movement direction	0: Forward 1: Reverse
Absolute/incremental value	Specify whether the station number is an absolute value or incremental value.
Command data	Specify the target station number.

Point Table Command: PTBL

The NS300 Module will start point table operation when it detects the leading edge of the PTBL bit. If this command is set to 0 while the axis is travelling, the servomotor will decelerate to a stop and the point table operation will end. The remaining travel distance will be cancelled.

Settings Data Area	Description
Absolute/incremental value	Specify whether the position data in the point table is an absolute value or incremental value.
Command data	Specify the point table number to be used.

Zero Point Return Command: HOME

The NS300 Module will start a zero point return when it detects the leading edge of the HOME bit. If this command is set to 0 while the axis is travelling, the servomotor will decelerate to a stop and the zero point return operation will end. The zero point return operation will not restart even if the HOME bit is set to 1 again.

The type of zero point return depends on the zero point return mode setting in Pn800.

Incremental Specification: INC

The INC bit specifies whether the data that indicates a position is used as an absolute value or an incremental value. Set this bit to 0 to specify an absolute position and to 1 to specify an incremental position.

This setting is used for the following commands.

- Station Command
- Point Table Command
- Positioning Command

Movement Direction: DIR

The DR bit specifies the movement direction. Set this bit to 0 for forward and to 1 for reverse operation.

This specification is used for the following commands.

- Feed Command
- Step Command
- Station Command

The movement direction specification is disabled during normal positioning.

■ Response Messages

The response messages for move commands are shown below.

Table 5.4 Responses for Move Commands

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	Response type				Command code			
2	HOME_R	PTBL_R	STN_R	STEP_R	FEED_R	0	HOLD_R	PRGS
3	POT	NOT	INPOS	NEAR	HOME_P	0	DIR_R	INC_R
4	Command message							
5								
6								
7								

Progressing Flag: PRGS

The PRGS bit is set to 1 during the execution of a command. For move commands, this flag will be set to 1 while outputting to the SGDH.

When command execution has been completed or when a Cancel Command or other stop command has been received, the Progressing Flag is set to 0.

Holding Flag: HOLD_R

The HOLD_R bit is set to 1 when a Hold Command is received from the host device and for the duration of the hold.

The host device can confirm that the NS300 Module correctly received the Hold Command by checking that the Holding Flag is set to 1.

Constant Feed Flag: FEED_R

The FEED_R bit reflects the status of the Constant Feed Command in the command message. The host device can confirm that the NS300 Module correctly received the Constant Feed Command by checking that the Feed Flag is set to 1.

This flag is set to 1 even if constant feeding cannot be executed because of a Servo OFF status, for example. The user must monitor for alarms during constant feeding for the Constant Feed Command.

The movement direction during constant feeding can be checked using the Movement Direction Flag: DIR_R.

Step Flag: STEP_R

The STEP_R bit reflects the status of the Step Command in the command message. The host device can confirm that the NS300 Module correctly received the Step Command by checking that the Step Flag is set to 1.

This flag is set to 1 even if the step operation cannot be executed because of a Servo OFF status, for example. The user must monitor for alarms during step operation.

Station Flag: STN_R

The STN_R bit reflects the status of the Station Command in the command message. The host device can confirm that the NS300 Module correctly received the Station Command by checking that the Station Flag is set to 1.

This flag is set to 1 even if the station operation cannot be executed because of a Servo OFF status, for example. The user must monitor for alarms during station operation.

Point Table Flag: PTBL_R

The PTBL_R bit reflects the status of the Point Table Command in the command message. The host device can confirm that the NS300 Module correctly received the Point Table Command by checking that the Point Table Flag is set to 1.

This flag is set to 1 even if the point table operation cannot be executed because of a Servo OFF status, for example. The user must monitor for alarms during point table operation.

Zero Point Return Flag: HOME_R

The HOME_R bit reflects the status of the Zero Point Return Command in the command message. The host device can confirm that the NS300 Module correctly received the Zero Point Return Command by checking that the Zero Point Return Flag is set to 1.

This flag is set to 1 even if the zero point return cannot be executed because of a Servo OFF status, for example. The user must monitor for alarms during zero point return.

Incremental Specification Flag: INC_R

The INC_R bit reflects the status of the Incremental Specification in the command message. The host device can confirm by the change of status of this flag that the NS300 Module has correctly received change in the incremental specification.

Movement Direction Flag: DIR_R

The DIR_R bit reflects the status of the Movement Direction Specification in the command message. This flag is set to 0 to indicate forward, and to 1 to indicate reverse.

Zero Point Flag: HOME_P

The HOME_P bit is set to 1 when the servomotor is within the zero point range. The zero point range is set in Pn806 (Zero Point Return Output Width).

When an incremental position detection system is used, this flag cannot be set to 1 for the period from when power is turned ON to the SGDH until the initial zero point return has been completed.

Near Signal Flag: NEAR

The NEAR bit is set to 1 when the current position is within the On-target position range. When the current position is outside the On-target position range, the flag is set to 0. The On-target position range is set in Pn852 (Positioning Proximity Detection Width).

In-position Flag: INPOS

The INPOS bit is set to 1 when the current position is within the positioning completed range of the target position. The flag is set to 0 when the current position is outside the positioning completed range. The On-target position range is set in Pn850 (Positioning Deadband).

Negative Overtravel Flag: NOT

The NOT bit indicates the status of the negative overtravel signal for the external input connected to CN1 on the SGDH.

Positive Overtravel Flag: POT

The POT bit indicates the status of the positive overtravel signal for the external input connected to CN1 on the SGDH.

5.3.4 Set/Read Command Messages

■ Command Messages

Details on bytes 1 to 7 of the command messages for set/read commands (MOD = 1) are shown below.

The response type does not need to be specified for set/read commands.

Table 5.5 Set/Read Commands

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	ALRST	ESTP	0	0	SVON	C_STRT
1	0				Command code			
2	Command number							
3								
4	Command message							
5								
6								
7								

Command Codes

A list of command codes is shown in the following table. Set "No operation" for commands that will not be executed.

The command codes in the response messages will basically be a copy of the command codes in the command messages. A warning for parameter setting error will be returned when the parameter number is different or the data is outside the setting range for the parameter.

Table 5.6 Command Codes

Command Code	Description
0000	No operation
1000	Read parameter
1001	Write parameter
1010	Set current position
1011	Set zero point
1100	Read alarm
1110	Reset Module

■ Response Messages

Details on bytes 1 to 7 of the response messages for set/read commands (MOD = 1) are shown below.

Table 5.7 Responses for Set/Read Commands

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>0</td><td>1</td><td>READY</td><td>PWRON</td><td>ESTP_R</td><td>ALRM</td><td>WARN</td><td>SVON_R</td><td>C_STRT_R</td></tr>
<tr><td>1</td><td colspan="4">0</td><td colspan="4">Command code</td></tr>
<tr><td>2</td><td colspan="8" rowspan="2">Command number</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td colspan="8" rowspan="4">Response data</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
</table>

Parameter Read Command

The Parameter Read Command reads SGDH and NS300 Module parameters.

To use the Parameter Read Command, make the following settings and then change the Command Start Command from 0 to 1.

- Command code
- Parameter number

Table 5.8 Parameter Read Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	ALRST	ESTP	0	0	SVON	C_STRT
1	0				8			
2	Parameter number							
3								
4	0							
5								
6								
7								

Table 5.9 Response for Parameter Read Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	0				8			
2	Parameter number							
3								
4	Parameter data							
5								
6								
7								

■ Parameter Write Command

The Parameter Write Command writes SGDH and NS300 Module parameters.

To use the Parameter Write Command, make the following settings and then change the Command Start Command from 0 to 1.

- Command code
- Parameter number
- Parameter data

Table 5.10 Parameter Write Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	ALRST	ESTP	0	0	SVON	C_STRT
1	0				9			
2	Parameter number							
3								
4	Parameter data							
5								
6								
7								

Table 5.11 Response for Parameter Write Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	0				9			
2	Parameter number							
3								
4	Parameter data							
5								
6								
7								

Current Position Setting Command

The Current Position Setting Command sets the specified value as the current position of the servomotor.

To use the Current Position Setting Command, make the following settings and then change the Command Start Command from 0 to 1.

- Command code
- Current position data

Table 5.12 Current Position Setting Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	ALRST	ESTP	0	0	SVON	C_STRT
1	0				10 (decimal)			
2	0							
3								
4	Current position data							
5								
6								
7								

Table 5.13 Response for Current Position Setting Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	0				10 (decimal)			
2	0							
3								
4	Current position data							
5								
6								
7								

■ Setting the Zero Point

If using an absolute encoder, the current position of the motor is set as the zero point. To execute the Zero Point Setting Command, set the command code and then change the Command Start Command from 0 to 1. It is not necessary to make any settings in the data area.

If the Zero Point Setting Command is completed successfully, an offset will be set in Pn809 (Zero Point Offset). The setting of this parameter will be deleted when the power supply to the NS300 Module is turned OFF. After carrying out the Zero Point Setting Command, always use the Module Reset Command to store the parameters in flash ROM.

Table 5.14 Zero Point Setting Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	ALRST	ESTP	0	0	SVON	C_STRT
1	0				11 (decimal)			
2	0							
3								
4	0							
5								
6								
7								

Table 5.15 Response for Zero Point Setting Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	0				11 (decimal)			
2	0							
3								
4	0							
5								
6								
7								

■ Alarm Read Command

The Alarm Read Command reads the last four alarms that have occurred on the SGDH and the NS300 Module.

To use the Alarm Read Command, make the command code settings and then change the Command Start Command from 0 to 1.

Table 5.16 Alarm Read Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	ALRST	ESTP	0	0	SVON	C_STRT
1	0				12 (decimal)			
2	0							
3								
4	0							
5								
6								
7								

Table 5.17 Response for Alarm Read Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	0				12 (decimal)			
2	0							
3								
4	Last alarm code							
5	Second last alarm code							
6	Third last alarm code							
7	Fourth last alarm code							

■ Module Reset Command

The Module Reset Command restarts the SGDH and NS300 Module software. When this command is executed, the NS300 Module parameters are stored in flash ROM and then the NS300 Module is restarted.

To use the Module Reset Command, make the command code settings and then change the Command Start Command from 0 to 1.

When the NS300 Module is resetting the Module, the Command Ready Flag is set to 0. When the reset has been completed, the flag is set to 1.

Table 5.18 Module Reset Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	ALRST	ESTP	0	0	SVON	C_STRT
1	0				14 (decimal)			
2	0							
3								
4	0							
5								
6								
7								

Table 5.19 Response for Module Reset Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	0				14 (decimal)			
2	0							
3								
4	0							
5								
6								
7								

5.4 Motion Command Methods

5.4.1 Constant Feed Command

■ Function

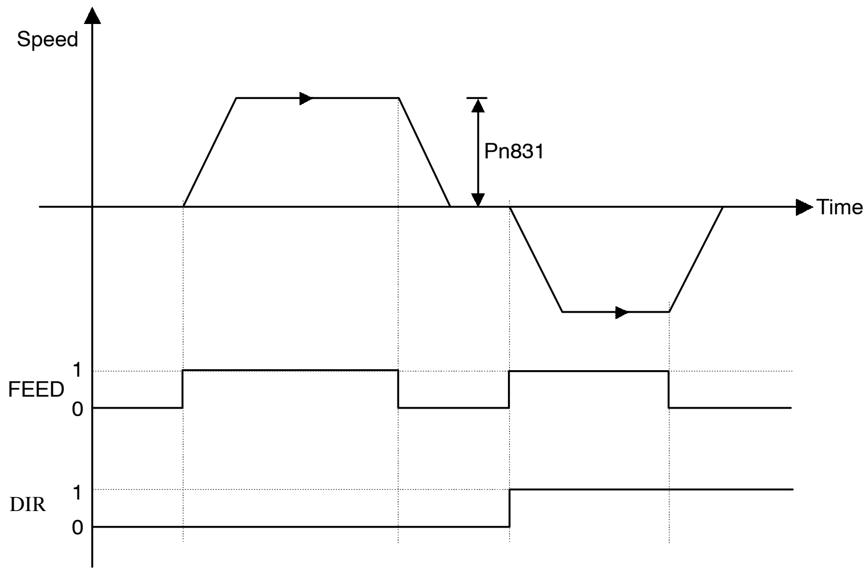
While the Constant Feed Command is set to 1, the axis travels in the direction specified as the movement direction at the speed specified in the parameters. Parameter settings are used for acceleration/deceleration speeds, acceleration/deceleration types, etc.

The speed during movement can be changed by changing the override value.

■ Related Parameters

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#58	Pn829	Filter Selection	0, 1, 2, 3	–	Immediate	0	B
	#59	Pn830	Constant Feed Reference Unit Selection	0, 1	–	Immediate	0	B
	#60	Pn831	Constant Feed Speed	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#61	Pn832	Acceleration Time for Constant Feed	1 to 10,000	ms	Immediate	100	B
	#62	Pn833	Deceleration Time for Constant Feed	1 to 10,000	ms	Immediate	100	C
	#63	Pn834	Switch Speed for Constant Feed Second Accel/Decel	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#64	Pn835	Accel/Decel Time for Constant FEED Second Accel/Decel	1 to 10,000	ms	Immediate	200	C
	#65	Pn836	Accel/Decel Type for Constant Feed	0, 1, 2, 3	–	Immediate	0	B
	#70	Pn840	Time Constant for Exponential Accel/Decel	4 to 1,000	ms	Immediate	25	C
	#71	Pn841	Bias Speed for Exponential Accel/Decel	1 to 240,000	1000 reference units/min	Immediate	0	C
	#72	Pn842	Time Constant of Travelling Average	4 to 1,000	ms	Immediate	25	C
	#73	Pn843	Maximum Feed Speed	1 to 240,000	1000 reference units/min	Immediate	24,000	B

■ Operation



■ Command Method

1. Set the Servo ON Command (byte 0, bit 1) to 1.
2. Set the movement direction (byte 3, bit 1).
3. Set the override value. The Pn830 setting determines whether the override will be set as a ratio (%) or as a speed (1000 reference units/min).
4. Set the Feed Command (byte 2, bit 3) to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	0
1	Response type				00h			
2	0	0	0	0	1	0	0	0
3	0	0	0	0	0	0	DIR	0
4	Override value (% or 1000 reference units/min)							
5								
6								
7								

5.4.2 Step Command

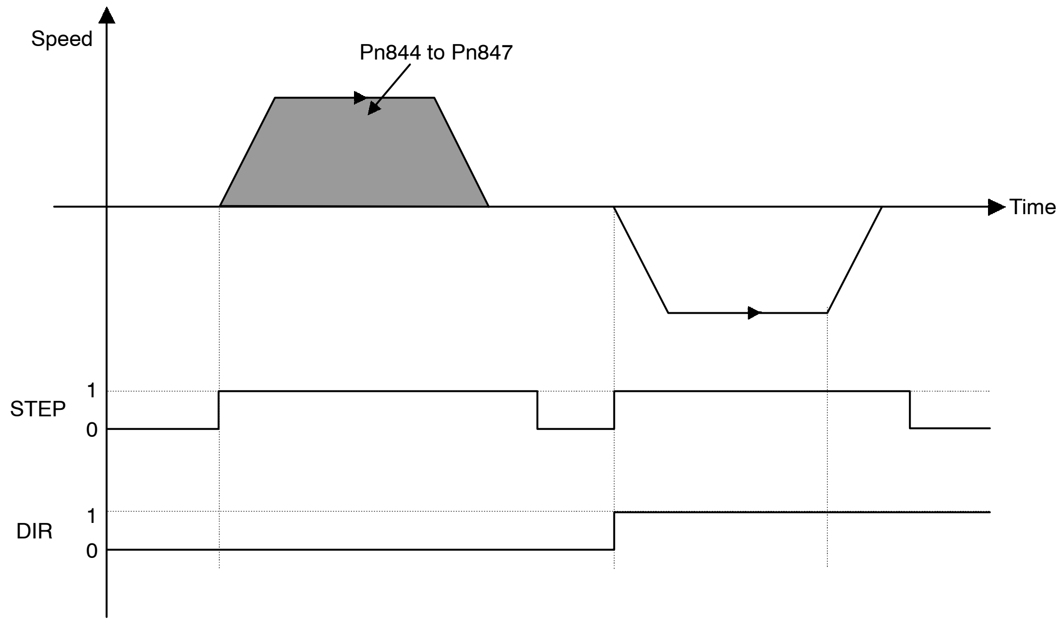
■ Function

When the Step Command is set to 1, the axis will travel in the set direction for the set travel distance and then stop. The travel distance can be selected from four parameters.

■ Related Parameters

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#51	Pn821	Feed Speed for Positioning	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#52	Pn822	Acceleration Time for Positioning	1 to 10,000	ms	Immediate	100	B
	#53	Pn823	Deceleration Time for Positioning	1 to 10,000	ms	Immediate	100	C
	#54	Pn824	Switch Speed for Positioning Second Accel/Decel	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#55	Pn825	Accel/Decel Time for Positioning Second Accel/Decel	1 to 10,000	ms	Immediate	200	B
	#56	Pn826	Accel/Decel Type for Positioning	0, 1, 2, 3	–	Immediate	0	B
	#58	Pn829	Filter Selection	0, 1, 2, 3	–	Immediate	0	B
	#70	Pn840	Time Constant for Exponential Accel/Decel	4 to 1,000	ms	Immediate	25	C
	#71	Pn841	Bias Speed for Exponential Accel/Decel	1 to 240,000	1000 reference units/min	Immediate	0	C
	#72	Pn842	Time Constant of Travelling Average	4 to 10,000	ms	Immediate	25	C
	#73	Pn843	Maximum Feed Speed	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#74	Pn844	Step Distance 1	0 to 99, 999, 999	Reference Units	Immediate	1	B
	#75	Pn845	Step Distance 2	0 to 99, 999, 999	Reference Units	Immediate	10	B
	#76	Pn846	Step Distance 3	0 to 99, 999, 999	Reference Units	Immediate	100	B
	#77	Pn847	Step Distance 4	0 to 99, 999, 999	Reference Units	Immediate	1,000	B

■ Operation



■ Command Method

1. Set the Servo ON Command (byte 0, bit 1) to 1.
2. Set the movement direction (byte 3, bit 1).
3. Select the travel distance to be used for step operation from within the range from Pn844 (=0) to Pn847 (=3).
4. Set the Step Command (byte 2, bit 4) to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	0
1	Response type				00h			
2	0	0	0	1	0	0	0	0
3	0	0	0	0	0	0	DIR	0
4	Step travel distance selection (0 to 3)							
5								
6								
7								

5.4.3 Station Command

■ Function

The Station Command can be used when the NS300 Module is used in a rotating system.

One rotation of the servomotor is divided into a specified number of stations and station numbers are allocated.

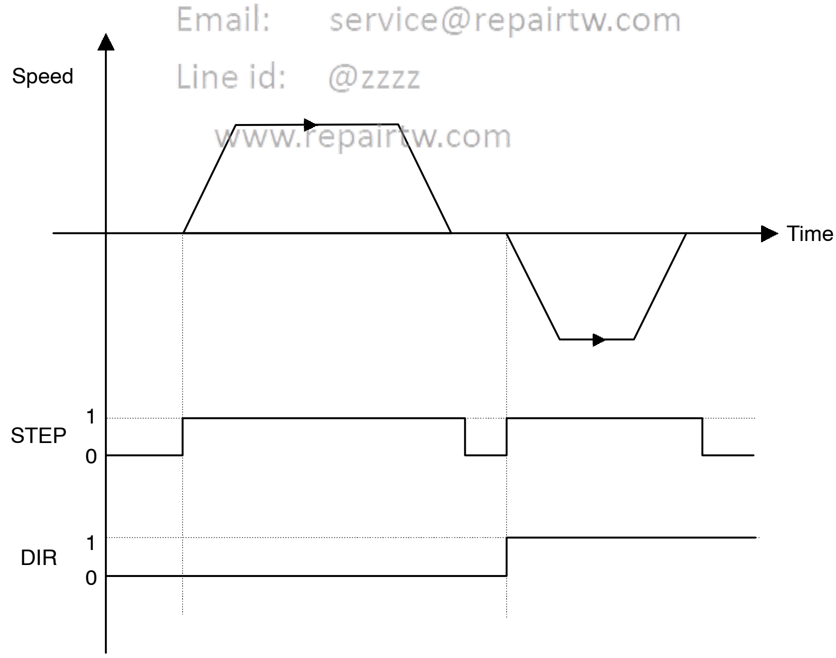
When a station number is specified, the axis travels in the specified direction to specified position.

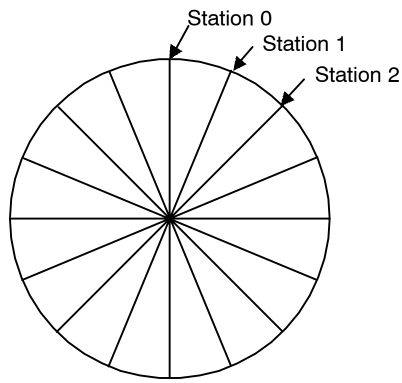
■ Related Parameters

The same speed and acceleration/deceleration data is used as for the Positioning Command.

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#32	Pn812	Coordinate Type	0, 1	–	Immediate	0	C
	#93	Pn853	Direction for Rotation System	0, 1	–	Immediate	0	B
	#100	Pn85A	Number of Stations	1 to 32, 767	–	Immediate	1	B

■ Operation





■ Command Method

1. Set the Servo ON Command (byte 0, bit 1) to 1.
2. Set the movement direction (byte 3, bit 1).
   The movement direction setting is disabled when the Pn853 setting is 1 (travel the shortest distance).
3. Set absolute/incremental (byte 3, bit 0). If an incremental position has been specified, set the value corresponding to (target station number) – (current station number) in bytes 4 to 7.
4. Set the target station number.
5. Set the Station Command (byte 2, bit 5) to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	0
1	Response type				00h			
2	0	0	1	0	0	0	0	0
3	0	0	0	0	0	0	DIR	INC
4	Target station number							
5								
6								
7								

5.4.4 Point Table Command

■ Function

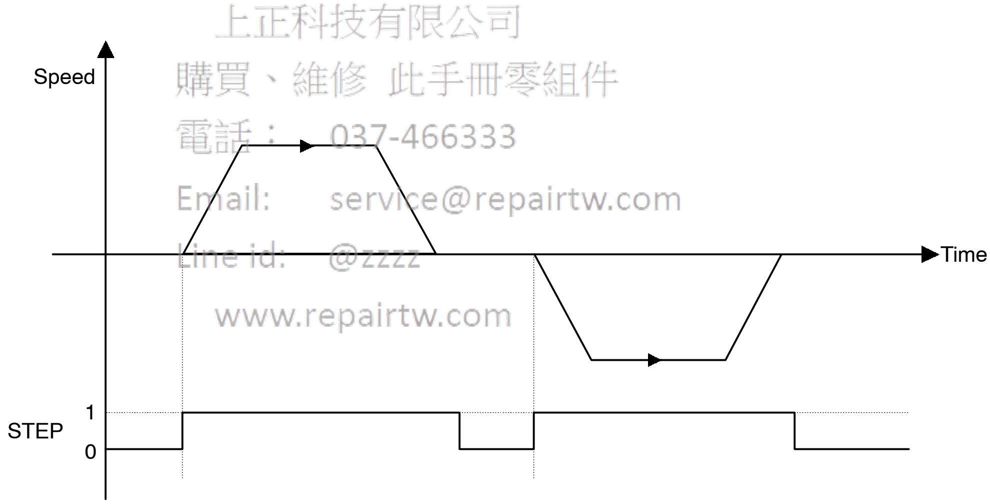
The Point Table Command performs positioning at the position and speed stored in advance in the point table.

■ Related Parameters

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#51	Pn821	Feed Speed for Positioning	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#52	Pn822	Acceleration Time for Positioning	1 to 10,000	ms	Immediate	100	B
	#53	Pn823	Deceleration Time for Positioning	1 to 10,000	ms	Immediate	100	C
	#54	Pn824	Switch Speed for Positioning Second Accel/Decel	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#55	Pn825	Accel/Decel Time for Positioning Second Accel/Decel	1 to 10,000	ms	Immediate	200	B
	#56	Pn826	Accel/Decel Type for Positioning	0, 1, 2, 3	–	Immediate	0	B
	#58	Pn829	Filter Selection	0, 1, 2, 3	–	Immediate	0	B
	#70	Pn840	Time Constant for Exponential Accel/Decel	4 to 1,000	ms	Immediate	25	C
	#71	Pn841	Bias Speed for Exponential Accel/Decel	1 to 240,000	1000 reference units/min	Immediate	0	C
	#72	Pn842	Time Constant of Travelling Average	4 to 1,000	ms	Immediate	25	C
	#73	Pn843	Maximum Feed Speed	1 to 240,000	1000 reference units/min	Immediate	24,000	B

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x65	#50	Pn900	Target Position 1	±99, 999, 999	Reference Units	Immediate	0	B
	#51	Pn901	Target Position 2	±99, 999, 999	Reference Units	Immediate	0	B
		:	:					
	#99	Pn931	Target Position 50	±99, 999, 999	Reference Units	Immediate	0	B
	#150	Pn940	Target Speed 1	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#151	Pn941	Target Speed 2	1 to 240,000	1000 reference units/min	Immediate	24,000	B
		:	:					
	#199	Pn971	Target Speed 50	1 to 240,000	1000 reference units/min	Immediate	24,000	B

■ Operation



■ Command Method

1. Set the Servo ON Command (byte 0, bit 1) to 1.
2. Set absolute/incremental (byte 3, bit 0). If an incremental position has been specified, the target position will be (current position) + (position stored in point table).
3. Set the point table number to be specified.
4. Set the Point Table Command (byte 2, bit 6) to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	0
1	Response type				00h			
2	0	1	0	0	0	0	0	0
3	0	0	0	0	0	0	DIR	INC
4	Point table number to be specified							
5								
6								
7								

5.4.5 Zero Point Return Command

■ Function

The Zero Point Return Command moves the axis in the specified direction, and sets the zero point based on the specified zero point return mode.

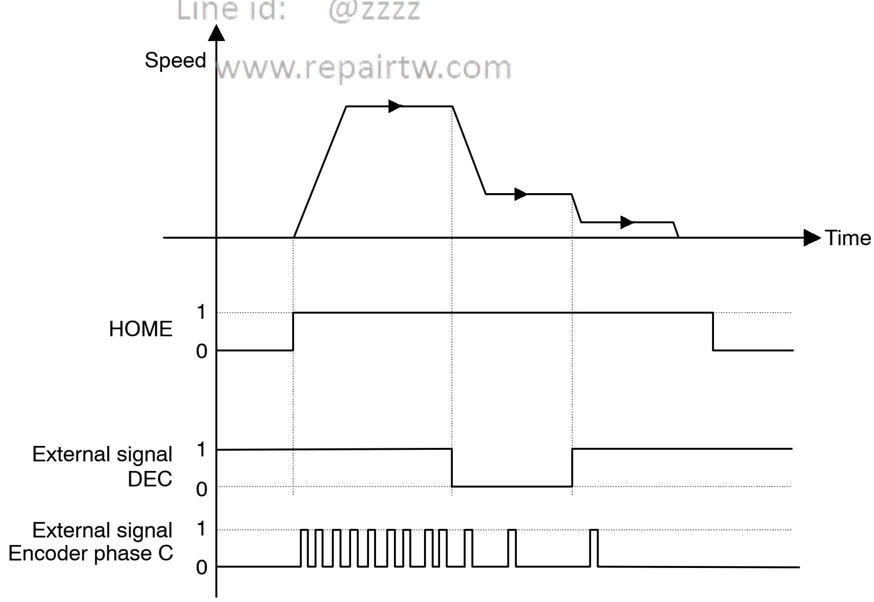
When an absolute position detection system has been selected, the positioning will be performed to the zero point.

■ Related Parameters

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#10	Pn800	Zero Point Return Mode	0 to 3	–	Immediate	0	B
	#11	Pn801	Zero Point Return Function Selection	0 to 7	–	Power-up	1	B
	#12	Pn802	Feed Speed for Zero Point Return	1 to 240,000	1000 reference units/min	Immediate	10,000	B
	#13	Pn803	Approach Speed for Zero Point Return	1 to 240,000	1000 reference units/min	Immediate	1,000	B
	#14	Pn804	Creep Speed for Zero Point Return	1 to 240,000	1000 reference units/min	Immediate	500	B
	#15	Pn805	Final Travel Distance for Zero Point Return	0 to 99,999,999	Reference Units	Immediate	0	B
	#16	Pn806	Output Width for Zero Point Return	0 to 32, 767	Reference Units	Immediate	100	B
	#17	Pn809	Zero Point Offset	–99,999,999 to 99,999,999	Reference Units	Immediate	0	C
	#18	Pn80A	Accel/Decel Time for Zero Point Return	1 to 10,000	ms	Immediate	100	B

■ Operation

The Zero Point Return Command performs zero point return based on each zero point return mode.



■ Command Method

Set the Servo ON Command (byte 0, bit 1) to 1.

Set the Zero Point Return Command (byte 2, bit 7) to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	0
1	Response type				00h			
2	1	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0							
5								
6								
7								

5.4.6 Positioning Command

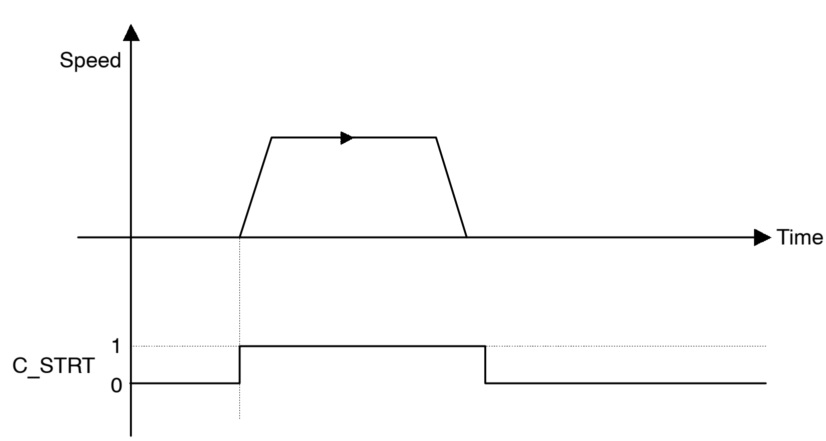
■ Function

The Positioning Command performs positioning to the specified target position.

■ Related Parameters

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#51	Pn821	Feed Speed for Positioning	1 to 240,000	1000 reference units/min	Immediate	24,000	B
	#52	Pn822	Acceleration Time for Positioning	1 to 10,000	ms	Immediate	100	B
	#53	Pn823	Deceleration Time for Positioning	1 to 10,000	ms	Immediate	100	C
	#54	Pn824	Switch Speed for Positioning Second Accel/ Decel	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#55	Pn825	Accel/Decel Time for Positioning Second Accel/Decel	1 to 10,000	ms	Immediate	200	B
	#56	Pn826	Accel/Decel Type for Positioning	0, 1, 2, 3	–	Immediate	0	B
	#58	Pn829	Filter Selection	0, 1, 2, 3	–	Immediate	0	B
	#70	Pn840	Time Constant for Exponential Accel/Decel	4 to 1,000	ms	Immediate	25	C
	#71	Pn841	Bias Speed for Exponential Accel/Decel	1 to 240,000	1000 reference units/min	Immediate	0	C
	#72	Pn842	Time Constant of Travelling Average	4 to 1,000	ms	Immediate	25	C
	#73	Pn843	Maximum Feed Speed	1 to 240,000	1000 reference units/min	Immediate	24,000	B

■ Operation



■ Command Method

1. Set the command code (byte 1, bits 0 to 3) to no operation (= 0) if it is not already set to 0.
2. Set the Servo ON Command (byte 0, bit 1) to 1.
3. Set absolute/incremental (byte 3, bit 0). If an incremental position has been specified, the target position will be (current position) + (position specified from bytes 4 to 7).
4. Set the target position in the command message (bytes 4 to 7).
5. Set simple positioning (=1) in the command code (byte 1, bits 0 to 3).
6. Change the Command Start Command (byte 0, bit 0) from 0 to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	1
1	Response type				01h			
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	Target position data							
5								
6								
7								

5.4.7 External Positioning

■ Function

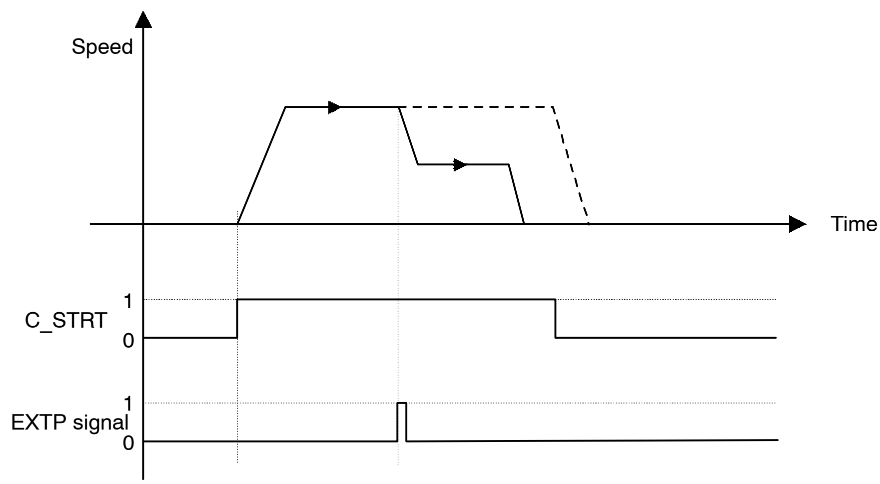
The External Positioning Command performs positioning at the specified target position. If the status of the external signal changes during movement, the axis will decelerate to the external positioning approach speed from the position where the status changed and travel the distance specified in the parameter.

■ Related Parameters

The same speed and acceleration/deceleration data is used as for the Positioning Command.

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#94	Pn854	Approach Speed for External Positioning	1 to 240,000	1,000 reference units/min	Immediate	24,000	B
	#95	Pn855	Travel Distance for External Positioning	-99, 999, 999 to 99, 999, 999	Reference Units	Immediate	0	B

■ Operation



■ Command Method

1. Set the command code (byte 1, bits 0 to 3) to no operation (= 0), if it is not already set to 0.
2. Set the Servo ON Command (byte 0, bit 1) to 1.
3. Set absolute/incremental (byte 3, bit 0). If an incremental position has been specified, the target position will be (current position) + (position specified from bytes 4 to 7).
4. Set the target position in the command message (bytes 4 to 7).
5. Set external positioning (=2) in the command code (byte 1, bits 0 to 3).
6. Change the Command Start Command (byte 0, bit 0) from 0 to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	1
1	Response type				02h			
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	Target position data							
5								
6								
7								

5.4.8 Notch Output Positioning Command

■ Function

The Notch Output Positioning Command performs positioning to the specified position.

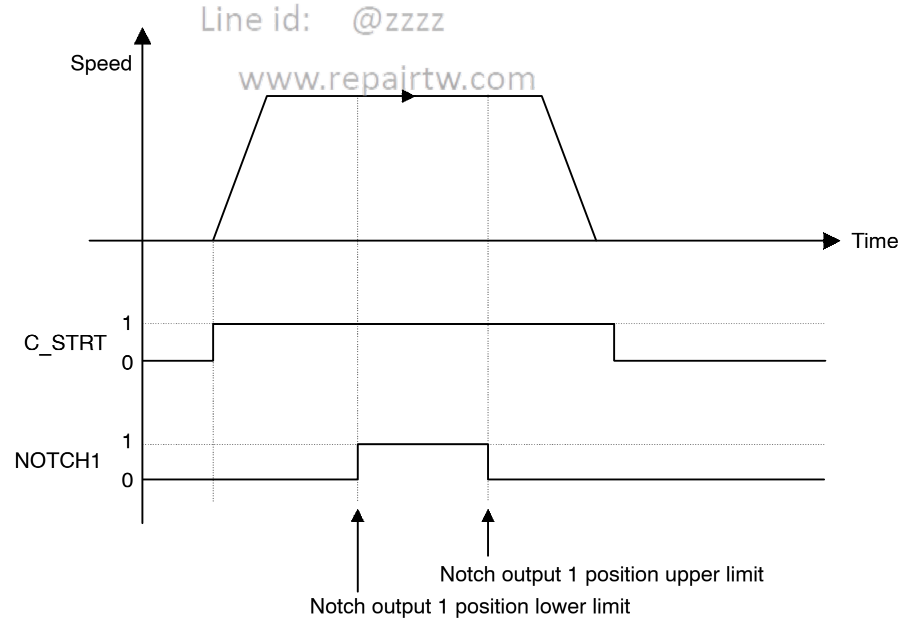
If a specified position is passed during the positioning, a notch output signal (notch signal) will be output.

Two notch signals can be used in the NS300 Module.

■ Related Parameters

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#160	Pn890	Notch Signal Output Position Setting	0, 1	–	Immediate	0	C
	#161	Pn891	Notch Signal Output Setting	0 to 3	–	Immediate	0	C
	#162	Pn892	Notch 1 Output Position Lower Limit	±99, 999, 999	Reference Units	Immediate	0	C
	#163	Pn893	Notch 1 Output Position Upper Limit	±99, 999, 999	Reference Units	Immediate	0	C
	#164	Pn894	Notch 2 Output Position Lower Limit	±99, 999, 999	Reference Units	Immediate	0	C
	#165	Pn895	Notch 2 Output Position Upper Limit	±99, 999, 999	Reference Units	Immediate	0	C

■ Operation



■ Command Method

1. Set the command code (byte 1, bits 0 to 3) to no operation (= 0), if it is not already set to 0.
2. Set the Servo ON Command (byte 0, bit 1) to 1.
3. Set absolute/incremental (byte 3, bit 0). If an incremental position has been specified, the target position will be (current position) + (position specified from bytes 4 to 7).
4. Set the target position in the command message (bytes 4 to 7).
5. Set positioning with notch signal output (=3) in the command code (byte 1, bits 0 to 3).
6. Change the Command Start Command (byte 0, bit 0) from 0 to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	1
1	Response type				03h			
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	Target position data							
5								
6								
7								

5.4.9 Multi-speed Positioning Command

■ Function

The Multi-speed Positioning Command changes the speed in stages and performs positioning to specified positions.

When the positions specified in the parameters are reached during axis travel, the axis switches to the next set speed and travels to the position specified in the next stage. Up to 16 speed switching positions can be set.

Set the speed switching positions as increments from the position where the Multi-speed Positioning Command is carried out.

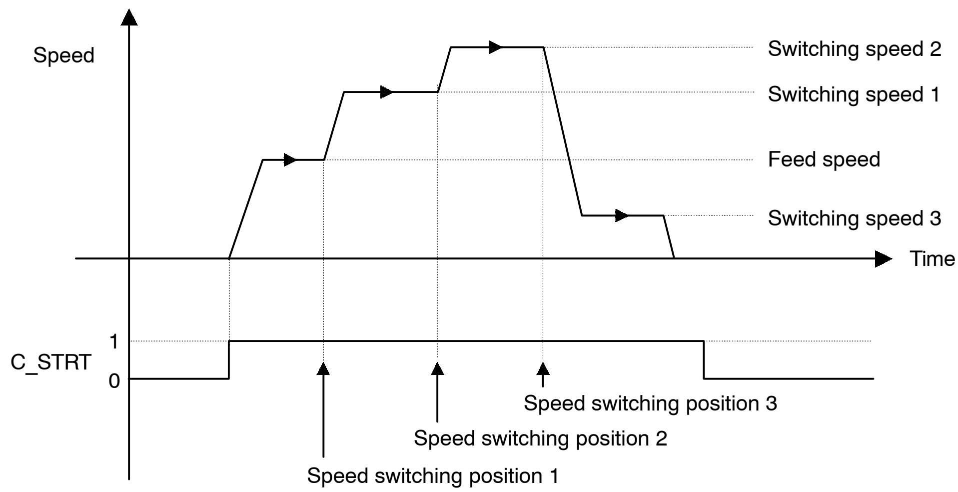
5

■ Related Parameters

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#111	Pn861	Number of Points for Speed Switching	0 to 16	–	Immediate	0	C
	#112	Pn862	Initial Feed Speed for Multi-speed Position-ing	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#113	Pn863	Speed Switching Posi-tion 1	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#114	Pn864	Speed Switching Posi-tion 2	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#115	Pn865	Speed Switching Posi-tion 3	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#116	Pn866	Speed Switching Posi-tion 4	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#117	Pn867	Speed Switching Posi-tion 5	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#118	Pn868	Speed Switching Posi-tion 6	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#119	Pn869	Speed Switching Posi-tion 7	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#120	Pn86A	Speed Switching Posi-tion 8	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#121	Pn86B	Speed Switching Posi-tion 9	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#122	Pn86C	Speed Switching Posi-tion 10	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#123	Pn86D	Speed Switching Posi-tion 11	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#124	Pn86E	Speed Switching Posi-tion 12	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#125	Pn86F	Speed Switching Posi-tion 13	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#126	Pn870	Speed Switching Posi-tion 14	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#127	Pn871	Speed Switching Posi-tion 15	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#128	Pn872	Speed Switching Posi-tion 16	0 to 99, 999, 999	Reference Units	Immediate	0	C
	#129	Pn873	Switching Speed 1	1 to 240,000	1000 reference units/min	Immediate	24,000	C

Object	Attrib-ute	No.	Name	Setting Range	Unit	Effective Timing	Factory Setting	Type
0x64	#130	Pn874	Switching Speed 2	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#131	Pn875	Switching Speed 3	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#132	Pn876	Switching Speed 4	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#133	Pn877	Switching Speed 5	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#134	Pn878	Switching Speed 6	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#135	Pn879	Switching Speed 7	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#136	Pn87A	Switching Speed 8	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#137	Pn87B	Switching Speed 9	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#138	Pn87C	Switching Speed 10	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#139	Pn87D	Switching Speed 11	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#140	Pn87E	Switching Speed 12	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#141	Pn87F	Switching Speed 13	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#142	Pn880	Switching Speed 14	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#143	Pn881	Switching Speed 15	1 to 240,000	1000 reference units/min	Immediate	24,000	C
	#144	Pn882	Switching Speed 16	1 to 240,000	1000 reference units/min	Immediate	24,000	C

■ Operation



■ Command Method

1. Set the command code (byte 1, bits 0 to 3) to no operation (= 0), if it is not already set to 0.
2. Set the Servo ON Command (byte 0, bit 1) to 1.
3. Set absolute/incremental (byte 3, bit 0). If an incremental position has been specified, the target position will be (current position) + (position specified from bytes 4 to 7).
4. Set the target position in the command message (bytes 4 to 7).
5. Set multi-speed positioning (=4) in the command code (byte 1, bits 0 to 3).
6. Change the Command Start Command (byte 0, bit 0) from 0 to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	1	0	0	1	1
1	Response type				04h			
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	Target position data							
5								
6								
7								

5.5 Commands from the Host Controller

5.5.1 Basic Operation

The basic operation of the NS300 Module is shown below.

1. After DeviceNet communications have started, check that the Command Ready (READY) is set to 1.
2. Set the Emergency Stop Command (ESTP) to 1 to clear emergency stop status.
3. Set the Servo ON Command (SVON) to 1 to turn ON the servo.
4. Confirm that the SERVOPACK servo is ON by checking the status of SVON_R.
5. Set a command.
6. Confirm that the Progressing Flag (PRGS) has changed to 1.
7. Monitor the Progressing Flag (PRGS). When it changes to 0 again, the operation has been completed.
8. Set another command.

5.5.2 Command Method

For the following commands that involve movement, always wait until one command has been completed before executing another command. If commands are executed simultaneously or while the axis is travelling, a command error warning will occur (A.95).

- Feed Command
- Step Command
- Station Command
- Point Table Command
- Zero Point Return Command
- Move command based on a Command Start Command

The Emergency Stop, Servo ON, Cancel, and Hold Commands are effective any time.

■ Servo ON/OFF Command

When the Servo ON Command (SVON) is changed from 0 to 1, current is supplied to the SGDH. When it is changed from 1 to 0, the current is not supplied.

If DeviceNet communications time out, the NS300 Module automatically enters Servo OFF status. To restart communications, the Servo ON Command must be changed from 0 to 1.

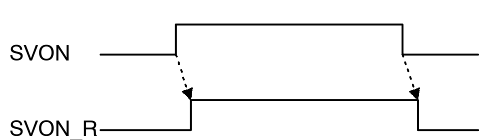


Figure 5.1 Servo ON/OFF Signal

■ Emergency Stop Command

While the Emergency Stop Command (ESTP) is set to 0, the SGDH is in emergency stop status. During this status, the Emergency Stop Flag (ESTP_R) is 0.

The emergency stop status can be released by setting the Emergency Stop Command (ESTP) to 1 and changing the Servo ON Command (SVON) from 0 to 1.

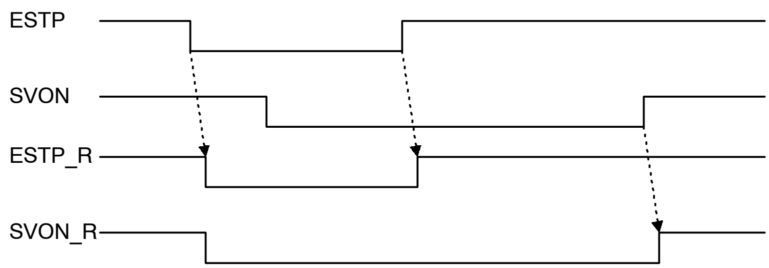


Figure 5.2 Emergency Stop Command

■ Alarm Reset Command

When an alarm occurs, use the following procedure to restart the NS300 Module.

1. Set the Servo ON Command (SVON) to 0 and set the Cancel Command (CANCEL) to 1.
2. Remove the cause of the alarm.
3. Clear any move commands that have been set.
4. Execute the Alarm Reset Command.
5. Check that the Alarm Flag (ALRM) is 0.

Alarm reset is executed by changing the Alarm Reset Command (ALRST) from 0 to 1. When execution of the alarm reset has been completed and all alarms have been cleared, the alarm bit (ALRM) will change to 0.

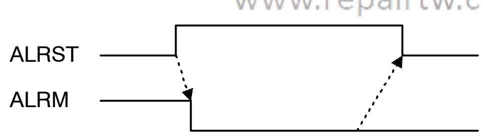


Figure 5.3 Alarm Rest Command

5

■ Constant Feed Command

While the Constant Feed Command (FEED) is set to 1, the axis travels in the direction specified as the movement direction (DIR) at the feed speed.

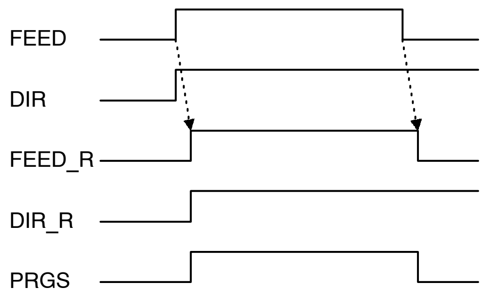


Figure 5.4 Constant Feed Command

■ Step Command

While the Step Command (STEP) is set to 1, the axis travels in the direction specified as the movement direction (DIR) at the feed speed for the step travel distance.

If the Step Command is set to 0 during the step operation, the step operation stops and the remaining travel distance is canceled.

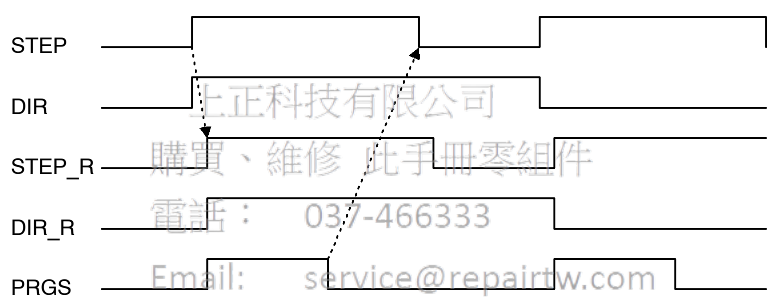


Figure 5.5 Step Command

■ Station Command

The station operation starts when the Station Command (STN) is changed from 0 to 1. The following data must be set before the station operation is started.

- Rotation direction: Specified in the byte 3 area.
- Station number: Specified at the word 1 of bytes 4 and 5.
- Absolute/incremental : Specify whether the station number is an absolute value or an incremental value.

■ Point Table Command

The point table operation starts when the Point Table Command (PTBL) is changed from 0 to 1. The following data must be set before the operation is started.

- Point table number: Specified in bytes 4 and 5 of word 1.

■ Zero Point Return Command

When the Zero Point Return Command (HOME) is changed from 0 to 1, the axis travels in the direction specified in the zero point return direction parameter. If the Zero Point Return Command is changed from 1 to 0 during zero point return, the zero point return stops. Therefore, the Zero Point Return Command must be maintained to 1 until the zero point return has been completed.

Using an Incremental Detection System

When the power is turned ON, the current position is 0 and the Zero Point Flag (HOME_P) is 0. When the zero point return has been completed, the Zero Point Flag changes to 1.

Using an Absolute Value Detection System

When the Zero Point Return Command is changed from 0 to 1, the zero point return is not performed but the axis is positioned to the machine coordinate zero point based on the positioning feed speed parameter.

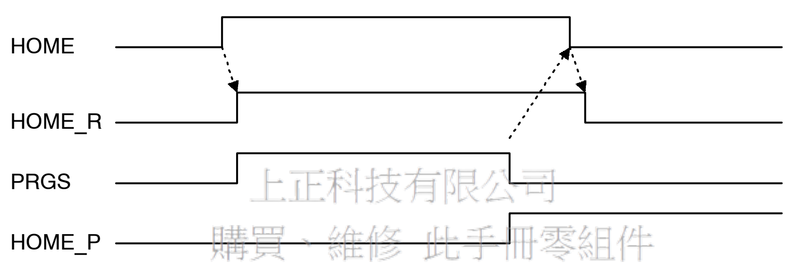


Figure 5.6 Zero Point Return Command

■ Positioning Command

When the Command Start Command (C_STRT) is changed from 0 to 1, positioning starts according to the command code.

If the Hold Command (HOLD) is changed from 0 to 1 during execution of positioning, axis travel is held. Confirm that the Hold Command has been received by checking that the Holding Flag (HOLD_R) is set to 1. Change the Hold Command from 1 to 0 to restart the remaining axis travel.

If the Cancel Command (CANCEL) is changed from 0 to 1 during execution of the positioning, the moving axis decelerates to stop and the remaining travel distance is discarded. Confirm that the Cancel Command has been received by checking that the Progressing Flag (PRGS) has changed from 1 to 0.

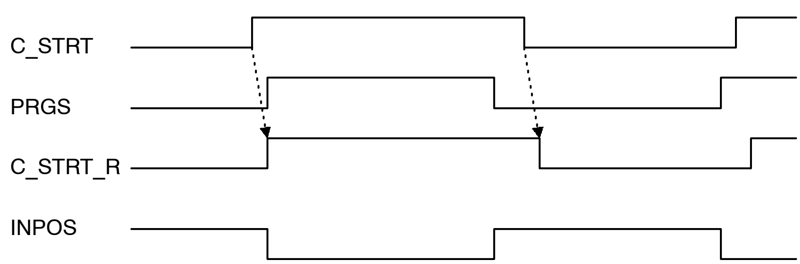


Figure 5.7 Positioning Command

■ Module Reset Command

The Module is reset by setting the Module Reset Command and changing the Command Start Command (C_STRT) from 0 to 1. When the Module Reset Command is executed, the Command Ready Flag (READY) is changed from 1 to 0. When NS300 Module and SGDH reset processing has been completed, the Command Ready Flag changes from 0 to 1.

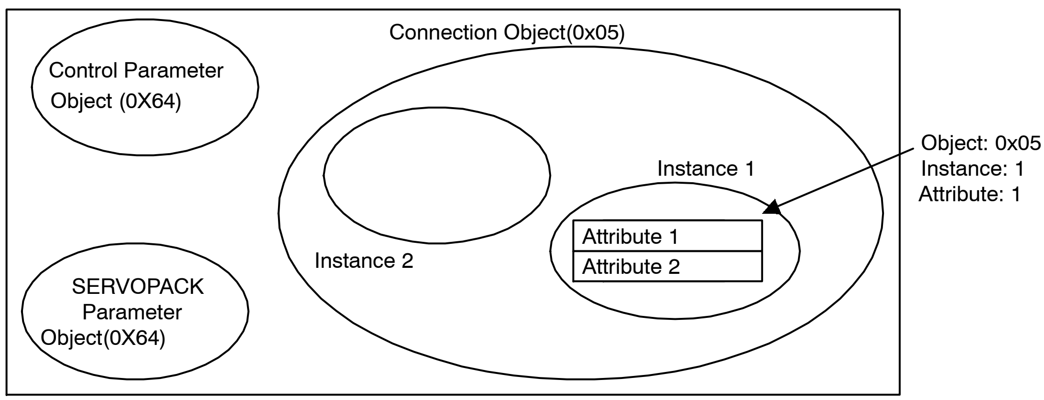
The Module reset operation process is outlined below.

- If the axis is travelling, it decelerates to stop and the remaining travel distance is discarded.
- If the current status is servo ON, it changes to servo OFF.
- If an alarm has occurred, the alarm is reset.
- All of the latest NS300 Module parameters are stored in flash memory.

5.6 Changing Parameters

5.6.1 Managing DeviceNet Data

In DeviceNet, all parameters and point tables are managed as objects, instances, and attributes. A conceptual diagram is given below.



NS300 Modules have the following objects.

Object Name	No. of Instances	Description
Identity Object	1	Manages device types and serial numbers.
Message Router Object	1	Acts as a router to distribute explicit messages to objects.
DeviceNet Object	1	Manages the physical connection to the DeviceNet.
Assembly Object	1	Manages response messages.
	2	Manages command messages.
Connection Object	1	Manages explicit messages.
	2	Manages I/O messages.
Control Parameter Object	1	Manages detailed motion settings.
Point Table Object	1	Manages point table data.
SERVOPACK Parameter Object	1	Manages SGDH parameters.

Instances within objects hold data called attributes. The attributes show the settings and status of the NS300 Module. If referencing or changing attributes via DeviceNet, you must specify the object name, instance number, and attribute number.

For example, when referencing via DeviceNet the attribute of the NS300 Module parameter Pn802 (Feed Speed for Zero Point Return) specify the attribute as follows:

- Control Parameter Object (0x64), Instance 1, Attribute 12

Refer to *Appendix B DeviceNet Attributes* for a table of attributes.

5.6.2 Editing Parameters

■ Editing Parameters Using Command Messages

SGDH parameters, NS300 Module parameters, and point table data can be changed using command messages.

Refer to *5.3 Command/Response Format*.

■ Editing Parameters Using Message Communications

DeviceNet supports message communications, called explicit messages. Parameters can be referenced or changed using message communications. To use explicit messages, specify the objects, instances, and attributes explained in *5.6.1 Managing DeviceNet Data* and change the parameters. The basic format of explicit messages is shown below.

Commands (Master Device to NS300 Module)

<table>
<tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0</td><td>0/1</td><td colspan="6">Master device node number</td></tr>
<tr><td>0</td><td colspan="7">Service code</td></tr>
<tr><td colspan="8">Object number</td></tr>
<tr><td colspan="8">Instance number</td></tr>
<tr><td colspan="8">Attribute number</td></tr>
<tr><td colspan="8">Service data</td></tr>
</table>

Responses (NS300 Module to Master Device)

<table>
<tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0</td><td>0/1</td><td colspan="6">Master device node number</td></tr>
<tr><td>1</td><td colspan="7">Service code</td></tr>
<tr><td colspan="8">Object number</td></tr>
<tr><td colspan="8">Instance number</td></tr>
<tr><td colspan="8">Attribute number</td></tr>
<tr><td colspan="8">Service data</td></tr>
</table>

The following example shows the Zero Point Return Feed Speed (Object 0x25, instance 1, attribute 12) being read by using the Get_Attribute_Single command (code: 0x0e) when the master device node number is 0.

Command (Master Device to NS300 Module)

7	6	5	4	3	2	1	0
0	0	0					
0	0x0e						
0x25							
0x01							
0x08							

Response (NS300 Module to Master Device)

7	6	5	4	3	2	1	0
0	0	0					
1	0x0e						
0x25							
0x01							
0x08							
0x00001234							

Refer to the manual for the master device for details on explicit messages.

5.7 Data Trace Function

The data trace function enables to read operating status data and I/O data stored in the memory of the SERVOPACK from a host controller using the explicit message of DeviceNet communications. If tracing has been selected, data will be stored in memory of the SERVOPACK. The stored data can be read from a host controller by reading trace data. The data trace function is outlined in the following table.

IMPORTANT

If the sticker on the side of the NS300 Module shows Ver. □□□OA or later, the trace data function can be used.

Table 5.20 Outline of Trace Function

Item	Description
Traced Items	Data: 2 specifications max. I/O: 2 specifications max.
Traced Data	Internal torque reference, speed feedback, reference pulse speed, and position errors
Traced I/O	ALM, /COIN, /V-CMP, /TGON, /S-RDY, /CLT, /VLT, /BK, /WARN, /NEAR, ALO1, ALO2, and ALO3
Traced Points	1,000 for each specification
Sampling Time	250 to 8,191,750 μs (set in increments of 250 μs)

Note: 1. A few minutes is required to complete tracing.
2. Trace parameters are not saved when the Module is reset. These parameters will revert to their default settings if the Module is reset or the power supply is turned OFF.
3. The display on the SERVOPACK's Panel Operator will go blank while tracing is being executed.

5

5.7.1 Trace Parameters

■ Setting a Trace

The following table lists the parameters used to select the data trace function.

Table 5.21 Parameters for Setting the Data Trace Functions

Object	Attribute	Access	Name	Data Type	Description
0x67	#10	Get/Set	Data Trace 1	UINT	Data trace 1
	#11	Get/Set	Data Trace 2	UINT	Data trace 2
	#12	Get/Set	I/O Trace 1	UINT	I/O trace 1
	#13	Get/Set	I/O Trace 2	UINT	I/O trace 2
	#14	Get/Set	Sampling Time	UINT	Sampling time
	#15	Get/Set	Trigger Target	UINT	Trigger
	#16	Get/Set	Trigger Target	INT	Trigger level
	#17	Get/Set	Edge Type	UINT	Edge type
	#18	Get/Set	Pre-Trigger	UINT	Amount of pre-trigger data
	#19	Get/Set	Start Trace	UINT	Trace start command
	#20	Get	Trace Status	UINT	Trace status

■ Description of Parameters

This section describes the parameters used for the data trace function.

Data Trace 1 (Object: 0x67, Instance: 0x01, Attribute: #10)

Select the first type of data to be traced for Data Trace 1.

Table 5.22 Data to be Traced

Setting	Data	Unit
0x0	Torque reference	%
0x1	Feedback speed	min^{-1}
0x3	Reference pulse speed	min^{-1}
0x4	Position errors	Reference units

Data Trace 2 (Object: 0x67, Instance: 0x01, Attribute: #11)

Select the second type of data to be traced for Data Trace 2. The settings are the same as those for Data Trace 1.

I/O Trace 1 (Object: 0x67, Instance: 0x01, Attribute: #12)

Select the first type of I/O to be traced for I/O Trace 1.

Table 5.23 I/O to be Traced

Setting	I/O	Description
0x0080	ALM	Alarm output
0x0081	/COIN	Positioning complete output
0x0082	/V-CMP	Speed coincidence output
0x0083	/TGON	Rotation detected output
0x0084	/S-RDY	Servo ready output
0x0085	/CLT	Torque control output
0x0086	/VLT	Speed limit detected output
0x0087	/BK	Brake interlock output
0x0088	/WARN	Warning output
0x0089	/NEAR	Near output
0x008B	ALO1	Alarm code output 1
0x008C	ALO2	Alarm code output 2
0x008D	ALO3	Alarm code output 3

I/O Trace 2 (Object: 0x67, Instance: 0x01, Attribute: #13)

Select the second type of I/O to be traced for I/O Trace 2. The settings are the same as those for I/O Trace 1.

Sampling Time (Object: 0x67, Instance: 0x01, Attribute: #14)

Select the time in which data can be traced for the Sampling Period. The time can be set in multiples of 250 μs between 250 and 8,191,750 μs.

Trigger Target (Object: 0x67, Instance: 0x01, Attribute: #15)

Select the item to be used as a trigger for the Trigger Target. Any of the items selected for Data Trace 1, Data Trace 2, I/O Trace 1, or I/O Trace 2 can be assigned, or no trigger can be selected. If no trigger is selected, then sampling will begin as soon as the trace is started, and the Trigger Level, Trigger Edge, and Pre-Trigger settings will be invalid.

Table 5.24 Trigger Settings

Setting	Description
0x0	No trigger
0x1	Data set for Data Trace 1
0x2	Data set for Data Trace 2
0x3	I/O set for I/O Trace 1
0x4	I/O set for I/O Trace 2

Trigger Level (Object: 0x67, Instance: 0x01, Attribute: #16)

Select the level to use to detect the trigger for the Trigger Level.

The unit for this setting will be the same as that for the Trigger Target. If the Trigger Target is set to I/O Trace 1, I/O Trace 2, or no trigger, this setting is invalid.

Edge Type (Object: 0x67, Instance: 0x01, Attribute: #17)

Select the direction of change to detect the trigger for the Edge Type. If the Trigger Target is set to no trigger, this setting is invalid.

Table 5.25 Edge Types

Setting	Description	Trace Type	Remarks
0x0	Rising Edge	Data trace	The trigger is detected when the data changes from below the trigger level to the trigger level or higher.
		I/O trace	The trigger is detected when the signal changes from low to high.
0x1	Falling Edge	Data trace	The trigger is detected when the data changes from above the trigger level to the trigger level or lower.
		I/O trace	The trigger is detected when the signal changes from high to low.
0x2	Changing Edge	Data trace	The trigger is detected when the data passes the trigger level.
		I/O trace	The trigger is detected when the signal level changes.

Pre-trigger (Object: 0x67, Instance: 0x01, Attribute: #18)

For the Pre-trigger, select the number of samples that can be saved as part of the 1000 points before the Trigger is activated. Set the number of samples to a value between 0 and 999. If the Trigger Target is set to no trigger, this setting is invalid.

Start trace (Object: 0x67, Instance: 0x01, Attribute: #19)

Set starting and canceling the trace for Start Trace. To start tracing again, specify starting the trace again.

Table 5.26 Start Trace

Setting	Description
0x0	No operation (NOP)
0x1	Start trace
0x2	Cancel trace

Trace Status (Object: 0x67, Instance: 0x01, Attribute: #20)

The trace status is stored in the Trace Status.

Table 5.27 Trace Status

Setting	Description
0x0000	Initial status
0x0001	Tracing
0x0002	Trace completed
0x0010	Trace canceled
0x0011	Setting error

5.7.2 Reading Trace Data

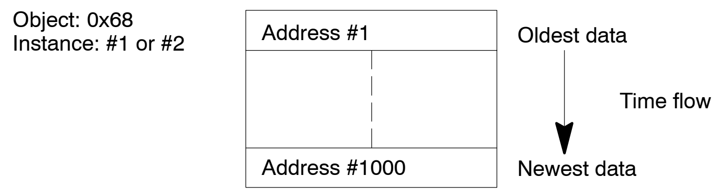
■ Trace Data Object

The data traced by the SERVOPACK is stored in the trace data object. The trace data object has four instances.

Trace	Data Range	Object and Instance
Data Trace 1	1 to 1,000	Object 0x68, Instance #1
Data Trace 2	1 to 1,000	Object 0x68, Instance #2
I/O Trace 1	1 to 63	Object 0x68, Instance #3
I/O Trace 2	1 to 63	Object 0x68, Instance #4

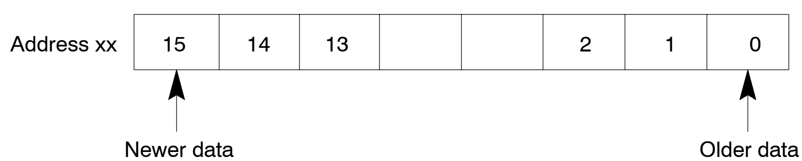
Data Trace 1 and Data Trace 2

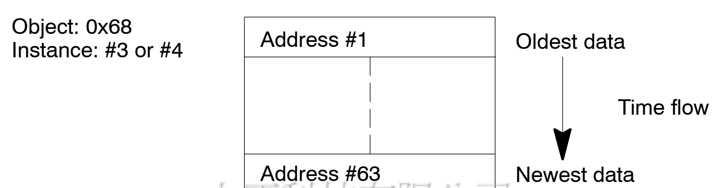
The following figure shows how data from a data trace is stored.



I/O Trace 1 and I/O Trace 2

The following figure shows how data from an I/O trace is stored. Zeros are stored in the final eight bits remaining in the 1000 points of data (bits 8 to 15 of address #63).





■ Explicit Messages

This section describes the commands and responses in explicit messages used to read trace data. Trace Data Read is used for Byte Data Read and Word Data Read.

Byte Data Read

Command (Master Device to NS300 Module)

7	6	5	4	3	2	1	0
		Destination node number					
0	Service code (0x1C)						
Object number (0x67)							
Instance number							
Lower byte of address							
Upper byte of address							
Number of bytes to read							

Response (NS300 Module to Master Device)

7	6	5	4	3	2	1	0
		Destination node number					
1	Service code (0x1C)						
Upper byte of data							
Lower byte of data							
:							
Upper byte of data							
Lower byte of data							

Read data (200 bytes max.)

Note: 1. The maximum number of bytes that can be read is 200.

2. Even if the start address plus the number of bytes exceeds the number of items (2,000 bytes for data trace 1 or 2 and 126 bytes for I/O trace 1 or 2), an error will not occur and the number of bytes that can be read will be returned.
Example: If an address of 1000 and 10 bytes are specified, only 2 bytes of data for the address of 1000 bytes will be read.

Error Responses

Response (NS300 Module to Master Device)

7	6	5	4	3	2	1	0
		Destination node number					
1	Service code (0x14)						
Error code							
Error code							

Word Data Read

Command (Master Device to NS300 Module)

7	6	5	4	3	2	1	0
		Destination node number					
0	Service code (0x1D)						
Object number (0x67)							
Instance number							
Lower byte of address							
Upper byte of address							
Number of words to read							

Response (NS300 Module to Master Device)

7	6	5	4	3	2	1	0
		Destination node number					
1	Service code (0x1D)						
Lower byte of data							
Upper byte of data							
:							
Lower byte of data							
Upper byte of data							

Read data
(200 bytes max.)

Note: 1. The maximum number of words that can be read is 200.

2. Even if the start address plus the number of words exceeds the number of items (2,000 words for data trace 1 or 2 and 63 words for I/O trace 1 or 2), an error will not occur and the number of words that can be read will be returned.
Example: If an address of 1000 and 10 words are specified, only one word of data for address 1000 bytes will be read.

Error Responses

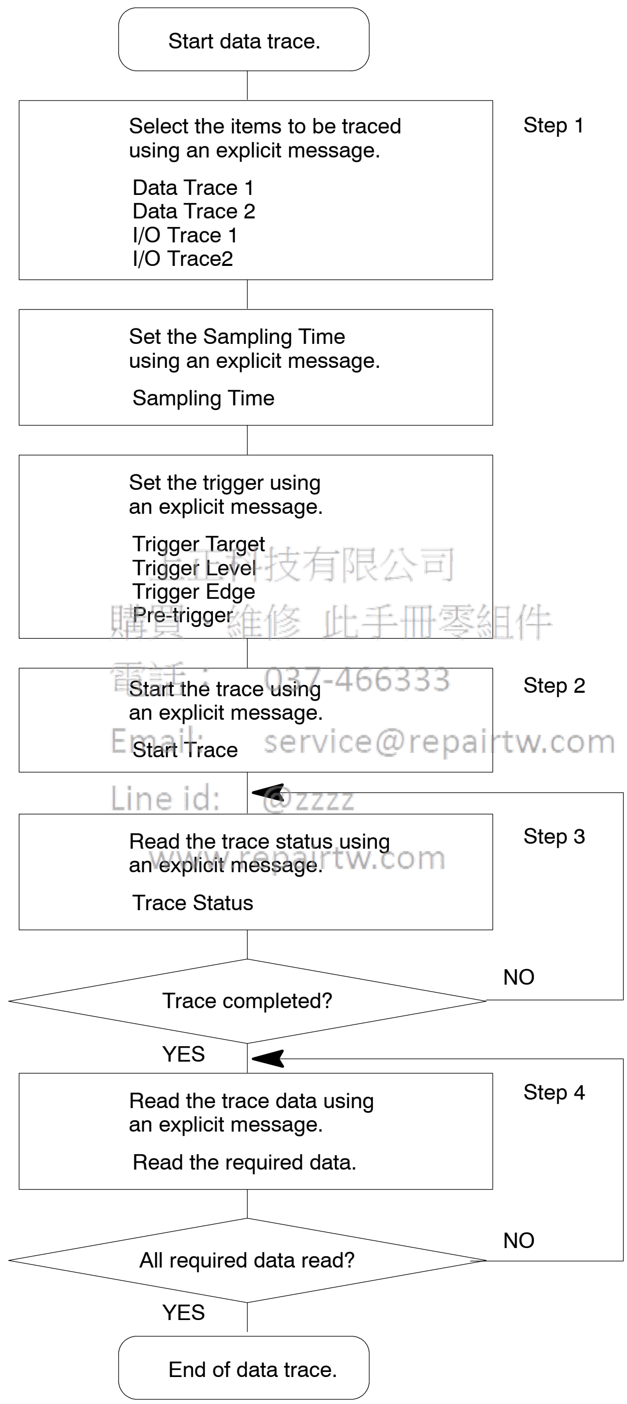
Response (NS300 Module to Master Device)

7	6	5	4	3	2	1	0
		Destination node number					
1	Service code (0x14)						
Error code							
Error code							

5.7.3 Executing Data Traces

Use the following procedure to execute a data trace from the host controller.

1. Select the items to be traced and other parameters.
2. Start the trace.
3. Read the trace status.
4. Read the trace data.



6

Parameter Settings

This chapter describes parameters and standard settings for I/O signals (CN1) when an NS300 Module is mounted.

6.1 Parameters and Standard Settings for NS300 Modules

6.1.1 Automatically Set Parameters

When an NS300 Module is mounted on an SGDH SERVOPACK and it is used for DeviceNet communications, the following parameters are automatically set. The following parameters will be treated as "reserved for system use," so do not change them. The SGDH SERVOPACK will be set for position control. It is not necessary to set parameters for speed and torque control, so do not change the settings.

Pn No.	Digit	Parameter Name	Set Value	Description
Pn000	1	Select control method	1	Position control
Pn004	1	Reserved	0	---
Pn200	1	Clear signal status	0	Clear the error counter with an H-level signal.
	2	Clear motion	1	Error counter is not cleared.
Pn202	---	Electronic Gear Ratio (Numerator)	1	Electronic gear on SGDH SERVOPACK is not used.
Pn203	---	Electronic Gear Ratio (Denominator)	1	Electronic gear on SGDH SERVOPACK is not used.
Pn204	---	Position command acceleration/deceleration time constant	0	Time constant = 0
Pn207	0	Select position command filter	0	Acceleration/deceleration filter
	1	Position control option	0	Not used
Pn50A	---	Select input signal 1	8881	Not used
Pn50B	---	Select input signal 2	□□88	Not used
Pn50C	---	Select input signal 3	8888	Not used
Pn50D	---	Select input signal 4	8888	Not used
Pn511	0	Select input signal 5	8	Not used

INFO

These parameters are set automatically the first time the power to the SERVOPACK is turned ON after the NS300 Module has been mounted. Startup will take approximately six seconds when these parameters are being set.

6.1.2 Standard Settings for CN1 I/O Signals

The standards settings for CN1 I/O signals when the NS300 Module is mounted are described below. To use the standard settings, change the parameters to the standard setting as shown below. The input signal setting from the NS300 Module will be force-changed, so the user cannot change this setting.

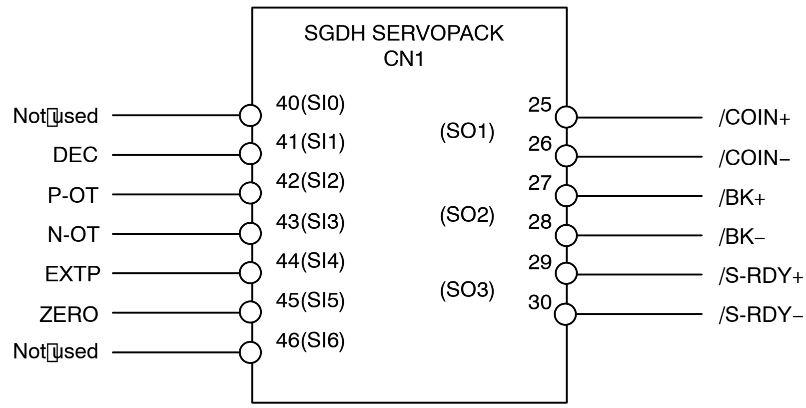


Figure 6.1 Standard CN1 I/O Signal Settings

Table 6.1 Factory Settings and Standard Settings for I/O Signals

Parameter	Description	Factory Setting	Standard Setting
Pn50E	Output signal selections 1	3211	3001
Pn50F	Output signal selections 2	0000	0200
Pn510	Output signal selections 3	0000	0000

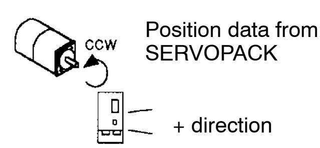
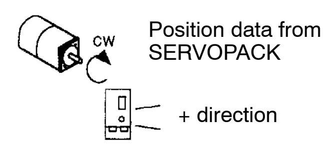
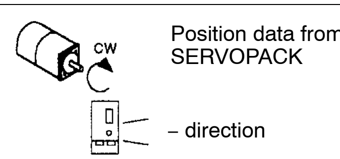
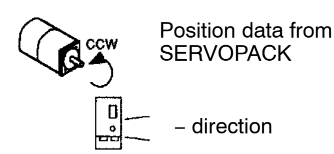
6.2 Settings According to Equipment Characteristics

This section describes the procedure for setting parameters according to the dimensions and performance of the equipment used.

6.2.1 Switching Servomotor Rotation Direction

The SERVOPACK has a Reverse Rotation Mode that reverses the direction of servomotor rotation without rewiring. Forward rotation in the standard setting is defined as counterclockwise as viewed from the load.

With the Reverse Rotation Mode, the direction of servomotor rotation can be reversed without changing other items. The direction (+, –) of shaft motion is reversed. There are no other changes.

	Standard Setting	**Reverse Rotation Mode**
Forward Reference		
Reverse Reference		

■ Setting Reverse Rotation Mode

Use parameter Pn000.0.

Pn000.0	**Direction Selection**	**Factory Setting: 0**	**Position Control**

Use the following settings to select the direction of servomotor rotation.

Setting	**Description**	
0	Forward rotation is defined as counterclockwise (CCW) rotation as viewed from the load.	(Standard setting)
1	Forward rotation is defined as clockwise (CW) rotation as viewed from the load.	(Reverse Rotation Mode)

6.2.2 Stop Mode Selection at Servo OFF

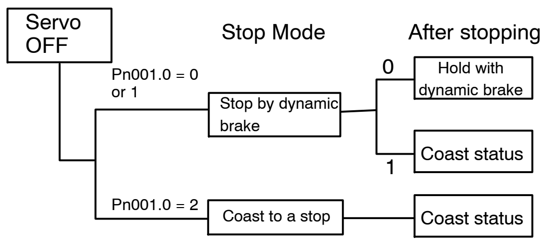
The SGDH SERVOPACK turns OFF under the following conditions:

- The SV_OFF command is transmitted.
- A servo alarm occurs.
- Power is turned OFF.

Specify the Stop Mode if any of these occurs during servomotor operation.

6

Pn001.0	Servo OFF Stop Mode	Factory Setting: 0	Position Control



The dynamic brake electrically applies a brake by using a resistor to consume servomotor rotation energy.

Refer to *6.5.1 Using the Dynamic Brake.*

Parameter	Setting	Item
Pn001.0	0 (Factory setting)	Uses the dynamic brake to stop the servomotor, and maintains dynamic brake status after stopping.
	1	Uses the dynamic brake to stop the servomotor, and cancels dynamic brake status after stopping to go into coast status.
	2	Coasts the servomotor to a stop. The servomotor is turned OFF and stops due to equipment friction.

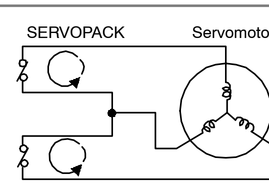
Note If the servomotor is stopped or rotating at extremely low speed when the item above is set to 0 (dynamic brake status after stopping with the dynamic brake), then braking power is not generated and the servomotor will coast to a stop the same as in coast status.

6

TERMS

◆ Dynamic brake (DB)

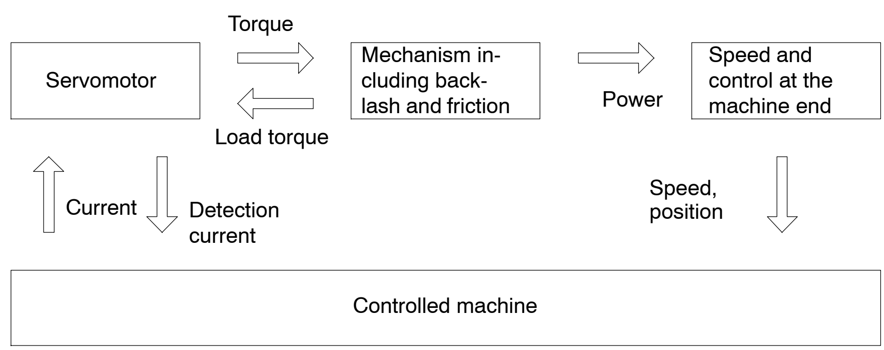
The dynamic brake is a common way of suddenly stopping a servomotor. Built into the SERVOPACK, the dynamic brake suddenly stops a servomotor by electrically shorting its electrical circuit.



6.2.3 Fully-closed Control

A fully-closed loop can be formed using the parameter settings on the SGDH SERVOPACK. In previous SERVOPACKs, a semi-closed method was used to control the motor, but with this function even more precise control is achieved because control involves the detection of the position and speed of actual machine operation.

Fully-closed control



Parameters must be set when using fully-closed control. Refer to *6.2.5 Parameter Settings* for details.

6.2.4 Fully-closed System Specifications

This section describes the fully-closed system specifications of the SGDH SERVOPACK when an NS300 Module is mounted.

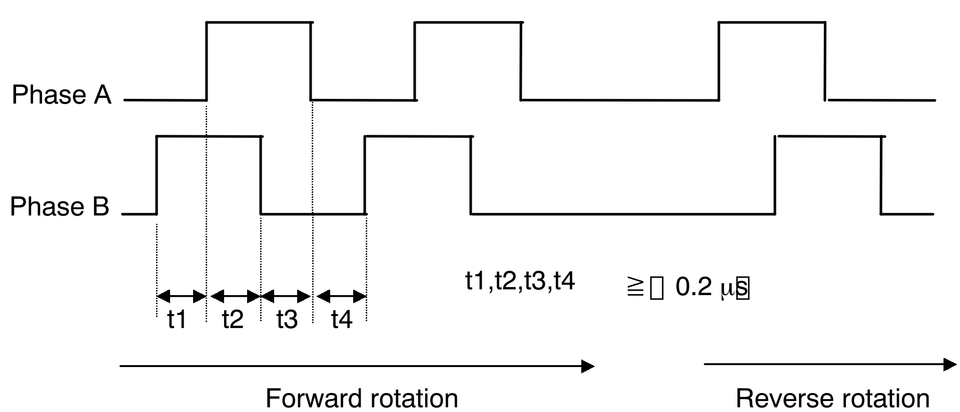
■ Fully-closed Encoder Pulse Output Form

5-V Differential line driver output (complies with EIA Standard RS-422A)

■ Fully-closed Encoder Pulse Signal Form

90° Phase difference 2-phase differential pulse: phase A, phase B

Maximum receivable frequency for SERVOPACK: 1 Mbps



6.2.5 Parameter Settings for the Fully-closed System

This section describes the parameters that must be set when using an NS300 Module.

■ Overflow Level

For information on parameter contents, refer to *6.2.1 Servo Gain Settings* of the *∑-II Series SGM□H/SGDH User's Manual : Design and Maintenance* (SIE-S800-32.2). The factory setting is made to minimize the chance of the motor going out of control due to wiring errors or other causes. After performing a trial operation at a low speed, change the setting to a higher value if necessary.

■ Fully-closed Encoder

Set the method for using the fully-closed encoder.

Pn002.3	Fully-closed Encoder Usage Method	Factory Setting: 0	Position Control

The setting details are as follows:

Parameter	Setting	Meaning
Pn002.3	0 (Factory setting)	Fully-closed encoder is not used.
	1	Fully-closed encoder is used without phase C.
	2	Fully-closed encoder is used with phase C.
	3	Fully-closed encoder is used in Reverse Rotation Mode without phase C.
	4	Fully-closed encoder is used in Reverse Rotation Mode with phase C.

When changes have been made to this parameter, turn OFF the power once. The set value will become effective when the power is turned ON again.

■ Number of Fully-closed Encoder Pulses

Set the number of fully-closed encoder pulses for each motor rotation.

When the number of fully-closed encoder pulses per motor rotation is not an integer, set the closest integer.

Error will occur in the speed monitor for position loop gain, feed forward, and reference pulse, but no position displacement will occur. Set the number of pulses with a multiplication factor of 1.

Pn206	Number of Fully-closed Encoder Pulses	Unit P/R	Setting Range: 513 to 65535	Factory Setting: 16384	Position Control

When changes have been made to this parameter, turn OFF the power once. The set value will become effective when the power is turned ON again.

6.3 Settings According to Host Controller

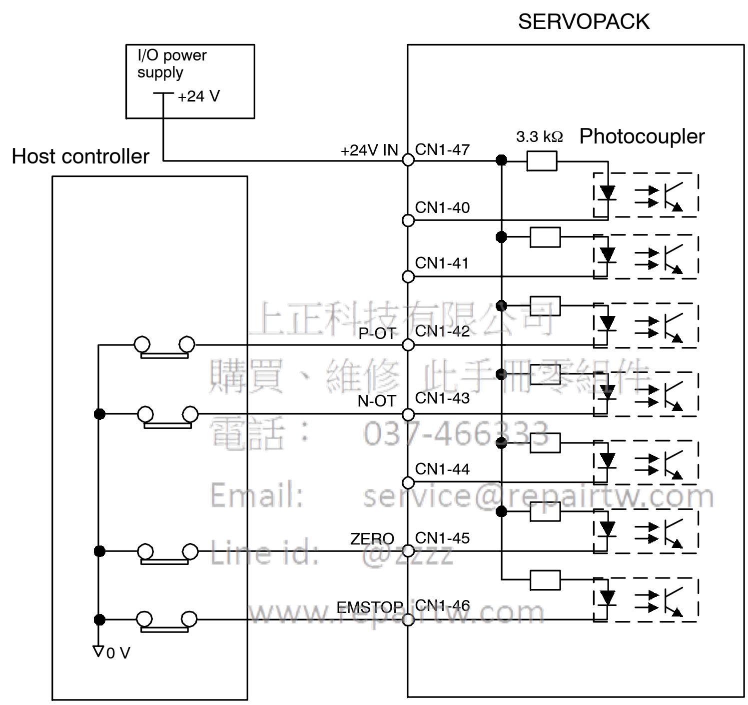
This section describes the procedure for connecting the SERVOPACK to the host controller and provides details on related parameters.

6.3.1 Sequence I/O Signals

Sequence I/O signals are used to control SERVOPACK operation. Connect these signal terminals as required.

■ Input Signal Connections

Connect the sequence input signals as shown below (standard settings).



IMPORTANT

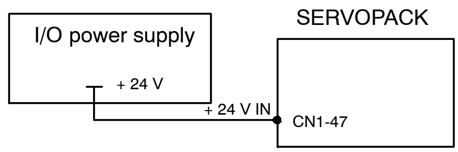
Provide an external input power supply; the SERVOPACK does not have an internal 24-V power supply.

- Sequence input signal power supply specifications: 24 ± 1 VDC, 50 mA min.

Yaskawa recommends using the same external power supply as that used for output circuits. The allowable voltage range for the 24-V sequence input circuit power supply is 11 to 25 V. Although a 12-V power supply can be used, contact faults can easily occur for relays and other mechanical contacts under low currents. Confirm the characteristics of relays and other mechanical contacts before using a 12-V power supply.

→ Input +24V IN CN1-47	24 V External I/O Power Supply Input	Position Control

The external power supply input terminal is common to sequence input signals.

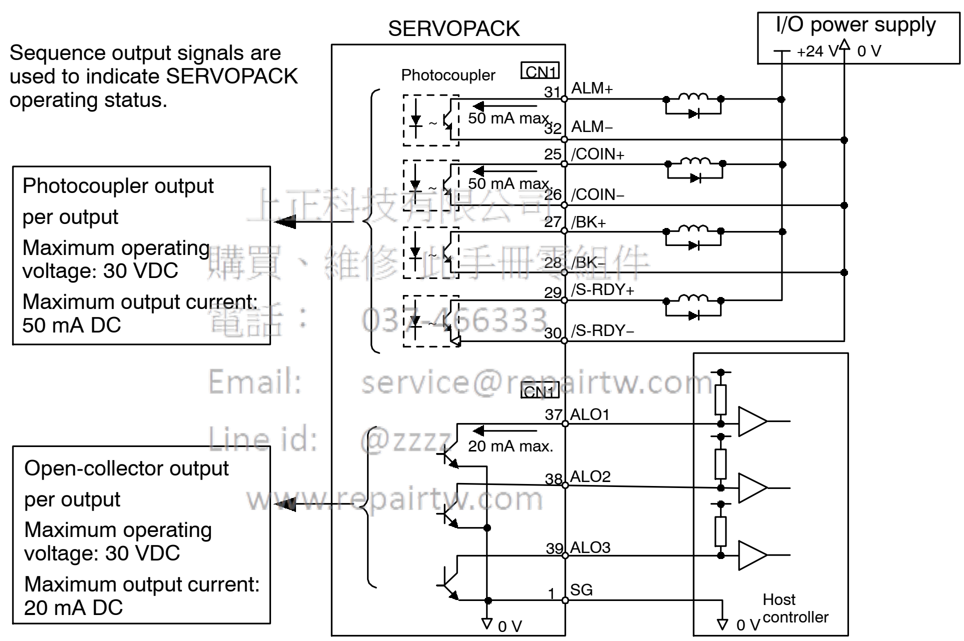


Connect an external I/O power supply.

Contact input signals: DEC (CN1-41)
P-OT (CN1-42)
N-OT (CN1-43)
EXTP (CN1-44)
ZERO (CN1-45)

■ Output Signal Connections

Connect the sequence output signals as shown in the following figure (standard settings).



IMPORTANT Provide a separate external I/O power supply; the SERVOPACK does not have an internal 24-V power supply. Yaskawa recommends using the same type of external power supply as that used for input circuits.

Function allocations for some sequence output signal circuits can be changed.

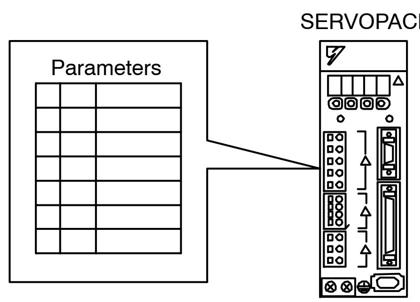
Refer to *6.4.3 Output Circuit Signal Allocations* for more details.

6.4 Setting Up the SERVOPACK

This section describes the procedure for setting parameters to operate the SERVOPACK.

6.4.1 Parameters

The Σ-II Series SERVOPACK provides many functions and has parameters that allow the user to specify functions and perform fine adjustments.



A Panel Operator, hand-held Digital Operator, or Device-Net commands is used to set parameters.

Parameters are divided into the following three groups.

Parameter	Function
Pn000 to Pn819	Specify SERVOPACK functions, set servo gains, etc.
Fn000 to Fn013	Execute auxiliary functions such as FEED operations and zero point searches.
Un000 to Un00D	Monitor the motor speed and torque reference value on the panel display.

6.4.2 Input Circuit Signal Allocation

The allocation of the sequence input signal circuit when the NS300 Module is mounted on the SGDH SERVOPACK is not changed. It will be as follows:

Terminal Numbers	Input Terminal Name	Symbol	Name
40	SI0	---	---
41	SI1	DEC	Deceleration limit switch
42	SI2	P-OT	Forward run prohibited
43	SI3	N-OT	Reverse run prohibited
44	SI4	EXTP	External signal positioning
45	SI5	ZERO	Zero point signal
46	SI6	---	---

6.4.3 Output Circuit Signal Allocations

Output signal functions can be allocated to the sequence signal output circuits shown below.

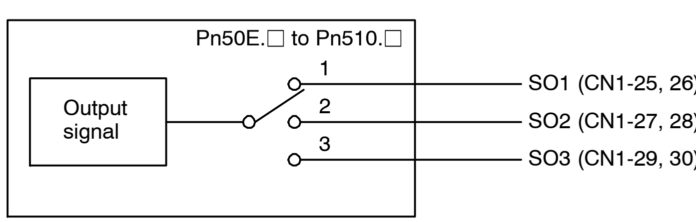
In general, allocate signals according to the standard settings in the following table.

CN1 Connector Terminal Numbers	Output Terminal Name	Factory Setting		Standard Setting	
		Symbol	Name	Symbol	Name
25	SO1	/COIN+	Positioning completed	/COIN+	Positioning completed
26		/COIN−		/COIN−	
27	SO2	/TGON+	Rotation detection	/BK+	Brake interlock
28		/TGON−		/BK−	
29	SO3	/S-RDY+	Servo ready	/S-RDY+	Servo ready
30		/S-RDY−		/S-RDY−	

The following table shows the output signal selection parameters and their factory settings and standard settings.

Pn50E	**Output Signal Selections 1**	**Factory Setting: 3211**	**Standard Setting: 3001**
Pn50F	**Output Signal Selections 2**	**Factory Setting: 0000**	**Standard Setting: 0200**
Pn510	**Output Signal Selections 3**	**Factory Setting: 0000**	**Standard Setting: 0000**

Select the CN1 connector terminals that will output the signals.



Output Signal	Parameter		Description
	Number	Setting	
Positioning Completed (/COIN)	Pn50E.0	0	Disabled (Not used for the output signal on the left.)
		1	Outputs the signal on the left from the SO1 (CN1-25 and 26) output terminal.
		2	Outputs the signal on the left from the SO2 (CN1-27 and 28) output terminal.
		3	Outputs the signal on the left from the SO3 (CN1-29 and 30) output terminal.
Speed Coincidence Detection (/V-CMP)	Pn50E.1	0 to 3	Same as Pn50E.0*
Rotation Detection (/TGON)	Pn50E.2	0 to 3	Same as Pn50E.0
Servo Ready (/S-RDY)	Pn50E.3	0 to 3	Same as Pn50E.0
Torque Limit Detection (/CLT)	Pn50F.0	0 to 3	Same as Pn50E.0
Speed Limit Detection (/VLT)	Pn50F.1	0 to 3	Same as Pn50E.0
Brake Interlock (/BK)	Pn50F.2	0 to 3	Same as Pn50E.0
Warning (/WARN)	Pn50F.3	0 to 3	Same as Pn50E.0
Near (/NEAR)	Pn510.0	0 to 3	Same as Pn50E.0
Phase C Detection (/C-PULS)	Pn510.1	0 to 3	Same as Pn50E.0

* Always OFF when an NS300 Module is mounted.

Note "Same as Pn50E.0" means output signals are disabled or allocated to output terminals SO1 to SO3 through parameter settings 0 to 3.

INFO Signals are output with OR logic when multiple signals are allocated to the same output circuit. Signals that are not detected are invalid.

■ Output Signal Reversal

The following parameter can be used to reverse the signals output on output terminals SO1 to SO3.

Pn512	Output Signal Reversal Settings	Factory Setting: 0000	Position Control

The settings specify which of the connector CN1 output signals are to be reversed.

Output Terminals	Parameter		Description
	Number	Setting	
SO1 (CN1-25, 26)	Pn512.0	0	Output signal not reversed.
		1	Output signal reversed.
SO2 (CN1-27, 28)	Pn512.1	0	Output signal not reversed.
		1	Output signal reversed.
SO3 (CN1-29, 30)	Pn512.2	0	Output signal not reversed.
		1	Output signal reversed.
Reserved	Pn512.3	---	---

6.4.4 Analog Monitors

The analog monitors can be changed by changing the PN003.0 and Pn003.1 parameter settings.

Pn003.0	**Analog Monitor 1**	**Factory Setting: 2**	**Position Control**
Pn003.1	**Analog Monitor 2**	**Factory Setting: 0**	**Position Control**

The monitor signals and units and the observation gains when observing using the analog monitor (CN5) are shown on the following table.

Pn003.0 and Pn003.1 Settings	Monitor Signal	Analog Monitor (CN5) Observed Gain
0	Servomotor speed	1 V/1000 min^{-1}
1	Speed reference	1 V/1000 min^{-1}
2	Torque reference	1 V/100 % rated torque
3	Position error	0.05 V/1 reference units
4	Position error	0.05 V/100 reference units
5	Reference pulse frequency (Servomotor speed conversion)	1 V/1000 min^{-1}
6	Servomotor speed	1 V/250 min^{-1}
7	Servomotor speed	1 V/125 min^{-1}
8 to F	Reserved motor signal	–

INFO Refer to *6.5 Analog Monitors* in the *Σ-II Series SGM□H/SGDH User's Manual: Design and Maintenance* (SIE-S800-32.2) for information on monitoring methods of analog monitors.

6.5 Setting Stop Functions

This section describes the procedure used to stably stop the SERVOPACK.

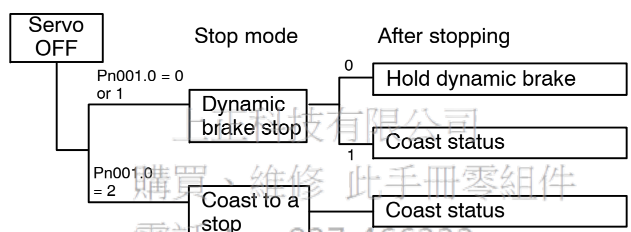
6.5.1 Using the Dynamic Brake

To stop the servomotor by applying the dynamic brake (DB), set the desired mode in the following parameter. The servomotor will stop due to equipment friction if the dynamic brake is not applied.

Pn001.0	Servo OFF or Alarm Stop Mode	Factory Setting: 0	Position Control

The SERVOPACK turns OFF under the following conditions:

- When the SV_OFF command is sent.
- A servo alarm occurs.
- Power is turned OFF.



Specify the Stop Mode if any of these occurs during servomotor operation.

Pn001.0 Setting	Description
0	Uses the dynamic brake to stop the servomotor. Maintains dynamic brake after the servomotor stops. *1
1	Uses the dynamic brake to stop the servomotor. Releases dynamic brake after the servomotor stops, and the servomotor coasts to a stop.
2	Coasts the servomotor to a stop. *2 The servomotor is turned OFF and stops due to equipment friction.

* 1. If the servomotor is stopped or moving at extremely low speed, it will coast to a stop.

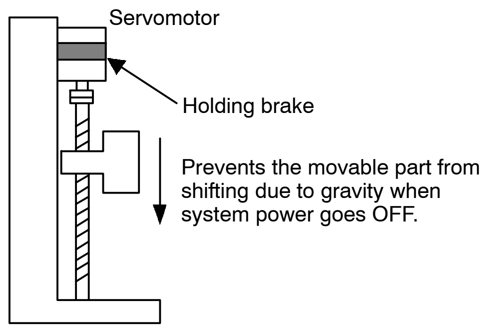
* 2. A dynamic brake is used when the control power and main power are turned OFF.

IMPORTANT

The dynamic brake is an emergency stop function. Do not repeatedly start and stop the servomotor using the SV_ON/SV_OFF command or by repeatedly turning power ON and OFF.

6.5.2 Using the Holding Brake

The holding brake is used when a Servodrive controls a vertical axis. In other words, a servomotor with brake prevents the movable part from shifting due to gravity when system power goes OFF.

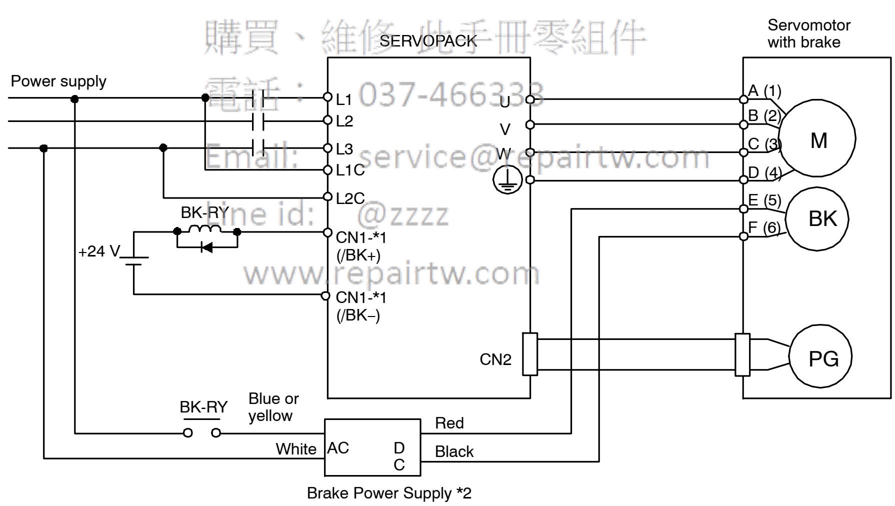


IMPORTANT

The brake built into the SGM□H servomotor with brakes is a de-energization brake, which is used only to hold and cannot be used for braking. Use the holding brake only to hold a stopped motor. Brake torque is at least 120% of the rated servomotor torque.

■ Wiring Example

Use the SERVOPACK sequence output signal /BK and the brake power supply to form a brake ON/OFF circuit. The following diagram shows a standard wiring example.



BK-RY: Brake control relay

*1: The output terminal signal is allocated with Pn50F.2

*2: Brake power supplies are available in 200-V and 100-V models.

Output to /BK	Brake Interlock Output	Position Control

This output signal controls the brake when using a servomotor with a brake and does not have to be connected when using a servomotor without a brake.

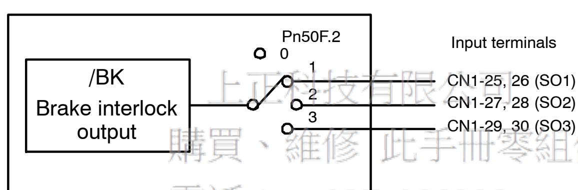
ON:	Closed or low level	Releases the brake.
OFF:	Open or high level	Applies the brake.

Related Parameters

Pn005	Brake operation
Pn506	Time Delay from Brake Reference until Servo OFF
Pn507	Speed Level for Brake Reference Output during Motor Operation
Pn508	Timing for Brake Reference Output during Motor Operation

The output signal in the following parameter must be selected when the /BK signal is used.

Pn50F	Output Signal Selection 2	Factory Setting: 0000	Position Control



Select the /BK output terminal.

Parameter	Setting	Output Terminal (CN1)	
		*1	*2
Pn50F.2	0	---	---
	1	25	26
	2	27	28
	3	29	30

Note Signals are output with OR logic when multiple signals are allocated to the same output circuit. Set other output signals to a value other than that allocated to the /BK signal in order to output the /BK signal alone. Refer to *6.4.3 Output Circuit Signal Allocation.*

■ Brake Operation

Set whether the brake is applied using the SERVOPACK parameter.

Pn005.0	**Brake Operation**	**Factory Setting:** **0**	**Position Control**

Pn005.0 Setting	Description
0	Performs brake operation using the SERVOPACK parameter.
1	Does not perform brake operation using the SERVOPACK parameter.

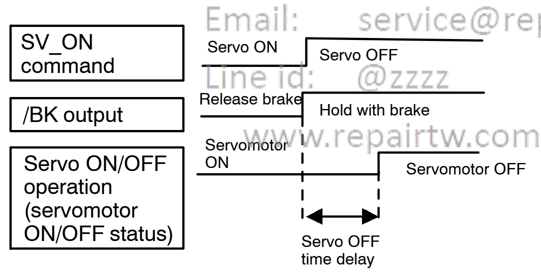
IMPORTANT When setting the Pn005.0 to 1, the SERVOPACK's parameters (Pn506, Pn507, Pn508) settings will be ignored.

■ 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.

Pn506	**Time Delay from Brake Reference until Servo OFF**	**Unit:** **10 ms**	**Setting Range:** **0 to 50**	**Factory Setting:** **0**	**Position Control**

This parameter is used to set the output time from the brake control output signal /BK until the servo OFF operation (servomotor output stop) when a servomotor with a brake is used.



With the standard setting, the servo is turned OFF when the /BK signal (brake operation) is output. 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.

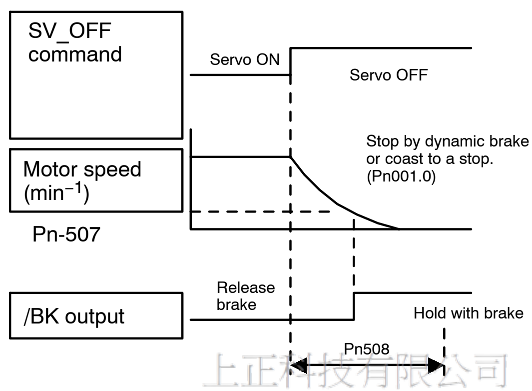
IMPORTANT The servomotor will turn OFF immediately if an alarm occurs. The equipment may move due to gravity in the time it takes for the brake to operate.

■ Holding Brake Setting

Set the following parameters to adjust brake ON timing so the holding brake is applied when the servomotor stops.

Pn507	**Brake Reference Output Speed Level during Motor Operation**	**Unit:** $\mathbf{min^{-1}}$	**Setting Range:** **0 to 10000**	**Factory Setting:** **100**	**Position Control**
Pn508	**Timing for Brake Reference Output during Motor Operation**	**Unit:** **10 ms**	**Setting Range:** **10 to 100**	**Factory Setting:** **50**	**Position Control**

Set the brake timing used when the servo is turned OFF by the SV_OFF command or when an alarm occurs during servomotor with brake operation.



Brake ON timing when the servomotor stops must be adjusted properly because servomotor brakes are designed as holding brakes. Adjust the parameter settings while observing equipment operation.

/BK Signal Output Conditions During Servomotor Operation

The circuit is open under either of the following conditions:

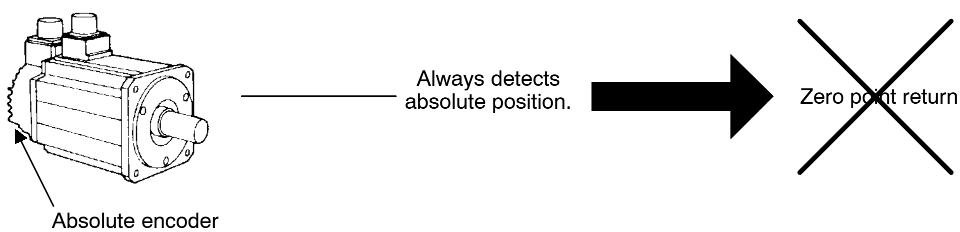
1	Motor speed drops below the setting at Pn507 after servo OFF.
2	The time set at Pn508 has elapsed since servo OFF.

The actual setting will be the maximum speed if Pn507 is set higher than the maximum speed.

6.6 Absolute Encoders

If a servomotor with an absolute encoder is used, a system to detect the absolute position can be made in the host controller. Consequently, operation can be performed without performing a zero point return immediately after the power is turned ON.

Motor: SGM□H-□□□1□···With 16-bit absolute encoder
SGM□H-□□□2□···With 17-bit absolute encoder



6.6.1 Selecting an Absolute Encoder

Select the absolute encoder usage with the following parameter.

Pn002.2	Absolute Encoder Usage	Factory Setting: 0	Position Control

"0" in the following table must be set to enable the absolute encoder.

Pn002.2 Setting	Description
0	Use the absolute encoder as an absolute encoder.
1	Use the absolute encoder as an incremental encoder.

Note This parameter setting goes into effect when the power is turned OFF and ON again after the change has been made.

6.6.2 Absolute Encoder Setup

Perform the setup operation for the absolute encoder in the following circumstances:

- When starting the machine for the first time
- When an encoder backup alarm is generated
- When the SERVOPACK’s power supply is turned OFF and the encoder’s cable is removed

Perform the setup operation in one of the following ways.

- Perform the operation by the absolute encoder (Fn008) using the Digital Operator. (Refer to the *Σ-II Series SGM□H/SGDH User’s Manual.*)
- Perform the operation by personal computer monitor software.

INFO

The absolute encoder setup operation is only possible when the servo is OFF. After the setup processing is finished, turn the power OFF and then ON again.

IMPORTANT

If the following absolute encoder alarms are displayed, the alarms must be cleared using the method described above for the setup operation. They cannot be cleared using the Alarm Reset Command.

- Encoder backup alarm (A.81)
- Encoder checksum alarm (A.82)

In addition, if a monitoring alarm is generated in the encoder, release the alarm by turning OFF the power.

6.6.3 Multiturn Limit Setting

When implementing absolute position detection systems for machines that turn m times in response to n turns in the load shaft, such as round tables, it is convenient to reset the multiturn data from the encoder to 0 every m turns. The Multiturn Limit Setting allows the value m to be set for the encoder.

Select the absolute encoder usage with the following parameter.

Pn002.2	**Absolute Encoder Usage**	**Factory Setting: 0**	**Position Control**

Set Pn002.2 to 0 to enable the absolute encoder.

Pn002.2 Setting	Description
0	Uses the absolute encoder as an absolute encoder.
1	Uses the absolute encoder as an incremental encoder.

The multiturn limit is set in the SERVOPACK using the following parameter.

Pn205	**Multiturn Limit Setting**	**Unit: rev**	**Setting Range: 0 to 65535**	**Factory Setting: 65535**	**Position Control**

If the Multiturn Limit Setting is set to 65535 (factory setting), the multiturn data will vary from –32768 to 32767. If any other value is set, the multiturn data will vary from 0 to the setting of Pn205.

If the servomotor rotates in the negative direction from 0, the multiturn data will change to the value set for Pn205. If the servomotor rotates in the positive direction from the value set in Pn205, the multiturn data will change to 0. Set Pn205 to m – 1.

INFO Turn the power OFF and then ON after changing the setting of parameter Pn002.2 or Pn205.

The multiturn limit value in the encoder is factory set to 65535, the same as the SERVOPACK. If the multiturn limit value in the SERVOPACK is changed with Pn205 and then the SERVOPACK power is turned OFF and ON, the following alarm will occur.

Alarm Name: Multiturn Limit Disagreement

Alarm Display	Alarm Code Outputs			Description of Alarm
	ALO1	ALO2	ALO3	
A.CC	ON	OFF	ON	The multiturn limit value is different in the encoder and SERVOPACK.

Note ON signals are low level; OFF signals are high level.

When this alarm occurs, the multiturn limit in the encoder must be changed. This operation is performed in one of the following ways.

- Refer to the *Σ-II Series SGM□H/SGDH User's Manual: Design and Maintenance* (SIE-S800-32.2) for details on changing the multiturn limit setting (Fn013) using a Digital Operator.
- Setup can also be performed using the personal computer monitor software.

INFO The multiturn limit setting in the encoder can be changed only when the Multiturn Limit Disagreement alarm has occurred. After changing the setting, turn the power supply OFF and then ON.

⚠ **WARNING** The multiturn limit value must be changed only for special applications. Changing it inappropriately or unintentionally can be dangerous.

⚠ **WARNING** If the Multiturn Limit Disagreement alarm occurs, check the setting of parameter Pn205 in the SERVOPACK to be sure that it is correct. If Fn013 is executed when an incorrect value is set in Pn205, an incorrect value will be set in the encoder. The alarm will disappear even if an incorrect value is set, but incorrect positions will be detected, resulting in a dangerous situation where the machine will move to unexpected positions.

TERMS

◆ Multiturn limit

The upper limit of multiturn data. The multiturn data will vary between 0 and the value of Pn205 (multiturn limit setting) when Pn002.2 is set to 0.

6.7 Digital Operator

6.7.1 Connecting the Digital Operator

There are two types of Digital Operator. One is a built-in operator incorporating a panel indicator and switches located on the front panel of the SERVOPACK. This type of Digital Operator is also called a Panel Operator. The other one is a Hand-held Digital Operator (i.e., the JUSP-OP02A-2 Digital Operator), which can be connected to the SERVOPACK through connector CN3 of the SERVOPACK.

There is no need to turn OFF the SERVOPACK to connect the Hand-held Digital Operator to the SERVOPACK. For details on how to use the Hand-held Digital Operator, refer to the *Σ-II Series SGM□H/SGDH User's Manual: Design and Maintenance* (SIE-S800-32.2).

6.7.2 Limitations in Using a Hand-held Digital Operator

When an NS300 Module is mounted, the Hand-held Digital Operator has the following limitations.

INFO

Disconnect the Hand-held Digital Operator during normal operation.

During Normal Operation

If the following command is sent via DeviceNet with a Hand-held Digital Operator connected to the SERVOPACK during normal operation, the following commands are not executed.

- Writing SGDH parameters
- SGDH parameters reading out
- Module reset
- Servo ON

6.7.3 Panel Operator Indicators

The Panel Operator indicators (LED) will not be lit in any of the following circumstances.

1. The indicators will not be lit for approximately 3 seconds when the power is turned ON.
2. The indicator will not be lit when the Hand-held Digital Operator is connected.
   It will be lit when the Hand-held Digital Operator is disconnected.
3. The indicator will not be lit momentarily when the following commands are received via DeviceNet or from a setup tool.
   - Writing SGDH parameters
   - Reading SGDH parameters

7

Using the NSxxx Setup Tool

This chapter describes how to set parameters and monitor basic operation of the NS300 Module using the NSxxx Setup Tool.

7.1 Connection and Installation

7.1.1 Connecting the NS300 Module

■ Connector Cables

Connect the CN11 port on the NS300 Module and the RS-232C port on the personal computer using the following cable.

Model	Name
DE9404559	SGD Monitor Cable

■ Cable Wiring

Wire the cables as follows:

CN11 Pin number	Symbol	Details	Personal computer pin number (9 pins)
1	TXD (red)	Serial data output	2
2	RXD (white)	Serial data input	3
3	GND (black)	Ground	5
4	GND (black)	Ground	5

7.1.2 Installing the Software

The following files are stored on the floppy disk for the NSxxx Setup Tool.

- NS_MMI.EXE (Execution module)
- ParmDef.CFG (Data files)
- RES_JPN.DLL (DLL in Japanese)
- RES_ENG.DLL (DLL in English)
- ParmDef(Jpn).CFG (Data files in Japanese)
- ParmDef(Eng).CFG (Data files in English)

Copy these files to any directory on the personal computer.

IMPORTANT To use the files in English, copy ParmDef(Eng).CFG to ParmDef.CFG.

7.2 How to Use

7.2.1 Screen Configuration at Startup

Start the Setup Tool as follows:

1. Double-click the ***NS_MMI.exe*** file. The following communications setting screen will be displayed.

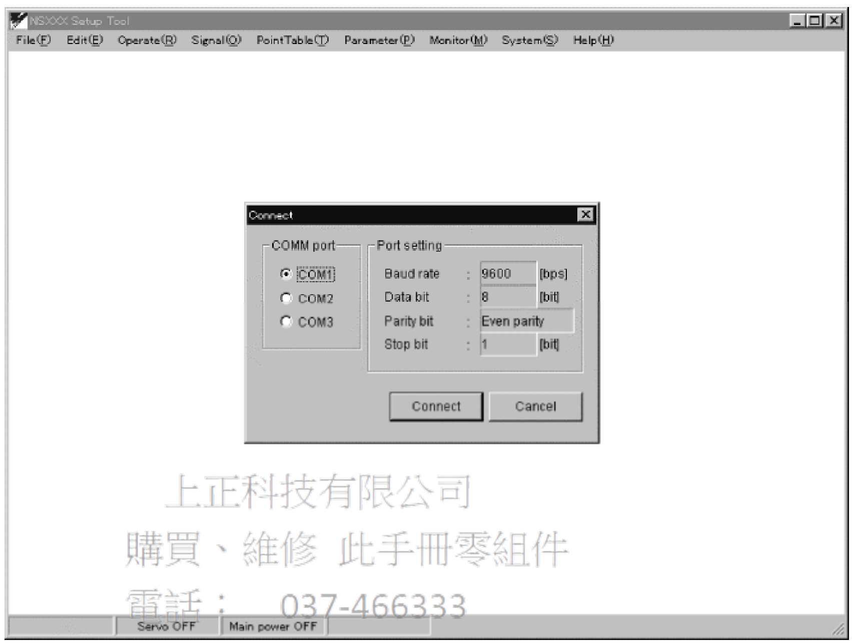


Figure 7.1 Communications setting screen

2. Perform one of the following operations.

- If using any COM port other than COM1 on the personal computer, change the COMM PORT setting.
- To use COM1, just click the ***Connect*** Button directly.

Next, check the following:

a) The communications power supply is being supplied via the SGDH control power supply to the NS300 Module.

b) The CN11 port on the NS300 Module is connected to the personal computer via a communications cable.

The following startup screen will be displayed.

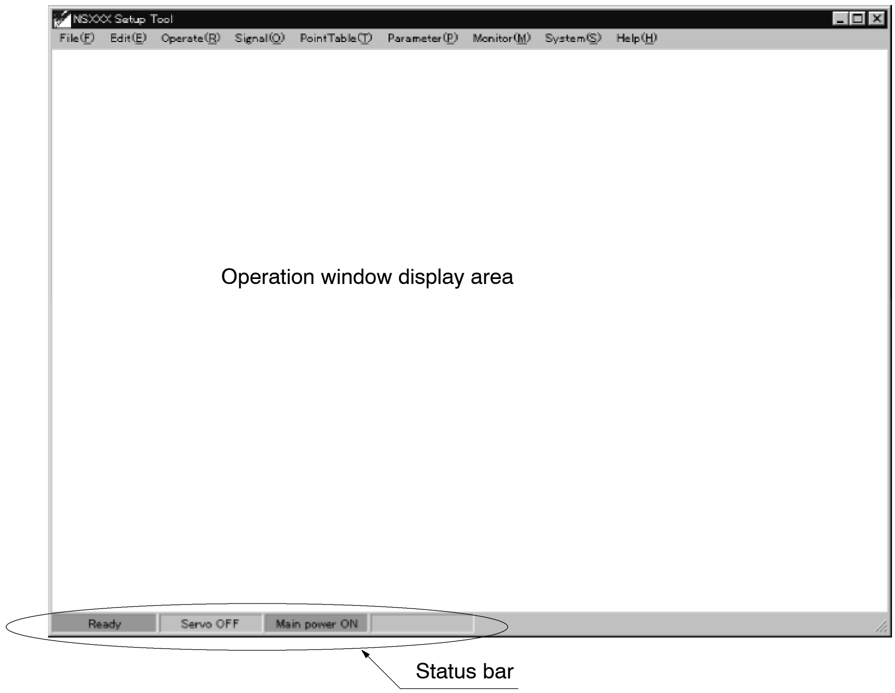


Figure 7.2 Startup Screen

The following information is normally displayed on the status bar.

- Ready

  Displays whether or not the NS300 Module is ready.

  If the Module is ready, this icon will be lit green.

- Servo ON/OFF

  Displays if the SGDH servo is ON or OFF.

  If the servo is ON, this icon will be lit green.

- Main Power ON

  Displays if the main power supply to the SGDH is ON.

  If the main power supply is being supplied normally, this icon will be lit green.

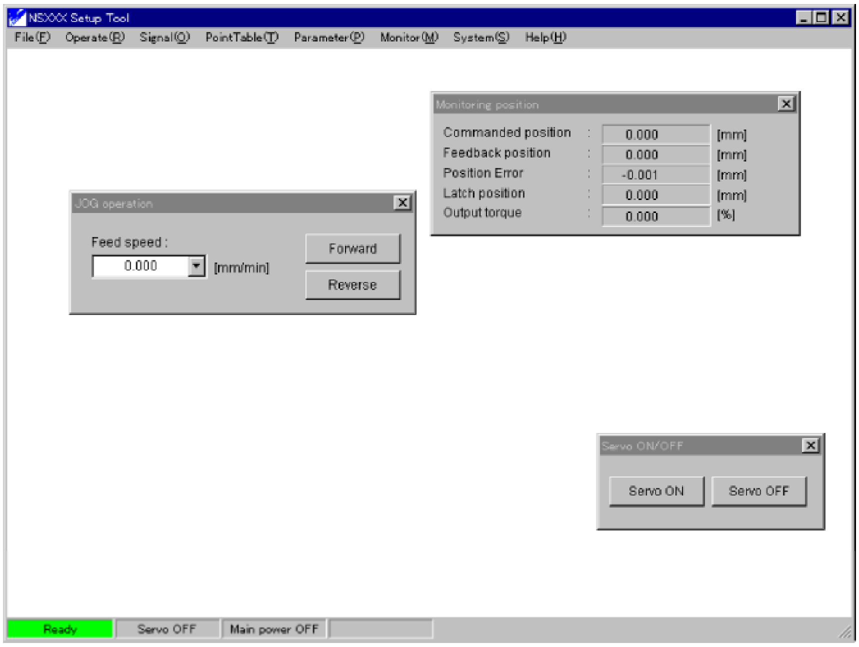
- Alarm

  Displays if an alarm has occurred in the NS300 Module or SGDH.

  If an alarm has occurred, this icon will be lit red.

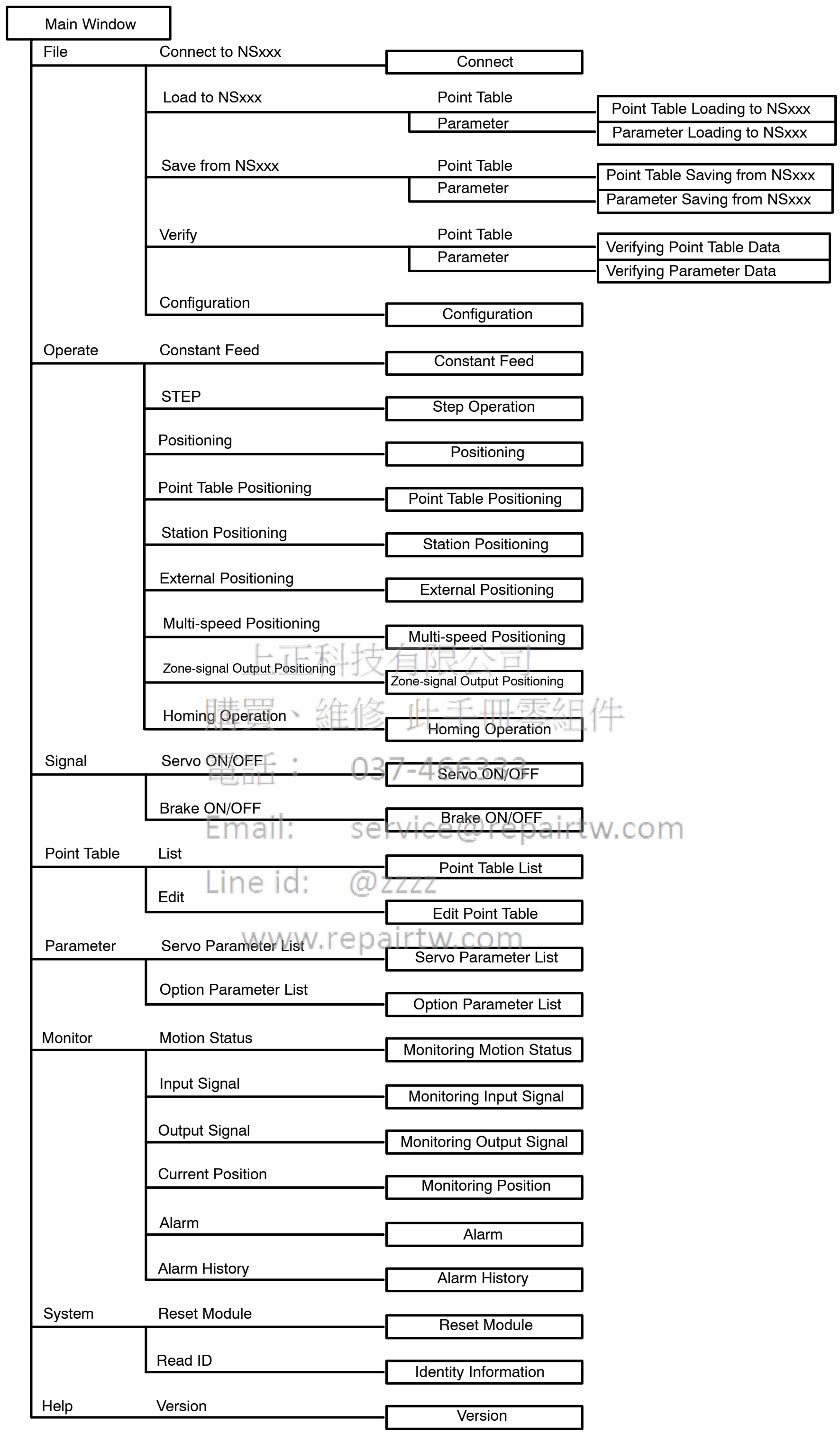
7

Select an item from the menu bar and make NS300 Module settings or perform simple operation, as shown below



7.2.2 Functions Configuration

The functional configuration of the Setup Tool is shown in the following diagram.



7

File Menu

1. Connect to NSxxx

   Starts communications with the NS300 Module.

2. Load to NSxxx

   Loads the parameter file stored in the personal computer to the NS300 Module.

3. Save from NSxxx

   Saves the parameter data or point table data within the NS300 Module in the personal computer.

4. Verify

   Compares the data stored in the personal computer and the data in the NS300 Module.

5. Configuration

   Sets the units and other settings.

Operate Menu

1. Constant Feed

   Performs constant feed speed.

2. STEP

   Performs step operation.

3. Positioning

   Sets the target position and performs positioning.

4. Point Table Positioning

   Performs positioning based on the specified data in the point table.

5. Station Positioning

   Performs positioning to the specified station.

6. External Positioning

   Sets the target position and performs positioning. If the external signal changes, the axis moves the distance set in the parameter and then stops.

7. Multi-speed Positioning

   Performs multi-speed positioning based on the set parameters.

8. Zone-signal Output Positioning

   Performs positioning while making notch outputs based on the set parameters.

9. Homing Operation

   Performs the zero point return.

■ Signal Menu

1. Servo ON/OFF

   Turns ON and OFF the SGDH servo.

2. Brake ON/OFF

   Turns ON and OFF the SGDH brake signal.

■ Point Table Menu

1. List

   Displays a list of the point table currently registered.

2. Edit

   Edits the point table.

■ Parameter Menu

1. Servo Parameter List

   Displays a table of SGDH parameters, which can be edited using the cursor.

2. Option Parameter List

   Displays a table of NS300 Module parameters, which can be edited using the cursor.

■ Monitor Menu

1. Motion Status

   Displays the current execution status.

2. Input Signal

   Displays the status of the external input signals connected to the CN1 port on the SGDH and the CN4 port on the NS300 Module.

3. Output Signal

   Displays the status of the external output signals connected to the CN1 port on the SGDH and the CN4 port on the NS300 Module.

4. Current Position

   Displays the current position of the servomotor in reference units.

5. Alarm

   Displays any alarms that are currently occurring. You can also clear the alarms using this function.

6. Alarm History

   Displays to a maximum of 10 the most recent alarms that have occur. You can also clear the alarm history using this function.

■ System Menu

1. Reset Module

Resets the NS300 Module and the SGDH.

When you reset the Module, the parameters that have been changed will be stored in flash ROM.

2. Read ID

Displays version information for the NS300 Module, SGDH, and so on.

■ Help Menu

- Version

Displays version information for the Setup Tool.

8

Ratings, Specifications, and Dimensions

This chapter provides the ratings, specifications, and dimensions of SGDH SERVOPACKs.

8

8.1 Ratings and Specifications

The following table lists the rating and specifications of NS300 Module.

Table 8.1 NS300 Module Ratings and Specifications

Item		Details
Applicable SERVOPACK		All SGDH-□□□E models
Installation Method		Mounted on the SGDH SERVOPACK
Basic Specifications	**Power Supply Method**	Supplied from the SGDH control power supply.
	Power Consumption	1.3 W
	Consumption Current	250 mA
	External Dimensions [mm]	20 x 142 x 128 (W x H x D)
	Approx. Mass [kg] (lb)	0.2 (0.441)
DeviceNet Communications	**Baud Rate Setting**	Select from 125 Kbps, 250 Kbps, or 500 Kbps using a rotary switch.
	Node Address Setting	Select the address from 0 to 63 using the rotary switches.
	Communications Power Supply	24 VDC (11 VDC to 25 VDC)
	Consumption Current	20 mA or less
Command Format	**Operation Specifications**	Positioning using DeviceNet communications
	Reference Input	DeviceNet communications Commands: Motion commands (position, speed), and reading and writing parameters
Position Control Functions	**Acceleration/ Deceleration Method**	Linear single/double-step, asymmetric, exponential, S-curve
	Fully-closed Control	Possible
Input Signals	**Fixed Allocation to CN1 Connector**	Forward/reverse run prohibited, zero point signal, emergency stop signal

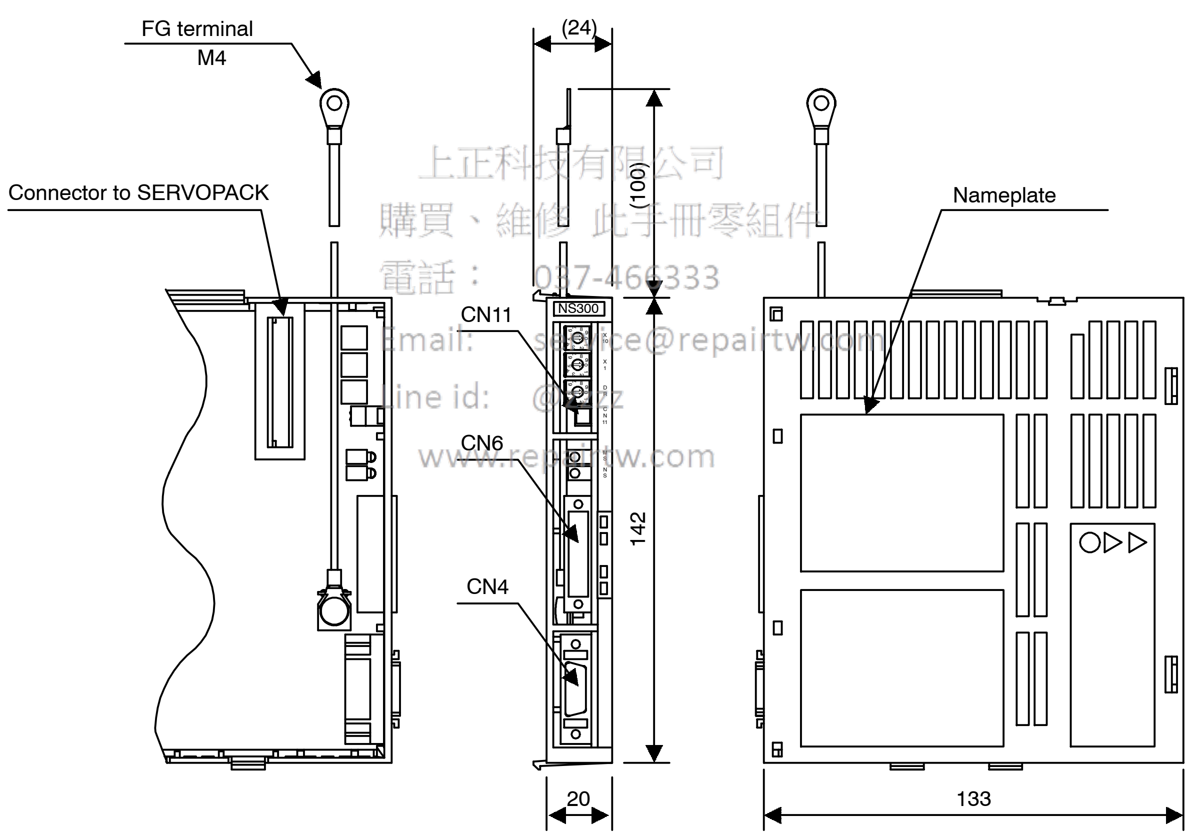
Item		Details
Internal Functions	**Position Data Latch Function**	Position data latching is possible using phase C, zero point signals, and external signals.
	Protection	Parameters damage, parameter setting errors, communications errors, etc.
	LED Indicators	MS: Module Status NS: Network Status

8.2 Dimensional Drawings

Dimensional drawings of the NS300 Module and SERVOPACKs are shown below.

8.2.1 NS300 Module

Dimensions of the NS300 Module are shown below.



Approx.. mass: 0.2 kg (0.661 lb)

9

Error Diagnosis and Troubleshooting

This chapter describes error diagnosis and troubleshooting.
In addition, troubleshooting procedures are described for problems which cause an alarm display and for problems which result in no alarm display.

9

9.1 Troubleshooting with Alarm Displays

Problems that occur in the Servodrives are displayed on the panel operator as “A.□□” or “CPF-□□”. “A.– –”, however, does not indicate an alarm. Refer to the following sections to identify the cause of an alarm and the action to be taken.

Contact your Yaskawa representative if the problem cannot be solved by the described procedures.

■ A.02

A.02: Parameter Breakdown

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — **A, B, C**

	Cause	Remedy
A	Power turned OFF during parameter write. Alarm occurred at the next power ON.	• Initialize parameters using Fn005 and reinput user settings. • Replace SERVOPACK.
B	Circuit board (1PWB) is defective.	Replace SERVOPACK.
C	The NS300 Module is defective.	Replace the NS300 Module.

■ A.03

A.03: Main Circuit Encoder Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — A

Cause		Remedy
A	Circuit board (1PWB or 2PWB) is defective.	Replace SERVOPACK.

■ A.04

A.04: Parameter Setting Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — A, B, C

Cause		Remedy
A	An out-of-range parameter was previously set or loaded.	• Reset all parameters in range. • Otherwise, re-load the correct parameter.
B	Circuit board (1PWB) is defective.	Replace SERVOPACK.
C	The NS300 Module is defective.	Replace the NS300 Module.

9

■ A.05

A.05: Combination Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — A, B

Cause		Remedy
A	The range of servomotor capacities that can be combined has been exceeded.	Replace the servomotor so that a suitable combination is achieved.
B	Encoder parameters have not been written properly.	Replace the servomotor.

■ A.10

A.10: Overcurrent or Heat Sink Overheated

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During servomotor operation — A, B, D, E, F, G, H

When SERVO ON (/S-ON) signal turned ON — C, D

At power ON — C

Cause		Remedy
A	Wiring shorted between SERVOPACK and servomotor.	Check and correct wiring.
B	Servomotor phase U, V, or W shorted.	Replace servomotor.
C	• Circuit board (1PWB) is defective. • Power transistor is defective.	Replace SERVOPACK.
D	Current feedback circuit, power transistor, DB relay, or circuit board defective.	Replace SERVOPACK.
E	The ambient temperature of the SERVOPACK exceeded 55°C.	Alter conditions so that the ambient temperature goes below 55°C.
F	The air flow around the heat sink is bad.	Follow the installation method and provide sufficient space as specified.
G	Fan stopped.	Replace SERVOPACK.
H	SERVOPACK is operating under an overload.	Reduce load.

Note: E to H can occur with all 400-V SERVOPACK models and 200-V SERVOPACK models for 1.5 to 5 kW.

■ A.30

A.30: Regenerative Error Detected

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During servomotor operation — **A, B**

Occurred when the control power turned ON — **D**

Occurred approximately 1 second after the main circuit power ON — **A, B, C**

Cause		Remedy
A	Regenerative transistor is abnormal.	Replace SERVOPACK.
B	Disconnection of the regenerative resistor.	Replace SERVOPACK or regenerative resistor.
C	Regenerative unit disconnected (for an external regenerative resistor).	Check wiring of the external regenerative resistor.
D	SERVOPACK is defective.	Replace SERVOPACK.

■ A.32

A.32: Regenerative Overload

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			**ALM Output**
ALO1	**ALO2**	**ALO3**	
ON	ON	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During servomotor operation — **A, B**

Cause		Remedy
A	Regenerative power exceeds the allowable value.	Use an external regenerative resistor that matches the regenerative power capacity.
B	Alarm occurs although an external regenerative resistor is used and the temperature rise of the regenerative resistor is small.	Reset the incorrect Pn600 parameter setting.

■ A.40

A.40: Main Circuit DC Voltage Error Detected: overvoltage

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During servomotor operation — **A, B, C, D**

Occurred when the control power turned ON — **E**

Occurred when main circuit power turned ON — **A, D**

Cause		Remedy
A	The power supply voltage is not within the range of specifications.	Check power supply.
B	Load exceeds capacity of the Regenerative unit.	Check specifications of load inertia moment and overhanging load.
C	Regenerative transistor is abnormal.	Replace SERVOPACK.
D	Rectifying diode is defective.	
E	SERVOPACK is defective.	

9

■ A.41

A.41: Main Circuit Voltage Error Detected: Undervoltage

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During servomotor operation — A, B, C

Occurred when the control power turned ON — D

Occurred when main circuit power turned ON — A, B, C

Cause		Remedy
A	The power supply voltage is not within the range of specifications.	Check power supply voltage.
B	Fuse blown.	Replace SERVOPACK.
D	Rectifying diode is defective.	
E	SERVOPACK is defective.	

■ A.51

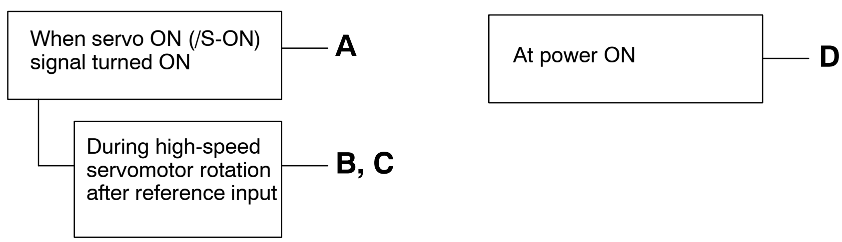
A.51: Overspeed

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



Cause		Remedy
A	Servomotor wiring is incorrect.	Check and correct wiring. (Check phase-U, -V, and -W motor wiring errors.)
B	Position or speed reference input is too large.	Lower the reference input values.
C	Incorrect reference input gain settings.	Check and correct the parameter settings.
D	Circuit board (1PWB) is defective.	Replace SERVOPACK.

9

■ A.71

A.71: Overload: Instantaneous Maximum Load

The alarm output, the status when LEDs are lit, and the remedy procedure are identical to those of A.72 below.

■ A.72

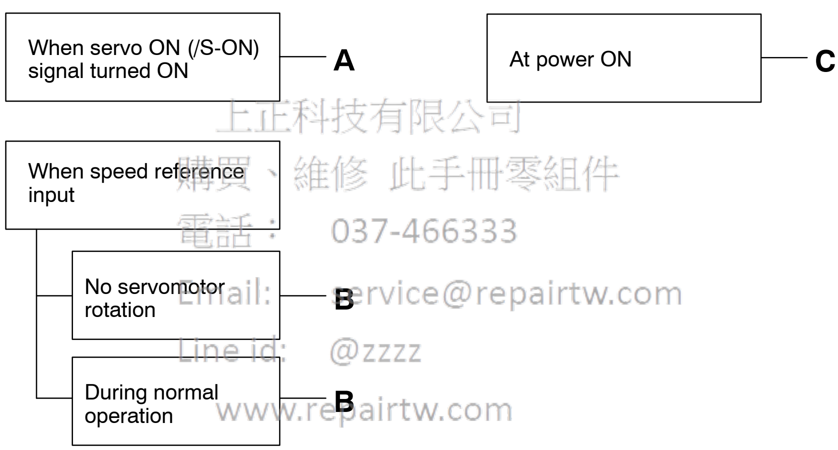
A.72: Overload: Continuous Maximum Load

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



Cause		Remedy
A	Servomotor wiring is incorrect or disconnected	Check wiring and connectors at servomotor.
B	Load greatly exceeds rated torque.	Reduce load torque and moment of inertia. Otherwise, replace with larger capacity servomotor.
C	Circuit board (1PWB) is defective.	Replace SERVOPACK.

■ A.73

A.73: Dynamic Brake Overload

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

When servo OFF signal turned ON — **A**

At power ON — **B**

Cause		Remedy
A	The product of the square of rotational motor speed and the combined moment of inertia of the motor and load (rotation energy) exceeds the capacity of the dynamic brake resistor built into SERVOPACK.	• Lower the rotational speed. • Lower the load moment of inertia. • Do not frequently use dynamic braking.
B	Circuit board (1PWB) is defective.	Replace SERVOPACK.

■ A.74

A.74: Overload of Surge Current Limit Resistor

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

When main circuit power turned ON or OFF — **A**

At power ON — **B**

Cause		Remedy
A	Frequently turning the main circuit power ON/OFF.	Do not repeatedly turn ON/OFF the main circuit power.
B	Circuit board (1PWB) is defective.	Replace SERVOPACK.

■ A.7A

A.7A: Heat Sink Overheated

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During servomotor operation — **A, B, C, D**

When control power turned ON — **E**

Cause		Remedy
A	The ambient temperature of the SERVOPACK exceeds 55°C.	Alter conditions so that the ambient temperature goes below 55°C.
B	The air flow around the heat sink is bad.	Follow installation method and provide sufficient surrounding space as specified.
C	Fan stopped.	Replace SERVOPACK.
D	SERVOPACK is operating under overload.	Reduce load.
E	SERVOPACK is defective.	Replace SERVOPACK.

Note: This alarm display tends to occur only with a SERVOPACK of 30 W to 1,000 W.

■ A.81

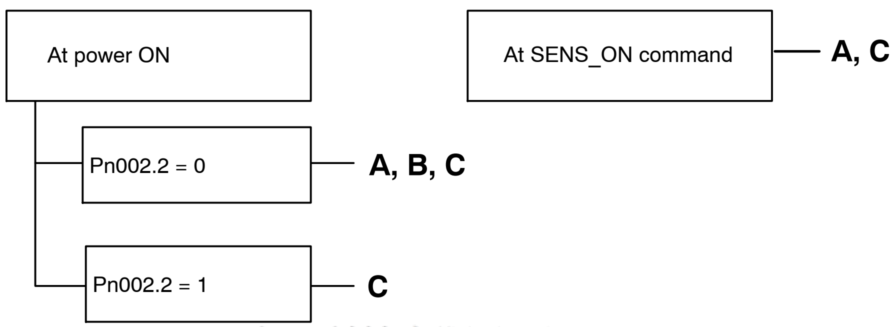
A.81: Absolute Encoder Backup Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm



	Cause	Remedy
A	The following power supplies to the absolute encoder all failed: • +5 V supply (supplied from SERVO-PACK) • Battery	Follow absolute encoder set-up procedure.
B	Absolute encoder malfunctioned	Replace servomotor.
C	Circuit board (1PWB) is defective.	Replace SERVOPACK.

9

■ A.82

A.82: Absolute Encoder Checksum Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — A, B

During operation — A, B

At SENS_ON command — B

Cause		Remedy
A	Error during encoder memory check	• Follow absolute encoder setup procedure. • Replace servomotor if error occurs frequently.
B	Circuit board (1PWB) is defective.	Replace SERVOPACK.

9

■ A.83

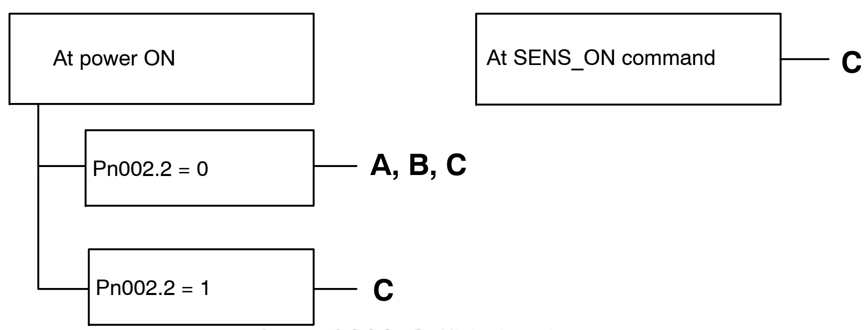
A.83: Absolute Encoder Battery Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm



	Cause	Remedy
A	• Battery is not connected. • Battery connection is defective.	Check and correct battery connection.
B	Battery voltage below specified value. Specified value: 2.7 V	Install a new battery while the control power to SERVOPACK is ON. After replacement, turn the power OFF and ON.
C	Circuit board (1 PWB) is defective.	Replace SERVOPACK.

Note: No alarm will occur at the SERVOPACK if the battery error occurs during operation.

9

■ A.84

A.84: Encoder Data Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — A

During operation — B

Cause		Remedy
A	Encoder is defective.	Replace the servomotor if the error occurs frequently.
B	Operational error in encoder caused by external noise.	Check and correct wiring around the encoder as follows: • Grounding of the servomotor • Separation between the encoder cable and the servomotor power cable • Insertion of toroidal cores onto cables

■ A.85

A.85: Absolute Encoder Overspeed

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — **A, B**

At SENS_ON command — **A, B**

Cause		Remedy
A	Absolute encoder turned ON at a speed exceeding 200 min^{-1}.	Turn ON power supply again with the servomotor stopped.
B	Circuit board (1PWB) is defective.	Replace SERVOPACK.

■ A.86

A.86: Absolute Encoder Overheated

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

During servomotor operation — A, B

At power ON — C, D

	Cause	Remedy
A	The ambient temperature of the servomotor is high.	Alter conditions so that the ambient temperature goes below 40°C.
B	Servomotor is operating under overload.	Reduce load.
C	Circuit board (1PWB) is defective.	Replace SERVOPACK.
D	Encoder is defective.	Replace servomotor.

■ A.94

A.94: Parameter Setting Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	OFF	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

When the command was sent — A

	Cause	Remedy
A	A value outside the DeviceNet communications setting range was set.	Reset correctly.

A.95

A.95: Command Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	OFF	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

When the command was sent — A, B

	Cause	Remedy
A	Presently unable to receive the command that has been sent.	Adjust conditions to match the command. Refer to the specifications for each command.
B	Unsupported command.	Do not send unsupported commands.

A.96

A.96: DeviceNet Communications Warning

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	OFF	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During DeviceNet communications — A, B

	Cause	Remedy
A	Contact between the cable and the connector is faulty.	Correct the connector wiring.
B	Malfunction due to noise.	Take noise prevention measures.

■ A.98

A.98: Main Power OFF

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	ON	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

When main power supply OFF — **A, B**

Cause		Remedy
A	Contact between the power supply cable and the connector is faulty.	Correct the connector wiring.
B	Power Supply Unit is defective.	Check the Power Supply Unit.

■ A.9A

A.9A: Not Completed within the Time Set in Pn851

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	ON	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During servomotor operation — **A, B**

Cause		Remedy
A	Positioning Completed Timeout setting is too small.	Correct the Positioning Completed Timeout setting.
B	Positioning Loop Gain or Speed Loop Gain setting is too small.	Correct the Positioning Loop Gain or Speed Loop Gain setting.

■ A.b1

A.b1: Reference Speed Input Read Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

During servomotor operation — A, B

At power ON — C

Cause		Remedy
A	Error in reference read-in unit (A/D convertor, etc.)	Reset alarm and restart operation.
B	Reference read-in unit is defective. (A/D convertor, etc.)	Replace SERVOPACK.
C	Circuit board (1PWB) is defective.	Replace SERVOPACK.

■ A.b6

A.b6: Communications LSI Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — A

Cause		Remedy
A	The NS300 Module is defective.	Replace the NS300 Module.

9

■ A.C6

A.C6: Fully-closed Encoder Phase-A, -B Disconnection

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

- At power ON — A
- 1 to 3 seconds after power ON — A, B, C, D
- During servomotor operation — A, B, C, D

	Cause	Remedy
A	Circuit board (1PWB) is defective.	Replace SERVOPACK.
B	Encoder wiring error or faulty contact.	Check the wiring and check that the connector is fully inserted on the encoder.
C	There is noise in the encoder wiring.	Separate the encoder wiring from the main circuit.
D	Encoder is defective.	Replace servomotor.

■ A.C7

A.C7: Fully-closed Encoder Phase-C Disconnection

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A

1 to 3 seconds after power ON — A, B, C, D

During servomotor operation — A, B, C, D

	Cause	Remedy
A	Circuit board (1PWB) is defective.	Replace SERVOPACK.
B	Encoder wiring error or faulty contact.	Check the wiring and check that the connector is fully inserted on the encoder.
C	There is noise in the encoder wiring.	Separate the encoder wiring from the main circuit.
D	Encoder is defective.	Replace servomotor.

■ A.CC

A.CC: Multiturn Limit Disagreement.

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A, B

Cause		Remedy
A	The setting of the Multiturn Limit Setting (Pn205) parameter in the SERVOPACK is incorrect.	Change parameter Pn205.
B	The multiturn limit has not been set in the encoder.	Check that the Multiturn Limit Setting (Pn205) parameter in the SERVOPACK is correct, and then execute the encoder multiturn limit setting change (Fn013) when a Multiturn Limit Disagreement (A.CC) occurs.

9

■ A.d0

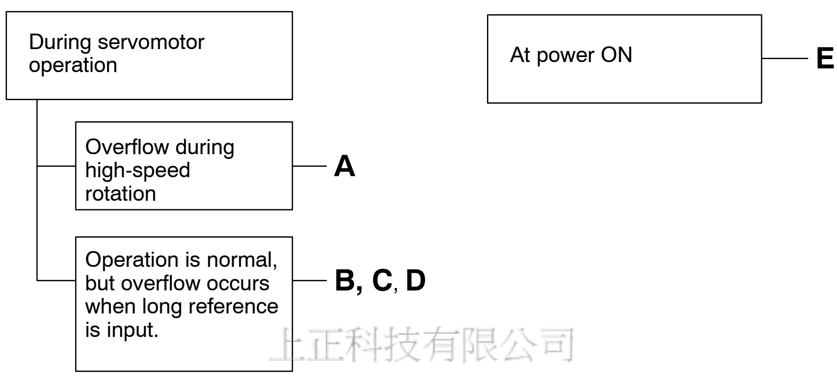
A.d0: Position Error Pulse Overflow

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).ON: Output transistor is ON.

Status and Remedy for Alarm



	Cause	Remedy
A	Servomotor wiring is incorrect or connection is poor.	Check wiring at servomotor.
B	SERVOPACK was not correctly adjusted.	Increase speed loop gain (Pn100) and position loop gain (Pn102).
C	Motor load was excessive.	Reduce load torque or moment of inertia. If problem not corrected, replace with a motor with larger capacity.
D	Position reference is too high.	• Reduce the acceleration/deceleration rate. • Change electronic gear ratio.

■ A.E0

A.E0: No NS300 Module

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A

Cause		Remedy
A	The NS300 Module is defective.	Replace the NS300 Module.

■ A.E1

A.E1: NS300 Module Timeout

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A

Cause		Remedy
A	The NS300 Module is defective.	Replace the NS300 Module.

A.E2

A.E2: Watchdog Counter Error in NS300 Module

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A

	Cause	Remedy
A	The NS300 Module is defective.	Replace the NS300 Module.

A.E6

A.E6: DeviceNet Duplicate MAC ID Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

Duplicate MAC ID — A

	Cause	Remedy
A	Duplicate node address	Check node addresses of all Modules on the DeviceNet network.

■ A.E7

A.E7: NS300 Module Detection Error when SGDH power is ON

A.E7 occurs when the SGDH is used without the NS300 Module after it has been used with the NS300 Module.

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			**ALM Output**
ALO1	**ALO2**	**ALO3**	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

NS300 Module detection error — **A, B**

Cause		**Remedy**
A	The NS300 Module is not mounted properly.	Check that NS300 Module mounted correctly.
B	The NS300 Module is not mounted.	Execute Fn014 from Digital Operator.

A.E8

A.E8: Rotary Switch Setting Error on NS300 Module Front Panel

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

Rotary switch setting error when power is turned ON — **A, B**

Cause		Remedy
A	Baud rate setting is incorrect.	Be sure the setting is between 0 and 2.
B	Node address setting is incorrect.	Be sure the setting is between 0 and 63.

■ A.E9

A.E9: DeviceNet BUS-OFF Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

BUS−OFF error — **A, B, C**

Cause		Remedy
A	There is no terminating resistance in the network.	Check that a terminator is mounted to both ends of the DeviceNet network.
B	There is noise in network wiring.	Separate the network wiring from the power supply circuit.
C	The baud rate is incorrect.	Check the communications settings of the rotary switches mounted on the front panel of the NS300 Module.

9

■ A.EA

A.EA: SERVOPACK Malfunction

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

At power ON — A

Status and Remedy for Alarm

Cause		Remedy
A	SERVOPACK is defective.	Replace SERVOPACK.

■ A.EB

A.EB: SERVOPACK Initial Access Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A

Cause		Remedy
A	SERVOPACK is defective.	Replace SERVOPACK.

■ A.EC

A.EC: SERVOPACK WDC Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A

During DeviceNet communications — B

	Cause	Remedy
A	SERVOPACK is defective.	Replace SERVOPACK.
B	DeviceNet communications interrupted.	Turn the power ON again.

■ A.ED

A.ED: NS300 Module Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During DeviceNet communications — A

	Cause	Remedy
A	Command was interrupted.	Do not connect a Hand-held Digital Operator or start communications with a personal computer during command execution.

■ CPF00

CPF00: Digital Operator Transmission Error 1

This alarm is not stored in the alarm trace-back function memory.

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
Not specified			

Status and Remedy for Alarm

At power ON. Digital Operator connected before SERVOPACK power turned ON. — **A**, **B**, **C**, **D**

Digital Operator connected to SERVOPACK while power turned ON. — **A**, **B**, **C**, **D**

Cause		Remedy
A	Cable defective or poor contact between Digital Operator and SERVOPACK	• Check connector connections. • Replace cable.
B	Malfunction due to external noise	Separate Digital Operator and cable from noise source.
C	Digital Operator is defective.	Replace Digital Operator.
D	SERVOPACK is defective.	Replace SERVOPACK.

■ CPF01

CPF01: Digital Operator Transmission Error 2
This alarm is not stored in the alarm trace-back function memory.

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
Not specified			

Status and Remedy for Alarm

During operation — A, B, C, D

Cause		Remedy
A	Cable defective or poor contact between Digital Operator and SERVOPACK	• Check connector connections. • Replace cable.
B	Malfunction due to external noise	Separate Digital Operator and cable from noise source.
C	Digital Operator is defective.	Replace Digital Operator.
D	SERVOPACK is defective.	Replace SERVOPACK.

■ A.– –

A.– –: Normal Operation
This is not an alarm display.

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

9

9.2 Troubleshooting Problems with No Alarm Display

Refer to the tables below to identify the cause of a problem which causes no alarm display and take the remedy described.

Turn OFF the servo system power supply before commencing the shaded procedures.

Contact your Yaskawa representative if the problem cannot be solved by the described procedures.

Table 9.1 Troubleshooting Table with No Alarm Display

Symptom	Cause	Inspection	Remedy
Servomotor does not start.	Power not connected	Check voltage between power supply terminals.	Correct the power circuit.
	Loose connection	Check terminals of connectors (CN1, CN2).	Tighten any loose parts.
	Connector (CN1) external wiring incorrect	Check connector (CN1) external wiring.	Refer to connection diagram and correct wiring.
	Servomotor or encoder wiring disconnected	–	Reconnect wiring.
	Overloaded.	Run under no load.	Reduce load or replace with larger capacity servomotor.
	Encoder type differs from parameter setting.	Check the type of encoder being used.	Set parameter Pn002.2 to the encoder type being used.
	P-OT and N-OT inputs are turned OFF.	Refer to *6.3*.	Turn P-OT and N-OT input signals ON.
	Software limit reached	Refer to *4.3.3*.	Operate the servomotor within software limits.
Servomotor does not run.	Motion commands have not been sent.	Check using DeviceNet communications or the DeviceNet monitor.	Send the motion commands.
			Send Servo ON command.
Servomotor moves instantaneously, then stops.	Servomotor or encoder wiring incorrect.	–	Refer to *Chapter 3 Connectors* and correct wiring.
Servomotor speed unstable	Wiring connection to motor is defective.	Check connection of phase-U, -V, and -W power leads encoder connectors.	Tighten any loose terminals or connectors.

Symptom	Cause	Inspection	Remedy
Servomotor vibrates at approximately 200 to 400 Hz.	Speed loop gain value is too high.	–	Reduce speed loop gain (Pn100) preset value.
High rotation speed over-shoot on starting and stop-ping	Speed loop gain value is too high.	–	Reduce speed loop gain (Pn100) preset value. Increase integration time constant (Pn101).
	Speed loop gain value too low compared to position loop gain value.	–	Increase speed loop gain (Pn100) preset value. Reduce the integration time constant (Pn101).
Servomotor overheated	Ambient temperature is too high.	Measure servomotor ambient temperature.	Reduce ambient temperature to 40°C max.
	Servomotor surface is dirty.	Visual check	Clean dust and oil from motor surface.
	Overloaded	Run under no load.	Reduce load or replace with larger capacity servomotor.
Abnormal noise	Mechanical mounting is incor-rect.	Check if servomotor mounting screws loose.	Tighten mounting screws.
		Check if coupling not centered.	Center coupling.
		Check if coupling unbalanced.	Balance coupling.
	Bearing is defective.	Check noise and vibration near bearing.	Consult your Yaskawa repre-sentative if defective.
	Machine causing vibrations	Check foreign object intrusion, damage or deformation of driv-ing parts of machine.	Consult with machine manufacturer if defective.

9

9.3 Alarm Display Table

Table 9.2 Alarm Display Table

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO 1	ALO 2	ALO 3			
A.02	OFF	OFF	OFF	OFF	Parameter Breakdown[*2]	EEPROM data of SERVOPACK is abnormal.
A.03					Main Circuit Encoder Error	Detection data for power circuit is abnormal.
A.04					Parameter Setting Error[*2]	The parameter setting is out of the allowable setting range.
A.05					Combination Error	SERVOPACK and servomotor capacities do not match each other.
A.10	ON	OFF	OFF	OFF	Overcurrent or Heat Sink Overheated[*2]	An overcurrent flowed through the IGBT. Heat sink of SERVOPACK was overheated.
A.30	ON	ON	OFF	OFF	Regeneration Error	• Regenerative resistor is defective. • Regenerative transistor is defective.
A.32					Regenerative Overload	Regenerative energy exceeds regenerative resistor capacity.
A.40	OFF	OFF	ON	OFF	Overvoltage [*3]	Main circuit DC voltage is excessively high.
A.41					Undervoltage [*3]	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 for Instantaneous Maximum Load	The motor was operating for several seconds to several tens of seconds under a torque largely exceeding ratings.
A.72					Overload for Continuous Maximum Load	The motor was operating continuously under a torque largely exceeding rating.
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[*1]	The heat sink of SERVOPACK is overheated.

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO 1	ALO 2	ALO 3			
A.81	OFF	OFF	OFF	OFF	Absolute Encoder Backup Error*2	All the power supplies for the absolute encoder have failed and position data was cleared.
A.82					Absolute Encoder Checksum Error*2	The checksum results of the absolute encoder memory are abnormal.
A.83					Absolute Encoder Battery Error	Battery voltage for the absolute encoder has dropped.
A.84					Encoder Data Error*2	Data in the encoder is abnormal.
A.85					Absolute Encoder Overspeed	The absolute 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 defective.
A.b2					Reference Torque Input Read Error	The A/D converter for reference torque input is defective.
A.b6					Gate Array Error	Communications LSI error
A.bF					System Alarm *2	A system error occurred in the SERVOPACK.
A.C1	ON	OFF	ON	OFF	Servo Overrun Detected	The servomotor ran out of control.
A.C6					Fully-closed Loop Phase-A/B Disconnected	Phase A or B of the fully closed encoder was disconnected.
A.C7					Fully-closed Loop Phase-C Disconnected	Phase C of the fully closed encoder was disconnected.
A.C8					Absolute Encoder Clear Error and Multi-turn Limit Setting Error *2	The multi-turn for the absolute encoder was not properly cleared or set.
A.C9					Encoder Communications Error *2	Communications between SERVOPACK and encoder is not possible.
A.CA					Encoder Parameter Error *2	Encoder parameters are incorrect.
A.Cb					Encoder Echoback Error *2	Contents of communications with encoder are incorrect.
A.CC					Multi-turn Limit Disagreement	Different multi-turn limits have been set in the encoder and SERVOPACK.
A.d0	ON	ON	OFF	OFF	Position Error Pulse Overflow	Position error pulse exceeded parameter (Pn505).

9

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO 1	ALO 2	ALO 3			
A.E0	OFF	ON	ON	OFF	No NS300 Module *2	No NS300 Module installed.
A.E1					NS300 Module Timeout *2	No response from the NS300 Module.
A.E2					Watchdog Counter Error of NS300 Module *2	WDC error in the NS300 Module
A.E6					DeviceNet Duplicate MAC ID Error	Same node address already exists on the DeviceNet network.
A.E7					NS300 Module Detection Error	No NS300 Module was detected when was power supplied to the SGDH.
A.E8					Rotary Switch Setting Error	Module rotary switch setting error
A.E9					DeviceNet BUS-OFF Error	Fatal communications error has occurred in DeviceNet communications.
A.EA					SERVOPACK Malfunction*2	SERVOPACK is defective.
A.EB					SERVOPACK Initial Access Error *2	Initial processing failed.
A.EC					SERVOPACK WDC Error	SERVOPACK WDC error
A.ED					NS300 Module Error	Command was interrupted.
A.F1	OFF	ON	OFF	OFF	Power Line NS300 Phase	One phase in the 3-phase main power supply is not connected.
CPF00	Not specified				Hand-held Digital Operator Transmission Error	Communications not possible between Hand-held Digital Operator (JUSP-OP02A-2) and the SERVOPACK (CPU error)
CPF01						
A.– –	OFF	OFF	OFF	ON	Not an error	Normal operation status.

Note: OFF: Output transistor is OFF (high). ON: Output transistor is ON (low).

* 1. This alarm display appears only within the range of 30 W to 1,000 W.

* 2. These alarms are not reset for the Alarm Reset Command. Eliminate the cause of the alarm and then turn OFF the power supply to reset the alarms.

* 3. For SERVOPACKs with a capacity of 6.0 kw or more, A.40 indicates a main circuit voltage error alarm. This means that either an overvoltage or an undervoltage has occurred at some stage.

9

9.4 Warning Codes

The warning codes and the relationship between ON/OFF warning code outputs are shown on the following table.

Normally, warning codes are not output. However, if the parameters are set for warning codes to be output, those outputs will be as indicated in table 9.3.

Table 9.3 Warning Codes and Warning Code Outputs

Warning Code	Warning Code Output			Servo Alarm Output	Warning Name	Description
	ALO1	ALO2	ALO3			
A.91	OFF	ON	ON	ON	Overload	This warning occurs before the overload alarms (A.71 or A.72) occur. If the warning is ignored and operation continues, an overload alarm may occur.
A.92	ON	OFF	ON	ON	Regenerative Overload	This warning occurs before the regenerative overload alarm (A.32) occurs. If the warning is ignored and operation continues, a regenerative overload alarm may occur.
A.94	ON	ON	OFF	ON	Parameter Setting Warning	A value outside the setting range was set using DeviceNet communications.
A.95	OFF	ON	OFF	ON	Command Warning	A command not supported in the product specifications was issued. The command reception conditions were not met.
A.96	ON	OFF	OFF	ON	Communications Warning	A DeviceNet communications error occurred (once).
A.98	ON	ON	ON	ON	Main Power OFF	The main power supply is not being supplied.
A.9A	ON	OFF	ON	ON	Not Completed within the Time Set in Pn851	Positioning was not completed within the set time.

Note: OFF: Output transistor is OFF (high). ON: Output transistor is ON (low).

9

A

DeviceNet Object Model

A

A.1 DeviceNet Object Model

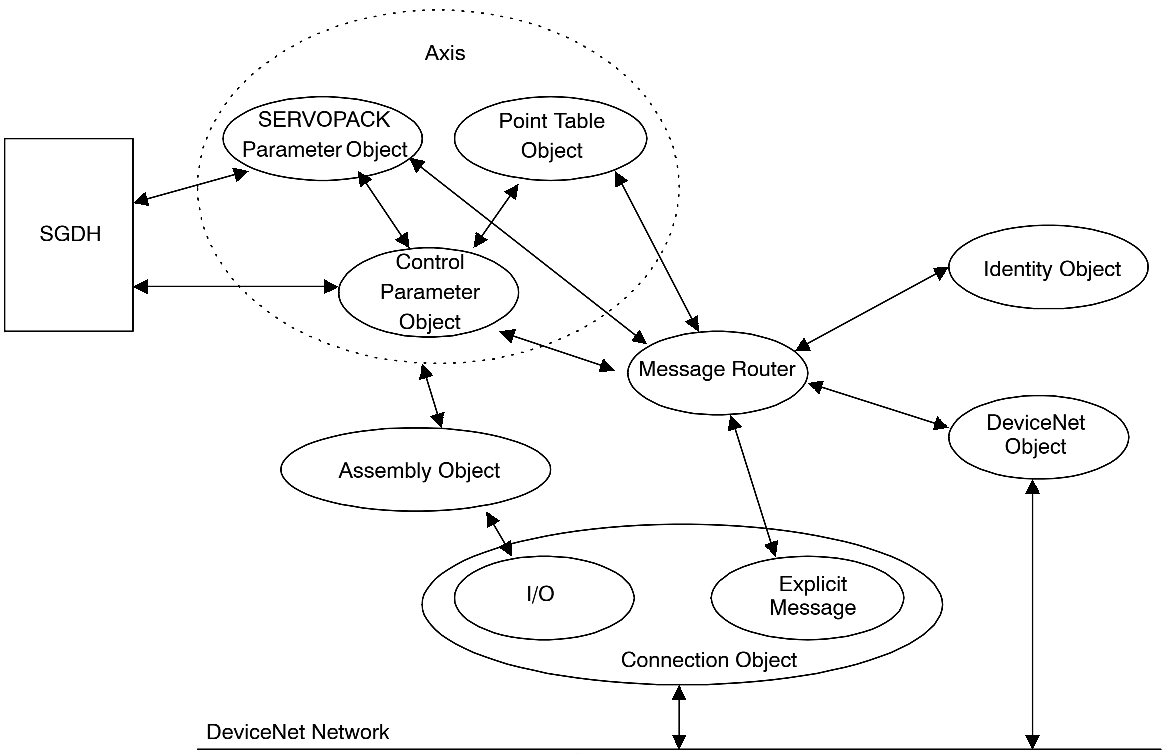


Figure A.1 DeviceNet Object Model

Object Class	Class Code	Instance No.	Function
Identity	0x01	1	Manages ID information, such as the device type, serial number, vendor, and ID.
Message Router	0x02	1	Routes explicit messages to the appropriate object.
DeviceNet	0x03	1	Manages the physical connection to the DeviceNet, and performs Master/ Slave connection set and release demands.
Assembly	0x04	1	Manages I/O output messages for Slave to Master.
		2	Manages I/O input messages from Master to Slave.
Connection	0x05	1	Manages explicit messages attributes.
		2	Manages I/O message (polled I/O) attributes.
Control Parameter	0x64	1	Manages position controller engine parameters.
Point Table	0x65	1	Manages point table data.
Servo Parameter	0x66	1	Manages parameters within SGDH SERVOPACK.

B

DeviceNet Attributes

This appendix lists the objects and attributes that can be used in DeviceNet.

B.1 Identity Object (0x01)

■ Class

Attributes: Not supported
Services: Not supported

■ Instances

Attributes

No	Access	Name	Data Type	Description	Value
1	Get	Vendor ID	UINT	Identification of each vendor by number	0x44
2	Get	Device Type	UINT	Identification of general type of product	0x00
3	Get	Product Code	USINT	Identification of a particular product of an individual vendor	0x50
4	Get	Revision	---	Revision of the item the Identity Object represents	1.0
5	Get	Status	WORD	Summary status of NS300 Module	---
6	Get	Serial Number	UDINT	Serial number of NS300 Module	Each module
7	Get	Product Name	STRING	Human readable identification	JUSP-NS300

Services

Service Code	Service	Description
0x05	Reset	Invokes the Reset Service for the NS300 Module.
0x0E	Get_Attribute_Single	Returns the contents of the specified attribute.

B.2 Message Router Object (0x02)

■ Class

Attributes: Not supported
Services: Not supported

■ Instances

Attributes: Not supported
Services: Not supported

B.3 DeviceNet Object (0x03)

■ Class

Attributes: Not supported
Services: Not supported

■ Instances

Attributes

No.	Access	Name	Data Type	Description	Value
1	Get	MAC ID	USINT	Node address	Range 0 to 63
2	Get	Baud Rate	USINT	Baud rate	Range 0 to 2
3	Get	BOI	BOOL	BUS-OFF interrupt	0x00
4	Get	Bus-Off Counter	USINT	Number of times CAN went to the BUS-OFF state	Range 0 to 255
5	Get	Allocation Information	Structure including byte and USINT	---	---
---	---	Allocation Choice Byte	Byte	Connection type for Master/Slave connection	---
---	---	Master’s MAC ID	USINT	Node address of Master	Range 0 to 63

Services

Service Code	Name	Description
0x0E	Get_Attribute_Single	Returns the contents of the specified attribute.
0x4B	Allocate_Master/Slave_Connection_Set	Requests the use of the Predefined Master/Slave Connection Set.
0x4C	Release_Master/Slave_Connection_Set	Opens the Master/Slave connection.

B.4 Assembly Object (0x04)

■ Class

Attributes: Not supported
Services: Not supported

■ Instances

Attributes

No.	Access	Name	Data Type	Description	Value
3	Get/Set	Data	Array	I/O data	---

Services

Service Code	Name	Description
0x0E	Get_Attribute_Single	Returns the contents of the specified attribute.

B.5 Connection Object (0x05)

■ Class

Attributes: Not supported
Services: Not supported

■ Instances

Attributes, Instance 1: Explicit Message

No.	Access	Name	Data Type	Description	Value
1	Get	State	USINT	Defines the state of the object.	---
2	Get	Instance_type	USINT	Defines either I/O or messaging connection.	0x0000
3	Get	TransportClass_ Trigger	Byte	Defines behavior of the connection.	0x8300
4	Get/Set	Produced_ Connection_ID	UINT	Placed in CAN Identifier Field when the connection transmits	---
5	Get/Set	Consumed_ Connection_ID	UINT	CAN Identifier Field value that denotes message to be received	---
6	Get/Set	Initial_Comm_ Characteristics	USINT	Defines the message group across which productions and consumption associated with this connection occur.	0x2100
7	Get	Produced_ Connection_Size	UINT	Maximum number of bytes transmitted across this connection	0xff00
8	Get	Consumed_ Connection_Size	UINT	Maximum number of bytes received across this connection	0xff00
9	Get/Set	Expected_Packet_ Rate	UINT	Defines timing associated with this connection.	---
12	Get	Watchdog_ Timeout_Action	USINT	Defines how to handle timeouts.	0x0100
13	Get	Produced_ Connection_Path_ Length	UINT	Number of bytes in the produced connection path attribute	0x0000
14	Get	Produced_ Connection_Path	USINT Array	Specified the application object whose data is to be sent by this connection object	---

No.	Access	Name	Data Type	Description	Value
15	Get	Consumed_ Connection_Path_ Length	UINT	Number of bytes in the consumed connection path attribute	0x0000
16	Get	Consumed_ Connection_Path	USINT Array	Specified the application object that are to receive the data received by this connection object	---

Attributes, Instance 2: Polled I/O

No.	Access	Name	Data Type	Description	Value
1	Get	State	USINT	Defines the state of the object.	---
2	Get	Instance_type	USINT	Defines either I/O or messaging connection.	0x0001
3	Get	Transport_Class_ Trigger	Byte	Defines behavior of the connection.	0x8200
4	Get/Set	Produced_ Connection_ID	UINT	Placed in CAN Identifier Field when the connection transmits	---
5	Get/Set	Consumed_ Connection_ID	UINT	CAN Identifier Field value that denotes message to be received	---
6	Get/Set	Initial_Comm_ Characteristics	USINT	Defines the message group across which productions and consumption associated with this connection occur.	0x0100
7	Get	Produced_ Connection_Size	UINT	Maximum number of bytes transmitted across this connection	0x0800
8	Get	Consumed_ Connection_Size	UINT	Maximum number of bytes received across this connection	0x0800
9	Get/Set	Expected_Packet_ Rate	UINT	Defines timing associated with this connection.	---
12	Get	Watchdog_ Timeout_Action	USINT	Defines how to handle timeouts.	0x0100
13	Get	Produced_ Connection_Path_ Length	UINT	Number of bytes in the produced connection path attribute	0x0000
14	Get	Produced_ Connection_Path	USINT Array	Specified the application object whose data is to be sent by this connection object	00_00_ 00_00_ 00_00_

B

No.	Access	Name	Data Type	Description	Value
15	Get	Consumed_ Connection_Path Length	UINT	Number of bytes in the consumed connection path attribute	0x0000
16	Get	Consumed_ Connection_Path	USINT Array	Specified the application object that are to receive the data received by this connection object	00_00_ 00_00_ 00_00_

B

Services

Service Code	Name	Description
0x05	Reset	Resets the specified instance.
0x0E	Get_Attribute_Single	Returns the contents of the specified attribute.
0x10	Set_Attribute_Single	Modifies the contents of the specified attribute.

B.6 Control Parameter Object (0x64)

■ Class

Attributes: Not supported
Services: Not supported

■ Instances

Attributes

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
10	Get/Set	Zero Point Return Mode	UINT	Sets the type of zero point return.	0 to 3	0
11	Get/Set	Zero Point Return Function Selection	UINT	Sets the function selection for zero point return. Bit 0: Direction of zero point return Bit 1: Zero point limit switch reversal Bit 2: Zero point pulse polarity selection	0 to 7	1
12	Get/Set	Feed Speed for Zero Point Return	DINT	Sets the feed speed for zero point return. Unit: 1000 reference units/min	1 to 240,000	10,000
13	Get/Set	Approach Speed	DINT	Sets the approach speed for zero point return. Unit: 1000 reference units/min	1 to 240,000	1,000
14	Get/Set	Creep Speed	DINT	Sets the creep speed for zero point return. Unit: 1000 reference units/min	1 to 240,000	500
15	Get/Set	Final Travel Distance	DINT	Sets the final travel distance for zero point return. Unit: Reference units	0 to 99,999,999	0
16	Get/Set	Zero Position Output Width	DINT	Sets the output width of the zero point. Unit: Reference units	0 to 32,767	100
17	Get/Set	Zero Position Offset	DINT	Sets the offset from the encoder coordinate system. Unit: Reference units	–99,999,999 to +99,999,999	0

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
18	Get/Set	Acceleration/ Deceleration Time Constant for Zero Point Return	DINT	Sets the acceleration/deceleration for zero point return. Unit: ms	1 to 10,000	100
30	Get/Set	Electric Gear (Numerator)	DINT	Sets the numerator of electric gear.	1 to 10,000,000	1
31	Get/Set	Electric Gear (Denominator)	DINT	Sets the denominator of electric gear.	1 to 10,000,000	1
32	Get/Set	Coordinate Type	BOOL	Sets the coordinate type. 0: Linear axis; 1: Rotary axis	0, 1	0
33	Get/Set	Command Resolution/R	DINT	Sets the reference unit per one machine rotation for rotary axis. Unit: Reference units	0 to 1,500,000	360,000
34	Get/Set	Backlash Compensation	UINT	Sets the compensated value for backlash. Unit: Reference units	0 to 32,767	0
35	Get/Set	Backlash Compensation Direction	UINT	Sets the direction for backlash compensation.	0, 1	0
36	Get/Set	Positive Software Limit	DINT	Sets the limit position for positive direction. Unit: Reference units	–99,999,999 to +99,999,999	99,999,999
37	Get/Set	Negative Software Limit	DINT	Sets the limit position for negative direction. Unit: Reference units	–99,999,999 to +99,999,999	–99,999,999
38	Get/Set	Function Selection	UINT	Bit 0 0: Software Limit is disabled. 1: Software Limit is enabled. Bit 1 0: Backlash Compensation is disabled. 1: Backlash Compensation is enabled.	0 to 3	0
39	Get/Set	Hardware Limit Selection	UINT	B0: Hardware Limit Enable 0: Disable 1: Enable B1:Hardware Limit Input Logic 0: Active low 1: Active high	0 to 3	0
40	Get/Set	Hardware Limit Action	UINT	Sets the action when using hardware limit.	0 to 3	0

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
41	Get/Set	Emergency Stop Selection	UINT	Sets the polarity and other settings for the emergency stop signal.	0 to 3	0
42	Get/Set	Emergency Stop Action	UINT	Sets the action when emergency stop.	0, 1	0
51	Get/Set	Feed Speed	DINT	Sets the feed speed for positioning. Unit: 1000 reference units/min	1 to 240,000	24,000
52	Get/Set	Acceleration/ Deceleration Time Constant	UINT	Sets the acceleration/deceleration time for positioning. Unit: ms	1 to 10,000	100
53	Get/Set	Deceleration Time Constant for Asymmetric	UINT	Sets the deceleration time for asymmetric acceleration/deceleration. Unit: ms	1 to 10,000	100
54	Get/Set	Switch Speed	DINT	Sets the switch speed for positioning second acceleration/deceleration time. Unit: 1000 reference units/min	1 to 240,000	12,000
55	Get/Set	Second A/D Time Constant	UINT	Sets the acceleration/deceleration time of second acceleration/deceleration for positioning. Unit: ms	1 to 10,000	200
56	Get/Set	Profile Type	UINT	Sets acceleration/deceleration type before interpolation. 0: None 1: Single-step linear 2: Double-step linear 3: Asymmetric linear	0 to 3	0
57	Get/Set	Feed Speed for External Positioning	DINT	Sets the feed speed for external positioning. Unit: 1000 reference units/min	1 to 240,000	10,000
58	Get/Set	Filter	UINT	Sets the type of filter. 0: None 1: Exponent 2: Exponent with bias 3: Travelling average	0 to 3	0
59	Get/Set	FEED Function Selection	UINT	Sets the reference unit for the speed setting for FEED.	0, 1	0
60	Get/Set	Feed Speed for FEED	DINT	Sets the constant feed speed for FEED. Unit: 1000 reference units/min	1 to 240,000	24,000
61	Get/Set	Acceleration/ Deceleration Time Constant For FEED	UINT	Sets the acceleration/deceleration time for the constant feeding. Unit: ms	1 to 10,000	100

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
62	Get/Set	Deceleration Time Constant for FEED	UINT	Sets the deceleration time for asymmetric acceleration/deceleration for the constant feeding. Unit: ms	1 to 10,000	100
63	Get/Set	Switch Speed for FEED	DINT	Sets the switch speed for second acceleration/deceleration for the constant feeding. Unit: 1000 reference units/min	1 to 240,000	24,000
64	Get/Set	Second AD Time Constant for FEED	UINT	Sets the acceleration/deceleration time for the second acceleration/deceleration for the constant feeding. Unit: ms	1 to 10,000	200
65	Get/Set	Profile Type for FEED	UINT	Sets the pre-interpolation acceleration/deceleration type for the constant feeding. 0: None 1: Single-step linear 2: Double-step linear 3: Asymmetric linear	0 to 3	0
70	Get/Set	Time Constant for Exponential Curve	UINT	Sets the time constant of exponential acceleration/deceleration. Unit: ms	4 to 1,000	25
71	Get/Set	Bias Speed	DINT	Sets the bias speed of exponential acceleration/deceleration. Unit: 1000 reference units/min	0 to 240,000	0
72	Get/Set	Time Constant of Moving Average	UINT	Sets the time constant of travelling average. Unit: ms	4 to 1,000	25
73	Get/Set	Maximum Feed Speed	DINT	Sets the maximum feed speed. Unit: 1000 reference units/min	1 to 240,000	24,000
74	Get/Set	Step Distance 1	DINT	Sets step distance 1 for STEP operation. Unit: Reference units	0 to 99,999,999	1
75	Get/Set	Step Distance 2	DINT	Sets step distance 2 for STEP operation. Unit: Reference units	0 to 99,999,999	10
76	Get/Set	Step Distance 3	DINT	Sets step distance 3 for STEP operation. Unit: Reference units	0 to 99,999,999	100
77	Get/Set	Step Distance 4	DINT	Sets step distance 4 for STEP operation. Unit: Reference units	0 to 99,999,999	1,000

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
90	Get/Set	Positioning Deadband	UINT	Sets the positioning completion range. Unit: Reference units	0 to 10,000	5
91	Get/Set	Positioning Timeout	UINT	Sets the timeout value when positioning is completed. Unit: ms	0 to 65535	0
92	Get/Set	Near Signal	UINT	Sets the width for the positioning proximity signal. Unit: Reference units	0 to 32767	10
93	Get/Set	Direction	BOOL	Sets the direction of rotation for station positioning.	0, 1	0
94	Get/Set	Approach Speed for External Positioning	DINT	Sets the approach speed for external positioning. Unit: 1000 reference units/min	1 to 240,000	24,000
95	Get/Set	Final Travel Distance for External Positioning	DINT	Sets the final travel distance for external positioning. Unit: Reference units	0 to 99,999,999	0
100	Get/Set	Stations	UINT	Sets the number of stations.	1 to 32767	1
111	Get/Set	Point Speed Switch Point	UINT	Sets the number of speed switching points.	0 to 16	0
112	Get/Set	Initial Speed	DINT	Sets the initial speed for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
113	Get/Set	Position 1 for Multi-speed	DINT	Sets speed-switching position 1 for multi-speed. Unit: Reference units	0 to 99,999,999	0
114	Get/Set	Position 2 for Multi-speed	DINT	Sets speed-switching position 2 for multi-speed. Unit: Reference units	0 to 99,999,999	0
115	Get/Set	Position 3 for Multi-speed	DINT	Sets speed-switching position 3 for multi-speed. Unit: Reference units	0 to 99,999,999	0
116	Get/Set	Position 4 for Multi-speed	DINT	Sets speed-switching position 4 for multi-speed. Unit: Reference units	0 to 99,999,999	0
117	Get/Set	Position 5 for Multi-speed	DINT	Sets speed-switching position 5 for multi-speed. Unit: Reference units	0 to 99,999,999	0

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No.	Access	Name	Data Type	Description	Setting Range	Default Setting
118	Get/Set	Position 6 for Multi-speed	DINT	Sets speed-switching position 6 for multi-speed. Unit: Reference units	0 to 99,999,999	0
119	Get/Set	Position 7 for Multi-speed	DINT	Sets speed-switching position 7 for multi-speed. Unit: Reference units	0 to 99,999,999	0
120	Get/Set	Position 8 for Multi-speed	DINT	Sets speed-switching position 8 for multi-speed. Unit: Reference units	0 to 99,999,999	0
121	Get/Set	Position 9 for Multi-speed	DINT	Sets speed-switching position 9 for multi-speed. Unit: Reference units	0 to 99,999,999	0
122	Get/Set	Position 10 for Multi-speed	DINT	Sets speed-switching position 10 for multi-speed. Unit: Reference units	0 to 99,999,999	0
123	Get/Set	Position 11 for Multi-speed	DINT	Sets speed-switching position 11 for multi-speed. Unit: Reference units	0 to 99,999,999	0
124	Get/Set	Position 12 for Multi-speed	DINT	Sets speed-switching position 12 for multi-speed. Unit: Reference units	0 to 99,999,999	0
125	Get/Set	Position 13 for Multi-speed	DINT	Sets speed-switching position 13 for multi-speed. Unit: Reference units	0 to 99,999,999	0
126	Get/Set	Position 14 for Multi-speed	DINT	Sets speed-switching position 14 for multi-speed. Unit: Reference units	0 to 99,999,999	0
127	Get/Set	Position 15 for Multi-speed	DINT	Sets speed-switching position 15 for multi-speed. Unit: Reference units	0 to 99,999,999	0
128	Get/Set	Position 16 for Multi-speed	DINT	Sets speed-switching position 16 for multi-speed. Unit: Reference units	0 to 99,999,999	0
129	Get/Set	Speed 1 for Multi-speed	DINT	Sets speed 1 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
130	Get/Set	Speed 2 for Multi-speed	DINT	Sets speed 2 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
131	Get/Set	Speed 3 for Multi-speed	DINT	Sets speed 3 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
132	Get/Set	Speed 4 for Multi-speed	DINT	Sets speed 4 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
133	Get/Set	Speed 5 for Multi-speed	DINT	Sets speed 5 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
134	Get/Set	Speed 6 for Multi-speed	DINT	Sets speed 6 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
135	Get/Set	Speed 7 for Multi-speed	DINT	Sets speed 7 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
136	Get/Set	Speed 8 for Multi-speed	DINT	Sets speed 8 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
137	Get/Set	Speed 9 for Multi-speed	DINT	Sets speed 9 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
138	Get/Set	Speed 10 for Multi-speed	DINT	Sets speed 10 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
139	Get/Set	Speed 11 for Multi-speed	DINT	Sets speed 11 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
140	Get/Set	Speed 12 for Multi-speed	DINT	Sets speed 12 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
141	Get/Set	Speed 13 for Multi-speed	DINT	Sets speed 13 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
142	Get/Set	Speed 14 for Multi-speed	DINT	Sets speed 14 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
143	Get/Set	Speed 15 for Multi-speed	DINT	Sets speed 15 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
144	Get/Set	Speed 16 for Multi-speed	DINT	Sets speed 16 for multi-speed. Unit: 1000 reference units/min	1 to 240,000	24,000
160	Get/Set	Increment for Notch Output	UINT	Sets notch output position. 0: Specifies absolute value 1: Specifies relative value	0, 1	0
161	Get/Set	Notch Signal	UINT	Sets notch output polarity reversal. Bit 0: Set to 1 to enable notch output 0 Bit 1: Set to 1 to enable notch output 1	0 to 3	0

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
162	Get/Set	Notch Position 00	DINT	Sets notch output position 1. Unit: Reference units	–99,999,999 to 99,999,999	0
163	Get/Set	Notch Position 01	DINT	Sets notch output position 2. Unit: Reference units	–99,999,999 to 99,999,999	0
164	Get/Set	Notch Position 10	DINT	Sets notch output position 3. Unit: Reference units	–99,999,999 to 99,999,999	0
165	Get/Set	Notch Position 11	DINT	Sets notch output position 4. Unit: Reference units	–99,999,999 to 99,999,999	0

Services

Service Code	Name	Description
0x0E	Get_Attribute_Single	Returns the specified attribute.
0x10	Set_Attribute_Single	Modifies the specified attribute.

B.7 Point Table Object (0x65)

■ Class

Attributes: Not supported
Services: Not supported

■ Instances

Attributes

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
50	Get/Set	Position 1	DINT	Target position 1 Unit: Reference units	–99,999,999 to 99,999,999	0
51	Get/Set	Position 2	DINT	Target position 2 Unit: Reference units	–99,999,999 to 99,999,999	0
52	Get/Set	Position 3	DINT	Target position 3 Unit: Reference units	–99,999,999 to 99,999,999	0
53	Get/Set	Position 4	DINT	Target position 4 Unit: Reference units	–99,999,999 to 99,999,999	0
54	Get/Set	Position 5	DINT	Target position 5 Unit: Reference units	–99,999,999 to 99,999,999	0
55	Get/Set	Position 6	DINT	Target position 6 Unit: Reference units	–99,999,999 to 99,999,999	0
56	Get/Set	Position 7	DINT	Target position 7 Unit: Reference units	–99,999,999 to 99,999,999	0
57	Get/Set	Position 8	DINT	Target position 8 Unit: Reference units	–99,999,999 to 99,999,999	0
58	Get/Set	Position 9	DINT	Target position 9 Unit: Reference units	–99,999,999 to 99,999,999	0
59	Get/Set	Position 10	DINT	Target position 10 Unit: Reference units	–99,999,999 to 99,999,999	0
60	Get/Set	Position 11	DINT	Target position 11 Unit: Reference units	–99,999,999 to 99,999,999	0
61	Get/Set	Position 12	DINT	Target position 12 Unit: Reference units	–99,999,999 to 99,999,999	0
62	Get/Set	Position 13	DINT	Target position 13 Unit: Reference units	–99,999,999 to 99,999,999	0
63	Get/Set	Position 14	DINT	Target position 14 Unit: Reference units	–99,999,999 to 99,999,999	0
64	Get/Set	Position 15	DINT	Target position 15 Unit: Reference units	–99,999,999 to 99,999,999	0
65	Get/Set	Position 16	DINT	Target position 16 Unit: Reference units	–99,999,999 to 99,999,999	0

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
66	Get/Set	Position 17	DINT	Target position 17 Unit: Reference units	–99,999,999 to 99,999,999	0
67	Get/Set	Position 18	DINT	Target position 18 Unit: Reference units	–99,999,999 to 99,999,999	0
68	Get/Set	Position 19	DINT	Target position 19 Unit: Reference units	–99,999,999 to 99,999,999	0
69	Get/Set	Position 20	DINT	Target position 20 Unit: Reference units	–99,999,999 to 99,999,999	0
70	Get/Set	Position 21	DINT	Target position 21 Unit: Reference units	–99,999,999 to 99,999,999	0
71	Get/Set	Position 22	DINT	Target position 22 Unit: Reference units	–99,999,999 to 99,999,999	0
72	Get/Set	Position 23	DINT	Target position 23 Unit: Reference units	–99,999,999 to 99,999,999	0
73	Get/Set	Position 24	DINT	Target position 24 Unit: Reference units	–99,999,999 to 99,999,999	0
74	Get/Set	Position 25	DINT	Target position 25 Unit: Reference units	–99,999,999 to 99,999,999	0
75	Get/Set	Position 26	DINT	Target position 26 Unit: Reference units	–99,999,999 to 99,999,999	0
76	Get/Set	Position 27	DINT	Target position 27 Unit: Reference units	–99,999,999 to 99,999,999	0
77	Get/Set	Position 28	DINT	Target position 28 Unit: Reference units	–99,999,999 to 99,999,999	0
78	Get/Set	Position 29	DINT	Target position 29 Unit: Reference units	–99,999,999 to 99,999,999	0
79	Get/Set	Position 30	DINT	Target position 30 Unit: Reference units	–99,999,999 to 99,999,999	0
80	Get/Set	Position 31	DINT	Target position 31 Unit: Reference units	–99,999,999 to 99,999,999	0
81	Get/Set	Position 32	DINT	Target position 32 Unit: Reference units	–99,999,999 to 99,999,999	0
82	Get/Set	Position 33	DINT	Target position 33 Unit: Reference units	–99,999,999 to 99,999,999	0
83	Get/Set	Position 34	DINT	Target position 34 Unit: Reference units	–99,999,999 to 99,999,999	0
84	Get/Set	Position 35	DINT	Target position 35 Unit: Reference units	–99,999,999 to 99,999,999	0
85	Get/Set	Position 36	DINT	Target position 36 Unit: Reference units	–99,999,999 to 99,999,999	0
86	Get/Set	Position 37	DINT	Target position 37 Unit: Reference units	–99,999,999 to 99,999,999	0
87	Get/Set	Position 38	DINT	Target position 38 Unit: Reference units	–99,999,999 to 99,999,999	0

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
88	Get/Set	Position 39	DINT	Target position 39 Unit: Reference units	–99,999,999 to 99,999,999	0
89	Get/Set	Position 40	DINT	Target position 40 Unit: Reference units	–99,999,999 to 99,999,999	0
90	Get/Set	Position 41	DINT	Target position 41 Unit: Reference units	–99,999,999 to 99,999,999	0
91	Get/Set	Position 42	DINT	Target position 42 Unit: Reference units	–99,999,999 to 99,999,999	0
92	Get/Set	Position 43	DINT	Target position 43 Unit: Reference units	–99,999,999 to 99,999,999	0
93	Get/Set	Position 44	DINT	Target position 44 Unit: Reference units	–99,999,999 to 99,999,999	0
94	Get/Set	Position 45	DINT	Target position 45 Unit: Reference units	–99,999,999 to 99,999,999	0
95	Get/Set	Position 46	DINT	Target position 46 Unit: Reference units	–99,999,999 to 99,999,999	0
96	Get/Set	Position 47	DINT	Target position 47 Unit: Reference units	–99,999,999 to 99,999,999	0
97	Get/Set	Position 48	DINT	Target position 48 Unit: Reference units	–99,999,999 to 99,999,999	0
98	Get/Set	Position 49	DINT	Target position 49 Unit: Reference units	–99,999,999 to 99,999,999	0
99	Get/Set	Position 50	DINT	Target position 50 Unit: Reference units	–99,999,999 to 99,999,999	0
150	Get/Set	Speed 1	DINT	Target speed 1 Unit: 1000 reference units/min	1 to 240,000	24,000
151	Get/Set	Speed 2	DINT	Target speed 2 Unit: 1000 reference units/min	1 to 240,000	24,000
152	Get/Set	Speed 3	DINT	Target speed 3 Unit: 1000 reference units/min	1 to 240,000	24,000
153	Get/Set	Speed 4	DINT	Target speed 4 Unit: 1000 reference units/min	1 to 240,000	24,000
154	Get/Set	Speed 5	DINT	Target speed 5 Unit: 1000 reference units/min	1 to 240,000	24,000
155	Get/Set	Speed 6	DINT	Target speed 6 Unit: 1000 reference units/min	1 to 240,000	24,000
156	Get/Set	Speed 7	DINT	Target speed 7 Unit: 1000 reference units/min	1 to 240,000	24,000
157	Get/Set	Speed 8	DINT	Target speed 8 Unit: 1000 reference units/min	1 to 240,000	24,000
158	Get/Set	Speed 9	DINT	Target speed 9 Unit: 1000 reference units/min	1 to 240,000	24,000
159	Get/Set	Speed 10	DINT	Target speed 10 Unit: 1000 reference units/min	1 to 240,000	24,000

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
160	Get/Set	Speed 11	DINT	Target speed 11 Unit: 1000 reference units/min	1 to 240,000	24,000
161	Get/Set	Speed 12	DINT	Target speed 12 Unit: 1000 reference units/min	1 to 240,000	24,000
162	Get/Set	Speed 13	DINT	Target speed 13 Unit: 1000 reference units/min	1 to 240,000	24,000
163	Get/Set	Speed 14	DINT	Target speed 14 Unit: 1000 reference units/min	1 to 240,000	24,000
164	Get/Set	Speed 15	DINT	Target speed 15 Unit: 1000 reference units/min	1 to 240,000	24,000
165	Get/Set	Speed 16	DINT	Target speed 16 Unit: 1000 reference units/min	1 to 240,000	24,000
166	Get/Set	Speed 17	DINT	Target speed 17 Unit: 1000 reference units/min	1 to 240,000	24,000
167	Get/Set	Speed 18	DINT	Target speed 18 Unit: 1000 reference units/min	1 to 240,000	24,000
168	Get/Set	Speed 19	DINT	Target speed 19 Unit: 1000 reference units/min	1 to 240,000	24,000
169	Get/Set	Speed 20	DINT	Target speed 20 Unit: 1000 reference units/min	1 to 240,000	24,000
170	Get/Set	Speed 21	DINT	Target speed 21 Unit: 1000 reference units/min	1 to 240,000	24,000
171	Get/Set	Speed 22	DINT	Target speed 22 Unit: 1000 reference units/min	1 to 240,000	24,000
172	Get/Set	Speed 23	DINT	Target speed 23 Unit: 1000 reference units/min	1 to 240,000	24,000
173	Get/Set	Speed 24	DINT	Target speed 24 Unit: 1000 reference units/min	1 to 240,000	24,000
174	Get/Set	Speed 25	DINT	Target speed 25 Unit: 1000 reference units/min	1 to 240,000	24,000
175	Get/Set	Speed 26	DINT	Target speed 26 Unit: 1000 reference units/min	1 to 240,000	24,000
176	Get/Set	Speed 27	DINT	Target speed 27 Unit: 1000 reference units/min	1 to 240,000	24,000
177	Get/Set	Speed 28	DINT	Target speed 28 Unit: 1000 reference units/min	1 to 240,000	24,000
178	Get/Set	Speed 29	DINT	Target speed 29 Unit: 1000 reference units/min	1 to 240,000	24,000
179	Get/Set	Speed 30	DINT	Target speed 30 Unit: 1000 reference units/min	1 to 240,000	24,000
180	Get/Set	Speed 31	DINT	Target speed 31 Unit: 1000 reference units/min	1 to 240,000	24,000
181	Get/Set	Speed 32	DINT	Target speed 32 Unit: 1000 reference units/min	1 to 240,000	24,000

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
182	Get/Set	Speed 33	DINT	Target speed 33 Unit: 1000 reference units/min	1 to 240,000	24,000
183	Get/Set	Speed 34	DINT	Target speed 34 Unit: 1000 reference units/min	1 to 240,000	24,000
184	Get/Set	Speed 35	DINT	Target speed 35 Unit: 1000 reference units/min	1 to 240,000	24,000
185	Get/Set	Speed 36	DINT	Target speed 36 Unit: 1000 reference units/min	1 to 240,000	24,000
186	Get/Set	Speed 37	DINT	Target speed 37 Unit: 1000 reference units/min	1 to 240,000	24,000
187	Get/Set	Speed 38	DINT	Target speed 38 Unit: 1000 reference units/min	1 to 240,000	24,000
188	Get/Set	Speed 39	DINT	Target speed 39 Unit: 1000 reference units/min	1 to 240,000	24,000
189	Get/Set	Speed 40	DINT	Target speed 40 Unit: 1000 reference units/min	1 to 240,000	24,000
190	Get/Set	Speed 41	DINT	Target speed 41 Unit: 1000 reference units/min	1 to 240,000	24,000
191	Get/Set	Speed 42	DINT	Target speed 42 Unit: 1000 reference units/min	1 to 240,000	24,000
192	Get/Set	Speed 43	DINT	Target speed 43 Unit: 1000 reference units/min	1 to 240,000	24,000
193	Get/Set	Speed 44	DINT	Target speed 44 Unit: 1000 reference units/min	1 to 240,000	24,000
194	Get/Set	Speed 45	DINT	Target speed 45 Unit: 1000 reference units/min	1 to 240,000	24,000
195	Get/Set	Speed 46	DINT	Target speed 46 Unit: 1000 reference units/min	1 to 240,000	24,000
196	Get/Set	Speed 47	DINT	Target speed 47 Unit: 1000 reference units/min	1 to 240,000	24,000
197	Get/Set	Speed 48	DINT	Target speed 48 Unit: 1000 reference units/min	1 to 240,000	24,000
198	Get/Set	Speed 49	DINT	Target speed 49 Unit: 1000 reference units/min	1 to 240,000	24,000
199	Get/Set	Speed 50	DINT	Target speed 50 Unit: 1000 reference units/min	1 to 240,000	24,000

Services

Service Code	Name	Description
0x0E	Get_Attribute_Single	Returns the specified attribute.
0x10	Set_Attribute_Single	Modifies the specified attribute.

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B.8 SERVOPACK Parameter Object (0x66)

Class

Attributes: Not supported
Services: Not supported

Instances

Attributes

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
10	Get/Set	Basic Function Selection	UINT	Sets function selection basic switches.	---	0000
11	Get/Set	Application Switch 1	UINT	Sets function selection application switches 1.	---	0000
12	Get/Set	Application Switch 2	UINT	Sets function selection application switches 2.	---	0000
13	Get/Set	Application Switch 3	UINT	Sets function selection application switches 3.	---	0002
14	Get/Set	Application Switch 4	UINT	Sets function selection application switches 4.	---	0000
15	Get/Set	Application Switch 5	UINT	Sets function selection application switches 5.	---	0000
30	Get/Set	Bias Acceleration Width *2	UINT	Sets the bias acceleration width. Unit: Reference units	0 to 250	7
50	Get/Set	Speed Loop Gain	UINT	Sets the speed loop gain. Unit: Hz	1 to 2000	40
51	Get/Set	Integral Time Constant for Speed Loop	UINT	Sets the integral time constant for speed loop. Unit: 0.01ms	15 to 51200	2000
52	Get/Set	Position Loop Gain	UINT	Sets the position loop gain. Unit: 1/s	1 to 2000	40
53	Get/Set	Inertia Ratio	UINT	Sets the inertia ratio. Unit: %	0 to 10000	0
54	Get/Set	Second Speed Loop Gain	UINT	Sets the second speed loop gain. Unit: Hz	1 to 2000	40
55	Get/Set	Integral Time Constant for Second Speed Loop	UINT	Sets the integral time constant for second speed loop. Unit: 0.01ms	15 to 51200	2000

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
56	Get/Set	Second Position Loop Gain	UINT	Sets the second position loop gain. Unit: 1/s	1 to 2000	40
57	Get/Set	Bias *1	UINT	Sets the bias. Unit: min^{-1}	0 to 450	0
58	Get/Set	Bias Width Addition	UINT	Sets the bias width addition. Unit: pulse	0 to 250	7
59	Get/Set	Feedforward	UINT	Sets the feed forward. Unit: %	0 to 100	0
60	Get/Set	Feedforward Filter Time Constant	UINT	Sets the feed forward filter time constant. Unit: 0.01 ms	0 to 6400	0
61	Get/Set	Gain-related Application Switch	UINT	Sets the gain-related application switch.	---	0000
62	Get/Set	Mode Switch Torque Reference	UINT	Sets the mode switch torque reference. Unit: %	0 to 800	200
63	Get/Set	Mode Switch Speed Reference *1	UINT	Sets the mode switch speed reference. Unit: min^{-1}	0 to 10000	0
64	Get/Set	Mode Switch Acceleration *1	UINT	Sets the mode switch acceleration. Unit: 10 min^{-1}/s	0 to 3000	0
65	Get/Set	Mode Switch Error Pulse	UINT	Sets the mode switch error pulse. Unit: pulse	0 to 10000	0
66	Get/Set	Online Autotuning	UINT	Sets the online autotuning switches.	---	10
67	Get/Set	Speed Feedback Compensation	UINT	Sets the speed feedback compensation. Unit: %	0 to 500	100
68	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: %	0 to 1000	100
69	Get/Set	Fixed Parameter	UINT	Fixed parameter	0 to 1000	1000
70	Get/Set	Fixed Parameter	UINT	Fixed parameter	0 to 1000	200
71	Get/Set	Fixed Parameter	UINT	Fixed parameter	0 to 65535	32
72	Get/Set	Fixed Parameter	UINT	Fixed parameter	0 to 65535	16
73	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: %	20 to 100	100

B

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
74	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: %	20 to 100	100
75	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: 1/s	1 to 2000	50
76	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: 0.1%	1 to 2000	1000
77	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: Hz	1 to 150	50
78	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: Hz	1 to 150	70
79	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: %	0 to 150	100
80	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: %	0 to 150	100
81	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: ms	0 to 2000	0
82	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: 0.01 ms	0 to 51200	0
83	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: Hz	10 to 250	50
84	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: Hz	0 to 250	0
85	Get/Set	Fixed Parameter	UINT	Fixed parameter Unit: %	0 to 100	0
90	Get/Set	Bias *2	UINT	Sets the bias. Unit: mm/s	0 to 450	0
91	Get/Set	Mode Switch (Speed Reference) *2	UINT	Sets the mode switch for speed reference. Unit: mm/s	0 to 5000	0
92	Get/Set	Mode Switch (Acceleration) *2	UINT	Sets the mode switch for acceleration. Unit: mm/s^2	0 to 3000	0

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
100	Get/Set	Position Control Reference Switches	UINT	Sets the position control reference selection switches.	---	0000
101	Get/Set	PG Divider *1	UINT	Sets the PG divider. Unit: p/r	16 to 16384	16384
102	Get/Set	Numerator Gear Ratio	UINT	Sets the electric gear ratio numerator.	1 to 65535	4
103	Get/Set	Denominator Gear Ratio	UINT	Sets the electric gear ratio denominator.	1 to 65535	1
104	Get/Set	Position A/D Constant	UINT	Sets the position reference acceleration/deceleration time constant. Unit: 0.01 ms	0 to 6400	0
105	Get/Set	Multi–turn Limit *1	UINT	Sets the multi-turn limit setting. Unit: rev	0 to 65535	65535
106	Get/Set	Fixed Parameter *1	UINT	Fixed parameter Unit: P/rev	513 to 65535	16384
107	Get/Set	Position Control Switches	UINT	Sets the position control function switches.	---	0000
108	Get/Set	Position Move Average Time	UINT	Sets the position reference travelling average time. Unit: 0.01 ms	0 to 6400	0
112	Get/Set	Linear Scale Pitch *2	UINT	Sets the linear scale pitch. Unit: μm	0 to 65535	0
113	Get/Set	Encoder Resolution *2	UINT	Sets the encoder resolution. Unit: Pulse/Scale Pitch	1 to 256	20
120	Get/Set	Speed Reference Input Gain	UINT	Sets the speed reference input gain. Unit: 0.01 V/rated speed	150 to 3000	600
121	Get/Set	Speed 1 *1	UINT	Sets the internal speed 1. Unit: min^{-1}	0 to 10000	100
122	Get/Set	Speed 2 *1	UINT	Sets the internal speed 2. Unit: min^{-1}	0 to 10000	200
123	Get/Set	Speed 3 *1	UINT	Sets the internal speed 3. Unit: min^{-1}	0 to 10000	300
124	Get/Set	FEED Speed *1	UINT	Sets the FEED speed. Unit: min^{-1}	0 to 10000	500
125	Get/Set	Soft Start Accel Time	UINT	Sets the soft start acceleration time. Unit: ms	0 to 10000	0

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No.	Access	Name	Data Type	Description	Setting Range	Default Setting
126	Get/Set	Soft Start Decel Time	UINT	Sets the soft start deceleration time. Unit: ms	0 to 10000	0
127	Get/Set	Speed Reference Time Constant	UINT	Sets the speed reference filter time constant. Unit: 0.01 ms	0 to 65535	40
128	Get/Set	Speed Feedback Time Constant	UINT	Sets the speed feedback filter time constant. Unit: 0.01 ms	0 to 65535	0
132	Get/Set	Internal Setting Speed 1 *2	UINT	Sets the internal setting speed 1. Unit: mm/s	0 to 5000	10
133	Get/Set	Internal Setting Speed 2 *2	UINT	Sets the internal setting speed 2. Unit: mm/s	0 to 5000	20
134	Get/Set	Internal Setting Speed 3 *2	UINT	Sets the internal setting speed 3. Unit: mm/s	0 to 5000	30
135	Get/Set	Jog Speed *2	UINT	Sets the jog speed. Unit: mm/s	0 to 5000	50
140	Get/Set	Torque Reference Input Gain	UINT	Sets the torque reference input gain. Unit: 0.01 V/rated speed	10 to 100	30
141	Get/Set	Torque Reference Time Constant	UINT	Sets the torque reference filter time constant. Unit: 0.01 ms	0 to 65535	100
142	Get/Set	Forward Torque Limit *1	UINT	Sets the forward torque limit. Unit: %	0 to 800	800
143	Get/Set	Reverse Torque Limit *1	UINT	Sets the reverse torque limit. Unit: %	0 to 800	800
144	Get/Set	Forward External Torque Limit	UINT	Sets the forward external torque limit. Unit: %	0 to 800	100
145	Get/Set	Reverse External Torque Limit	UINT	Sets the reverse external torque limit. Unit: %	0 to 800	100
146	Get/Set	Emergency Stop Torque	UINT	Sets the emergency stop torque. Unit: %	0 to 800	800
147	Get/Set	Speed Limit *1	UINT	Sets the speed limit during torque control. Unit: min^{-1}	0 to 10000	10000
148	Get/Set	Torque Function Switches	UINT	Sets the torque function switches.	---	0000

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
149	Get/Set	Notch Filter Frequency	UINT	Sets the notch filter frequency. Unit: Hz	50 to 2000	2000
152	Get/Set	Speed Limit During force Control [*2]	UINT	Sets the speed limit during force control. Unit: mm/s	0 to 5000	5000
153	Get/Set	Polarity Detection Speed Loop Gain [*2]	UINT	Sets the polarity detection speed loop gain. Unit: Hz	1 to 2000	40
154	Get/Set	Integral Time Constant for Polarity Detection Speed Loop Gain [*2]	UINT	Sets the integral time constant for polarity detection speed loop gain. Unit: 0.01ms	15 to 51200	3000
155	Get/Set	Forward Forse Limit [*2]	UINT	Sets the forward forse limit. Unit: %	0 to 800	30
156	Get/Set	Reverse Forse Limit [*2]	UINT	Sets the reverse forse limit. Unit: %	0 to 800	30
161	Get/Set	Zero Clamp Level [*1]	UINT	Sets the zero clamp level. Unit: min^{-1}	0 to 10000	10
162	Get/Set	Rotation Detection Level [*1]	UINT	Sets the rotation detection level. Unit: min^{-1}	0 to 10000	20
163	Get/Set	Speed Coincidence Signal Width [*1]	UINT	Sets the speed coincidence signal detection width. Unit: min^{-1}	0 to 100	10
165	Get/Set	Overflow Level	UINT	Sets the overflow level. Unit: 0.256 mm	1 to 32767	1024
166	Get/Set	Brake Reference Servo Off Delay Time	UINT	Sets the brake signal servo off delay time. Unit: 10 ms	0 to 50	0
167	Get/Set	Brake Reference Output Speed Level [*1]	UINT	Sets the brake signal output speed level. Unit: min^{-1}	0 to 10000	100
168	Get/Set	Wait Time for Brake	UINT	Sets the waiting time for servo-OFF brake reference. Unit: 10 ms	10 to 100	50
169	Get/Set	Hold Time	UINT	Sets the momentary hold time. Unit: ms	20 to 1000	20
170	Get/Set	Input Signal 1	UINT	Sets the input signal selection 1.	---	2100
171	Get/Set	Input Signal 2	UINT	Sets the input signal selection 2.	---	6543

No.	Access	Name	Data Type	Description	Setting Range	Default Setting
172	Get/Set	Input Signal 3	UINT	Sets the input signal selection 3.	---	8888
173	Get/Set	Input Signal 4	UINT	Sets the input signal selection 4.	---	8888
174	Get/Set	Output Signal 1	UINT	Sets the output signal selection 1.	---	3211
175	Get/Set	Output Signal 2	UINT	Sets the output signal selection 2.	---	0000
176	Get/Set	Output Signal 3	UINT	Sets the output signal selection 3.	---	0000
177	Get/Set	Fixed Parameter	UINT	Fixed parameter	---	8888
178	Get/Set	Output Signal Reversal Setting	UINT	Sets the output signal reversal settings.	---	0000
184	Get/Set	Zero Clamp Level *2	UINT	Sets the zero clamp level. Unit: mm/s	0 to 5000	10
185	Get/Set	Zero Speed Level *2	UINT	Sets the zero speed level. Unit: mm/s	1 to 5000	20
186	Get/Set	Speed Coincidence Signal Output Band *2	UINT	Sets the speed coincidence signal output band. Unit: mm/s	0 to 100	100
187	Get/Set	Barke Command Output Speed Level *2	UINT	Sets barke command output speed level. Unit: mm/s	0 to 5000	100
190	Get/Set	Regenerative Register Capacity	UINT	Sets the regenerative register capacity. Unit: 10 W	---	0
191	Get/Set	Fixed Parameter	UINT	Fixed parameter	---	0

Services

Service Code	Name	Description
0x0E	Get_Attribute_Single	Returns the specified attribute.
0x10	Set_Attribute_Single	Modifies the specified attribute.

* 1. These parameters are for the exclusive use of the rotary motor system.
* 2. These parameters are for the exclusive use of the linear motor system.

C

Alarm and Warning Codes

This appendix lists the alarm and warning codes within DeviceNet.

C.1 Alarm Codes

Alarm codes are displayed on the front of the SGDH and, at the same time, can also be read as response message data at the host device connected via DeviceNet. Alarms are also displayed using the MS and NS indicators on the NS300 Module.

The MS indicator is the module status; the NS indicator is the network status. The required indicator responses are shown in the table.

The alarm codes are shown below.

Table C.1. Alarm Codes

Code	MS	NS	Alarm Name	Description
A.02	Flashes Red.	–	Parameter Breakdown	EEPROM data of SERVOPACK is abnormal.
A.03	Lit Red.	–	Main Circuit Encoder Error	Detection data for power circuit is abnormal.
A.04	Flashes Red.	–	Parameter Setting Error	The parameter setting is out of the allowable setting range.
A.05	Flashes Red.	–	Combination Error	SERVOPACK and servomotor capacities do not match each other.
A.10	Flashes Red.	–	Overcurrent or Heat Sink Overheated	An overcurrent flowed through the IGBT. Heat sink of SERVOPACK was overheated.
A.30	Lit Red.	–	Regeneration Error	• Regenerative resistor is defective. • Regenerative transistor is defective.
A.32	Flashes Red.	–	Regenerative Overload	Regenerative energy exceeds regenerative resistor capacity.
A.40	Flashes Red.	–	Overvoltage	Main circuit DC voltage is excessively high.
A.41	Flashes Red.	–	Undervoltage	Main circuit DC voltage is excessively low.
A.51	Flashes Red.	–	Overspeed	Rotational speed of the motor is excessively high.
A.71	Flashes Red.	–	Overload for Instantaneous Maximum Load	The motor was operating for several seconds to several tens of seconds under a torque largely exceeding ratings.
A.72	Flashes Red.	–	Overload for Continuous Maximum Load	The motor was operating continuously under a torque exceeding ratings.
A.73	Flashes Red.	–	Dynamic Brake Overload	When the dynamic brake was applied, rotational energy exceeded the capacity of dynamic brake resistor.
A.74	Flashes Red.	–	Overload of Surge Current Limit Resistor	The main circuit power was frequently turned ON and OFF.
A.7A	Flashes Red.	–	Heat Sink Overheated	The heat sink of SERVOPACK is overheated.
A.81	Flashes Red.	–	Absolute Encoder Backup Error	All the power supplies for the absolute encoder have failed and position data was cleared.
A.82	Flashes Red.	–	Absolute Encoder Checksum Error	The checksum results of the absolute encoder memory are abnormal.
A.83	Flashes Red.	–	Absolute Encoder Battery Error	Battery voltage for the absolute encoder has dropped.

Code	MS	NS	Alarm Name	Description
A.84	Lit Red.	–	Encoder Data Error	Data in the encoder is abnormal.
A.85	Flashes Red.	–	Absolute Encoder Overspeed	The absolute encoder was rotating at high speed when the power was turned ON.
A.86	Flashes Red.	–	Encoder Overheated	The internal temperature of encoder is too high.
A.B1	Flashes Red.	–	Reference Speed Input Read Error	The A/D converter for reference speed input is defective.
A.B2	Flashes Red.	–	Reference Torque Input Read Error	The A/D converter for reference torque input is defective.
A.B6	Flashes Red.	–	Gate Array Error	Communications LSI error
A.BF	Flashes Red.	–	System Alarm	A system error occurred in the SERVOPACK.
A.C1	Flashes Red.	–	Servo Overrun Detected	The servomotor ran out of control.
A.C6	Flashes Red.	–	Fully-closed Loop Phase-A/B Dis-connected	Phase A or B of the fully-closed encoder was dis-connected.
A.C7	Flashes Red.	–	Fully-closed Loop Phase-C Discon-nected	Phase C of the fully-closed encoder was discon-nected.
A.C8	Lit Red.	–	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	Flashes Red.	–	Encoder Communications Error	Communications between SERVOPACK and encoder is not possible.
A.CA	Lit Red.	–	Encoder Parameter Error	Encoder parameters are incorrect.
A.CB	Flashes Red.	–	Encoder Echoback Error	Contents of communications with encoder are incorrect.
A.CC	Flashes Red.	–	Multi-turn Limit Disagreement	Different multi-turn limits have been set in the encoder and SERVOPACK.
A.D0	Flashes Red.	–	Position Error Pulse Overflow	Position error pulse exceeded parameter (Pn505).
A.E0	–	–	No NS300 Module	No NS300 Module installed.
A.E1	–	–	NS300 Module Timeout	No response from the NS300 Module.
A.E2	–	–	Watchdog Counter Error of NS300 Module	WDC error in the NS300 Module
A.E6	–	Lit Red.	DeviceNet Duplicate MAC ID Error	Same node address already exists on the Device-Net network.
A.E7	–	Lit Red.	NS300 Module Detection Error	No NS300 Module was detected when was pow-er supplied to the SGDH.
A.E8	Flashes Red.	–	Rotary Switch Setting Error	Module rotary switch setting error
A.E9	–	Lit Red.	DeviceNet BUS-OFF Error	Fatal communications error has occurred in Devi-ceNet communications.
A.EA	Flashes Red.	–	SERVOPACK Malfunction	SERVOPACK is defective.
A.EB	Flashes Red.	–	SERVOPACK Initial Access Error	Initial processing failed.
A.EC	Flashes Red.	–	SERVOPACK WDC Error	SERVOPACK WDC error
A.ED	Lit Red.	–	NS300 Module Error	Command was interrupted.

Code	MS	NS	Alarm Name	Description
A.EE	Flashes Red.	–	Option Parameter Error	The parameters of the NS300 Module contain abnormalities.
A.F1	Flashes Red.	–	Power Line Open Phase	One phase in the 3-phase main power supply is not connected.

C.2 Warning Codes

The warning codes are shown below.

Warning Code	MS LED	NS LED	Warning Name	Description
A.91	Flashes Red.	–	Overload	This warning occurs before the overload alarms (A.71 or A.72) occur. If the warning is ignored and operation continues, an overload alarm may occur.
A.92	Flashes Red.	–	Regenerative Overload	This warning occurs before the regenerative overload alarm (A.32) occurs. If the warning is ignored and operation continues, a regenerative overload alarm may occur.
A.94	Flashes Red.	–	Parameter Setting Warning	A value outside the setting range was set using DeviceNet communications.
A.95	Flashes Red.	–	Command Warning	A command not supported in the product specifications was issued. The command reception conditions were not met.
A.96	Flashes Red.	–	Communications Warning	A DeviceNet communications error occurred (once).
A.98	Flashes Red.	–	Main Power OFF	The main power supply is not being supplied.
A.9A	Flashes Red.	–	Not Completed within the Time Set in Pn851	Positioning was not completed within the set time.

C

Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

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- 00−09: Date of original publication
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September 2000	−	−	First edition
March 2001	1	All chapters	Completely revised
November 2002	2	Back cover	Revision: Address
June 2003	3	All chapters	Revision: Option Unit changed to Application Module, NS300 Unit changed to NS300 Module, and Steps changed to Reference units.
		4.3.4	Revision: Section on speed, acceleration, and deceleration
		5.3.4	Addition: Section on setting the zero point
		5.7	Addition: Section on data trace function
		B.8	Addition: Attribute No. 30, 90, 91, 92, 112, 113, 132, 133, 134, 135, 152, 153, 154, 155, 156, 184, 185, 186, and 187.
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Σ-Ⅱ Series SGDH

DeviceNet INTERFACE MODULE

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Specifications are subject to change without notice for ongoing product modifications and improvements.

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