



YASKAWA

AC Servo Drives

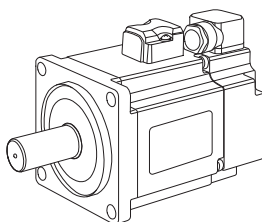
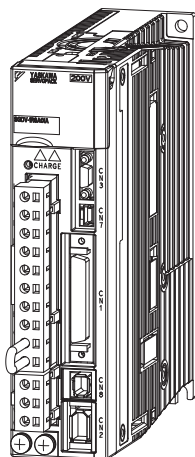
Σ -V Series

USER'S MANUAL

Setup

Rotational Motor

SGDV SERVOPACK
SGMJV/SGMAV/SGMPS/SGMGV/SGMSV/SGMCS Servomotors



| | |
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About this Manual

This manual describes procedures required for installation, wiring, and connecting Σ -V Series servo drives, including a JOG operation for servomotors not connected to machinery.

Be sure to refer to this manual and perform setup operations correctly.

Keep this manual in a location where it can be accessed for reference whenever required.

■ Description of Technical Terms

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

| Term | Meaning |
|--------------------------------|---|
| Servomotor | Σ -V Series SGMJV, SGMAV, SGMPS, SGMGV, SGMSV, or SGMCS (Direct Drive) servomotor |
| SERVOPACK | Σ -V Series SGD V SERVOPACK |
| Servo Drive | A set including a servomotor and SERVOPACK (i.e., a servo amplifier) |
| Servo System | A servo control system that includes the combination of a servo drive with a host controller and peripheral devices |
| Analog pulse model | Analog voltage and pulse-train reference used for SERVOPACK interface. |
| M-II model | MECHATROLINK-II communications reference used for SERVOPACK interface. |
| M-III model | MECHATROLINK-III communications reference used for SERVOPACK interface. |
| Command option attachable type | SERVOPACK for which a command option module can be installed. |

■ IMPORTANT Explanations

The following icon is displayed for explanations requiring special attention.



- Indicates important information that should be memorized, as well as precautions, such as alarm displays, that do not involve potential damage to equipment.

■ Notation Used in this Manual

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:

Example

$\overline{S-ON} = /S-ON$

■ Manuals Related to the Σ -V Series

Refer to the following manuals as required.

| Name | Selecting Models and Peripheral Devices | Ratings and Specifications | System Design | Panels and Wiring | Trial Operation | Trial Operation and Servo Adjustment | Maintenance and Inspection |
|--|---|----------------------------|---------------|-------------------|-----------------|--------------------------------------|----------------------------|
| Σ -V Series Product Catalog (KAEP S800000 42) | ✓ | ✓ | | | | | |
| Σ -V Series User's Manual Design and Maintenance Rotational Motor/ Analog Voltage and Pulse Train Reference (SIEP S800000 45) | | ✓ | ✓ | ✓ | | ✓ | ✓* |
| Σ -V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-II Communications Reference (SIEP S800000 46) | | ✓ | ✓ | ✓ | | ✓ | ✓* |
| Σ -V Series User's Manual MECHATROLINK-II Command (SIEP S800000 54) | | | ✓ | | ✓ | ✓ | |
| Σ -V Series User's Manual Operation of Digital Operator (SIEP S800000 55) | | | | | ✓ | ✓ | ✓ |
| Σ -V Series User's Manual Design and Maintenance Rotational Motor/ Command Option Attachable Type (SIEP S800000 60) | | ✓ | ✓ | ✓ | | ✓ | ✓ |

(cont'd)

| Name | Selecting Models and Peripheral Devices | Ratings and Specifications | System Design | Panels and Wiring | Trial Operation | Trial Operation and Servo Adjustment | Maintenance and Inspection |
|--|---|----------------------------|---------------|-------------------|-----------------|--------------------------------------|----------------------------|
| Σ-V Series User's Manual MECHATROLINK-III Command (SIEP S800000 63) (Will be available soon.) | | | ✓ | | ✓ | ✓ | |
| Σ-V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-III Communications Reference (SIEP S800000 64) | | ✓ | ✓ | ✓ | | ✓ | ✓* |
| Σ-V Series User's Manual Indexer Module (SIEP C720829 02) (Will be available soon.) | | ✓ | ✓ | ✓ | | ✓ | ✓* |
| Σ-V Series User's Manual EtherCAT (CoE) Network Module (SIEP C720829 04) | | ✓ | ✓ | ✓ | | ✓ | ✓* |
| AC SERVOMOTOR Safety Precautions (TOBP C230200 00) | | | | ✓ | | | ✓ |
| Σ-V Series AC SERVOPACK SGDV Safety Precautions (TOBP C710800 10) | ✓ | | | ✓ | | | ✓ |
| Σ-V Series Option Module Safety Precautions (TOBP C720829 00) | ✓ | | | ✓ | | | ✓ |
| Σ-V Series Command Option Module Installation Guide (TOBP C720829 01) | ✓ | | | ✓ | | | ✓ |

(cont'd)

| Name | Selecting Models and Peripheral Devices | Ratings and Specifications | System Design | Panels and Wiring | Trial Operation | Trial Operation and Servo Adjustment | Maintenance and Inspection |
|--|---|----------------------------|---------------|-------------------|-----------------|--------------------------------------|----------------------------|
| Σ -V Series Indexer Module Installation Guide (TOBP C720829 02) | ✓ | | | ✓ | | | ✓ |
| Σ -V Series Feedback Option Module Installation Guide (TOBP C720829 03) | ✓ | | | ✓ | | | ✓ |
| Σ Series Digital Operator Safety Precautions (TOBP C730800 00) | | | | | | | ✓ |

* Refer to these manuals for troubleshooting of problems which may occur during setup. (Troubleshooting which is common for command option modules is described in *Σ -V Series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60).

■ 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.

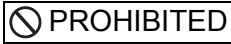



Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.




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.



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



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



Safety Precautions

These safety precautions are very important. Read them before performing any procedures such as checking products on delivery, storage and transportation, installation, wiring, operation and inspection, or disposal. Be sure to always observe these precautions thoroughly.

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 or damage to the product.
- **Never touch the inside of the SERVOPACKs.**
Failure to observe this warning may result in electric shock.
- **Do not remove the cover of the power supply terminals while the power is ON.**
Failure to observe this warning may result in electric shock.
- **After the power is turned OFF or after a voltage resistance test, do not touch terminals while the CHARGE lamp is ON.**
Residual voltage may cause electric shock.
- **Follow the procedures and instructions provided in this manual for trial operation.**
Failure to do so may result not only in faulty operation and damage to equipment, but also in personal injury.
- **The multi-turn output range for the Σ -V Series absolute position detecting system is different from that of earlier systems (15-bit and 12-bit encoders). In particular, change the system to configure the Σ series infinite-length positioning system with the Σ -V Series.**
- **The multi-turn limit value need not be changed except for special applications.**
Changing it inappropriately or unintentionally can be dangerous.
- **If the Multi-turn 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.
- **Do not remove the front cover, cables, connectors, or optional items from the upper front of the SERVOPACK while the power is ON.**
Failure to observe this warning may result in electric shock.
- **Do not damage, press, exert excessive force on, or place heavy objects on the cables.**
Failure to observe this warning may result in electric shock, stopping operation of the product, or fire.
- **Do not modify the product.**
Failure to observe this warning may result in injury, fire, or damage to the product.

WARNING

- Provide an appropriate braking device on the machine side to ensure safety. The holding brake on a servomotor with a brake is not a braking device for ensuring safety.
Failure to observe this warning may result in injury.
- Do not come close to the machine immediately after resetting a momentary power loss. The machine may restart unexpectedly. Take appropriate measures to ensure safety against an unexpected restart.
Failure to observe this warning may result in injury.
-  • Connect the ground terminal according to local electrical codes (100 Ω or less for a SERVOPACK with a 100, 200 V power supply. 10 Ω or less for a SERVOPACK with a 400 V power supply.)
Improper grounding may result in electric shock or fire.
-  • Installation, disassembly, or repair must be performed only by authorized personnel.
Failure to observe this warning may result in electric shock or injury.
- The person who designs a system using the safety function (Hard Wire Baseblock function) must have full knowledge of the related safety standards and full understanding of the instructions in *Σ -V Series User's Manual Design and Maintenance* (SIEP S800000 45/46/60/64).
Failure to observe this warning may result in injury or damage to the product.

■ Storage and Transportation

CAUTION

- Do not store or install the product in the following locations.
Failure to observe this caution may result in fire, electric shock, or damage to the product.
 - Locations subject to direct sunlight
 - Locations subject to temperatures outside the range specified in the storage/installation temperature conditions
 - Locations subject to humidity outside the range specified in the storage/installation humidity conditions
 - Locations subject to condensation as the result of extreme changes in temperature
 - Locations subject to corrosive or flammable gases
 - Locations subject to dust, salts, or iron dust
 - Locations subject to exposure to water, oil, or chemicals
 - Locations subject to shock or vibration
- Do not hold the product by the cables, motor shaft or detector 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.

■ Storage and Transportation (cont'd)

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.

■ Installation

CAUTION

- Never use the product 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

- Be sure to wire correctly and securely.
Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Do not connect a commercial power supply to the U, V, or W terminals for the servomotor connection.
Failure to observe this caution may result in injury or fire.
- Securely connect the main circuit power supply terminals and servomotor connection terminals.
Failure to observe this caution may result in fire.
- Do not bundle or run the main circuit cables together with the I/O signal cables or the encoder cables in the same duct. Keep them separated by at least 30 cm.
Failure to do so may result in malfunction.
- Use shielded twisted-pair wires or multi-core shielded twisted-pair wires for I/O signal cables and the encoder cables.
- I/O signal cables must be no longer than 3 m, encoder cables must be no longer than 50 m, and control power supply (+24 V, 0 V) cables for a 400 V input SERVOPACK must be no longer than 10 m.
- Do not touch the power terminals while the CHARGE lamp is ON after turning power OFF because high voltage may still remain in the SERVOPACK. Make sure the charge indicator is off first before starting an inspection.
- Observe the following precautions when wiring main circuit terminals.
 - Remove detachable main circuit terminals from the SERVOPACK prior to wiring.
 - Insert only one main circuit cable per opening in the main circuit terminals.
 - Make sure that no part of the core wire comes into contact with (i.e., short-circuit) adjacent wires.
- Install a battery at either the host controller or the battery unit of the encoder, but not both.
It is dangerous to install batteries at both ends simultaneously, because that sets up a loop circuit between the batteries.
- Always use the specified power supply voltage.
An incorrect voltage may result in fire or malfunction.
- 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 breakers or other safety devices against short-circuiting in external wiring.
Failure to observe this caution may result in fire.
- Take appropriate and sufficient countermeasures for each form of potential interference when installing systems in the following locations.
 - Locations subject to static electricity or other forms of noise
 - Locations subject to strong electromagnetic fields and magnetic fields
 - Locations subject to possible exposure to radioactivity
 - Locations close to power suppliesFailure to observe this caution may result in damage to the product.

■ Wiring (cont'd)

CAUTION

- Do not reverse the polarity of the battery when connecting it. Failure to observe this caution may result in damage to the battery, the SERVO-PACK, or cause an explosion.
- Wiring or inspection must be performed by a technical expert.
- Use a 24 VDC power supply with double insulation or reinforced insulation.
- Failures caused by incorrect wiring or wrong voltage application in the brake circuit may damage the equipment or cause an accident resulting in death or injury. Follow the procedures and instructions for wiring and trial operation precisely as described in this manual.
- Leakage current may increase depending on the type of noise filter and the grounding conditions.
When using a detector or a breaker for leakage current, select the appropriate one by considering the type of noise filter and the grounding conditions. For details, contact the manufacturer of the noise filter.
- Incorrect wiring or incorrect voltage application to the output circuit may cause short-circuit.
The above failures will prevent the holding brake from working, which may damage the machine or cause an accident resulting in death or injury.
- Inverting the polarity of the brake signal (/BK), i.e. positive logic, will prevent the holding brake from working in case of its signal line disconnection. If this setting is absolutely necessary, check the operation and confirm that there are no safety problems.

■ Operation

CAUTION

- Conduct trial operations on the servomotor alone, with the motor shaft disconnected from the machine to avoid accidents.
Failure to observe this caution may result in injury.
- During trial operation, confirm that the holding brake works correctly. Furthermore, secure system safety against problems such as signal line disconnection.
- 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.
- Do not frequently turn power ON and OFF.
 - Frequently turning power ON and OFF causes elements inside the SERVOPACK to deteriorate. Do not use the servo drive with an application that requires frequently turning power ON and OFF.
 - After the actual operation starts, the allowable interval for turning power ON and OFF is one hour or longer.

■ Operation (cont'd)

CAUTION

- When using JOG operations (Fn002) origin search operations (Fn003), or EasyFFT operations (Fn206), the dynamic brake function does not work for reverse overtravel or forward overtravel. Take necessary precautions.
Failure to observe this caution may result in damage to the product.
- When using the servomotor for a vertical axis, install safety devices to prevent workpieces from falling due to alarms or overtravels. Set the servomotor so that it will stop in the zero clamp state when overtravel occurs.
Failure to observe this caution may cause workpieces to fall due to overtravel.
- When not using turning-less function, set to the correct moment of inertia ratio (Pn103).
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 or damage to the product due to unstable operation.
- When an alarm occurs, remove the cause, reset the alarm after confirming safety, and then resume operation.
Failure to observe this caution may result in damage to the product, fire, or injury.
- Do not use the holding brake of the servomotor for braking.
Failure to observe this caution may result in malfunction.
- Always use the servomotor and SERVOPACK in one of the specified combinations.
Failure to observe this caution may result in fire or malfunction.
- The servomotor stopping method of turning the main-circuit or control-circuit power OFF without turning the servo OFF during operation can not be set in Parameter Pn001. Use the following method to stop the servomotor.
 - When turning the main-circuit power OFF without turning the servo OFF:
The servomotor will be stopped by dynamic braking (DB).
 - When turning the control-circuit power OFF without turning the servo OFF:
The stopping method will vary depending on the SERVOPACK model.
Refer to the Σ -V Series User's Manual Design and Maintenance for details.

■ Maintenance and Inspection

CAUTION

- Do not disassemble the SERVOPACK.
Failure to observe this caution may result in electric shock or injury.
- Do not attempt to change wiring while the power is ON.
Failure to observe this caution may result in electric shock or injury.
- When replacing the SERVOPACK, resume operation only after copying the previous SERVOPACK parameters to the new SERVOPACK.
Failure to observe this caution may result in damage to the product.
- Be sure to eliminate static electricity before operating buttons and switches inside the front cover.
Failure to observe this caution may result in damage to the product.

■ Disposal

CAUTION

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

■ General Precautions

Observe the following general precautions to ensure safe application.

- The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual.
- The drawings presented in this manual are typical examples and may not match the product you received.
- 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.

Warranty

(1) Details of Warranty

■ Period of Warranty

The period of warranty for a product that was purchased (hereafter “delivered product”) is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

■ Scope of Warranty

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the period of warranty above. Defects due to the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life are also outside the scope of this warranty.

Failures that occur for any of the following causes are outside the scope of the warranty.

1. Using or handling the product under conditions or in environments not described in product catalogs or manuals, or separately agreed-upon specifications
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Using the delivered product in a manner in which it was not originally intended
5. Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
6. Events for which Yaskawa is not responsible, such as natural or human-made disasters

(2) Limitations of Liability

1. Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
2. Yaskawa shall not be responsible for programming (including parameter settings) or the results of program execution if a programmable Yaskawa product was programmed by the user or by a third party.

(3) Suitability for Use

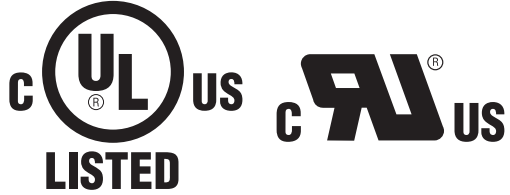
1. It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
3. Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
 - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
 - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
 - Systems, machines, and equipment that may present a risk to life or property
 - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
 - Other systems that require a similar high degree of safety
4. Never use the product for an application involving serious risk to life or property without first ensuring that the required safety has been designed into the system with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
5. The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
6. Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

(4) Changes to Specifications

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. When a catalog or a manual is revised, the catalog or manual code is updated and the new catalog or manual is published as a next edition. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

Applicable Standards

■ North American Safety Standards (UL)



| | Model | UL* Standards (UL File No.) |
|------------|---|--------------------------------|
| SERVOPACK | • SGDV | UL508C (E147823) |
| Servomotor | <ul style="list-style-type: none"> • SGMJV • SGMAV • SGMPS • SGMGV • SGMSV | UL1004 (E165827) |

* Underwriters Laboratories Inc.

■ European Standards



| | Model | Low Voltage Directive | EMC Directive | | Safety Standards |
|------------|---|--|--|--------------------------|-------------------------------|
| | | | EMI | EMS | |
| SERVOPACK | • SGDV | EN50178 EN61800-5-1 | EN55011/A2 group 1 class A EN61800-3 | EN61800-3 EN61000-6-2 | EN954-1 IEC61508-1 to 4 |
| Servomotor | <ul style="list-style-type: none"> • SGMJV • SGMAV • SGMPS • SGMGV • SGMSV | IEC60034-1 IEC60034-5 IEC60034-8 IEC60034-9 | EN55011/A2 group 1 class A EN61800-3 | EN61800-3 EN61000-6-2 | – |

Note: Because SERVOPACKs and servomotors are built into machines, certification is required after installation in the user's product.

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Revision History

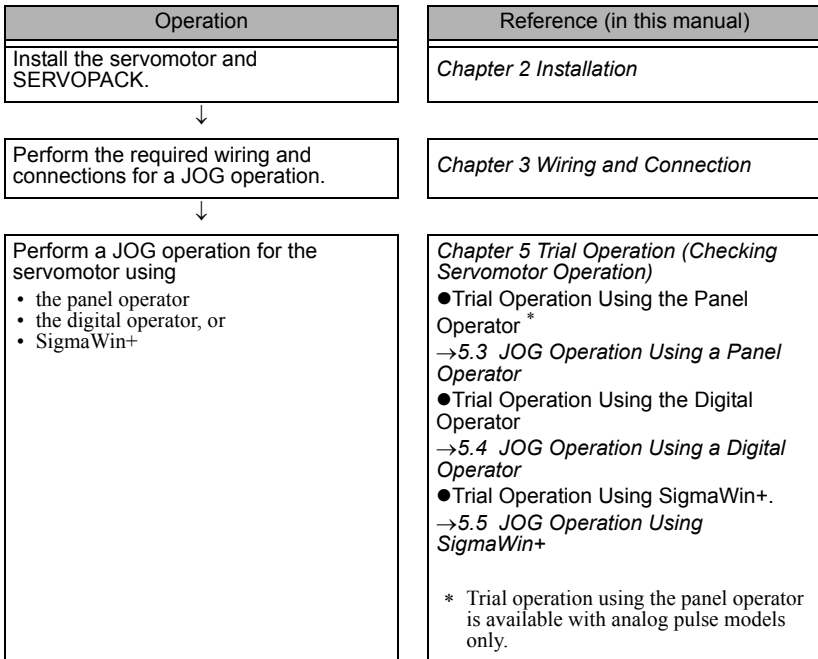
Overview of Setup

This chapter describes how to set up the Σ -V series of servo drives.

This chapter describes the flow of the setup procedure from installation until a JOG operation. A panel operator, a digital operator, and SigmaWin+, (which is an engineering tool that can be used with a PC) are available to set up a servo drive. The panel operator is included with the SERVOPACK of analog pulse models, and the digital operator and SigmaWin+ are sold separately.

| |
|--|
|  CAUTION |
| <ul style="list-style-type: none"> • An alarm or warning may be generated if communications are executed with the host controller during operation using SigmaWin+ or the digital operator. If an alarm or warning is generated, the process currently being executed may be aborted and the system may stop. |

| | |
|---|--|
|  IMPORTANT | Be sure to read <i>5.2 Inspection and Checking before Trial Operation.</i> |
|---|--|



Installation

This chapter describes how to install the servomotor and the SERVOPACK.

| | | |
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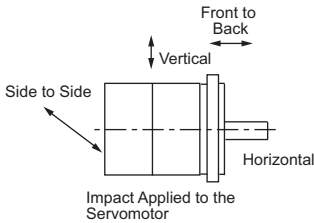
2.1 Installation Environment and Applicable Standards

The installation environment and the applicable standards for servomotors and SERVOPACKs are described in this section.

2.1.1 Servomotor Installation Environment

- Ambient temperature: 0 to 40°C
- Ambient humidity: 80% RH or less (with no condensation)
- Altitude: 1, 000 m or less
- Vibration resistance

The servomotor will withstand the following vibration acceleration in three directions: vertical, side to side, and front to back.



| Servomotor Model | Vibration Acceleration at Flange |
|--|---|
| SGMJV, SGMJV, SGMP, SGMPS, SGMCS-02 to -35 | 49 m/s ² |
| SGMGV-03 to -44, SGMSV-10 to -50 | 49 m/s ² (Front to back direction: 24.5m/s ²) |
| SGMGV-55 to -1E, SGMCS-45 to -2Z | 24.5 m/s ² |
| SGMSV-70 | 14.7 m/s ² |

- Shock resistance: 490 m/s² at servomotor flange
- Installation site: An environment that satisfies the following conditions
 - Indoors and free of corrosive or explosive gases
 - Well-ventilated and free of dust and moisture
 - Facilitates inspection and cleaning
 - Free of high magnetic field

2.1.2 SERVOPACK Installation Environment

- Surrounding air temperature: 0 to 55°C
- Ambient humidity: 90% RH or less (with no condensation)
- Altitude: 1,000 m or less
- Vibration resistance: 4.9 m/s²
- Shock resistance: 19.6 m/s²
- Installation Precautions

- Mounting in a Control Panel

To prevent the temperature around the SERVOPACK from exceeding 55°C, take into account the size of the control panel, the layout of the SERVOPACK, and the cooling method. For details, refer to 2.3 *SERVOPACK Installation*.

- Mounting Near a Heating Unit

To prevent the temperature around the SERVOPACK from exceeding 55°C, suppress radiant heat from the heating unit and temperature rise due to convection.

- Mounting Near a Vibration Source

To prevent vibration from being transmitted to the SERVOPACK, install a vibration isolator underneath the SERVOPACK.

- Mounting to a Location Exposed to Corrosive Gas

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

- Other Locations

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

<Note>

When storing the SERVOPACK with the power OFF, store it in an environment with the following temperature and humidity:

- -20 to +85°C, 90% RH or less. (with no condensation)

2.1.3 Installation Conditions for Applicable Standards

| | |
|-------------------------|--|
| Applicable Standards | UL508C EN50178, EN55011/A2 group1 classA, EN61000-6-2, EN61800-3, EN61800-5-1, EN954-1, IEC61508-1 to 4 |
| Operating Conditions | Overvoltage Category: III Pollution degree: 2 Protection class: IP10 |
| Installation Conditions | UL Standard and Low Voltage Directive: Satisfy the conditions outlined in <i>Σ-V Series AC SERVOPACK SGD V Safety Precautions</i> (TOBP C710800 10) EMC Directive: Certification is required after installation in the user's machine under the conditions outlined in <i>2.4 EMC Installation Conditions</i> of this manual. |

2.2 Servomotor Installation

2.2.1 Orientation

Servomotors can be installed either horizontally or vertically.

Servomotors with gears can be installed only horizontally, depending on gear lubrication conditions. Refer to *Σ -V Series Product Catalog* (KAEP S800000 42) for details.

2.2.2 Installation Standards

The motor rated specifications (rated output, rated torque, and rated speed) are the continuous allowable values at an ambient temperature of 40°C when servomotors are installed with heat sinks.

For more information on heat sinks, refer to *Σ -V Series Product Catalog* (KAEP S800000 42).

When a motor is mounted on a small surface, the motor temperature may rise considerably because of the limited heat radiating abilities of the surface. To restrict the temperature rise, you should either mount a heat sink or limit the electrical, thermal, and mechanical stress on the motor (derating). Refer to *Σ -V Series Product Catalog* (KAEP S800000 42) for the relation between heat sink size and derating. The data in the catalog is given only for reference, as the actual temperature rise depends on how the heat sink (motor mounting section) is fixed on the installation surface and what material is used for the motor mounting section. Always check the actual motor temperature.

If the servomotor is covered, or if a heating element is installed near the servomotor, the motor temperature may rise considerably. In this case, take following counter-measures.

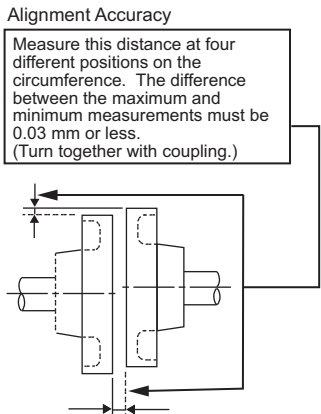
- Reduce the load ratio.
- Reconsider the motor heating conditions.
- Install a cooling fan to forcedly cool the motor.

2.2.3 Connecting Servomotor to Machine

The end of the motor shaft is coated with anticorrosive paint. Thoroughly remove the paint prior to installation.

Align the shaft of the servomotor with the shaft of the machine, and then couple the shafts. Install the servomotor so that alignment accuracy falls within the following range. Vibration will damage the bearings or encoders if the shafts are not properly aligned.

Do not allow direct impact to be applied to the shafts when installing the coupling as the encoder mounted on the opposite end of the shaft may be damaged.



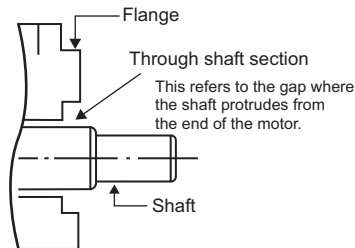
2.2.4 Protective Structure

The servomotor protective structure* is described below.

| Model | Without Gears | With Gears |
|-----------------|---|------------|
| SGMJV, SGMAV | IP65 | IP55 |
| SGMPS | IP55 IP67 (Optional) | IP55 |
| SGMGV | IP67 | – |
| SGMSV | IP67 (SGMSV-70 servomotor only: IP22) | – |
| SGMCS-02 to -35 | IP42 (expect for gaps on the rotating section of the shaft) | – |
| SGMCS-45 to -2Z | IP44 | – |

* Except through shaft section. The protective structure specifications can be satisfied only when using a specified cable.

When the through shaft section is subject to oil exposure, refer to 2.2.5 *Other Precautions*.



2.2.5 Other Precautions

■ Handling Oil and Water

If the servomotor is used in a location that is subject to water or oil mist, use a servomotor with an oil seal to seal the through shaft section. Precautions on using a servomotor with an oil seal are described below.

- Put the oil surface under the oil seal lip.
- Use an oil seal in favorably lubricated condition.
- When using a servomotor with its shaft upward direction, be sure that oil will not stay in the oil seal lips.

■ Cable Stress

Make sure there are no bends or tension on the motor main circuit cables and encoder cables.

Be especially careful to wire encoder cables so that they are not subject to stress because the core wires are very thin at only 0.2 or 0.3 mm².

■ Connectors

Observe the following precautions:

- Make sure there is no foreign matters such as dust and metal chips in the connector before connecting.
- When the connectors are connected to the motor, be sure to connect the end of motor main circuit cables before connecting the encoder cable's end.
If the encoder cable's end is connected, the encoder may break because of the voltage differences between FG.
- Make sure of the pin arrangement.
- Do not apply shock to resin connectors. Otherwise, they may be damaged.
- When handling a servomotor with its cables connected, hold the servomotor or the connectors and cables will be damaged.
- Fix the connector to SGMJV, SGMAV, SGMPS-01/-02/-04 or SGMGV-03/-05 servomotors with screws. Make sure that the connector is securely fixed with screws.
If not, the protective construction specifications may not be satisfied.
- Be sure not to apply stress on the connector. The connector may be damaged by stress.

■ Radial and Thrust loads

Design the mechanical system so thrust and radial loads applied to the servomotor shaft end during operation fall within the allowable ranges of each motor. Refer to *Σ-V Series Product Catalog* (KAEP S800000 42) for the allowable ranges.

2.3 SERVOPACK Installation

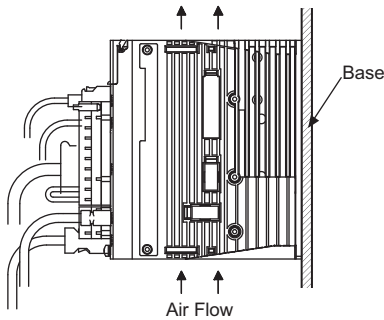
2.3.1 Orientation

The SERVOPACK is available in models that are base-mounted, models that are rack-mounted, and models that are duct-ventilated. In any case, mount the SERVOPACK with a vertical orientation.

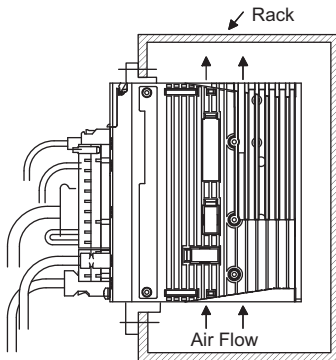
Firmly secure the SERVOPACK to the mounting surface, using either two or four mounting holes depending on the SERVOPACK capacity.

Note: For SERVOPACKs of command option attachable type, installation conditions may differ depending on the attached option module. For details, refer to the user's manual for each option module.

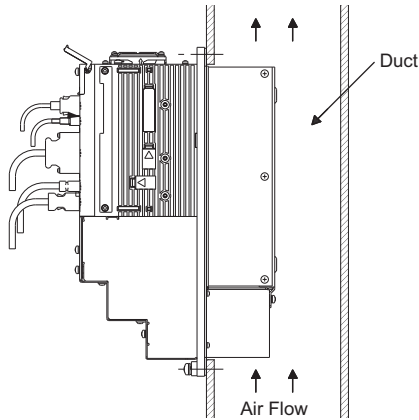
- Base-mounted



- Rack-mounted



- Duct-ventilated



2.3.2 Installation Standards

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

Note: For SERVOPACKs of command option attachable type, installation conditions may differ depending on the attached option module. For details, refer to the user's manual for each option module.

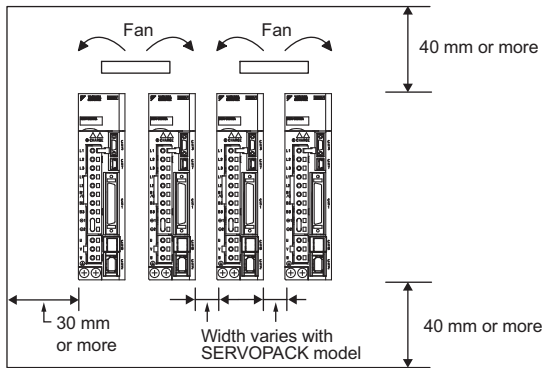
- SERVOPACK Mounting Orientation

Mount the SERVOPACK vertically to the wall, with the front panel (the side with the panel operator display) facing out.

- Cooling

Refer to the following diagram and leave sufficient space for cooling by fans and natural convection.

- Mounting SERVOPACKs Side by Side in a Control Panel



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

| SERVOPACK Model SGDV- | Side | | Top and bottom |
|--|---------------|---------------|----------------|
| | Left | Right | |
| R70F, R90F, 2R1F, R70A, R90A, 1R6A, 2R8A | 1 mm or more | | 40 mm or more |
| 2R8F, 3R8A, 5R5A, 7R6A | 1 mm or more | 10 mm or more | |
| 120A, 180A, 200A, 330A, 470A, 550A, 590A, 780A, 1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D, 210D, 260D, 280D, 370D | 10 mm or more | | |

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

- Inside the Control Panel

The conditions inside the control panel should be the same as the environmental conditions of the SERVOPACK. Refer to 2.1.2 *SERVOPACK Installation Environment*.

2.4 EMC Installation Conditions

This section describes the recommended installation conditions that satisfy EMC guidelines for each model of the SGDV SERVOPACK. The conditions required for the standard type (base-mounted) of SERVOPACK are described. Refer to this section for other SERVOPACK models such as the rack-mounted types as well.

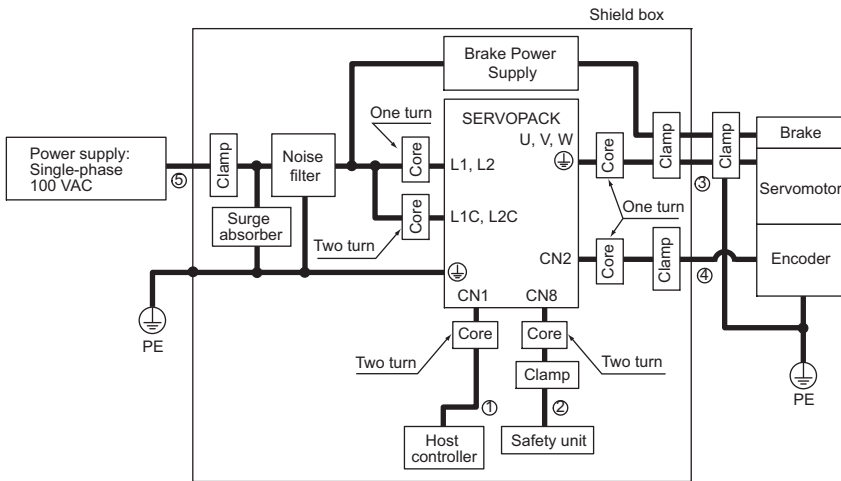
This section describes the EMC installation conditions satisfied in test conditions prepared by Yaskawa. The actual EMC level may differ depending on the actual system's configuration, wiring, and other conditions. However, because this product is built-in, check that the following conditions are still met after being installed in the user's product.

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

2.4.1 SGDV-□□□□01A (Analog Pulse Model)

■ Single-phase 100 V

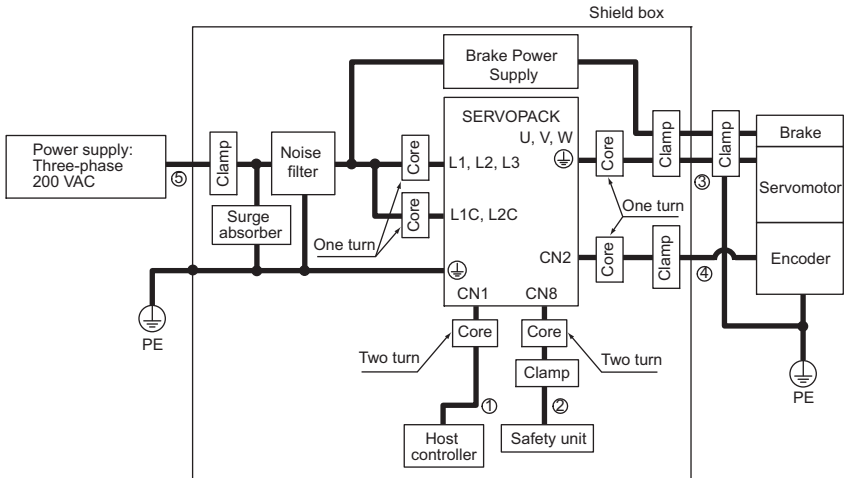
- SGDV-□□□F01A (□□□ = R70, R90, 2R1, 2R8)



| Symbol | Cable Name | Specification |
|--------|--------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield cable |

■ Three-phase 200 V

- SGDV-□□□A01A (□□□ = R70, R90, 1R6, 2R8, 3R8, 5R5, 7R6)

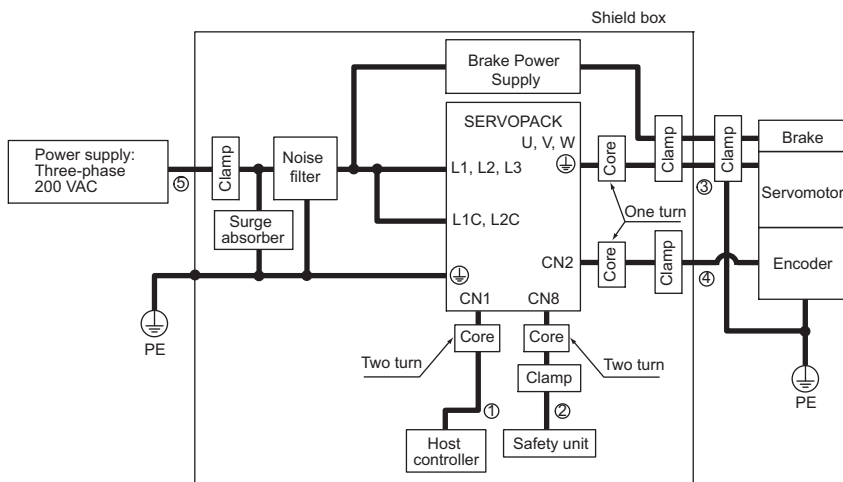


| Symbol | Cable Name | Specification |
|--------|--------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield cable |

2.4.1 SGDV-□□□□01A (Analog Pulse Model)

■ Three-phase 200 V

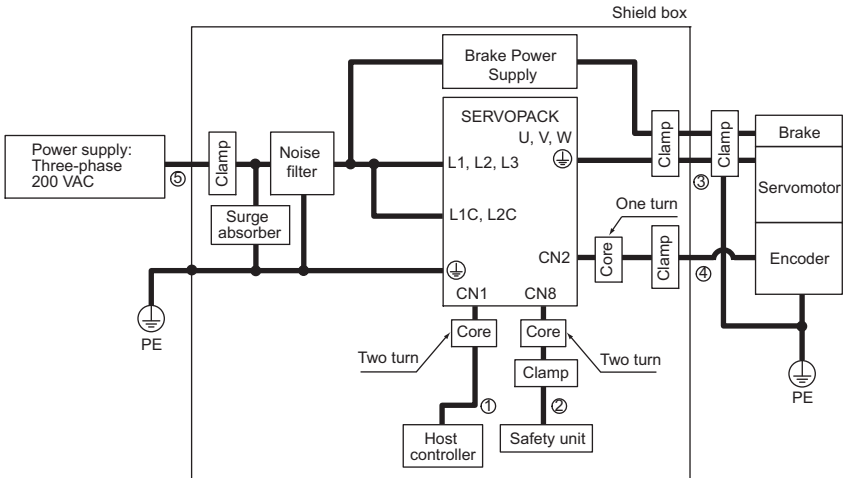
- SGDV-□□□A01A (□□□ = 120)



| Symbol | Cable Name | Specification |
|--------|--------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield cable |

■ Three-phase 200 V

- SGDV-□□□A01A (□□□ = 180, 200, 330)

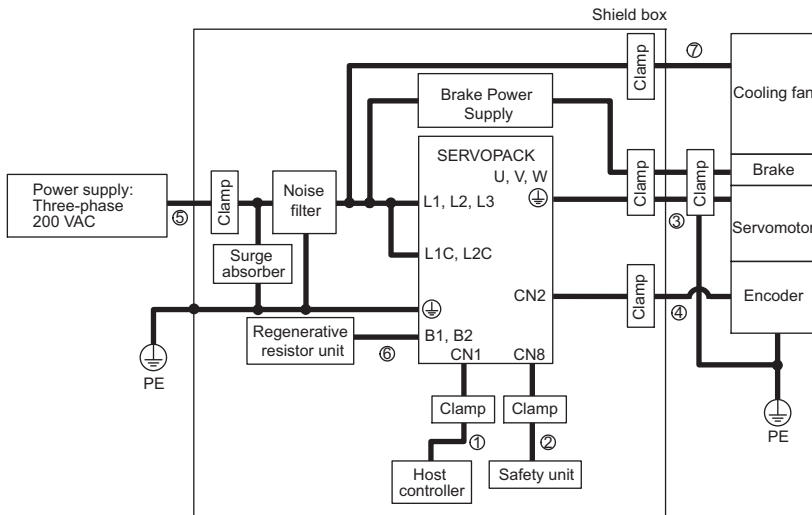


| Symbol | Cable Name | Specification |
|--------|--------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield cable |

2.4.1 SGDV-□□□□01A (Analog Pulse Model)

■ Three-phase 200 V

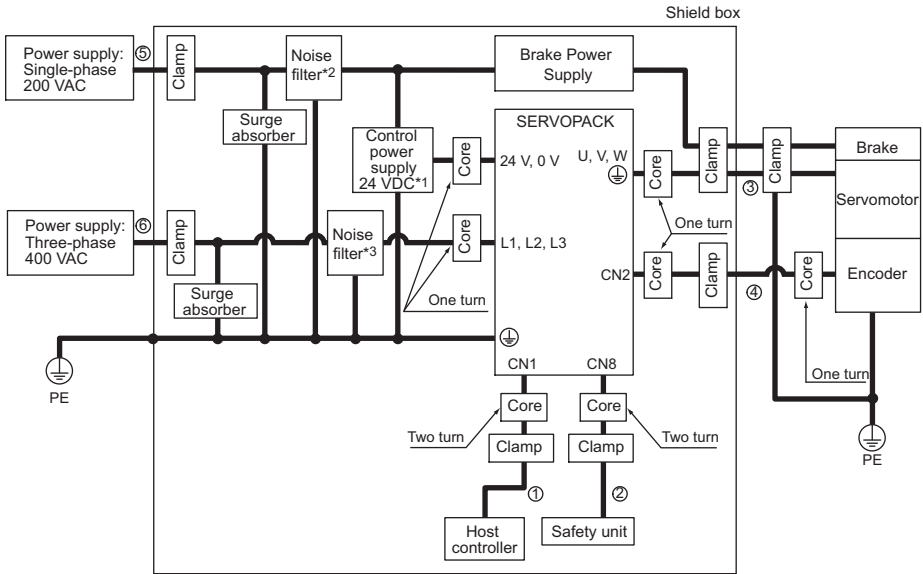
- SGDV-□□□□A01A (□□□ = 470, 550, 590, 780)



| Symbol | Cable Name | Specification |
|--------|----------------------------------|------------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield cable |
| ⑥ | Regenerative resistor unit cable | Non-shield cable |
| ⑦ | Cooling fan cable | Shield cable |

■ Three-phase 400 V

- SGDV-□□□D01A (□□□ = 1R9, 3R5, 5R4, 8R4, 120, 170)



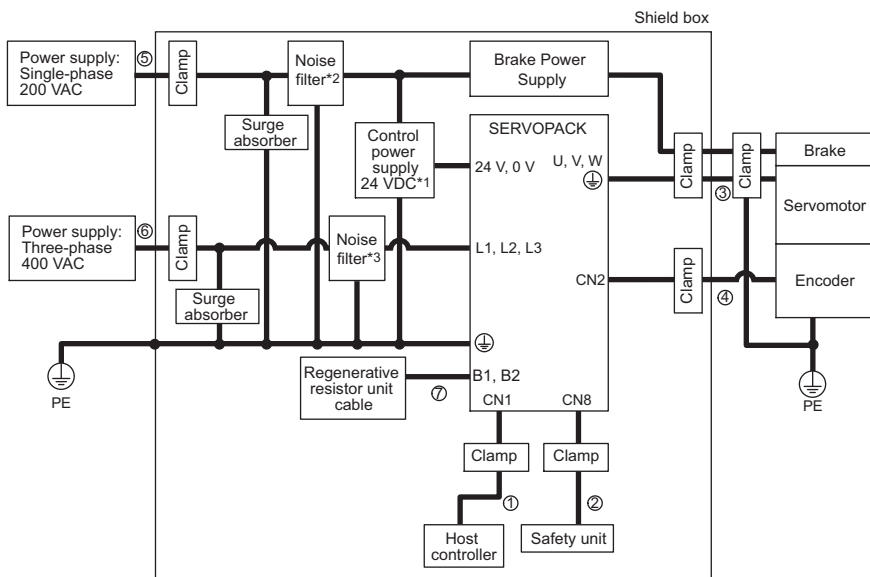
| Symbol | Cable Name | Specification |
|--------|--------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Control power cable | Shield cable |
| ⑥ | Main circuit cable | Shield cable |

- *1. Products that have received CE marking are recommended for the 24 VDC power supply.
- *2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.
Model number: FN2070-6/07 (SCHAFFNER)
- *3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

2.4.1 SGDV-□□□□01A (Analog Pulse Model)

■ Three-phase 400 V

- SGDV-□□□□01A (□□□ = 210, 260, 280, 370)



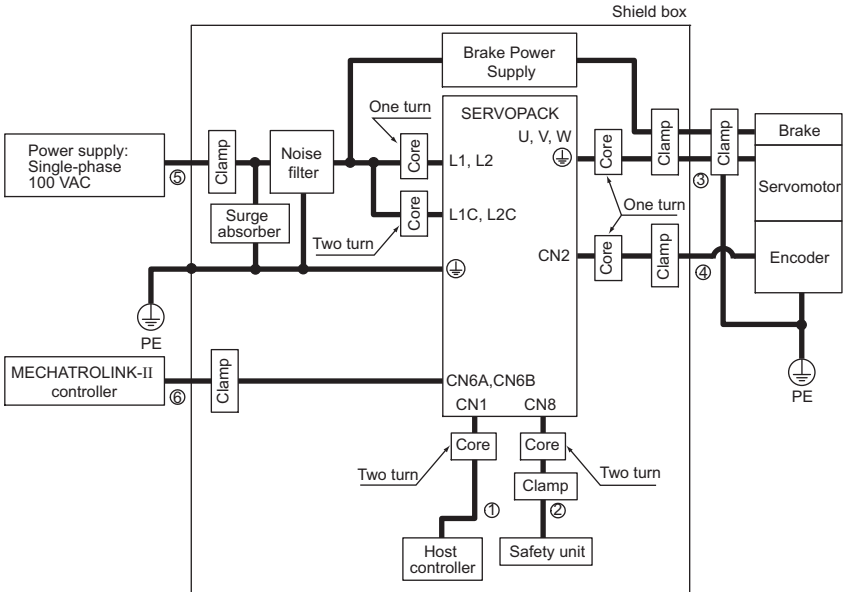
| Symbol | Cable Name | Specification |
|--------|----------------------------------|------------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Control power cable | Shield cable |
| ⑥ | Main circuit cable | Shield cable |
| ⑦ | Regenerative resistor unit cable | Non-shield cable |

- *1. Products that have received CE marking are recommended for the 24 VDC power supply.
- *2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.
Model number: FN2070-6/07 (SCHAFFNER)
- *3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S80000 42)

2.4.2 SGDV-□□□□11A (M-II Model)

■ Single-phase 100 V

- SGDV-□□□F11A (□□□ = R70, R90, 2R1, 2R8)

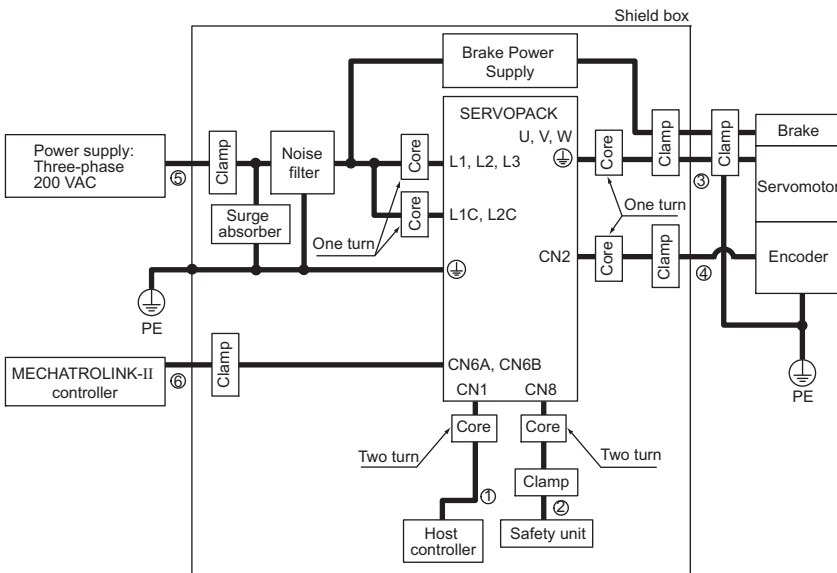


| Symbol | Cable Name | Specification |
|--------|-------------------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield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

2.4.2 SGDV-□□□□11A (M-II Model)

■ Three-phase 200 V

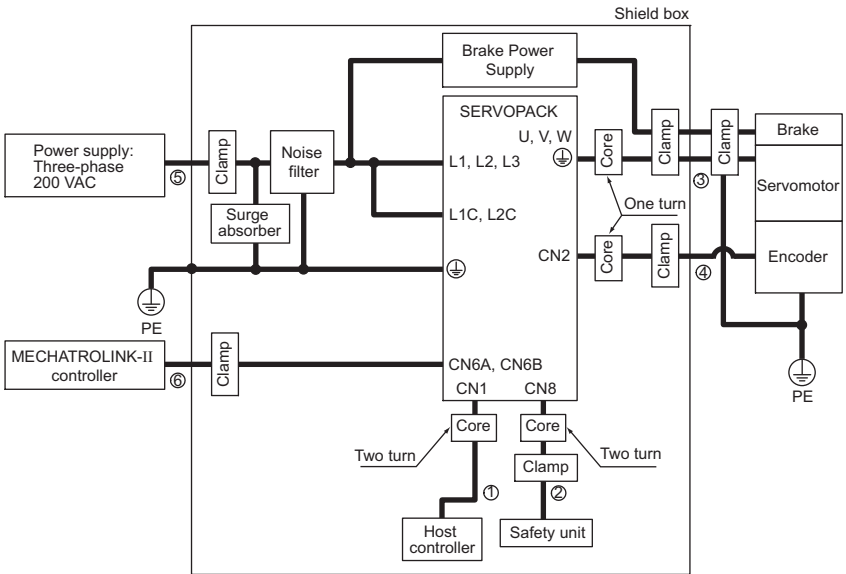
- SGDV-□□□□A11A (□□□ = R70, R90, 1R6, 2R8, 3R8, 5R5, 7R6)



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

■ Three-phase 200 V

- SGDV-□□□A11A (□□□ = 120)

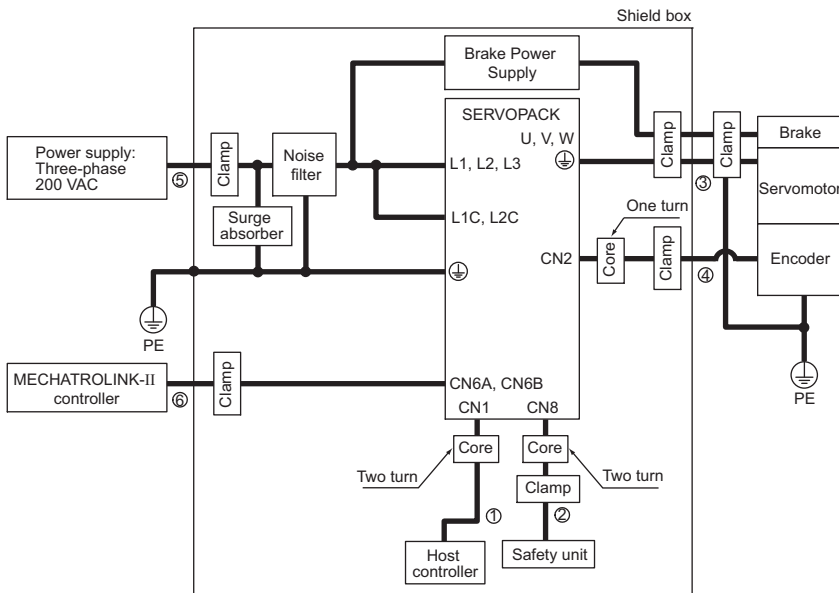


| Symbol | Cable Name | Specification |
|--------|-------------------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield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

2.4.2 SGDV-□□□□11A (M-II Model)

■ Three-phase 200 V

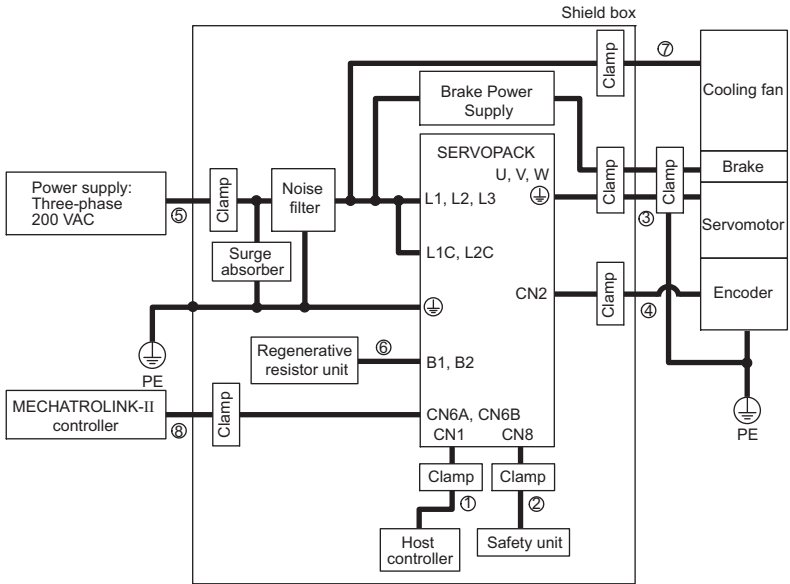
- SGDV-□□□□A11A (□□□ = 180, 200, 330)



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

■ Three-phase 200 V

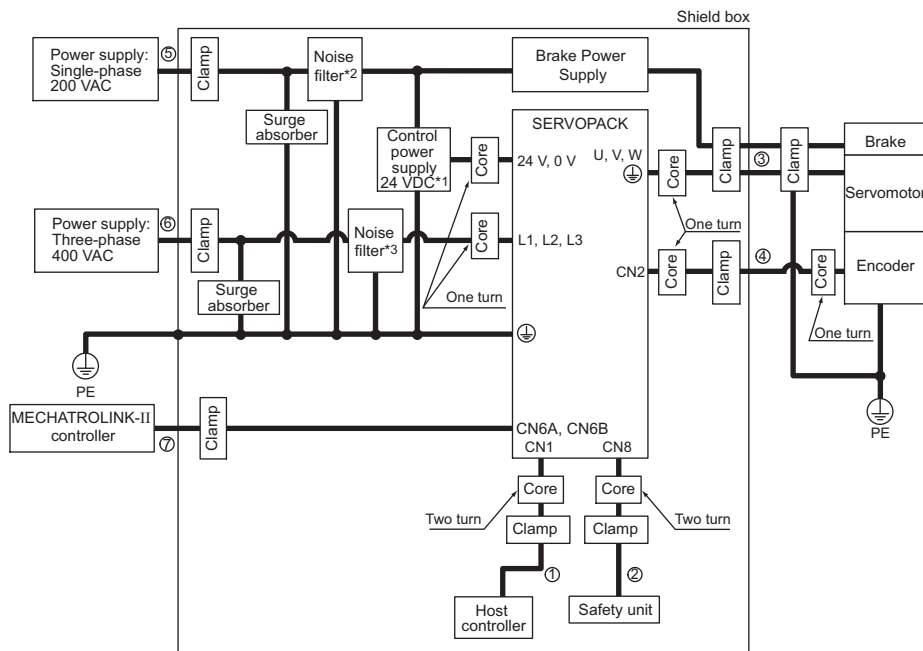
- SGDV-□□□A11A (□□□ = 470, 550, 590, 780)



| Symbol | Cable Name | Specification |
|--------|-------------------------------------|------------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield cable |
| ⑥ | Regenerative resistor unit cable | Non-shield cable |
| ⑦ | Cooling fan cable | Shield cable |
| ⑧ | MECHATROLINK-II communication cable | Shield cable |

■ Three-phase 400 V

- SGDV-□□□□11A (□□□ = 1R9, 3R5, 5R4, 8R4, 120, 170)

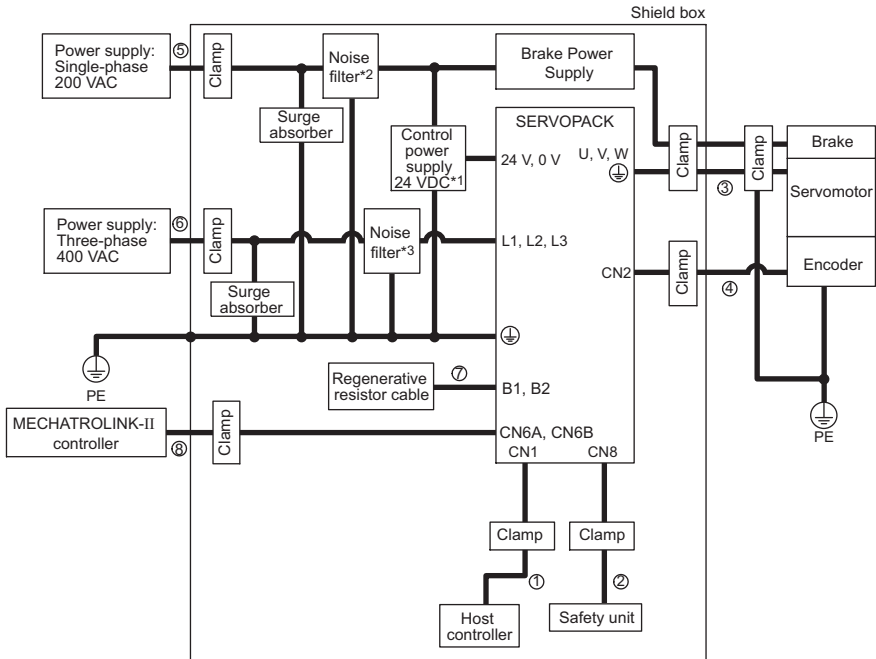


| Symbol | Cable Name | Specification |
|--------|-------------------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Control power cable | Shield cable |
| ⑥ | Main circuit cable | Shield cable |
| ⑦ | MECHATROLINK-II communication cable | Shield cable |

- *1. Products that have received CE marking are recommended for the 24 VDC power supply.
- *2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.
Model number: FN2070-6/07 (SCHAFFNER)
- *3. For more information on this filter, refer to *ΣV Series Product Catalog*. (KAEP S800000 42)

■ Three-phase 400 V

- SGDV-□□□D11A (□□□ = 210, 260, 280, 370)



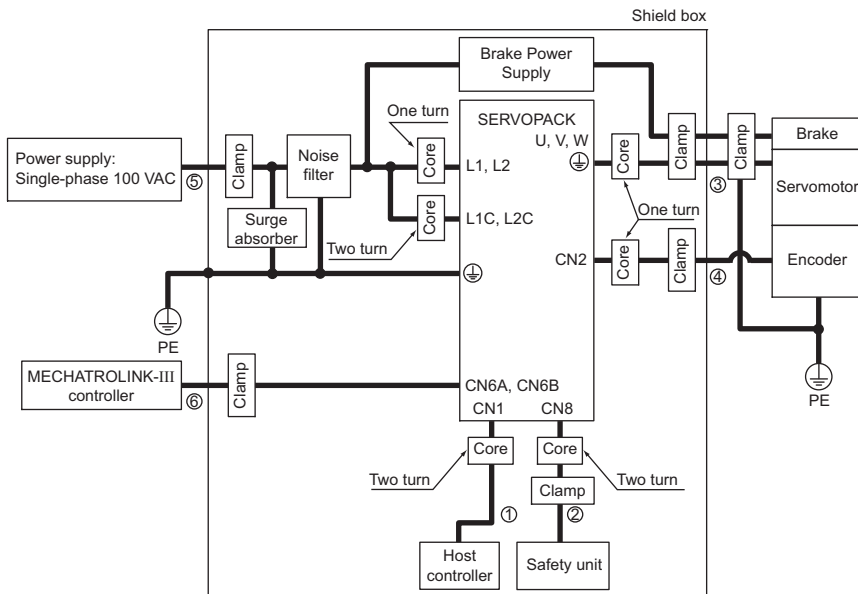
| Symbol | Cable Name | Specification |
|--------|-------------------------------------|------------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Control power cable | Shield cable |
| ⑥ | Main circuit cable | Shield cable |
| ⑦ | Regenerative resistor unit cable | Non-shield cable |
| ⑧ | MECHATROLINK-II communication cable | Shield cable |

- *1. Products that have received CE marking are recommended for the 24 VDC power supply.
- *2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.
Model number: FN2070-6/07 (SCHAFFNER)
- *3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

2.4.3 SGDV-□□□□21A (M-III Model)

■ Single-phase 100 V

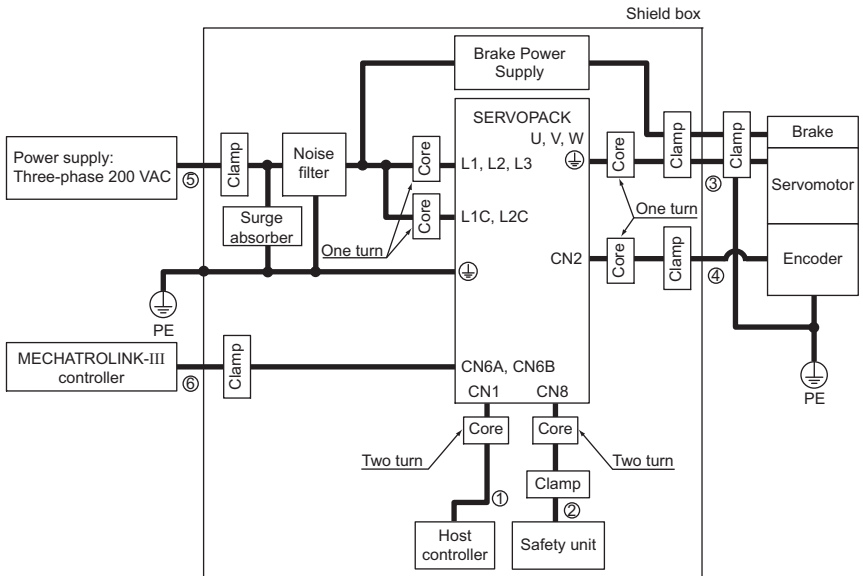
- SGDV-□□□□F21A (□□□□ = R70, R90, 2R1, 2R8)



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

■ Three-phase 200 V

- SGDV-□□□A21A (□□□ =R70, R90, 1R6, 2R8, 3R8, 5R5, 7R6)

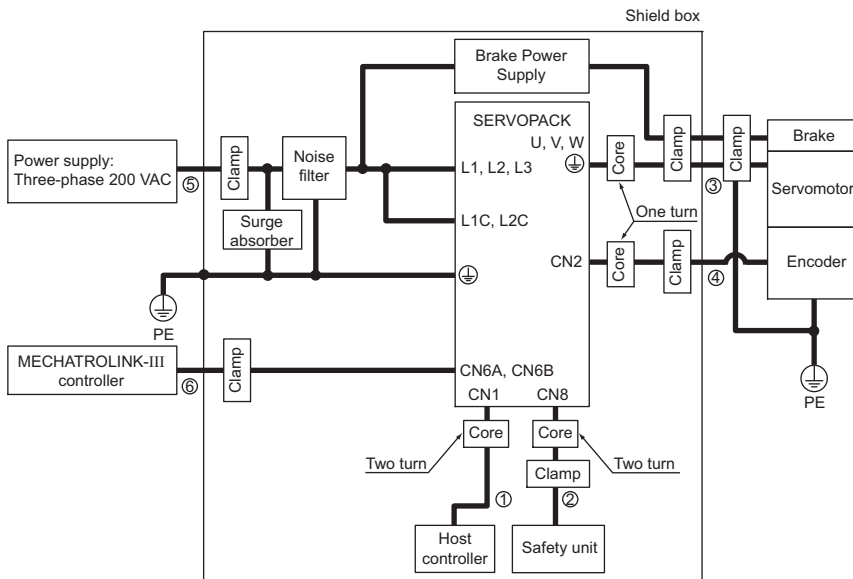


| Symbol | Cable Name | Specification |
|--------|--------------------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable |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

2.4.3 SGDV-□□□□21A (M-III Model)

■ Three-phase 200 V

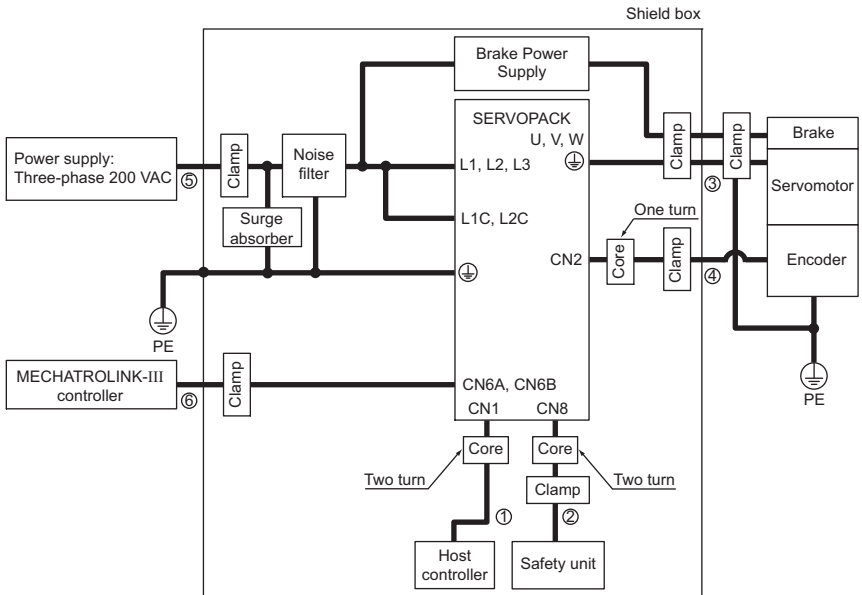
- SGDV-□□□□A21A (□□□ = 120)



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

■ Three-phase 200 V

- SGDV-□□□A21A (□□□ = 180, 200, 330)

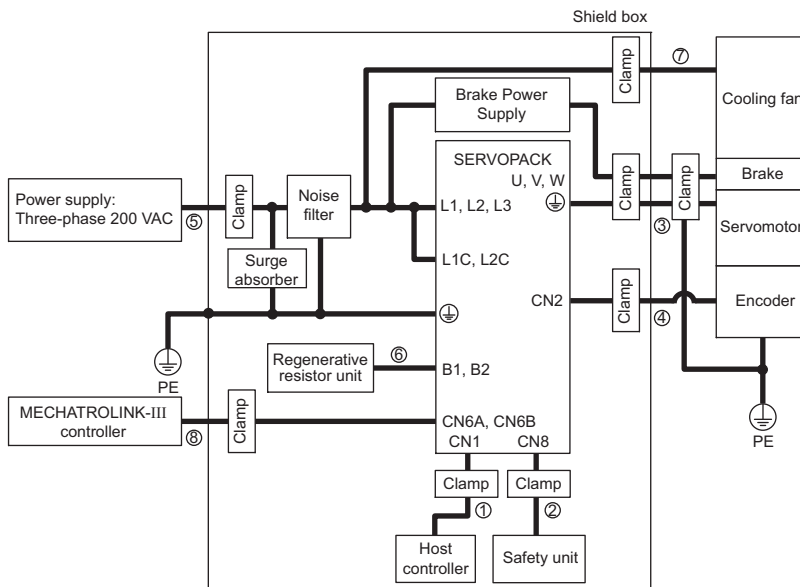


| Symbol | Cable Name | Specification |
|--------|--------------------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable |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

2.4.3 SGDV-□□□□21A (M-III Model)

■ Three-phase 200 V

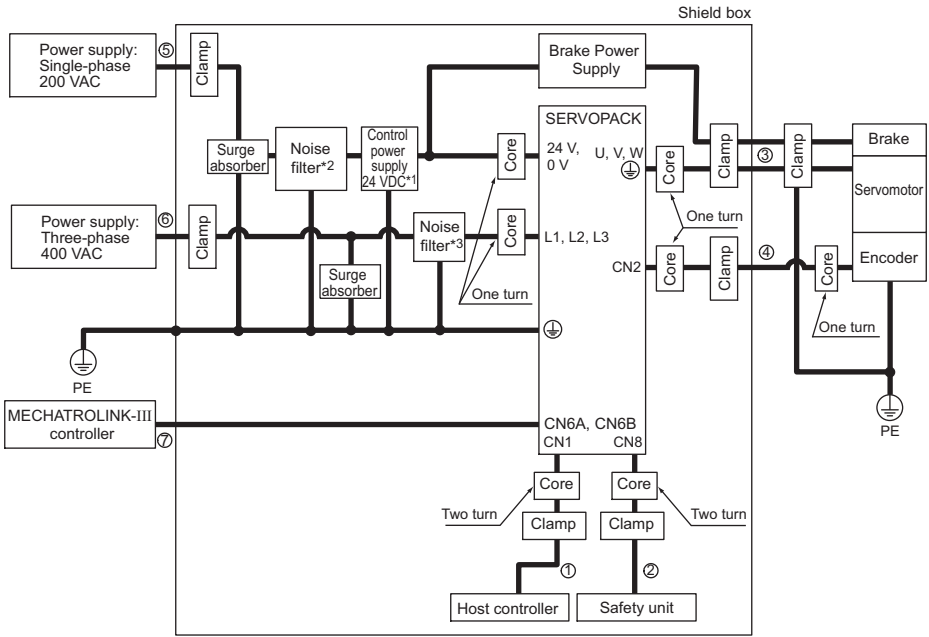
- SGDV-□□□□A21A (□□□ = 470, 550, 590, 780)



| Symbol | Cable Name | Specification |
|--------|--------------------------------------|------------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Main circuit cable | Shield cable |
| ⑥ | Regenerative resistor unit cable | Non-shield cable |
| ⑦ | Cooling fan cable | Shield cable |
| ⑧ | MECHATROLINK-III communication cable | Shield cable |

■ Three-phase 400 V

- SGDV-□□□D21A (□□□ = 1R9, 3R5, 5R4, 8R4, 120, 170)



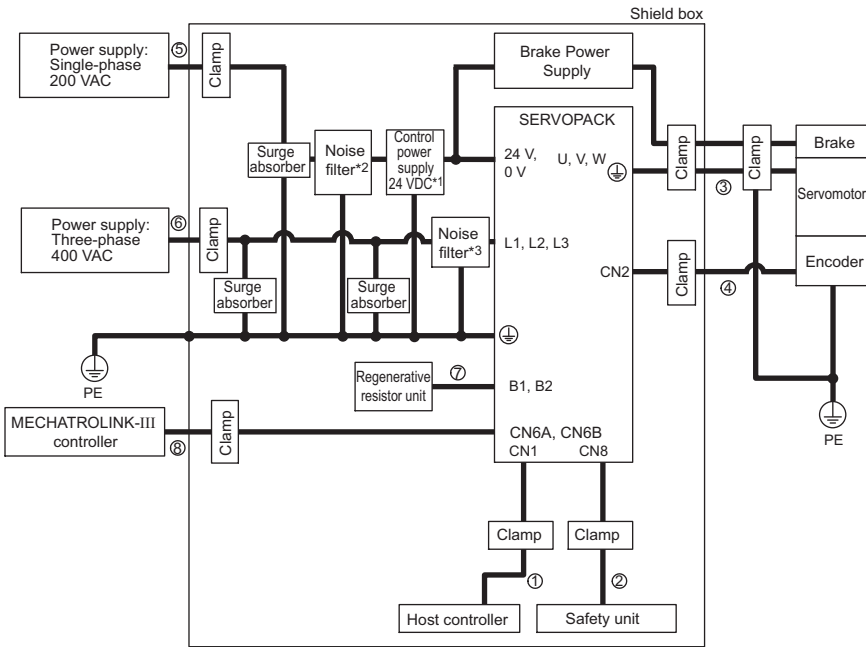
| Symbol | Cable Name | Specification |
|--------|--------------------------------------|---------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Control power cable | Shield cable |
| ⑥ | Main circuit cable | Shield cable |
| ⑦ | MECHATROLINK-III communication cable | Shield cable |

- *1. Products that have received CE marking are recommended for the 24 VDC power supply.
- *2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.
Model number: FN2070-6/07 (SCHAFFNER)
- *3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S80000 42)

2.4.3 SGD V-□□□□21A (M-III Model)

■ Three-phase 400 V

- SGD V-□□□□21A (□□□ = 210, 260, 280, 370)



| Symbol | Cable Name | Specification |
|--------|--------------------------------------|------------------|
| ① | I/O signal cable | Shield cable |
| ② | Safety signal cable | Shield cable |
| ③ | Motor main circuit cable | Shield cable |
| ④ | Encoder cable | Shield cable |
| ⑤ | Control power cable | Shield cable |
| ⑥ | Main circuit cable | Shield cable |
| ⑦ | Regenerative resistor unit cable | Non-shield cable |
| ⑧ | MECHATROLINK-III communication cable | Shield cable |

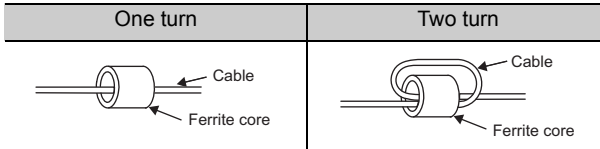
- *1. Products that have received CE marking are recommended for the 24 VDC power supply.
- *2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.
Model number: FN2070-6/07 (SCHAFFNER)
- *3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

2.4.4 SGD□-□□□□E1A (Command Option Attachable Type)

For SERVOPACKs of command option attachable type, EMC installation conditions may differ depending on the attached option module. For details, refer to the user's manual for each option module.

2.4.5 Other Precautions

■ Attachment Methods of Ferrite Cores



■ Recommended Ferrite Core

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

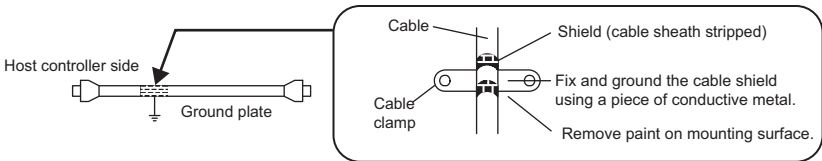
■ Recommended Noise Filter and Surge Absorber

For more information on recommended noise filters and surge absorbers, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

■ Fixing the Cable

Fix and ground the cable shield using a piece of conductive metal.

- Example of Cable Clamp



■ Shield Box

A shield box, which is a closed metallic enclosure, is effective as reinforced shielding against electromagnetic interference (EMI) from SERVOPACKs. The structure of the box should allow the main body, door, and cooling unit to be attached to the ground. The box opening should be as small as possible.

<Note>

Do not connect the digital operator and the analog monitor cable to the SERVOPACK during operations. Connect them only when the machinery is stopped during maintenance.

Wiring and Connection

This chapter describes how to set up the wiring and connections required for trial operation.

For more information on the wiring and connection, refer to the following manuals.

- Σ -V Series User's Manual Design and Maintenance Rotational Motor/
Analog Voltage and Pulse Train Reference (SIEP S800000 45)
- Σ -V Series User's Manual Design and Maintenance Rotational Motor/
MECHATROLINK-II Communications Reference (SIEP S800000 46)
- Σ -V Series User's Manual Design and Maintenance Rotational Motor/
Command Option Attachable Type (SIEP S800000 60)
- Σ -V Series User's Manual Design and Maintenance Rotational Motor/
MECHATROLINK-III Communications Reference (SIEP S800000 64)

| | | |
|-------|---|------|
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| 3.2 | System Configuration Diagram | 3-3 |
| 3.2.1 | Connecting to SGD \square \square \square \square 01A SERVOPACK (Analog Pulse Model) | 3-3 |
| 3.2.2 | Connecting to SGD \square \square \square \square 11A SERVOPACK (M-II Model) | 3-7 |
| 3.2.3 | Connecting to SGD \square \square \square \square 21A SERVOPACK (M-III Model) | 3-11 |
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3.1 Precautions for Wiring

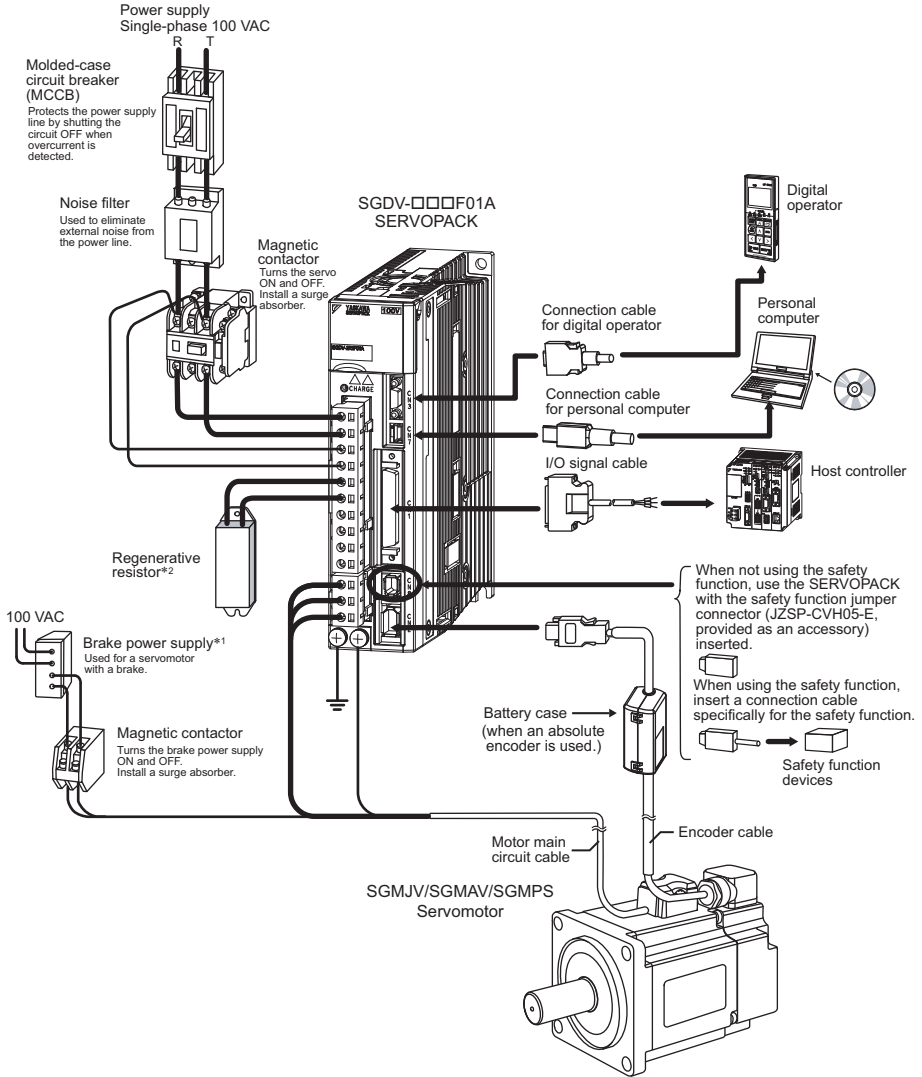
 CAUTION

- Be sure to wire correctly and securely.
Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Do not bundle or run the main circuit cables together with the I/O signal cables or the encoder cables in the same duct. Keep them separated by at least 30 cm.
Failure to do so may result in malfunction.
- Use shielded twisted-pair wires or multi-core shielded twisted-pair wires for I/O signal cables and the encoder cables.
- I/O signal cables must be no longer than 3 m, encoder cables must be no longer than 50 m, and control power supply (+24 V, 0 V) cables for a 400 V input SERVOPACK must be no longer than 10 m.
- Do not touch the power terminals while the CHARGE lamp is ON after turning power OFF because high voltage may still remain in the SERVOPACK.
Make sure the charge indicator is off first before starting an inspection.
- Leakage current may increase depending on the type of noise filter and the grounding conditions.
When using a detector or a breaker for leakage current, select the appropriate one by considering the type of noise filter and the grounding conditions.
For details, contact the manufacturer of the noise filter.
- Incorrect wiring or incorrect voltage application to the output circuit may cause short-circuit.
The above failures will prevent the holding brake from working, which may damage the machine or cause an accident resulting in death or injury.
- Inverting the polarity of the brake signal (/BK), i.e. positive logic, will prevent the holding brake from working in case of its signal line disconnection.
If this setting is absolutely necessary, check the operation and confirm that there are no safety problems.

3.2 System Configuration Diagram

3.2.1 Connecting to SGD-V-□□□□01A SERVOPACK (Analog Pulse Model)

■ SGD-V-□□□□01A

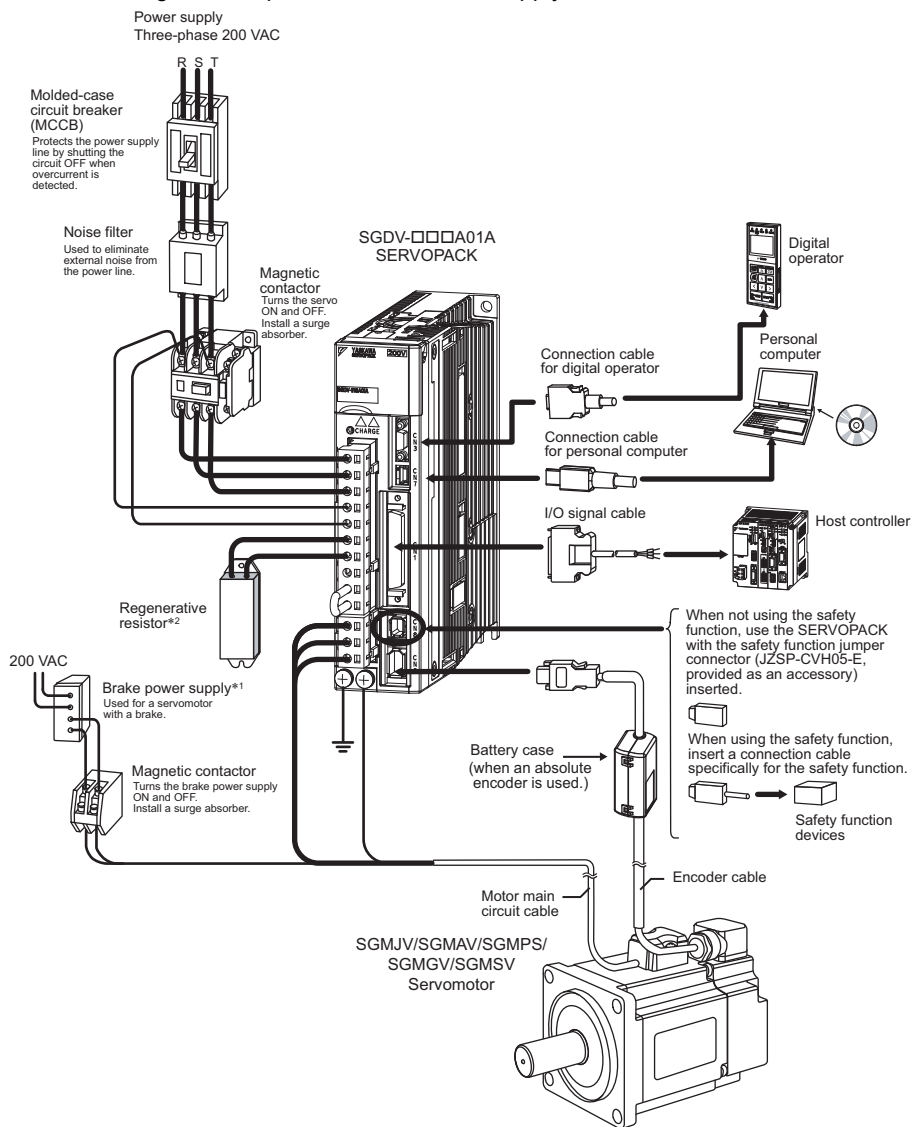


*1. Use a 24 VDC power supply. (not included)

*2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.

■ SGDV-□□□□01A

- Using a Three-phase, 200-V Power Supply

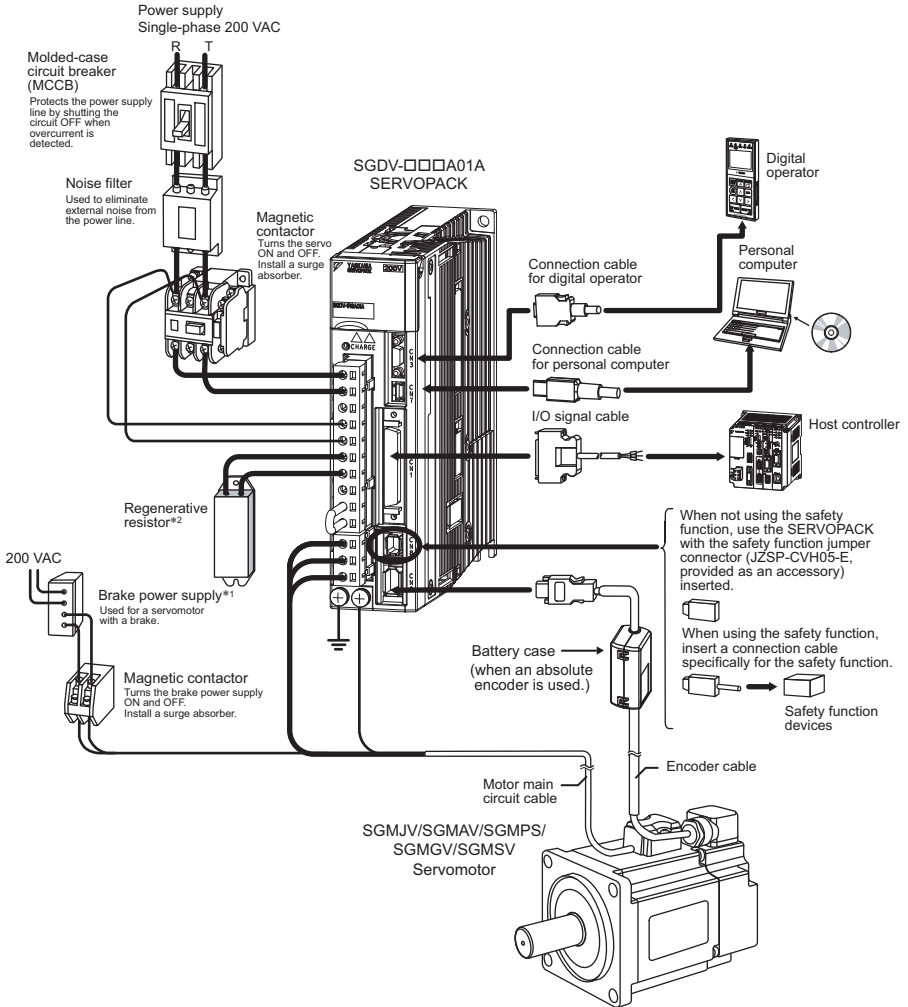


*1. Use a 24 VDC power supply. (not included)

*2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.

• Using a Single-phase, 200-V Power Supply

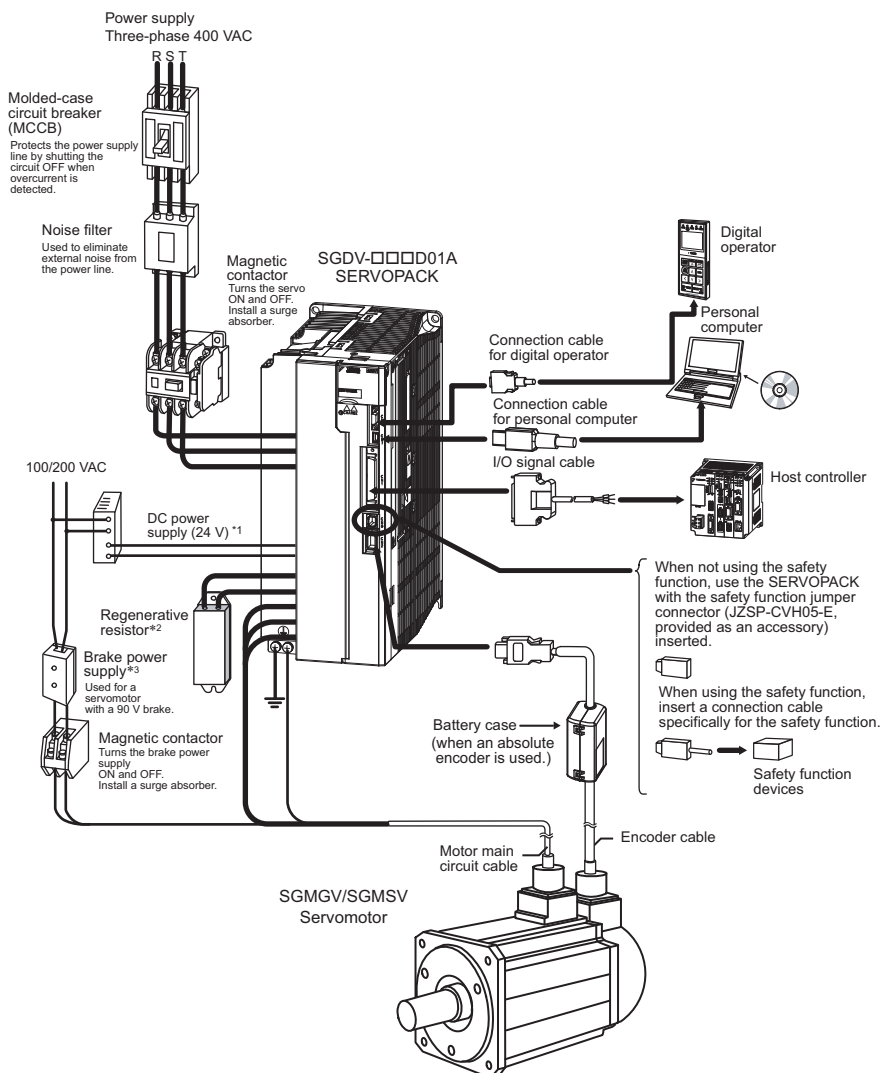
The Σ -V Series SERVOPACK for a 200-V power supply input has input specifications for a three-phase power supply, but some models can also be used with a single-phase 200-V power supply. For details, refer to *Σ -V Series User's Manual Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference* (SIEP S800000 45).



- *1. Use a 24 VDC power supply. (not included)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.

3.2.1 Connecting to SGDV-□□□□01A SERVOPACK (Analog Pulse Model)

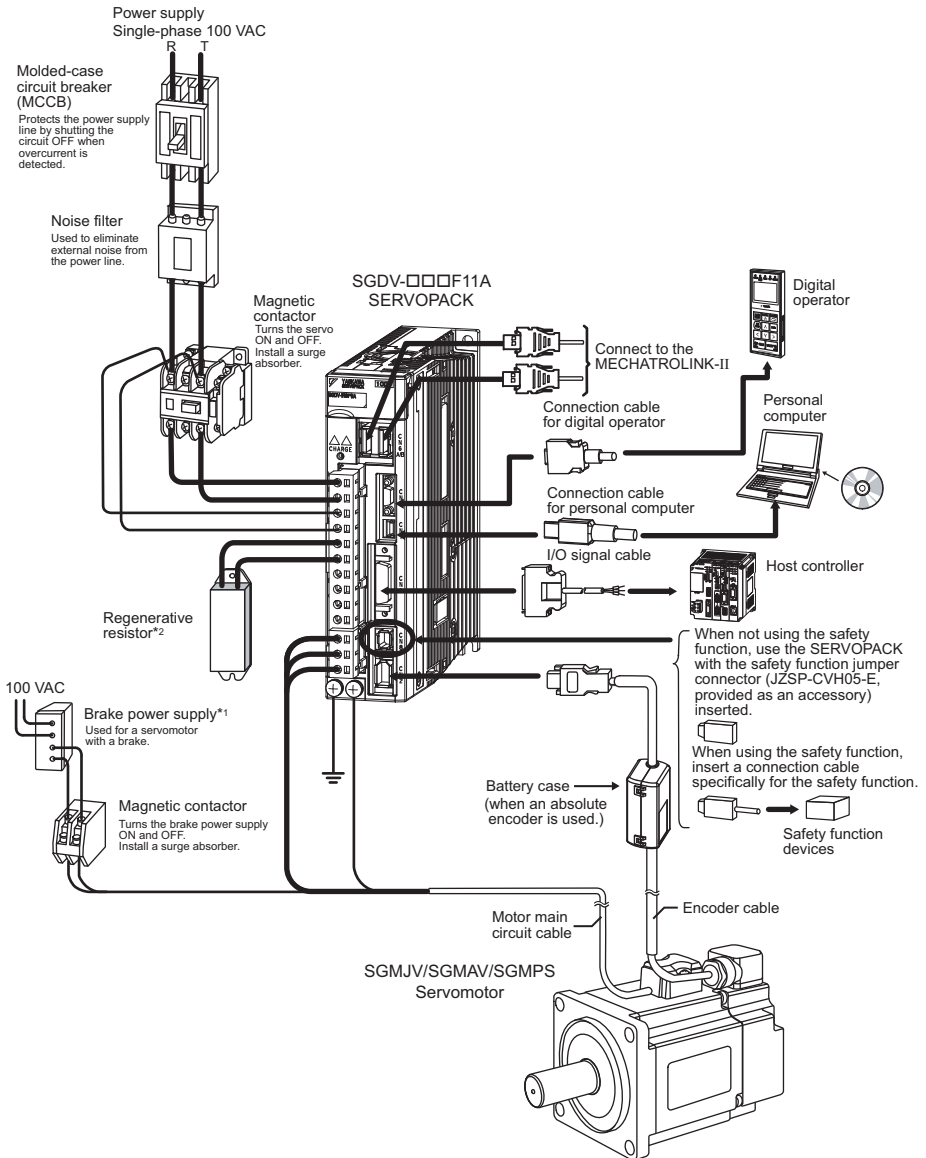
■ SGDV-□□□□01A



- *1. Use a 24 VDC power supply with double insulation or reinforced insulation. (The power supply is not included)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to *3.4 Connecting Regenerative Resistors*.
- *3. Use a following power supply for 90 V brake. For details, refer to *Σ-V series Product Catalog* (KAEP S800000 42).
 - For 200 V input voltage: LPSE-2H01-E
 - For 100 V input voltage: LPDE-1H01-E

3.2.2 Connecting to SGDV-□□□□11A SERVOPACK (M-II Model)

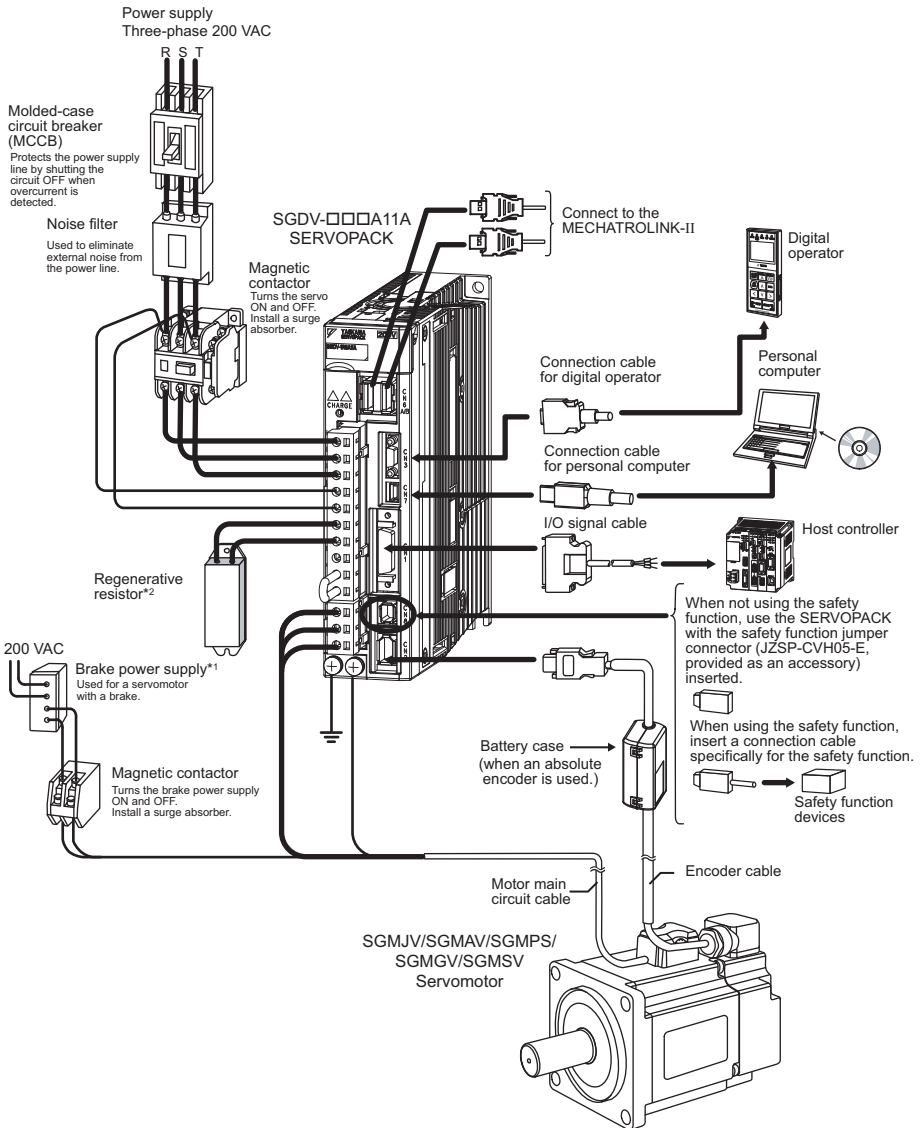
■ SGDV-□□□□11A



3.2.2 Connecting to SGDV-□□□□11A SERVOPACK (M-II Model)

■ SGDV-□□□□11A

- Using a Three-phase, 200-V Power Supply

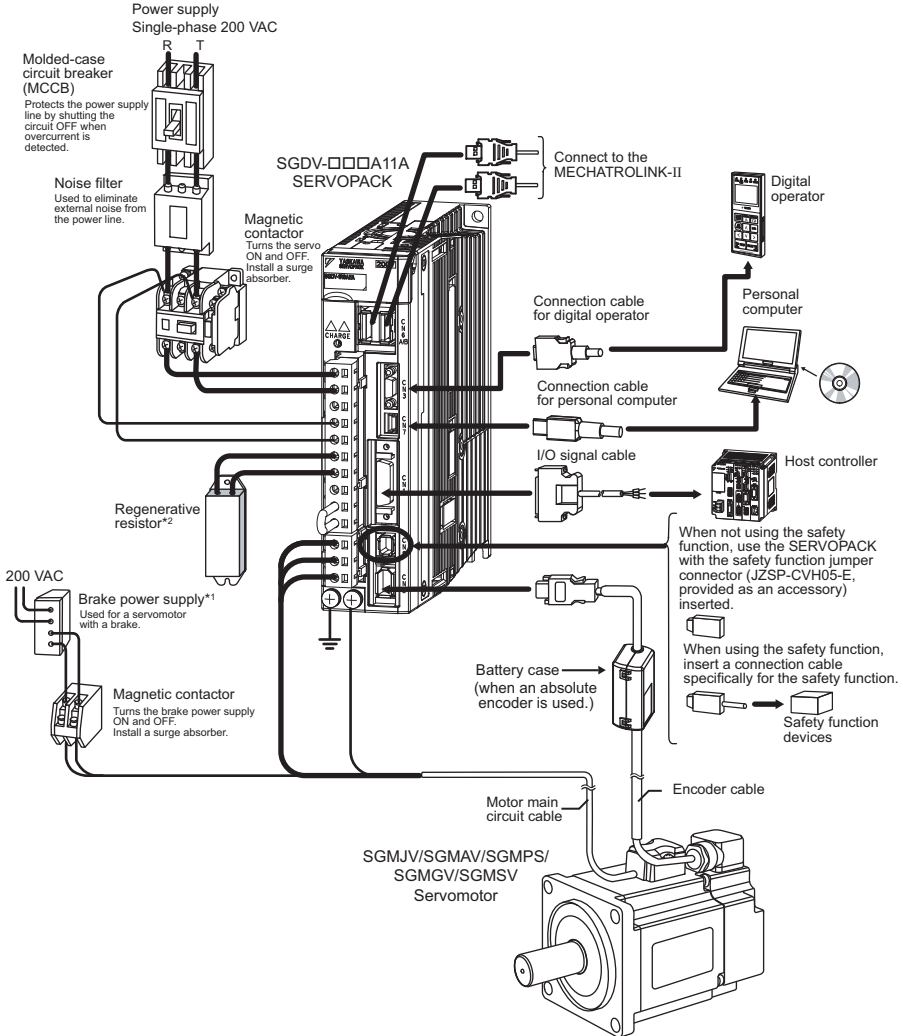


*1. Use a 24 VDC power supply. (not included.)

*2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.

• Using a Single-phase, 200-V Power Supply

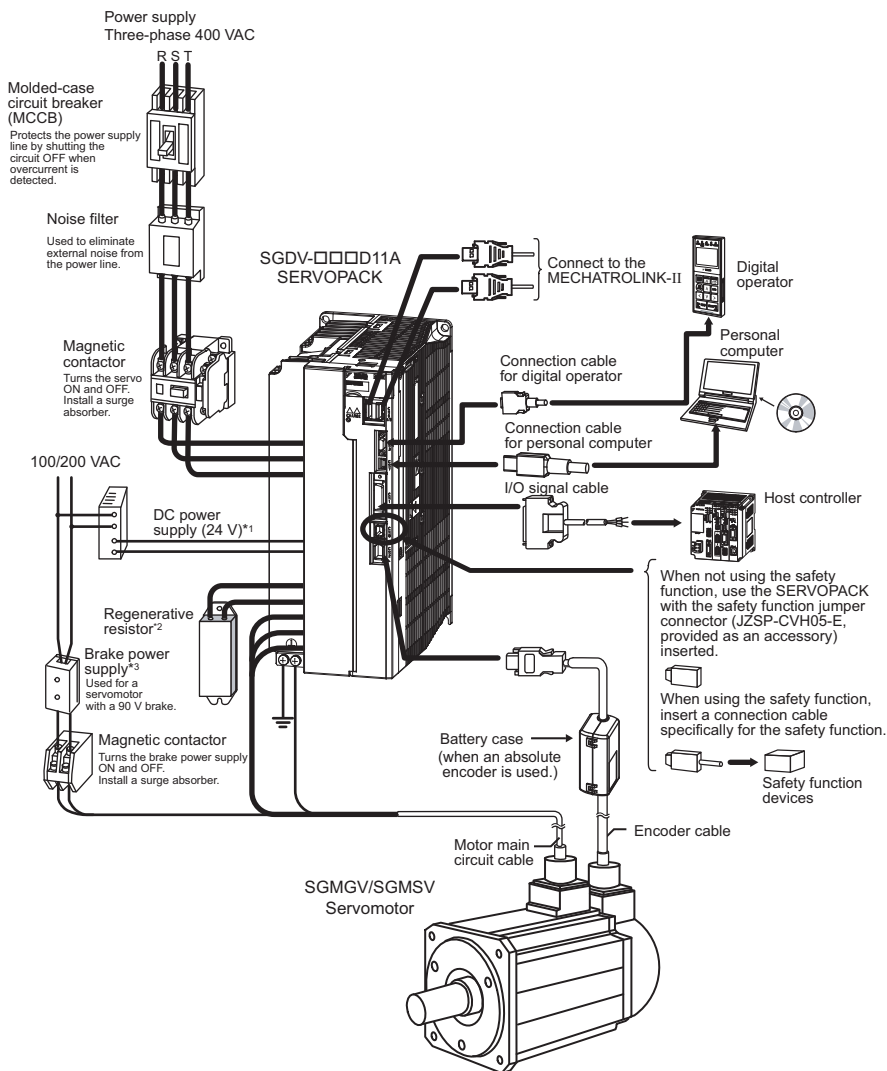
The Σ -V Series SERVOPACK for a 200-V power supply input has input specifications for a three-phase power supply, but some models can also be used with a single-phase 200-V power supply. For details, refer to *Σ -V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference* (SIEP S800000 46).



- *1. Use a 24 VDC power supply. (not included.)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 *Connecting Regenerative Resistors*.

3.2.2 Connecting to SGDV-□□□□11A SERVOPACK (M-II Model)

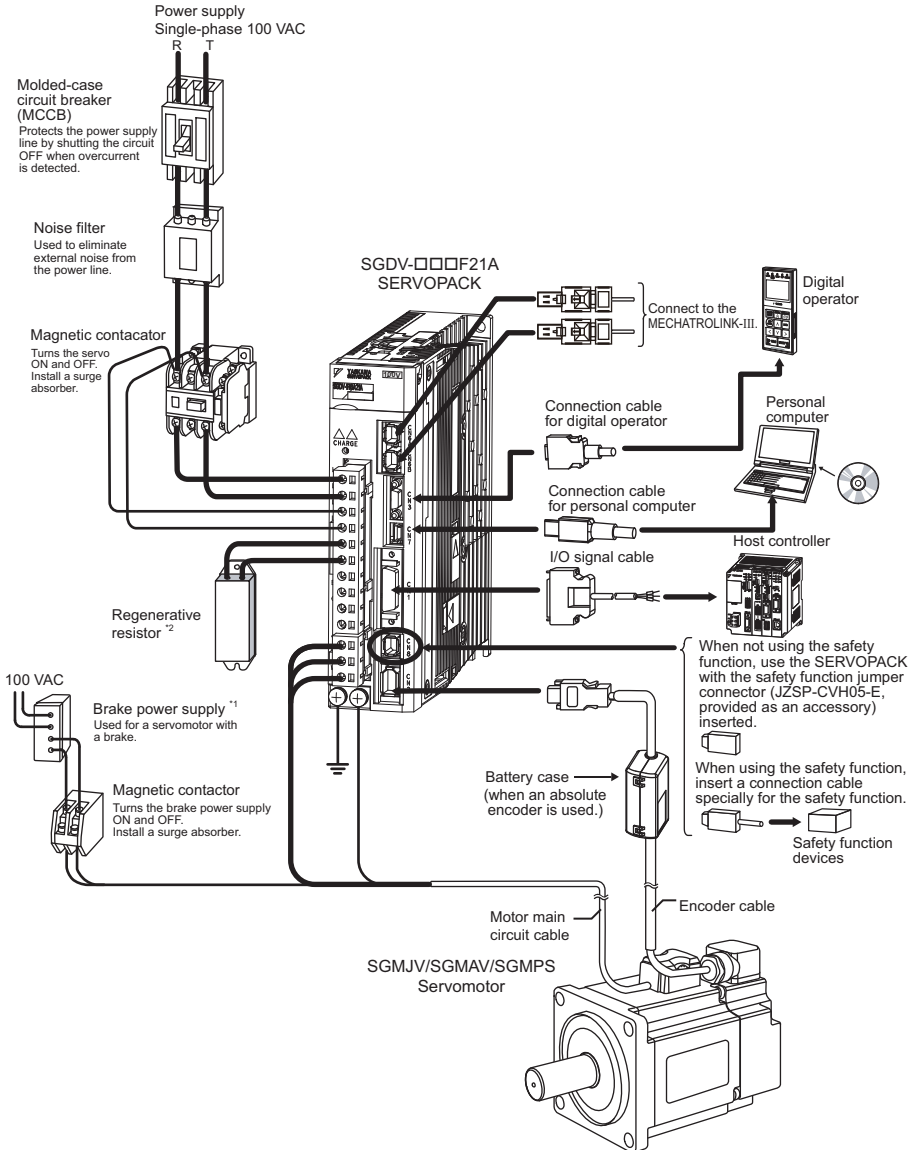
■ SGDV-□□□□11A



- *1. Use a 24 VDC power supply with double insulation or reinforced insulation. (The power supply is not included)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.
- *3. Use a following power supply for 90 V brake. For details, refer to Σ -V series Product Catalog (KAEP S800000 42).
 - For 200 V input voltage: LPSE-2H01-E
 - For 100 V input voltage: LPDE-1H01-E

3.2.3 Connecting to SGDV-□□□□21A SERVOPACK (M-III Model)

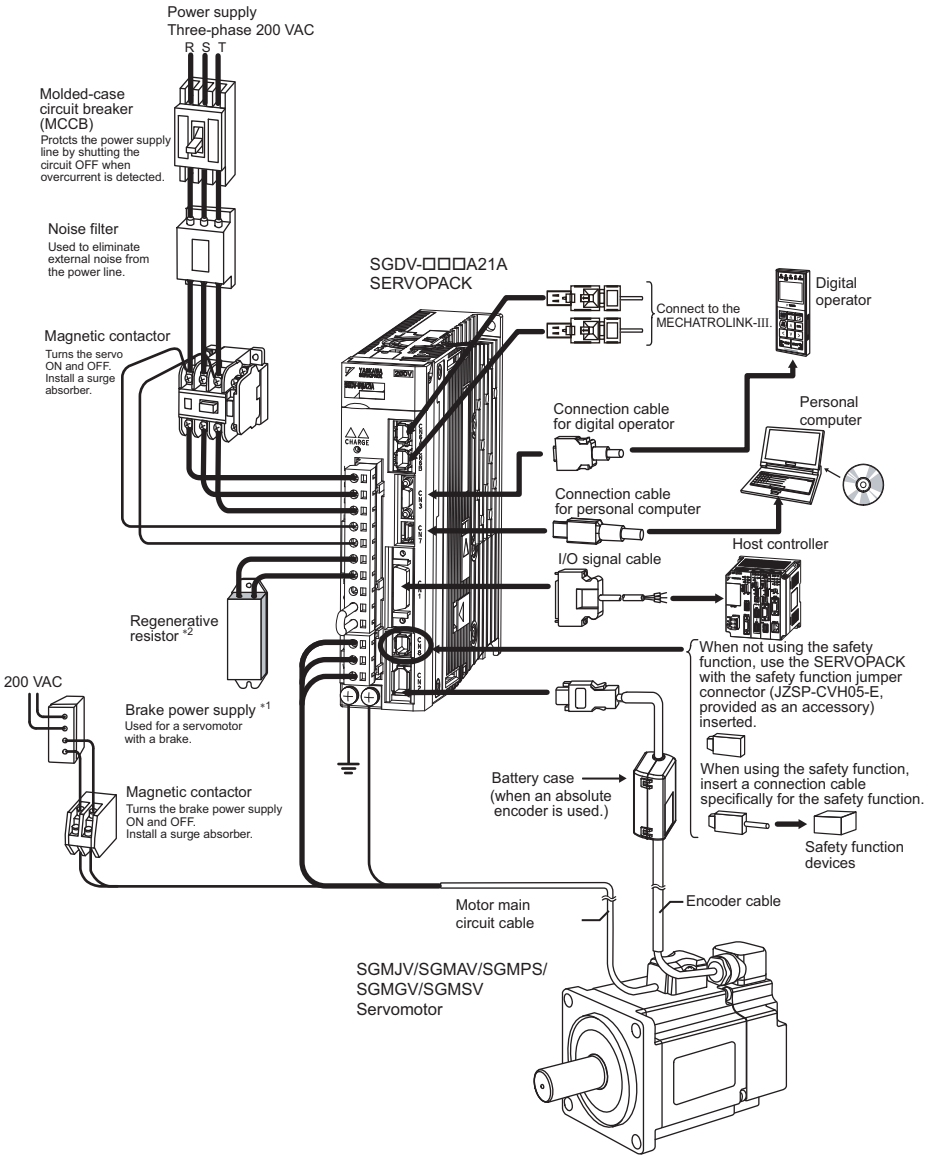
■ SGDV-□□□□F21A



3.2.3 Connecting to SGDV-□□□□21A SERVOPACK (M-III Model)

■ SGDV-□□□□21A

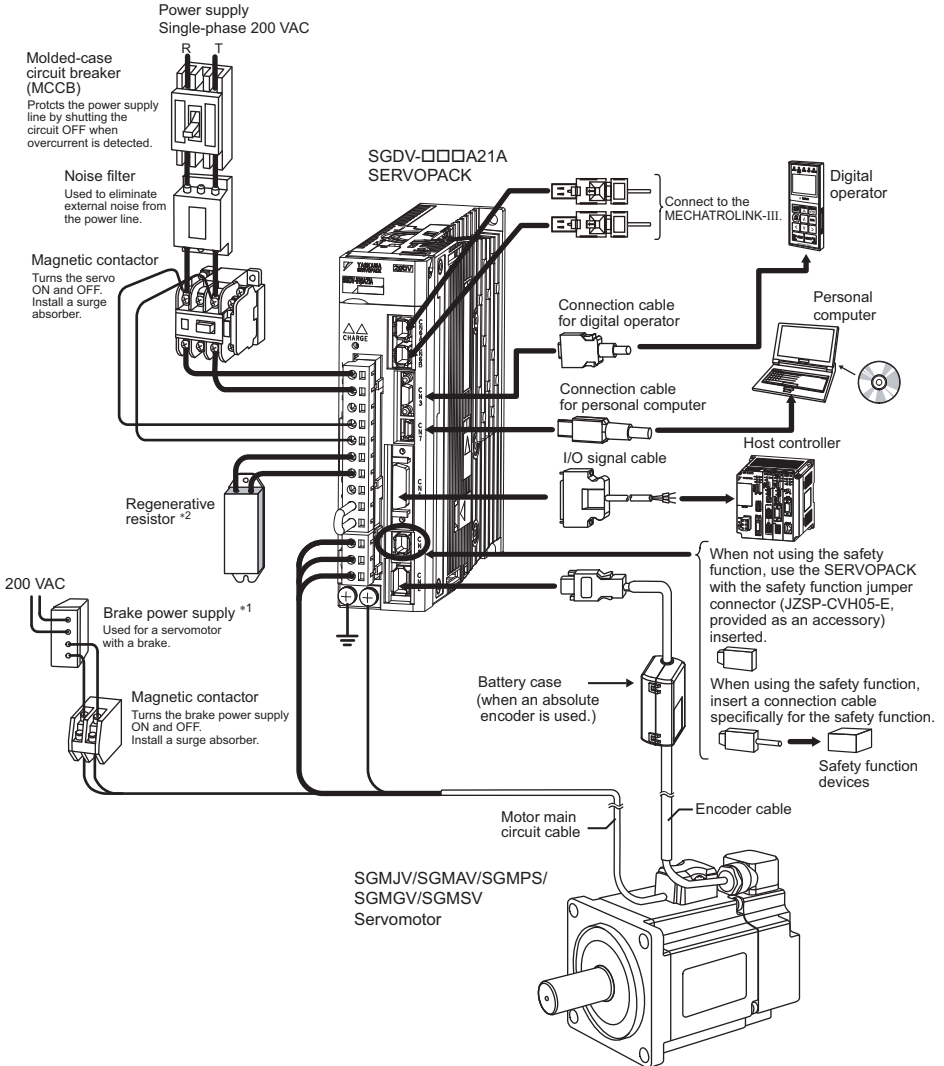
- Using a Three-phase, 200-V Power Supply



*1. Use a 24 VDC power supply. (not included.)
 *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.

• Using a Single-phase, 200-V Power Supply

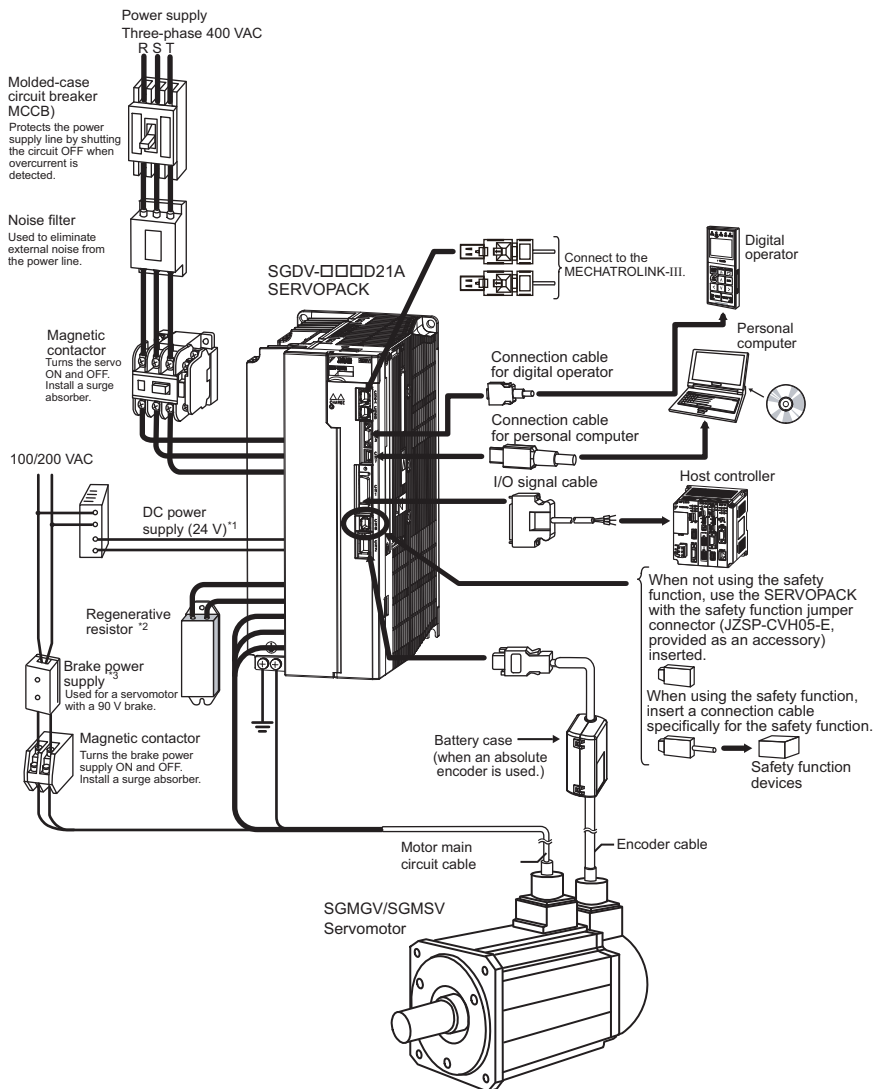
The Σ -V Series SERVOPACK for a 200-V power supply input has input specifications for a three-phase power supply, but some models can also be used with a single-phase 200-V power supply. For details, refer to *Σ -V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-III Communications Reference (SIEP S800000 64)*.



- *1. Use a 24 VDC power supply. (not included.)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.

3.2.3 Connecting to SGDV-□□□□21A SERVOPACK (M-III Model)

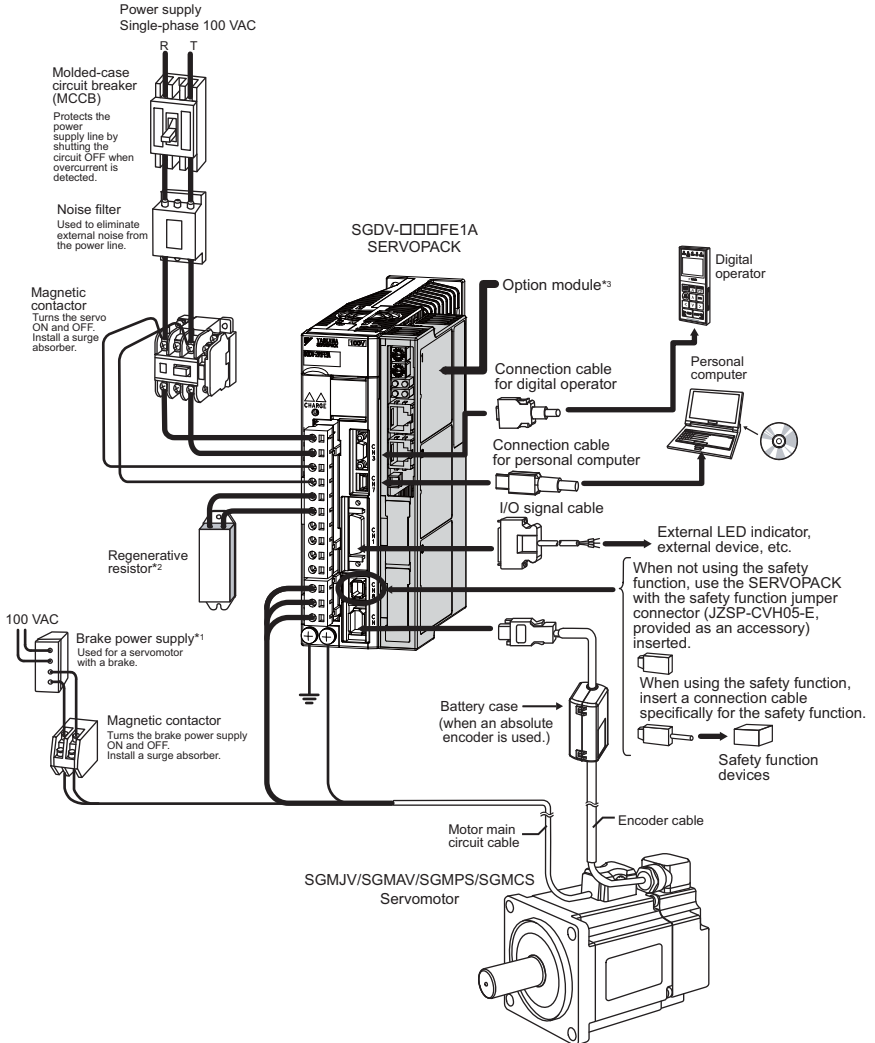
■ SGDV-□□□□21A



- *1. Use a 24 VDC power supply with double insulation or reinforced insulation. (The power supply is not included)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 *Connecting Regenerative Resistors*.
- *3. Use a following power supply for 90 V brake. For details, refer to *Σ-V series Product Catalog* (KAEP S800000 42).
 - For 200 V input voltage: LPSE-2H01-E
 - For 100 V input voltage: LPDE-1H01-E

3.2.4 Connecting to SGDV-□□□□E1A SERVOPACK (Command Option Attachable Type)

■ SGDV-□□□□E1A

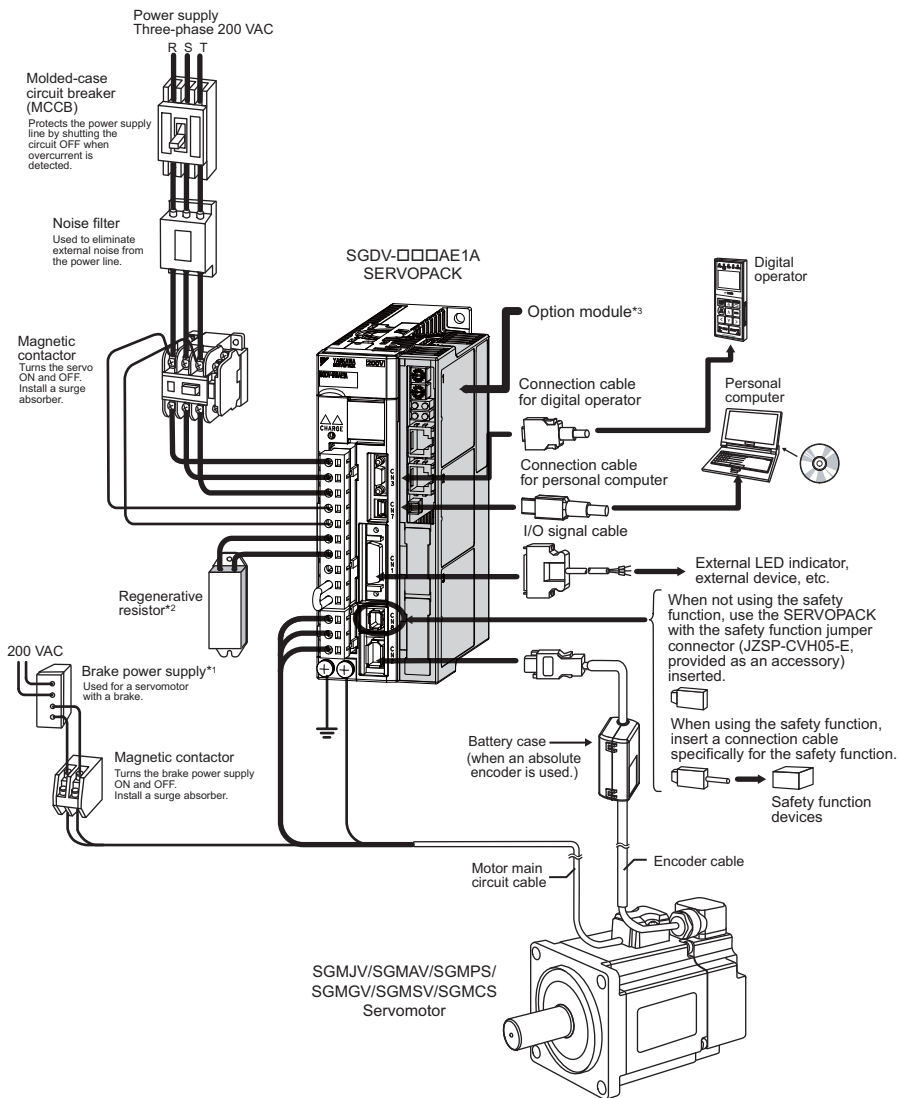


- *1. Use a 24-VDC power supply. (not included.)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 *Connecting Regenerative Resistors*.
- *3. For connection to the command option module, refer to the user's manual of the corresponding option module.

3.2.4 Connecting to SGDV-□□□□E1A SERVOPACK (Command Option Attachable Type)

■ SGDV-□□□□E1A

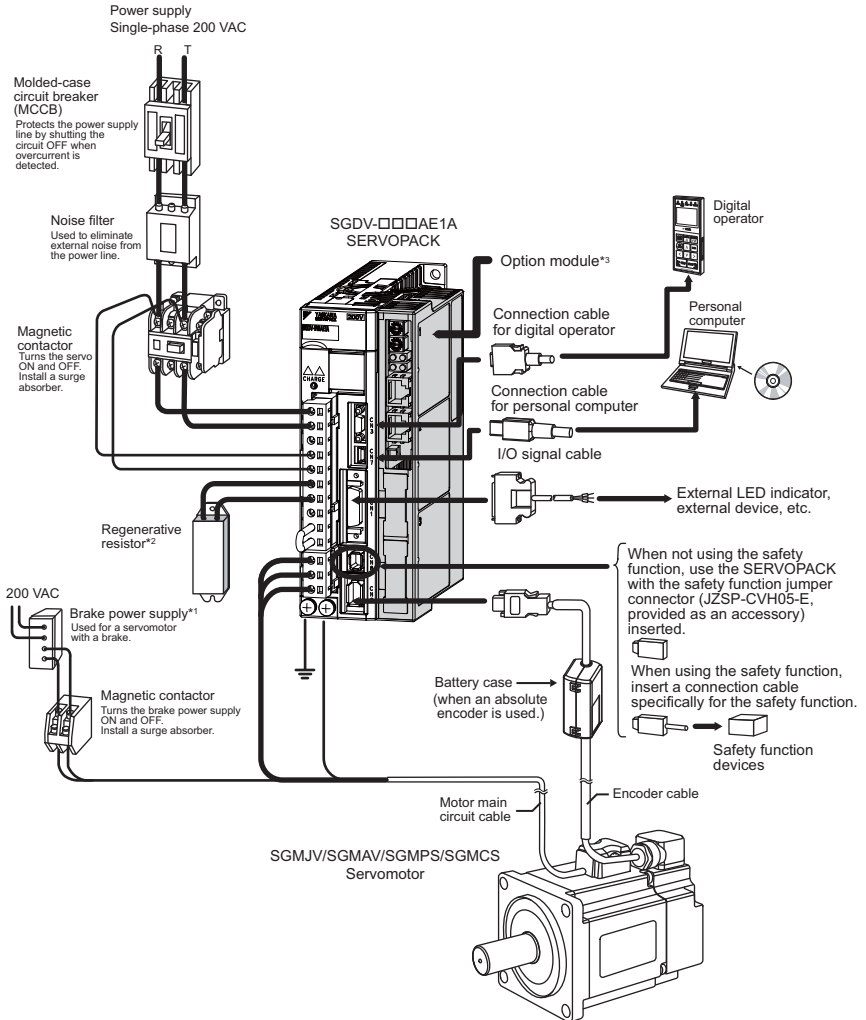
- Using a Three-phase, 200-V Power Supply



- *1. Use a 24-VDC power supply. (not included.)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.
- *3. For connection to the command option module, refer to the user's manual of the corresponding option module.

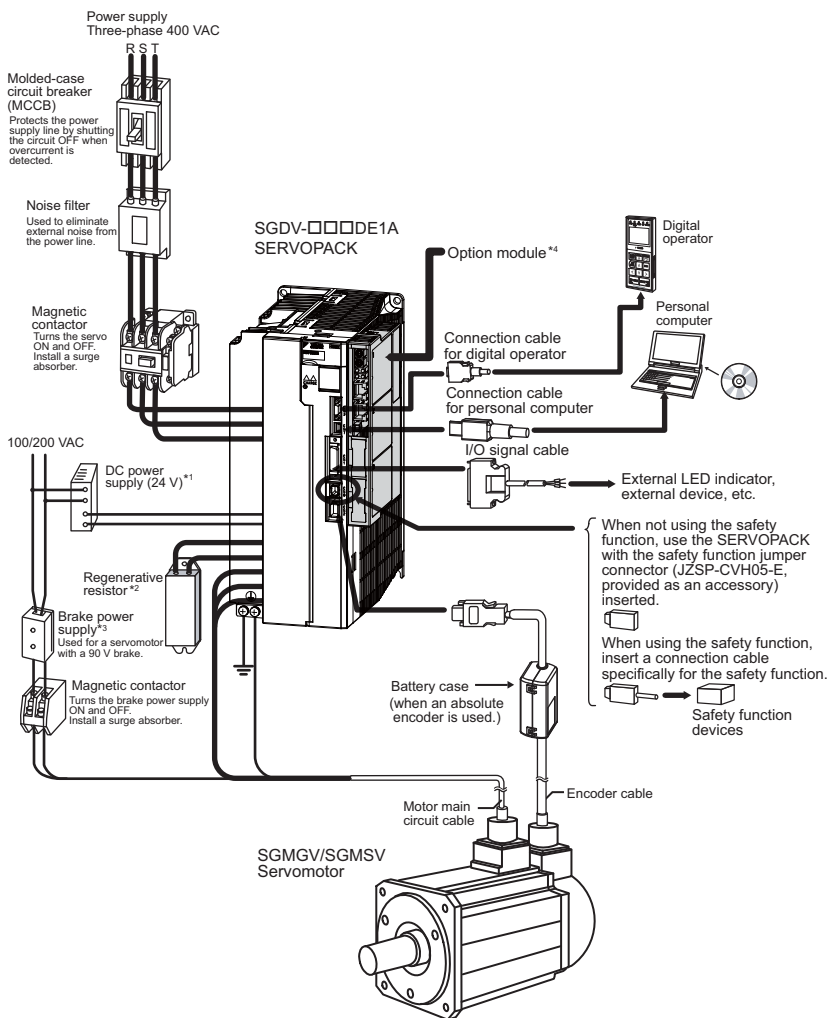
- Using a Single-phase, 200-V Power Supply

The Σ -V Series SERVOPACK for a 200-V power supply input has input specifications for a three-phase power supply, but some models can also be used with a single-phase 200-V power supply. For details, refer to *Σ -V Series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S80000 60).



- Use a 24-VDC power supply. (not included.)
- Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 *Connecting Regenerative Resistors*.
- For connection to the command option module, refer to the user's manual of the corresponding option module.

■ SGDV-□□□□E1A

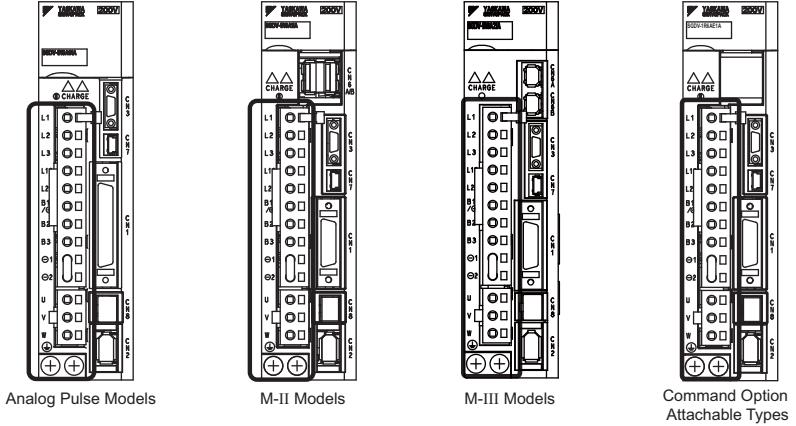


- *1. Use a 24-VDC power supply with double insulation or reinforced insulation. (The power supply is not included)
- *2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 *Connecting Regenerative Resistors*.
- *3. Use a following power supply for 90-V brake. For details, refer to *Σ-V series Product Catalog* (KAEP S800000 42).
 - For 200-V input voltage: LPSE-2H01-E
 - For 100-V input voltage: LPDE-1H01-E
- *4. For connection to the command option module, refer to the user's manual of the corresponding option module.

3.3 Main Circuit Wiring

The names, specifications, and functions of the main circuit terminals required for trial operation are given below.

3.3.1 Names and Functions of Main Circuit Terminals



| Name | Terminal Symbols | Model SGDV-□□□□ | Description |
|-------------------------------|------------------|-----------------|--|
| Main circuit input terminals | L1, L2 | □□□F | Single-phase 100 to 115 V, +10% to -15% (50/60 Hz) |
| | L1, L2, L3 | □□□A | Three-phase 200 to 230 V, +10% to -15% (50/60 Hz) |
| | | □□□D | Three-phase 380 to 480 V, +10% to -15% (50/60 Hz) |
| Control power input terminals | L1C, L2C | □□□F | Single-phase 100 to 115 V, +10% to -15% (50/60 Hz) |
| | | □□□A | Single-phase 200 to 230 V, +10% to -15% (50/60 Hz) |
| | 24V, 0V | □□□D | 24 VDC, ±15% |


3.3.2 SERVOPACK Main Circuit Wire Size

(cont'd)

| Name | Terminal Symbols | Model SGD□-□□□□ | Description |
|---|---------------------------|---|--|
| External regenerative resistor terminals | B1/⊕, B2, or B1, B2 | R70F, R90F, 2R1F, 2R8F, R70A, R90A, 1R6A, 2R8A | If the regenerative capacity is insufficient, connect an external regenerative resistor (option) between B1/⊕ and B2. |
| | | 3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A, 1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D | If the internal regenerative resistor is insufficient, remove the wire between B2 and B3 and connect an external regenerative resistor (option) between B1/⊕ and B2, or B1 and B2. |
| | | 470A, 550A, 590A, 780A, 210D, 260D, 280D, 370D | Connect a regenerative resistor unit (option) between B1/⊕ and B2, or B1 and B2. |
| DC reactor connection terminals for power supply harmonic suppression | ⊖ 1, ⊖ 2 | □□□A □□□D | Normally short ⊖ 1 and ⊖ 2. If a countermeasure against power supply harmonic waves is needed, connect a DC reactor between ⊖ 1 and ⊖ 2. |
| Main circuit plus terminals | B1/⊕ or B1 | □□□A □□□D | Use when DC power supply input is used. |
| Main circuit minus terminals | ⊖ 2 or ⊖ | □□□A □□□D | |
| Servomotor connection terminals | U, V, W | Use for connecting to the servomotor. | |
| Ground terminals (× 2) | ⊕ | Use for connecting the power supply ground terminal and servomotor ground terminal. | |

3.3.2 SERVOPACK Main Circuit Wire Size

This section describes the SERVOPACK Main Circuit Wire Size.

| | |
|--|---|
|  IMPORTANT | <ol style="list-style-type: none"> 1. Wire sizes are selected for three cables per bundle at 40°C surrounding air temperature with the rated current. 2. Use a wire with a minimum withstand voltage of 600 V for the main circuit. 3. If cables are bundled in PVC or metal ducts, take into account the reduction of the allowable current. 4. Use a heat-resistant wire under high surrounding air or panel temperatures, where polyvinyl chloride insulated wires will rapidly deteriorate. |
|--|---|

■ Wire Types

Use the following type of wire for main circuit.

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

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

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

| AWG Size | Nominal Cross Section Diameter (mm ²) | Configuration (Number of Wires/mm ²) | Conductive Resistance (Ω/km) | Allowable Current at Surrounding Air Temperature (A) | | |
|----------|---|--|------------------------------|--|------|------|
| | | | | 30°C | 40°C | 50°C |
| 20 | 0.5 | 19/0.18 | 39.5 | 6.6 | 5.6 | 4.5 |
| 19 | 0.75 | 30/0.18 | 26.0 | 8.8 | 7.0 | 5.5 |
| 18 | 0.9 | 37/0.18 | 24.4 | 9.0 | 7.7 | 6.0 |
| 16 | 1.25 | 50/0.18 | 15.6 | 12.0 | 11.0 | 8.5 |
| 14 | 2.0 | 7/0.6 | 9.53 | 23 | 20 | 16 |
| 12 | 3.5 | 7/0.8 | 5.41 | 33 | 29 | 24 |
| 10 | 5.5 | 7/1.0 | 3.47 | 43 | 38 | 31 |
| 8 | 8.0 | 7/1.2 | 2.41 | 55 | 49 | 40 |
| 6 | 14.0 | 7/1.6 | 1.35 | 79 | 70 | 57 |
| 4 | 22.0 | 7/2.0 | 0.85 | 91 | 81 | 66 |

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

3.3.2 SERVOPACK Main Circuit Wire Size

■ Single-phase, 100 V

| External Terminal Name | Terminal Symbols | SERVOPACK Model SGD V- | | | |
|---|------------------|------------------------|-----|--------|-----|
| | | R70 | R90 | 2R1 | 2R8 |
| Main circuit power input terminals | L1, L2 | HIV1.25 | | HIV2.0 | |
| Control power input terminals | L1C, L2C | HIV1.25 | | | |
| Servomotor connection terminals | U, V, W | HIV1.25 | | | |
| External regenerative resistor connection terminals | B1/⊕, B2 | HIV1.25 | | | |
| Ground terminal | ⊖ | HIV2.0 or higher | | | |


■ Three-phase, 200 V

| External Terminal Name | Terminal Symbols | SERVOPACK Model SGD V- | | | | | | | | | | | | | | | |
|---|------------------|------------------------|-----|-----|--------|-----|-----|-----|--------|--------|--------|---------|---------|---------|-----|-----|--|
| | | R70 | R90 | 1R6 | 2R8 | 3R8 | 5R5 | 7R6 | 120 | 180 | 200 | 330 | 470 | 550 | 590 | 780 | |
| Main circuit power input terminals | L1, L2, L3 | HIV1.25 | | | HIV2.0 | | | | HIV3.5 | | HIV5.5 | HIV8.0 | HIV14.0 | HIV22.0 | | | |
| Control power input terminals | L1C, L2C | HIV1.25 | | | | | | | | | | | | | | | |
| Servomotor connection terminals | U, V, W | HIV1.25 | | | HIV2.0 | | | | HIV3.5 | HIV5.5 | HIV8.0 | HIV14.0 | | HIV22.0 | | | |
| External regenerative resistor connection terminals | B1/⊕, B2 | HIV1.25 | | | | | | | HIV2.0 | HIV3.5 | HIV5.5 | HIV8.0 | | HIV22.0 | | | |
| Ground terminal | ⊖ | HIV2.0 or higher | | | | | | | | | | | | | | | |

■ Three-phase, 400 V

| External Terminal Name | Terminal Symbols | SERVOPACK Model SGD- | | | | | | | | | |
|---|-------------------|----------------------|-----|-----|--------|-----|--------|--------|--------|--------|---------|
| | | 1R9 | 3R5 | 5R4 | 8R4 | 120 | 170 | 210 | 260 | 280 | 370 |
| Main circuit power input terminals | L1, L2, L3 | HIV1.25 | | | HIV2.0 | | HIV3.5 | | HIV5.5 | HIV8.0 | HIV14.0 |
| Control power input terminals | 24V, 0V | HIV1.25 | | | | | | | | | |
| Servomotor connection terminals | U, V, W | HIV1.25 | | | HIV2.0 | | HIV3.5 | HIV5.5 | | HIV8.0 | HIV14.0 |
| External regenerative resistor connection terminals | B1/⊕, B2 (B1, B2) | HIV1.25 | | | | | HIV2.0 | HIV3.5 | | HIV5.5 | HIV8.0 |
| Ground terminal | ⊕ | HIV2.0 or higher | | | | | | | | | |

3.3.3 Typical Main Circuit Wiring Examples

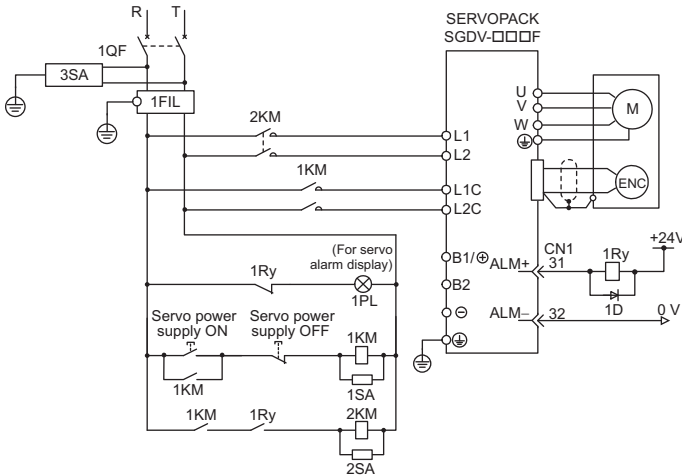


IMPORTANT

- Use a molded-case circuit breaker (1QF) or fuse to protect the main circuit.
The SERVOPACK connects directly to a commercial power supply; it is not isolated through a transformer or other device. Always use a molded-case circuit breaker (1QF) or fuse to protect the servo system from accidents involving different power system voltages or other accidents.
- Install a ground fault detector.
The SERVOPACK does not have a built-in protective circuit for grounding.
To configure a safer system, install a ground fault detector against overloads and short-circuiting, or install a ground fault detector combined with a molded-case circuit breaker.
- Do not frequently turn power ON and OFF.
 - Frequently turning power ON and OFF causes elements inside the SERVOPACK to deteriorate. Do not use the servo drive with an application that requires frequently turning power ON and OFF.
 - After the actual operation starts, the allowable interval for turning power ON and OFF is one hour or longer.

The following wiring examples show the Σ -V Series SGD V SERVOPACK (Analog pulse model).

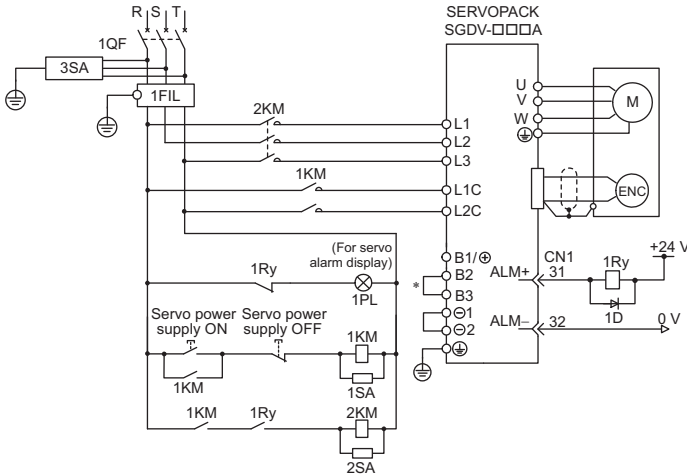
■ Single-phase 100 V, SGD V-□□□F (SGDV-R70F, R90F, 2R1F, 2R8F)



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

■ Three-phase 200 V, SGD□-□□□□A

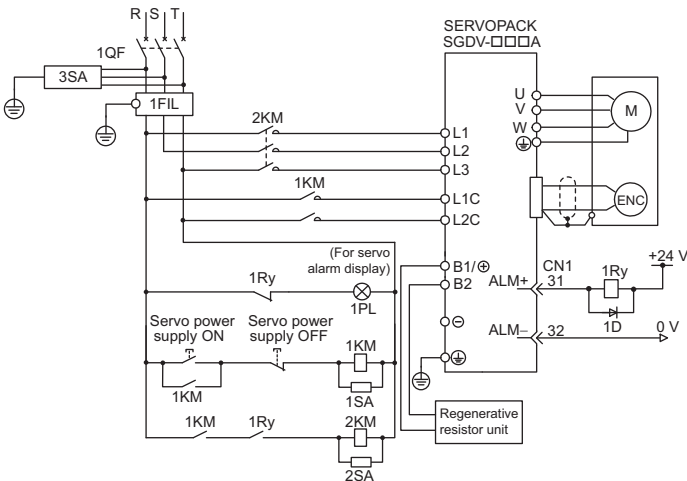
- SGD□-R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A



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

* For SGD□-R70A, -R90A, -1R6A, -2R8A, terminals B2 and B3 are not short-circuited.

- SGD□-470A, 550A, 590A, 780A

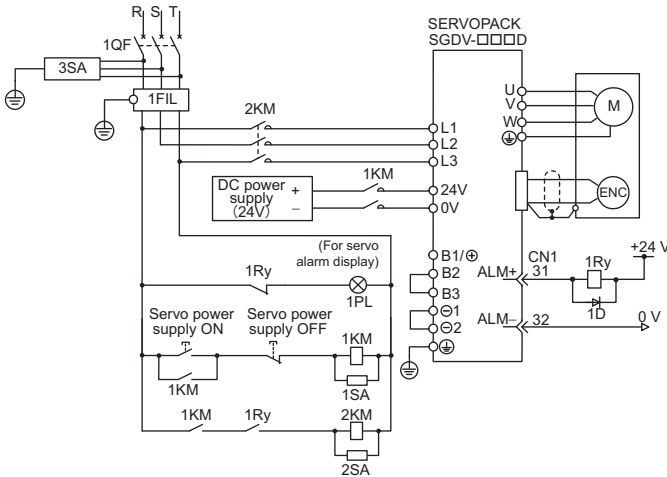


- | | |
|--|---------------------|
| 1QF: Molded-case circuit breaker | 1PL: Indicator lamp |
| 1FIL: Noise filter | 1SA: Surge absorber |
| 1KM: Magnetic contactor (for control power supply) | 2SA: Surge absorber |
| 2KM: Magnetic contactor (for main power supply) | 3SA: Surge absorber |
| 1Ry: Relay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

3.3.3 Typical Main Circuit Wiring Examples

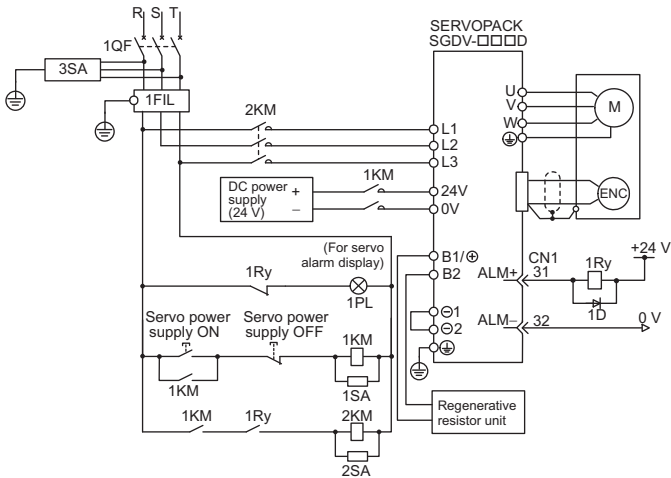
■ Three-phase 400 V, SGDV-□□□□

- SGDV-1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D



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

- SGDV-210D, 260D, 280D, 370D



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

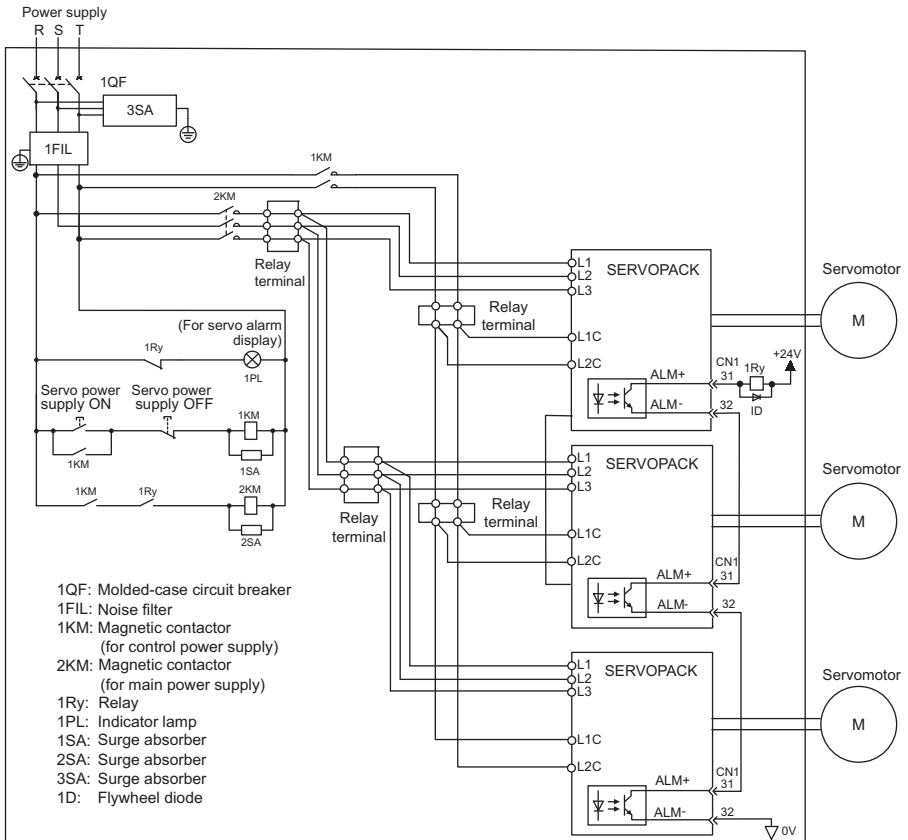
■ Precautions When Using More Than One SERVOPACK

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

• Wiring Example (Analog pulse model)

Connect the alarm output (ALM) terminals for the three SERVOPACKs in series to enable alarm detection relay 1RY to operate.

When the alarm occurs, the ALM output signal transistor is turned OFF.



3.3.4 Wiring the Main Circuit Terminal Connector (Spring Type)

- **Precautions**

When using more than one SERVOPACK with a DC power supply, refer to these manuals here for the appropriate wiring, connections, and required settings.

- Σ -V Series User's Manual
Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45)
- Σ -V Series User's Manual
Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference (SIEP S800000 46)
- Σ -V Series User's Manual
Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)
- Σ -V Series User's Manual
Design and Maintenance Rotational Motor/MECHATROLINK-III Communications Reference (SIEP S800000 64)

3.3.4 Wiring the Main Circuit Terminal Connector (Spring Type)

Two types of main circuit terminals are available: a connector type and a terminal screw type.

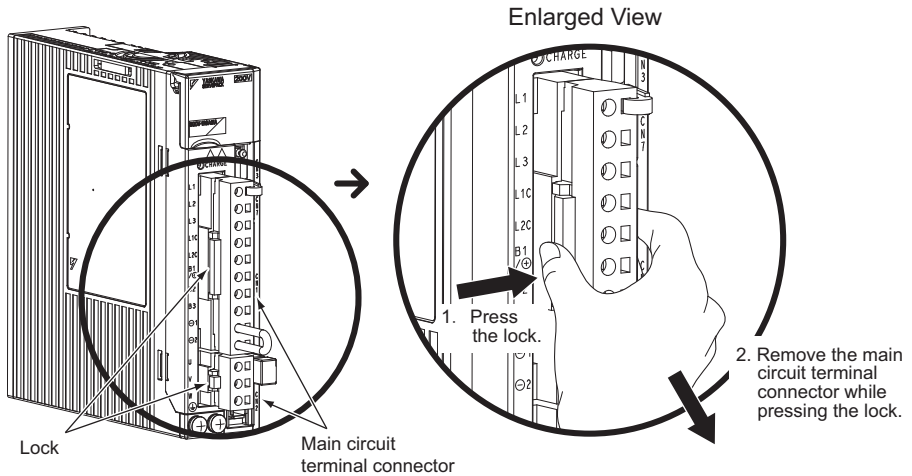
- SERVOPACKs with terminal screws:
SGDV-180A, 200A, 330A, 470A, 550A, 590A, 780A, 8R4D, 120D, 170D, 210D, 260D, 280D, 370D
- SERVOPACKs with connectors:
SGDV-R70F, R90F, 2R1F, 2R8F, R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, 1R9D, 3R5D, 5R4D

A spring connector is used for SERVOPACKs with connectors. The following section describes how to wire the main circuit terminal using a connector.

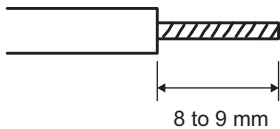
|  CAUTION |
|---|
| <ul style="list-style-type: none">• Observe the following precautions when wiring main circuit terminal connectors.<ul style="list-style-type: none">• Do not turn ON the power to the SERVOPACK until all wiring has been completed, including the main circuit terminal connectors.• Remove detachable main circuit terminal connectors from the SERVOPACK prior to wiring.• Insert only one main circuit cable per opening in the main circuit terminal connector.• Make sure that no part of the core wire comes into contact with (i.e., short-circuit) adjacent wires. |

■ Wiring Procedure

1. Remove the main circuit terminal connector from the SERVOPACK.



2. Strip the end of the wires.



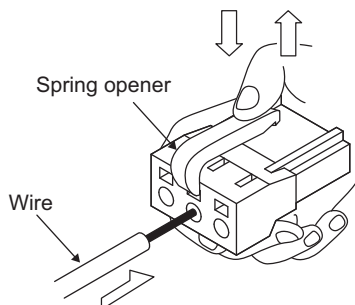
Applicable wire sizes:
Refer to 3.3.2 SERVOPACK
Main Circuit Wire Size.

3. Open the wire terminal on the terminal connector housing with a tool, using the following methods. Either method can be used to open the wire terminal.

■ Using a spring opener

Use the spring opener provided with the SERVOPACK to open the wire terminal as shown in the diagram.

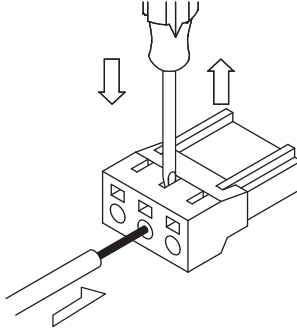
Note: The spring opener (1981045-1) made by Tyco Electronics AMP K.K. can also be used.



3.3.4 Wiring the Main Circuit Terminal Connector (Spring Type)

■ Using a screwdriver

Use a commercially available flat-blade screwdriver with a blade width of 3.0 to 3.5 mm. Insert the screwdriver into the slot and press down firmly to open the wire terminal.



- 4.** Insert the wire core into the opening, and then secure the wire into position by removing the opener or screwdriver to close the opening.
- 5.** Make all the required connections in the same way.
- 6.** Attach the connector to the SERVOPACK.

3.4 Connecting Regenerative Resistors

This section describes how to connect regenerative resistors and set the regenerative resistor capacity. To learn how to select a regenerative resistor, and for detailed specifications, refer to *Σ-V Series Product Catalog* (KAEP S800000 42).

For more information on how to set the capacity of regenerative resistors, refer to *Σ-V Series User's Manual Design and Maintenance* (SIEP S800000 45/46/60/64).

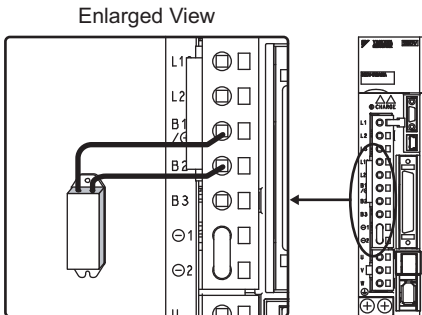
⚠ WARNING

- Be sure to connect the regenerative resistor correctly. Failure to observe this warning may result in fire or damage to the product.

3.4.1 Connecting Regenerative Resistor

- **SERVOPACKs:** Model SGD_V-R70F, R90F, 2R1F, 2R8F, R70A, R90A, 1R6A, 2R8A

Connect an external regenerative resistor between B1/⊕ and B2 terminals. After connecting a resistor, select the capacity.

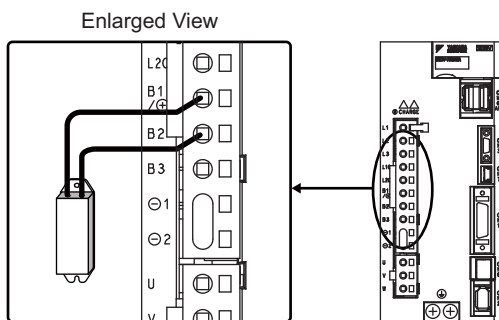


3.4.1 Connecting Regenerative Resistor

- **SERVOPACKs:** Model SGDV-3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A, 1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D

Disconnect the wiring between the SERVOPACK's B2 and B3 terminals and connect an external regenerative resistor between the B1/⊕ and B2 terminals or between the B1 and B2 terminals.

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



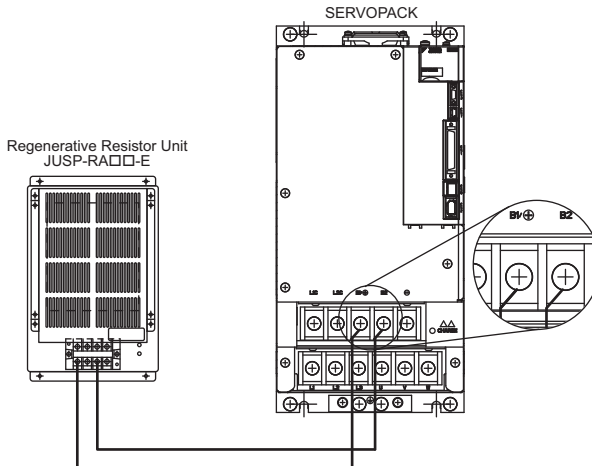
■ **SERVOPACKs: Model SGDV-470A, 550A, 590A, 780A, 210D, 260D, 280D, 370D**

No built-in regenerative resistor is provided, so the external regenerative resistor is required. The regenerative resistor units are as follow:

| Main Circuit Power Supply | Applicable SERVOPACK Model SGDV | Applicable Regenerative Resistor Unit | Resistance (Ω) | Specifications |
|---------------------------|---------------------------------|---------------------------------------|-------------------------|--|
| Three-phase 200 V | 470A | JUSP-RA04-E | 6.25 | 25 Ω (220 W); 4 resistors in parallel |
| | 550A, 590A, 780A | JUSP-RA05-E | 3.13 | 25 Ω (220 W); 8 resistors in parallel |
| Three-phase 400 V | 210D, 260D | JUSP-RA18-E | 18 | 18 Ω (220 W); 2 resistors in series with 2 in parallel. |
| | 280D, 370D | JUSP-RA19-E | 14.25 | 28.5 Ω (220 W); 2 resistors in series with 4 in parallel. |

Connect a regenerative resistor unit between B1/⊕ and B2 terminals.

When using a regenerative resistor unit, set Pn600 to 0W (factory setting).



Safety Function

This chapter describes the safety functions.

| | |
|--|-----|
| 4.1 Outline | 4-2 |
| 4.2 Hard Wire Base Block (HWBB) Function | 4-3 |
| 4.3 Safety Function Signal (CN8) Names and Functions | 4-4 |
| 4.4 Precautions When Not Using the Safety Function | 4-4 |
| 4.5 When Using the Safety Function | 4-5 |

4.1 Outline

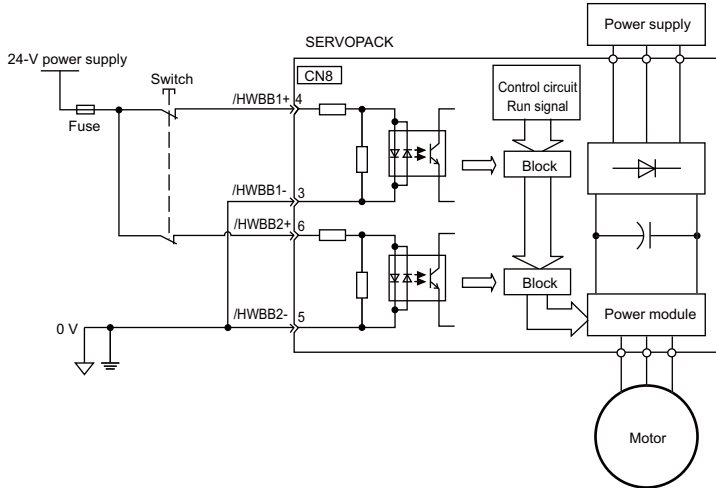
The safety function is incorporated in the SERVOPACK to reduce the risk associated with the machine by protecting workers from injury and by securing safe machine operation. Especially when working in hazardous areas inside the safeguard, as for machine maintenance, it can be used to avoid adverse machine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

The person who designs a system using the safety function (Hard Wire Baseblock function) must have full knowledge of the related safety standards and full understanding of the following manuals.

- Σ -V Series User's Manual
Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45)
- Σ -V Series User's Manual
Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference (SIEP S800000 46)
- Σ -V Series User's Manual
Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)
- Σ -V Series User's Manual
Design and Maintenance Rotational Motor/MECHATROLINK-III Communications Reference (SIEP S800000 64)

4.2 Hard Wire Base Block (HWBB) Function

The Hard Wire Base Block function (hereinafter referred to as HWBB function) is a safety function designed to baseblock the motor (shut off the motor current) by using the hardwired circuits: Each circuit for two channel input signals blocks the run signal to turn off the power module, and the motor current is shut off. (Refer to the diagram below.)



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

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

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

WARNING

- Perform risk assessment for the system and confirm that the safety requirements with the following standards are fulfilled before using the HWBB function.
EN954-1 Category3
IEC61508-1 to 4 SIL2

4.3 Safety Function Signal (CN8) Names and Functions

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

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

* Do not use unused terminals. (connected to the internal circuits)

4.4 Precautions When Not Using the Safety Function

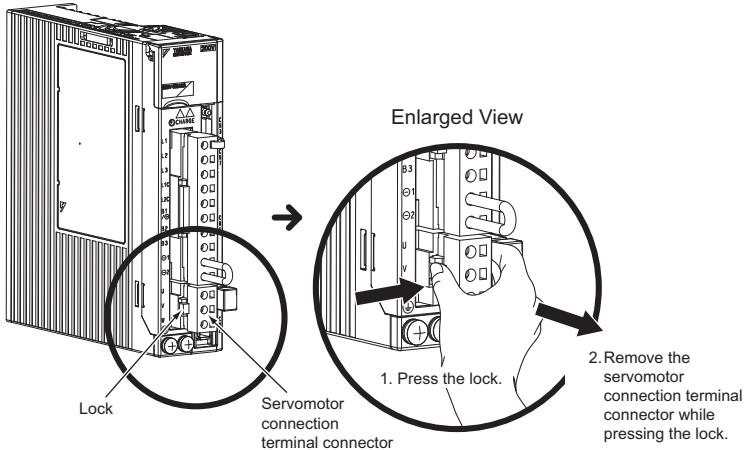
When not using the safety function or when performing a JOG operation, use the SERVOPACK with the safety function jumper connector (JZSP-CVH05-E, provided as an accessory) inserted. If the SERVOPACK is used without the jumper connector inserted into CN8, no current will flow to the motor and no torque will be output.

When Hbb is displayed on the panel operator and digital operator, the motor is base-blocked by the safety function. Check to see if the JZSP-CVH05-E jumper connector is correctly inserted into CN8.

4.5 When Using the Safety Function

Connect a safety device using the following procedure.

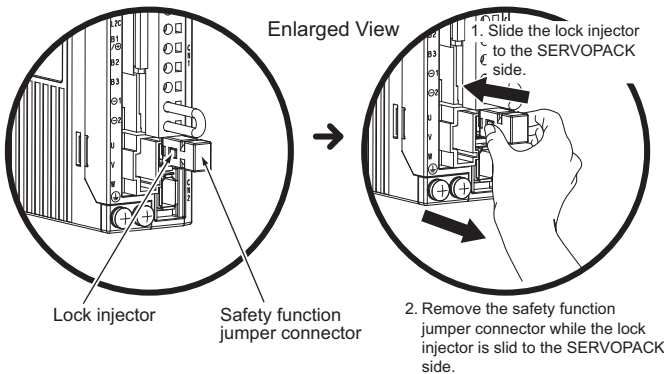
1. <When using the SERVOPACK SGD-V-R70F, R90F, 2R1F, R70A, R90A, 1R6A, 2R8A, 1R9D, 3R5D, or 5R4D>
Remove the servomotor connection terminal connector while pressing the lock.



<When using a SERVOPACK other than above>

It is not necessary to remove the servomotor connection terminal connector. Proceed to the next step.

2. Slide the lock injector of the safety function jumper connector to the SERVOPACK side to unlock and remove the safety function jumper connector.



Note: The safety function jumper connector may be damaged if it is removed without being unlocking.

3. Connect a safety device to CN8.

Note: When not using the safety function, use the SERVOPACK with the safety function jumper connector inserted in CN8. If the SERVOPACK is used without the jumper connector inserted into CN8, no current will flow to the motor and no torque will be output. In this case, "Hbb" will be displayed on the Panel Operator or the Digital Operator.

Trial Operation (Checking Servomotor Operation)

This chapter describes how to perform trial operation.

| | |
|--|------|
| 5.1 Outline | 5-2 |
| 5.2 Inspection and Checking before Trial Operation | 5-2 |
| 5.3 JOG Operation Using a Panel Operator | 5-5 |
| 5.4 JOG Operation Using a Digital Operator | 5-7 |
| 5.5 JOG Operation Using SigmaWin+ | 5-10 |

5.1 Outline

The trial operation described here is a JOG operation for servomotors not connected to machinery (without a load). The purpose of this trial operation is to check whether the SERVOPACK and servomotor are properly connected and whether the servomotor is operating normally.

To conduct trial operation executed from the host controller for the servomotor without load, or for the servomotor connected to the machine, refer to the following manuals.

- Σ -V Series User's Manual Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45)
- Σ -V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference (SIEP S800000 46)
- Σ -V Series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)
- Σ -V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-III Communications Reference (SIEP S800000 64)

CAUTION

- Conduct trial operation on the servomotor alone with the motor shaft disconnected from the machine to avoid any unexpected accidents. If it is unavoidable to perform trial operation while connected to a machine, then always make sure that an emergency stop can be immediately executed.

5.2 Inspection and Checking before Trial Operation

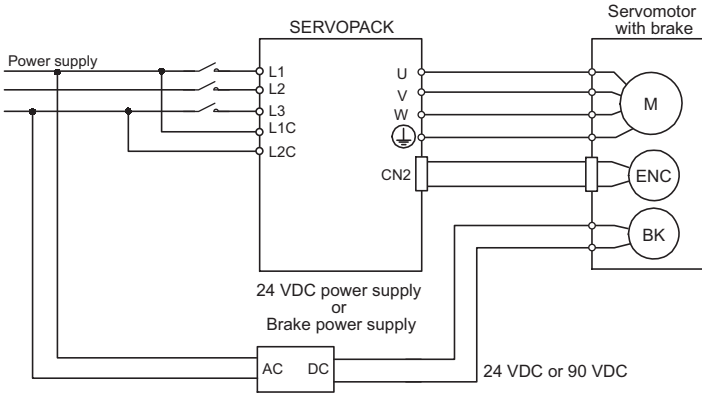
To ensure safe and correct trial operation, inspect and check the following items before starting trial operation.

■ Servomotors


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

- Are all wiring and connections correct?
- Are all nuts and bolts securely tightened?
- If the servomotor has an oil seal, is the seal undamaged and is the motor oiled?
- If the servomotor has a brake, is the brake released beforehand? To release the brake, apply the specified voltage (24 VDC or 90 VDC). The following diagram shows an example of the circuit wiring needed to release the holding brake before a trial operation.

An example of the circuit wiring



- A 24 VDC power supply is not included.
- Brake power supply Input voltage of 200 V: LPSE-2H01-E
Input voltage of 100 V: LPDE-1H01-E



IMPORTANT

Configure the relay circuit to apply the holding brake by the emergency stop.

Relay Circuit Example

The diagram shows a SERVOPACK with a Photocoupler. The Photocoupler is connected to a relay circuit. The relay is controlled by a 5 to 24 VDC supply and an Emergency stop switch. The relay output is connected to the brake terminal of the servomotor.

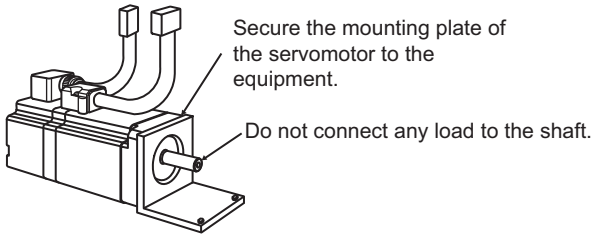
■ SERVOPACKs

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

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

■ Installing the Servomotor and SERVOPACK

Install the servomotor and SERVOPACK according to the installation conditions.



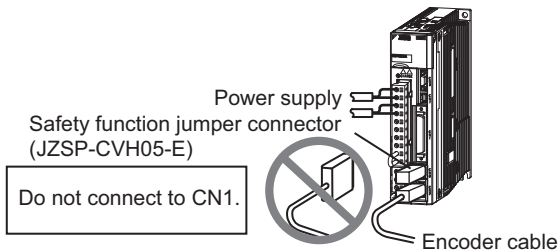
<Note>

- Be sure to secure the servomotor to the equipment, or the servomotor may turn over when it starts rotating.
- Do not connect anything to the servomotor shaft.

■ Checking the Main Circuit Power Supply, Servomotor, and Encoder Wiring

Once again, check the main circuit power supply, servomotor, and encoder wiring that was described in *Chapter 3 Wiring and Connection*.

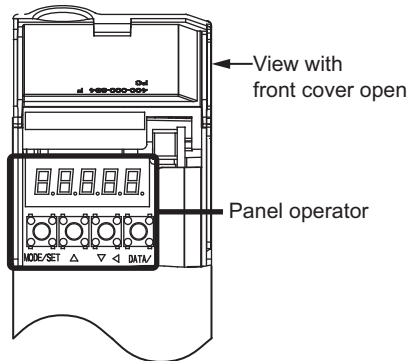
Perform a trial operation with the safety function jumper connector (JZSP-CVH05-E, provided as an accessory) inserted into the CN8 connector.



5.3 JOG Operation Using a Panel Operator

This section describes the procedure for executing a JOG operation using a panel operator.

The panel operator is located under the front cover of the SERVOPACK (analog pulse models only).



| Step | Display after operation | Keys | Operation |
|------|-------------------------|----------------------------------|--|
| 1 | Alternate display | | Turn ON the power to the SERVOPACK. The forward run prohibited (P-OT) or reverse run prohibited (N-OT) message is displayed. When the JOG operation is executed, P-OT and N-OT are automatically disabled. |
| 2 | | MODE/SET ▲ ▼ DATA/◀ | Press the MODE/SET Key to select the utility function mode. |
| 3 | | MODE/SET ▲ ▼ DATA/◀ | Press the Up (▲) or Down (▼) Cursor Key to select Fn02. |
| 4 | | MODE/SET ▲ ▼ DATA/◀ | Press the DATA/SHIFT Key for approximately one second. |
| 5 | | MODE/SET ▲ ▼ DATA/◀ | Press the MODE/SET Key. The servomotor power will turn ON. |

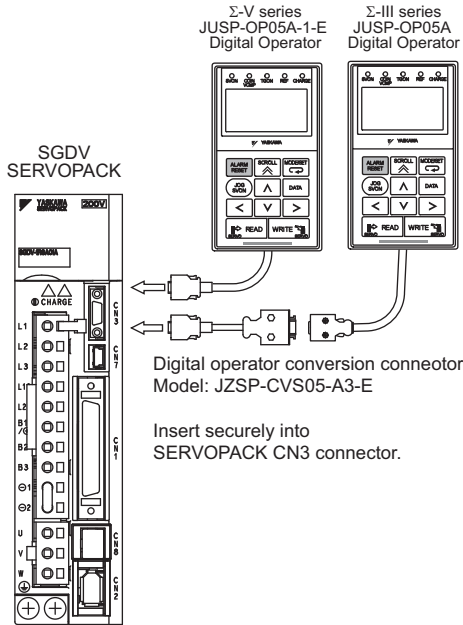
(cont'd)

| Step | Display after operation | Keys | Operation |
|------|------------------------------|------|---|
| 6 | | | <p>Press the Up Cursor Key to rotate the servomotor in the forward direction and press the Down Cursor Key to rotate it in reverse. The servomotor will operate while the key is being pressed. (The factory setting is 500 min⁻¹.)</p> <p>Forward rotation</p> <p>Reverse rotation</p> <p>Confirm that the servomotor operation is correct. At the same time, carefully inspect the servomotor's condition and check the following points in particular. If a problem is found, correct it.</p> <ul style="list-style-type: none"> • Is there any unusual vibration? • Is there any unusual sound? • Is the temperature rising unusually high? |
| 7 | | | <p>Press the MODE/SET Key. The servomotor power will be OFF.</p> <p>Note: The servomotor can be turned OFF by pressing the DATA/SHIFT Key for approximately one second.</p> |
| 8 | | | <p>Press the DATA/SHIFT Key for approximately one second. "Fn002" is displayed again.</p> |
| 9 | <p>↑ ↓ Alternate display</p> | | <p>Press the MODE/SET Key to return to the initial display (step 1).</p> |

5.4 JOG Operation Using a Digital Operator

This section describes the procedure for executing a JOG operation using a digital operator.









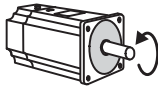
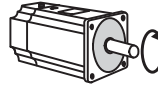




Connect the digital operator to the SERVOPACK CN3 connector.





The digital operator can be connected or removed while the SERVOPACK power is ON.

| Step | Display after operation | Keys | Operation |
|------|--|------|--|
| 1 | <pre>BB - PRM/MON - Un000= 00000 Un002= 00000 Un008= 0000000000 Un00D= 0000000000</pre> | | Turn ON the power to the SERVOPACK. A message saying that the file list is being loaded will appear and then the parameter/monitor mode will appear. |
| 2 | <pre>BB - FUNCTION - Fn000:Alm History Fn002:JOG Fn003:Z-Search Fn004:Program JOG</pre> | | Press the Key to view the main menu of the Utility Function mode. Press the Key or Key to select Fn002. |

(cont'd)

| Step | Display after operation | Keys | Operation |
|------|---|---|---|
| 3 | <pre> BB - JOG - Pn304=00500 Un000= 00000 Un002= 00000 Un00D= 0000000000 </pre> |  | <p>Press the  Key. The display changes to the execution display of Fn002.</p> |
| 4 | <pre> RUN - JOG - Pn304=00500 Un000= 00000 Un002= 00000 Un00D= 0000000000 </pre> |  | <p>Press the  Key. "RUN" is displayed as the status, and the servomotor power turns ON.</p> |
| 5 | <pre> RUN - JOG - Pn304=00500 Un000= 00000 Un002= 00000 Un00D= 0000000000 </pre> |   | <p>Press the  Key to rotate the servomotor in the forward direction and press the  Key to rotate it in reverse. The servomotor will operate while the key is being pressed. (The factory setting is 500 min⁻¹.)</p> <div style="display: flex; flex-direction: column; align-items: center;">  <p>Forward rotation</p>  <p>Reverse rotation</p> </div> <p>Confirm that the servomotor operation is correct. At the same time, carefully inspect the servomotor's condition and check the following points in particular. If a problem is found, correct it.</p> <ul style="list-style-type: none"> • Is there any unusual vibration? • Are there any unusual sound? • Is the temperature rising unusually high? |
| 6 | <pre> BB - JOG - Pn304=00500 Un000= 00000 Un002= 00000 Un00D= 0000000000 </pre> |  | <p>After confirming that the servomotor is running correctly, press the  Key. "BB" is displayed as the status, and the servomotor power turns OFF.</p> |
| 7 | <pre> BB - FUNCTION - Fn000:Alm History Fn002: JOG Fn003: Z-Search Fn004: Program JOG </pre> |  | <p>Press the  Key to return to the main menu of the Utility Function mode.</p> |

(cont'd)

| Step | Display after operation | Keys | Operation |
|------|--|---|--|
| 8 | <pre> BB -PRM/MON- Un000= 00000 Un002= 00000 Un008= 0000000000 Un00D= 0000000000 </pre> |  | Press the  Key twice to return to the initial display (step 1). |

■ Alarm Display

An alarm is automatically displayed if a problem occurs for some reason. Check the alarm using the user's manual for the corresponding SERVOPACK or command option module (refer to *n Manuals Related to the S-V Series* on page iv) and apply the appropriate measures.

```

A. 710      -ALARM-
A_ 710 00001207196
1 : 720 00000032651
2 : 511 00000009043
3 : ----

```

■ Error Display

The following messages will be displayed if a communications error occurs between the SERVOPACK and the digital operator due to a connection problem such as poor connector contact. Check the connections and turn the power ON again. If the problem still persists, the digital operator or SERVOPACK must be replaced.

```

      CPF00
COM-ERR(OP&SV)

```

```

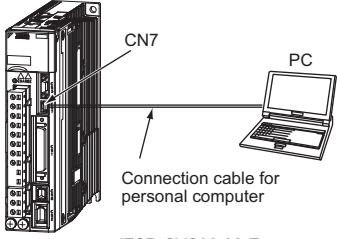



      CPF01
COM-ERR(OP&SV)

```



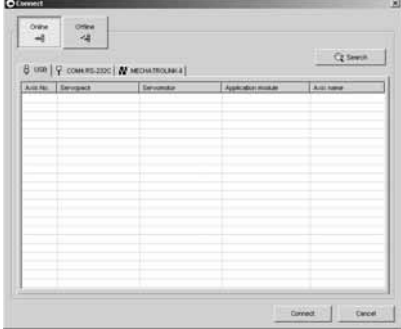

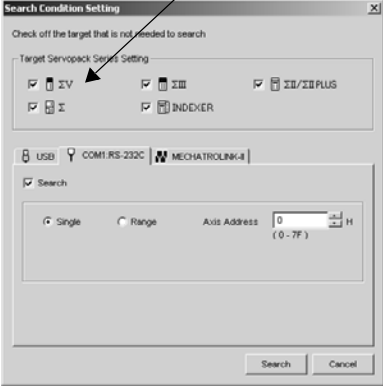

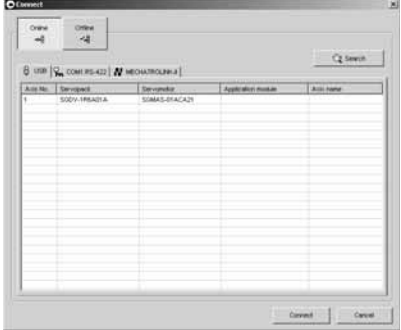
5.5 JOG Operation Using SigmaWin+

This section describes the procedure for executing a JOG operation using SigmaWin+.

In the following example, test-run procedures are explained using the JOG operation window of Test Run on the main menu of SigmaWin+.




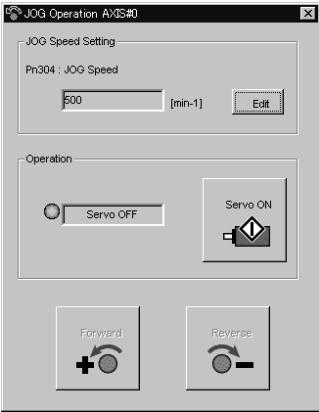
| Step | Operation | Display |
|------|--|---|
| 1 | <ul style="list-style-type: none"> Connect a computer. Use a connection cable to connect a SERVOPACK to a computer which has SigmaWin+ installed. <p>SERVOPACK</p>  <p>JZSP-CVS06-02-E</p> | |
| 2 | <ul style="list-style-type: none"> Start SigmaWin+ and open the main window. (1) Turn ON the SERVOPACK. (2) Turn ON the computer. (3) Double click the YE_Applications folder on the desktop. (4) Double click the SigmaWin+ icon to display the SigmaWin+ startup screen. |  <p>YE_Applications</p>  <p>SigmaWin+ English Edition</p>  <p>Startup Screen</p> |

(cont'd)


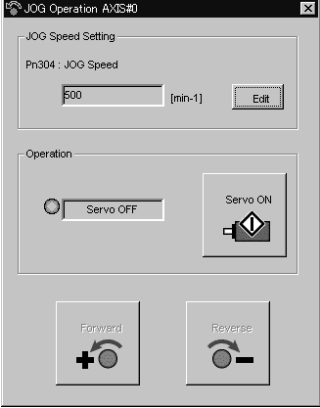

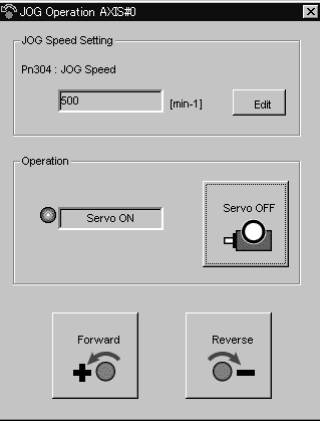
| Step | Operation | Display |
|-----------------------|--|---|
| <p>2 (cont'd)</p> | <p>(5) Once SigmaWin+ is started, the connection window is displayed.</p> <p>Note:  is used for operation with no SERVOPACK connected.</p> <p>Click  to search for the connected SERVOPACK.</p> |  <p>Connection Window</p> |
| | <p>(6) Search Condition Setting window is open.</p> <p>Select Σ-V(<input checked="" type="checkbox"/> ΣV), and click .</p> <p>A dialog box will open first to tell you a search has started, and then the search result will be shown in the connection window.</p> <p>Note: If the message, “Servopack not found” is displayed, refer to 2.2 <i>Selecting a SERVOPACK</i> of SigmaWin+ English Edition Online Manual (YE_Applications -> Manual).</p> |  <p>Select only Σ-V</p> <p>Search Condition Setting Window</p> |
| | <p>(7) Select the SERVOPACK to be connected.</p> <p>Click . (Place the cursor over the SERVOPACK to be connected, and then click on it.)</p> <p>The main window of SigmaWin+ will then open.</p> |  |



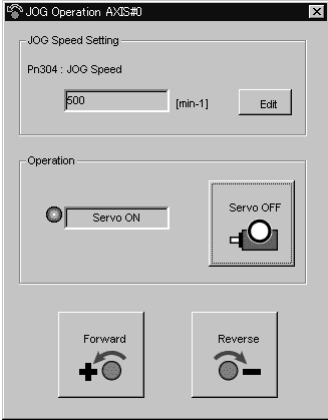

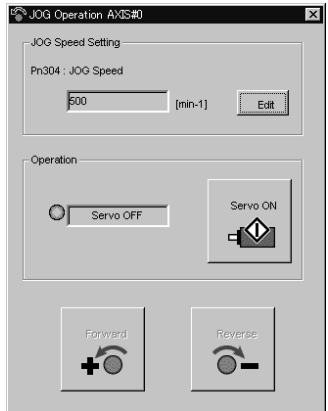

Trial Operation (Checking Servomotor Operation)

(cont'd)

| Step | Operation | Display |
|------|---|--|
| 3 | <p>• Run test operation.</p> <p>(1) Select Test Run first, and then select Jog (J) from the menu on the main window.</p> <p>(2) Warnings for the JOG operation window will be displayed. Read them and click  .</p> <p>(3) The JOG operation window is open.</p> | <p style="text-align: center;">Test Run (R) → Jog (J)</p>  <p style="text-align: center;">Main Window</p>  <p style="text-align: center;">Warnings for the JOG Operation Window</p>  <p style="text-align: center;">JOG Operation Window</p> |

(cont'd)

| Step | Operation | Display |
|------|---|--|
| 4 | <ul style="list-style-type: none"> Set the JOG speed The motor speed is set to 500 [min⁻¹]. Click  if you need to change it. |  |
| 5 | <ul style="list-style-type: none"> Servo ON Click  . The display changes from Servo OFF to Servo ON and is lit in green. |  |

| Step | Operation | Display |
|------|---|--|
| 6 | <p>• Start JOG operation.</p> <p>When you click  the servomotor will rotate in the forward direction. When you click  it will rotate in reverse.</p> <p>Confirm that the servomotor operation is correct. At the same time, carefully inspect the servomotor's condition and check the following points in particular. If a problem is found, correct it.</p> <ul style="list-style-type: none"> • Is there any unusual vibration? • Is there any unusual sound? • Is the temperature rising unusually high? |  |
| 7 | <p>• Servo OFF</p> <p>Click  . (Screen display will return to the display shown at step 4.)</p> |  |
| 8 | <p>• Terminate JOG operation.</p> <p>Click  to end JOG operation.</p> | <p>You will return to the main window.</p> |

Refer to the online manual for SigmaWin+ for details. Follow the steps below to view the online manual.

<How to view the online manual>

1. Turn ON the computer.
2. Open the YE_Applications folder.
3. Open the Manual folder.
4. Open SigmaWin+ English Edition Online Manual.

Revision History

The revision dates and numbers of the revised manuals are given at the bottom of the back cover.

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└ Date of original publication

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| | | Back Cover | Revision: Address |
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| | | All chapters | Completely revised |
| | | Back Cover | Revision: Address |

AC Servo Drives

Σ -V Series

USER'S MANUAL

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Rotational Motor

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