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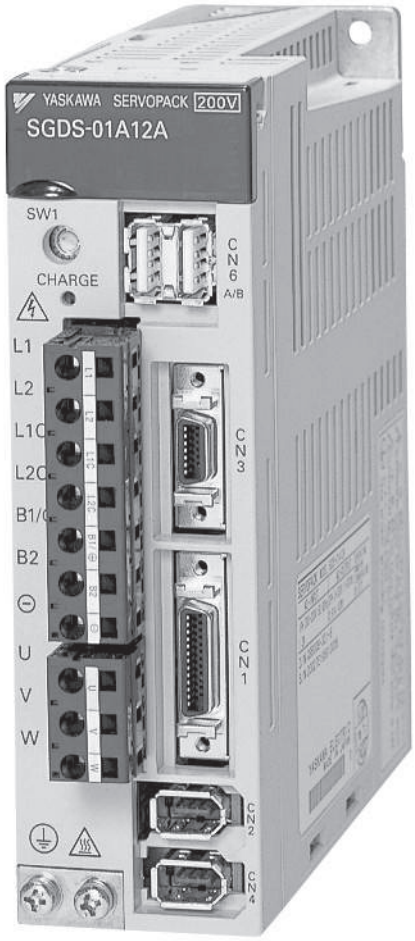


SGDS Sigma III Servo Amplifier User Manual for Mechatrolink-II Communications

About this Manual

■ Description of Technical Terms

The terms in this manual are defined as follows:

- Servomotor or motor = Σ II Series SGMAH, SGMPH, SGMSH, SGMCS (direct drive) servomotor.
- SERVOPACK = Σ III Series SGDS SERVOPACK with MECHATROLINK II interface.
- 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.
- Parameter = A parameter for the SERVOPACK

■ Quick access to your required information

Read the chapters marked with ✓ to get the information required for your purpose.

Chapter	SERVOPACKs, Servomotors, and Peripheral Devices	Ratings and Character-istics	System Design	Panel Configura-tion and Wiring	Trial Operation and Servo Adjustment	Inspection and Maintenance	Fully-closed Control
Chapter 1 Outline	✓						
Chapter 2 Selections	✓						
Chapter 3 SERVOPACK Specifications and Dimensional Drawings	✓	✓	✓	✓			
Chapter 4 Specifications and Dimensional Drawings of Cables and Peripheral Devices	✓	✓	✓	✓			
Chapter 5 Wiring			✓	✓	✓		
Chapter 6 MECHATROLINK II Communications			✓	✓	✓		
Chapter 7 Operation					✓		
Chapter 8 Adjustments						✓	
Chapter 9 Fully-closed Control							✓
Chapter 10 Inspection, Maintenance, and Troubleshooting						✓	
Chapter 11 Appendix	✓		✓		✓	✓	

■ 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.

- Indicates supplemental information.

◀ EXAMPLE ▶
- Indicates application examples.

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

■ 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

Related Manuals

Refer to the following manuals as required.

Manual Name	Manual Number	Contents
Σ III Series AC SERVOPACK SGDS Safety Precautions	TOBPS80000000	Describes the safety precautions of Σ III series SERVOPACK.
Σ III Series SGM□S/SGDS Digital Operator Operation Manual	TOBPS80000001	Provides detailed information on the operation of the JUSP-OP05A Digital Operator.

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.

In some situations, the precautions indicated could have serious consequences if not heeded.

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

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

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

ISO	JIS
	

The ISO symbol is used in this manual.

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

Notes for Safe Operation

Read this manual thoroughly before checking products on delivery, storage and transportation, installation, wiring, operation and inspection, and disposal of the AC servo drives.

⚠ WARNING

- Never touch any rotating motor parts while the motor is running.
  Failure to observe this warning may result in injury.
- Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.
  Failure to observe this warning may result in injury.
- Never touch the inside of the SERVOPACKs.
  Failure to observe this warning may result in electric shock.
- Do not touch terminals for five minutes after the power is turned OFF.
  Residual voltage may cause electric shock.
- Do not touch terminals for five minutes after voltage resistance test.
  Residual voltage may cause electric shock.
- Follow the procedures and instructions for trial operation precisely as described in this manual.
  Malfunctions that occur after the servomotor is connected to the equipment not only damage the equipment, but may also cause an accident resulting in death or injury.
- The output range of multi-turn data for Σ-III series absolute detection system differs from that for conventional systems (15-bit encoder and 12-bit encoder). Especially when “Infinite length positioning system” of conventional type is to be configured with Σ-III series, be sure to make the system modification.
- The multi-turn limit value must be changed only for special applications.
  Changing it inappropriately or unintentionally can be dangerous.
- If the Multi-turn Limit Disagreement alarm (A.CC0) 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.
- Do not remove the front cover, cables, connectors, or optional items while the power is ON.
  Failure to observe this warning may result in electric shock.
- Do not damage, press, exert excessive force, or place heavy objects on the cables.
  Failure to observe this warning may result in electric shock, stopping operation of the product, or burning.
- Provide an appropriate stopping device on the machine side to ensure safety. A holding brake for a servomotor with brake is not a stopping device for ensuring safety.
  Failure to observe this warning may result in injury.
- Do not come close to the machine immediately after resetting momentary power loss to avoid an unexpected restart. Take appropriate measures to ensure safety against an unexpected restart.
  Failure to observe this warning may result in injury.
- Connect the ground terminal to electrical codes (ground resistance: 100 Ω or less).
  Improper grounding may result in electric shock or fire.

⚠ WARNING

- Installation, disassembly, or repair must be performed only by authorized personnel.
  Failure to observe this warning may result in electric shock or injury.

- Do not modify the product.
  Failure to observe this warning may result in injury or damage to the product.

■ Checking on Delivery

⚠ CAUTION

- Always use the servomotor and SERVOPACK in one of the specified combinations.
  Failure to observe this caution may result in fire or malfunction.

■ Storage and Transportation

⚠ CAUTION

- Do not store or install the product in the following places.
  - Locations subject to direct sunlight.
  - Locations subject to temperatures outside the range specified in the storage or installation temperature conditions.
  - Locations subject to humidity outside the range specified in the storage or installation humidity conditions.
  - Locations subject to condensation as the result of extreme changes in temperature.
  - Locations subject to corrosive or flammable gases.
  - Locations subject to dust, salts, or iron dust.
  - Locations subject to exposure to water, oil, or chemicals.
  - Locations subject to shock or vibration.

  Failure to observe this caution may result in fire, electric shock, or damage to the product.
- Do not hold the product by the cables or motor shaft while transporting it.
  Failure to observe this caution may result in injury or malfunction.
- Do not place any load exceeding the limit specified on the packing box.
  Failure to observe this caution may result in injury or malfunction.

■ Installation

⚠ CAUTION

- Never use the products in an environment subject to water, corrosive gases, inflammable gases, or combustibles.
  Failure to observe this caution may result in electric shock or fire.
- Do not step on or place a heavy object on the product.
  Failure to observe this caution may result in injury.
- Do not cover the inlet or outlet ports and prevent any foreign objects from entering the product.
  Failure to observe this caution may cause internal elements to deteriorate resulting in malfunction or fire.
- Be sure to install the product in the correct direction.
  Failure to observe this caution may result in malfunction.
- Provide the specified clearances between the SERVOPACK and the control panel or with other devices.
  Failure to observe this caution may result in fire or malfunction.
- Do not apply any strong impact.
  Failure to observe this caution may result in malfunction.

■ Wiring

⚠ CAUTION

- Do not connect a three-phase power supply to the U, V, or W output terminals.
  Failure to observe this caution may result in injury or fire.
- Securely connect the power supply terminal screws and motor output terminal screws.
  Failure to observe this caution may result in fire.
- 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 shielded wires or multi-core twisted pair shielded wires for signal and encoder (PG) feedback lines.
  The maximum length is 3 m (118.11 in) for reference input lines and is 20 m (787.40 in) for PG feedback lines.
- Do not touch the power terminals for five minutes after turning power OFF because 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. Do not turn power ON or OFF more than once per minute.
  Since the SERVOPACK has a capacitor in the power supply, a high charging current flows for 0.2 seconds when power is turned ON. Frequently turning power ON and OFF causes main power devices like capacitors and fuses to deteriorate, resulting in unexpected problems.
- Observe the following precautions when wiring main circuit terminal blocks.
  - Remove the terminal block from the SERVOPACK prior to wiring.
  - Insert only one wire per terminal on the terminal block.
  - Make sure that the core wire is not electrically shorted to adjacent core wires.
- Do not connect the SERVOPACK for 100 V and 200 V directly to a voltage of 400 V.
  The SERVOPACK will be destroyed.
- Install the battery at either the host controller or the battery case of the encoder.
  It is dangerous to install batteries at both simultaneously, because that sets up a loop circuit between the batteries.
- Be sure to wire correctly and securely.
  Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Always use the specified power supply voltage.
  An incorrect voltage may result in burning.
- Take appropriate measures to ensure that the input power supply is supplied within the specified voltage fluctuation range. Be particularly careful in places where the power supply is unstable.
  An incorrect power supply may result in damage to the product.
- Install external brakers or other safety devices against short-circuiting in external wiring.
  Failure to observe this caution may result in fire.

⚠ CAUTION

- Take appropriate and sufficient countermeasures for each when installing systems in the following locations.
  - Locations subject to static electricity or other forms of noise.
  - Locations subject to strong electromagnetic fields and magnetic fields.
  - Locations subject to possible exposure to radioactivity.
  - Locations close to power supplies.

  Failure to observe this caution may result in damage to the product.
- Do not reverse the polarity of the battery when connecting it.
  Failure to observe this caution may damage the battery or cause it to explode.

■ Operation

⚠ CAUTION

- Conduct trial operation on the servomotor alone with the motor shaft disconnected from machine to avoid any unexpected accidents.
  Failure to observe this caution 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.
- Forward run prohibited (P-OT) and reverse run prohibited (N-OT) signals are not effective during zero point search mode using parameter Fn003.
- When using the servomotor for a vertical axis, install the safety devices to prevent workpieces to fall off due to occurrence of alarm or overtravel. Set the servomotor so that it will stop in the zero clamp state at occurrence of overtravel.
  Failure to observe this caution may cause workpieces to fall off due to overtravel.
- When not using the normal autotuning, set to the correct moment of inertia ratio.
  Setting to an incorrect moment of inertia ratio may cause vibration.
- Do not touch the SERVOPACK heatsinks, regenerative resistor, or servomotor while power is ON or soon after the power is turned OFF.
  Failure to observe this caution may result in burns due to high temperatures.
- Do not make any extreme adjustments or setting changes of parameters.
  Failure to observe this caution may result in injury due to unstable operation.
- When an alarm occurs, remove the cause, reset the alarm after confirming safety, and then resume operation.
  Failure to observe this caution may result in injury.
- Do not use the servo brake of the servomotor for ordinary braking.
  Failure to observe this caution may result in malfunction.

■ Maintenance and Inspection

⚠ CAUTION

- When replacing the SERVOPACK, resume operation only after transferring the previous SERVOPACK parameters to the new SERVOPACK.
  Failure to observe this caution may result in damage to the product.
- Do not attempt to change wiring while the power is ON.
  Failure to observe this caution may result in electric shock or injury.

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

■ Disposal

⚠ CAUTION

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

■ 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.

CONTENTS

1

Outline

1.1 Checking Products

1.1.1 Check Items

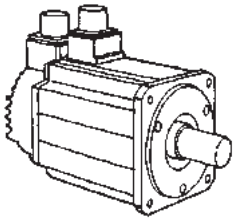
Check the following items when Σ-III Series products are delivered.

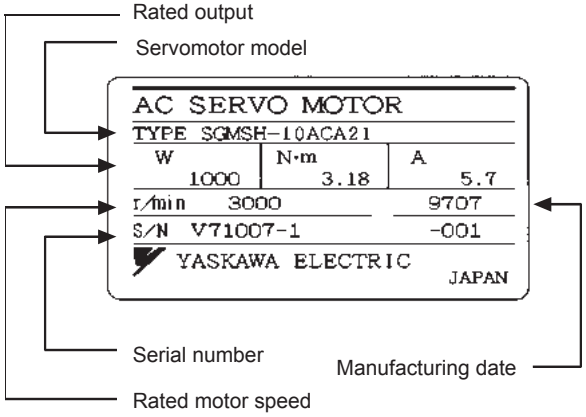
Check Items	Comments
Are the delivered products the ones that were ordered?	Check the model numbers marked on the nameplates on the servomotor and SERVOPACK. (Refer to the descriptions of model numbers in the following section.)
Does the servomotor shaft rotate smoothly?	The servomotor shaft is normal 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.

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

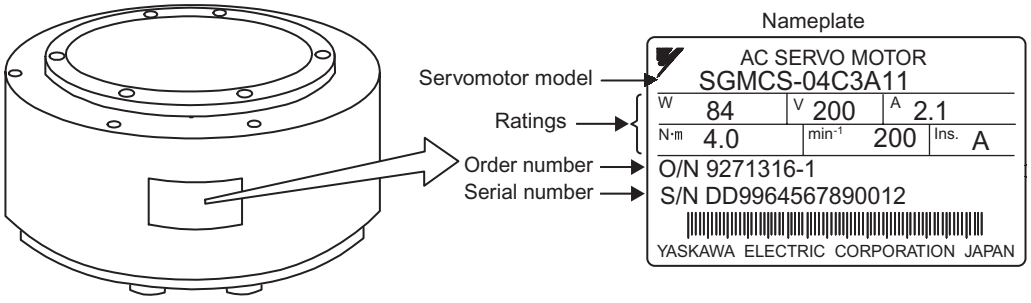
1.1.2 Servomotors

(1) External Appearance and Nameplate Example

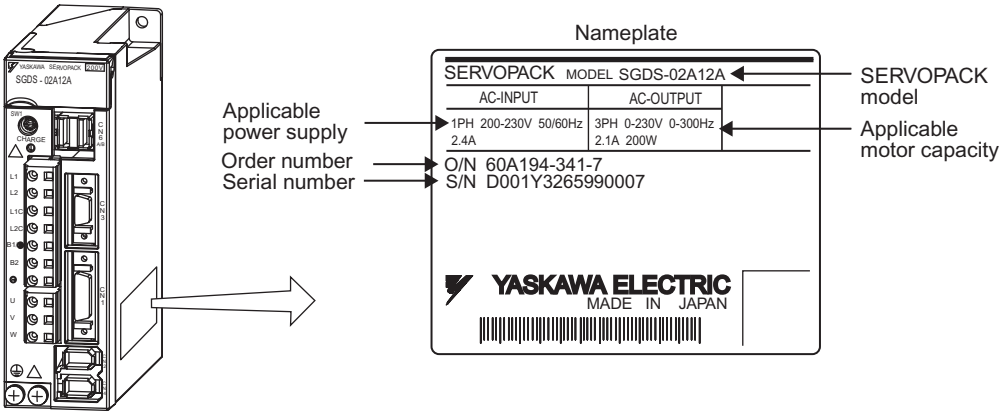




(2) Type SGMCS



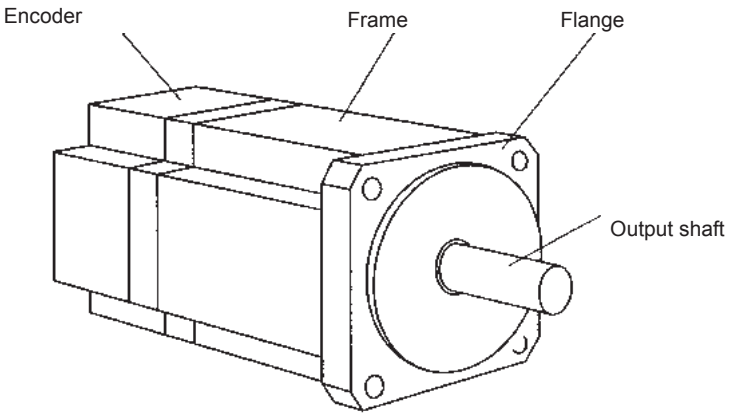
1.1.3 Servo Amplifiers



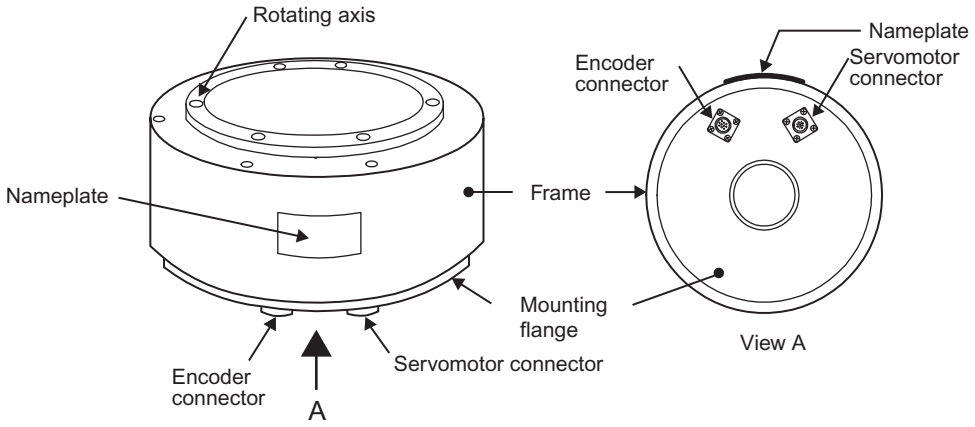
1.2 Product Part Names

1.2.1 Servomotors

(1) The figure below shows part names for servomotors with or without brakes.



(2) Type SGMCS Direct-drive



1.3 Model Numbers

1.3.1 Standard Servomotors

SGMPH - 01 A A A 2 S

Sigma II Series Servomotor Name
SGMAH
SGMPH
SGMGH
SGMSH
SGMUH
SGMBH

Servomotor Capacity (See Table 1.1)

Power Supply
A: 200V
B: 100V*
D: 400V

*The only 100V servomotors are the 0.2kW or less SGMAH and SGMPH models.

Serial Encoder Specifications (See Table 1.2)

Design Revision Order
A SGMAH
SGMPH
SGMGH (1500rpm)
SGMSH
SGMUH
E: SGMPH (IP67 waterproof specification)
SGMBH : A = 200% Peak Torque
B = 250% Peak Torque

Shaft End Specifications
(See Table 1.3)

Brake and Oil Seal Specifications
1: Standard
S: With oil seal
C: With $24V_{DC}$ brake
E: S + C
For AvailableSGMBH: See Catalog for options

Table 1.1: Servomotor Capacity (kW)

Symbol	SGMAH	SGMPH	SGMGH	SGMSH	SGMUH	SGBMH	Symbol	SGMAH	SGMPH	SGMGH	SGMSH	SGMUH	SGMBH
	3000rpm	3000rpm	1500rpm	3000rpm	6000rpm	1500rpm		3000rpm	3000rpm	1500rpm	3000rpm	6000rpm	1500rpm
A3	0.03	—	—	—	—	—	40	—	—	—	4.0	4.0	—
A5	0.05	—	—	—	—	—	44	—	—	4.4	—	—	—
01	0.1	0.1	—	—	—	—	50	—	—	—	5.0	—	—
02	0.2	0.2	—	—	—	—	55	—	—	5.5	—	—	—
04	0.4	0.4	—	—	—	—	75	—	—	7.5	—	—	—
05	—	—	0.45	—	—	—	1A	—	—	11	—	—	—
08	0.75	0.75	—	—	—	—	1E	—	—	15	—	—	—
09	—	—	0.85	—	—	—	2B	—	—	—	—	—	22
10	—	—	—	1.0	1.0	—	3Z	—	—	—	—	—	30
13	—	—	1.3	—	—	—	3G	—	—	—	—	—	37
15	—	1.5	—	1.5	1.5	—	4E	—	—	—	—	—	45
20	—	—	1.8	2.0	—	—	5E	—	—	—	—	—	55
30	—	—	2.9	3.0	3.0	—							

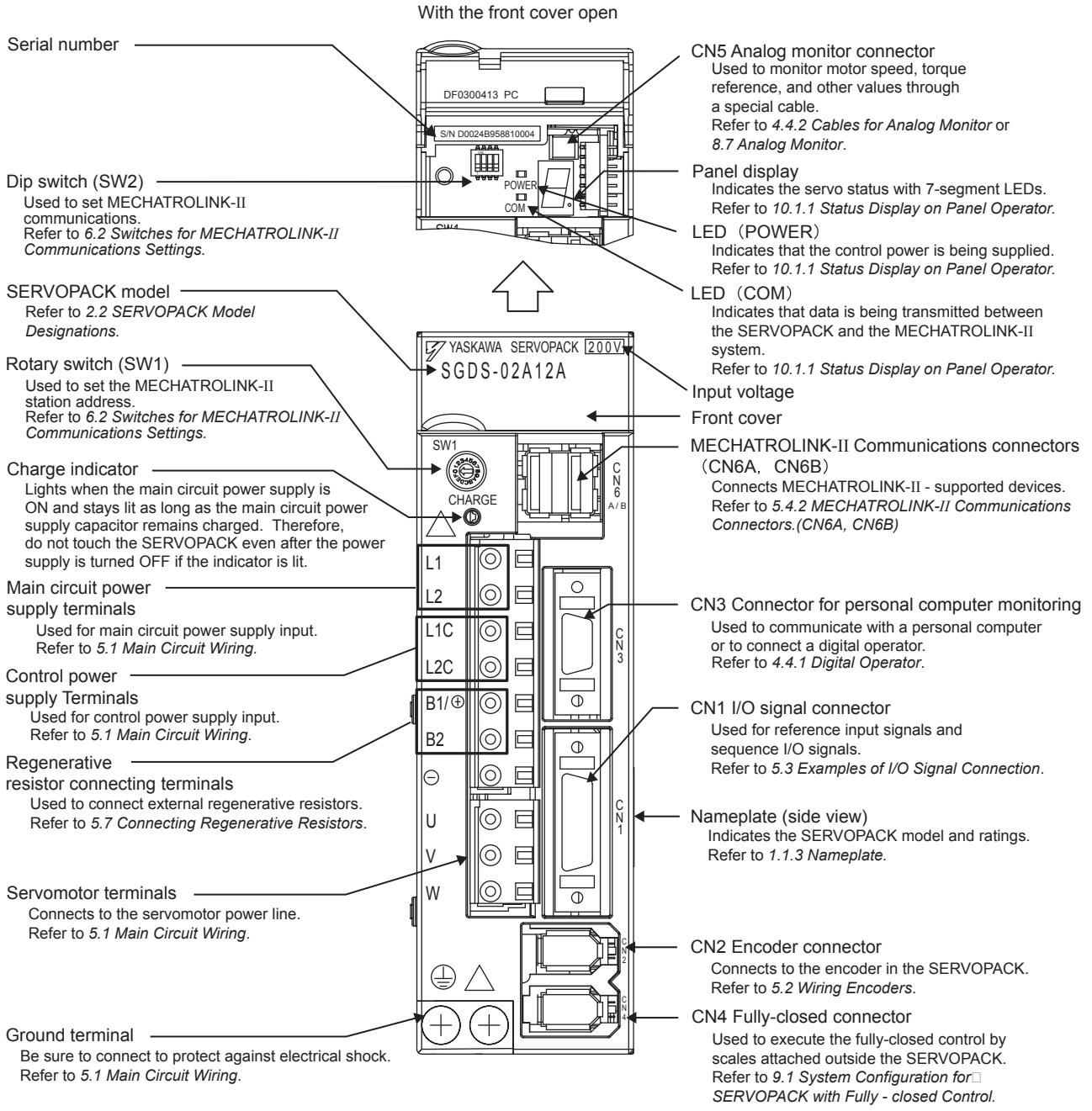
Table 1.2: Serial Encoders

Code	Specification	SGMAH	SGMPH	SGMGH	SGMSH	SGMUH
1	16-bit absolute encoder	Standard	Standard	—	—	—
2	17-bit absolute encoder	—	—	Standard	Standard	Standard
A	13-bit incremental encoder	Standard	Standard	—	—	—
B	16-bit incremental encoder	Optional	Optional	—	—	—
C	17-bit incremental encoder	—	—	Standard	Standard	Standard

Table 1.3: Shaft End Specifications (Straight)

Code	Specification	SGMAH	SGMPH	SGMGH	SGMSH	SGMUH	SGMBH
2	Straight without key	Optional	Optional	Optional	Optional	Optional	—
4	Straight with key	Standard	Standard	—	—	—	Standard
6	Straight with key and tap	Optional	Optional	Standard	Standard	Standard	Optional
8	Straight with tap	Optional	Optional	Optional	—	—	—
K	Straight without key, foot mounted	—	—	—	—	—	Optional
L	Straight with key & tap, foot mounted	—	—	—	—	—	Optional (55kW Standard)

1.3.2 Servo Amplifiers



INFO

■ Connecting terminal

For connecting a reactor, refer to *4.4.9 AC/DC Reactors for Power Supplied Designed for Minimum Harmonics*.