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SV660P Series Servo Drive

Hardware Guide

Industrial Automation | Intelligent Elevator | New Energy Vehicle | Industrial Robot | Rail Transit

Data code 19011391C00

Preface

Introduction

The SV660P series high-performance AC servo drive covers a power range from 50 W to 7.5 kW. The servo drive, which covers a power range from 0.05 kW to 7.5 kW, supports Modbus, CANopen and CANlink communication protocols and carries necessary communication interfaces to operate with the host controller for a networked operation of multiple servo drives.

The servo drive supports adaptive stiffness level setting, inertia auto-tuning, and vibration suppression for easy use. It allows a quiet and stable operation together with an MS1 series high-response servo motor (with low or high inertia) equipped with a 23-bit single-turn/multi-turn absolute encoder.

The servo drive serves to achieve quick and accurate position control, speed control, and torque control in automation equipment such as electronic manufacturing devices, manipulators, packing devices, and machine tools.

This guide introduces installation and wiring of the servo drive, including preparations before installation, unpacking inspection and transportation, wiring, and routine maintenance.

More documents

Name	Data Code	Description
SV660P Series Servo Drive Selection Guide	19011390	Provides instructions on product selection, including the list of supporting components, technical data on the drive and motor, and the selection guide of cables.
SV660P Series Servo Drive Hardware Guide	19011391	Presents electrical design guidance of the equipment, description of terminals, required certificates and standards and solutions to common EMC problems.
SV660P Series Servo Drive Commissioning Guide	19011392	Presents servo commissioning and parameter descriptions, including the operating panel, commissioning software, commissioning procedure and a parameter list.
SV660P Series Servo Drive Function Guide	19011393	Presents functions and parameters, including function overview, basic servo functions, adjustment and parameter list.
SV660P Series Servo Drive Communication Guide	19012201	Presents functions and parameters of the servo drive, including Modbus communication configuration, parameter descriptions, and communication application cases.

Name	Data Code	Description
SV660P Series Servo Drive Troubleshooting Guide	19011907	Introduces faults and fault levels, the troubleshooting process, warning codes and fault codes.
SV660P Series Servo Drive Safety Guide	19011884	Presents the safety function and related certifications and standards, wiring, commissioning process, troubleshooting, and functions.
SV660P Series Servo Drive Manual Package	PS00005513	Provides information on selection, installation, commissioning, function, troubleshooting and parameters of the equipment.

Revision History

Date	Version	Description
2023-04	C00	• Updated the product image on the front cover. • SIZE E does not support zero-distance installation anymore.
2023-01	B01	• Added warranty information in the preface. • Added information on recommended control terminal cable specifications. • Added new content in wiring precautions: After all cables are connected, it is recommended to tie them at the point 10cm–20cm away from the connector end. • Deleted section Control Terminal CN1 (-PS Model).
2022-08	B00	• Modified the storage temperature range. • Added section Control Terminal CN1 (-PS Model). • Added information on port damage due to absence of a current limiting resistor. • Updated the manual structure.
2021-12	A05	• Added the table "Cable specifications and recommended models" to section 3.5.2; deleted information on the PE conductor. • Modified grounding instructions of a single device in section 3.5.6. • Modified the table “Recommended cable sizes” in section 3.7.3. • Minor corrections.
2021-10	A04	• Optimized sections Safety Instructions, Cable Models, Cable Specifications and Recommended Models, and Wiring and Setup of the Regenerative Resistor. • Added information on unpacking weight and fan installation in section Installation. • Deleted the information on braking resistance selection process in section Wiring and Setup of the Regenerative Resistor.

Date	Version	Description
2021-04	A03	• Updated the model number rules of the drive. • Updated the description of cable model numbers. • Updated the model number rules of cables. • Updated the terminal pin assignment of the power line connector (servo motor side). • Added section Precautions for Wiring Encoder Signal Cables.
2020-12	A02	Modified the model number rules of motors.
2020-11	A01	Minor corrections.
2020-08	A00	First release

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version in the following way:

- *http://www.inovance.com*.
- Scan the QR code on the equipment to acquire more.

Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. You will be charged for any repair work after the warranty period expires.

Within the warranty period,maintenance fee will be charged for the following damage:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance fee is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see the Product Warranty Card.

Table of Contents

General Safety Instructions

Safety Precautions

- This section explains the safety precautions that need to be observed to use this product correctly. Before using this product, please read the instruction manual and correctly understand the relevant information of safety precautions. Failure to comply with the safety precautions may result in death, serious injury, or equipment damage.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper use.

Safety Levels and Definitions

	Indicates that failure to comply with the notice will result in death or severe personal injuries.
	Indicates that failure to comply with the notice may result in death or severe personal injuries.
	Indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

General Safety Instructions

- Drawings in the selection guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions. Install the covers or protective guards as specified, and use the equipment in accordance with the instructions described in the user guide.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.

Unpacking

- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the unpacking sequence. Do not strike the package violently.
- Check whether there is damage, rust, or injuries on the surface of the equipment and equipment accessories before unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation

- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.

- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Installation

- The equipment can be operated by well-trained and qualified professionals only. Non-professionals are not allowed.

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.

- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, cut off power connections with all equipment. Residual voltage exists after power cut-off. Therefore, wait at least the time designated on the equipment warning label before further operations. Measure the DC voltage of the main circuit and make sure it is below the safe voltage, otherwise there will be the danger of electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.

- Do not connect the input power supply to the output end of the equipment. Failure to comply will result in equipment damage or even a fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in a fire.
- After wiring is done, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in an electric shock or equipment damage.

- During wiring, follow the proper electrostatic discharge (ESD) procedure, and wear an antistatic wrist strap. Failure to comply will damage the equipment or the internal circuits of the equipment.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-on

- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in an electric shock.

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, make sure that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may resulting in a fire. Failure to comply may result in a fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

Operation

- The equipment must be operated only by professionals. Failure to comply will result in death or personal injuries.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply will result in an electric shock.

- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power ON. Failure to comply will result in an electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power ON. Failure to comply will result in an electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.

- Submit the repair request according to the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries or equipment damage.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal

- Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death.
- Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Additional Precautions

Cautions for the dynamic brake

- Dynamic braking can only be used for emergency stop in case of failure and sudden power failure. Do not trigger failure or power failure frequently.
- Ensure that the dynamic braking function has an operation interval of more than 5 minutes at high speed, otherwise the internal dynamic braking circuit may be damaged.

- Dynamic braking is common in rotating mechanical structures. For example, when a motor has stopped running, it keeps rotating due to the inertia of its load. In this case, this motor is in the regenerative state and short-circuit current passes through the dynamic brake. If this situation continues, the drive, and even the motor, may be burned.

Safety Label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. See the following table for descriptions of the safety labels.

Safety Label	Description
	• Never fail to connect Protective Earth (PE) terminal. Read the manual and follow the safety instructions before use. • Do not touch terminals within 15 minutes after disconnecting the power supply to prevent the risk of electric shock. • Do not touch the heatsink with power ON to prevent the risk of burn.

1 Installation

Read through the safety instructions in Chapter "Fundamental Safety Instructions". Failure to comply may result in serious consequence.

- Observe the installation direction described in this chapter. Failure to comply may result in equipment fault or damage.
- Do not install or operate damaged or defective equipment. Failure to comply can result in personal injury.
- Do not install the equipment in environments exposed to water splashes or corrosive gases. Failure to comply can result in equipment fault.
- Do not install the equipment near inflammable gases or combustible objects. Failure to comply can result in a fire or electric shock.
- Install the equipment inside a fire-proof cabinet that provides electrical protection. Failure to comply may result in a fire.
- Ensure the specified clearance is reserved among the servo drive, the interior surface of the control cabinet, and other machines. Failure to comply can result in a fire or equipment fault.
- Do not put heavy objects on the equipment. Failure to comply may result in personal injury or equipment damage.
- Do not subject the equipment to strong shock. Failure to comply may result in equipment damage.
- Do not block the air inlet/outlet of the equipment or allow unwanted objects to fall into the equipment. Failure to comply may result in a fire or equipment fault.

1.1 Installation of the Servo Drive

1.1.1 Unpacking Inspection

Check the following items upon unpacking.

Item	Description
Check whether the delivered product is consistent with your order.	Check whether the servo drive model and specifications comply with your order. See the dimensions of the packing box in *"Table 1–1 " on page 14*. The deliverables include the product, cushion, carton box, and screw bag, as shown in *"Figure 1–1 " on page 14* .
Check whether the product is intact.	Check whether the product delivered is in good condition. If there is any missing or damage, contact Inovance or your supplier immediately.

Table 1–1 Dimensions of the outer packing box

SIZE	Servo Drive Model SV660P****I	Outer Width (mm)	Outer Height (mm)	Outer Depth (mm)	Weight (kg)
A	S1R6, S2R8	250.0	90.0	195	0.96
B	S5R5	225.0	90	205.0	1.17
C	S7R6, T3R5, T5R4	235.0	105.0	215.0	1.48
D	S012, T8R4, T012	235.0	130.0	225.0	2.02
E	T017, T021, T026	320.0	150.0	280.0	3.94

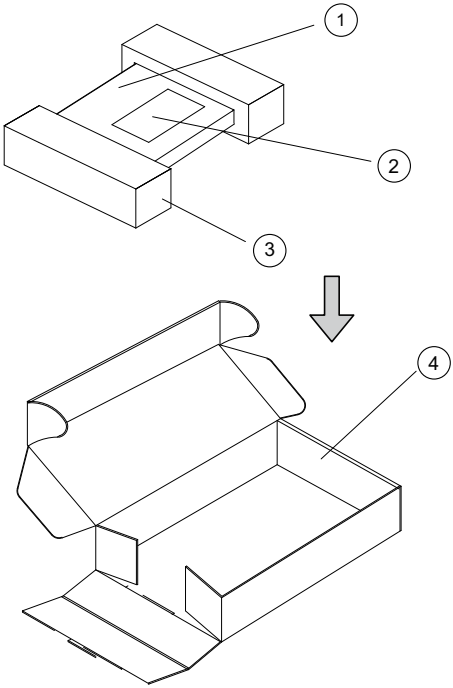


Figure 1-1 Contents inside the packing box

No.	Parameter Name
1	Product
2	Terminal accessories (varying with product models)
3	Cushion
4	Carton box

1.1.2 Installation Environment

Table 1–2 Environment requirements

Item	Requirement
Installation location	Indoors
Grid overvoltage	Overvoltage Class III (OVC III).
Altitude	The maximum altitude is 2000 m. • For altitudes not higher than 1000 m, derating is not required. • Derating is required for altitudes above 1000 m (derate 1% for every additional 100 m). • For altitudes above 2000 m, contact Inovance.
Temperature	• Mounting/Operating temperature: 0°C to 55°C For temperatures between 0°C to 45°C, derating is not required. For temperatures above 45°C, derate 2% for every additional 1°C. • Storage/Transportation temperature: -20°C to +70°C. • To improve the reliability of the machine, use the servo drive in environments without dramatic temperature change. • When installing the servo drive into an enclosed environment such as a control cabinet, use a cooling fan or air conditioner to keep the temperature of the inlet air below 45°C. Failure to comply will result in overheat or fire. • Install the servo drive on the surface of an incombustible object and leave sufficient surrounding space for heat dissipation. • Take measures to prevent the servo drive from being frozen.
Ambient humidity	Below 90% RH (no condensation)
Storage humidity	Below 90% RH (no condensation)
Vibration	Below 4.9m/s^2 • During transportation with packing box: compliant with EN 60721-3-2 Class 2M3. • During installation without packing box: compliant with ISTA 1H.
Shock	Below 19.6m/s^2

Item	Requirement
IP rating	IP20.
Environment	Pollution Degree 2 and below Install the servo drive in a place that meets the following requirements: • Free from direct sunlight, dust, corrosive gas, explosive and inflammable gas, oil mist, vapor, water drop, and salty element • Insusceptible to vibration (away from equipment that may generate strong vibration, such as a punch press) • Free from unwanted objects such as metal powder, oil, and water inside the servo drive • Free from radioactive substances, combustible materials, harmful gases and liquids, and salt corrosion • Away from combustible materials such as wood • Do not use the equipment in vacuum.

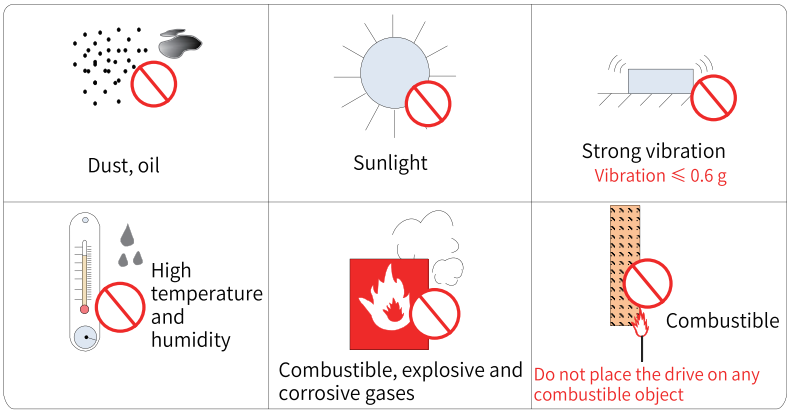


Figure 1-2 Environment requirements

1.1.3 Installation Clearance

Servo drives in different power ratings require different installation clearances. When installing multiple servo drives side by side, it is recommended to reserve a clearance of at least 10 mm (0.39 in.) between every two servo drives and a clearance of at least 50 mm (1.97 in.) above and below each servo drive for heat dissipation.

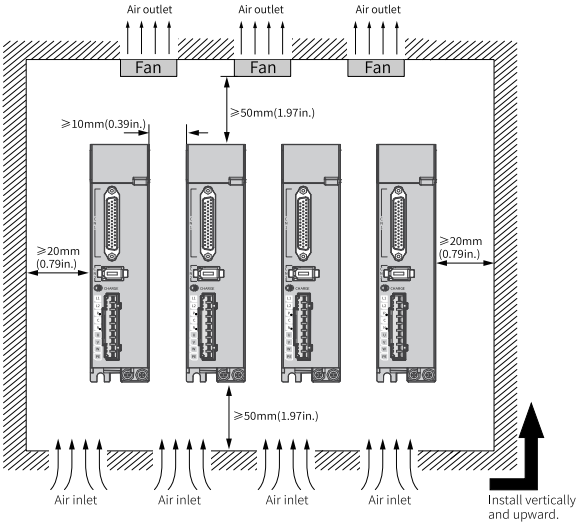


Figure 1-3 Clearance for side-by-side installation

Servo drives rated at 0.2 kW to 0.75 kW (SIZE A and SIZE B) support compact installation, in which a clearance of at least 1 mm (0.04 in.) must be reserved between every two servo drives. When adopting compact installation, derate the load rate to 75%.

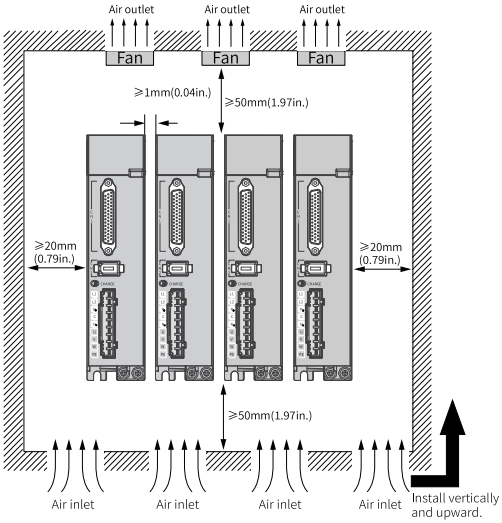


Figure 1-4 Clearance for compact installation

Servo drives in sizes C and D (rated power: 1.0 kW to 3 kW) support zero-clearance installation between every two servo drives, without derating.

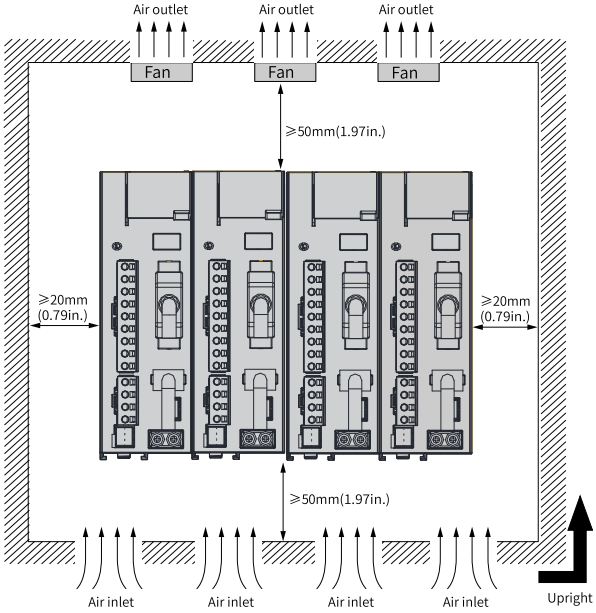


Figure 1-5 Zero-clearance installation

1.1.4 Installation Dimensions

Drives in Size A (rated Power: 0.2 kW to 0.4 kW): SV660PS1R6I, SV660PS2R8I

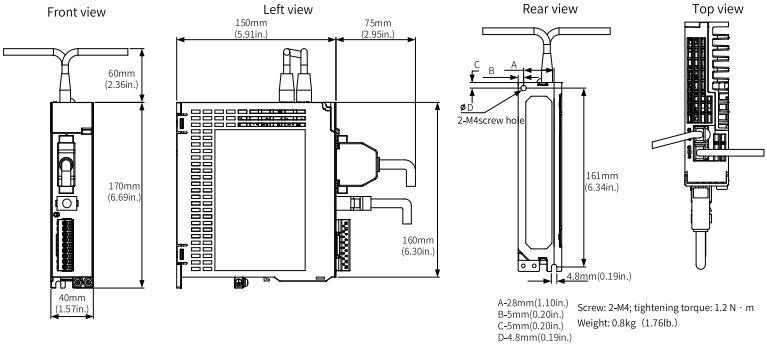


Figure 1-6 Dimension drawing of servo drives in size A

Drives in Size B (rated Power: 0.75 kW: SV660PS5R5I

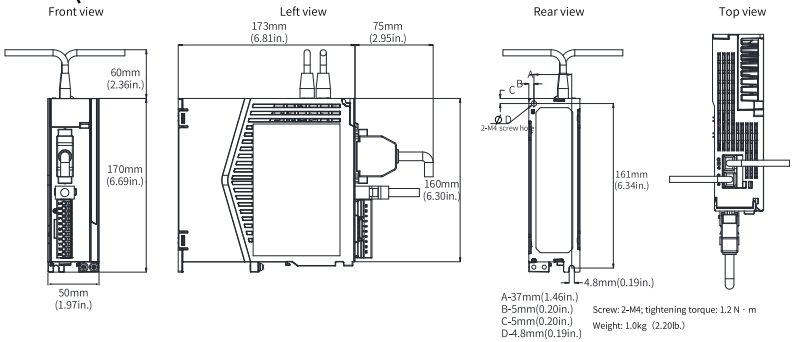


Figure 1-7 Dimension drawing of servo drives in size B

Servo drives in size C (rated power: 1.0 kW to 1.5 kW): SV660PS7R6I, SV660PT3R5I, and SV660PT5R4I

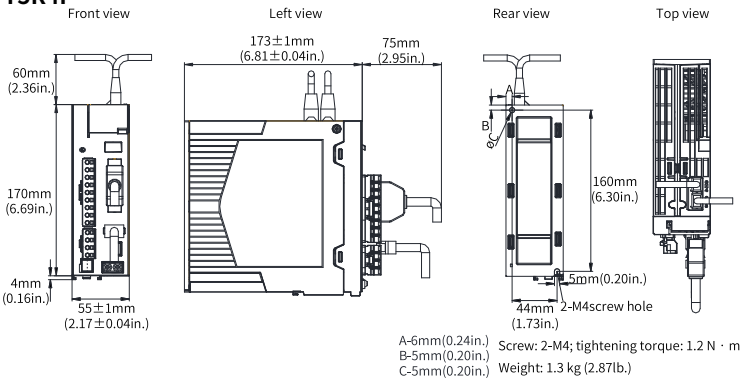


Figure 1-8 Dimension drawing of servo drives in size C

Servo drives in size D (rated power: 1.5 kW to 3.0 kW): SV660PS012I, SV660PT8R4I, and SV660PT012I

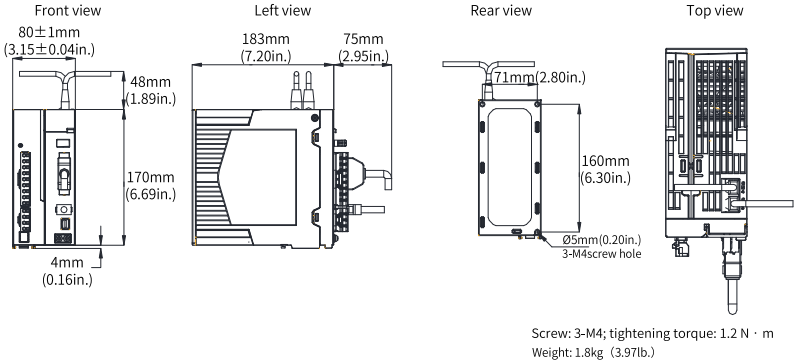


Figure 1-9 Dimension drawing of servo drives in size D

Servo drives in size E (rated power: 5.0 kW to 7.5 kW): SV660PT017I, SV660PT021I, and SV660PT026I

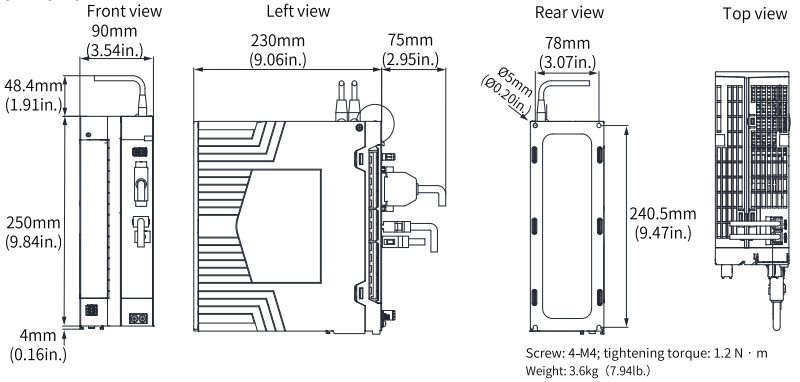
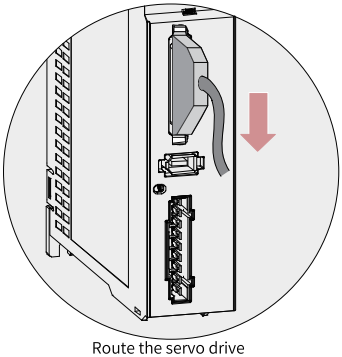
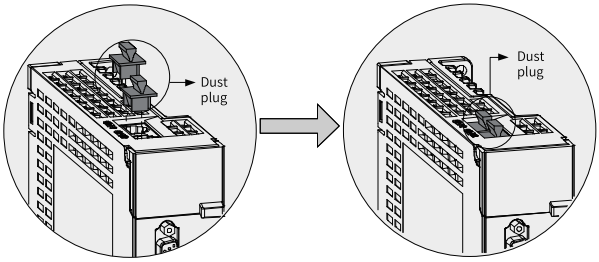


Figure 1-10 Dimension drawing of servo drives in size E

1.1.5 Installation Precautions

Table 1–3 Installation Precautions

Item	Description
Installation Method	• Install the servo drive vertically and upward to facilitate heat dissipation. For installation of multiple servo drives inside the cabinet, install them side by side. For dual-row installation, install an air guide plate. • Make sure the servo drive is installed vertically to the wall. Cool the servo drive down with natural convection or a cooling fan. Secure the servo drive to the mounting surface through two to four mounting holes (the number of mounting holes depends on the capacity of the servo drive). • Install the servo drive vertically to the wall, with its front (actual mounting face) facing the operator. • The mounting bracket (if needed) must be made of incombustible materials.
Cooling	As shown in *"1.1.3 Installation Clearance" on page 16*, reserve sufficient space around the servo drive to ensure a good heat dissipation through the cooling fan or natural convection. Take the heat dissipated by other devices inside the cabinet into consideration. Install a cooling fan to the upper part of the servo drive to avoid excessive temperature rise in a certain area, keeping an even temperature inside the control cabinet.
Grounding	Ground the grounding terminal properly. Failure to comply may result in electric shock or malfunction due to interference.

Item	Description
Wiring requirements	As shown in the figure below, route the servo drive cables downwards to prevent liquid from flowing into the servo drive along the cables.  Route the servo drive cables downwards.
Dust-proof cover (included in the standard configuration)	Insert the dust-proof cover into the communication port (CN3/CN4) not in use. This is to prevent unwanted objects, such as solids or liquids, from falling into the servo drive and resulting in faults. Each servo drive is delivered with two dust-proof covers inserted into the communication ports by default. You can place an order for more dust-proof covers as needed (model: NEX-02-N2B; manufacturer: PINGOOD).  **Note:** • Dust-proof cover: Prevents unwanted objects, such as solids or liquids, from falling into the servo drive and resulting in faults. • Dust-proof covers are delivered along with the servo drive. Keep the dust-proof covers in a proper place.

1.1.6 Installation Instructions

The servo drive supports backplate mounting only.

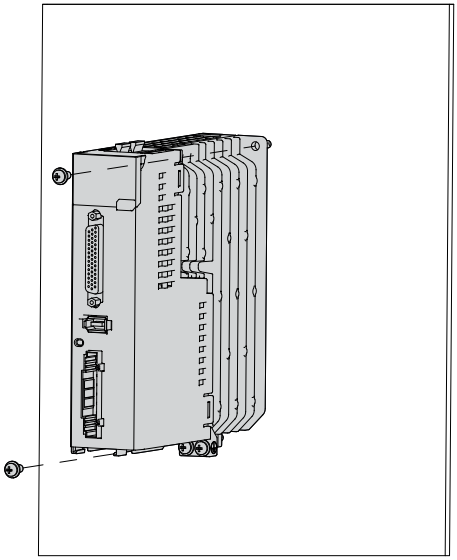


Figure 1-11 Backplate mounting

Note

Servo drives in sizes A, B, and C are secured by two screws, with one screw on the top and the other one at the bottom. Servo drives in size D are secured by three screws, with two screws on the top and another one at the bottom. Servo drives in size E are secured by four screws, with two screws on the top and the other two at the bottom.

1.2 Installation of Optional Parts

1.2.1 Instructions for Installing the Fuse and Circuit Breaker

Caution

To prevent electric shock, when the fuse is blown or the circuit breaker trips, wait for at least the time designated on the warning label before powering on the drive or operating peripheral devices. Failure to comply can result in death, severe personal injury, or equipment damage.

To comply with EN 61800-5-1 and UL 61800-5-1, install a fuse/circuit breaker on the input side of the servo drive to prevent accidents caused by short circuit in the internal circuit.

1.2.2 Instructions for Installing the AC Input Reactor

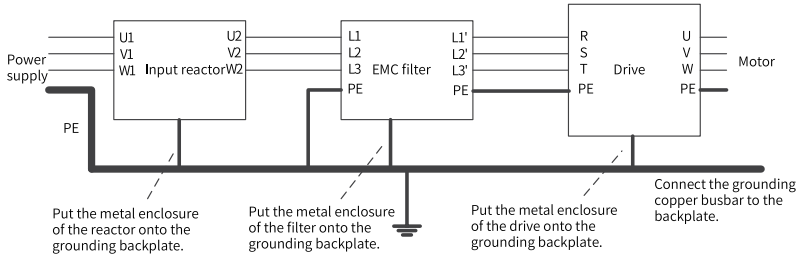


Figure 1-12 Installing the AC input reactor

1.2.3 Instructions for Installing the EMC Filter

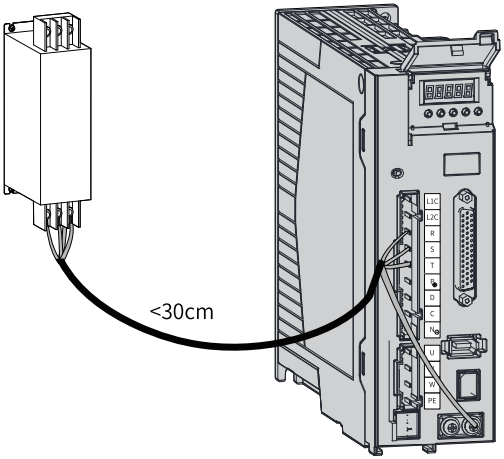


Figure 1-13 Installing the AC input reactor

1.2.4 Installation of the Magnetic Ring and Ferrite Clamp

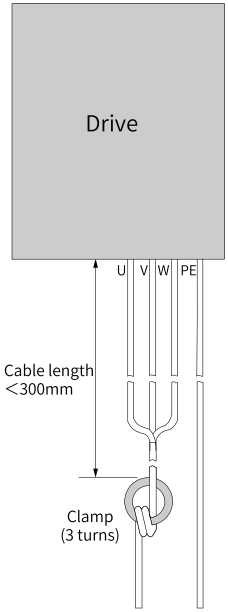


Figure 1-14 Installation of the magnetic ring

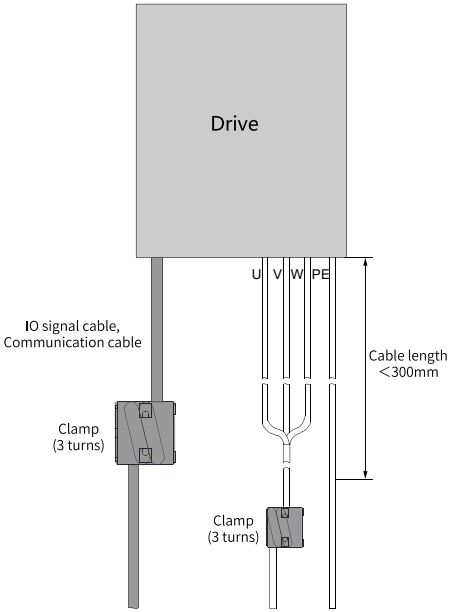


Figure 1-15 Installation of the ferrite clamp

2 System Wiring

2.1 System Wiring

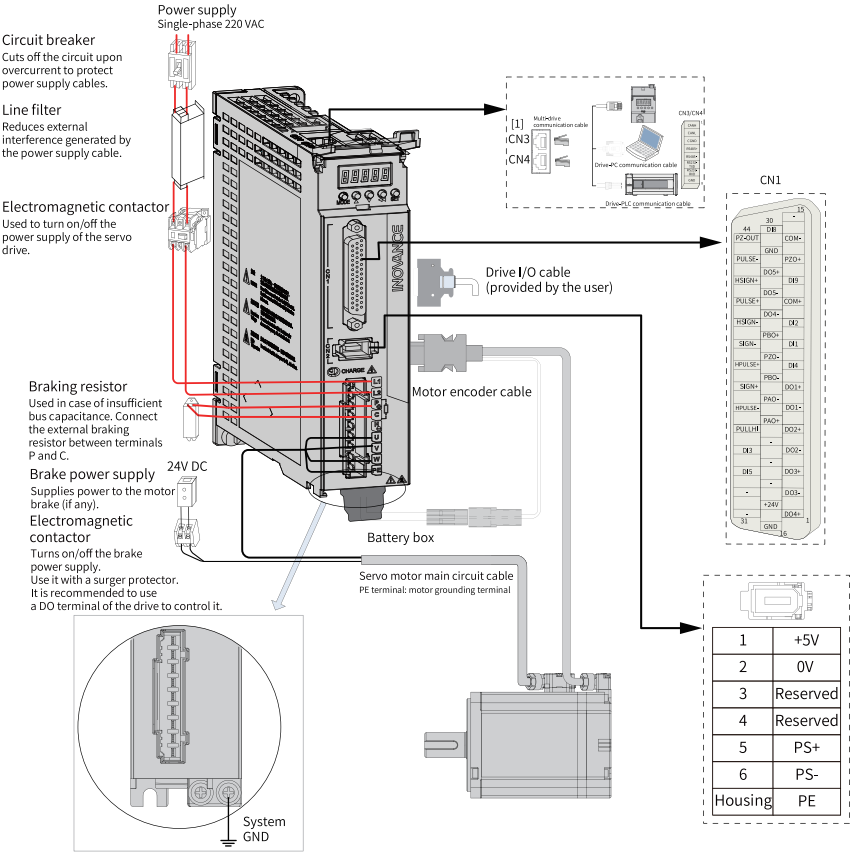


Figure 2-1 Wiring example of a single-phase 220 V system

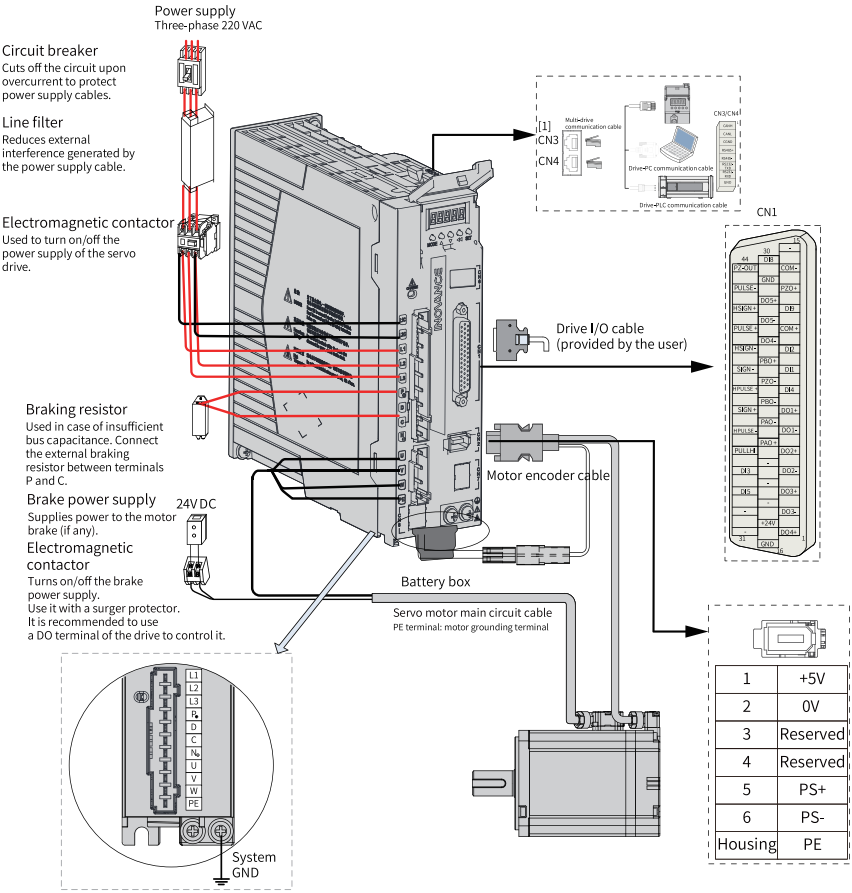


Figure 2-2 Wiring example of a three-phase 220V system

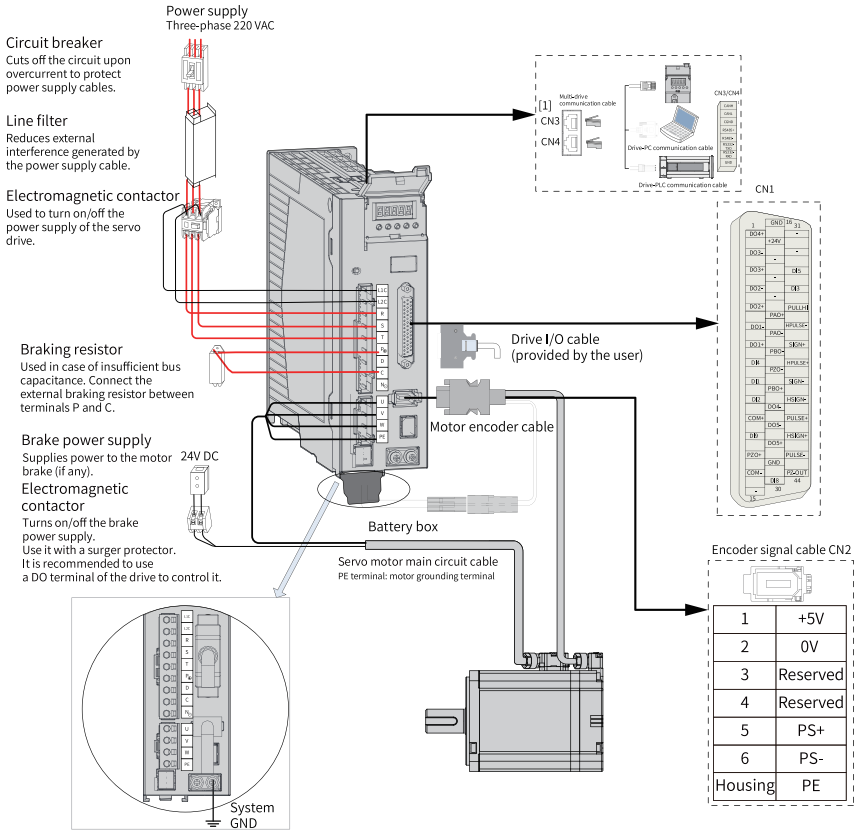


Figure 2-3 Wiring example of a three-phase 380 V system

Note

[1] CN3 and CN4 communication terminals can be used interchangeably. Their pin assignments are exactly the same.

2.2 System Composition

- The servo drive is directly connected to an industrial power supply, with no isolation such as a transformer. A fuse or circuit breaker therefore must be connected to the input power supply to prevent electric shock in the servo system. For the sake of safety, install a residual current device (RCD) to provide protections against overload and short circuit or a specialized RCD to protect the grounding cable.

- Do not start or stop the motor by using the electromagnetic contactor. As a high-inductance device, the motor may generate high voltages instantaneously, which may break down the contactor.
- When connecting an external power supply to the control circuit or a 24 VDC power supply, pay attention to the power capacity as insufficient power capacity will lead to insufficient supply current, resulting in failure of the servo drive or the brake. This is especially true when the power supply is used to power up multiple servo drives or brakes. The brake must be powered up by a 24 VDC power supply that matches the motor model and meets the brake power requirements.

Note

- The built-in regenerative resistor or jumper bar is not available in models S1R6 and S2R8. If an external regenerative resistor is needed for these models, connect it between terminals P⊕ and C.
- Remove the jumper between P⊕ and D before using the external regenerative resistor. Failure to comply will result in overcurrent and damage the braking transistor.
- Do not connect the external regenerative resistor to the positive or negative pole of the bus directly. Failure to comply will damage the servo drive and result in a fire.
- Do not select any resistor lower than the minimum allowed resistance value. Failure to comply will result in E201.0 (Hardware overcurrent) or damage the servo drive.
- Make sure parameters H02.25 (Regenerative resistor setting), H02.26 (Power of external regenerative resistor) and H02.27 (Resistance of external regenerative resistor) are set properly before operating the servo drive.
- Install the external regenerative resistor on an incombustible object such as a metal.

3 Electrical Wiring Diagrams

3.1 Wiring diagram of the Position Control Mode

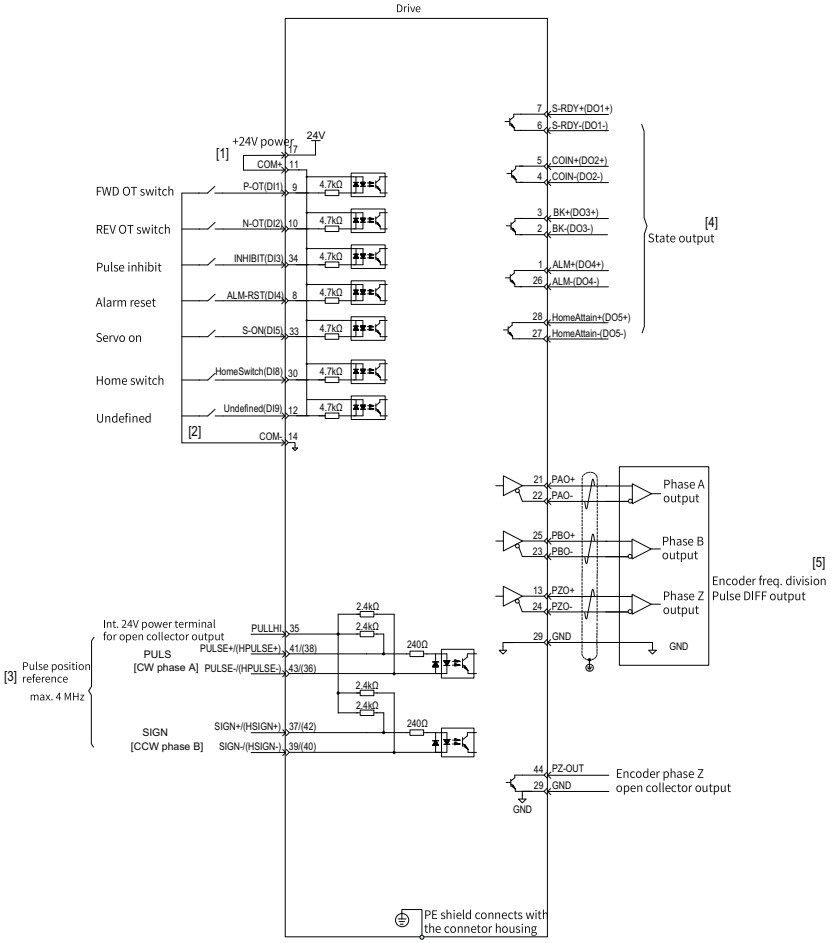


Figure 3-1 Wiring diagram of the Position Control Mode

Note

- [1] The range of the internal +24 V power supply is 20 V to 28 V, with maximum operating current being 200 mA.
- [2] DI8 and DI9 are high-speed DIs that must be used according to their functions assigned.
- [3] Use the shielded twisted pairs for pulse terminals, with both ends of the shield connected to PE. Connect GND and signal GND of the host controller properly. The high-speed and low-speed pulse instruction inputs (differential input) share the same interface. The corresponding function code is set according to the frequency of the input pulse.
- [4] The DO power supply (voltage range: 5 V to 24 V) needs to be prepared by users. The DO terminals support a maximum voltage of 30 VDC and a maximum current of 50 mA.
- [5] Use the shielded twisted pair cable as the frequency-division cable, with both ends of the shield connected to PE. Connect GND and signal GND of the host controller properly.

3.2 Wiring Diagram for Torque Control Mode

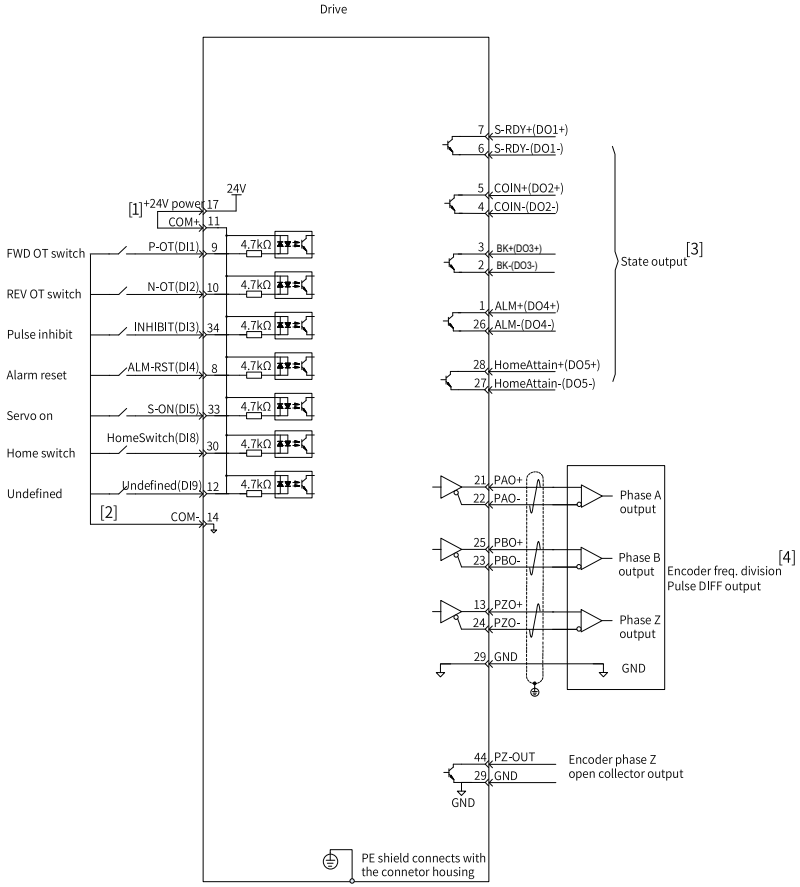


Figure 3-2 Wiring Diagram for Torque Control Mode

Note

- [1] The range of the internal +24 V power supply is 20 V to 28 V, with maximum operating current being 200 mA.
- [2] DI8 and DI9 are high-speed DIs that must be used according to their functions assigned.
- [3] The DO power supply (voltage range: 5 V to 24 V) needs to be prepared by users. The DO terminals support a maximum voltage of 30 VDC and a maximum current of 50 mA.
- [4] Use the shielded twisted pair cable as the frequency-division cable, with both ends of the shield connected to PE. Connect GND and signal GND of the host controller properly.

4 Wiring Terminals

4.1 Wiring Precautions

Read through the safety instructions in Chapter "Fundamental Safety Instructions". Failure to comply may result in serious consequences.

- Do not use the power from IT system for the servo drive. Use the power from TN/TT system for the drive. Failure to comply may result in an electric shock.
- Connect an electromagnetic contactor between the input power supply and the main circuit power supply of the drive (L1, L2 for single-phase; L1, L2, L3/R, S, T for three-phase) to form a structure allowing independent power cutoff on the power supply side of the drive. This is to prevent fire accident caused by continuous high current generated upon fault.
- Check that the input power supply of the drive is within the specified voltage range. Failure to comply may result in faults.
- Do not connect the output terminals U, V, and W of the drive to a three-phase power supply. Failure to comply may result in physical injury or a fire.
- Do not connect the motor terminals U, V, and W to a mains power supply. Failure to comply may result in physical injury or a fire.
- Use the ALM (fault) signal to cut off the main circuit power supply. A faulty braking transistor may overheat the regenerative resistor and lead to a fire.
- Connect the PE terminal of the drive to the PE terminal of the control cabinet. Failure to comply may result in an electric shock.
- Ground the entire system properly. Failure to comply may result in equipment malfunction.
- After the power supply is cut off, residual voltage is still present in the internal capacitor of the drive, wait for at least 15 min before further operations. Failure to comply may result in an electric shock.

Caution

- The specification and installation of external cables must comply with applicable local regulations.
- Observe the following requirements when the servo drive is used on a vertical axis.
  - Set the safety device properly to prevent the workpiece from falling upon warning or overtravel.
  - Ensure the positive/negative polarity of the 24 V power supply is correct. Otherwise, the axis may fall and cause personal injury or equipment damage.
- Observe the following requirements during wiring of the power supply and main circuit:
  - When the main circuit terminal is a connector, remove the connector from the servo drive before wiring.
  - Insert one cable into one cable terminal of the connector. Do not insert multiple cables into one cable terminal.
  - When inserting cables, take enough care to prevent the cable conductor burrs from being short circuited to the neighboring cable.
  - Insulate the connecting part of the power supply terminals to prevent electric shock.
  - Do not connect a 220 V servo drive to a 380 V power supply directly.
  - Install safety devices such as a circuit breaker to prevent short circuit in external circuits. Failure to comply may result in a fire.
  - Cut off the main circuit power supply and switch off the S-ON signal after an alarm signal is detected.
  - After all cables are connected, it is recommended to tie them at the point 10cm–20cm away from the connector end.
- Connect the servo drive to the motor directly. Do not use an electromagnetic contactor during wiring. Failure to comply may result in equipment fault.
- Do not put heavy objects onto cables or pull cables with excessive force. Failure to comply may result in cable damage, leading to an electric shock.
- When connecting DO terminals to relays, ensure the polarity of the flywheel diode is correct. Wrong polarity will result in equipment damage or signal output failure.
- Keep a distance of at least 30 cm between main circuit cables and I/O signal cables/encoder cables. Failure to comply may result in equipment malfunction.
- Use twisted pairs or multi-conductor shielded twisted pairs as the I/O signal cable or encoder cable. Failure to comply may result in equipment malfunction.
- The maximum wiring lengths of the I/O signal cable and the encoder cable are 3 m and 10 m respectively.
- Use a power supply filter to reduce the electromagnetic interference on electronic devices surrounding the servo drive.
- Take proper shielding measures in the following locations to prevent equipment damage:

- Locations with interference caused by static electricity
- Locations with strong electric field or magnetic field
- Locations with radioactive rays

Size A (rated power: 0.2 kW–0.4 kW): SV660PS1R6I, SV660PS2R8I

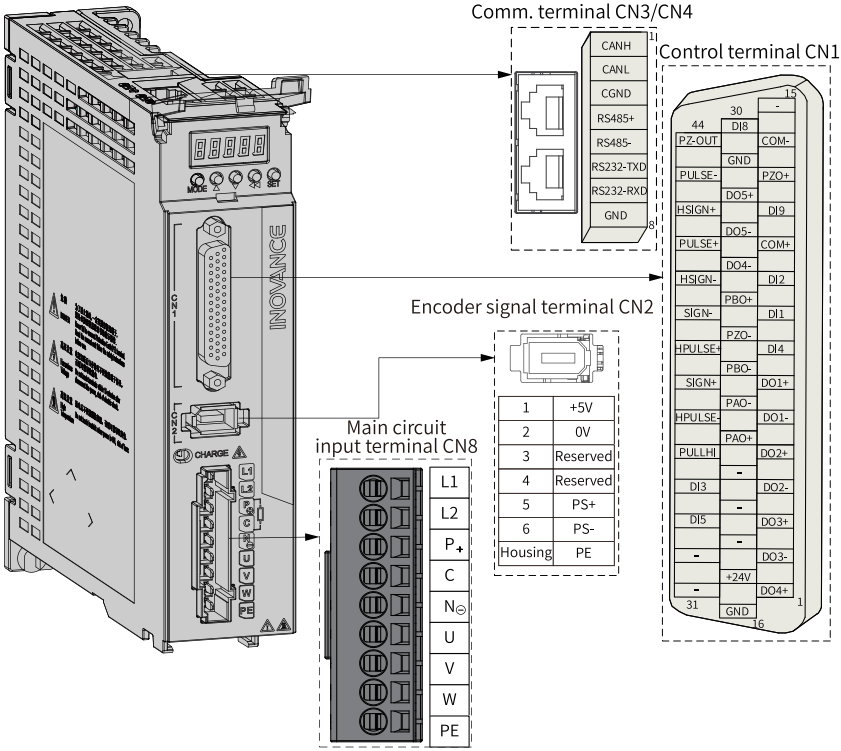


Figure 4-1 Terminal pin layout of servo drives in size A

Rated power: (SIZE B: 0.75 kW): SV660PS5R5I

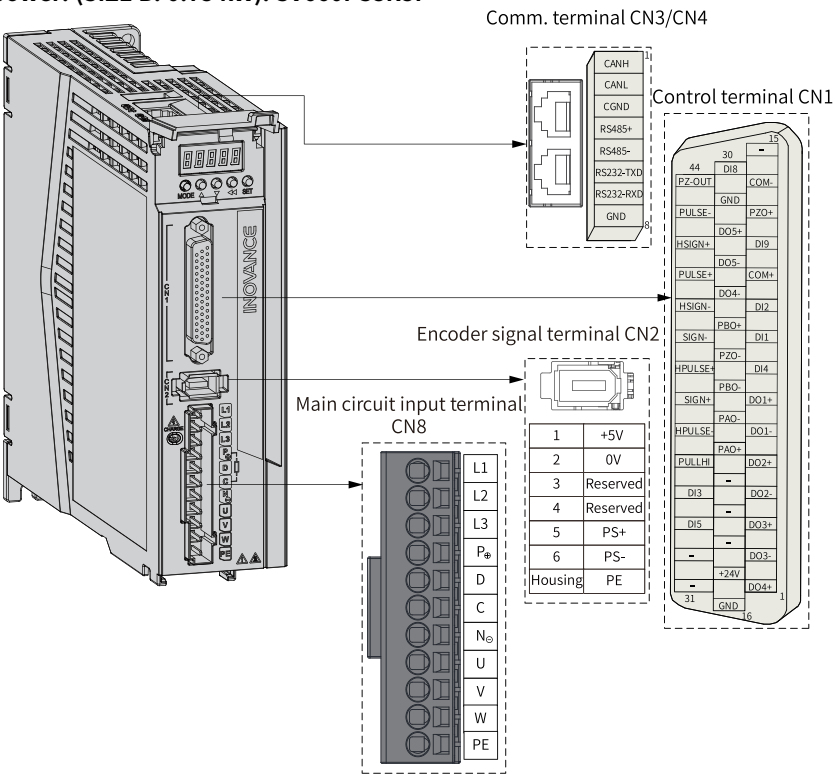


Figure 4-2 Terminal pin layout of servo drives in size B

Servo drives in size C and size D (rated power: 1.0 kW to 1.5 kW): size C: SV660PS7R6I; size D: SV660PS012I

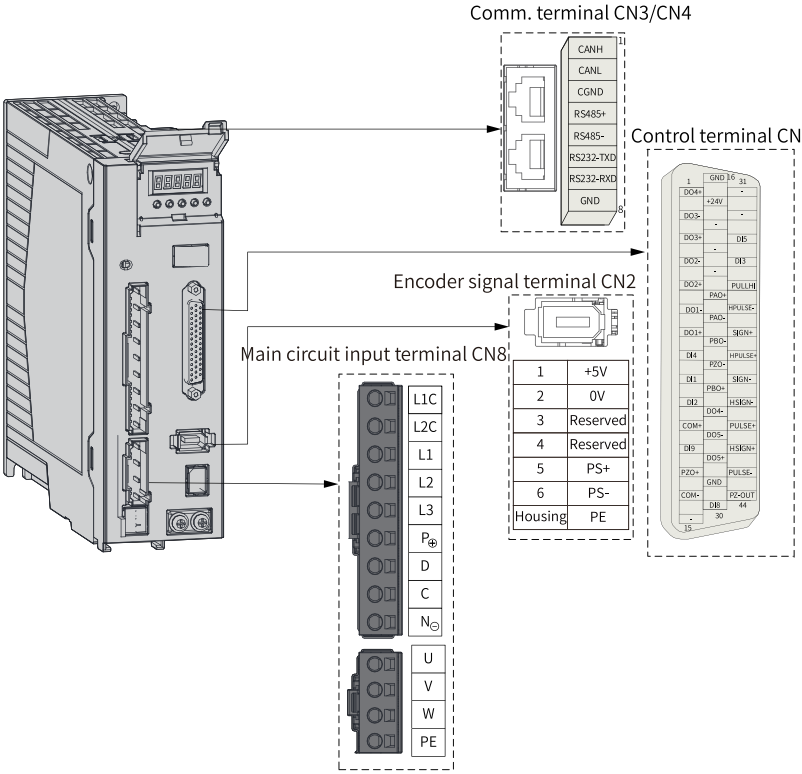


Figure 4-3 Terminal pin layout of servo drives in size C (SV660PS7R6I) and size D (SV660PS012I)

Servo drives in size C and size D (rated power: 1.0 kW to 3.0 kW): size C: SV660PT3R5I and SV660PT5R4I; size D: SV660PT8R4I and SV660PT012I

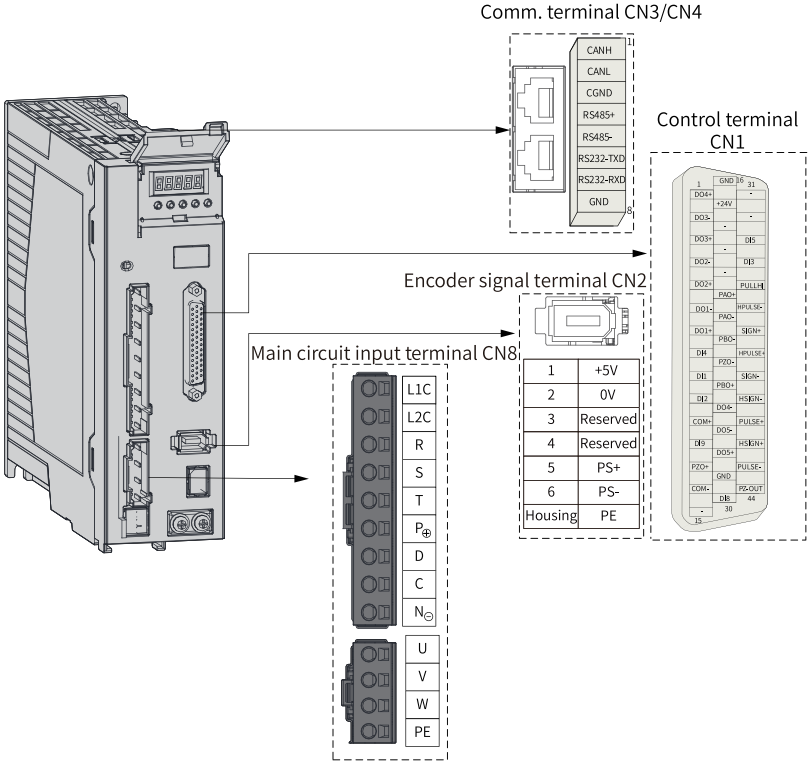


Figure 4-4 Terminal pin layout of servo drives in size C (SV660PT3R5I, SV660PT5R4I) and size D (SV660PT8R4I, SV660PT012I)

Size E (rated power: 5.0 kW to 7.5 kW): SV660PT017I, SV660PT021I, and SV660PT026I

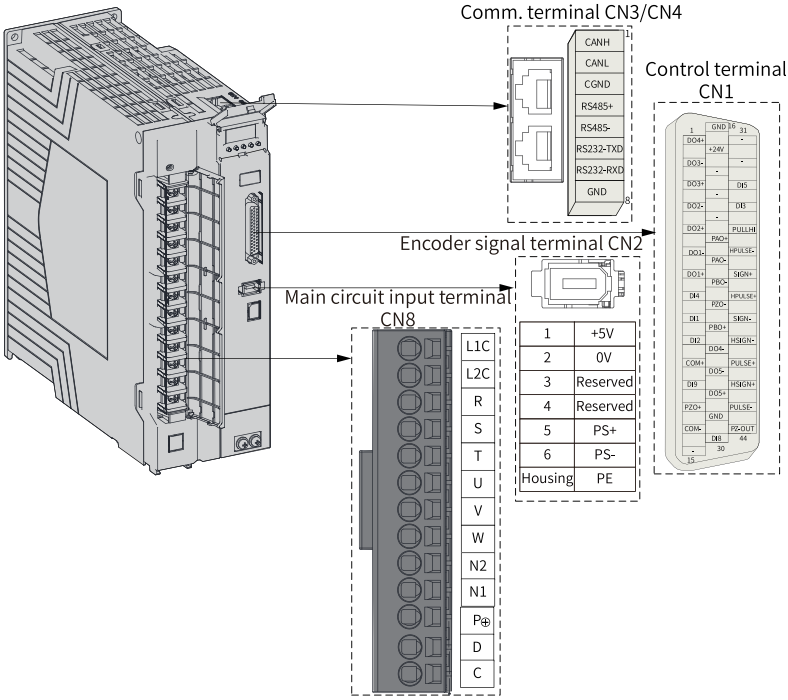


Figure 4-5 Terminal pin layout of servo drives in size E

4.2 Main Circuit Terminals

4.2.1 Wiring Precautions

- Do not connect the input power supply cables to the output terminals U, V, and W. Failure to comply will damage the servo drive.
- When cables are bundled in a duct, take current reduction ratio into consideration because of the poor cooling condition.
- It is recommended to use Teflon cables featuring a higher temperature limit when the temperature inside the cabinet exceeds the temperature limit of regular cables. As the surface of regular cables may be easily hardened and cracked under low temperature, take thermal insulation measures for cables laid in environments with low temperature.
- The bending radius of a cable must be more than 10 times its outer diameter to prevent the internal conductor from breaking due to long-time bending.

- Do not bundle power cables and signal cables together or route them through the same duct. Power cables and signal cables must be separated by at least 30 cm to prevent interference.
- High voltage may be still present in the servo drive after the power supply is switched off. Do not touch the power supply terminals within 15 minutes after power-off.
- Do not switch on/off the power supply frequently. If the power supply is switched on or off frequently within 1s, E740.0/E136.0/E430.0 may occur (see the Troubleshooting Guide for details). In this case, power on the servo drive again after waiting for the specified ON/OFF interval. If frequent ON/OFF operation is needed, the time interval between ON and OFF must be at least 1 min.
  The servo drive carries a capacitor in the power supply part, and this capacitor will be charged with a high current for 0.2s upon power-on. Turning on/off the power supply frequently affects the performance of main circuit components inside the servo drive.
- Use a grounding cable with the same cross-sectional area as the main circuit cable. If the cross-sectional area of the main circuit cable is less than 1.6 mm2, use a grounding cable with a cross-sectional area of 2.0 mm2.
- Do not power on the servo drive if terminal screws or cables are loose. Failure to comply may lead to a fire.

4.2.2 Main Circuit Wiring Requirements

Servo drive power input cables and motor cables may generate strong electromagnetic interference. To prevent the electromagnetic interference incurred by long-distance parallel routing and coupling between disturbing cables and control cables, keep a clearance of at least 30 cm between main circuit cables and signal cables. Main circuit cables include the RST cable, UVW cable, DC bus, and braking cable. Signal cables include the I/O signal cable, communication cable, and encoder cable.

Cable ducts must be connected and grounded properly. Aluminum cable ducts can be used to ensure equipotentiality of the device. The filter, servo drive, and motor must be properly connected to systems (machines or devices), with spraying protection applied at the installation part and the conductive metal kept in full contact.

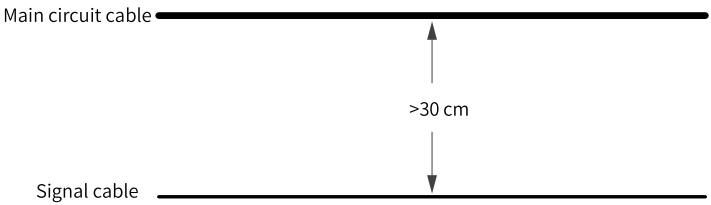


Figure 4-6 Cable layout

Wiring requirements

The wiring mode compliant with the Low Voltage Directive is supported.

- Terminals P⊕, C, and NΘ are used to connect optional parts. Do not connect these terminals to an AC power supply.
- To protect the main circuit, separate and cover the surface that may come into contact with the main circuit.
- Prevent foreign objects from entering the wiring area of the terminal block.
- Do not solder the twisted conductors.
- The tightening torque may vary with terminals. Tighten terminal screws with the specified tightening torque. You can use a torque screwdriver, torque ratchet, or torque wrench to tighten terminal screws.
- When using an electric screwdriver to tighten terminal screws, set the electric screwdriver to low speed to prevent damage to the terminal screws.
- Tighten the terminal screws with an angle not greater than 5°. Failure to comply may damage the terminal screws.

4.2.3 Recommended Cable Specifications and Models

Table 4–1 Input/Output current specifications of the servo drive

Drive model SV660P****I		Rated input current (A)	Rated output current (A)	Maximum Output Current (A)
Single-phase 220V				
Size A	S1R6	2.3	1.6	5.8
	S2R8	4	2.8	10.1
Size B	S5R5	7.9	5.5	16.9
Size C	S7R6	9.6	7.6	23
Size D	S012	12.8	11.6	32
Three-phase 220V				
Size C	S7R6	5.1	7.6	23
Size D	S012	8	11.6	32
Three-phase 380 V				

Drive model SV660P****I		Rated input current (A)	Rated output current (A)	Maximum Output Current (A)
Size C	T3R5	2.4	3.5	11
	T5R4	3.6	5.4	14
Size D	T8R4	5.6	8.4	20
	T012	8	11.9	29.75
Size E	T017	12	16.5	41.25
	T021	16	20.8	52.12
	T026	21	25.7	64.25

Table 4–2 Recommended main circuit cables

Drive model SV660P****I			L1C, L2C		L1, L2, L3/R, S, T		P⊕, D, C, NΘ, N2, N1		U, V, W, PE		Grounding terminal	
Size	Model	Rated input current (A)	(mm^2)	AWG	(mm^2)	AWG	(mm^2)	AWG	(mm^2)	AWG	(mm^2)	AWG
Single-phase 220V												
Size A	S1R6	2.3	2 x 0.82	18	3 x 1.31	16	2 x 1.31	16	3 x 1.31	16	2.08	14
	S2R8	4	2 x 0.82	18	3 x 1.31	16	2 x 1.31	16	3 x 1.31	16	2.08	14
Size B	S5R5	7.9	2 x 0.82	18	3 x 1.31	16	2 x 1.31	16	3 x 1.31	16	2.08	14
Size C	S7R6	9.6	2 x 0.82	18	3 x 1.31	16	2 x 1.31	16	3 × 1.31[1]	16	2.08	14
			2 x 0.82		3 x 1.31		2 x 1.31		3 × 2.08[2]	14		14
Size D	S012	12.8	2 x 0.82	18	3 x 2.08	14	2 x 2.08	14	3 x 2.08	14	2.08	14
Three-phase 220V												
Size C	S7R6	5.1	2 x 0.82	18	3 x 1.31	16	2 x 1.31	16	3 × 1.31[1]	16	1.31[1]	16
									3 × 2.08[2]	14	2.08[2]	14
Size D	S012	8	2 x 0.82	18	3 x 2.08	14	2 x 2.08	14	3 x 2.08	14	2.08	14
Three-phase 380 V												
Size C	T3R5	2.4	2 x 0.82	18	3 x 1.31	16	2 x 1.31	16	3 x 1.31	16	2.08	14
	T5R4	3.6	2 x 0.82	18	3 x 1.31	16	2 x 1.31	16	3 x 1.31	16	2.08	14
Size D	T8R4	5.6	2 x 0.82	18	3 x 1.31	16	2 x 1.31	16	3 x 1.31	16	2.08	14
	T012	8	2 x 0.82	18	3 x 2.08	14	2 x 2.08	14	3 x 2.08	14	2.08	14
Size E	T017	12	2 x 0.82	18	3 x 5.27	10	2 x 5.27	10	3 × 3.33[3]	12	3.33[3]	12
									3 × 5.27[4]	10	5.27[4]	10
	T021	16	2 x 0.82	18	3 x 5.27	10	2 x 5.27	10	3 x 5.27	10	5.27	10
	T026	21	2 x 0.82	18	3 x 5.27	10	2 x 5.27	10	3 x 5.27	10	5.27	10

Note

- [1]: For MS1H1-10C30CB motors.
- [2]: For MS1H2-10C30CB/MS1H3-85B15CB motors.
- [3]: For MS1H2-40C30CD/MS1H2-50C30CD motors.
- [4]: For MS1H3-44C15CD motors.

Table 4–3 Recommended Cable Specifications and Models

Cable Type	Cable Size	OD (mm)
Power cable	4×12AWG	12.2±0.4
	4×14AWG	10.5±0.3
	4×16AWG	9.5±0.4
	4×18AWG	7.8±0.2
	4×20AWG	6.5±0.2
Power cable shield	4×12AWG	12.9±0.4
	4×14AWG	11.2±0.4
	4×16AWG	10.1±0.4
	4×18AWG	8.3±0.2
	4×20AWG	6.5±0.2
Power cable + brake cable	4 × 20AWG + 2 × 24AWG	6.5±0.2
Brake cable	2×18AWG	5.8±0.2
	2×20AWG	5.0±0.2

Table 4–4 Main circuit cable lug and tightening torque

Servo drive model SV660P**I			Recommended PVC Cable Model (at 40°C)			
SIZE	Model	Rated Input Current (A)	U, V, W, PE Cable Lug	Brake Cable Lug	Grounding Cable Lug	Tightening Torque (N·m)
Single-phase 220V						
Size A	S1R6	2.3	GTVE10008	GTVE05008	TVR2-4	-
	S2R8	4			TVR2-4	-
Size B	S5R5	7.9			TVR2-4	-
Size C	S7R6	9.6			TVR2-4	-
Size D	S012	12.8	GTVE15008	GTVE10008	TVR2-4	-
Three-phase 220V						
Size C	S7R6	5.1	GTVE10008	GTVE05008	TVR2-4	-
Size D	S012	8	GTVE15008	GTVE10008	TVR2-4	-
Three-phase 380 V						

Servo drive model SV660P**I			Recommended PVC Cable Model (at 40°C)			
SIZE	Model	Rated Input Current (A)	U, V, W, PE Cable Lug	Brake Cable Lug	Grounding Cable Lug	Tightening Torque (N·m)
Size C	T3R5	2.4	GTVE10008	GTVE05008	TVR2-4	-
	T5R4	3.6			TVR2-4	-
Size D	T8R4	5.6			TVR2-4	-
	T012	8	GTVE15008	GTVE10008	TVR2-4	-
Size E	T017	12	TVS1.25-4	GTVE10008	TVR1.25-4	1.36
	T021	16	TVS2-4	GTVE10008	TNR2-4	1.36
	T026	21	TVS3.5-4	GTVE10008	TNR3.5-4	1.36

Table 4–5 TVR2-4 cable lug

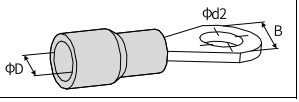
Lug Model		D (mm)	d2 (mm)	B (mm)	Dimension Drawing
TVR	2-4	4.5	4.3	8.5	

Table 4–6 Recommended terminal blocks

Servo drive model SV660P****I		Terminal Block
Size A	S1R6	9EDGK-5.0-09P-13-01AH & Gaozheng & B/BBB1
	S2R8	
Size B	S5R5	9EDGK-5.0-11P-13-05AH & Gaozheng & B/BBA2
Size C	S7R6	9EDGK-7.5-09P-13-1014A(H) & Gaozheng & B/BAB1+9EDGK-7.5-04P-13-1015A_H & Gaozheng & B/BAA2
	T3R5	
	T5R4	
Size D	S012	
	T8R4	
	T012	
Size E	T017	-
	T021	
	T026	

Table 4–7 Specifications of motor output cables

MS1H1/H4 05B–10C (applicable to 0.05 kW–1 kW)			
Cable type	Regular cable	Flexible cable	Oil-resistant shielded flexible cable
Cable model	S6-L-M/B***-X.X	S6-L-M/B***-X.X-T	S6-L-M/B***-X.X-TS

MS1H1/H4 05B–10C (applicable to 0.05 kW–1 kW)			
Cable specifications	UL2517 (rated temperature: 105°C) 4Ex20AWG+2Cx24AWG	UL2517 (rated temperature: 105°C) 4Ex20AWG+2Cx24AWG	UL2517 (rated temperature: 105°C) 4Ex20AWG+2Cx24AWG
	Power cable: 20AWG (0.52 mm^2); OD of insulation: 1.7 mm	Power cable: 20AWG (0.52 mm^2); OD of insulation: 1.7 mm	Power cable: 20AWG (0.52 mm^2); OD of insulation: 1.7 mm
	Brake cable: 24AWG (0.205 mm^2); OD of insulation: 1.1 mm	Brake cable: 24AWG (0.205 mm^2); OD of insulation: 1.1 mm	Brake cable: 24AWG (0.205 mm^2); OD of insulation: 1.1 mm
Sheath diameter	6.5±0.2 mm		
Internal structure and conductor colors			
Fill in "X.X" in the model number with cable length.			

Table 4–8 Specifications of motor output cables

MS1H2 10C–50C (Applicable to 1 kW–5 kW)/MS1H3 85B–18C (Applicable to 850 W–1.8 kW)			
Cable type	Regular cable	Flexible cable	Oil-resistant shielded flexible cable
Cable model	S6-L-M/B***-X.X	S6-L-M/B***-X.X-T	S6-L-M/B***-X.X-TS
Cable specifications	UL2586 (rated temperature: 105°C) 4Ex16AWG+2Cx18AWG	UL2586 (rated temperature: 105°C) 4Ex16AWG+2Cx18AWG	UL2586 (rated temperature: 105°C) 4Ex16AWG+2Cx18AWG
	Power cable: 16AWG (1.31 mm^2) OD of insulation: 3.1 mm	Power cable: 16AWG (1.31 mm^2) OD of insulation: 3.25 mm	Power cable: 16AWG (1.31 mm^2) OD of insulation: 3.25 mm
	Brake cable: 18AWG (0.823 mm^2) OD of insulation: 2.0 mm	Brake cable: 18AWG (0.823 mm^2) OD of insulation: 2.15 mm	Brake cable: 18AWG (0.823 mm^2) OD of insulation: 2.15 mm
Sheath diameter	9.5±0.3 mm (main circuit)	10.0±0.3 mm (main circuit)	10.5±0.3 mm (main circuit)
Internal structure and conductor colors			
Fill in "X.X" in the model number with cable length.			

Table 4–9 Specifications of motor output cables

MS1H3 29C–75C (Applicable to 2.9 kW–7.5 kW)			
Cable type	Regular cable	Flexible cable	Oil-resistant shielded flexible cable
Cable model	S6-L-M/B***-X.X	S6-L-M/B***-X.X-T	S6-L-M/B***-X.X-TS
Cable specifications	UL2586 (rated temperature: 105°C) 4Ex12AWG+2Cx18AWG	UL2586 (rated temperature: 105°C) 4Ex12AWG+2Cx18AWG	UL2586 (rated temperature: 105°C) 4Ex12AWG+2Cx18AWG
	Power cable: 12AWG (3.31 mm^2) OD of insulation: 4.1 mm	Power cable: 12AWG (3.31 mm^2) OD of insulation: 4.2 mm	Power cable: 12AWG (3.31 mm^2) OD of insulation: 4.2 mm
	Brake cable: 18AWG (0.823 mm^2) OD of insulation: 2.0 mm	Brake cable: 18AWG (0.823 mm^2) OD of insulation: 2.15 mm	Brake cable: 18AWG (0.823 mm^2) OD of insulation: 2.15 mm
Sheath diameter	12.2±0.4 mm (main circuit)	12.5±0.4 mm (main circuit)	13.2±0.4 mm (main circuit)
Internal structure and conductor colors			
Fill in "X.X" in the model number with cable length.			

Cable selection

To comply with the EMC standards, use shielded cables. You can use shield-less cables if EMC is not a concern.

Shielded cables are divided into three-conductor shielded cables and four-conductor shielded cables, as shown in the following figure.

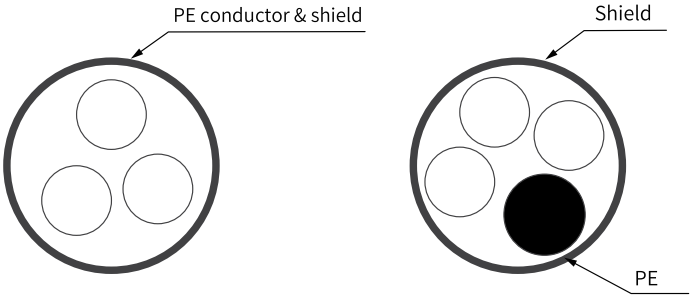


Figure 4-7 Recommended power cable

If the conductivity of the three-conductor cable shield is insufficient, add an extra PE cable. Or use a four-core shielded cable, with one core being the PE wire. The shield

of the shielded cable is comprised of cooper braids to suppress radio frequency interference. To enhance the shield performance and conductivity, the braided density of the shield must be greater than 90%.

Observe national or regional regulations when selecting cable dimensions. The IEC cable must meet the following requirements:

- EN 60204-1 and IEC 60364-5-52 standards
- Copper conductors with PVC insulation
- Ambient temperature: 40°C; cable surface temperature: 70°C. Contact the manufacturer if the ambient temperature exceeds 40°C).

For details about requirements on UL cable selection, see *" Cable requirements" on page 113*.

Note

If the recommended cable specifications for peripheral devices or optional parts exceed the applicable cable specification range, contact Inovance.

4.2.4 Main circuit terminal layout

Size A (rated power: 0.2 kW–0.4 kW): SV660PS1R6I, SV660PS2R8I

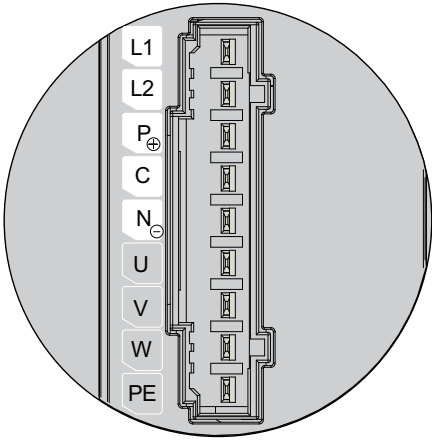


Figure 4-8 Main circuit terminal pins of size A drive

Table 4–10 Description of main circuit terminal pins of servo drives in size A

No.	Parameter Name	Description
1	L1, L2 (power input terminals)	See the nameplate for the rated voltage class.
2	P⊕, NΘ (DC bus terminals)	Used by the common DC bus for multiple servo drives.
	P⊕, C Terminals for connecting external braking resistor	If an external regenerative resistor is needed, connect it between terminals P⊕ and C.
3	U, V, W (terminals for connecting the servo motor)	Connected to U, V, and W phases of the servo motor.
4	Motor grounding terminal	Connected to the grounding terminal of the motor for grounding purpose.

Rated power: (SIZE B: 0.75 kW): SV660PS5R5I

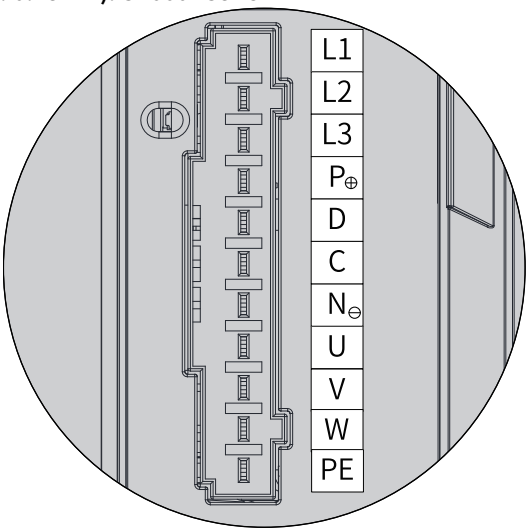


Figure 4-9 Pin assignment of main circuit terminal of servo drives in SIZE B

Table 4–11 Description of main circuit terminal pins of servo drives in SIZE B

No.	Parameter Name	Description
1	L1, L2, L3 (power input terminals)	See the nameplate for the rated voltage class. Note: S5R5 (750 W) models support single-phase 220 V input only, with a 220 V power supply connected between terminals L1 and L2.
2	P⊕, NΘ (DC bus terminals)	Used by the common DC bus for multiple servo drives.
	P⊕, D, C Terminals for connecting external braking resistor	If an external regenerative resistor is needed, connect it between terminals P⊕ and C. Servo drives in size B are equipped with the built-in regenerative resistor, with terminals P⊕ and D jumpered by default.
3	U, V, W (terminals for connecting the servo motor)	Connected to U, V, and W phases of the servo motor.
4	Motor grounding terminal	Connected to the grounding terminal of the motor for grounding purpose.

Rated power (SIZE C/SIZE D: 1.0kW–1.5kW): SV660PS7R6I, SV660PS012I

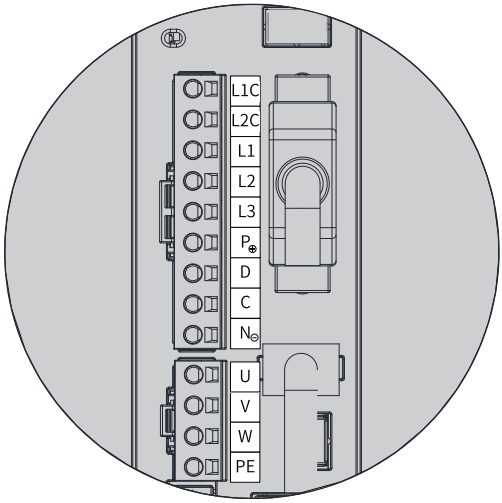


Figure 4-10 Main circuit terminal pin layout of servo drives in size C (SV660PS7R6I) and size D (SV660PS012I)

Table 4–12 Description of main circuit terminal pins of servo drives in size C (SV660PS7R6I) and size D (SV660PS012I)

No.	Parameter Name	Description
1	L1C, L2C Control circuit power input terminals	See the nameplate for the rated voltage class.
2	L1, L2, L3 Main circuit power input terminals	See the nameplate for the rated voltage class.
3	P⊕, NΘ (DC bus terminals)	Used by the common DC bus for multiple servo drives.
	P⊕, D, C Terminals for connecting external braking resistor	If an external regenerative resistor is needed, connect it between terminals P⊕ and C. SIZE C and SIZE D use a built-in regenerative resistor, with terminals P⊕ and D jumped.
4	U, V, W (terminals for connecting the servo motor)	Connected to U, V, and W phases of the servo motor.
5	Motor grounding terminal	Connected to the grounding terminal of the motor for grounding purpose.

Servo drives in size C and size D (rated power: 1.0 kW to 3.0 kW): SV660PT3R5I, SV660PT5R4I, SV660PT8R4I, and SV660PT012I

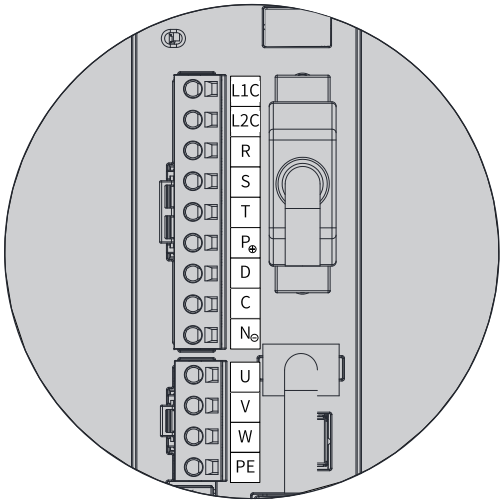


Figure 4-11 Main circuit terminal pin layout of servo drives in size C (SV660PT3R5I, SV660PT5R4I) and size D (SV660PT8R4I, SV660PT012I)

Table 4–13 Description of main circuit terminal pins of servo drives in size C (SV660PT3R5I, SV660PT5R4I) and size D (SV660PT8R4I, SV660PT012I)

No.	Parameter Name	Description
1	L1C, L2C Control circuit power input terminals	See the nameplate for the rated voltage class.
2	R, S, and T Main circuit power input terminals	See the nameplate for the rated voltage class.
3	P⊕, NΘ (DC bus terminals)	Used by the common DC bus for multiple servo drives.
	P⊕, D, C Terminals for connecting external braking resistor	If an external regenerative resistor is needed, connect it between terminals P⊕ and C. SIZE C and SIZE D use a built-in regenerative resistor, with terminals P⊕ and D jumped.
4	U, V, W (terminals for connecting the servo motor)	Connected to U, V, and W phases of the servo motor.
5	Motor grounding terminal	Connected to the grounding terminal of the motor for grounding purpose.

Size E (rated power: 5.0 kW to 7.5 kW): SV660PT017I, SV660PT021I, and SV660PT026I

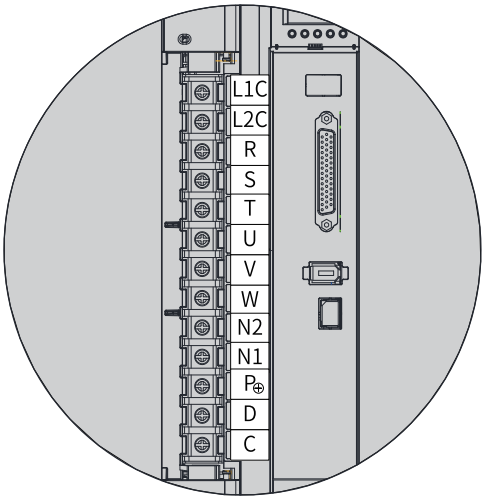


Figure 4-12 Pin assignment of main circuit terminal of servo drives in size E

Table 4–14 Description of main circuit terminal pins of servo drives in size E

No.	Parameter Name	Description
1	L1C, L2C Control circuit power input terminals	See the nameplate for the rated voltage class.
2	R, S, and T Main circuit power input terminals	See the nameplate for the rated voltage class.
3	U, V, W (terminals for connecting the servo motor)	Connected to U, V, and W phases of the servo motor.
4	N2, N1 Terminals for connecting external reactor	Terminals and are shorted by default. When the power high-order harmonics need to be suppressed, remove the jumper and connect a reactor between N1 and N2. Install a DC reactor between terminals N1 and N2.
5	P⊕, D, C Terminals for connecting external braking resistor	If an external regenerative resistor is needed, connect it between terminals P⊕ and C. SIZE E use a built-in regenerative resistor, with terminals P⊕ and D jumped.

4.2.5 Connecting the Motor (UVW)

Keep the lead wire of the motor cable shield as short as possible, with its width (b in the following figure) not shorter than 1/5 of its length (a in the following figure).

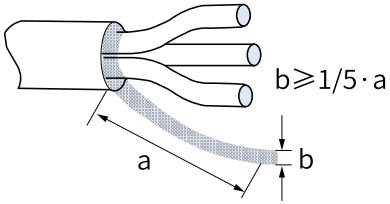


Figure 4-13 Lead-out of the motor cable shield

- The following figure shows the wiring diagram for a terminal-type motor.

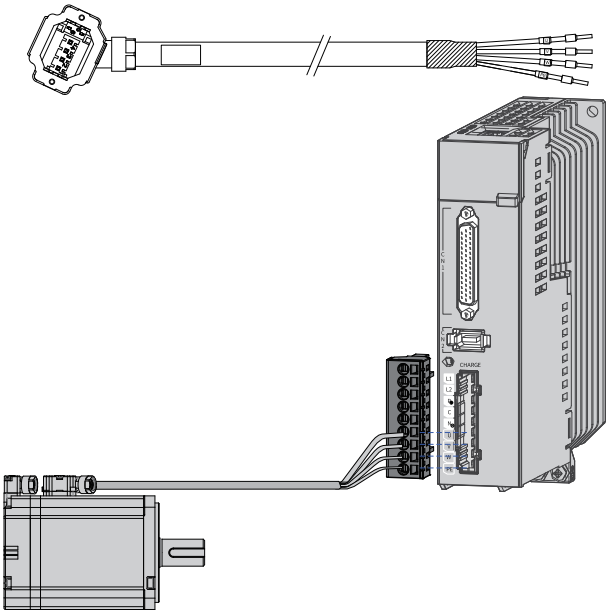
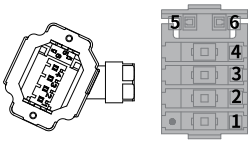


Figure 4-14 Wiring between the servo drive and terminal-type motor

Table 4–15 Description of the power cable connector (motor side)

Flange Size [1]	Illustration	Pin		
		Pin No.	Signal Name	Color
Terminal-type: 40 60 80	 Black 6-pin connector	1	PE	Yellow/ Green
		2	W	Red
		3	V	Black
		4	U	White
		5	Brake (polarity insensitive)	Brown
		6		Blue

Note

- [1] The flange size refers to the width of the mounting flange (in mm).
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.

- The connection diagram for a flying leads type motor is shown in the following figure.

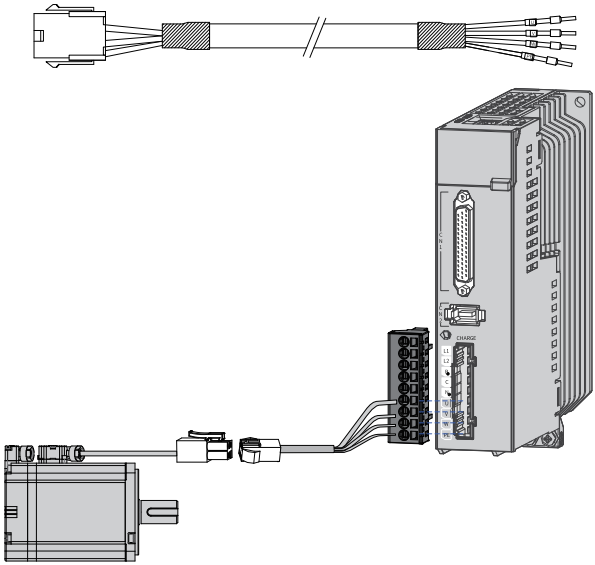
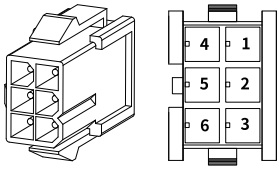


Figure 4-15 Wiring between the servo drive and terminal-type motor

Table 4–16 Description of the power cable connector (motor side)

Flange Size [1]	Illustration	Pin		
		Pin No.	Signal Name	Color
Flying leads type: 40 60 80	 Black 6-pin connector Recommendation: Plastic housing: MOLEX-50361736 Terminal: MOLEX-39000061	1	U	White
		2	V	Black
		4	W	Red
		5	PE	Yellow/ Green
		3	Brake (polarity insensitive)	Brown
		6		Blue

Note

- [1]: The flange size refers to the width of the mounting flange.
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.

- The following table describes the connector for high-power motor power cables.

Table 4–17 Description of the power cable connector (motor side)

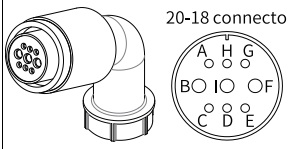
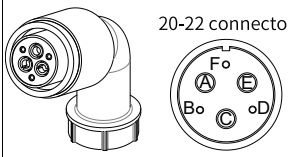
Flange Size [1]	Illustration	Pin		
		Pin No.	Signal Name	Color
100 130	 MIL-DTL-5015 series 3108E20-18S military-spec connector	B	U	Blue
		I	V	Black
		F	W	Red
		G	PE	Yellow/Green
		C	Brake (polarity insensitive)	Red
		E		Black

Table 4–18 Description of the power cable connector (motor side)

Flange Size [1]	Illustration	Pin		
		Pin No.	Signal Name	Color
180	 MIL-DTL-5015 series 3108E20-22S military-spec connector	A	U	Blue
		C	V	Black
		E	W	Red
		F	PE	Yellow/Green
		B	Brake (polarity insensitive)	Red
		D		Black

Note

- [1]: The flange size refers to the width of the mounting flange.
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.

4.2.6 Wiring of External EMC Filter

Install the filter near the input terminals of the drive. The cable between the filter and the drive must be shorter than 30 cm. Connect the grounding terminal of the filter together with the grounding terminal of the drive. Ensure the filter and the drive are installed onto the same conductive mounting surface that is connected to the main grounding of the control cabinet.

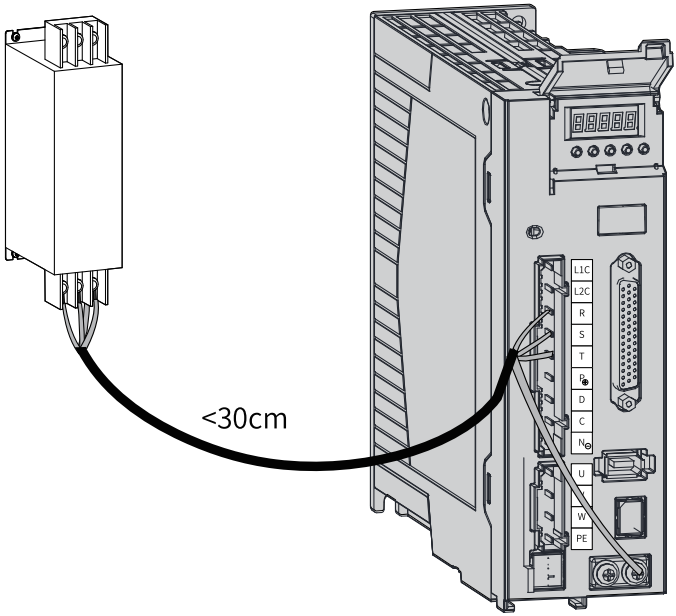


Figure 4-16 Installing the filter

4.2.7 Wiring of the Power Supply

- Single-phase 220 V models: SV660PS1R6I, SV660PS2R8I, SV660PS5R5I, SV660PS7R6I and SV660PS012I

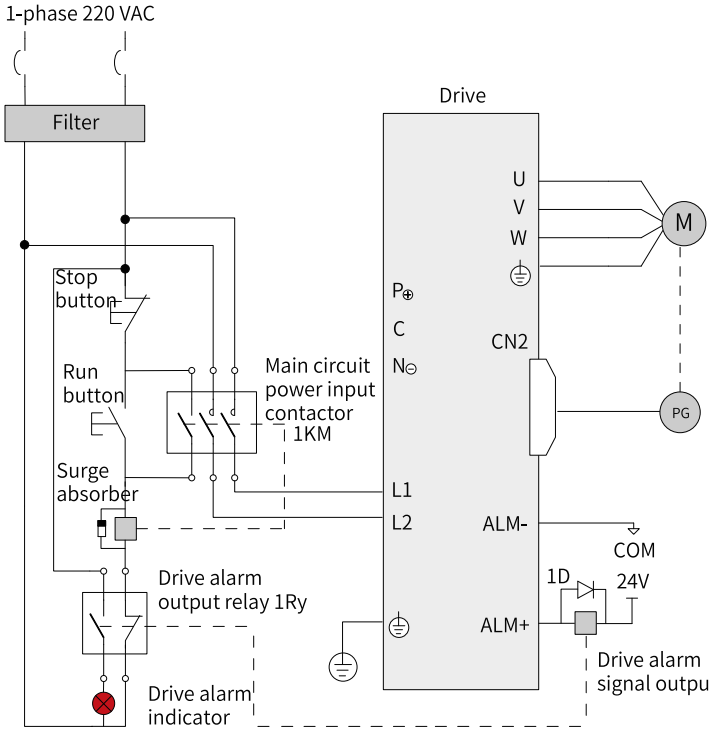


Figure 4-17 Main circuit wiring

Note

- 1KM: Electromagnetic contactor; 1Ry: Relay; 1D: Flywheel diode
- DO is set as alarm output (ALM+/-). When the servo drive alarms, the power supply will be cut off automatically. SV660PS1R6I and SV660PS2R8I are not configured with built-in regenerative resistors, if the regenerative resistor is needed, connect an external regenerative resistor between P⊕ and C.

- Three-phase 220 V models: SV660PS7R6I, SV660PS012I

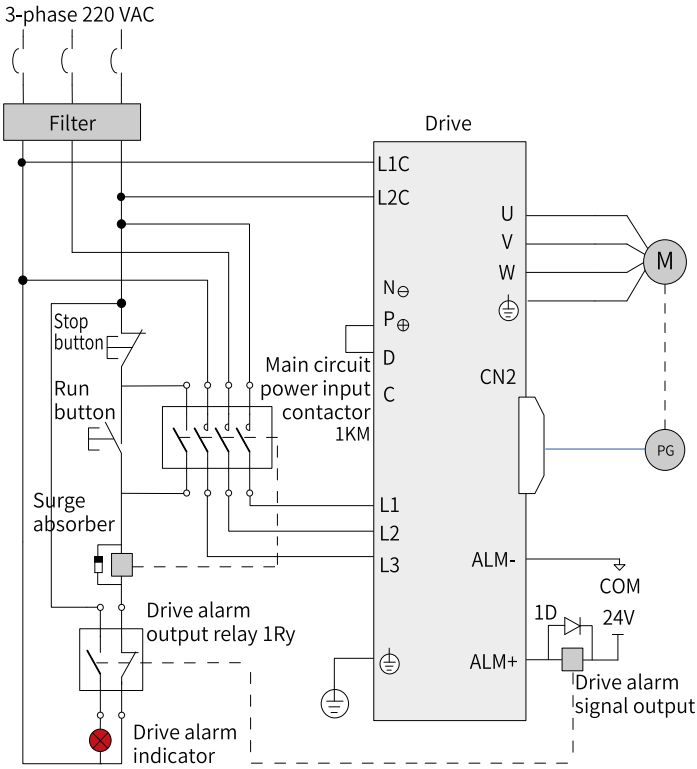


Figure 4-18 Main circuit wiring of three-phase 220 V models

Note

- 1KM: Electromagnetic contactor; 1Ry: Relay; 1D: Flywheel diode
- The DO is set as alarm output (ALM+/-). When the servo drive alarms, the power supply is cut off automatically and the alarm indicator lights up.

- Three-phase 380 V models: SV660PT3R5I, SV660PT5R4I, SV660PT8R4I, SV660PT012I, SV660PT021I, SV660PT026I

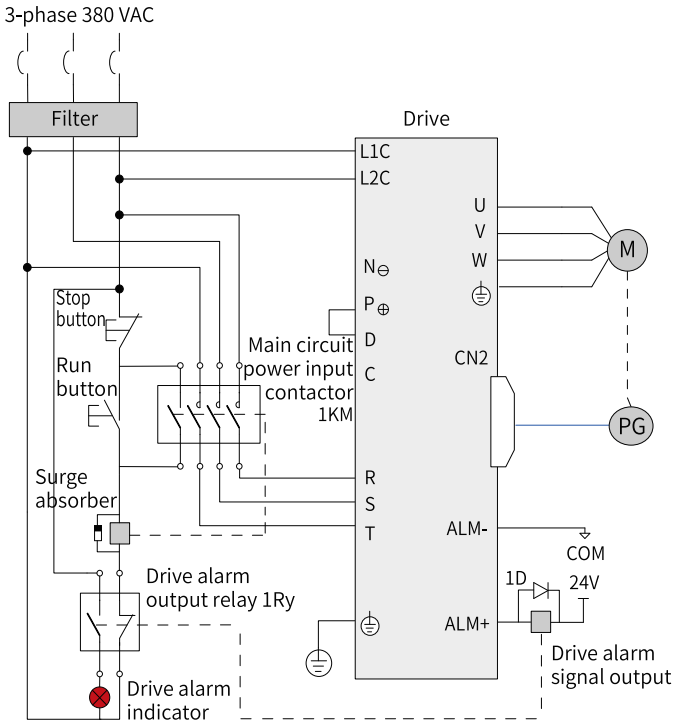


Figure 4-19 Main circuit wiring of three-phase 380 V models

Note

- 1KM: Electromagnetic contactor; 1Ry: Relay; 1D: Flywheel diode
- The DO is set as alarm output (ALM+/-). When the servo drive alarms, the power supply is cut off automatically and the alarm indicator lights up.

4.2.8 Grounding and Wiring

Observe the following requirements to ensure a proper grounding of the servo drive.

- To prevent electric shocks, ground the grounding terminal properly. Observe related national or regional regulations during grounding.
- To prevent electric shocks, ensure the protective grounding conductor complies with technical specifications and local safety standards. Keep the length of the grounding cable as short as possible. As the leakage current of the equipment may exceed 3.5 mA, it is recommended to use a copper protective grounding conductor with a cross-sectional area of at least 10 mm^2, or use two protective grounding conductors with the same specification.
- The dimensions of the grounding cable must comply with the electrical device technical standards. Keep the length of the grounding cable as short as possible. Failure to comply will lead to unstable potential in the grounding terminals away from the grounding point due to leakage current, resulting in an electric shock.

- For use of multiple servo drives, observe all the grounding instructions for the drive. Improper grounding of the device will lead to malfunction of the drive and the device.
- Do not share the same grounding cable with other devices (such as welding machines or high-current electrical devices). Improper grounding of the device will lead to drive or device faults caused by electrical interference.
- For use of multiple servo drives, observe all the grounding instructions for the drive. Improper grounding of the device will lead to malfunction of the drive and the device.
- For drives equipped with optional VDR and insulation resistor grounding screws, remove the grounding screw before voltage resistance test. Failure to comply may cause the drive to fail the test.

Grounding requirements

Observe the following requirements to ensure a proper grounding of the drive.

- The protective grounding conductor must be a yellow/green cable comprised of copper conductors. Do not connect the protective grounding conductor to a switching device (such as a circuit breaker) in serial.
- Ground the grounding terminal properly. Improper grounding will lead to device malfunction or damage.
- Do not connect the grounding terminal to the N terminal of the neutral wire of the power supply.

- It is recommended to install the drive to a conductive metal surface. Ensure the whole conductive bottom of the drive is connected properly to the mounting face.
- Tighten the grounding screw with specified tightening torque to prevent the protective grounding conductor from being secured improperly.

Single-drive grounding

Installation of an individual drive:

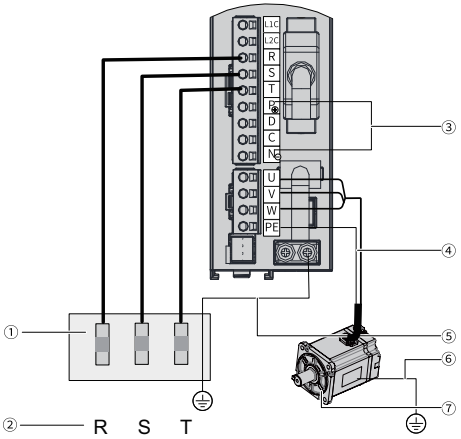


Table 4–19 Single-drive grounding

No.	Description
①	Input protection (fuse or circuit breaker) Connect the lower end of the fuse to the filter.
②	Input power supply
③	Do not ground the DC bus terminal or the regenerative resistor terminal.
④	Connect the output PE terminal of the servo drive to the motor output cable shield.
⑤	Connect the PE cable on the input power supply side to the input PE terminal of the servo drive.
⑥	Ground the motor enclosure.
⑦	Three-phase motor

Note

The main circuit terminal layout varies with different models and is subject to the physical product.

Multi-drive grounding

Side-by-side installation of multiple drives:

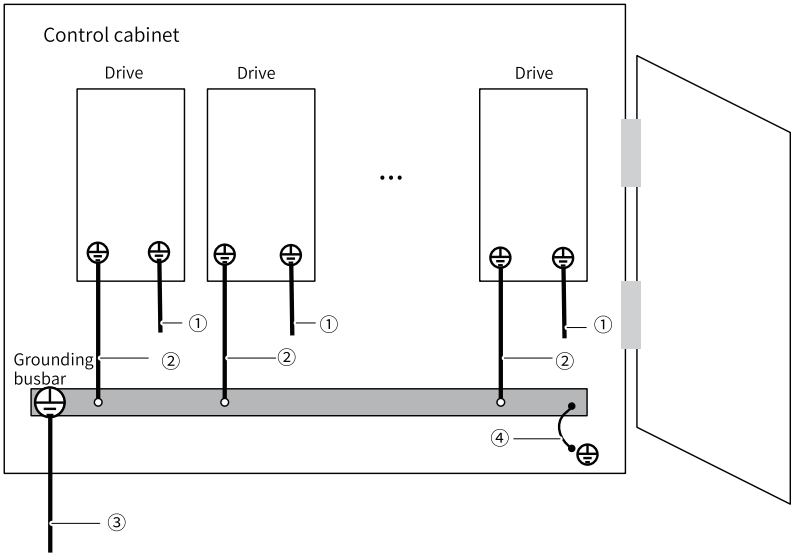


Table 4–20 Description for grounding of multiple drives installed side by side

No.	Description
①	Connect the motor output cable shield to the output PE terminal of the servo drive.
②	Connect the main circuit input PE terminal of the servo drive to the grounding copper busbar of the control cabinet through a protective grounding conductor.
③	Connect the PE cable on the input power supply side to the grounding copper busbar of the control cabinet.
④	Connect the grounding copper busbar of the control cabinet to the metal enclosure of the control cabinet through the protective grounding conductor.

Grounding the control cabinet system

The most cost-effective method of suppressing interference in a control cabinet is to isolate the interference source from devices that may be interfered with. Divide the control cabinet into multiple EMC compartments or use multiple control cabinets based on the intensity of interference sources, and install each device in accordance with the following wiring principles.

Table 4–21 Wiring requirements

No.	Wiring requirements
1	Place the control unit and the drive unit in two separate control cabinets.
2	If multiple control cabinets are used, connect the control cabinets by using a PE cable with a cross-sectional area of at least 16 mm^2 for equipotentiality between the control cabinets.
3	If only one control cabinet is used, place different devices in different compartments of the control cabinet based on signal intensity.
4	Apply equipotential bonding to devices in different compartments inside the control cabinet.
5	Shield all communication (such as RS485) and signal cables drawn from the control cabinet.
6	Place the power input filter in a position near the input interface of the control cabinet.
7	Apply spray coating to each grounding point in the control cabinet.

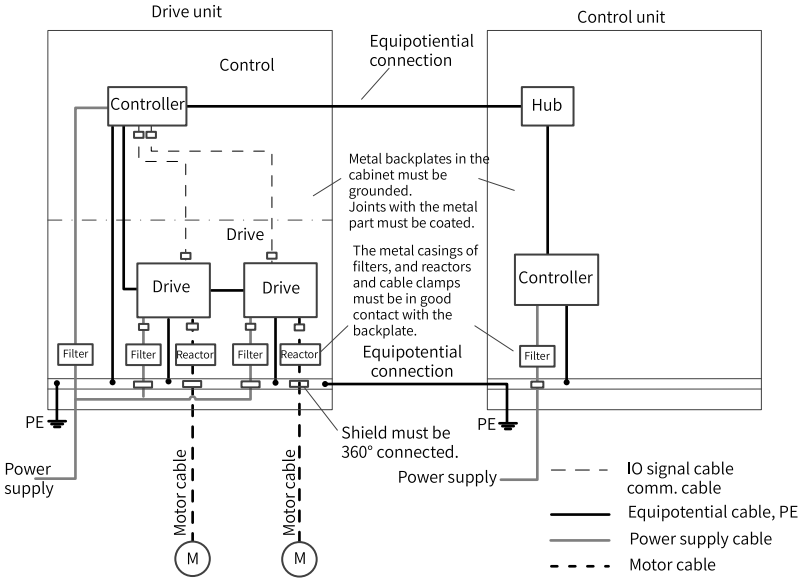


Figure 4-20 Recommended wiring for the control cabinet system

4.3 Description of Control Terminal (CN1)

Observe the requirements in standard EN 60204-1 during connecting control circuit cables.

I/O signal cable selection

It is recommended to use shielded signal cables to prevent I/O signal circuit from being disturbed by external noise. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pairs for digital signals.

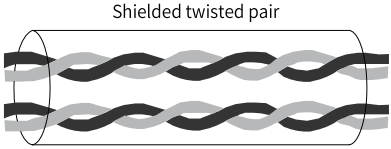


Figure 4-21 Diagram of shielded twisted pairs

Control Cable Specifications

Table 4–22 Recommended Control Cable Specifications

Control terminal	Connector Kit/Material No.	AWG
CN1	DB44	24 to 30

I/O signal layout

I/O signals include DI/DO signals and relay output signals.

Observe the following requirement during control circuit wiring:

Route the control circuit cables and main circuit cables or other power cables through different routes with a distance of at least 30 cm. Failure to comply may result in disturbed I/O signals.

4.3.1 Terminal Layout

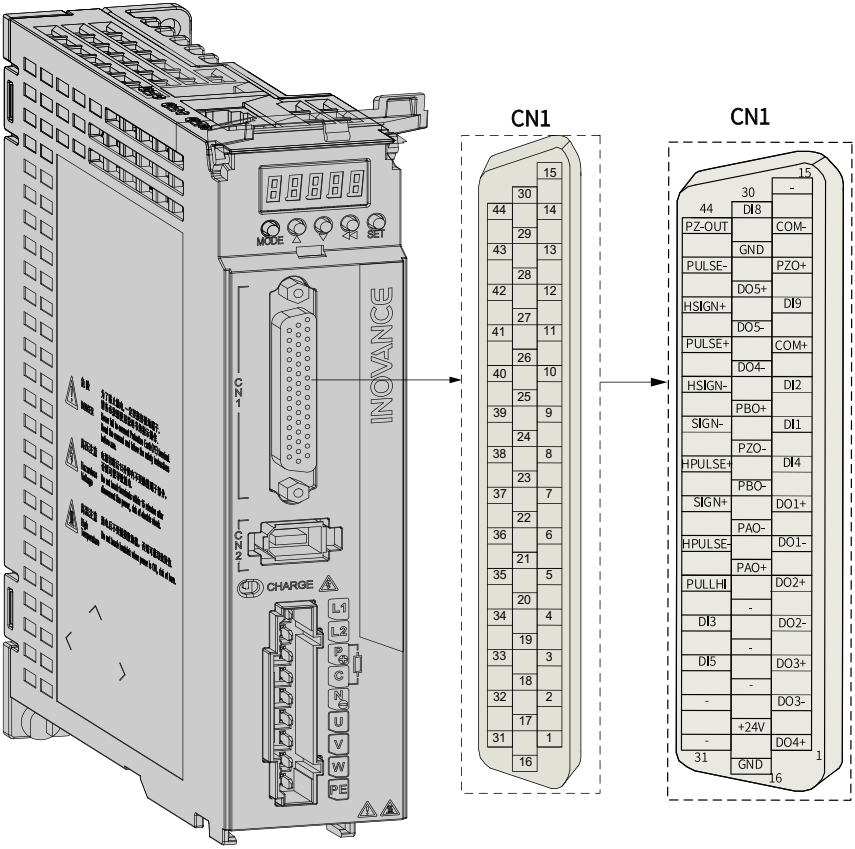


Figure 4-22 Control terminal pin layout of servo drives in sizes A and B

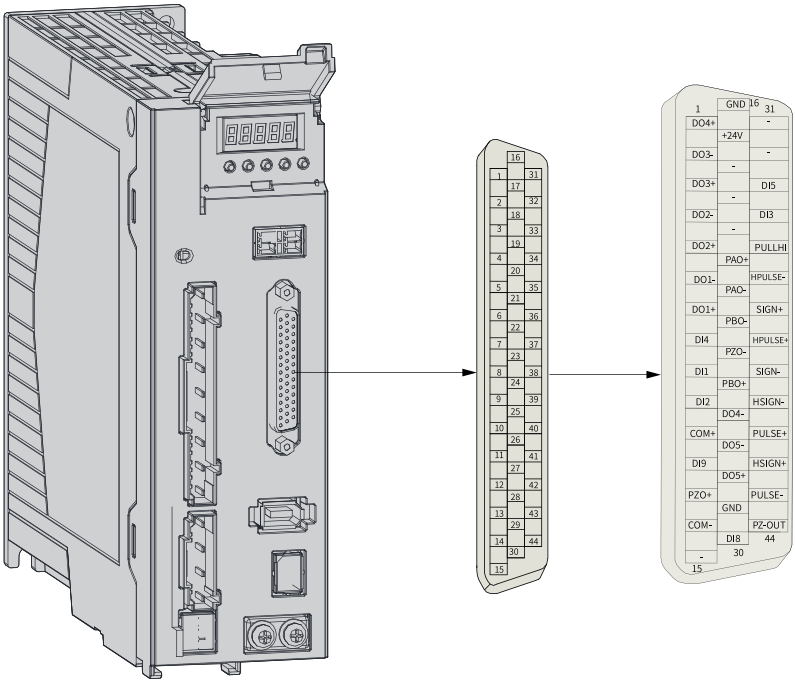


Figure 4-23 Control terminal pin layout of servo drives in sizes C, D, and E

Note

- CN1: Plastic housing of plug on cable side: DB25P (manufacturer: SZTDK), black housing. Core: HDB44P male solder (manufacturer: SZTDK).
- Use shielded cables as signal cables, with both ends of the shielded cable grounded.

Table 4–23 Position Reference Input Signals

Signal Name		Pin No.	Function	
Position reference	PULSE+	41	Low-speed pulse reference input mode: • Differential drive input • Open-collector	Pulse input form: • Direction+Pulse • Quadrature pulse of phases A and B • CW/CCW pulse
	PULSE–	43		
	SIGN+	37		
	SIGN–	39		
	PULLHI	35		
	HPULSE+	38	High-speed input pulse reference	
	HPULSE–	36		
	HSIGN+	42	High-speed position reference sign	
	HSIGN–	40		

Table 4–24 Description of DI/DO signals

Signal Name		Default Function	Pin No.	Function
General	DI1	P-OT	9	Positive limit switch
	DI2	N-OT	10	Negative limit switch
	DI3	INHIBIT	34	Pulse input forbidden
	DI4	ALM-RST	8	Alarm reset (edge-triggered)
	DI5	S-ON	33	Servo ON
	DI8	HomeSwitch	30	Home switch
	DI9	Reserved	12	-
	+24V		17	Internal 24 V power supply, voltage range: 20 to 28 V, maximum output current: 200 mA
	COM–		14	
	COM+		11	Common terminal of DI terminals.
	DO1+	S-RDY+	7	Servo ready
	DO1-	S-RDY-	6	
	DO2+	COIN+	5	Position reached
	DO2-	COIN–	4	
	DO3+	BK+	3	Brake output
	DO3-	BK-	2	
	DO4+	ALM+	1	Fault output
	DO4-	ALM-	26	
	DO5+	HomeAttain+	28	Homing completed
	DO5-	HomeAttain–	27	

Table 4–25 Encoder frequency-division output signals

Signal Name	Default Function	Pin No.	Function	
General	PAO+	21	Phase A frequency-division output signal	Quadrature frequency-division pulse output signals of phases A and B
	PAO–	22		
	PBO+	25	Phase B frequency-division output signal	
	PBO–	23		
	PZO+	13	Phase Z frequency-division output signal	Home pulse output signal
	PZO–	24		
	PZ-OUT	44	Phase Z frequency-division output signal	Home pulse open-collector output signal.
	GND	29	Home pulse open-collector output signal ground	
	GND	16	-	
	PE	Housing	-	

4.3.2 Position Reference Input Signals

For descriptions of position reference input signals, see *"Table 4–23 " on page 68*.

The reference pulses and signs on the host controller side can be outputted through the differential drive or open-collector. The following table lists the maximum input frequency and minimum pulse width.

Table 4–26 Correspondence between pulse input frequency and pulse width

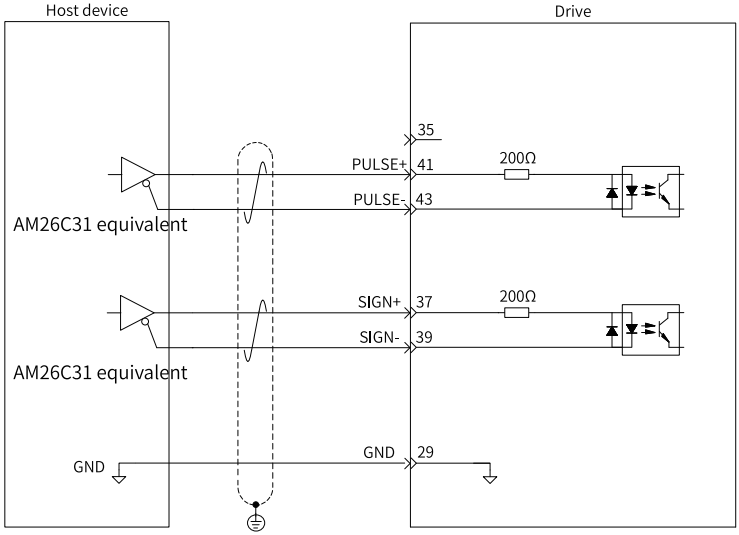
Pulse Mode		Max. Frequency (pps)	Minimum Pulse Width (us)	Voltage (V)
Low speed	Differential	200k	2.5	> 3.0
	Open-collector	200k	2.5	24
High-speed differential		4M	0.125	> 3.0

Note

- You can either use high-speed pulses or low-speed pulses, but not both of them together.
- If the output pulse width of the host controller is smaller than the minimum pulse width, a pulse receiving error will occur on the drive.
- The symbol  represents shielded twisted pairs.

Low-speed pulse reference input

- Differential mode



Note

This is a 5 V system. Do not input 24 V power.

- Open-collector mode
  ① For use of the internal 24 V power supply of the servo drive:

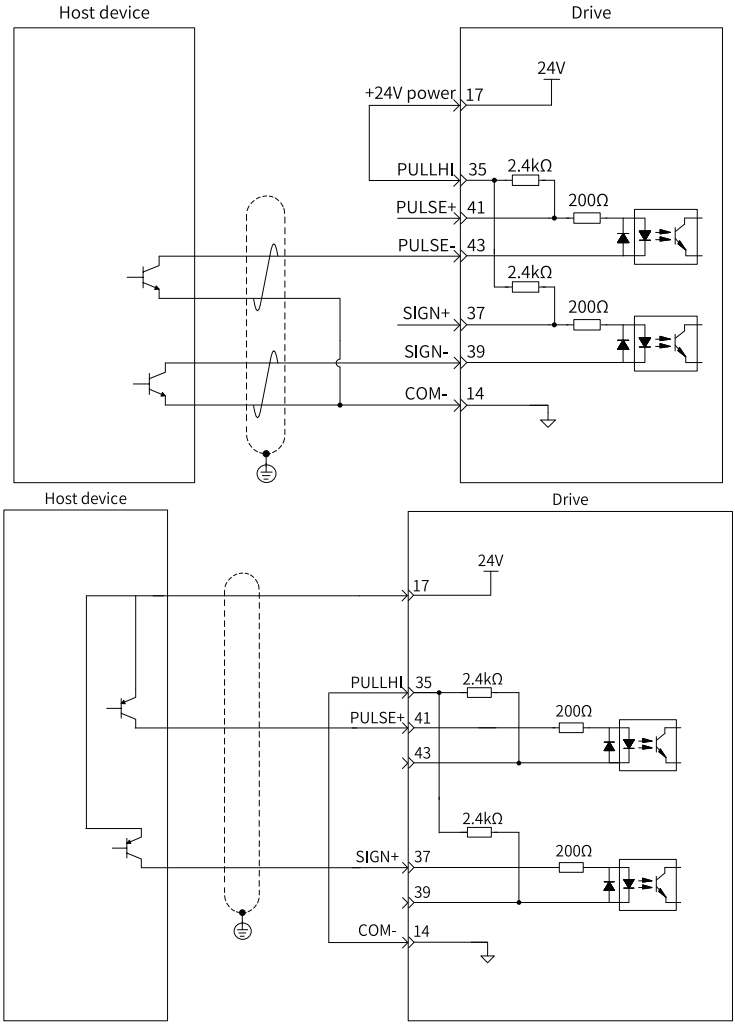


Figure 4-24 Correct: The internal 24 V power supply of the servo drive is used.

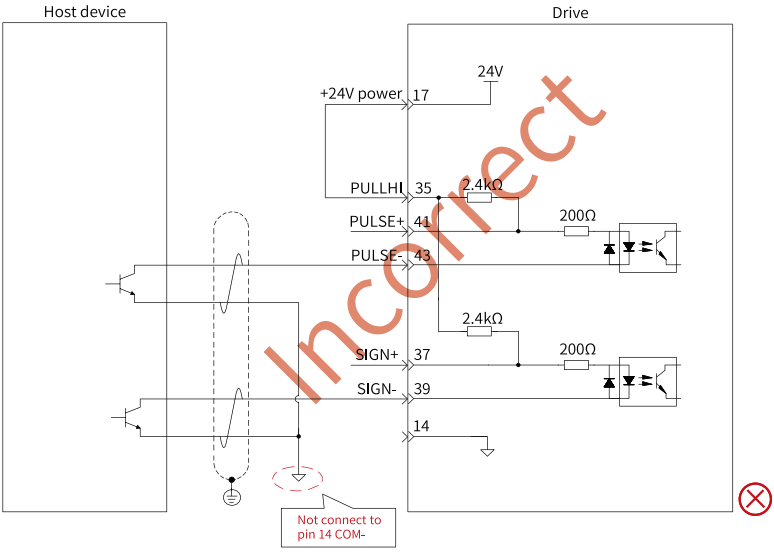
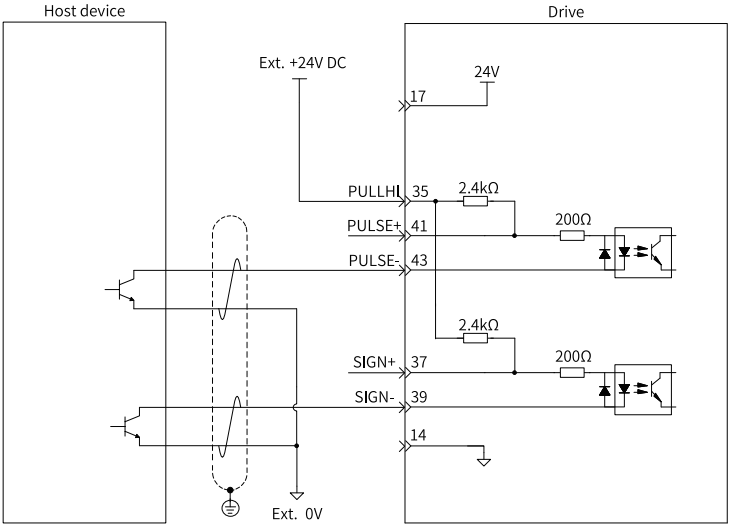
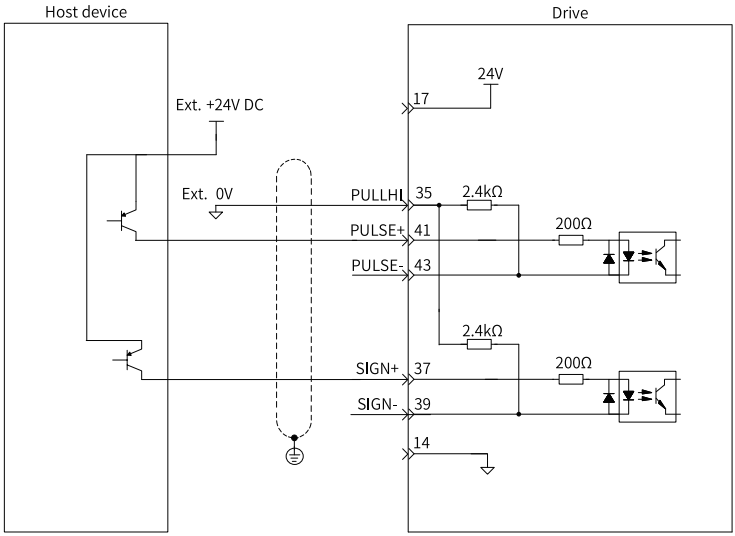


Figure 4-25 Incorrect: Pin 14 (COM–) is not connected, leading to failure in forming a closed-loop circuit.

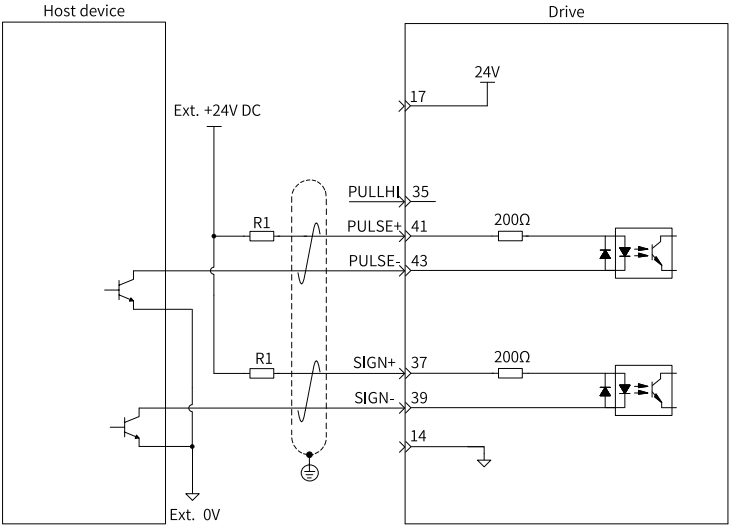
When the external power supply is used:

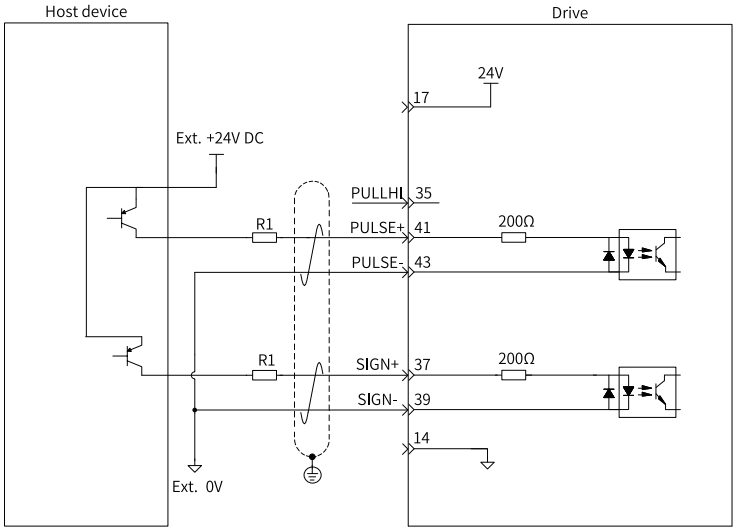
- Scheme 1: Using the built-in resistor (recommended)





- Scheme 2: Using the external resistor





Select resistor R1 based on the following formula.

$$\frac{V_{CC} - 1.5}{R1 + 200} = 10\ mA$$

Table 4–27 Recommended resistance of R1

V_{CC} Voltage (V)	R1 Resistance (kΩ)	R1 Power (W)
24	2.4	0.5
12	1.5	0.5

- The following figures show examples of improper wiring.
- 1: The current limiting resistor is not connected, resulting in terminal burnout.

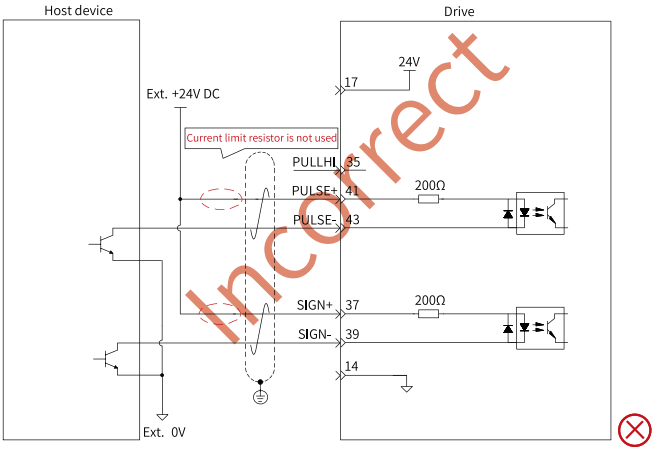


Figure 4-26 Incorrect wiring example 1: The current limiting resistor is not connected, resulting in terminal burnout.

Note

- Some models comes with a detection feature on SIGN+ and SIGN- to detect if SIGN + is connected to 24 V, SIGN- is connected to external 0 V, but no current limit resistor is connected. When this case is detected, the drive issues an E991.1 warning.
- In this case, check the wiring and then test the drive. Otherwise, the port may be damaged.
- This feature cannot detect polarity reversal.

    - 2: Multiple terminals share the same current limiting resistor, resulting in pulse receiving error.

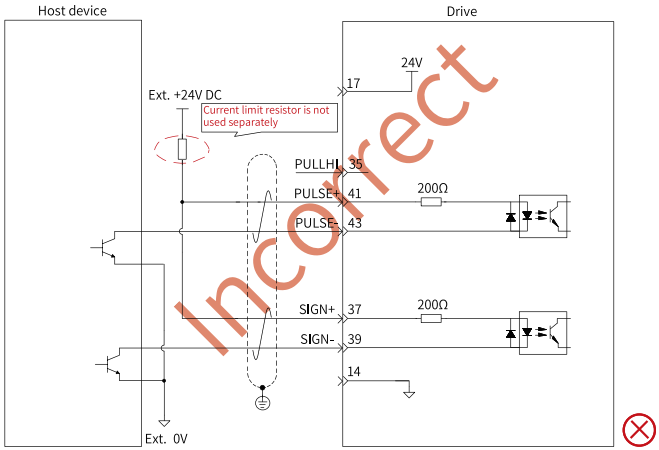


Figure 4-27 Incorrect wiring example 2: Multiple terminals share the same current limiting resistor, resulting in pulse receiving error.

- Incorrect wiring 3: The SIGN port is not connected, preventing these two ports from receiving pulses.

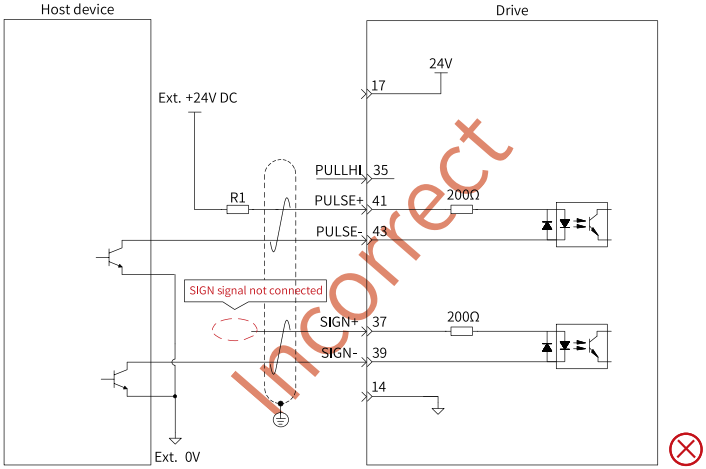


Figure 4-28 Incorrect wiring example 3: The SIGN port is not connected, preventing these two ports from receiving pulses.

- Wrong wiring 4: Terminals are connected incorrectly, resulting in terminal burnout.

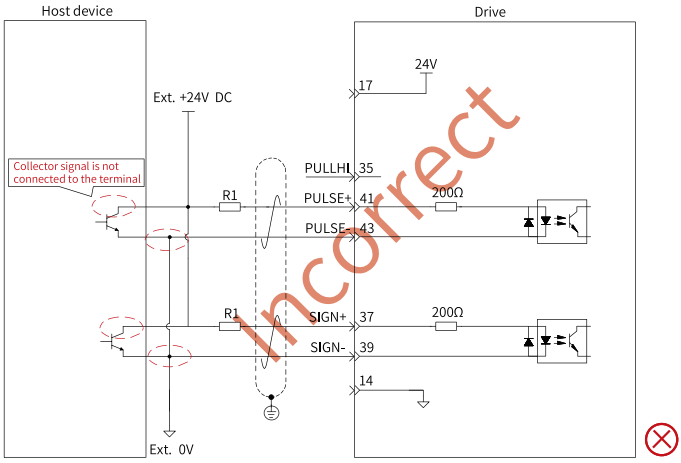


Figure 4-29 Incorrect wiring example 4: Terminals are connected incorrectly, resulting in terminal burnout.

- Wrong wiring 5: Multiple terminals share the same current limiting resistor, resulting in pulse receiving error.

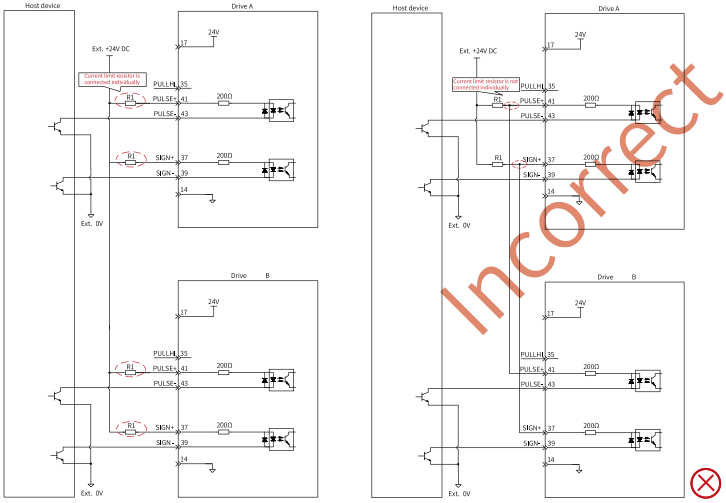
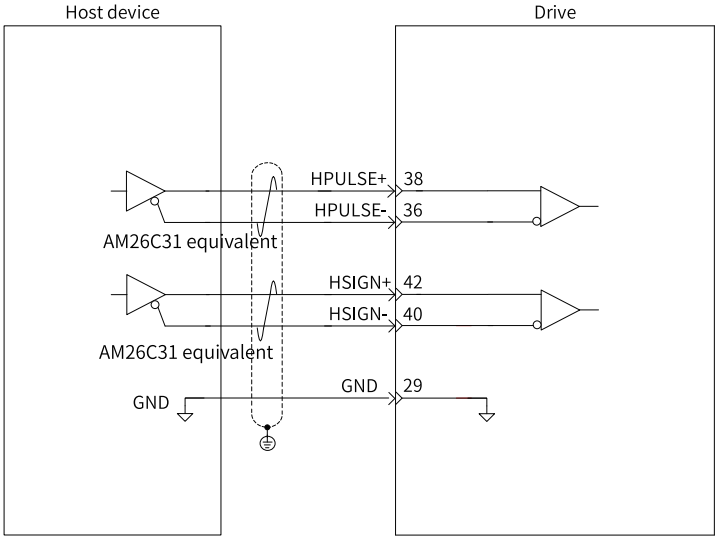


Figure 4-30 Incorrect wiring example 5: Multiple terminals share one current limiting resistor, resulting in a pulse receiving error.

High-speed pulse reference input

High-speed reference pulses and signs on the host controller side can be outputted to the servo drive through the differential drive only.



Note

- This is a 5 V system. Do not input 24 V power.
- Some models comes with a detection feature on HSIGN+ and HSIGN- to detect if HSIGN+ is connected to 24 V, HSIGN- is connected to external 0 V, but no current limit resistor is connected. When this case is detected, the drive issues an E991.1 warning.
- In this case, check the wiring and then test the drive. Otherwise, the port may be damaged.
- This feature cannot detect polarity reversal.

Caution

The differential input must be 5 V. Otherwise, unstable pulse input will occur on the servo drive, resulting in the following situations:

- Pulse loss during pulse input
- Reference inverted during reference direction input
- Connect 5 V GND of the host controller to the GND of the servo drive to reduce noise interference.

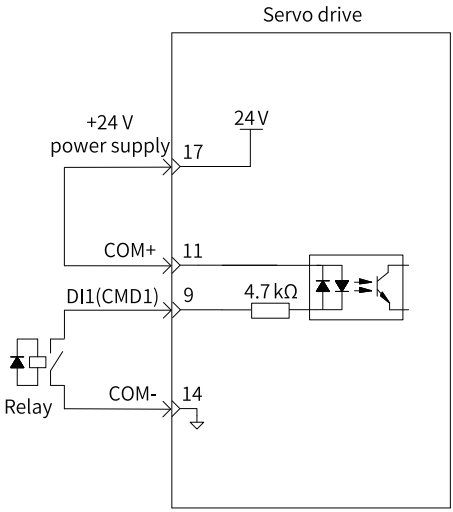
4.3.3 DI/DO Signals

For description of DI/DO signals, see *"Table 4–24 " on page 69*.

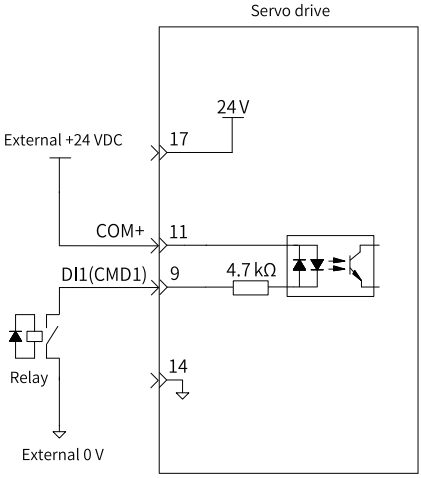
DI circuit

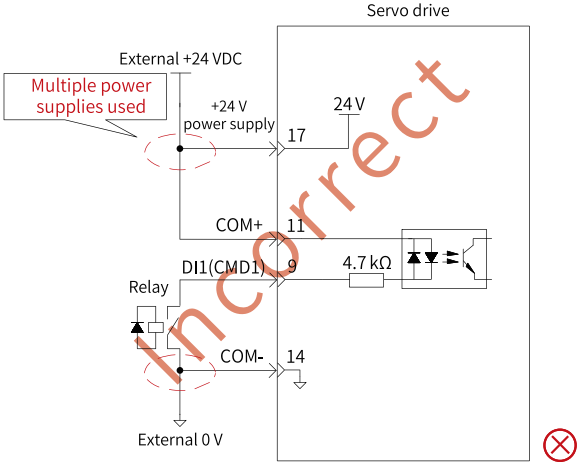
The circuits for DI1–DI5, DI8, and DI9 are the same. The following description takes DI1 circuit as an example.

- The host controller provides relay output:
  - When you use the internal 24 V power supply:

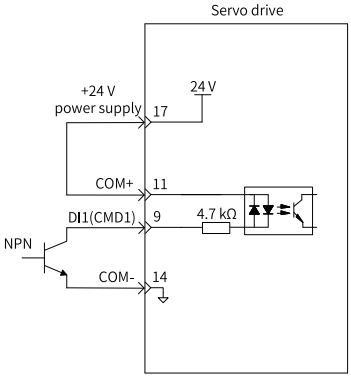


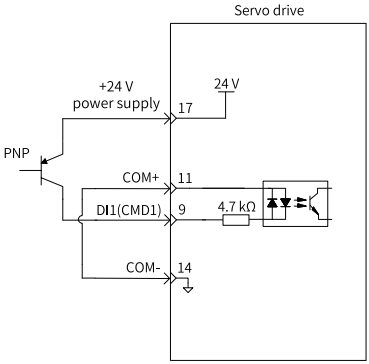
  - When you use an external power supply:



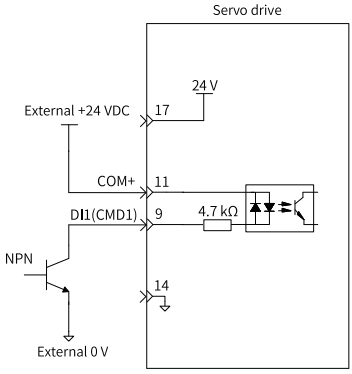


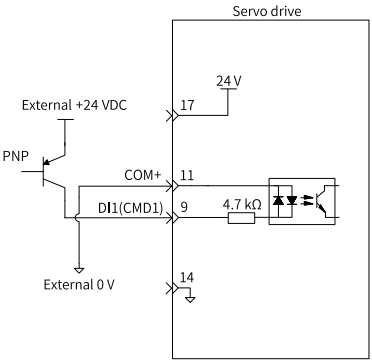
- The host controller provides open-collector output.
  - When you use the internal 24 V power supply:





- When you use an external power supply:





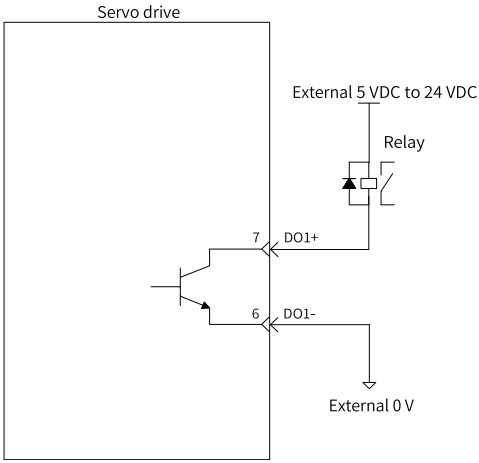
Note

PNP and NPN input cannot be used together in the same circuit.

DO circuit

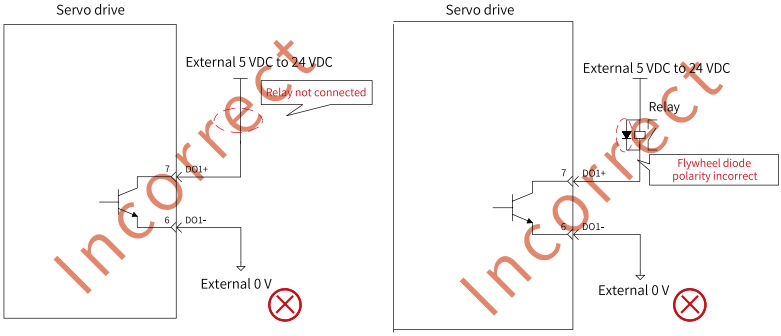
The circuits for DO1 to DO5 are the same. The following description takes DO1 circuit as an example.

- The host controller provides relay input.

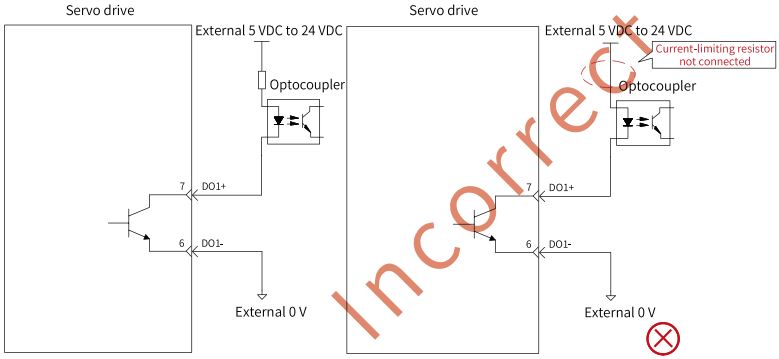


Note

When the host controller provides relay input, a flywheel diode must be installed. Otherwise, the DO terminals may be damaged.



- The host controller provides optocoupler input:



Note

The maximum permissible voltage and current capacity of the optocoupler output circuit inside the servo drive are as follows:

- Maximum voltage: 30 VDC
- Maximum current: DC 50 mA

4.3.4 Encoder Frequency-Division Output Signals

For details on encoder frequency-division output signals, see *"Table 4–25 Encoder frequency-division output signals" on page 70*.

Encoder frequency-division output circuit outputs differential signals via the differential drive. Typically, this circuit provides feedback signals to the host controller in a position control system. Use a differential or optocoupler receiving circuit on the host controller side to receive feedback signals. The maximum output current is 20 mA.

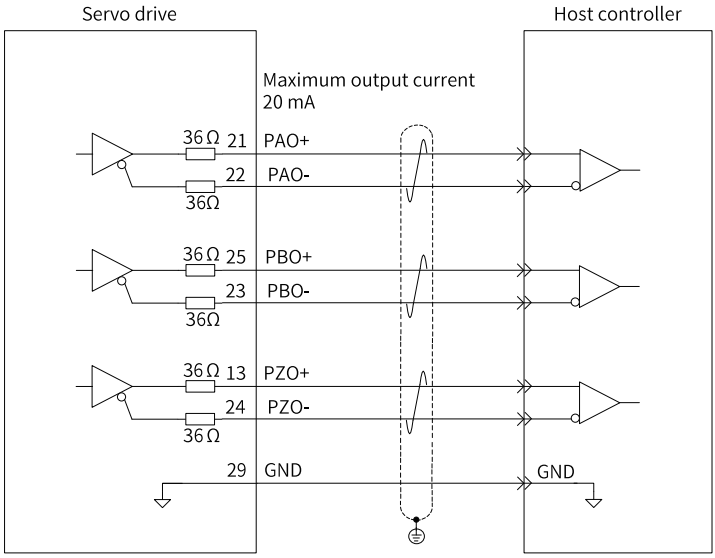


Figure 4-31 Differential receiving circuit

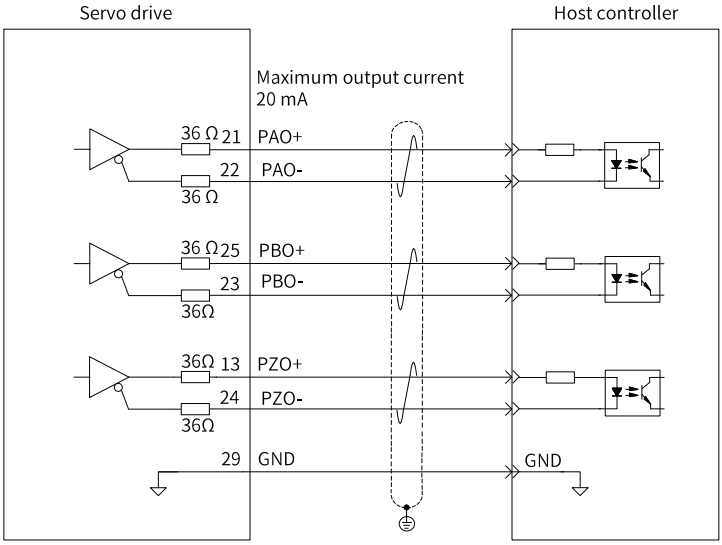
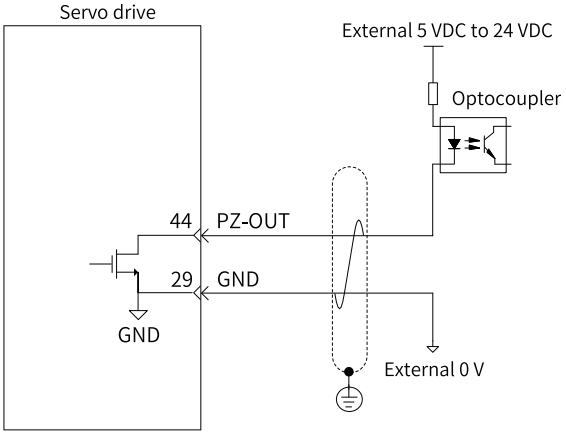


Figure 4-32 Optocoupler receiving circuit

Encoder phase Z output circuit outputs OC signals. Typically, this circuit provides feedback signals to the host controller in a position control system. An optocoupler

circuit, relay circuit, or bus receiver circuit shall be used in the host controller to receive feedback signals.



Caution

To reduce noise interference, use shielded twisted pairs to connect the 5V GND of the host controller to the GND of the servo drive.

4.3.5 Wiring of the Brake

The brake is used to prevent the motor shaft from moving and lock the position of the motor and the motion part when the drive is in the non-operational status.

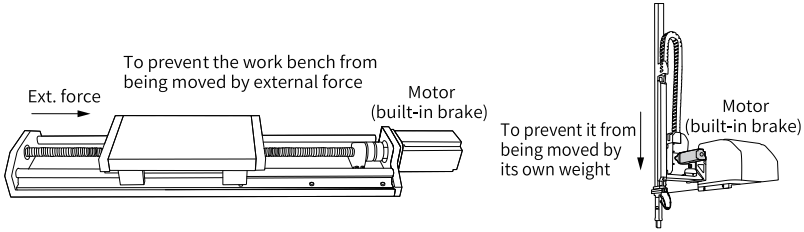


Figure 4-33 Application of the brake

Caution

- Use the built-in brake for position-lock purpose only. Do not use this brake for any other purposes (such as braking) other than position-lock in the stop state.
- The brake coil has no polarity.
- Switch off the S-ON signal after the motor stops.
- When the motor with brake runs, the brake may generate a click sound, which does not affect its function.
- When brake coils are energized (the brake is released), flux leakage may occur on the shaft end. Pay special attention when using magnetic sensors around the motor.

The connection of brake input signals is polarity-insensitive. Users need to prepare a 24 V power supply. The following figure shows the standard wiring of the brake signals (BK) and the brake power supply.

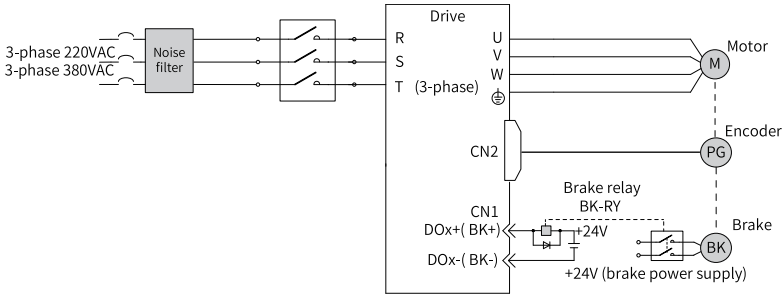


Figure 4-34 Wiring of the brake

Pay attention to the following precautions during wiring:

When deciding the length of the motor brake cable, take the voltage drop caused by cable resistance into consideration. The input voltage must be at least 21.6 V to enable the brake to work properly. The following table lists brake specifications of Inovance MS1 series servo motors.

Table 4–28 Brake specifications

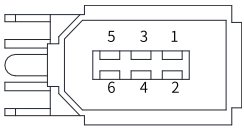
Motor Model	Holding Torque (N·m)	Supply Voltage (VDC) ±10%	Coil Resistance (Ω)±7%	Exciting Current (A)	Release Time (ms)	Apply Time (ms)	Backlash (°)
MS1H1-05B/10B MS1H4-10B	0.32	24	94.4	0.25	⩽ 20	⩽ 40	⩽ 1.5
MS1H1-20B/40B MS1H4-20B/40B	1.5		75.79	0.32	⩽ 20	⩽ 60	⩽ 1.5
MS1H1-75B/10C MS1H4-75B/10C	3.2		57.6	0.42	⩽ 40	⩽ 60	⩽ 1
MS1H2-10C/15C/ 20C/25C	8		32.73	0.73	⩽ 40	⩽ 100	⩽ 1
MS1H2-30C/40C/ 50C MS1H3-85B/13C/ 18C	16		24	1	⩽ 60	⩽ 120	⩽ 1
MS1H3-29C/44C/ 55C/75C	50		18.58	1.29	⩽ 100	⩽ 200	⩽ 1

Note

- The brake cannot share the same power supply with other electrical devices. This is to prevent malfunction of the brake due to voltage or current drop caused by other working devices.
- Use cables with a cross-sectional area above 0.5 mm^2.

4.4 Encoder Terminal CN2

4.4.1 Terminal Layout



Encoder signal terminal CN2

Figure 4-35 Encoder terminal pin layout

Table 4–29 Description of encoder terminal pins

No.	Name	Description
1	+5 V	5 V power supply
2	0 V	-
3	Reserved	-
4	Reserved	-
5	PS+	Encoder signal
6	PS-	
Enclosure	PE	Shield

4.4.2 Connecting the Absolute Encoder

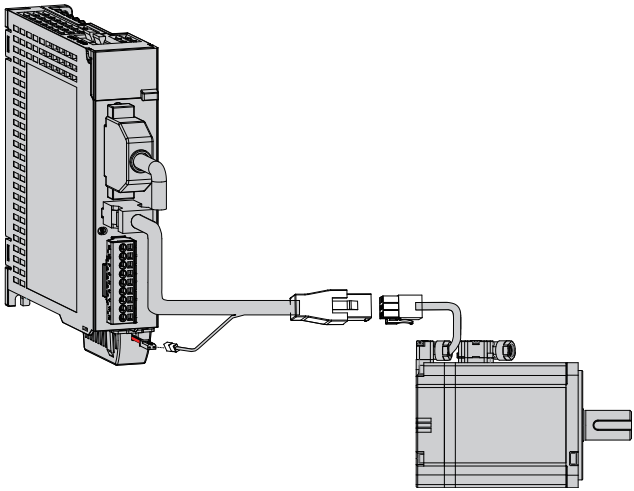


Figure 4-36 Signal wiring example of the absolute encoder[1]

Note

- [1]: The figure shows encoder cable wiring.
- The encoder cable color is subject to the color of the actual product. Cable colors mentioned in this guide all refer to Inovance cables.

The following figure describes the lead wire color of the battery box.

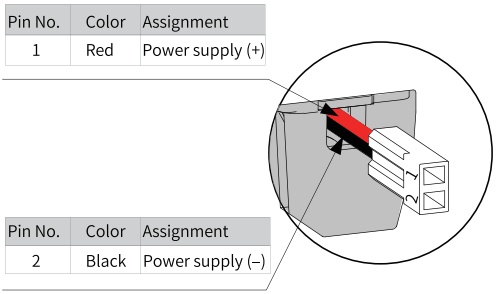
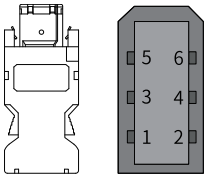
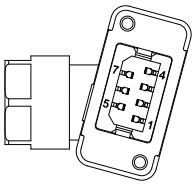


Figure 4-37 Lead wire color of the battery box

Note

- 存储期间请按规定环境温度存储，并保证电池接触可靠、电量足够，否则可能导致编码器位置信息丢失。
- 电池盒（含）电池型号：S6-C4A。

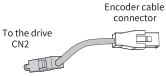
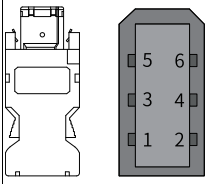
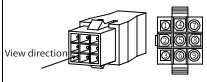
Table 4–30 Terminal-type motor encoder cable connector

Motor Frame Size[1]	Illustration		Pin			
			Pin No.	Signal Name	Color	Type
Terminal-type: 40 60 80	Servo drive side	 6-pin male (right side as the connecting side)	1	+5V	Red	Twisted pair
			2	GND	Orange	
			5	PS+	Blue	Twisted pair
			6	PS-	Purple	
			Enclosure	PE	-	-
	Motor side	 7-pin connector	1	PS+	Blue	Twisted pair
			2	PS-	Purple	
			3	DC+	Brown	Twisted pair
			4	DC-	Black	
			5	+5V	Red	Twisted pair
			6	GND	Orange	
			7	PE	-	-

Note

[1] The flange size refers to the width of the mounting flange.

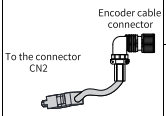
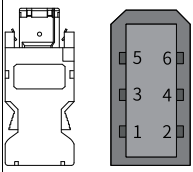
Table 4–31 Flying leads type motor encoder cable connector (9-pin)

Motor Frame Size[1]	Illustration			Pin			
				Pin No.	Signal Name	Color	Type
Flying leads type: 40 60 80		Servo drive side	 6-pin male (right side as the connecting side)	1	+5V	Red	Twisted pair
				2	GND	Orange	
				5	PS+	Blue	Twisted pair
				6	PS-	Purple	
				Enclosure	PE	-	-
		Motor side	 9-pin connector Recommended: Plastic enclosure: AMP 172161-1; terminal: AMP 770835-1	1	Battery (+)	Brown	Twisted pair
				4	Battery (-)	Black	
				3	PS+	Blue	
				6	PS-	Purple	
				9	+5V	Red	-
				8	GND	Orange	
				7	Shield	-	

Note

[1] The flange size refers to the width of the mounting flange.

Table 4–32 Absolute encoder cable connector (MIL-DTL-5015 series 3108E20-29S aviation connector)

Motor Frame Size[1]	Illustration			Pin			
				Pin No.	Signal Name	Color	Type
100 130 180		Servo drive side	 6-pin male (right side as the connecting side)	1	+5V	Red	Twisted pair
				2	GND	Orange	
				5	PS+	Blue	Twisted pair
				6	PS-	Purple	
				Enclosure	PE	-	-
		Motor side		A	PS+	Blue	Twisted pair
				B	PS-	Purple	
				E	Battery (+)	Brown	-
				F	Battery (-)	Black	
				G	+5V	Red	-
				H	GND	Orange	
				J	Shield	-	

Note

[1] The flange size refers to the width of the mounting flange (in mm).

4.4.3 Installing Absolute Encoder Battery Box

The optional S6-C4A battery box contains the following items:

- One plastic case.
- One battery (3.6 V, 2,600 mAh).
- Terminal block and crimping terminal.

Installing the battery box

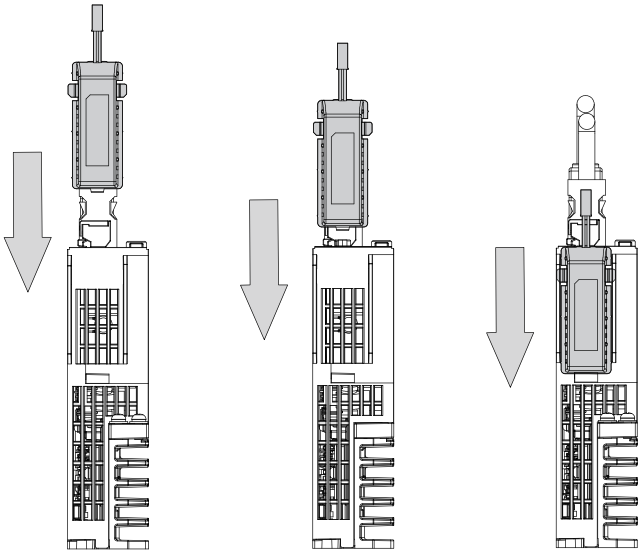
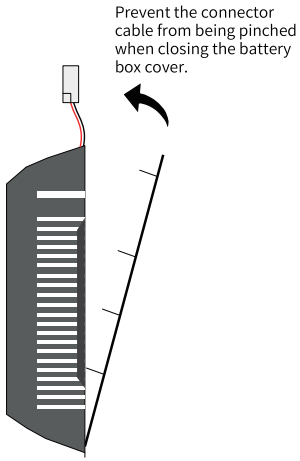


Figure 4-38 Installing the battery box (bottom view)

Removing the battery box

The battery may generate leakage liquid after long-term use. Replace it every two years. Remove the battery box in steps shown in the preceding figure, but in the reverse order.

When closing the battery box cover, prevent the connector cable from being pinched.



Improper use of the battery may result in liquid leakage which corrodes the components or leads to battery explosion. Observe the following precautions during use:

- Insert the battery with polarity (+/-) placed correctly.
- Leaving an idled or retired battery inside the device may lead to electrolyte leakage. The electrolyte inside the battery is highly corrosive, not only corroding surrounding components but also incurring the risk of short circuit. It is recommended to replace the battery every 2 years.
- Do not disassemble the battery because the internal electrolyte may spread out and result in personal injury.
- Do not throw a battery into the fire. Failure to comply may result in an explosion.
- Do not short-circuit the battery or strip off the battery case. Prevent terminals (+) and (-) of the battery from coming into contact with the metal. Contact with the metal can result in a high current, not only weakening the battery power, but also incurring the risk of explosion due to severe heating.
- This battery is not rechargeable.
- Dispose of the retired battery according to local regulations.

4.4.4 Encoder Cable Specifications

- Ground the shielded layers on both the servo drive side and the motor side. Otherwise, the servo drive will report a false alarm.
- Do not connect cables to the "reserved" terminals.
- Given the voltage drop caused by cable resistance and signal attenuation caused by distributed capacitance, it is recommended to use twisted-pair cables of 26AWG or above (as per UL2464 standard) with length no longer than 10 m as the encoder cable.

Note

It is recommended to use 22AWG to 26AWG cables and a matching terminal AMP170359-1 for 10B, 20B, 40B, and 75B series motors. If a longer cable is required, increase the cable diameter properly. See *"Table 4–33 Recommended cables" on page 95* for details.

Table 4–33 Recommended cables

Cable Size	Cable Size (mm^2)	Ω/km	Allowable Length (m)	OD (mm)
3P×26AWG	0.13	143	10.0	6.0±0.2
3P×25AWG	0.16	89.4	16.0	6.2±0.2
3P×24AWG	0.2	79.6	18.0	6.5±0.2
3P×23AWG	0.26	68.5	20.9	6.8±0.2
3P×22AWG	0.32	54.3	26.4	7.0±0.2
3P×21AWG	0.41	42.7	33.5	7.3±0.2
3P×20AWG	0.52	33.9	42.2	7.6±0.3
3P×19AWG	0.57	26.9	53.2	8.5±0.3
3P×18AWG	0.81	21.4	66.8	8.8±0.3
3P×17AWG	1.03	16.3	87.7	9.7±0.3
3P×16AWG	1.31	13.5	105.0	11.4±0.3

Note

If the cables of above 16AWG are required, contact the sales personnel of Inovance.

4.5 Communication Terminals CN3 and CN4

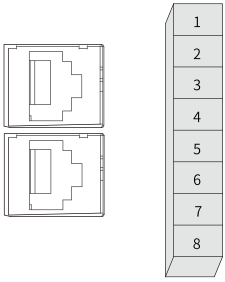


Figure 4-39 Pins of Terminals CN3 and CN4

Table 4–34 Pin assignment

Pin No.	Description	Description
1	CANH	CAN communication port
2	CANL	
3	CGND	CAN communication ground
4	RS485+	RS485 communication port
5	RS485-	

Pin No.	Description	Description
6	RS232-TXD	RS232 transmitting end, connected to the receiving end of the host controller
7	RS232-RXD	RS232 receiving end, connected to the transmitting end of the host controller
8	GND	Ground
Enclosure	PE	Shield

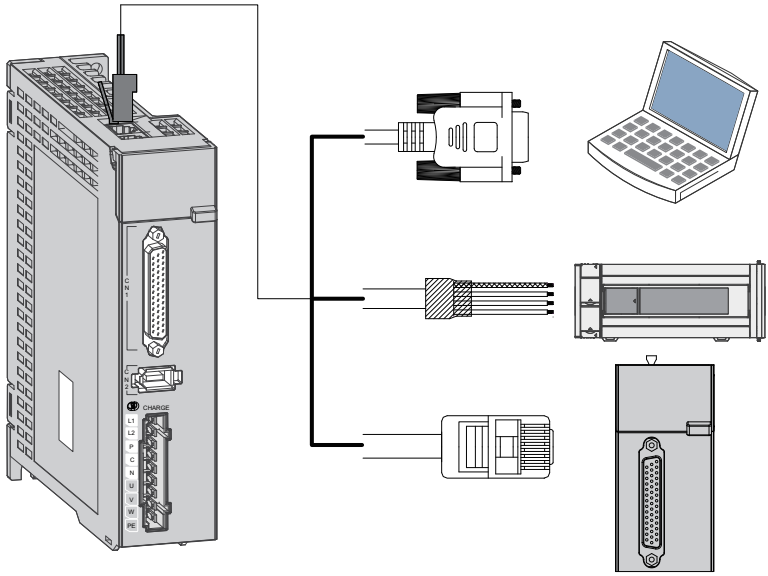


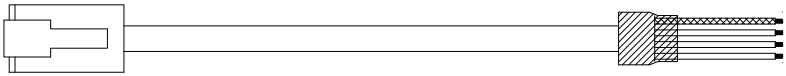
Figure 4-40 Wiring of communication cables

CN3 and CN4 are identical communication terminals connected in parallel internally.

CN3 and CN4 terminals in the drive are used for communication with the PC, PLC, and other drives. For pin assignment of CN3/CN4, see *"Table 4–34 Pin assignment" on page 95*.

CAN communication connection

- **CAN communication with PLC**
  The following figure shows the cable used for CAN communication between the servo drive and PLC.



A B

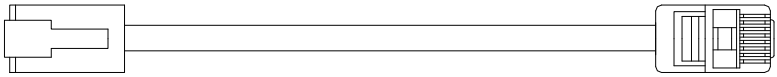
Figure 4-41 Outline drawing of cable used for CAN communication between the servo drive and PLC

Use a three-conductor shielded cable to connect the CAN bus, with the three conductors connected to CANH, CANL, and CGND (CGND represents isolated RS485 circuit) respectively. Connect CANH and CANL with twisted pairs. Connect CGND to the CAN reference ground. Connect the shield to the device ground. Connect a 120 Ω termination resistor on each end of the bus to prevent CAN signal reflection.

Table 4–35 Pin connection relation of the cable used for CAN communication between the servo drive and PLC

RJ45 on the Drive Side (A)			PLC Side (B)		
Communication Type	Pin No.	Description	Communication Type	Pin No.	Description
CAN	1	CANH	CAN	1	CANH
	2	CANL		2	CANL
	3	CGND		3	CGND
-	Enclosure	PE (shield layer)	-	Enclosure	PE (shield layer)

- **CAN communication among multiple servo drives connected in parallel**
  The following figure shows the cable used for CAN communication among multiple servo drives connected in parallel.



A B

Figure 4-42 Outline drawing of multi-drive communication cable

Table 4–36 Pin connection relation of multi-drive communication cable (pins in CAN group used only)

RJ45 on the Drive (A)			RJ45 on the Drive Side (B)		
Communication Type	Pin No.	Description	Communication Type	Pin No.	Description
CAN	1	CANH	CAN	1	CANH
	2	CANL		2	CANL
	3	CGND		3	CGND
-	Enclosure	PE (shield layer)	-	Enclosure	PE (shield layer)

Use the daisy chain mode for CAN bus, as shown in the following figure.

- Shielded twisted pair cables are recommended for connecting the CAN bus. Twisted pairs are recommended for connecting CANH and CANL.
- Connect a 120 Ω termination resistor on each end of the bus to prevent signal reflection.
- Connect the reference grounds of CAN signals of all the nodes together.
- Up to 64 nodes can be connected.

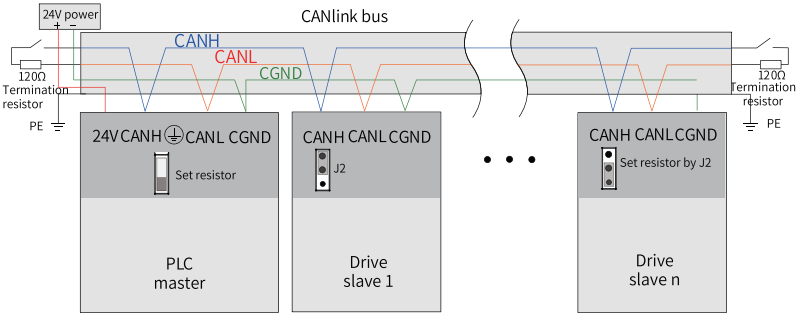


Figure 4-43 CAN bus topology

Caution

Do not connect the CGND terminal of the host controller to the GND terminal of the servo drive. Failure to comply will damage the machine.

The transmission distance of CAN bus is directly dependent on the baud rate and communication cable. The following table shows the relationship between the maximum transmission distance of CAN bus and the baud rate.

No.	Speed (bps)	Transmission Distance (m)	Number of Nodes	Cross-sectional Area (mm^2)
1	1M	25	64	0.205
2	500 k	95	64	0.34
3	100k	560	64	0.5
4	50k	1100	64	0.75

RS485 Communication Connection

- **RS485 communication with PLC**
  The following figure shows the cable used for 485 communication between the servo drive and PLC.

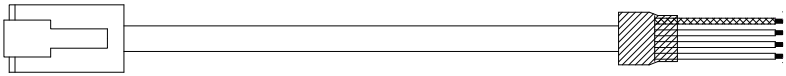


Figure 4-44 Outline drawing of cable used for CAN communication between the servo drive and PLC

Use a three-conductor shielded cable to connect the RS485 bus, with the three conductors connected to 485+, 485-, and GND (GND represents non-isolated RS485 circuit) respectively. Connect RS485+ and RS485- with two conductors twisted together and connect the remaining conductor to the RS485 reference ground (GND). Connect the shield to the device ground (PE). Connect a 120 Ω termination resistor on each end of the bus to prevent RS485 signal reflection.

Table 4–37 Pin connection relation of the cable used for CAN communication between the servo drive and PLC

RJ45 on the Drive (A)			PLC Side (B)		
Communication Type	Pin No.	Description	Communication Type	Pin No.	Description
RS485	4	485+	RS485	4	485+
	5	485-		5	485-
	8	GND		8	GND
-	Enclosure	PE (shield layer)	-	Enclosure	PE (shield layer)

- **Wiring of multi-drive RS485 communication**

  The following figure shows the cable used for multi-drive RS485 communication.

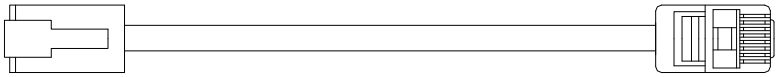


Figure 4-45 Outline drawing of multi-drive communication cable

Table 4–38 Pin connection relation of the cable used for multi-drive RS485 communication (pins in 485 group used only)

RJ45 on the Drive (A)			RJ45 on the Drive Side (B)		
Communication Type	Pin No.	Description	Communication Type	Pin No.	Description
RS485	4	485+	RS485	4	485+
	5	485-		5	485-
	8	GND		8	GND
-	Enclosure	PE (shield layer)	-	Enclosure	PE (shield layer)

In case of a large number of nodes, connect the RS485 bus using the daisy chain mode. Connect the reference grounds of RS485 signals of all the nodes (up to 128 nodes) together.

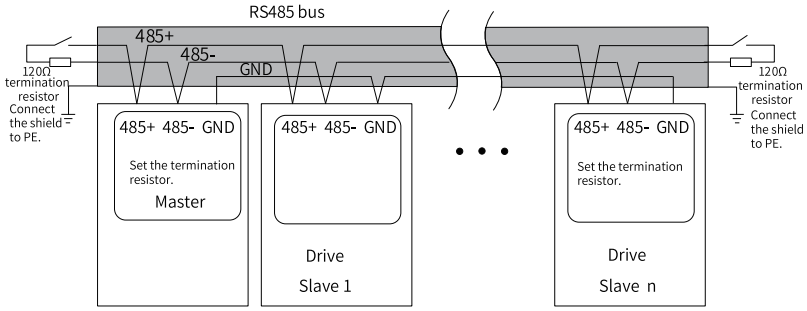


Figure 4-46 RS485 bus topology

Caution

Do not connect the GND terminal ( ) of the host controller to the CGND terminal of the servo drive. Failure to comply will damage the device.

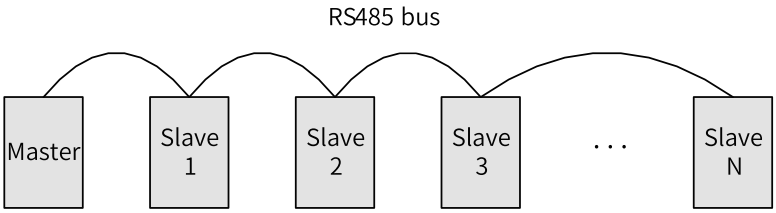


Figure 4-47 Daisy chain mode

The following table lists the maximum number of nodes and transmission distance supported by the standard RS485 circuit at different transmission rate.

Table 4–39 Transmission distance and number of nodes

No.	Transmission Rate (kbps)	Transmission Distance (m)	Number of Nodes	Cable Size
1	115.2	100	128	AWG26
2	19.2	1000	128	AWG26

Communication Connection with PC (RS232 communication)

You can connect the servo drive and the PC using the PC communication cable during RS232 communication. It is recommended to use RS232 communication interface. The outline drawing of the PC communication cable is shown in the following figure.

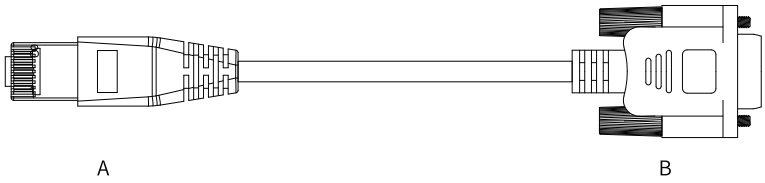


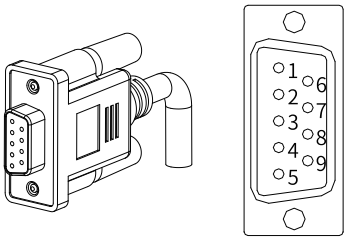
Figure 4-48 PC communication cable

Table 4–40 Pin connection relation between the servo drive and PC communication cable

RJ45 on the Drive (A)		DB9 on the PC (B)	
Signal Name	Pin No.	Signal Name	Pin No.
RS232-TXD	6	PC-RXD	2
RS232-RXD	7	PC-TXD	3
GND	8	GND	5
PE (shield layer)	Enclosure	PE (shield layer)	Enclosure

Pin assignment of DB9 terminal on the PC side is shown in the following table.

Table 4–41 Pin definition of DB9 terminal on the PC side ("B" in the preceding figure)

Pin No.	Description	Description	Pin
2	PC-RXD	PC receiving end	
3	PC-TXD	PC transmitting end	
5	GND	Ground	
Enclosure	PE	Shield	

If the host controller supports USB interface only, use the serial-to-USB cable.

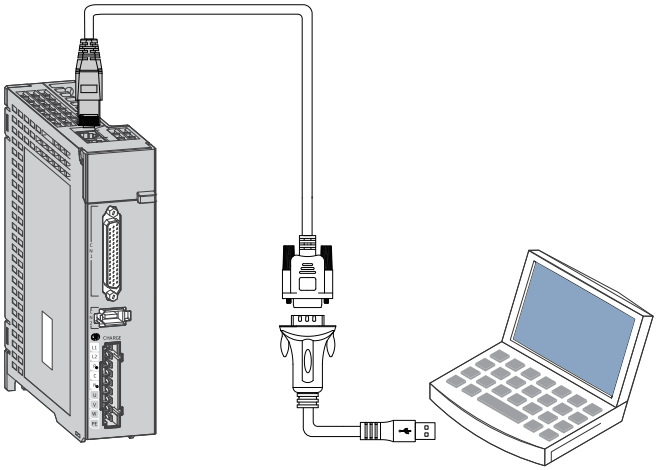


Figure 4-49 PC communication cable

Recommendations: Manufacture: Z-TEK Model: ZE551A, equipped with a 0.8 m USB extension cable Chip model: FT232

4.6 Wiring and Setting of the Regenerative Resistor

Connecting the regenerative resistor

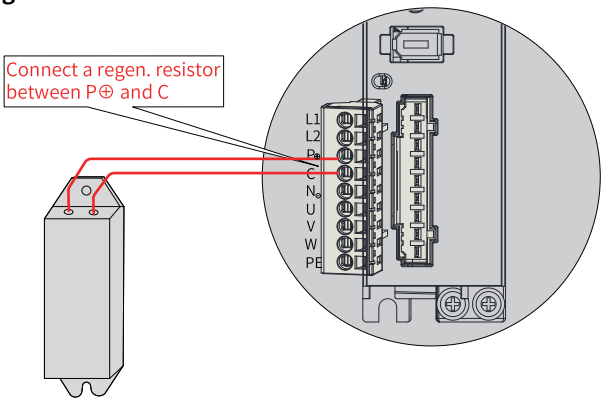


Figure 4-50 Wiring of external regenerative resistor

For cables used for terminals P⊕ and C, see *"4.2.3 Recommended Cable Specifications and Models" on page 43*.

Observe the following precautions when connecting the external regenerative resistor:

- The built-in regenerative resistor or jumper bar is not available in models S1R6 and S2R8. If an external regenerative resistor is needed for these models, connect it between terminals P⊕ and C.
- Remove the jumper between terminals P⊕ and D before using the external regenerative resistor. Failure to comply will result in overcurrent and damage the braking transistor.
- Do not connect the external regenerative resistor to the positive or negative pole of the bus directly. Failure to comply will damage the servo drive and result in a fire.
- Select a resistor with resistance higher than or equal to the minimum permissible value. Failure to comply will result in Er.201 (Overcurrent) or damage the servo drive.
- Make sure parameters H02.25 (Regenerative resistor setting), H02.26 (Power of external regenerative resistor) and H02.27 (Resistance of external regenerative resistor) are set properly before operating the servo drive.
- Install the external regenerative resistor on an incombustible object such as a metal.

5 Maintenance

5.1 Routine Maintenance

Standard operating conditions:

Average annual ambient temperature: 30°C Average load rate: ＜ 80% Daily operating time: ＜ 20 h

5.1.1 Routine Checklist

Check the following items during routine inspection.

Table 5–1 Routine checklist

No.	Routine Checklist	Checked
1	The ambient temperature and humidity are normal. There is no dust or unwanted objects in the servo drive.	☐
2	There is no abnormal vibration or noise.	☐
3	The voltage of the power supply is normal.	☐
4	There is no strange smell.	☐
5	There are no fibers adhered to the air inlet.	☐
6	There is no intrusion of unwanted object on the load end.	☐

5.1.2 Routine Cleaning List

Check the following items during routine cleaning.

Table 5–2 Routine cleaning list

No.	Routine Cleaning List	Checked
1	Clean the dust on the equipment surface, especially the metallic dust.	☐
2	Keep the front end of the servo drive and the connectors clean.	☐

Note

- Cut off the power supply before cleaning. Clean the equipment with an air gun or a piece of dry cloth.
- Do not use the gasoline, diluent, alcohol, acidic or alkaline detergent during cleaning to prevent enclosure discoloration or damage.

5.2 Periodic maintenance

5.2.1 Periodic Checklist

Table 5–3 Periodic checklist

No.	Item	Checked
1	The screws used to fix the couplings between devices are in place.	☐
2	There is no sign of overheating.	☐
3	Terminal blocks are in good condition without any sign of damage.	☐
4	The clamping units of terminal blocks are in place.	☐

5.2.2 Periodic Maintenance List

The electrical and electronic parts inside the servo drive may be mechanically worn out and degraded. To keep the servo drive and servo motor in good condition, perform parts replacement based on the replacement cycles listed in the following table. Contact Inovance or Inovance agent before replacement to double check whether the part needs to be replaced.

Equipment	Components	Standard Replacement Interval	Remarks
Servo drive	Bus filter capacitor	About five years	The standard replacement interval is for reference only. If any device/ component works improperly within the replacement interval, replace it immediately.
	Cooling fan	2 to 3 years (10000 h to 30000 h)	
	Aluminum electrolytic capacitor on the PCB	About five years	
	Pre-charge relay	100,000 operations (depending on the operating conditions)	
	Pre-charge resistor	20,000 operations (depending on the operating conditions)	
Motor	Bearing	3 to 5 years (20,000 h to 30,000 h)	
	Oil seal	5000 h	
	Encoder	3 to 5 years (20,000 h to 30,000 h)	
	Absolute encoder battery	Depends on the operating condition. See the operation instructions for the encoder battery for details.	

5.3 Replacement

5.3.1 Replacing the Motor Flat Key

Caution

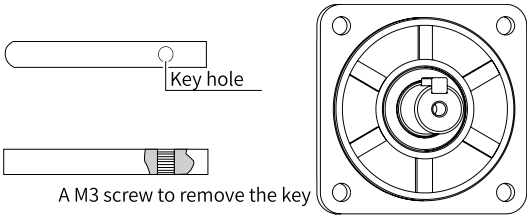
- Observe all the requirements presented in this chapter. Failure to comply may result in equipment fault or damage.
- Violent disassembly is not allowed. Take enough care during disassembly to prevent personal injury.

Standard MS1 series motors in flange sizes 60, 80, and 130 adopt C-type flat key that carries the disassembly hole. To disassemble the flat key, select a proper disassembly bolt (inner hexagon bolt recommended) based on the following table.

Specification of the key disassembly bolt		
Motor Size	Dimensions of the Flat Key	Specifications of the Disassembly Bolt (Inner Hexagon Bolt)
Size 40	Type-A flat key—A3×3×14	No disassembly hole
Size 60	Type-C flat key—C5×5×16.5	M3 x 10 and above
Size 80	Type-C flat key—C6×6×25	M3 x 15 and above
Size 100	Type-C flat key—C8×7×35	M3 x 20 and above
Size 130	Type-C flat key—C8×7×35	M3 x 20 and above
Size 180	Type-C flat key—C10×8×64	M3 x 20 and above

- Tool needed: an Allen wrench
- Disassembly procedure:

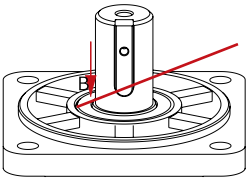
  1. Select a proper disassembly bolt (inner hexagon bolt recommended) based on the motor model.
  2. Use an Allen wrench to screw down the screw until the A-A end of the flat key is detached from the keyway, as shown below. See the following figure.



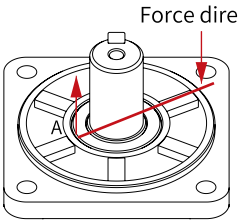
5.3.2 Removing the Motor Oil Seal

- Tools needed: a pair of needle-nose pliers, a pair of slip-proof gloves, and a piece of cotton cloth.
- Disassembly procedure:

  1. Put the cotton cloth onto the supporting point B to avoid the end cover from being scratched during disassembly.
  2. Secure the motor and use the needle-nose pliers to hold point A of the oil seal lip.
  3. Pry the oil seal out gradually against the supporting point B.



(Support point B is at the step of the extension)



(Support point A is at the outer lip of the oil seal)

6 Certification and Standard Compliance

Table 6–1 Compliance list

Certification	Directive		Standard
CE Certification	EMC directives	2014/30/EU	EN IEC 61800-3
	LVD Directive	2014/35/EU	EN 61800-5-1 EN 60034
	RoHS Directive	2011/65/EU	EN 50581
UL/cUL certification	-		UL61800-5-1 C22.2 No.274-17 UL 1004-6 CSA C22.2 No. 100-14

Note

The drive complies with the latest version of directives and standards for CE and UL/cUL certifications.

6.1 CE Certification

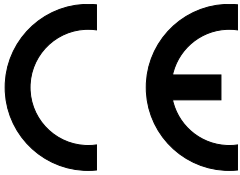


Figure 6-1 CE mark

- The CE mark indicates compliance with the Low Voltage Directive (LVD), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (RoHS) directives.
- The CE mark is required for engaging in commercial business (production, importation, and distribution) in Europe.
- The drive complies with LVD, EMC, and RoHS directives and carries the CE mark.
- Machines and devices integrated with this drive must also comply with CE requirements for distribution in Europe.
- The integrator who integrates this drive into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE certification.

6.1.1 Requirement for Compliance with EMC Directive

The SV660P series servo drive, which is applicable to the first environment and second environment, complies with EMC Directive 2014/30/EU and standard EN IEC 61800-3.

As required by EMC Directive 2014/30/EU and standard EN IEC 61800-3, install an EMC filter on the input side of the drive and use shielded cables on the output side. Ensure the filter is grounded properly and the shield of the output cable is grounded 360 degrees.

- When applied in the first environment, the drive may generate radio interference. In addition to the CE compliance requirements described in this chapter, take additional measures, if necessary, to prevent the radio interference generated by the drive.

Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. In other words, EMC includes two aspects: 1) The electromagnetic interference generated by a device during normal operation cannot exceed a certain limit. 2) The device must have sufficient immunity to the electromagnetic interference in the environment.

EN IEC 61800-3 defines the following two types of environments.

- First environment: Environment that includes domestic premises, and establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes
- Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

Drives are divided into the following four categories based on the intended application environment.

- Category C1 drive: Power drive system (PDS) with rated voltage less than 1000 V, intended for use in the first environment

- Category C2 drive: PDS with rated voltage less than 1000 V, which is neither a plug-in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by professionals
- Category C3 drive: PDS with rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment
- Category C4 drive: PDS with rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment

6.1.2 Requirements for compliance with the LVD

The drive has been tested in accordance with EN61800-5-1 to determine compliance with LVD. Observe the following requirements to enable machines and devices integrated with this drive to comply with LVD.

Installation location

Install the drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by IEC 606641-1.

Installation Environment

For requirements of the installation environment, see *"1.1.2 Installation Environment" on page 15*.

Protection

The drive must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations and relevant IEC standards.

Drives (IP20) intended to be installed inside the cabinet must be installed in a structure that prevents intrusion of unwanted objects from the top and the front.

Main circuit wiring requirements

For wiring requirements of the main circuit terminals, see SV660P Series Servo Drive Hardware Guide.

Requirements of protective devices

To comply with EN 61800-5-1, install a fuse/circuit breaker on the input side of the drive to prevent accidents caused by short circuit in the internal circuit.

For recommended fuse/circuit breaker models, see Chapter "Optional Parts" in SV660P Series Servo Drive Selection Guide.

6.2 UL&cUL Certification

Figure 6-2 UL/cUL marking

The UL/cUL mark commonly applies to products sold in the United States and Canada. Products with UL/cUL mark have been inspected and assessed by the UL organization. To pass UL/cUL certification, main built-in components of electrical products must also be UL certified.

The drive has been tested in accordance with UL 61800–5–1 and CSA C22.2 No. 274-17 to determine compliance with UL/cUL standards. Observe the following requirements to enable machines and devices integrated with this drive to comply with UL/cUL standards.

Installation location

Install the drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by UL61800–5–1.

Ambient temperature

According to the protection level, the ambient temperature must be maintained within the following range:

Ambient temperature for open-type drives: 0°C to + 50°C

Installation requirements

Installation requirements for open-type drives:

SV660P series servo drives are open-type drives that must be installed in a fireproof cabinet with the housing that provides effective electrical and mechanical protection. The installation must conform to local laws and regulations and related NEC requirements.

Main circuit wiring requirements

On-site installation of output terminals (such as P⊕, C, and NΘ) is not allowed.

- Terminals P⊕, C, and NΘ are used to connect optional parts. Do not connect these terminals to an AC power supply.

- To protect the main circuit, separate and cover the surface that may come into contact with the main circuit.
- The control circuit is the internal safety extra-low voltage (SELV) circuit, which must be insulated and isolated from other circuits. Make sure that the control circuit is connected to the external SELV circuit.
- Prevent foreign matters from entering the wiring part of the terminal block.
- Do not solder the twisted conductors.
- The tightening torque may vary with terminals. Tighten terminal screws with the specified tightening torque. You can use the torque screwdriver, ratchet, or wrench.
- When using an electric screwdriver to tighten terminal screws, set a low speed to prevent damage to the terminal screws.
- Tighten the terminal screws with an angle not higher than 5°. Failure to comply may damage the terminal screws.

Wiring requirements of the control circuit

Observe the requirements in UL508 during wiring.

Cable requirements

Cable dimensions must be compliant with requirements in NEC (National Electric Code) and CEC (Canadian Electrical Code) Part I and local regulations.

- Use cables with copper conductors.
- The recommended cable for the main circuit is a class 2 600V indoor heat-resistant PVC cable with continuous maximum allowable temperature of 75 ° C. The following conditions are used as premises:
  - Ambient temperature: ＜ 40°C.
  - Normal operating ratings

If the recommended cables for peripheral equipment or options are not suitable for the product, contact Inovance.

Cable selection

To comply with UL61800-5-1 and CSA C22.2 No. 274-17, power cables used for SV660P series servo drives must meet the following requirements:

- Compliant with NEC, Table 310-16 of NFPA70.
- Comprised of copper conductors with a rated temperature not lower than 75°C (167°F)
- Cable size must be 14AWG or higher.
- With a rated voltage not lower than the rated voltage of the servo drive
- It is recommended to use cables compliant with UL758 Style 2517 and Style 2586 as motor main circuit cables.

Requirements of protective devices

To comply with UL61800-5-1, install a fuse/circuit breaker on the input side of the drive to prevent accidents caused by short circuit in the internal circuit.

Install sufficient protective devices against short circuit in branch circuits according to applicable regulations and this guide. The drive is applicable to circuits with a rated breaking capacity lower than 5000 A and a maximum voltage of 480 VAC (class 400 V).

Note

All breaker protective devices must be UL-certified.

For the SV660 drive applied in North America, the recommended protective devices are as follows:

Fuse type: Semiconductor Fuse						
Servo drive model SV660P****I			Recommended Fuse UL-compliant FWH series			
Size	Model	Rated Input Current	Manufacturer	Model	Rated Voltage	Rated current (A)
Three-phase 380 V						
Size E	T017	12	COOPER BUSSMANN LLC	FWH-50B	500	50
	T021	16		FWH-70B	500	70
	T026	21		FWH-125B	500	125

Circuit Breaker Type: Inverse Time Circuit Breaker						
Servo drive model SV660P****I			Recommended Fuse UL-compliant 3VA6 series			
Size	Model	Rated Input Current	Manufacturer	Model	Rated Voltage	Rated current (A)
Single-phase 220 V						
Size A	S1R6	2.3	Siemens SIEMENS AG	3VA6140-6HL31	480	40
	S2R8	4.0		3VA6140-6HL31	480	40
Size B	S5R5	7.9		3VA6140-6HL31	480	40
Size C	S7R6	9.6		3VA6210-6HL31	480	100
Size D	S012	12.8		3VA6210-6HL31	480	100
Three-phase 220 V						
Size C	S7R6	5.1	Siemens SIEMENS AG	3VA6210-6HL31	480	100
Size D	S012	8.0		3VA6210-6HL31	480	100
Three-phase 380 V						

Circuit Breaker Type: Inverse Time Circuit Breaker						
Servo drive model SV660P****I			Recommended Fuse UL-compliant 3VA6 series			
Size	Model	Rated Input Current	Manufacturer	Model	Rated Voltage	Rated current (A)
Size C	T3R5	2.4	Siemens SIEMENS AG	3VA6210-6HL31	480	100
	T5R4	3.6		3VA6210-6HL31	480	100
Size D	T8R4	5.6		3VA6210-6HL31	480	100
	T012	8.0		3VA6210-6HL31	480	100

7 Solutions to Common EMC Problems

7.1 Malfunction of the Residual Current Device (RCD)

If an RCD is needed, select the RCD according to the following requirements:

- The drive may generate DC leakage current in the protective conductor, a B-type RCD therefore must be used.
- The drive may generate high-frequency leakage current during operation. To prevent malfunction of the RCD, install an RCD with tripping current not lower than 100 mA for each servo drive.
- When multiple drives connected in parallel share one RCD, select an RCD with tripping current not lower than 300 mA.
- Recommended RCD manufacturers are Siemens and Schneider.

When malfunction occurs on the RCD, take the following measures.

Table 7–1 Measures against leakage current

Symptom	Possible Cause	Measure
The RCD trips at the moment of power-on.	The anti-interference performance of the RCD is weak.	• It is recommended to use Siemens or Schneider RCDs. • It is recommended to use an RCD with a higher tripping current. • Move the unbalanced load to the front end of the RCD.
	The tripping current of the RCD is too low.	
	An unbalanced load is connected to the rear end of the RCD.	
	The capacitance of the front end of the servo drive against the ground is too high.	
The RCD trips during operation.	The anti-interference performance of the RCD is weak.	• It is recommended to use Siemens or Schneider RCDs. • It is recommended to use an RCD with a higher tripping current. • Install a simple filter on the input side of the servo drive and wind magnetic rings on the LN and RST cables near the RCD, as shown in *"Figure 7–1 Magnetic ring on the input side" on page 117*. • Reduce the carrier frequency without compromising the performance. • Reduce the length of motor cables.
	The tripping current of the RCD is too low.	
	An unbalanced load is connected to the rear end of the RCD.	
	The distributed capacitance of the motor cable or motor against the ground is too high.	

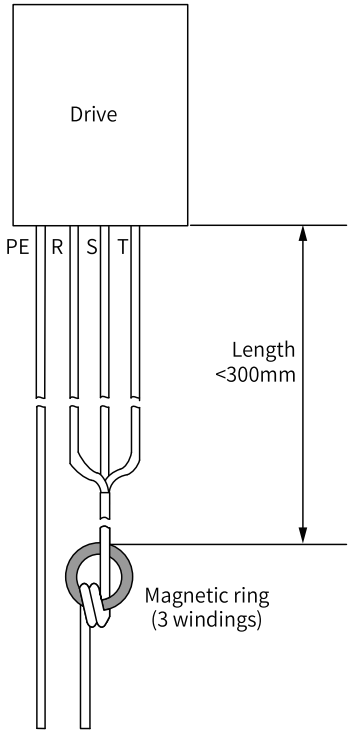


Figure 7-1 Magnetic ring on the input side

7.2 Harmonic Suppression

To suppress harmonics and improve the power factor to allow the drive to fulfill the standards, install an AC input reactor on the input side of the drive. For the reactor model and installation mode, see *"1.2.2 Instructions for Installing the AC Input Reactor" on page 24*.

7.3 Control Circuit Interference

7.3.1 High-speed Pulse Interference

Take the measures listed in the following table to suppress interference.

No.	Step
1	Used shielded twisted pair cables with both ends of the cable grounded (see *" I/O signal cable selection" on page 66*).
2	Connect the motor enclosure to the PE terminal of the drive.

No.	Step
3	Connect the PE terminal of the drive to the PE terminal of the mains power supply.
4	Add an equipotential bonding grounding cable between the host controller and drive (see *"Figure 4–20 Recommended wiring for the control cabinet system" on page 65*).
5	Separate signal cables from power cables with a distance of at least 30 cm.
6	Install the ferrite clamp or wind the magnetic ring on the signal cable by one or two turns. (see *"1.2.4 Installation of the Magnetic Ring and Ferrite Clamp" on page 25*).
7	Install the magnetic ring on the output side (UVW) of the drive by two to four turns (see *"1.2.4 Installation of the Magnetic Ring and Ferrite Clamp" on page 25*).
8	Use shielded power cables and ground the shield properly.

7.3.2 Common I/O Signal Interference

The drive generates strong interference during operation. Although EMC measures are taken, interference may still exist due to improper wiring or grounding during use. When the drive disturbs or is disturbed by other devices, adopt the following measures.

Step	Measure
1	Use shielded cables as the I/O signal cables and connect the shield to the PE terminal. For details, see *" I/O signal cable selection" on page 66*.
2	Reliably connect the PE terminal of the motor to the PE terminal of the servo drive, and connect the PE terminal of the servo drive to the PE terminal of the grid.
3	Add an equipotential bonding grounding cable between the host controller and drive (see *"Figure 4–20 Recommended wiring for the control cabinet system" on page 65*).
4	Install the magnetic ring on the output side (UVW) of the drive by two to four turns (see *"1.2.4 Installation of the Magnetic Ring and Ferrite Clamp" on page 25*).
5	Increase the filter capacitance for low-speed DIs. A capacitance up to 0.1 μF is recommended, as shown in *"Figure 7–2 I/O signal cables with capacitance increased" on page 119*.
6	Increase the filter capacitance between AI and GND. A capacitance up to 0.22 μF is recommended.

Step	Measure
7	Install a ferrite clamp or wind a magnetic ring on the signal cable by one or two turns. (see *"1.2.4 Installation of the Magnetic Ring and Ferrite Clamp" on page 25*).
8	Use shielded power cables and ground the shield properly.

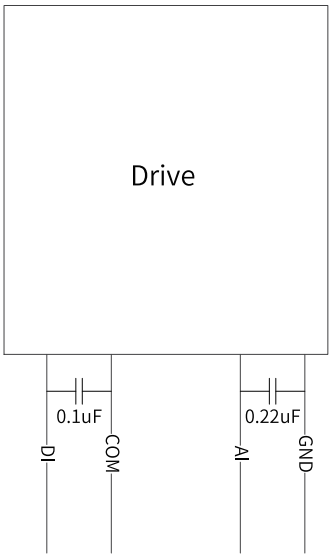


Figure 7-2 I/O signal cables with capacitance increased

7.4 RS485&CAN Communication Interference

Take the measures listed in the following table to suppress interference.

Step	Measure
1	Install a 120 Ω termination resistor on each end of the bus.
2	Replace with multi-conductor shielded twisted pair cables and ground both ends of the shield.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	Adopt daisy chain mode for multi-node communication layout.
5	Add an equipotential bonding grounding cable between nodes during multi-node communication (See *"Figure 4–20 Recommended wiring for the control cabinet system" on page 65*).

Step	Measure
6	Install ferrite clamps on both sides of the communication cable or wind the magnetic ring by one or two turns (see *"Figure 1–15 " on page 26*).
7	Install the magnetic ring on the output side (UVW) of the drive by two to four turns (see *"Figure 1–14 " on page 25*).
8	Use shielded power cables and ground the shield properly.

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