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SV660ND Series Servo Drive

Hardware Guide

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

Data code PS00005125 A03

Preface

Introduction

Thank you for purchasing the SV660ND series servo drive developed by Inovance.

The SV660ND AC servo drive is a high performance multi-drive product. It comes with a capacity of 0.4 kW and 0.75 kW, as well as support for EtherCAT bus communication. It features STO (SIL3) one-key tuning and adaptive notch filters, which allow for easy use of the product. It offers quiet and stable operation and accurate position control by working with an MS1 series high-response servo motor with a 23-bit-turn absolute encoder.

Its high integration, bus support, small size, easy commissioning and environment robustness make it a perfect match for equipment of cell phone manufacture, robots, machine tool, lithium battery, silicon semiconductor, touchscreen and LED.

This guide provides the servo drive electrical design guidance, terminal introduction, certification and standard requirements, and suggestions for solving common EMC problems.

- The drawings in the user guide are shown for illustration only and may be different from the product. Actual products may vary.
- The instructions are subject to change due to product upgrade, specification modifications as well as efforts to increase the accuracy and convenience of the user guide.

More information

Document name	Document code	Description
SV660ND Series Servo Drive Selection Guide	PS00005789	Provides instructions on product selection, including the list of supporting components, technical data on the drive and motor, and the selection guide of cables.
SV660ND Series Servo Drive Installation Guide	PS00005790	Provides instructions on product installation, including installation steps, mechanical installation, and electrical installation.
SV660ND Series Servo Drive Commissioning Guide	PS00006000	Describes the parameters, troubleshooting, operating panel, commissioning software, and commissioning flow and steps.
SV660ND Series Servo Drive Function Guide	PS00005950	Introduces product functions and parameters, including function overview, basic servo functions, adjustment and parameter descriptions.

Document name	Document code	Description
SV660ND Series Servo Drive Communication Guide	PS00006002	Introduces the functions and parameters of the servo drive, including EtherCAT communication configuration, parameter description, and communication application cases.
SV660ND Series Servo Drive Troubleshooting Guide	PS00006001	Introduces faults and fault levels, the troubleshooting process, warning codes, and fault codes.
SV660ND Series Servo Drive Maintenance Guide	PS00005791	Provides instructions on maintenance and repair of the equipment.
SV660ND Series Servo Drive Safety Guide	PS00005950	Introduces the safety function and related certifications and standards, wiring, commissioning process, troubleshooting, and functions.
SV660ND Series Servo Drive Manual Package	PS00005852	Describes model selection, installation, wiring, commissioning, functions, troubleshooting, and parameters.
SV660ND Series Servo Drive Hardware Guide (This guide)	PS00005125	Provides electrical design guidance of the equipment, description of terminals, required certificates and standards, and solutions to common EMC problems.

Revision history

Date	Version	Description
December 2024	A03	• Made minor corrections. • Updated the wiring diagram of the brake. • Deleted the description "The CN6 terminal is applicable only to non-standard models (-FS)".
2024-09	A02	• Updated the wiring of the motor PE cable. • Updated the "Safety Precautions" section.
2024-03	A01	• Added the CE and KC certifications. • Updated the Suzhou address and added the My Inovance QR code on the cover page.
2022-05	A00	First issue

Access to the guide

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

- Do keyword searching under Service and Support at *http://www.inovance.com*.

- Scan the QR code on the equipment to acquire more.
- Scan the QR code below to install My Inovance app, where you can search for and download user guides.

Warranty disclaimer

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. Maintenance will be charged after the warranty expires.

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

For detailed warranty descriptions, see the Product Warranty Card.

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Fundamental Safety Instructions

Safety Disclaimer

- This chapter provides essential safety instructions for proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to observe the safety instructions may result in death, personal injuries, or equipment damage.
- "Danger", "Warning", and "Caution" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- Use this product according to designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injury or property damage caused by improper use.

Safety Levels and Definitions



"DANGER" indicates that failure to comply with the notice can result in death or severe personal injuries.



"WARNING" indicates that failure to comply with the notice may result in death or severe personal injuries.



"CAUTION" indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

Safety Precautions

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified, and then perform operations in accordance with the user guide.
- Product illustrations in this guide are for reference only. Refer to the actual product for specific information.

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 in sequence. Do not hit the package violently.
- Check whether there is damage, rust, or signs of bumping 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 that 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.
- Do not stand or stay below the equipment when it is being hoisted.
- 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 strictly based on the requirements. Failure to comply may result in equipment damage.
- Do not store or transport the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Do not store the equipment for more than three months. If the storage duration exceeds this limit, enhance protective measures and conduct necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Do not transport the equipment with other devices or materials that may harm or have negative impacts on the equipment.

Installation



- Installation must be carried out by skilled personnel who have undergone specialized electrical training and possess comprehensive electrical expertise. Non-professionals are not allowed to install the equipment.

WARNING

- Read through the guide and safety instructions before installation.
- Do not install the 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 can result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock.
- When installing the equipment in an enclosed 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 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 a terminal device, an protective enclosure against file, electrical disturbance, and mechanical damage 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 on an incombustible object such as metal and do not touch or attach the equipment to combustibles. Failure to comply can result in fire.

CAUTION

- 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 top of the equipment. Failure to comply can block ventilation holes, resulting in over-temperature caused by poor ventilation.
- Resonance may occur when the equipment operating at a constant speed switches to 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

DANGER

- Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals.
- Before wiring, disconnect all the power supplies of the equipment. Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. Measure the DC voltage of the main circuit and ensure that the voltage is within the safety range. Failure to comply can result in electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power on. Failure to comply can result in electric shock.
- Ensure the equipment is grounded properly. Failure to comply can result in electric shock.



- Do not connect the input power supply to the output end of the equipment. Failure to comply can result in equipment damage or even 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.
- Tighten the terminal screws with the tightening torque specified in the guide. Failure to comply may result in overheat, damage to the connection parts, or fire.
- After wiring, 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 electric shock or equipment damage.



- Follow the electrostatic discharge (ESD) procedure and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or to the internal circuit.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding. Failure to comply can result in equipment malfunction.

Power-on



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



- After wiring and parameter setting, perform a trial run to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before powering on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in fire.
- Before powering 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 can result in personal injuries or even death.
- During operation, do not touch any connecting terminals or disassemble any component of the equipment. Failure to comply can result in electric shock.



- Do not touch the equipment enclosure, fan, or resistor with bare hands. Failure to comply may result in burns.
- During operation, prevent metal or other objects from falling into the equipment. Failure to comply may result in fire or equipment damage.

Maintenance



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



- Perform routine and periodic inspection and maintenance on the equipment in accordance with maintenance requirements and keep a record.

Repair



- Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals.
- Do not maintain the equipment with power on. Failure to comply can result in 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.



- Require for repair services in accordance with the product 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.
- Troubleshooting and repair must be performed by professionals according to the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment in accordance with the replacement instructions.
- Do not operate on damaged equipment. Failure to comply may result in death, personal injuries, or 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

Precautions for dynamic brake

- Dynamic braking can only be used for emergency shutdown in case of equipment faults and sudden power failure. Do not trigger faults or power failure frequently.
- When the equipment is operating at high speed, ensure an interval of more than five minutes for the dynamic braking function. Failure to comply may result in damage to the internal dynamic braking circuit.
- Dynamic braking is common in rotary mechanical structures. When a motor is stopped by dynamic braking, the inertia of the load keeps making it rotate. This generates a short-circuit current that flows through the dynamic brake. If this situation continues, the drive, and even the motor, may be burned.

Precautions for grounding

When applications such as electric welders are involved, connect the PE cable of the motor to the screws of the die-cast structural component of the drive. Failure to comply may result in motor burnout.

Effects of electromagnetic fields on medical implants

- The motor is hazardous to persons wearing medical implants nearby the equipment.
- The electromagnetic field affects the function of medical implants being used (such as cardiac pacemakers), resulting in malfunctioning.

Safety Labels

To ensure safe operations, comply with safety signs on the equipment and do not damage or remove the safety labels. See the following table for descriptions of the safety labels:

Safety Labels	Description
	• Connect the PE terminal properly to prevent electric shock. Read through the guide and follow the safety instructions before use. • Do not touch terminals within 15 minutes after powering off to prevent electric shock. • Do not touch the heat sink with power on to prevent burns.

1 System Connection

1.1 System Connection Diagram

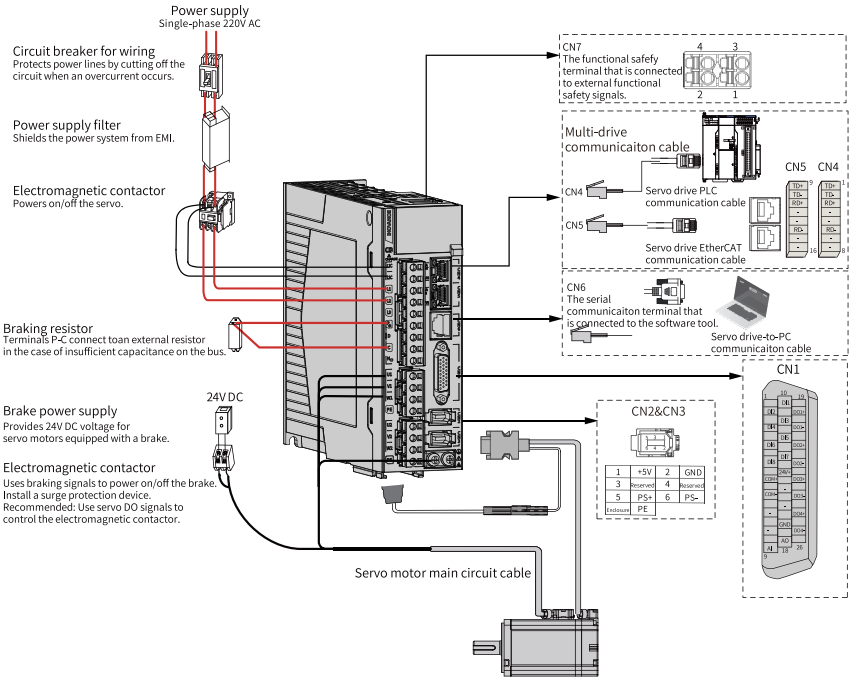


Figure 1-1 Wiring example of a single-phase 220 V system

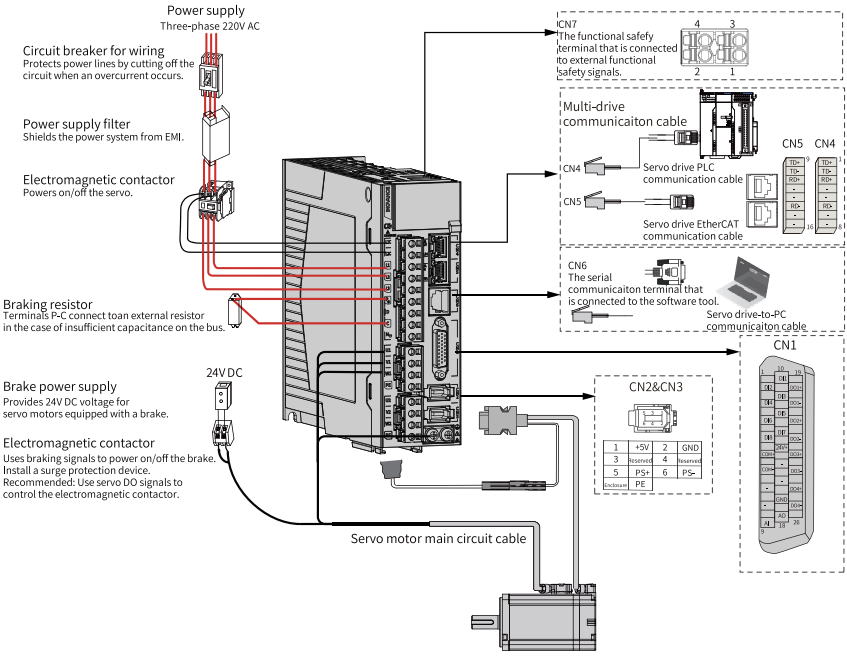


Figure 1-2 Wiring example of a three-phase 220 V system

1.2 System Composition

- The drive is directly connected to an industrial power supply, with no isolation such as a transformer. A fuse or a circuit breaker therefore must be connected to the input power supply to prevent electric shocks in the servo system. To ensure system safety, install a residual current device (RCD) to protect the system against overload and short circuits or a specialized RCD to protect the grounding cable.
- Do not use an electromagnetic contactor to start or stop the servo motor. As a high-inductance device, the motor may generate transient high voltage that may break down the contactor.
- When connecting an external control power supply or a 24 VDC power supply, pay attention to the power supply capacity. When the power supply is used to power up multiple drives or brakes, the capacity may be insufficient, leading to insufficient current supply and failure of the drive or brake. The brake must be powered up by a 24 VDC power supply that matches the motor model and meets the brake power requirements.



- Models S1R6 and S2R8 do not have built-in braking resistors or jumper bars. If an external braking resistor is required, connect it between terminals P ⊕ and C.
- Remove the jumper between terminals P ⊕ and D before using the external braking resistor. Failure to comply will result in overcurrent and damage the braking transistor.
- Do not directly connect the external braking resistor to the positive or negative electrode of the bus. Failure to comply will damage the drive and result in a fire.
- Do not select a resistor lower than the minimum allowed resistance value. Failure to comply will result in E201.0 (Hardware overcurrent) or damage the drive.
- Make sure that the parameters related to the braking resistor, H02.25, H02.26, and H02.27 are accurately set before using the drive.
- Install the external braking resistor on incombustible matters, such as metal.

2 Electrical Design

2.1 Peripheral Component Design

Selecting the circuit breaker

If a residual current device (RCD) is needed, select the RCD according to the following requirements:

- Use a B-type RCD because the drive may generate DC leakage current in the protective conductor.
- For each drive, use an RCD whose tripping current is not lower than 150 mA to prevent RCD malfunction due to high-frequency leakage current generated by the drive.
- When multiple drives are connected in parallel and share one RCD, select an RCD whose tripping current is not lower than 300 mA.
- It is recommended to use Chint or Schneider RCDs.

Installing a fuse

Note

To avoid electric shocks, do not power on the drive or operate peripherals immediately after a fuse burns or a circuit breaker trips. Instead, wait at least a period of time specified on the product warning label before further operations. Failure to comply will result in product damage, physical injuries, or even death.

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

Installing an electromagnetic contactor

Turning on or off the side electromagnetic contactor can start or stop the servo drive. However, frequent turn-on/-off may cause drive faults. Therefore, start/stop the servo drive at most once per hour. Do not use the electromagnetic contactor as the power switch of the drive. Otherwise, the lifetime of the drive may be reduced.

Selecting AC input reactors

The AC input reactor is an option used to suppress the harmonics in the input current. In applications where harmonics need to be suppressed, install an external AC input reactor.

The following figure shows the connection of the AC input reactor.

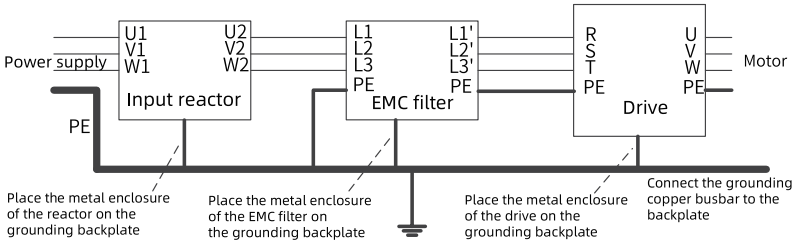


Figure 2-1 Connection of the AC input reactor

Selecting the EMC filter

Note

- The connecting cable between the filter and the controller must be as short as possible (less than 30 cm).
- Make sure that the filter and the controller are connected to the same grounding reference plane, and make sure that the filter is reliably grounded. Otherwise, the filtering effect of the filter cannot be achieved.

Use CE-compliant filters that comply with the emission requirements in Category C2 of EN 61800-3 C2 and EN 12015. Properly ground the filter. Keep the cable that connects the filter and controller shorter than 30 cm.

The following figure shows the connection of the EMC filter.

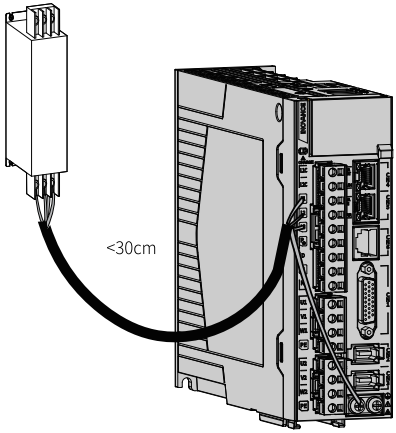


Figure 2-2 Connection of the EMC filter

Selecting the magnetic ring and ferrite clamp

The drive generates strong interference during operation and may disturb or be disturbed by other devices in the case of improper routing or grounding. In this case,

wind the drive output (U/V/W) cables to the magnetic ring by two to four turns, and wind the signal cable to the magnetic ring by one or two turns or install a ferrite clamp on the signal cable.

- Amorphous magnetic ring: featuring high permeability when the frequency is within 1 MHz and excellent anti-interference performance, but not as low-cost as the ferrite clamp
- Ferrite clamp: featuring high permeability when the frequency is above 1 MHz and excellent suppression performance on interference generated by low-power drives and signal cables

The following figure shows the connection of the magnetic ring and ferrite clamp.

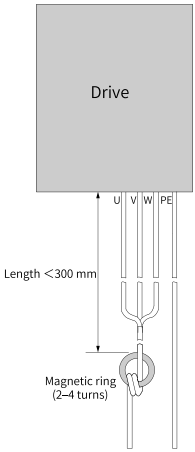


Figure 2-3 Connection of the magnetic ring

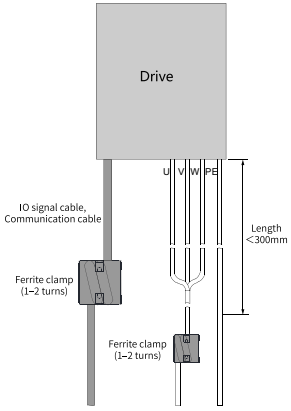


Figure 2-4 Connection of the ferrite clamp

Selecting the braking resistor

When the motor torque direction is opposite to the direction of rotation, the energy is fed back to the servo drive from the motor side, leading to bus voltage rise. Once the bus voltage rises to the braking threshold, the excessive energy must be consumed by a braking resistor. Otherwise, the servo drive will be damaged. The regenerative resistor can be a built-in or an external one. The internal and built-in braking resistors cannot be used together.

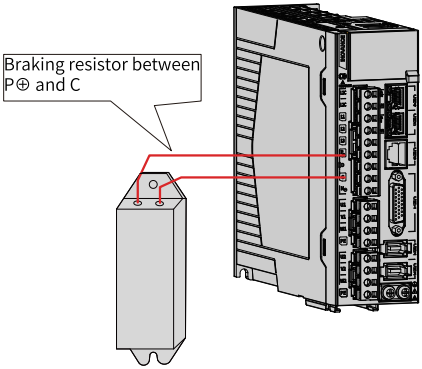


Figure 2-5 Wiring of external braking resistor

For cables used for terminals P⊕ and C, see *"2.2.1.3 Power Cable Specifications" on page 24*.

CAUTION

Observe the following precautions when connecting the external braking resistor:

- The built-in braking resistor or jumper bar is not available in model S2R8. If an external braking resistor is required, connect it between terminals P⊕ and C.
- Remove the jumper between terminals P⊕ and D before using the external braking resistor. Failure to comply will result in overcurrent and damage the braking transistor.
- Do not directly connect the external braking resistor to the positive or negative pole of the bus. Failure to comply will damage the 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 drive.
- Make sure parameters H02.25 (Braking resistor setting), H02.26 (Power of external braking resistor) and H02.27 (Resistance of external braking resistor) are set properly before you operate the servo drive.
- Install the external braking resistor on incombustible matters, such as metal.

2.2 Power Cable Selection

2.2.1 Power Supply Cable

2.2.1.1 Rules



Read the section Rules carefully. Failure to comply may result in serious consequences.

- Do not use the power from the IT system for the drive. Use the power from the 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 (R, S and T) to form a structure which allows independent power cutoff on the drive power side. This is to prevent fire accidents caused by continuous high current generated upon fault.
- Make sure that the input power supply of the drive is within the specified voltage range. Failure to comply may result in faults.
- The main circuit cable must remain away from the motor so that its insulation will not be damaged by high temperature of the motor surface.
- Use the ALM (fault) signal to cut off the main circuit power supply. A faulty braking transistor may overheat the braking 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 still exists in the internal capacitor of the drive. Wait for at least 15 minutes before further operations. Failure to comply may result in an electric shock.
- The specification and installation of external cables must comply with applicable local regulations.
- Observe the following requirements when the drive is used on a vertical axis.
  - Set the safety device properly to prevent the workpiece from falling upon warning or overtravel.
  - Make sure that the positive/negative polarity of the 24 V power supply is correct. Otherwise, the axis may fall and cause physical injuries or equipment damage.
- It is recommended to use Teflon cables with a high temperature limit when the temperature inside the cabinet exceeds the temperature limit of regular cables. Take thermal insulation measures for cables laid in environments with low a temperature because the surface of regular cables may be easily hardened and cracked at low temperatures.
- The drive must be properly grounded. Failure to comply may result in device malfunction or 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.
- 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.
- Use a power supply filter to reduce the electromagnetic interference on electronic devices surrounding the servo drive.

2.2.1.2 Power Cable Types

- The bending radius of a cable must be above 10 times its outer diameter to prevent the internal conductor from breaking due to long-time bending.
- Use cables with a rated voltage above 600 VAC and rated temperature above 75°C. Under an ambient temperature of 30°C and normal cooling conditions, the permissible current density of the cable cannot exceed 8 A/mm2 when the total current is below 50 A, or 5 A/mm2 when the total current is above 50 A. The allowable current density (A/mm^2) can be adjusted based on the following formula in case of high ambient temperature or bundled cables.
  Allowable current density = 8 x Reduction coefficient of current-carrying density of the conductor x Current correction coefficient

  $$\text{Current correction coefficient} = \sqrt{(\text{Maximum allowable temperature} - \text{Ambient temperature}) \div 30}$$

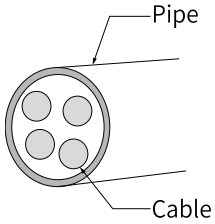


Table 2–1 Reduction coefficient of conductor current-carrying density

Number of cables in a duct	Current reduction coefficient
< 3	0.7
4	0.63
5 to 6	0.56
7–15	0.49

- 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.
- Use a grounding cable with the same cross-sectional area as the main circuit cable. The cross-sectional area of the grounding cable (excluding the motor grounding cable) must not be less than 2.5mm^2 under any condition.

Cable selection

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

Use a four-conductor shielded cable, with one core being the PE wire, as shown in the following figure.

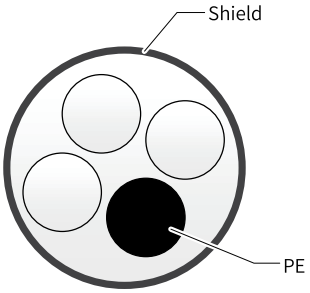


Figure 2-6 Four-conductor shielded cable

To effectively suppress radio frequency interference, the shield of the shielded cable consists of copper braid. To enhance the shielding performance and conductivity, the braid density of the shield must be greater than or equal to 85%.

Observe national or regional regulations when selecting cable dimensions. Requirements on IEC cable selection:

- Compliant with EN 60204-1 and IEC 60364-5-52 standards.
- PVC insulated cables with copper conductors.
- Heat resistance: maximum cable surface temperature of 70°C at an ambient temperature of 40°C.

Note

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

Cable shield requirements

Take proper shielding measures in the following locations to prevent equipment damage:

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

Connect the motor power cable shield to the grounding cable to ensure reliable grounding, as shown in the following figure.

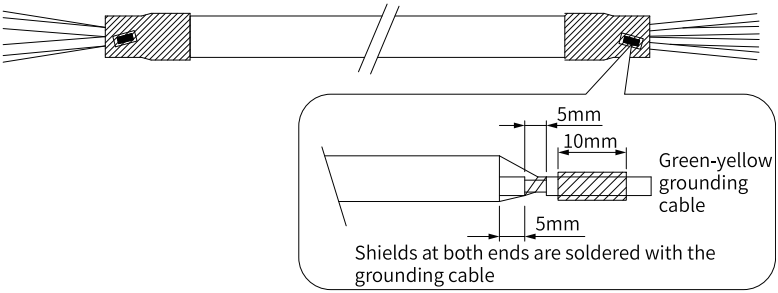


Figure 2-7 Wiring of the shield

2.2.1.3 Power Cable Specifications

Table 2–2 Recommended main circuit cables

Drive model SV630ND****I			L1C, L2C		L1, L2, L3		U1, V1, W1, PE U2, V2, W2, PE		P ⊕ , N ⊖ , D, C	
Size	Model	Rated input current (A)	(mm^2)	(AWG)	(mm^2)	(AWG)	(mm^2)	(AWG)	(mm^2)	(AWG)
Single-phase 220 V										
A	S2R8	7.2	2 x 0.52	20	3 x 0.52	20	4 x 0.52	20	2 x 0.52	20
B	S5R5	12.4	2 x 0.52	20	3 x 0.52	20	4 x 0.52	20	2 x 0.52	20
Three-phase 220 V										
A	S2R8	4.2	2 x 0.52	20	3 x 0.52	20	4 x 0.52	20	2 x 0.52	20
B	S5R5	7.5	2 x 0.52	20	3 x 0.52	20	4 x 0.52	20	2 x 0.52	20

Table 2–3 Recommended cable lug model and tightening torque for the main circuit terminal

Drive model SV660ND****I			Recommended PVC cable model (at 40℃)				
Size	Model	Rated input current (A)	Power cable lug (mm^2)	Recommended power cable lug model	Recommended brake cable lug model	Recommended PE cable lug model	Tightening torque (N·m)
Single-phase 220 V							
A	S2R8	7.2	-	GTVE10008	GTVE05008	TVR2-4	1.36
B	S5R5	12.4	-	GTVE15008	GTVE10008		1.36
Three-phase 220 V							
A	S2R8	4.2	-	GTVE10008	GTVE05008	TVR2-4	1.36
B	S5R5	7.5	-				1.36

The following table lists the data for recommended cable lugs (manufacturer: Suzhou Yuanli Metal Enterprise Co., Ltd) for your reference.

Table 2–4 Cable lug dimensions and appearance (for grounding cables)

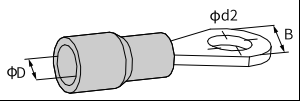
Lug model		D (mm)	d2 (mm)	B (mm)	Appearance
TVR	2-4	4.5	4.3	8.5	

Table 2–5 Recommended servo cable specifications and models

Cable type	Cable size	Outer diameter (mm)
Power cable	4 x 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 x 20AWG +2 x 24AWG	6.5±0.2
Brake cable	2×18AWG	5.8±0.2
	2×20AWG	5.0±0.2

Table 2–6 Specifications of motor output cables

MS1H1/H4 05B–10C (0.05 kW to 1 kW)			
Cable type	Regular cable	Drag chain cable	Oil-resistant shielded drag chain 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	UL2517 (rated temperature: 105℃) 4E x 20AWG + 2C x 24AWG	UL2517 (rated temperature: 105℃) 4E x 20AWG + 2C x 24AWG	UL2517 (rated temperature: 105℃) 4E x 20AWG + 2C x 24AWG
	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 outer diameter	Φ6.5±0.2 mm		
Internal structure and conductor colors			
Fill in "X.X" in the model number with cable length.			

2.2.1.4 Power Cable Shield

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

2.2.2 Motor Cable

2.2.2.1 Rules

Note

- 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.
- The main circuit cable must be away from the motor so that its insulation will not be damaged by high temperature of the motor surface.
- Connect the servo drive to the motor directly. Do not use an electromagnetic contactor during wiring. Failure to comply may result in equipment fault.

2.2.2.2 Power Cable Types

For details, see *"2.2.1.2 Power Cable Types" on page 21*.

2.2.2.3 Power Cable Specifications

For details, see *"2.2.1.3 Power Cable Specifications" on page 24*.

2.2.2.4 Power Cable Shield

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

Connect the motor power cable shield to the grounding cable to ensure reliable grounding, as shown in the following figure.

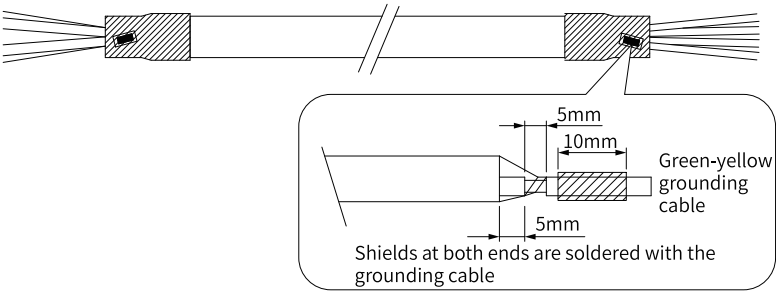


Figure 2-8 Wiring of the shield

2.2.3 Encoder Cable

2.2.3.1 Rules

- Ground the shielded layers on both the drive side and the motor side. Otherwise, the drive will report a false alarm.
- Given the voltage drop caused by cable resistance and signal attenuation caused by distributed capacitance, it is recommended to use twisted-pair shielded cables of 26AWG or above (as per UL20276 standard) with length no longer than 10 m as the encoder cable.

Note

It is recommended to use AWG22 to AWG26 cables and matching AMP170359-1 connectors for the 10B, 20B, 40B, and 75B series motors. If a longer cable is required, increase the cable diameter accordingly. For details, see *"Table 2-7 Recommended cables" on page 28*.

2.2.3.2 Encoder Cable Specifications

- Ground the shielded layers on both the drive side and the motor side. Otherwise, the drive will report a false alarm.
- Given the voltage drop caused by cable resistance and signal attenuation caused by distributed capacitance, it is recommended to use twisted-pair shielded cables of 26AWG or above (as per UL20276 standard) with length no longer than 10 m as the encoder cable.

Note

It is recommended to use 22AWG to 26AWG cables for 10B, 20B, 40B, and 75B series motors. If a longer cable is required, increase the cable diameter properly. See the following table for details.

Table 2–7 Recommended cables

Cable diameter (AWG)	Cable unit resistance (Ω/km)	Allowable length (m)
3P x 26	143	0 to 10
1P × 22 + 2P × 26	54.3	10 to 26.4
1P × 20 + 2P × 24	33.9	26.4 to 42.2
1P × 18 + 2P × 22	21.4	42.2 to 66.8
1P × 16 + 2P × 18	13.5	66.8 to 105.0

Note

- The above length can be increased by 2 m to 3 m.
- If the cables of above 16AWG are required, contact the sales personnel of Inovance.
- In the preceding table, P refers to two twisted pairs of cables. 1P: +5V/0V twisted pair; 2P: DC+/- twisted pair; PS+/- twisted pair; 3P: +5V/0V twisted pair; DC+/- twisted pair. PS+/- twisted pair.

2.2.3.3 Adapters of Power Cables and Encoder Cables

Recommended power cable connectors are Molex-39039062 and Molex-469990295. The recommended encoder cable is TE-1-172169-9. See the following figure.

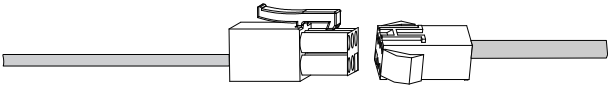


Figure 2-9 Power cable adapter

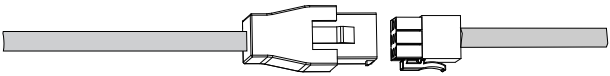


Figure 2-10 Encoder cable adapter

2.3 Control Cable Selection

2.3.1 Rules

Observe the following requirements during wiring of the control circuit.

CAUTION

- When connecting DO terminals to relays, make sure that the polarity of the flywheel diode is correct. Incorrect polarity will result in equipment damage or signal output failure.
- Keep a distance of at least 30 cm between the main circuit cables and I/O signal cables/encoder cables. Otherwise, the equipment may malfunction due to disturbed I/O signals.
- 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.

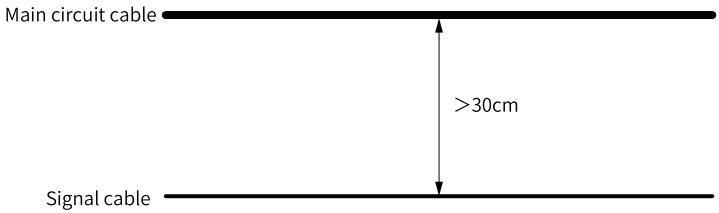


Figure 2-11 Cable wiring diagram

2.3.2 Control Cable Types

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

When wiring control circuits, follow these requirements:

Maintain a minimum distance of 30 cm between the main circuit wiring (RST, UVW) and other power lines or electrical lines to prevent interference with IO signals.

2.3.3 Control Cable Specifications

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

Table 2–8 Recommended control cable specifications

Control terminal	Connector fit/Material No.	Recommended wire gauge (AWG)
CN1	DB15	24 to 30
CN6	15120648	20 to 24

2.3.4 Control Cable Shield

To ensure that IO signal lines are not affected by strong external interference noise, it is recommended to use shielded cables with a shielding layer. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables for digital signals.

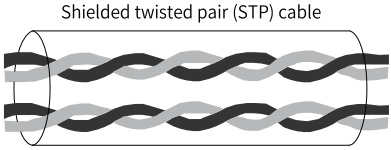


Figure 2-12 Diagram of shielded twisted pairs

2.4 Selection of Communication Cables

Communication cable selection

The EtherCAT communication cable must be an Ethernet Category 5 (100Base-TX) cable or a high-strength shielded network cable. The cables used for the servo drive must also be network cables, with a length shorter than 100 m. The shielded network cable enhances the anti-interference capacity of the system.

Rules

EtherCAT cables are connected to the network ports (IN and OUT) equipped with a metal shield. The electrical characteristics comply with standards IEEE 802.3 and ISO 8877.

Communication cable specifications

Table 2–9 Cable specifications

Material code	Cable model	Length (m)	Cable specification
15040261	S6-L-T04-0.3	0.3	Cat 5e four-conductor cable
15040262	S6-L-T04-3.0	3.0	
15041960	S6-L-T04-0.2	0.2	
15041961	S6-L-T04-0.5	0.5	
15041962	S6-L-T04-1.0	1.0	
15041963	S6-L-T04-2.0	2.0	
15041964	S6-L-T04-5.0	5.0	
15041965	S6-L-T04-10.0	10.0	
1504QV45	S6-L-T07-0.3	0.3	Cat 6a eight-conductor cable
1504QV46	S6-L-T07-1.0	1.0	
1504QV47	S6-L-T07-3.0	3.0	
1504QV49	S6-L-T08-0.3	0.3	Cat 7 eight-conductor cable
1504QV50	S6-L-T08-1.0	1.0	
1504QV51	S6-L-T08-3.0	3.0	

Communication cable specifications

Table 2–10 Specifications

Item	Description
UL certification	Compliant with UL certification
Cat 5e four-conductor cable	Cat.5e four-conductor cable.
Cat 6a eight-conductor cable	Cat 6a eight-conductor cable.
Cat 7 eight-conductor cable	Cat 7 eight-conductor cable.
Double-shielded	Braided shield (coverage: 85%), and aluminum foil shield (coverage: 100%).
Ambient temperature	-40℃ to +60℃.

If you choose an EtherCAT communication cable, you can select a cable according to the relevant Beckhoff specifications.

During planning, select cables according to the specifications provided by the cable manufacturer. If the connection between the devices is movable, use flexible cables to prevent cable damage. If the connector is installed in a chemically corrosive environment, use cables with proper special coating to prevent cable damage. If other environmental restrictions exist, use cables specially designed according to the specific information provided by the cable manufacturer.

Selection of circuit cables (Beckhoff recommended):

To maintain permanent links, the cable must conform to the worst-case angle value described in *"Table 2-11 Reference parameters of fixed cables for permanent links" on page 32* and *"Table 2-12 Reference parameters of flexible cables for permanent links" on page 32*:

Table 2–11 Reference parameters of fixed cables for permanent links

Item	Category **A** cable (fixed)
Nominal impedance (tolerance) of the cable	100 Ω ± 15 Ω (IEC 61156-5)
Balance or unbalance	Balance
DC round-trip resistance a	≤ 115 Ω/km
Number of lead wires	4 (2 pairs)
Shield	S/FTQ
Transmission impedance	< 50 mΩ/m at 10 MHz
Installation type	Static without movements after installation
Delay deviation	≤ 20 ns/100 m
The DC round-trip circuit resistor a (also known as the DC circuit resistor) is calculated by measuring the DC resistance of the two-way cable, that is, connecting two pairs of wires on one side of the cable and measuring the resistance between the same wires on the other side. If you measure the resistance between the two ends of a single cable, the obtained value is about half the value of the resistance between the two ends of the cable. Therefore, you need to take into account the corresponding reference value, which is ≤ 57.5 Ω/km.	

Table 2–12 Reference parameters of flexible cables for permanent links

Item	Category **B** cable (flexible)
Nominal impedance (tolerance) of the cable	100 Ω ± 15 Ω (IEC 61156-5)
Balance or unbalance	Balance
DC round-trip resistance a	≤ 115 Ω/km
Number of lead wires	4 (2 pairs)
Shield	S/FTQ
Transmission impedance	< 50 mΩ/m at 10 MHz
Installation type	Flexible with occasional movement or vibration
Delay deviation	≤ 20 ns/100 m
The DC round-trip circuit resistor a (also known as the DC circuit resistor) is calculated by measuring the DC resistance of the two-way cable, that is, connecting two pairs of wires on one side of the cable and measuring the resistance between the same wires on the other side. If you measure the resistance between the two ends of a single cable, the obtained value is about half the value of the resistance between the two ends of the cable. Therefore, you need to take into account the corresponding reference value, which is ≤ 57.5 Ω/km.	

Table 2–13 Example of cables used for permanent links

	Fixed	Flexible
Shield	S/FTQ	S/FTQ
Round-trip resistance	≤ 115 Ω/km	≤ 115 Ω/km
Insertion loss (@100 MHz)	19.5 dB/100 m	21.3 dB/100 m
Near-end crosstalk (@100 MHz)	50 dB/100 m	50 dB/100 m

EtherCAT communication uses only four cables. Therefore, it is recommended to use four-conductor (two pairs) balanced Ethernet cables. You can also use four pairs of cables, as long as their performance in insertion loss (IL) and near-end crosstalk (NEXT) is comparable to that of four-conductor cables and does not exceed the worst-case angle value reported in *"Table 2-11 Reference parameters of fixed cables for permanent links" on page 32* and *"Table 2-12 Reference parameters of flexible cables for permanent links" on page 32*. Additional unused pairs (especially if they are not properly terminated on the device at both ends) increase signal crosstalk between adjacent pairs, compromising cable performance.

2.5 Cable Routing

2.5.1 Routing Requirements

- 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 into consideration since the cooling condition becomes poor.
- 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 5 minutes after power-off.
- Do not frequently switch on and switch off the power supply. If the power supply is switched on and off frequently within 1s, E740.0, E136.0, or E430.0 may occur. In this case, power on the servo drive again after waiting for the specified ON/OFF interval. For details about the errors, see section Description of Error Codes in *SV660ND Series Servo* Drive Troubleshooting Guide. If you need to frequently switch on and off, the time interval between ON and OFF must be at least 1 minute.
  Because the servo drive contains a capacitor in the power supply part, the capacitor will be charged with a high current for 0.2 seconds upon power-on. Frequently turning on and off power supply affects the performance of the main circuit components inside the servo drive.
- Do not power on the servo drive if terminal screws or cables are loose. Failure to comply may lead to a fire.

Observe national or regional regulations when selecting cable dimensions. Requirements on IEC cable selection:

- Compliant with IEC 60204-1 and IEC 60364-5-52 standards.
- PVC insulated cables with copper conductors.
- Maximum cable surface temperature of 70°C at an ambient temperature of 40°C. (Contact Inovance if the ambient temperature exceeds 40°)

Note

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

2.5.2 Routing Instructions

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, 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.

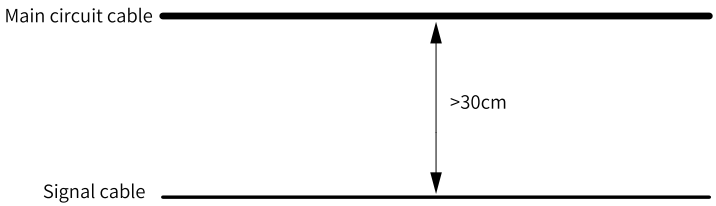


Figure 2-13 Cable layout

Wiring requirements

- 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 it from all surfaces that may come into contact with it and provide covers as required.
- 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 at an angle lower than 5 degrees. Failure to comply may result in screw damage.

2.5.3 Grounding

To properly ground the drive, observe the following requirements.



- 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 a single drive does not exceed AC 3.5 mA or DC 10 mA, the grounding cable of the drive must be has the same conductor cross-sectional area as the phase cable. On the other hand, the leakage current of multiple drives connected in parallel may exceed 3.5 mA, therefore, 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 cross-sectional area of the grounding cable (except the motor grounding cable) must not be smaller than 2.5 mm^2.
- 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.

Grounding requirements

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

- Use a yellow-green cable with copper conductors for the protective grounding conductor. Do not connect the protective grounding conductor to switching devices such as circuit breakers in series.
- 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.
- Install the drive on a conductive metal mounting surface. Ensure that the whole conductive bottom of the drive is attached properly to the mounting surface.
- Fasten the grounding screws by using the recommended tightening torque to avoid loose or excessively tight protective grounding conductors.

Grounding a single device

Installation of an individual drive:

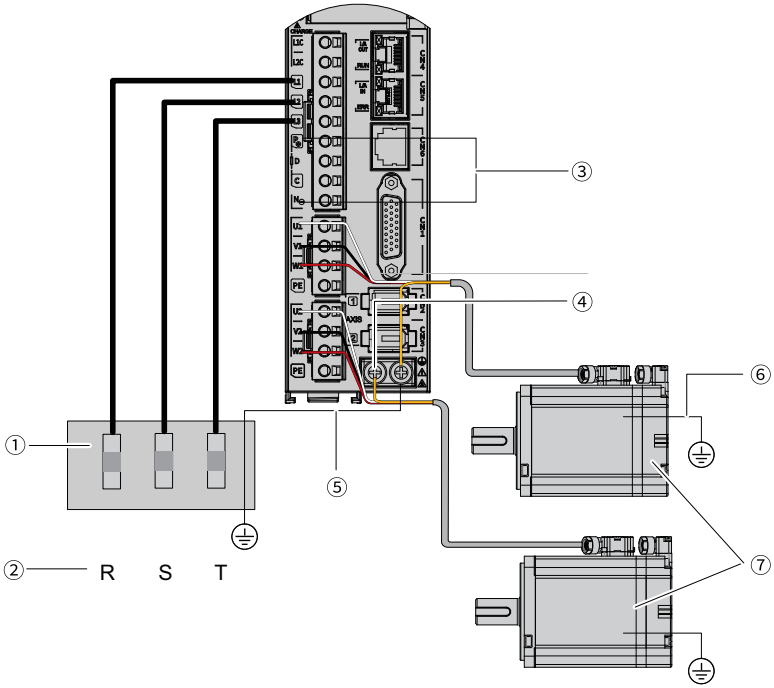


Table 2–14 Grounding a single drive

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 grounding terminal of the 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 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.	

Grounding multiple devices

Side-by-side installation of multiple drives:

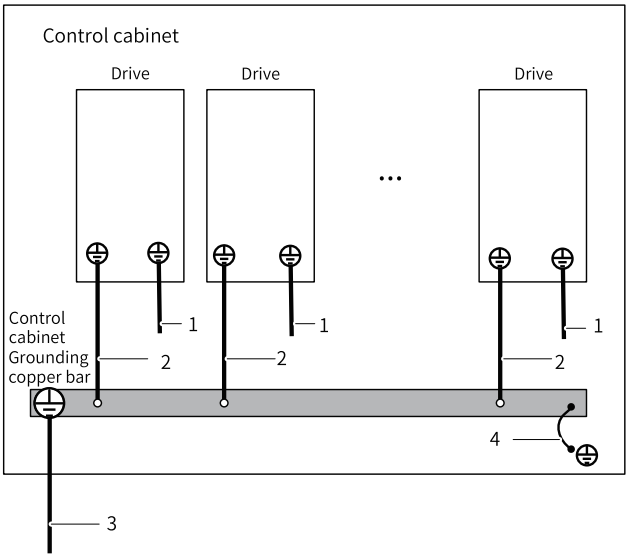


Table 2–15 Grounding drives installed in parallel

No.	Description
①	Connect the motor output cable shield to the output PE terminal of the drive.
②	Connect the main circuit input PE terminal to the grounding copper busbar of the control cabinet through the 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 2–16 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 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.

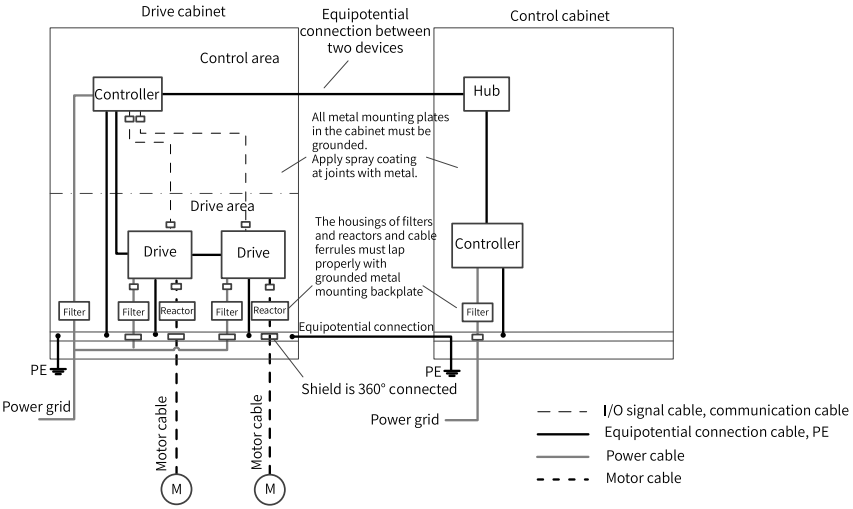


Figure 2-14 Recommended wiring for the control cabinet system

3 Wiring Terminals

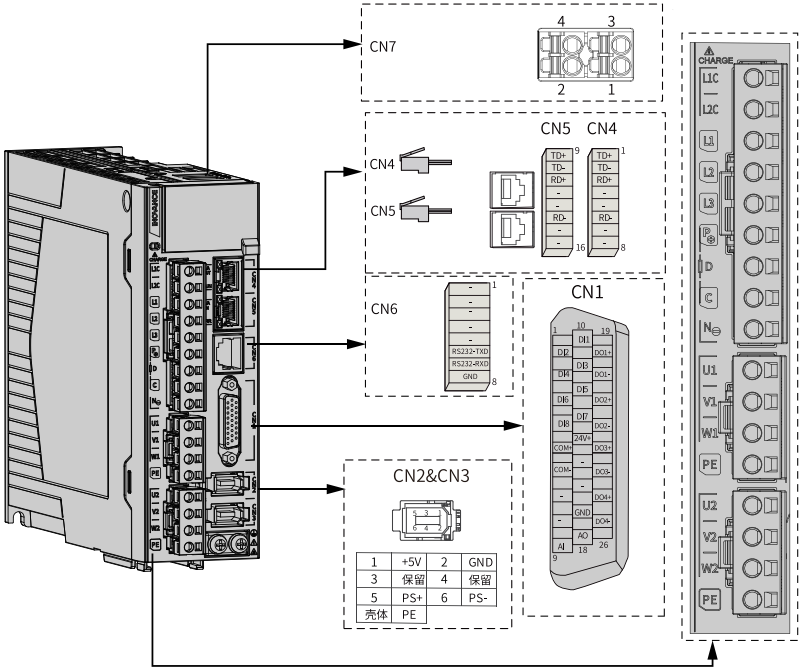


Figure 3-1 Terminal pin layout of the servo drive main circuit

For pin assignment of the main circuit terminal, see *"3.1 Main Circuit Terminal Layout" on page 40*.

3.1 Main Circuit Terminal Layout

Terminal layout

Servo drives in Size A and B (rated power: 0.4 kW to 0.75 kW): SV660NDS2R8I and SV660NDS5R5I



Figure 3-2 Terminal pin layout of the servo drive main circuit

Table 3–1 Main circuit terminal pins of the drive

Name	Description
L1C, L2C (control circuit power input terminals)	Input the control circuit power supply according to the rated voltage class on the nameplate.
L1, L2, L3T (main circuit power input terminals)	Input the main circuit power supply according to the rated voltage class on the nameplate.
P⊕, D, and C (terminals for connecting an external braking resistor)[1]	Remove the jumper bar between terminals P⊕ and D before connecting an external braking resistor between terminals P⊕ and C.
P ⊕ and N⊖,(servo bus terminals)	Used by the common DC bus for multiple servo drives.
U, V, W (terminals for connecting the servo motor)	Used to connect the U, V, and W phases of the motor.
PE terminal	It is recommended not to connect the PE cable to the motor.

Note

[1] The S2R8 model does not have a built-in braking resistor or jumper bar. If an external braking resistor is required, connect it between terminals P ⊕ and C.

Terminal description

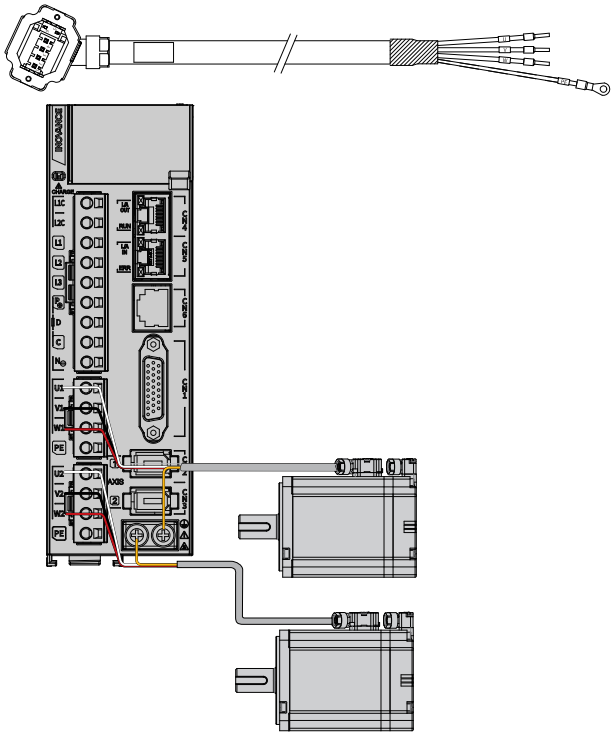
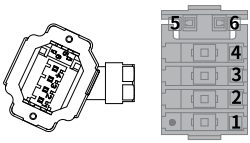


Figure 3-3 Wiring between the servo drive and terminal-type motor

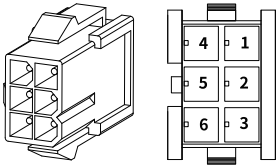
Table 3–2 Power cable connector (motor side) for terminal-type motors

Applicable frame size[1]	Drawing of the connector	Terminal pin layout		
		Pin No.	Signal name	Color
Terminal-types: 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.
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.
- Ground the motor to the PE position of the drive screw if possible. For details, see System Wiring Diagram.

Table 3–3 Flying leads power cable connector (motor side)

Applicable frame size [1]	Drawing of the connector	Terminal pin layout		
		Pin No.	Signal name	Color
Flying leads type: 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.
- Ground the motor to the PE position of the drive screw if possible. For details, see System Wiring Diagram.

3.2 Control Terminal CN1

3.2.1 Terminal Layout

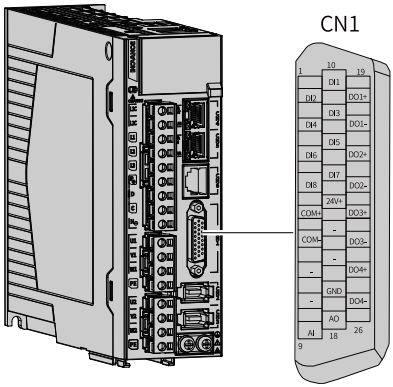


Figure 3-4 Control terminal pin layout (CN1)

Note

Use shielded cables as signal cables, with both ends of the shielded cable grounded.

Table 3–4 CN1 terminal pins

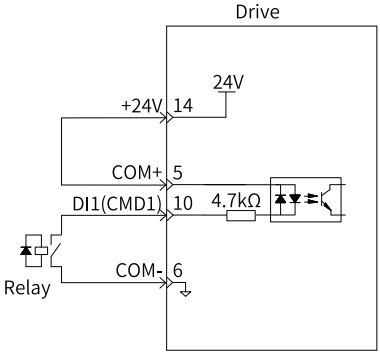
Signal		Default function	Pin No.	Function
General	DI1	P-OT	10	Axis 1 positive switch
	DI2	P-OT	1	Axis 2 positive switch
	DI3	N-OT	11	Axis 1 negative switch
	DI4	N-OT	2	Axis 2 negative switch
	DI5	HomeSwitch	12	Axis 1 home switch
	DI6	HomeSwitch	3	Axis 2 home switch
	DI7	TouchProbe1	13	Axis 1 probe 1
	DI8	TouchProbe1	4	Axis 2 probe 1
	+24V		14	Internal 24 V power supply; voltage range: 20 V to 28 V; maximum output current: 150 mA
	COM-		6	
	COM+		5	Common terminal of DI terminals
	DO1+	S-RDY+	19	Axis 1 ready
	DO1-	S-RDY-	20	
	DO2+	S-RDY+	21	Axis 2 ready
	DO2-	S-RDY-	22	
	DO3+	BK+	23	Axis 1 brake output
	DO3-	BK-	24	
	DO4+	BK+	25	Axis 2 brake output
	DO4-	BK-	26	
	AI		9	Analog input (voltage-type)
	AO		18	Analog output
	GND		17	Common terminal of AI/AO

3.2.2 DI/DO Signals

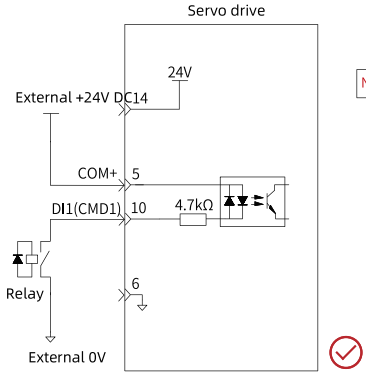
DI circuit

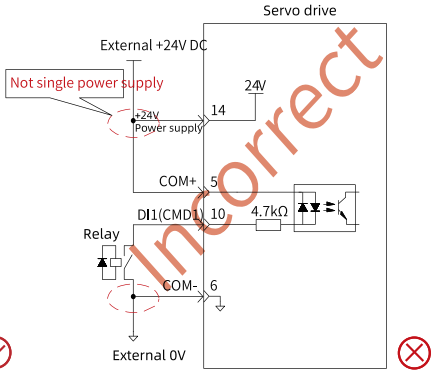
The circuits for DI1 to DI8 are the same. The following description takes DI1 circuit as an example.

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

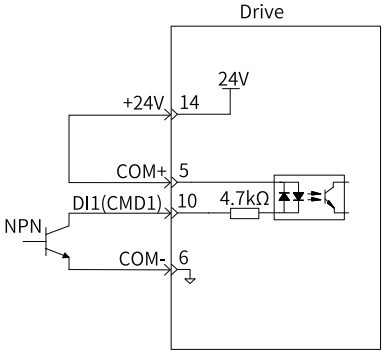


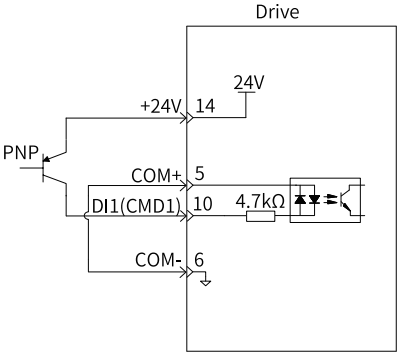
- When you use an external power supply:



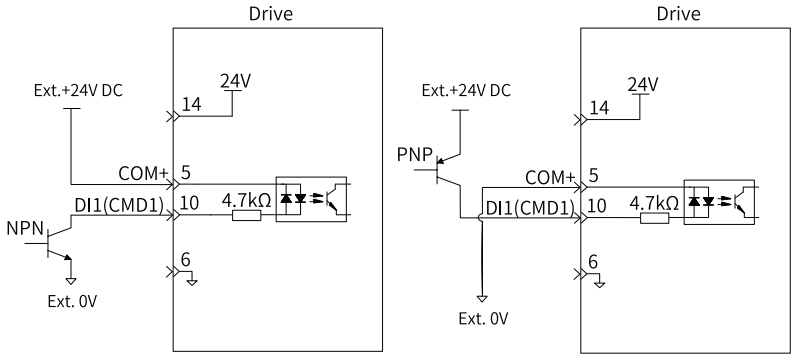


- The host controller provides open-collector output.
  - When you use the internal 24 V power supply:





  - When you use an external power supply:



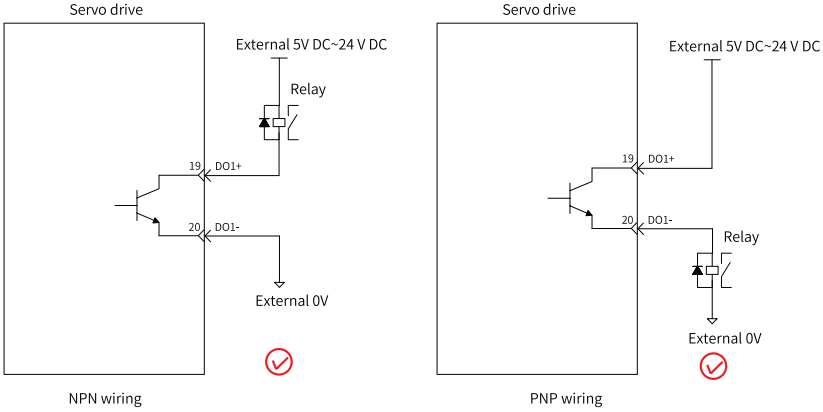
Note

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

DO circuit

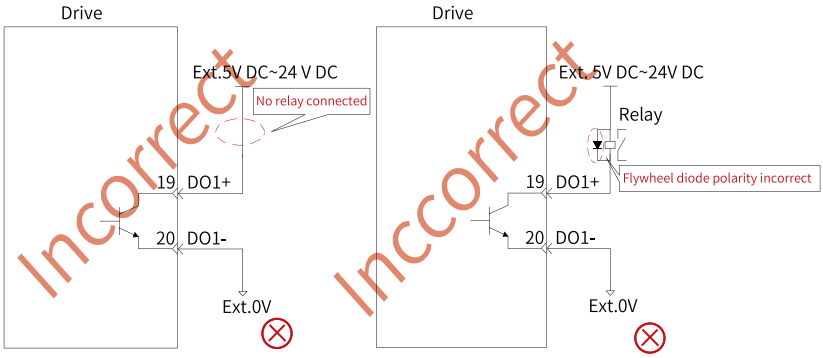
The circuits for DO1 to DO4 are the same. The following description takes DO1 circuit as an example.

- The host controller provides relay input.

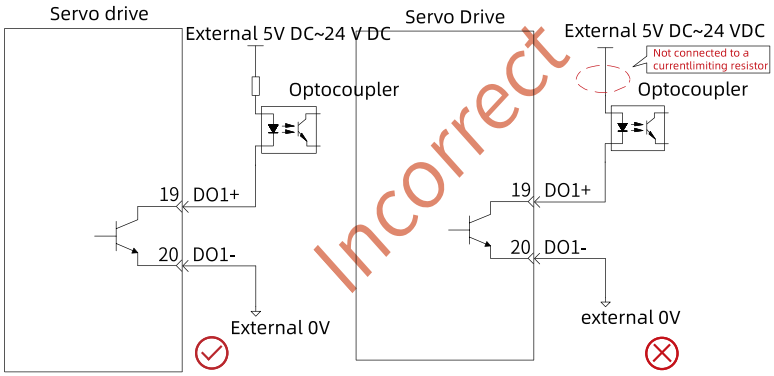


Note

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:

- Max. voltage: 30 VDC
- Max. current: DC 50 mA

3.2.3 AI/AO Signals

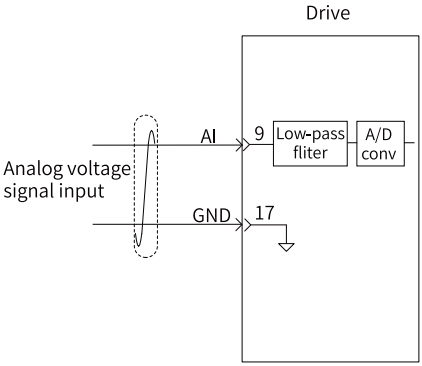
Analog input signal

The input terminal for analog speed and torque signals is AI.

AI is a voltage-type analog input terminal with a resolution of 12 bits. The voltage value is set in group H03.

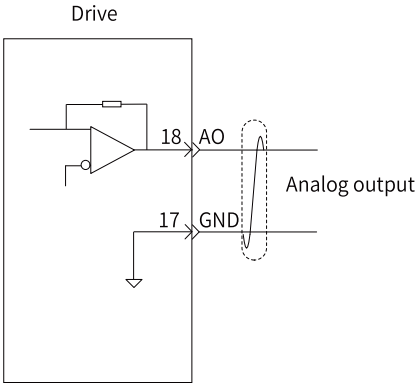
- Voltage-type input specification: -10 V to +10 V; maximum permissible voltage: ±12 V

- Input impedance: 10 kΩ



Analog output signal

The output terminal for analog speed and torque signals is AO, supporting a voltage range of -10 V to +10 V. The voltage value is set in group H04.



Note

- Make sure that different power supplies are used to power the brake and brake control signals. This is to avoid electromagnetic interference on electronic devices.
- A flywheel diode can suppress voltage spikes during the power-on and power-off of the relay. Recommended diode model: 1N4001 Required specifications: 1. Voltage reverse ≥ 50 V; 2. Forward current ≥ twice the rated current of the relay coil.
- It is recommended to use cables with a cross-sectional area above 0.5 mm^2.

3.2.4 Wiring of the Brake

The brake is used to prevent the servo motor shaft from moving and lock the motor position when the servo drive is not running. This is to keep the mechanical motion parts from moving due to gravity or external forces.

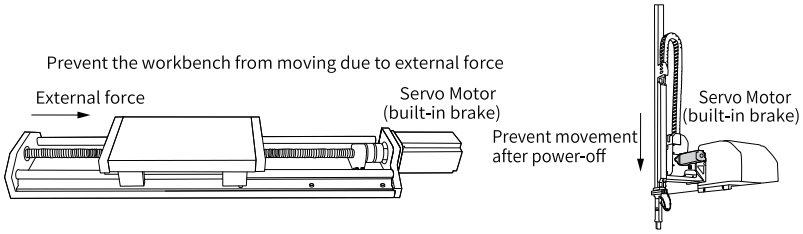


Figure 3-5 Application of the brake

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 (brake is released), flux leakage may occur on the shaft end. Pay attention when using magnetic sensors around the motor.

The connection of the motor brake input signal has no polarity. 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.

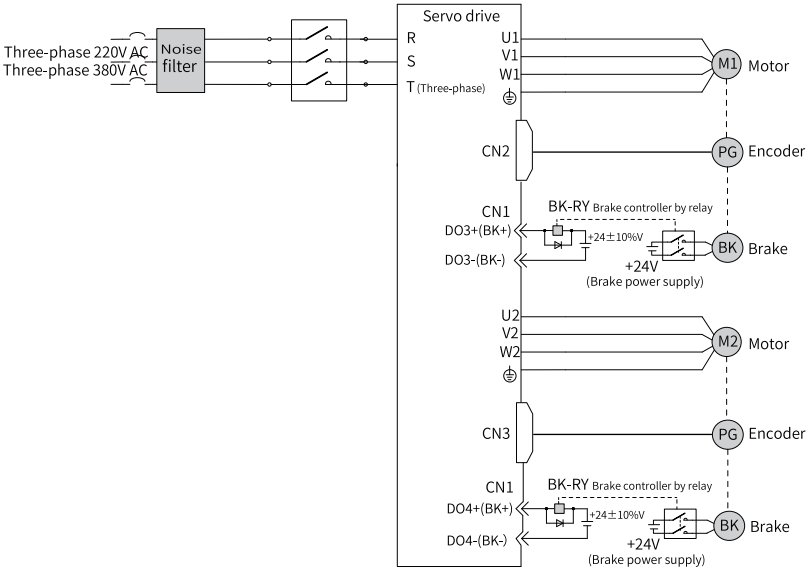


Figure 3-6 Wiring of the brake

Note

- Make sure that different power supplies are used to power the brake and brake control signals. This is to avoid electromagnetic interference on electronic devices.
- A flywheel diode can suppress voltage spikes during the power-on and power-off of the relay. Recommended diode model: 1N4001 Required specifications: 1. Voltage reverse ≥ 50 V; 2. Forward current ≥ twice the rated current of the relay coil.
- It is recommended to use cables with a cross-sectional area above 0.5 mm^2.

Pay attention to the following precautions during wiring:

When determining the length of the motor brake cable, take full account of the voltage drop caused by cable resistance. 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 motors.

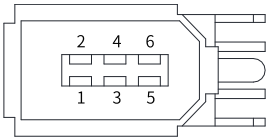
Table 3–5 Brake specifications

Motor model	Holding torque (N·m)	Power supply voltage (VDC) ±10%	Coil resistance (Ω)±7%	Excitation current (A)	Release time (ms)	Close time (ms)	Backlash (°)
MS1H1-40B MS1H4-40B	1.5	24	75.79	0.32	≤ 20	≤ 60	≤ 1.5
MS1H1-75B/ MS1H4-75B	3.2		57.6	0.42	≤ 40	≤ 60	≤ 1

3.3 Encoder Terminals CN2 and CN3

The layout and wiring of CN2 and CN3 terminals are the same. CN2 is the axis 1 motor encoder terminal and CN3 is the axis 2 motor encoder terminal. The following text takes the CN2 terminal as an example.

Terminal layout



Encoder signal terminal CN2 (drive side)

Figure 3-7 Encoder terminal pin layout of the servo drive

Table 3–6 Description of encoder terminal pins of the servo drive

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

Terminal description

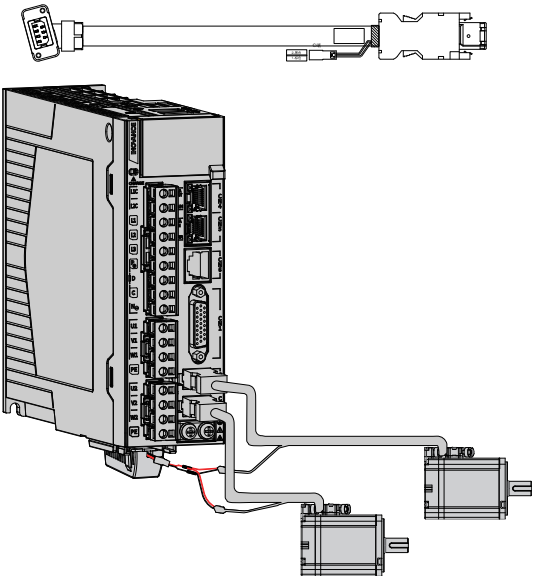


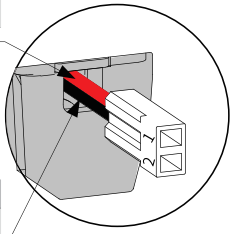
Figure 3-8 Wiring example of absolute encoder signals [1]

Note

- [1] The preceding figure shows the wiring of a 23-bit multi-turn absolute encoder.
- 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.

Pin No.	Cable color	Description
1	Red	Power supply +



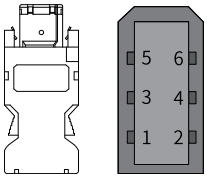
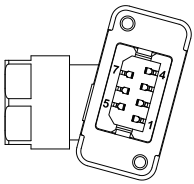
Pin No.	Cable color	Description
2	Black	Power supply -

Figure 3-9 Lead wire color of the battery box

Note

- Keep the battery in environments within the required ambient temperature range and ensure the battery is in reliable contact and carries sufficient power capacity. Otherwise, encoder data loss may occur.
- Model of the battery box (battery included): S6-C9A

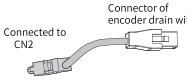
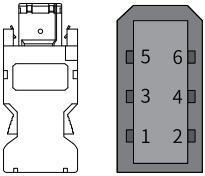
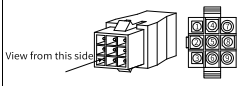
Table 3–7 Terminal-type motor encoder cable connector

Applicable motor frame size [1]	Drawing of the connector		Terminal pin layout			
			Pin No.	Signal name	Color	Type
Terminal-types: 60 80	Drive side	 6-pin male (right side as the joint 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 frame size refers to the width of the mounting flange (in mm).

Table 3–8 Encoder cable connector of flying leads type motors

<table>
<tr><th rowspan="2">Applicable motor frame size [1]</th><th colspan="2" rowspan="2">Drawing of the connector</th><th colspan="4">Terminal pin layout</th></tr>
<tr><th>Pin No.</th><th>Signal name</th><th>Color</th><th>Type</th></tr>
<tr><td rowspan="11">Flying leads types:
60
80</td><td rowspan="11"></td><td rowspan="5">Drive side</td><td rowspan="5">
6-pin male (right side as the joint side)</td><td>1</td><td>+5V</td><td>Red</td><td rowspan="2">Twisted pair</td></tr>
<tr><td>2</td><td>GND</td><td>Orange</td></tr>
<tr><td>5</td><td>PS+</td><td>Blue</td><td rowspan="2">Twisted pair</td></tr>
<tr><td>6</td><td>PS-</td><td>Purple</td></tr>
<tr><td>Enclosure</td><td>PE</td><td>-</td><td>-</td></tr>
<tr><td rowspan="6">Motor side</td><td rowspan="6">
9-pin connector
Recommended: Plastic enclosure: AMP 172161-1;
Terminal: AMP 770835-1</td><td>1</td><td>Battery (+)</td><td>Brown</td><td rowspan="4">Twisted pair</td></tr>
<tr><td>4</td><td>Battery (-)</td><td>Black</td></tr>
<tr><td>3</td><td>PS+</td><td>Blue</td></tr>
<tr><td>6</td><td>PS-</td><td>Purple</td></tr>
<tr><td>9</td><td>+5V</td><td>Red</td><td rowspan="3">-</td></tr>
<tr><td>8</td><td>GND</td><td>Orange</td></tr>
<tr><td>7</td><td>Shield</td><td>-</td></tr>
</table>

Note

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

3.4 Communication Terminals CN4 and CN5

Terminal layout

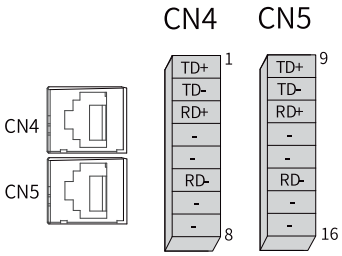


Figure 3-10 Communication terminal pin layout of the servo drive

Table 3–9 EtherCAT communication terminal pins

Pin No.	Name	Description
1	TD+	Transmits data (+)
2	TD-	Transmits data (-)
3	RD+	Receives data (+)
4 and 5	-	-
6	RD-	Receives data (-)
7 and 8	-	-
9	TD+	Transmits data (+)
10	TD-	Transmits data (-)
11	RD+	Receives data (+)
12 and 13	-	-
14	RD-	Receives data (-)
15 and 16	-	-

Terminal description

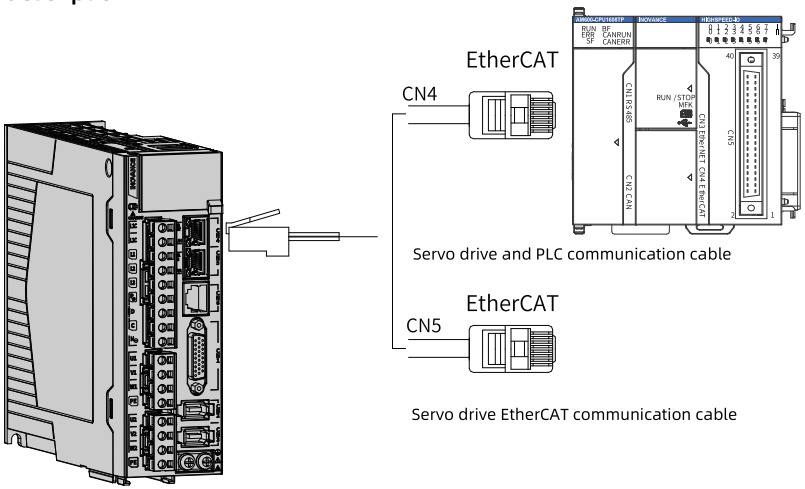


Figure 3-11 Wiring of communication cables

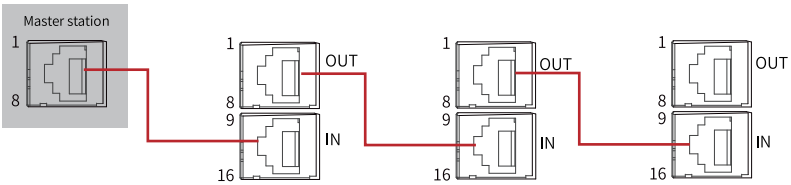
The communication signal connectors (CN4 and CN5) are EtherCAT network port connectors. The communication ports of the master station are connected to CN5 (IN) and CN4 (OUT) are connected to the next slave device. For more information about the CN4 and CN5 terminal pins, see *"Table 3-9 EtherCAT communication terminal pins" on page 56*.

Terminal connection

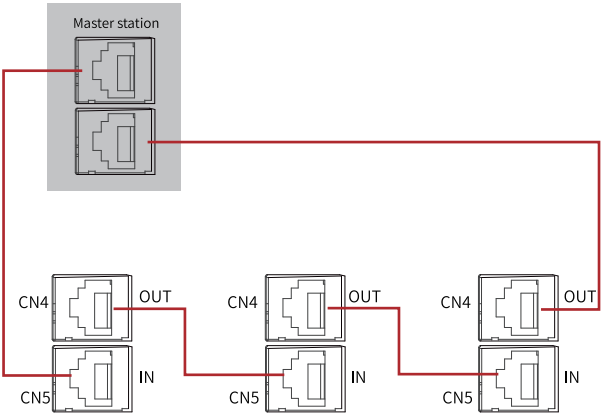
- Topology

The EtherCAT communication topology is flexible without limits.

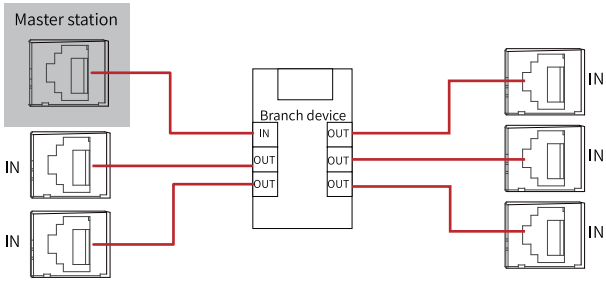
- Linear topology:



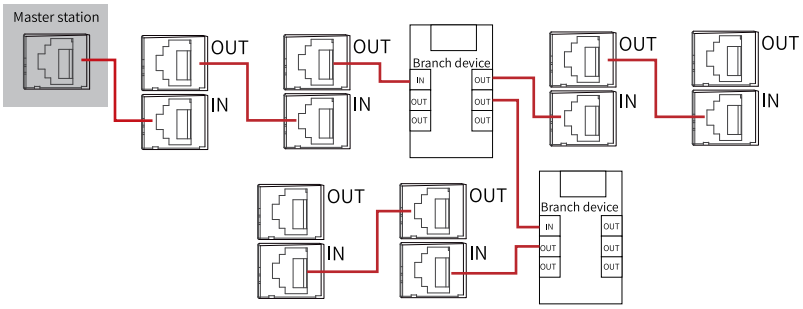
- Redundant ring topology:



- Star topology:



- Tree topology:



Ordering

Table 3–10 Instructions for communication cable selection

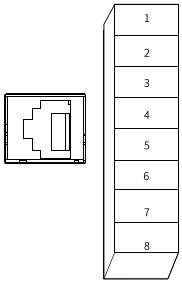
Cable specifications	Supplier
0.2 m to 10 m	Inovance and Inovance designated suppliers
Longer than 10 m	

Table 3–11 Cable ordering information

Material code	Cable model	Cable specification (m)
15040261	S6-L-T04-0.3	0.3
15040262	S6-L-T04-3.0	3.0
15041960	S6-L-T04-0.2	0.2
15041961	S6-L-T04-0.5	0.5
15041962	S6-L-T04-1.0	1.0
15041963	S6-L-T04-2.0	2.0
15041964	S6-L-T04-5.0	5.0
15041965	S6-L-T04-10.0	10.0

3.5 Communication Terminal CN6

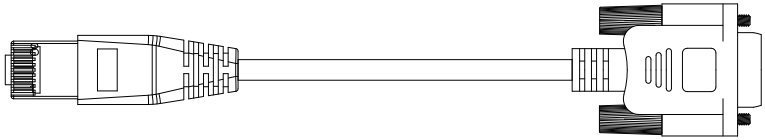
Terminal layout



Pin No.	Definition point
1 to 5	-
6	RS232-TXD
7	RS232-RXD
8	GND

Terminal descriptions

You can connect the drive to the PC through the CN6 terminal. It is recommended to use RS232, the common communication interface. The cable is shown in the following figure.



A B

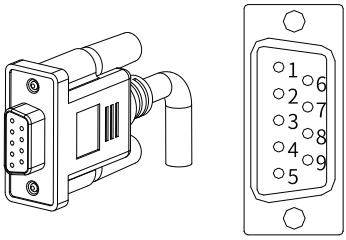
Figure 3-12 Appearance of the PC communication cable

Table 3–12 Pin connection between the drive and PC communication cable

RJ45 on the drive side (A)		DB9 on the PC side (B)	
Signal name	Pin No.	Signal name	Pin No.
RS-232-TXD	6	PC-RXD	2
RS-232-RXD	7	PC-TXD	3
GND	8	GND	5
PE (shield layer)	Enclosure	PE (shield layer)	Enclosure

Pin assignment of the DB9 terminal on the PC side:

Table 3–13 Pin assignment of the DB9 terminal on the PC side

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

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

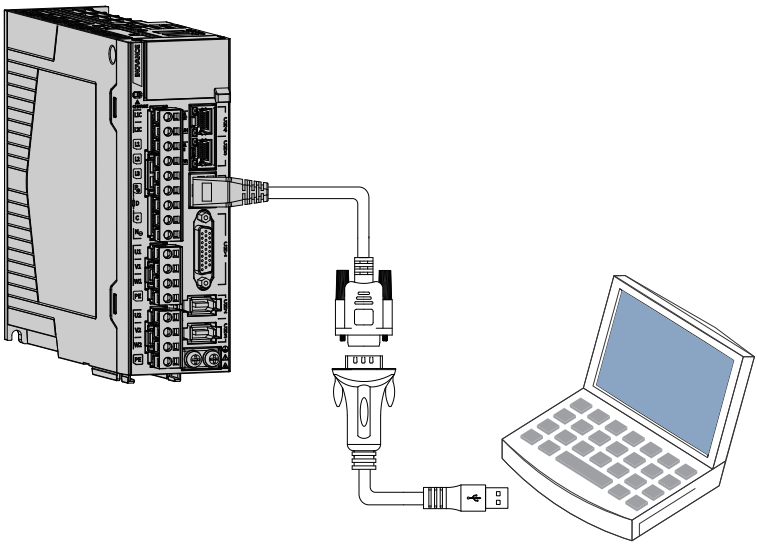


Figure 3-13 Serial-to-USB conversion

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

3.6 STO Safety Terminal CN7

Terminal layout

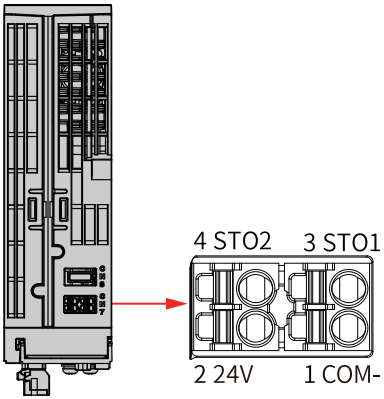


Table 3–14 STO safety terminal pins of the servo drive

Pin No.	Definition	Description
1	COM-	STO reference ground
2	24 V	24 V power supply
3	STO1	Control input of STO1
4	STO2	Control input of STO2

Two isolated inputs are configured to be dual-channel inputs of the STO function: STO1/ STO2.

To facilitate commissioning, an additional pin with power supply and voltage (+24V) is added. STO1 and STO2 need to be connected to the 24 V terminal if a safety circuit is installed but the STO function is not needed.

Note

The STO terminal is applicable only to non-standard models (-FS).

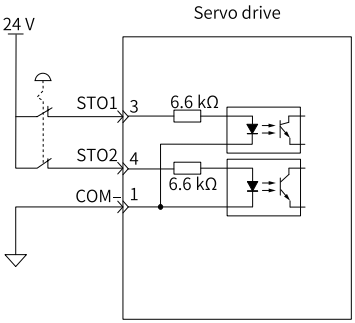
Terminal description

- **Electrical specifications and connection of the input circuit**
  This section describes the characteristics of the input signals assigned to the CN7 connectors.
  - Specifications
    The drive operates normally only when the input states of STO1 and STO2 are both "High" ("1" or "H").

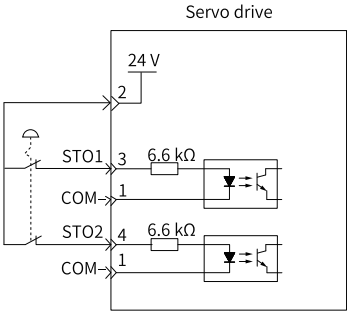
    The drive does not operate when the input states of STO1 or STO2 are different or are both "Low" ("0" or "L").
  - Electrical characteristics of Safety Request Input Signal are as follows:

Item	Characteristics	Description
Voltage range	24 VDC (±15%)	-
Input current	3.6 mA (Type)	Input current of STO1 and STO2 (3.6 mA)
Standards of logic levels	"0" < 5 V, "1" > 15 V	-
Digital input impedance	6.6 kΩ	-

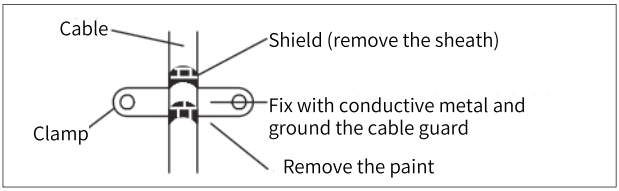
  - Wiring example for an external 24 V



- Wiring example for an internal 24 V



- **EMC requirements**
  - To avoid short circuits between two adjacent conductors, either use shielded cables connected to the protective ground, or use flat cables with one grounding wire inserted between each two signal conductors.
  - It is recommended to use double-shield or single-shield twisted multi-pair cables.
  - Fix and ground the cable shield by using a piece of conductive metal.
    Example of cable clamp:



  - The maximum allowable cable length between the drive and the activation switch is 30 m.
- **Other requirements**
  - All wiring must be well protected, routed, and clamped where practicable.
  - Make sure that the cable is not pulled or pinched during installation.

- Use STO DI channels through different routes to prevent possible faults. If impossible, protect the cable with double shields.

Cable	Description
Category	Low voltage, double-shielded or single-shielded twisted multi-pair cable.
Maximum size	0.8 mm^2 (18 AWG)
Minimum size	0.3 mm^2 (28 AWG)
Maximum length	The maximum length between the STO input and the operating contact is 30 m.

Applicable servo drives

STO applies to the following -FS servo drives:

Size	Power range (kW)	Structure	W×H×D (mm^3)
A	0.4	Split-type structure	55 x 170 x 183
B	0.75	Split-type structure	75 x 170 x 183

3.7 Wiring of the External Braking Resistor

Connecting the braking resistor

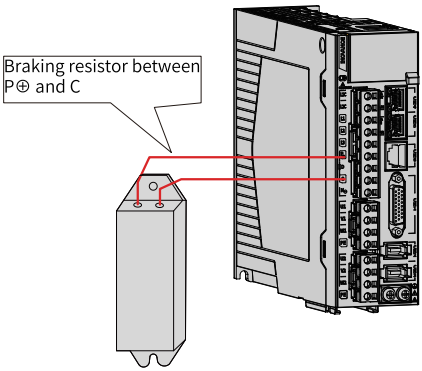


Figure 3-14 Wiring of the external braking resistor

For cables used for terminals P⊕ and C, see *"2.2.1.3 Power Cable Specifications" on page 24*.



CAUTION

Observe the following precautions when connecting the external braking resistor:

- The built-in braking resistor or jumper bar is not available in model S2R8. If an external braking resistor is required, connect it between terminals P ⊕ and C.
- Remove the jumper between terminals P ⊕ and D before using the external braking resistor. Failure to comply will result in overcurrent and damage the braking transistor.
- Do not directly connect the external braking resistor to the positive or negative pole of the bus. Failure to comply will damage the 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 drive.
- Make sure parameters H02.25 (Braking resistor setting), H02.26 (Power of external braking resistor) and H02.27 (Resistance of external braking resistor) are set properly before you operate the servo drive.
- Install the external braking resistor on incombustible matters, such as metal.

4 Certification and Standard Requirements

4.1 Certification, Directive and Standard

CE certification

Directive	Standard	
EMC Directive 2014/30/EU	Servo drive	EN 61800-3 EN 61800-6-2 EN 61800-6-4 EN 55011
	Servo motor	
Low Voltage Directive 2014/35/EU	Servo drive	EN 61800-5-1
	Servo motor	EN 60034-1 EN 60034-5
RoHS 2011/65/EU	Servo drive	EN 50581
	Servo motor	

KC certification

Certification	Standard	
KC certification	Servo drive	KN 61800-3 (Ver 2014.06) (IEC 61800-3 Ver 2012.03)

4.2 CE Certification

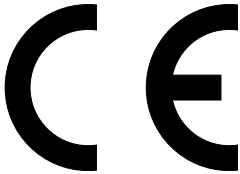


Figure 4-1 CE marking

- The CE mark indicates compliance with the Low Voltage Directive (LVD), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (RoHS) directives for commercial trades (production, import, and sales) in Europe.
- The CE mark is mandatory for engaging in commercial business (production, importation, and distribution) in Europe.
- This product complies with the LVD, EMC, and RoHS directives and is labeled with 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 the CE mark to the final assembly has the responsibility of ensuring compliance with CE certification.

4.2.1 Requirements for Compliance with EMC Directive

The drive is applicable to the first environment and second environment and 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. Make sure that the filter is properly grounded 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 to prevent radio interference if necessary.

Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices or systems 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 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

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

- C1 equipment: power drive system (PDS) with the rated voltage lower than 1000 V, which is intended for use in the first environment
- Category C2 equipment: PDS with rated voltage less than 1,000 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 equipment: PDS with rated voltage less than 1,000 V, intended for use in the second environment and not intended for use in the first environment.

- Category C4 equipment: PDS with rated voltage equal to or above 1,000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

4.2.2 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 the LVD.

Installation location

Install the product in a place with overvoltage category III and pollution degree 2 or below as specified by IEC 60664-1.

Installation environment

For requirements of the installation environment, see SV660ND Series Servo Drive Installation Guide.

Installation protection requirements

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.

Requirements for main circuit wiring

For wiring requirements of the main circuit terminals, see SV660ND Series Servo Drive Hardware Guide.

Requirements for protective devices

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

For recommended fuse and circuit breaker models, see Chapter "Optional Parts" in SV660ND Series Servo Drive Selection Guide.

4.3 KC Certification



Figure 4-2 KC certification mark

The KC mark indicates compliance with the Compliance Standards Requirements KC), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (KCC) directives for commercial trades (production, import, and sales) in the ROK.

- The KC mark is required for engaging in commercial business (production, importation, and distribution) in the ROK.
- Machines and devices integrated with this drive must also comply with KC requirements for distribution in the ROK.
- The integrator who integrates this drive into other products and attaches the KC mark to the final assembly has the responsibility of ensuring compliance with KC certification.
- Observe the following requirements to enable machines and devices integrated with this drive to comply with KC standards.



Appllicant Suzhou Inovance Technology Co., Ltd.
AC Servo Drive
Model SV670 series
Made In China
Manufacturer
Suzhou Inovance Technology Co.,Ltd.

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5 Solutions to Common EMC Problems

5.1 Malfunction of Residual Current Device

If a residual current device (RCD) is needed, select the RCD according to the following requirements:

- Use a B-type RCD because the drive may generate DC leakage current in the protective conductor.
- For each drive, use an RCD whose tripping current is not lower than 150 mA to prevent RCD malfunction due to high-frequency leakage current generated by the drive.
- When multiple drives are connected in parallel and share one RCD, select an RCD whose tripping current is not lower than 300 mA.
- It is recommended to use Chint or Schneider RCDs.

If the RCD malfunctions, perform troubleshooting according to the following table:

Table 5-1 Troubleshooting for leakage current

Symptom	Possible Cause	Solution
Tripping upon power-on	The anti-interference performance of the RCD is poor.	• Use an RCD from a recommended manufacturer. • Use an RCD with a higher tripping current. • Move the unbalanced load to the line side of the RCD.
	The tripping current of the RCD is too low.	
	Unbalanced load is connected to the load side of the RCD.	
	The capacitance of the front end of the drive is too high.	
Tripping during operation	The anti-interference performance of the RCD is poor.	• Use an RCD from a recommended manufacturer. • Use an RCD with a higher tripping current. • Install a simple filter on the input side of the drive, and wind the LN/RST cables through a magnetic ring near the RCD, as shown in *"Figure 5-1 Magnetic ring on the input side" on page 70*. • Reduce the carrier frequency without compromising the performance. • Use shorter motor cables.
	The tripping current of the RCD is too low.	
	Unbalanced load is connected to the load side of the RCD.	
	For motor cables and the motor, the distributed capacitance to ground is too high.	

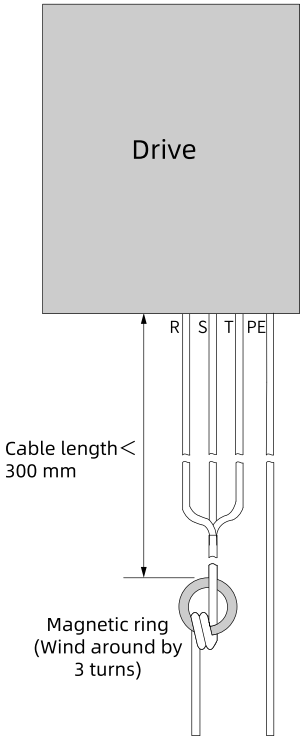


Figure 5-1 Magnetic ring on the input side

5.2 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 details about reactor models, see the selection guide. For details about the installation method, see *"Selecting AC input reactors" on page 16*.

5.3 Control Circuit Interference

5.3.1 EtherCAT Communication Interference

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

No.	Step
1	The communication cable must be shielded Cat 5e.
2	The communication port is tight and secure without the risk of poor contact.

No.	Step
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	Add an equipotential bonding grounding cable between nodes during multi-node communication (See *" Grounding the control cabinet system" on page 38*).
5	The maximum allowable cable length between two nodes is 100 m.
6	Wind the ferrite clamp around the communication cable on both sides by one or two turns (See *" Selecting the magnetic ring and ferrite clamp" on page 17*).
7	At the drive output side, wind the output U/V/W cable onto a magnetic ring for two to four turns. For details, see *" Selecting the magnetic ring and ferrite clamp" on page 17*).
8	Use shielded power cables and ground the shield properly.

5.3.2 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	Solution
1	Use shielded cables as the I/O signal cables and connect the shield to the PE terminal. For details, see *"2.3.4 Control Cable Shield" on page 30*.
2	Properly 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 wire between the host controller and the servo drive.
4	Wind the magnetic ring around the drive output (U/V/W) cables by two to four turns. For details, see *" Selecting the magnetic ring and ferrite clamp" on page 17*.
5	Increase the filter capacitance for low-speed DIs. A capacitance up to 0.1 μF is recommended, as shown in *"Figure 5-2 I/O signal cables with capacitance increased" on page 72*.
6	Increase the filter capacitance between AI and GND. A capacitance up to 0.22 μF is recommended.
7	Install a ferrite clamp or wind a magnetic ring on the signal cable by one or two turns. (see *" Selecting the magnetic ring and ferrite clamp" on page 17*).
8	Use shielded power cables and ground the shield properly.

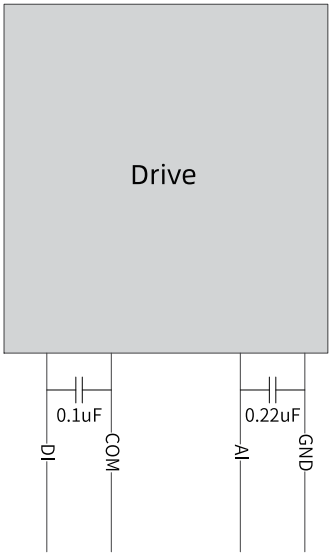


Figure 5-2 I/O signal cables with capacitance increased

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