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MD580 Series Low-Voltage High-Performance Industrial AC Drive (690 V)

Installation Guide

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

Data code 19012183 A00

Preface

About This Guide

The MD580 series is the low-voltage, high-performance engineering AC drive (690 V) that can be used to drive both permanent magnet synchronous motors and AC asynchronous motors. Adopting the high-performance vector control technology, the MD580 series features high torque output at a low speed, excellent dynamic characteristics, superior overload capabilities, and stable performance. It provides rich and powerful combined functions, such as user programming and software monitoring, and supports multiple encoder types and communication buses.

The MD580 series is a new-generation AC drive (single-drive system) designed for single-drive applications in the end user (EU) heavy industry and in the traditional original equipment manufacturer (OEM) industry. It is widely applied in industries such as petrochemical engineering, metallurgy, papermaking, printing, packaging, woodworking machine tool, food and beverage, logistics and warehousing, textile printing and dyeing, fans, and water pumps.

This guide introduces the installation and wiring of the AC drive, including pre-installation preparations, unpacking and transportation,mechanical installation, and electrical installation.

More Documentation

Document Name	Data Code	Description
MD580 Series Low-Voltage High-Performance Engineering AC Drive (690 V) Hardware Guide	19012181	This guide describes the system composition, technical specifications, components, dimensions, options (including installation accessories, cables, and peripheral electrical components), expansion cards, certifications, and standards of the AC drive.
MD580 Series Low-Voltage High-Performance Engineering AC Drive (690 V) Installation Guide	19012183	This guide describes the installation and wiring of the drive, including pre-installation preparations, unpacking and transportation, mechanical installation, and electrical installation.
MD580 Series Low-Voltage High-Performance Engineering AC Drive (690 V) Maintenance Guide	19012182	This guide describes the routine maintenance and component replacement.

Document Name	Data Code	Description
MD580 Series Low-Voltage High-Performance Engineering AC Drive Communication Guide	19011708	This guide describes the communication expansion card in brief, composition, size, installation, electrical connection, and parameter configuration.
MD580 Series Low-Voltage High-Performance Engineering AC Drive Function Guide	19011709	This guide describes function applications, fault codes, and parameters of the AC drive.
MD580 Series Low-Voltage High-Performance Engineering AC Drive Commissioning Guide	19012184	This guide describes the parameters, troubleshooting, operating panel, commissioning software, and commissioning flow and steps.

Revision History

Date	Version	Description
March 2023	A00	First release

How to Obtain

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

Log in to Inovance's website (*www.inovance.com*), choose **Support** > **Download**, search by keyword, and then download the PDF file.

Warranty Agreement

Under the condition of normal use, if the product is faulty or damaged, Inovance provides the warranty service within the warranty period (specified in the order). After the warranty period expires, maintenance will be charged.

Within the warranty period, maintenance will also be charged for the damage caused by the following causes:

- The user does not perform operations in compliance with the user manual of the product.
- The product is damaged due to fire, flood, and abnormal voltage.
- The user uses the product for abnormal functions.
- The user uses the product outside the specified specification range.
- The product is damaged by force majeure, such as natural disasters, earthquakes, or lightning strikes.

- The user uses the product outside the general process specification range, or the product is damaged after the product is used in the environment with corrosive gases (such as sulfide gas, acid gas, conductive dust, etc.) or with high humidity.

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

Table of Contents

Fundamental Safety Instructions

Safety Precautions

- 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 comply with the safety instructions may result in death, severe personal injuries, or equipment damage.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper use.

Safety Levels and Definitions

Indicates that failure to comply with the notice will result in death or severe personal injuries.

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

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

General Safety Instructions

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

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

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

Storage and Transportation

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

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

Installation

- The equipment must be operated only by professionals with electrical knowledge.

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

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

Wiring

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, cut off all the power supplies of the equipment, and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.

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

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

Power-on

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

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

Operation

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

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

Maintenance

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

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

Repair

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

- Require repair services according to 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.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal
WARNING • 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.

Safety signs

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

Safety Label	Description
	• Read through the safety instructions before operating the equipment. Failure to comply may result in death, personal injuries, or equipment damage. • Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result in an electric shock.

1 Installation Flowchart

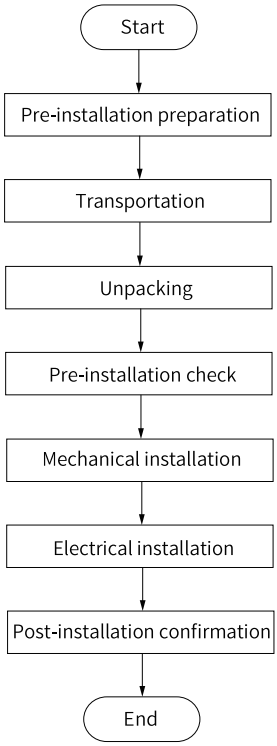


Figure 1-1 Installation flowchart

2 Preparation

2.1 Personnel

- Only professionals who have electrical expertise and have received relevant training on the electrical equipment can perform the installation.
- The installation personnel must be trained in functional safety and understand system hazards and safety features.

2.2 Installation Environment

Table 2–1 Environment requirements

Environment	Requirement
Installation location	Indoors
Grid overvoltage	Overvoltage category III (OVC III)
Temperature	Installation/Operation: –10°C to +50°C (–10°C to +40°C: no derating; over +40°C: derated by 1.5% for every additional 1°C) Storage/Transportation: –25°C to +70°C • For better reliability, use the AC drive in places without drastic temperature changes. • For use in an enclosed space such as a control cabinet, use a cooling fan or air conditioner to keep the temperature of air taken into the AC drive below 50°C. Failure to comply may result in overheating or fire. • Install the AC drive on a flame-retardant surface, with sufficient clearance reserved for heat dissipation. • Take measures to prevent the AC drive from being frozen.
Humidity	< 95% RH (non-condensing)
Environment	Pollution degree 2 or below Install the AC drive in a place that meets the following requirements: • Free from direct sunlight, dust, corrosive gas, combustible or explosive gas, oil mist, water vapor, drip, or salt • Insusceptible to vibration (away from equipment that may generate strong vibration, such as a punch press) • Free from unwanted objects such as metallic dust, oil, and water that may enter the AC drive • Free from radioactive materials, combustible materials, and hazardous gas and liquid, and salt corrosion • Away from combustible materials such as wood

Environment	Requirement
Altitude	2000 m or below; derated by 1% for every additional 100 m when the altitude is above 1000 m; maximum altitude: 4000 m (TN, TT, or IT star grid, North America delta grid); isolation transformer required when the altitude is above 2000 m
Vibration resistance	• For transportation with packaging: compliant with class 2M3 in EN60721-3-2 • For installation with packaging removed: compliant with ISTA 1H

2.3 Installation Clearance

S4 to S9 Models

- Installing one AC drive

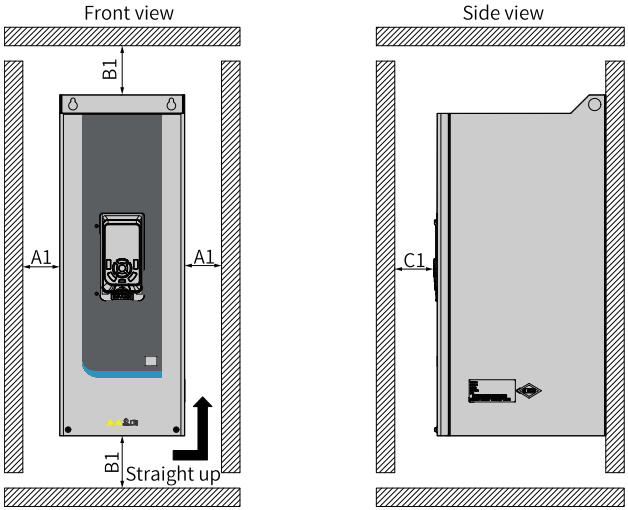


Figure 2-1 Clearance for installation of one AC drive (S4 to S9 models)

Table 2–2 Installation clearance

Power Rating	Clearance (mm)		
5.5 kW to 22 kW	A1 ⩾ 10	B1 ⩾ 160	C1 ⩾ 40
30 kW to 45 kW	A1 ⩾ 50	B1 ⩾ 200	C1 ⩾ 40
55 kW to 110 kW	A1 ⩾ 50	B1 ⩾ 300	C1 ⩾ 40
132 kW to 250 kW	A1 ⩾ 50	B1 ⩾ 400	C1 ⩾ 40

- Installing multiple AC drives side by side
  The AC drive dissipates heat upward. When multiple AC drives are required to work together, install them side by side. Keep their tops level with each other, especially for those of different sizes.

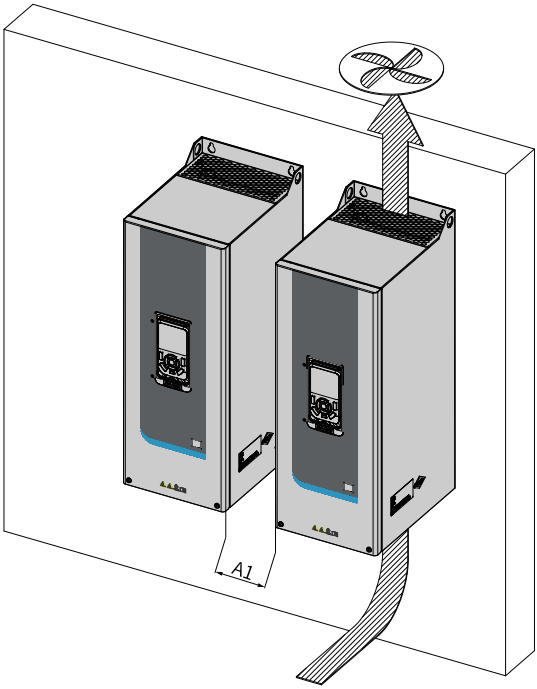


Figure 2-2 Installing multiple AC drives (S4 to S9 models) side by side

Table 2–3 Installation clearance

Power Rating	Clearance (mm)
5.5 kW to 22 kW	A1 ⩾ 10
30 kW to 45 kW	A1 ⩾ 50
55 kW to 110 kW	A1 ⩾ 50
132 kW to 250 kW	A1 ⩾ 50

- Installing multiple AC drives one above another
  If one AC drive needs to be installed above another, install an air guide plate to prevent heat dissipated by the lower AC drive from causing temperature rise of the upper AC drive and thereby overheating or overload faults. For details, see *"Figure 2–3 " on page 17* .

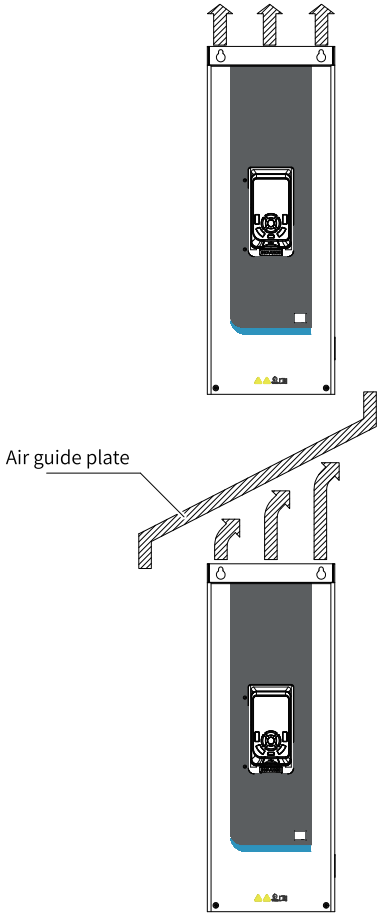


Figure 2-3 Requirements for installing one AC drive above another (S4 to S9 models)

2.3.1 In-Cabinet Clearance

For S4 to S9 models, multi-layer installation is recommended. That is, install one AC drive above another. The following table lists the minimum clearance between the upper and lower AC drives. Install an air guide plate above each AC drive except for the top one.

Table 2–4 Minimum clearance for multi-layer installation

Item	S4	S5	S6 and S7	S8 and S9
L1	⩾ 100 mm	⩾ 200 mm	⩾ 300 mm	⩾ 300 mm
L2	⩾ 100 mm	⩾ 200 mm	⩾ 300 mm	⩾ 300 mm

Item	S4	S5	S6 and S7	S8 and S9
L3	⩾ 100 mm	⩾ 200 mm	⩾ 300 mm	⩾ 300 mm
L4	⩾ 100 mm	⩾ 200 mm	⩾ 300 mm	⩾ 300 mm

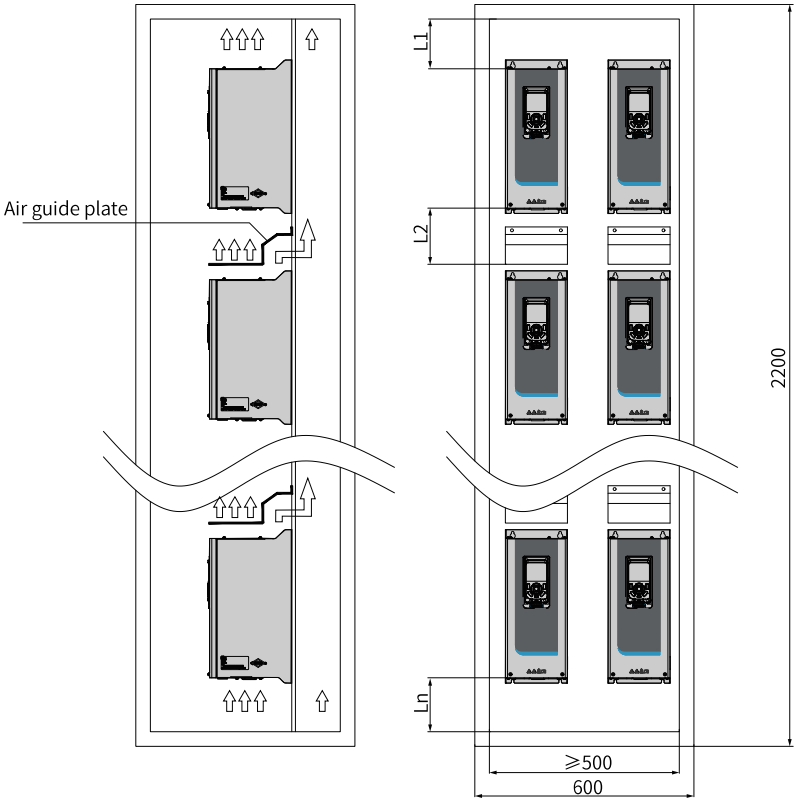


Figure 2-4 Minimum clearance for multi-layer installation

Note

- Install the fan in the correct air exhaust direction to ensure that air flows from inside to outside of the cabinet. Otherwise, hot air cannot be exhausted and the drive may be overheated or damaged.
- Ensure that the distance between the top cover of the air outlet and the fan outlet is at least 200 mm. Otherwise, the fan cooling performance may deteriorate.

2.3.2 Heat Dissipation Requirements

Air Inlet

The cabinet is forcibly cooled by a built-in fan. Therefore, to ensure that enough cooling air enters the cabinet, open an air inlet large enough on the cabinet door.

The air flows from bottom to top after being heated. Therefore, the cabinet air inlet must be at least 50 mm lower than the air inlet of the drive, as shown in the following figure.

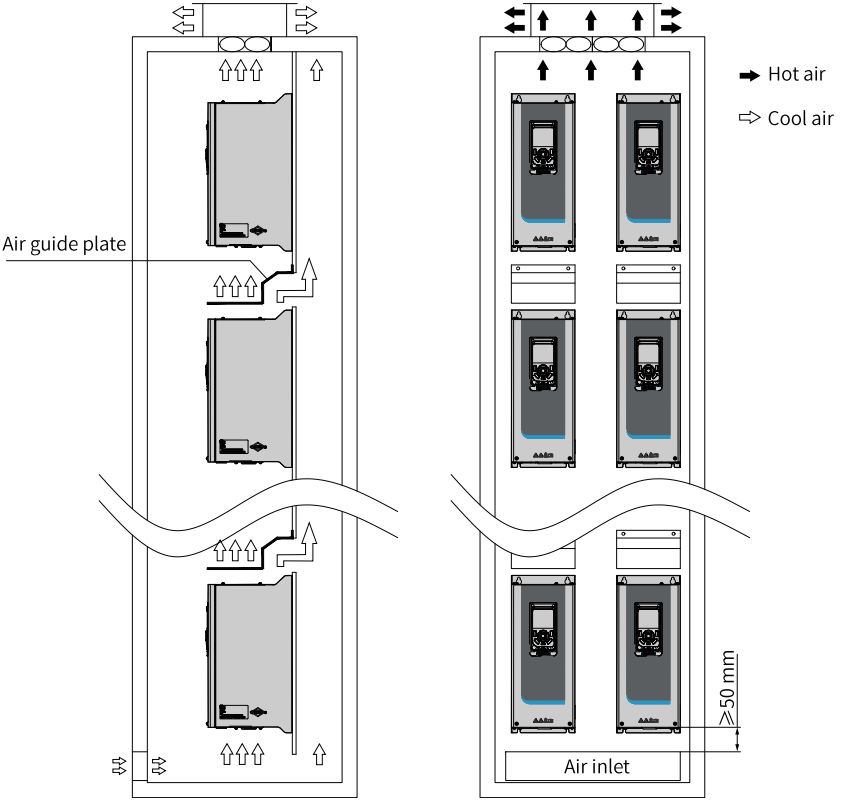


Figure 2-5 Position of the cabinet air inlet

Caution

Where multiple AC drives are installed in one cabinet, if air is blown into the air inlet with a fan from the outside, air distribution of the drives in the cabinet will be affected, thereby affecting the overall heat dissipation effect. Therefore, do not install the fan at the cabinet air inlet to blow air into the cabinet.

The effective ventilation area of the cabinet air inlet is calculated as follows: $S = (1.5 \text{ to } 2.0) \times (S_{AC\ drive\ 1} + S_{AC\ drive\ 2} + S_{AC\ drive\ 3} + \ldots + S_{AC\ drive\ N})$.

- S indicates the effective ventilation area of the cabinet air inlet.
- $S_{AC\ drive}$ indicates the effective ventilation area of an AC drive (unit: cm^2).
- The effective ventilation area of the cabinet air inlet is the actual through-hole area of an opening. The effective ventilation area is equal to the opening area multiplied by the opening rate.

Table 2–5 Effective ventilation area of the AC drives

AC Drive Model	Effective Ventilation Area of AC Drive (unit: cm^2)
S4 (5.5 kW to 22 kW)	57
S5 (30 kW to 45 kW)	51
S6 and S7 (55 kW to 110 kW)	101
S8 and S9 (132 kW to 250 kW)	355

Top Air Outlet

To ensure sufficient heat dissipation of the AC drive, hot air in the cabinet must be exhausted to the outside. You can adopt natural air cooling or forced air cooling in cabinet design.

- Natural air cooling
  - The air flows from bottom to top after being heated. In this mode, heat discharged by the AC drive is exhausted to outside from the air outlet at the top of the cabinet.
  - This might cause hot air to accumulate at the top of the cabinet, thereby raising the air pressure. In addition, the air pressure at the cabinet air inlet becomes low due to suction of the fan for the AC drive. In this case, there is an air pressure difference between the air outlet and air inlet inside the cabinet, which causes an air flow. This air flow forces hot air at the air outlet to flow towards the air inlet and be sucked into the AC drive again, causing the

temperature of the AC drive to rise significantly, which is detrimental to the performance of the AC drive.

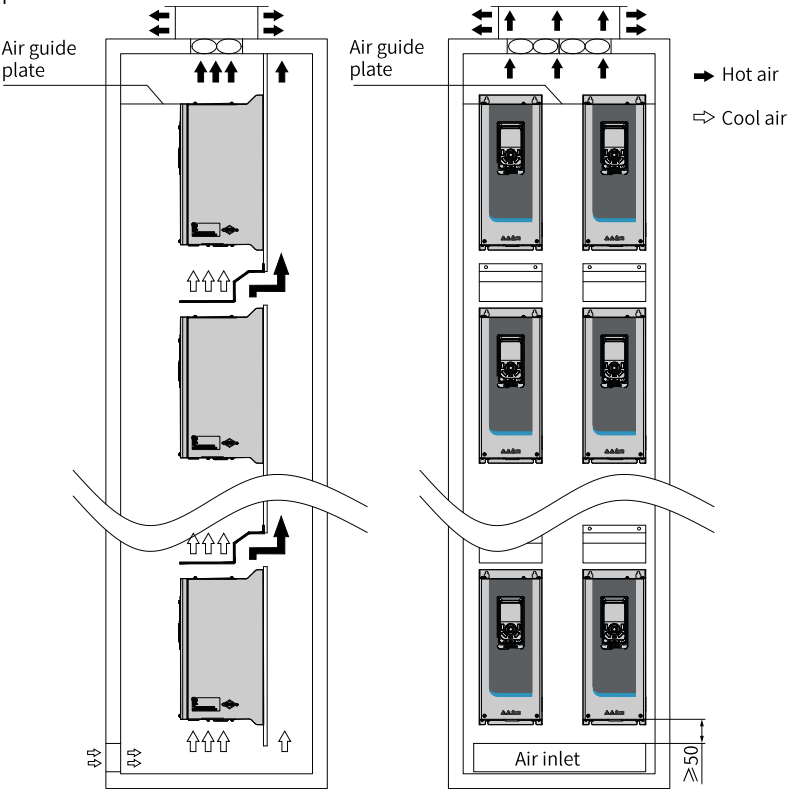


Figure 2-6 Backflow of hot air in a self-ventilated cabinet (without isolation devices)

- Therefore, isolation devices are required in the cabinet working in natural air cooling mode to prevent backflow, as shown in the following figure. An isolation device can be a plate or an exhaust duct.

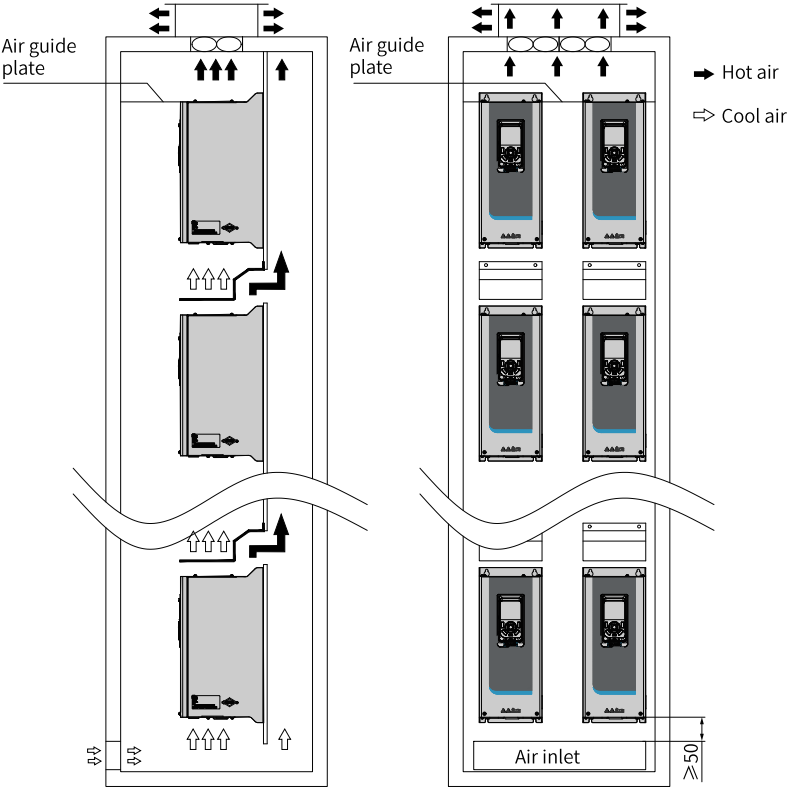


Figure 2-7 Backflow of hot air in a self-ventilated cabinet (with isolation devices)

Compared with air at the air inlet, air at the air outlet of the AC drive is higher in temperature but lower in density. To ensure that hot air in the cabinet can be exhausted to outside, the effective ventilation area (S) of the cabinet air outlet must be 1.2 to 1.5 times the effective ventilation area of the cabinet air inlet when natural air cooling is used.

- Forced air cooling
  - In forced air cooling mode, a fan is installed on the top of the cabinet to draw hot air out of the cabinet. This is a commonly used ventilation mode.
  - To ensure that the hot air can be discharged out of the cabinet, the total air volume of the fan cannot be smaller than that of all AC drives in the cabinet. The following table lists the cooling air volume required by the AC drive.

Table 2–6 AC drive cooling air volume

AC Drive Model	Cooling Air Volume (CFM)
S4 (5.5 kW to 22 kW)	55
S5 (30 kW to 45 kW)	110
S6 and S7 (55 kW to 110 kW)	142
S8 and S9 (132 kW to 250 kW)	406

Cabinet Fan Installation

To select a cabinet fan, do as follows:

1. Calculate the sum of the cooling air volume required by all AC drives based on *"Table 2–6 AC drive cooling air volume" on page 23*.
2. Determine the maximum air volume (Q_{max}) of the cabinet fans.
3. Determine the specifications and quantity of fans according to the maximum air volume (Q_{max}).

Note

- The maximum air volume of the cabinet is 1.3 to 1.5 times the sum of the cooling air volume.
- The maximum air volume of the cabinet is 1.6 to 2.2 times the sum of the cooling air volume if mesh filters, shutters, or other components are installed at the cabinet air outlet.
- The air volume of the selected fan cannot be smaller than the maximum air volume Q_{max}. If a single fan cannot meet this requirement, you can use multiple fans installed side by side.

"Figure 2–8 Q_{max} of a system fan" on page 24 shows typical specifications of the fan air volume.

Curve SN	Air Volume	Maximum Air Volume	Nominal Voltage	Frequency	Noise	Sound Power	Input Power	Speed	Temperature	Service Life<1>	Service Life<2>
	m^3/h	CFM	V	Hz	dB (A)	Bel (A)	W	r/min	°C	h	h
①	380	223.6	115	60	56	6.8	27.0	3350	–25 to +55	60000	32000
②	320	188.3	230	50	51	6.4	28.0	3350	–25 to +65	55000	18000

Note

- <1>: This service life is obtained based on the working environment of 40°C.
- <2>: This service life is obtained based on the maximum operating temperature.

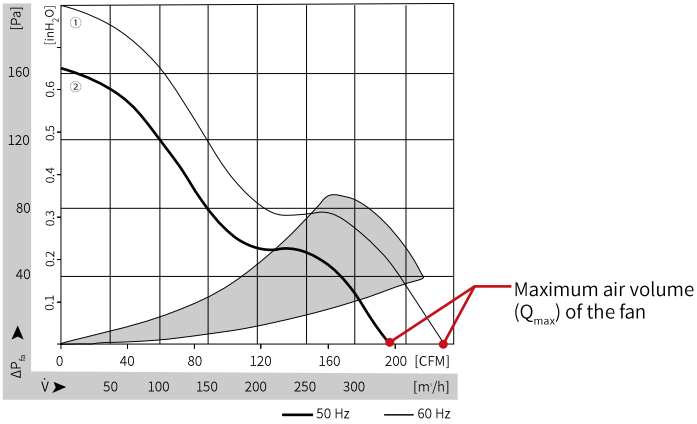


Figure 2-8 Q_{max} of a system fan

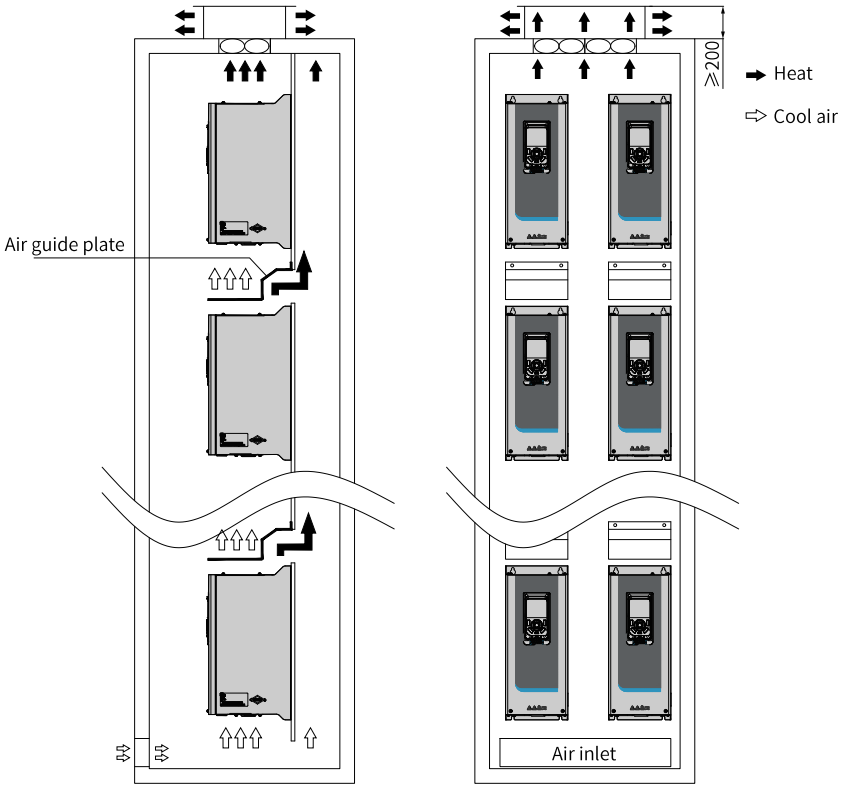


Figure 2-9 Cabinet ventilation system

Note

- Install the fan in the correct air exhaust direction to ensure that air flows from inside to outside of the cabinet. Otherwise, hot air cannot be exhausted and the drive may be overheated or damaged.
- Ensure that the distance between the top cover of the air outlet and the fan outlet is at least 200 mm, as shown in *"Figure 2–9 Cabinet ventilation system" on page 25*. Otherwise, the fan cooling performance may deteriorate.

2.4 Tools

2.4.1 Tools for Mechanical Installation

The following table lists the tools for mechanical installation.

Table 2–7 Tools for mechanical installation

Tool	Description
Electric drill with an appropriate drilling bits	It is used to drill mounting holes on the mounting surface.
Wrench or socket wrench	It is used to tighten or loosen screws. S4 and S5 models: socket wrench (#10) S6 and S7 models: socket wrench (#10 and #13) S8 and S9 models: socket wrench (#10, #13, #16, and #18)
Phillips and straight (2.5 mm to 6 mm) screwdrivers	They are used to tighten or loosen screws.
Torque wrench	It is used to tighten or loosen screws.
Crowbar	It is used to pry off the cover to facilitate installation.
Crane	It is used to lift the equipment.
Tape measure	It is used to measure the installation dimensions of the equipment.
Gloves	They are used to prevent static electricity.
Screws	They are used to fix the equipment to the mounting surface.
Shield bracket (optional)	It is used to fix the cable shield in occasions where shielded cables are used.

2.4.2 Tools for Wiring

For wiring of main circuit terminals, use appropriate installation tools based on terminal dimensions to secure the joints well. The following table lists the tools for wiring of main circuit terminals.

Structure	Recommended Fastener	Tool
S4	M4 SEMS screw	Phillips screwdriver (#3 slot)
S5	M6 SEMS screw	Phillips screwdriver (#3 slot)
S6 and S7	M8 nut, spring washer, and flat washer	Socket wrench (#13 socket)
S8 and S9	M12 nut, spring washer, and flat washer	Socket wrench (#19 socket), socket, and extension rod (150 mm)

2.5 Options

2.5.1 Ground Bracket of Cable Shield

The ground bracket of the cable shield is optional and needs to be purchased separately.

2.6 Cable Preparation

2.6.1 Cables

Table 2–8 Recommended cables and lugs for the main circuit

Structure	Model MD580-01S-XXXX	Rated Input Current (A)	RST/UVW		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Cable (mm^2)<1>	Cable Lug	Cable (mm^2)<1>	Cable Lug		
S4	07A4-7-B(-LCD)	7.4	3 x 1	RNBS1.25-4	1	RNBS1.25-4	M4	5.6 (49.6)
	09A9-7-B-(-LCD)	11	3 x 1.5	RNBS1.25-4	1.5	RNBS1.25-4	M4	5.6 (49.6)
	14A3-7-B(-LCD)	16	3 x 2.5	RNB3.5-4	2.5	RNB3.5-4	M4	5.6 (49.6)
	0019-7-B(-LCD)	21	3 x 2.5	RNB3.5-4	2.5	RNB3.5-4	M4	5.6 (49.6)
	0023-7-B(-LCD)	26	3 x 2.5	RNB3.5-4	2.5	RNB3.5-4	M4	5.6 (49.6)
	0027-7-B(-LCD)	30	3 x 4	RNB3.5-4	4	RNB3.5-4	M4	5.6 (49.6)
S5	0035-7(-LCD)	39	3 x 4	RNB5.5-6	4	RNB5.5-6	M6	2.59 (22)
	0042-7(-LCD)	47	3 x 6	RNB5.5-6	6	RNB5.5-6	M6	2.59 (22)
	0049-7(-LCD)	55	3 x 10	Yuanli-GTNR10-6	10	Yuanli-GTNR10-6	M6	2.59 (22)
S6	0061-7(-LCD)	68	3 x 10	RNB8-8	10	RNB8-8	M8	13.53 (115)
	0084-7(-LCD)	94	3 x 25	RNB22-8	25	RNB22-8	M8	13.53 (115)
S7	0098-7(-LCD)	110	3 x 25	RNB22-8	25	RNB22-8	M8	13.53 (115)
	0119-7(-LCD)	134	3 x 35	RNBS38-8	35	RNBS38-8	M8	13.53 (115)
S8	0142-7(-LCD)	159	3 x 50	RNB60-12	50	RNB60-12	M12	36.4 (310)
	0174-7(-LCD)	195	3 x 70	RNB60-12	70	RNB60-12	M12	36.4 (310)
S9	0210-7(-LCD)	236	3 x 95	RNB70-12	95	RNB70-12	M12	36.4 (310)
	0271-7(-LCD)	304	3 x 120	Yuanli-GTNR120-12	120	Yuanli-GTNR120-12	M12	36.4 (310)

Note

- Cables in the preceding table conform to standards in China.
- <1>: 3 x 10 indicates a 3-core cable with the cross-sectional area of 10 square millimeters. The recommended lugs include the RNB and RNBS series of Kise as well as the GTNR series of Yuanli.

3 Unpacking and Transportation

3.1 Unpacking

3.1.1 Precautions

Caution

If the equipment is damaged during transportation, its electrical safety can no longer be ensured. Do not connect the equipment before a thorough high-voltage test is performed.

- When receiving goods from the shipping company, you must check the goods against the delivery note. Notify the shipping company immediately of any missing components or damage. Seek support from the Inovance office or your local agent if necessary.
- The equipment volume, weight, packaging method, and packaging components vary with the model and size of the AC drive.

3.1.2 Unpacking Procedures

S4 Models

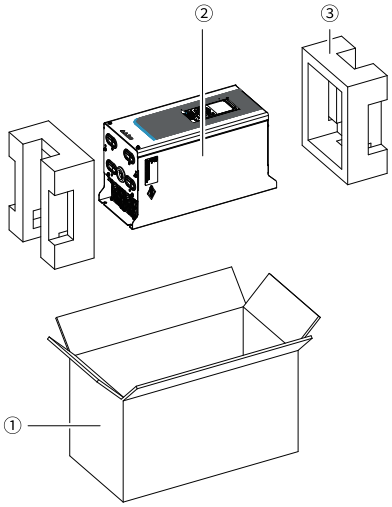


Figure 3-1 Packing list of S4 models

No.	Name
①	Carton
②	AC drive (with plastic protective film)
③	Expanded polyethylene (EPE)

1. Remove the sealing tape and open the carton .
2. Take out the accessories of the AC drive.
3. Take out the AC drive together with the EPE.
4. Check the AC drive for any damage.
5. Dispose of or recycle packaging according to local regulations.

S5 Models

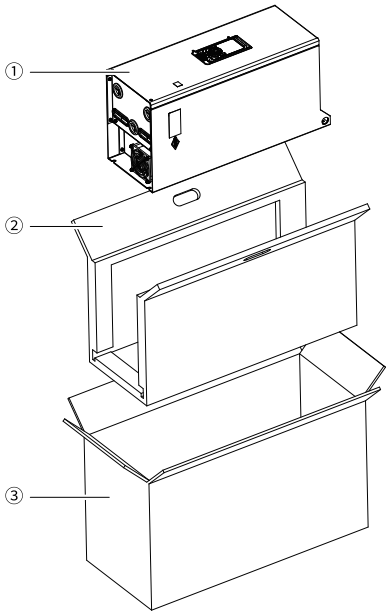


Figure 3-2 Packing list of S5 models

No.	Name
①	AC drive (with plastic protective film)
②	EPE
③	Carton

1. Remove the sealing tape and open the carton.
2. Take out the accessories of the AC drive.
3. Take out the AC drive together with the EPE.
4. Check the AC drive for any damage.

5. Dispose of or recycle packaging according to local regulations.

S6 to S9 Models

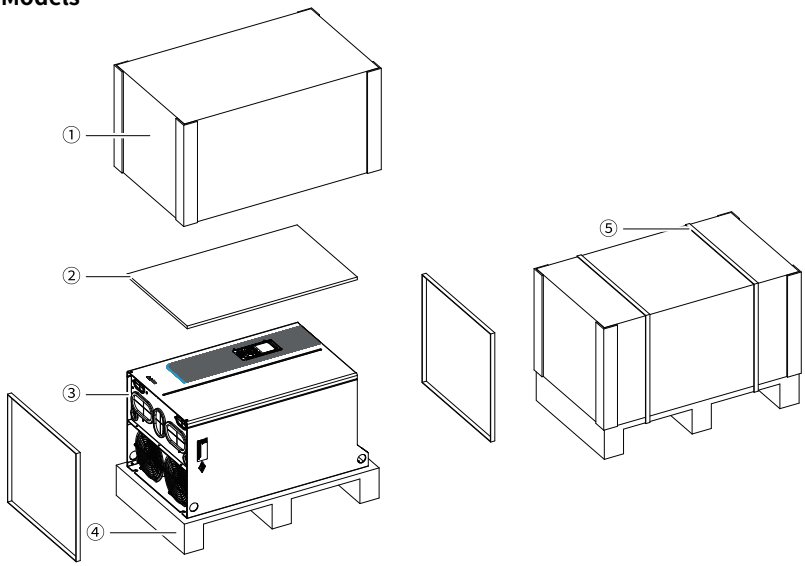


Figure 3-3 Packing list of S6 to S9 models

No.	Name
①	Carton cover
②	EPE
③	AC drive (with plastic protective film)
④	Pallet
⑤	Strapping band

1. Remove the strapping band and uncover the carton cover.
2. Remove all filler materials.
3. Take out the AC drive and accessories.
4. Cut the plastic film covering the AC drive.
5. Check the AC drive for any damage.
6. Dispose of or recycle packaging according to local regulations.

3.1.3 Check upon Unpacking

Check against the following checklist upon unpacking.

Table 3–1 Unpacking checklist

☑	No.	Check That
☐	1	The exterior of the product is not damaged, scratched, or concaved.
☐	2	No ordered option is missing.
☐	3	The nameplate matches the purchased product model.
☐	4	The warning labels are not damaged, scratched, or blurred.

Pack the equipment for later storage or installation.

3.2 Precautions for Storage

Caution

- Store the AC drive in a clean and dry room, with temperatures between –25°C and +70°C and temperature variations smaller than 1°C/min.
- For long-term storage, cover the AC drive or take other appropriate measures to protect it against contamination and environmental influences.
- Store the AC drive with the original packing carton of Inovance.
- Do not expose the AC drive to an environment with moisture, high temperature, or direct sunlight for a long time.
- Switch on the AC drive once every six months for at least five hours to prevent the electrolytic capacitor from deteriorating after long-term storage. Increase the input voltage slowly to the rated value by using a voltage regulator. You can also contact Inovance for technical support.

3.3 Transportation

3.3.1 Precautions

Caution

- S4 models are small and light and therefore can be handled without using specialized equipment.
- S5 to S9 models must be handled with appropriate lifting tools.
- Comply with local regulations when handling this AC drive.
- To prevent personal injuries, do not handle the AC drive by holding its upper cover or outer cover, and make sure that all screws are fastened before handling. Loose screws may cause the AC drive body to fall off, resulting in personal injuries.
- The AC drive is originally lying flat. Put it upright before lifting and handling.
- Ensure that the load capacity of the crane for transportation is larger than the weight of the equipment.
- Ensure that the upper cover, terminals, and other components of the AC drive are secured firmly with screws before vertical lifting. Failure to comply may result in personal injuries due to fall-off of the equipment.
- When lifting the AC drive with a lifting rope, do not subject the AC drive to excessive vibration or impact. Failure to comply may result in personal injuries due to fall-off of the equipment.
- When lifting the AC drive with a lifting rope, do not overturn the AC drive or keep it suspended for a long time. Failure to comply may result in personal injuries due to fall-off of the equipment.

3.3.2 Transportation Before Unpacking

- Secure the AC drive to a wooden pallet when it is transported with a forklift. Secure the AC drive to a wooden pallet and lift the AC drive and pallet together when a crane is used for transportation. For details, see the following figure.

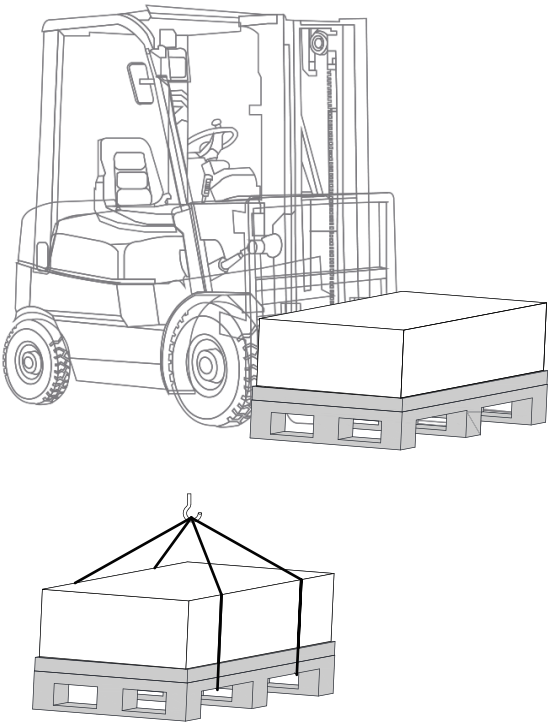


Figure 3-4 Transportation before unpacking

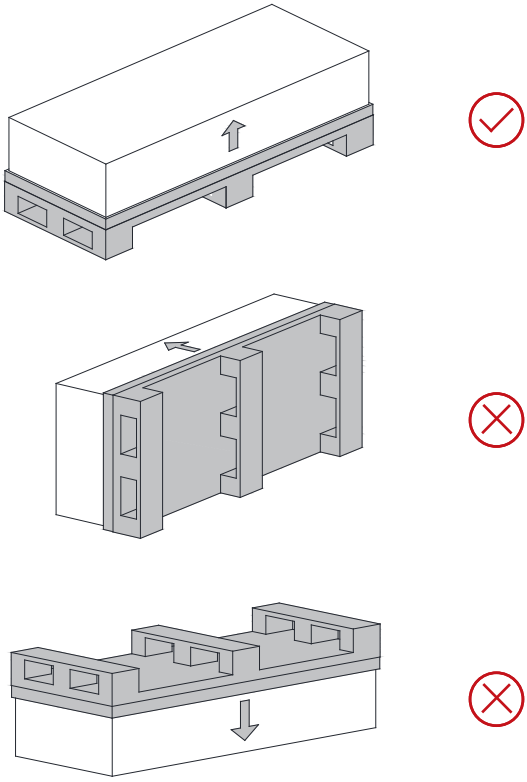


Figure 3-5 Transportation method

3.3.3 Transportation After Unpacking

AC Drive Weight	Personnel Required for Handling
< 15 kg	1
⩾ 15 kg	2, with proper lifting device

Perform the following steps when a crane is used for transportation:

1. Hook the lifting rope onto the two auxiliary lifting eyes on the top of the AC drive. It is recommended that the lifting angle be greater than 45 degrees and the height be 0.3 m or lower.
2. Slowly tighten the lifting rope by using the crane to lift the equipment.
3. Slowly put down the AC drive, pause at a certain height, and then slowly put it on the ground or installation surface. Then you can install the equipment to the control cabinet.

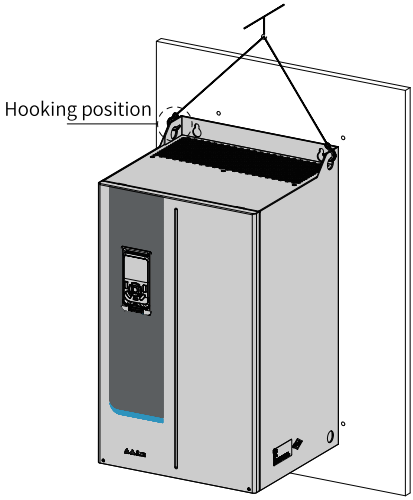


Figure 3-6 Lifting the AC drive

Caution

If the AC drive is placed vertically, do not stress on any side of the AC drive or place it on an inclined surface. The AC drive is large and heavy (nearly 70 kg). If the inclination exceeds 5°, it may topple.

4 Mechanical Installation

4.1 Safety Cautions

- Reserve sufficient clearance for heat dissipation of the AC drive and other devices in the same cabinet.
- Cover the top of the AC drive with a piece of cloth or paper during installation to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment. Failure to comply may cause malfunction of the AC drive. After installation, remove the cloth or paper to prevent overheating caused by poor ventilation.
- Tighten all screws with the specified tightening torque. Failure to comply may result in an electric shock or fire.
- Keep combustible and explosive materials away from the AC drive.

4.2 Installation Method

S4 to S9 models support backplate mounting.

4.3 Inspection Before Installation

- Check whether the installation environment meets the requirements. For details, see *"2.2 Installation Environment" on page 14*.
- Check whether the site meets the installation requirements. For details, see *" Installation Clearance" on page 15*.
- Install the AC drive vertically upward only, as shown in the following figure. Do not lie down the AC drive horizontally or by its side, or install it in the upside-down direction.

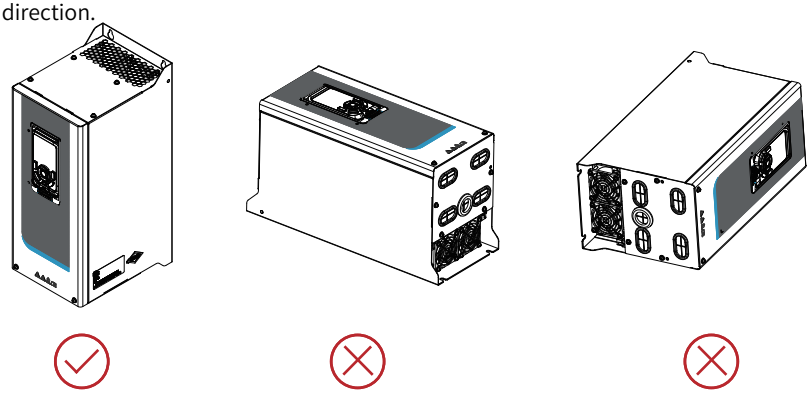


Figure 4-1 Installation direction

4.4 Backplate Mounting

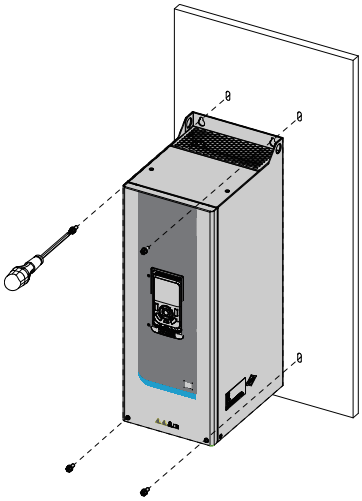


Figure 4-2 Backplate mounting of S4 and S5 models

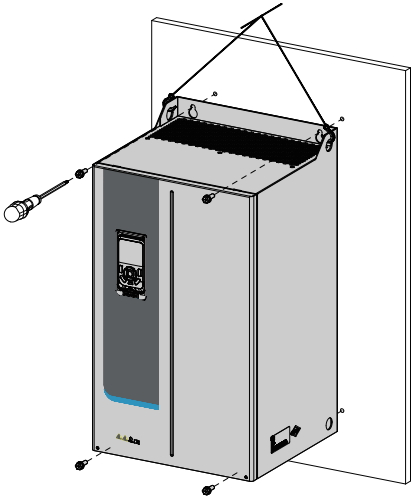


Figure 4-3 Backplate mounting of S6 to S9 models

4.5 Removing and Installing the Cover

Removing the Cover

When wiring the control circuit, remove the cover first if a PG card, function expansion card, or explosion-proof card needs to be connected.

Caution

When removing the cover, hold the cover with both hands and carefully lift the lower part of the cover to prevent it from falling off. Failure to comply may result in equipment damage or personal injuries.

Before removing the cover, ensure that the AC drive is the power-off state for over 10 minutes.

The following figure shows the positions of the control board and expansion cards on the AC drive after the cover is removed.

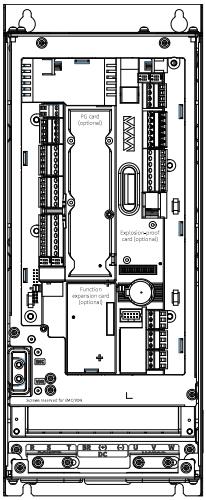
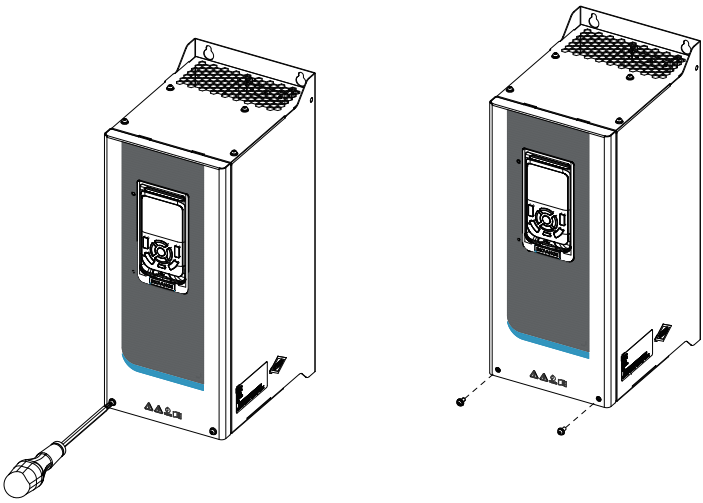


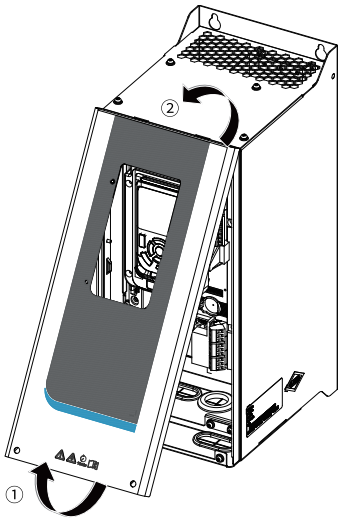
Figure 4-4 Control board position

The following section takes the S4 to S7 models as an example to illustrate how to remove the cover.

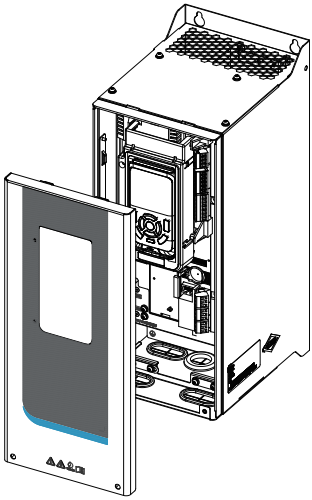
1. Unscrew the two fixing screws of the cover with a screwdriver.



2. Hold the cover with both hands, lift the lower part of the cover (as shown in ①), push the cover upward, and lift the upper part of the cover (as shown in ②).



3. Remove the cover, as shown in the following figure.



Installing the Cover

To install the cover, follow the steps in the reverse order of removing the cover.

4.6 Installing the Ground Bracket of the Cable Shield

Use shielded cables as motor output cables. Use a ground bracket of the cable shield to achieve all-round connection with the shield, and crimp the drain wire of the shield to the PE terminal. The following figure shows the installation of the shield ground bracket for S8 and S9 models. The installation is similar for other models.

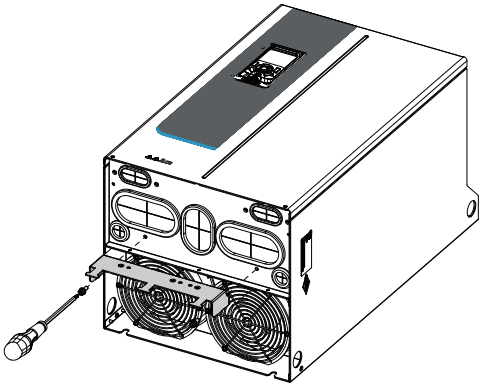


Figure 4-5 Installation of the shield bracket

The following figure shows wiring of the shield.

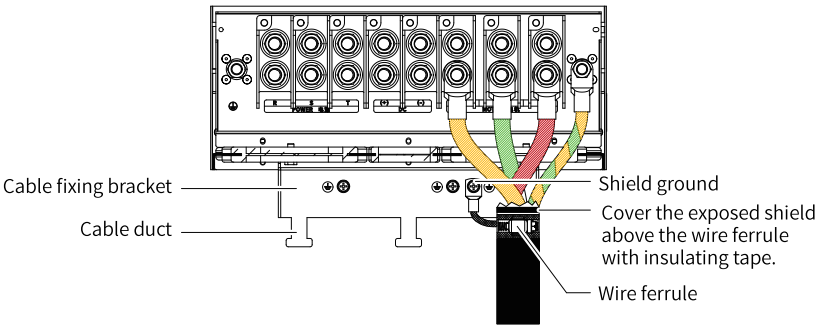


Figure 4-6 Wiring of the shield

4.7 Installing the MDKE-10 Bracket

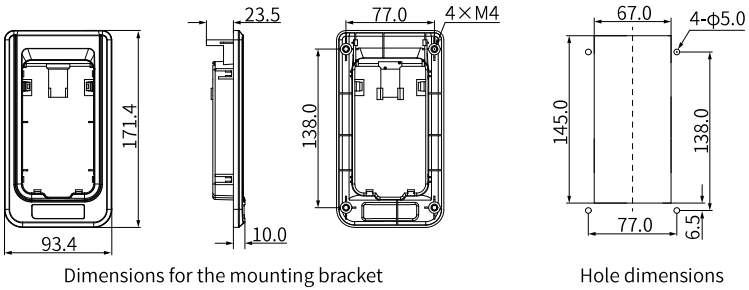


Figure 4-7 Bracket dimensions and mounting hole sizes (mm) of the MDKE-10

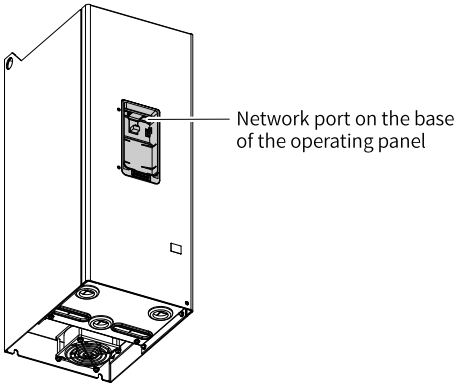
Note

No bolts are required if the door is 1.5 mm in thickness.

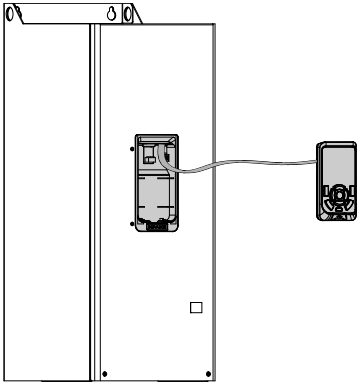
When the AC drive is installed inside a cabinet, you can remove the operating panel from the AC drive and make it a hand-held panel by connecting an external network cable to facilitate on-site operation.

Procedure for Connecting an External Operating Panel

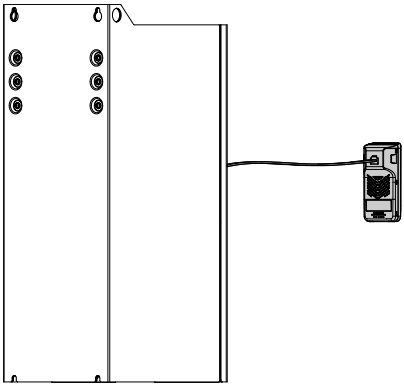
1. Remove the operating panel from the AC drive. The network interface is exposed, as shown in the following figure.



2. Connect one end of a network cable to the network port on the base bracket of the operating panel, as shown in the following figure.



3. Connect the other end of the network cable to the hand-held operating panel, as shown in the following figure.



4.8 Installing the SOP-20-880 Bracket

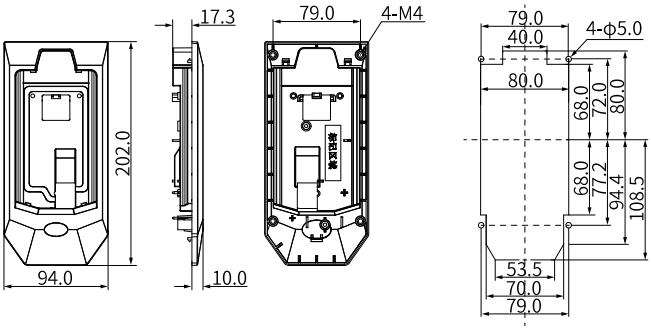
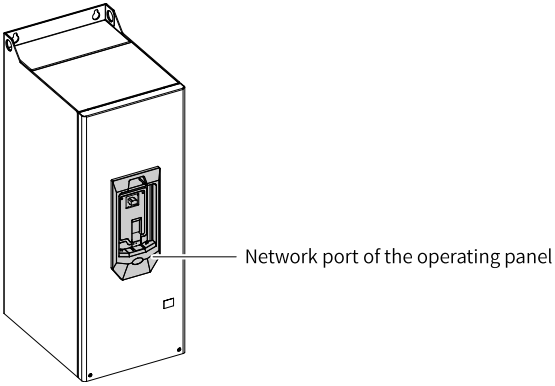


Figure 4-8 Bracket dimensions and mounting hole sizes (mm) of the SOP-20-880

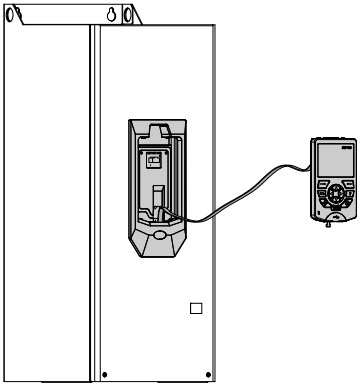
When the AC drive is installed inside a cabinet, you can remove the operating panel from the AC drive and make it a hand-held panel by connecting an external network cable to facilitate on-site operation.

Procedure for Connecting an External Operating Panel

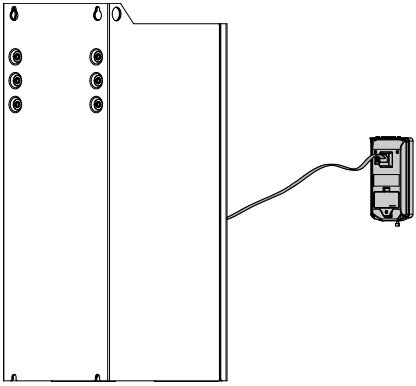
1. Remove the operating panel from the AC drive. The network interface is exposed, as shown in the following figure.



2. Connect one end of a network cable to the network port on the base bracket of the operating panel, as shown in the following figure.



3. Connect the other end of the network cable to the hand-held operating panel, as shown in the following figure.



4.9 Installing the Expansion Card

The AC drive is equipped with five field bus cards, including Modbus RTU, PROFIBUS DP, CANopen, PROFINET IO, and Modbus TCP cards, two PG cards, and one explosion-proof card. The installation positions are shown in the following figure. Before installing the expansion cards, remove the front cover of the AC drive.

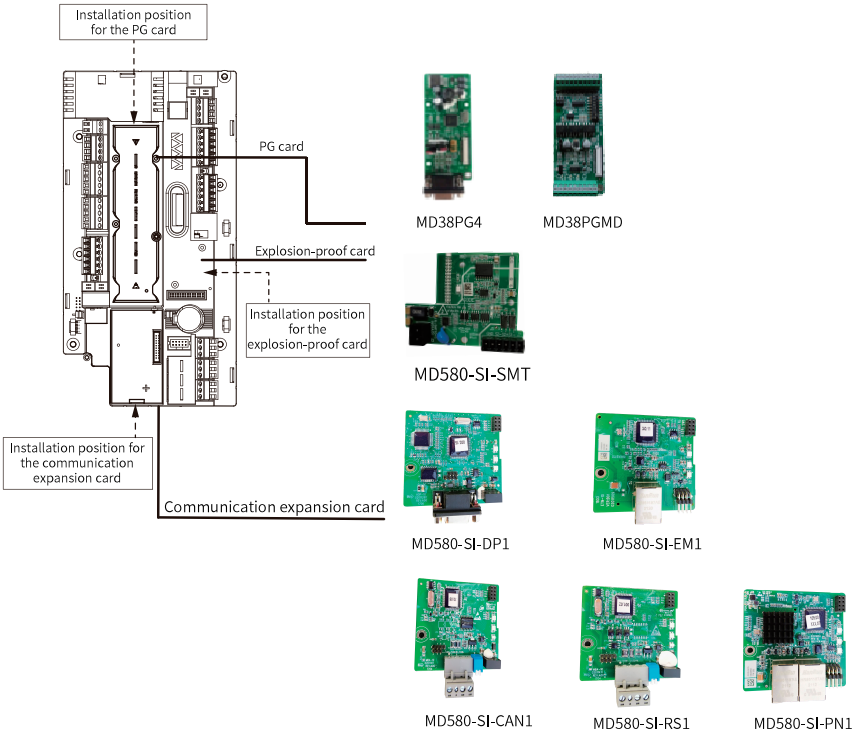


Figure 4-9 Installation position of expansion cards

4.10 Inspection After Installation

☑	No.	Check That
☐	1	The installation clearance meets requirements listed in *" Installation Clearance" on page 15*.
☐	2	The heat dissipation clearance meets requirements listed in *"2.3.2 Heat Dissipation Requirements" on page 19*.
☐	3	The cabinet fans meet requirements listed in *"2.3.2 Heat Dissipation Requirements" on page 19* if the AC drive is installed in a cabinet.
☐	4	The AC drive adopts the vertical backplate mounting mode.
☐	5	The fixing screws are tightened.

5 Electrical Installation

5.1 Safety Precautions

- All connection work must be carried out when the equipment is de-energized.
- Only qualified professionals are allowed to operate the equipment.
- Take caution when operating the equipment disconnected from the power supply, because external power supply voltage may still exist. The power and control terminals may be live even when the equipment is stopped.
- Before switching on the equipment, ensure that the voltage is lower than 36 VDC.
- Ensure that the AC drive and other components are installed and connected in accordance with the recognized technical rules of the country and the region. Pay special attention to cable dimensions, fuses, grounding, shutdown, disconnection, and overcurrent protection.
- If a safety device trips in a branch circuit, the current may have been disconnected. To reduce the risk of fire or an electric shock, check the conductive parts and other components and replace the damaged parts. If the safety device trips in a branch circuit, identify the cause of the trip and rectify the problem.

5.2 Inspection Before Wiring

- Never wire the AC drive when the power is on. Keep all circuit breakers in the OFF state during wiring. Failure to comply may result in an electric shock.
- Before operation, cut off the input and output power, and wait at least 10 minutes until the power indicator is off.
- Ensure that the motors, cabinets, and other components are installed and connected in accordance with the recognized technical rules of the country and the region. Pay special attention to provisions on cable dimensions, safety device, grounding, disconnection, isolation, and over-current protection.
- Conduct all connection work when the cabinet is de-energized because cabinet equipment is operated under high voltages.
- Take caution when operating the equipment disconnected from power supply, as there may still be external supply voltage. The main circuit and control circuit terminals may be live even when the motor is not running.

5.3 Main Circuit Wiring

5.3.1 Main Circuit Terminals

Table 5–1 Main circuit terminals

Symbol	Terminal Name	Function
R, S, T	Three-phase power input terminals	Connected to a three-phase AC input power supply
(+), (–)	DC bus positive and negative terminals	Connected to the common DC bus
(+), BR	Braking resistor connection terminals	Connected to the braking resistor
U, V, W	Output terminals	Connected to a three-phase motor
⏚	Grounding (PE) terminal	Connected to ground

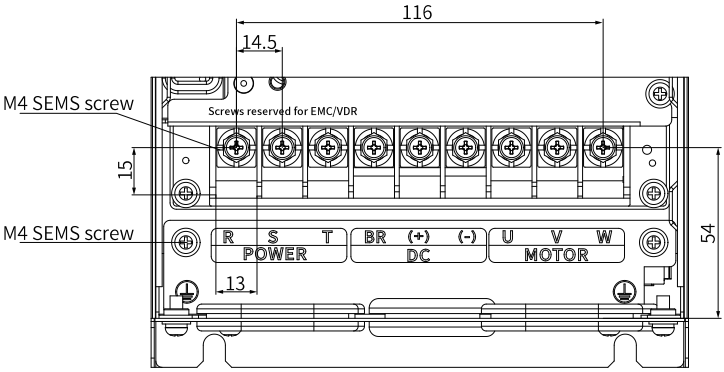


Figure 5-1 Layout of main circuit terminals of S4 models (mm)

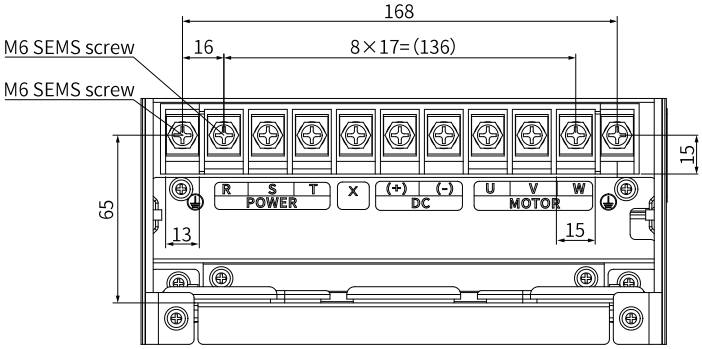


Figure 5-2 Layout of main circuit terminals of S5 models (mm)

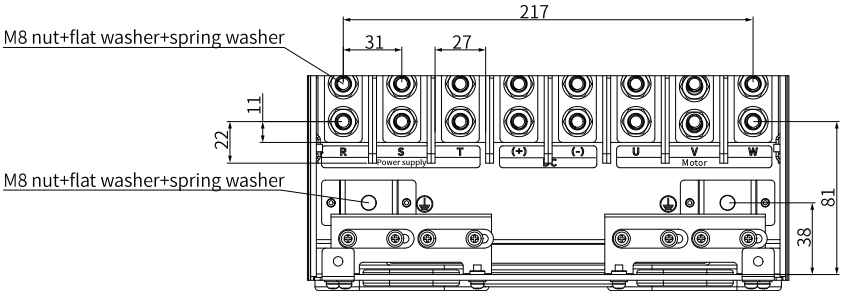


Figure 5-3 Layout of main circuit terminals of S6 and S7 models (mm)

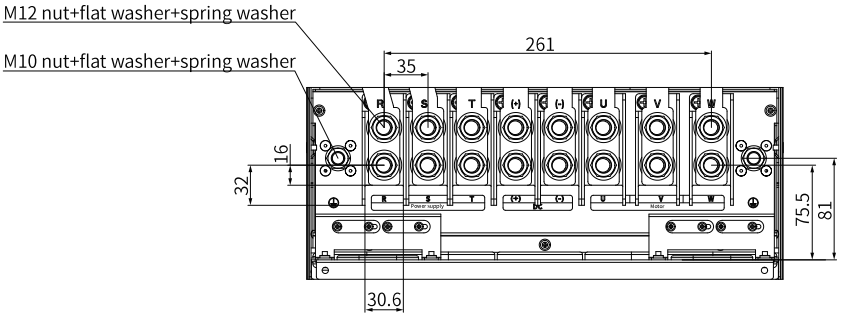


Figure 5-4 Layout of main circuit terminals of S8 and S9 models (mm)

5.3.2 Wiring of Main Circuit Terminals

R, S, and T terminals of the input power supply

- The cable connection on the input side of the drive has no requirements on the phase sequence.

- Specifications and installation of external main circuit cables must comply with local regulations and related IEC requirements.
- Use copper lead cables with appropriate dimensions according to the recommended main circuit cables.

DC bus terminals (+) and (-)

- After the drive is switched off, DC bus terminals (+) and (-) have residual voltage. Wait at least 10 minutes before operating the drive. Failure to comply will result in electric shock.
- When wiring an external braking component, ensure that terminals (+) and (-) are connected correctly. Failure to comply will result in damage to the drive and braking components or even fire.
- The cable length of the braking unit cannot be longer than 10 m. Use the twisted pair cables or closely-paired cables for parallel connection.
- Do not connect the braking resistor directly to the DC bus. Failure to comply may result in damage to the drive or even fire.

U, V, and W terminals on the output side

- Specifications and installation of external main circuit cables must comply with local regulations and related IEC requirements.
- Use copper lead cables with appropriate dimensions.
- Avoid connecting a capacitor or surge protection device on the output side. Failure to comply will result in frequent triggering of the protection mechanism or even damage to the AC drive.
- An excessively long motor cable may result in electrical resonance due to the distributed capacitance. The electrical resonance may lead to damage to motor insulation or high leakage current, triggering the overcurrent protection mechanism of the AC drive. When using a motor cable longer than 100 m, install an AC output reactor close to the AC drive.

To prevent animals such as rats, insects, and ants from entering the cabinet and damaging the devices in the cabinet, seal the cable inlet and outlet with fireproof mud after connecting the main power terminal and ground terminal.

5.3.3 Requirements on Wiring of the Main Circuit

Main circuit wiring requirements

- Terminals BR, (-), and (+) are used to connect options. Do not connect the terminals to the AC power supply.
- To protect the main circuit, separate and cover the surface that may come into contact with the main circuit.
- The control circuit is the internal safety extra-low voltage (SELV) circuit that must be strictly insulated and isolated from other circuits. Make sure that the control circuit is connected to the external SELV circuit.
- Prevent foreign objects from entering the wiring part of the terminal block.
- Avoid soldering when using stranded wires.
- The tightening torque may vary with terminals. Tighten terminal screws with the specified tightening torque. Use screwdrivers, ratchets, or wrenches to tighten screws as required.
- 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 within 5 degrees. Failure to comply may result in screw damage.

Motor cable shield requirements

Use shielded cables for motor output cables. Strip the cable to expose the shield, crimp the shield to the wire ferrule slot of the bracket with the wire ferrule, and crimp the lead wire of the shield to the PE terminal, as shown in *"Figure 4–6 Wiring of the shield" on page 42*.

Keep the shield drain wire of the motor cable as short as possible, and ensure that the the wire diameter is equal to or larger than 1/5 the width.

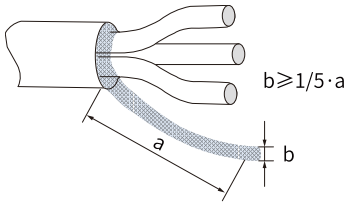


Figure 5-5 Drain wire of the motor cable shield

5.3.4 Protection Requirement

Use the heat-shrinkable tube to wrap the copper tube of the cable lug and the cable conductor completely.

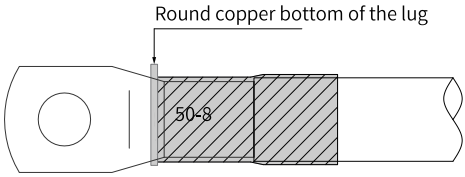


Figure 5-6 Cable with the heat-shrinkable tube

5.4 Wiring of the Control Circuit

5.4.1 Control Circuit Terminals

"Figure 5–7 Layout of control circuit terminals" on page 52 shows the layout of control circuit terminals.

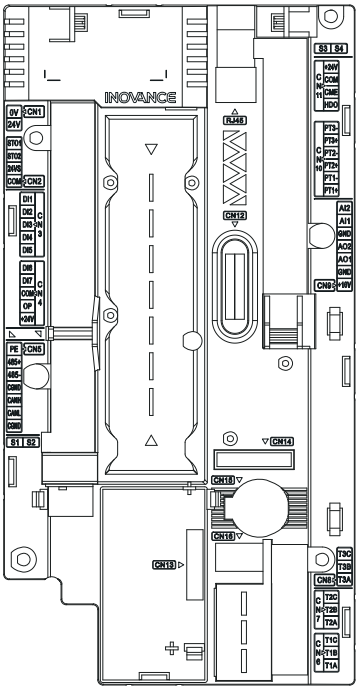


Figure 5-7 Layout of control circuit terminals

Table 5–2 Functions of control circuit terminals

External Terminal	Terminal Type	Terminal Name	Definition	Performance Indicator
CN3	Digital input terminal	DI1-OP	Common multi-function input	• Isolated sinking/sourcing input programmable terminal; input frequency: < 100 Hz • Internally isolated from COM and 24V; short-circuited to +24V by a jumper by default
		DI2-OP		
		DI3-OP		
		DI4-OP		
		DI5-OP		
CN4		DI6-OP		
		DI7-OP	Multi-function high-speed pulse input	Maximum input frequency: 100 kHz; can be used as a common DI
CN11	Digital output terminal	HDO-CME	Programmable pulse frequency output	• Internal emitter connected to COM (can be used as the common programmable open collector terminal that supports 24 VDC/50 mA); maximum output frequency: 100 kHz • Internally isolated from COM and GND; short-circuited to COM by a jumper by default

External Terminal	Terminal Type	Terminal Name	Definition	Performance Indicator
CN9	Analog input terminal	AI1-GND	Single-ended analog input channel AI1	• 0 V to 10 V or 0 mA to 20 mA; 12-bit resolution; correction accuracy: ±0.5%; input impedance in voltage input mode: 22.1 kΩ; input impedance in current input mode: 500 Ω or 250 Ω • Input from the temperature sensor (PT100, PT1000, KTY84, or PTC) supported
		AI2-GND	Single-ended analog input channel AI2	0 V to 10 V or 0 mA to 20 mA; 12-bit resolution; correction accuracy: ±0.5%; input impedance in voltage input mode: 22.1 kΩ; input impedance in current input mode: 500 Ω or 250 Ω
	Analog output terminal	AO1-GND	Single-ended analog output channel AO1	• 0 V to 10 V (default mode) or 0 mA to 20 mA; 12-bit resolution; correction accuracy: ±1%; maximum load current output in voltage mode: 2 mA; load impedance in voltage mode: > 5 kΩ; • load impedance in current mode: < 500 Ω
		AO2-GND	Single-ended analog output channel AO2	
	On-board power supply output terminal	+10V-GND	10 V analog voltage output	• 10 V±10%, maximum current: 10 mA • Internally isolated from COM and CME
		+24V-COM	On-board 24 V power supply to external devices	24 V±10%; no-load ghost voltage: ⩽ 30 V; maximum output current: 200 mA; internally isolated from OP/CME/GND
CN1	External 24 V power supply input terminal	24V-0V	External 24 V power supply input	External 24 V power supply input; maximum input voltage: 30 V; used by the control board; minimum input current: 1 A; internally isolated from COM, CME, and GND

External Terminal	Terminal Type	Terminal Name	Definition	Performance Indicator
CN2	STO terminal	STO1	STO1	• Internal: STO1 and STO2 connected to +24VS by jumper by default • External: STO1, STO2, and +24VS can connect to the external 24 V power supply. For wiring, see descriptions of the STO function.
		STO2	STO2	
		+24VS	Power supply+ for STO1 and STO2	
		COM	Power ground of STO1 and STO2	
CN6	Relay output terminal	TA1/ TB1/ TC1	TA-TB: normally closed (NC) TA-TC: normally open (NO)	Contact capacity: 250 VAC/3 A (COSϕ = 0.4)
CN7		TA2/ TB2/ TC2		
CN8		TA3/ TB3/ TC3		
CN5	RS485 communication terminal	C485+	RS485 positive communication signal	External RS485 communication, standard Modbus RTU
		C485-	RS485 negative communication signal	
		CGND	RS485 communication signal ground	
	CAN communication terminal	CANH	CAN_H signal of CAN communication	Master and slave CAN communication; master and slave synchronization supported
		CANL	CAN_L signal of CAN communication	
		CGND	CAN communication signal ground	
CN12	Operating panel RS485 communication terminal	RS485+	RS485 positive communication signal	RS485 internal bus, used for commissioning by using the LED operating panel, external LCD operating panel, or PC
		RS485-	RS485 negative communication signal	
		GND	RS485 communication signal ground	
CN10	Temperature sensor terminal	PT1+, PT1-	Three-channel temperature sensor input	Common temperature sensors (PT100, PT1000, PTC, and KTY84) supported; temperature display on the operating panel by setting parameters in group F; parameters related to temperature offset correction available in group F
		PT2+, PT2-		
		PT3+, PT3-		

External Terminal	Terminal Type	Terminal Name	Definition	Performance Indicator
-	DIP switch	S1	Board-mounted RS485 communication terminal resistor switch	Connected by default
		S2	CANlink communication terminal resistor switch	Connected by default
		S3	Operating panel RS485 communication resistor switch	Connected by default
		S4	Operating panel CAN communication resistor switch	Connected by default; reserved

Note

- If the ambient temperature exceeds 23°C, the output current decreases by 1.8 mA for every additional 1°C. The maximum output current is 170 mA at 40°C. When OP is short-circuited to 24 V, the current of the DI terminal must also be considered.
- You can select 500 Ω or 250 Ω input impedance based on the maximum output voltage of the signal source. For example, if you select 500 Ω, the maximum output voltage cannot be lower than 10 V so that 20 mA current can be detected at AI2.

Table 5–3 External terminals

External Terminal	Name	Terminal Type	Signal Type
CN1	J32	Plug-in terminal block	External 24 V power supply input
CN2	J33	Plug-in terminal block	Safety function
CN3	J34	Plug-in terminal block	Common digital input
CN4	J35	Plug-in terminal block	Common or high-speed digital input
CN5	J36	Plug-in terminal block	RS485/CAN communication
CN6	J31	Plug-in terminal block	Relay 1
CN7	J30	Plug-in terminal block	Relay 2

External Terminal	Name	Terminal Type	Signal Type
CN8	J29	Plug-in terminal block	Relay 3
CN9	J40	Plug-in terminal block	AI, AO, and 10 V outputs
CN10	J39	Plug-in terminal block	Temperature sensor
CN11	J38	Plug-in terminal block	HDO and 24 V outputs
RJ45	J42	RJ45	External commissioning
CN12	J4	FPC	Encoder
CN13	J15	Box header connector	Communication expansion card
CN14	J3	Female header	I/O expansion card

Note

CN14 is a reserved external interface.

5.4.2 Wiring of Control Circuit Terminals

Wiring AI1

Weak analog voltage signals are prone to suffer external interference. Therefore, a shielded cable is required, and the wiring distance must be as short as possible (no longer than 20 m), as shown in *"Figure 5–8 AI wiring" on page 57*. In applications where the analog signal suffers severe interference, install a filter capacitor or ferrite magnetic core at the analog signal source side. Connect the lead wire of the shield of the AI to the PE terminal of the AC drive.

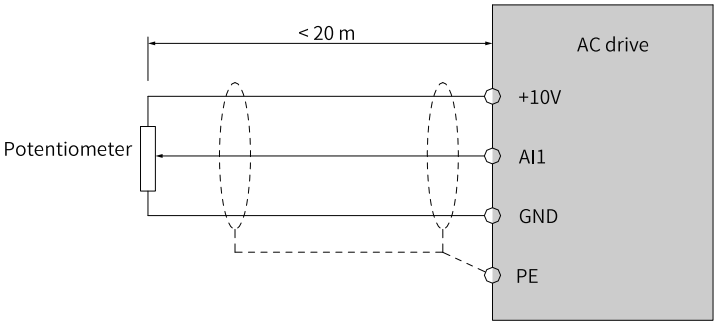


Figure 5-8 AI wiring

Wiring AI1/AI2

- When AI1 is used for voltage signal input, check whether the temperature detection function of AI1 is invalid (invalid by default). When AI1 is used to collect temperature data, set the AI temperature detection parameter in F6 group to the sensor type that detects temperature.
- When AI1/AI2 is used for current signal input, the current flows to the AI1/AI2 terminal and the current flows from the GND terminal. Set related parameters through the operating panel to switch to the current mode. For details, see the software guide.

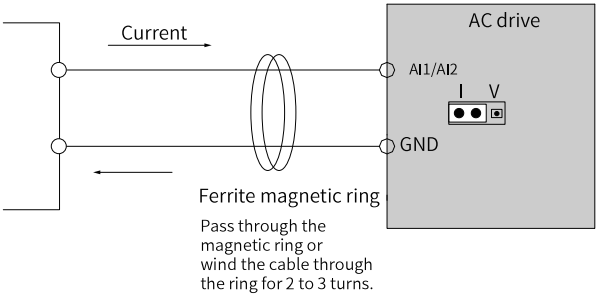
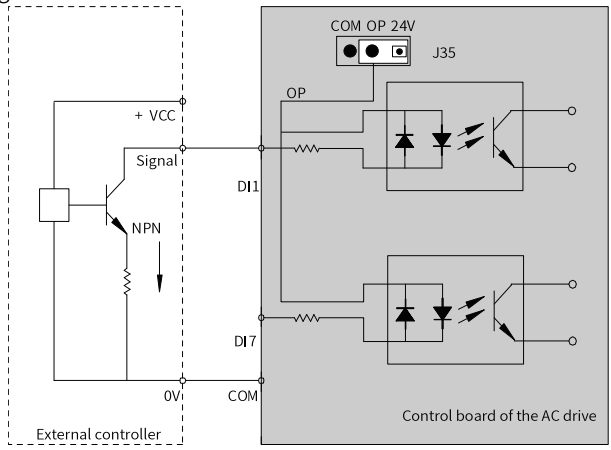


Figure 5-9 Wiring AI1/AI2

Wiring DI1 to DI7

- Sink wiring mode



Sink wiring method when the internal 24 V of the AC drive is used

Figure 5-10 Sink wiring mode

To use the internal 24 V power supply, which is the most commonly used method, short OP and 24V of the jumper terminal J35-CN4 on the AC drive control board, and connect the COM terminal of the AC drive to the 0V terminal of the external controller.

In the sink wiring mode, the DIs of different AC drives cannot be connected in parallel. Otherwise, the DI may malfunction. If DIs of different AC drives must be connected in parallel, connect the anode of a diode to the DI in series and the diode needs to satisfy the requirement: IF > 40 mA and VR > 40 V, as shown in *"Figure 5–11 Parallel connection of DIs of different AC drives in sink wiring mode" on page 59*.

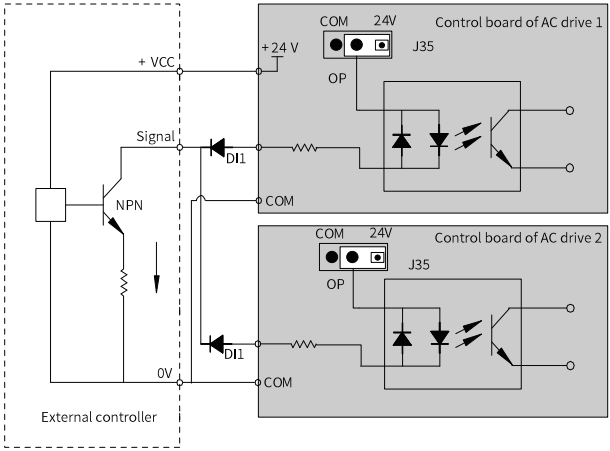


Figure 5-11 Parallel connection of DIs of different AC drives in sink wiring mode

- Source wiring mode

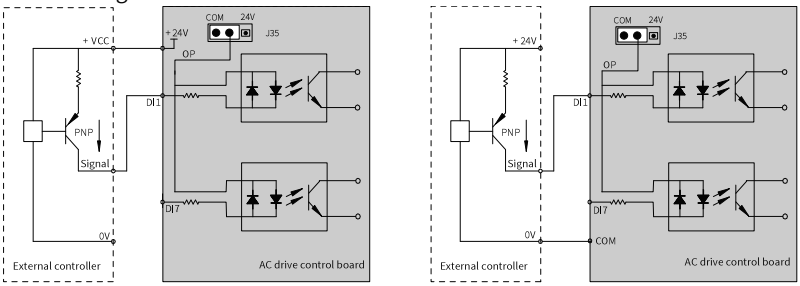


Figure 5-12 Source wiring mode

- To use the internal 24 V power supply, short OP and 24V of the jumper terminal J35-CN4 on the AC drive control board, and connect the COM terminal of the AC drive to the 0V terminal of the external controller.
- To use the external power supply, short OP and COM of the jumper terminal J35-CN4 on the AC drive control board, connect the COM terminal of the AC drive to the 0V terminal of the external controller, and connect the anode of the 24 V external power supply to the DI through the control contact on the external controller.

Wiring the DO

When the DO needs to drive a relay, connect a snubber diode on both sides of the relay coil. Otherwise, the 24 V DC power supply may be damaged. Ensure that the driving capacity does not exceed 50 mA.

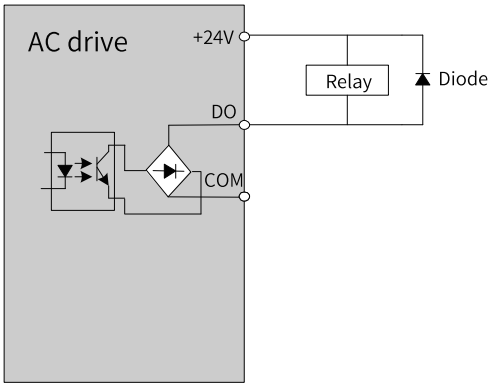


Figure 5-13 Wiring the DO

Note

Be sure to correctly install the polarity of the snubber diode; otherwise, the 24 VDC power supply will be damaged immediately upon the DO output.

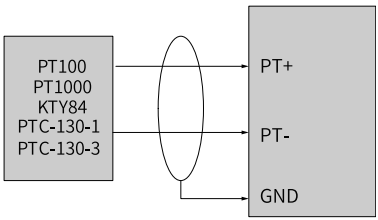


Figure 5-14 Wiring the PT temperature detector

Note

- The MD580 supports temperature sampling from four channels simultaneously, and each channel supports four types of temperature sensors.
- The AI supports several functions. To use the AI for temperature detection, set parameters in F6 group. For details about how to set parameters, see related software sections.
- When the temperature sensor is used under high or low temperature, temperature drift will occur due to the sensor characteristics.

Wiring the relay output terminal

The inductive load (relay, contactor, and motor) causes voltage peak after the current is disconnected. To minimize the interference at cutoff, use a voltage dependent resistor (VDR) at the relay contact for protection and install absorption circuits such as VDRs, RC absorption circuits, and diodes on the inductive load, as shown in *"Figure 5–15 Anti-interference processing of relay output terminals" on page 61*.

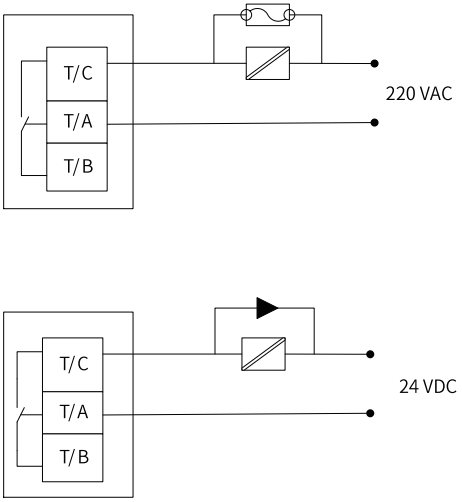


Figure 5-15 Anti-interference processing of relay output terminals

Note

The power supply connected with the control circuit must use class 2 power supply; otherwise, the operation performance of the AC drive will be degraded.

Tubular terminal requirements

Use tubular terminals with insulating sleeves. Keep the exposed conductor of a single or twisted cable no longer than 6 mm, as shown in *"Figure 5–16 Requirements on tubular terminals of the control circuit cable" on page 62*.

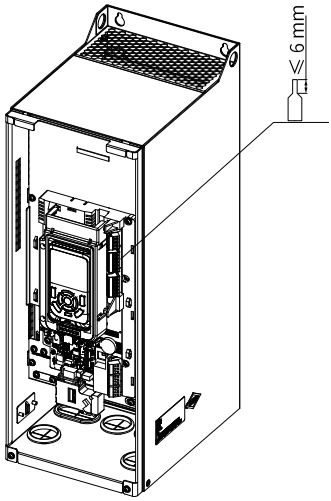


Figure 5-16 Requirements on tubular terminals of the control circuit cable

Table 5–4 Specification of the control circuit cable

Single Cable mm² (AWG)	Twisted Cable mm² (AWG)	Tightening Torque (N · m)
0.5-0.75 (AWG20-AWG18)		0.565

Note

- If the cable is a single-conductor cable, the diameter of the cable should not be less than 18AWG. If the cable is an unshielded twisted pair cable, the diameter of the cable should not be less than 20AWG.
- If the cable is a four-conductor cable or above, the diameter of the cable should not be less than 24AWG.
- If the cable diameter is larger than 18AWG, the length of the cable conductor must be between 6 mm and 8 mm after crimping. Do not install the top cover to avoid stress on the terminal and PCB.

5.4.3 Control Circuit Wiring Requirements

Requirements on grounding the AI shield

Weak analog voltage signals are prone to suffer external interference. Therefore, a shielded cable is required, and the wiring distance must be as short as possible (no longer than 20 m). In applications where the analog signal suffers severe interference, install a filter capacitor or ferrite magnetic core at the analog signal source side.

- Use the shielded cable together with the shield grounding bracket (option) to ground the shield in 360°.
- Keep the shield drain wire as short as possible and fix the drain wire to the standard grounding copper busbar of the AC drive by the screw.

Requirements on wiring encoder signal cables

Requirements on wiring encoder signal cables are as follows:

- During on-site installation and commissioning, route the encoder cables and power cables through different routes. Never bundle the encoder cables and power cables together to prevent interference to the encoder.
- It is recommended to use shielded twisted pair cables. For differential encoders, connect the twisted pair cables based on the differential pairs, and connect the shield to the ground terminal (PE terminal) of the AC drive.
- For some large-scale equipment, the length of the motor cable between the drive and the motor is long (>10 m). The grounding resistor of the encoder cable shield will increase due to the effect of cable parasitic inductance. In this case, the encoder shield does not need to be connected to the ground terminal (PE) of the drive.

Requirements on wiring I/O signal cables

- I/O signals include analog input (AI), analog output (AO), digital input (DI), digital output (DO) and relay output signals. Before wiring the I/O terminals, disconnect the main power supply and ensure that the danger indicator of the AC drive is off.
- To avoid interference to the I/O signals, separate the I/O signal cables at least 30 cm from the main circuit cables (R, S, and T cables and U, V, and W cables) and other power cables (or power supply cables).
- To avoid malfunction of the AC drive and equipment, separate the cable connecting the relay output terminal at least 30 cm from other I/O signal cables.

The following figure shows the recommended cabling.

Requirements on the wiring loop area

For cables that transmit low-level sensor signals and shared cables that transmit relay signals, lay them close to each other to avoid the large loop area. Use twisted pair cables for analog signals. Lay digital signal cables close to each other.

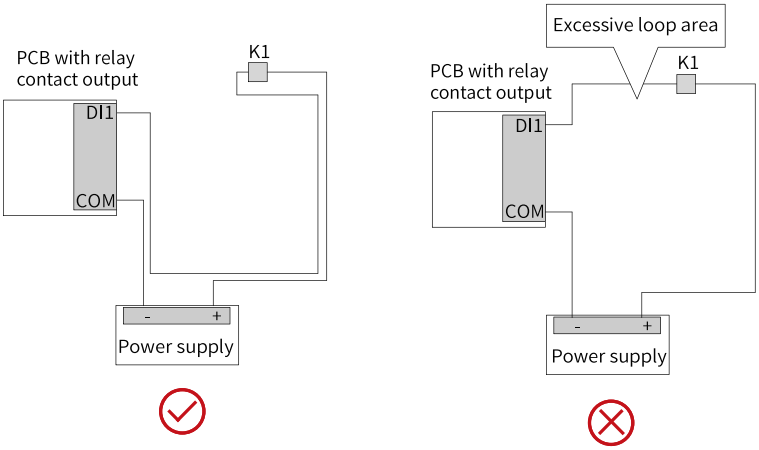


Figure 5-17 Recommended wiring loop area

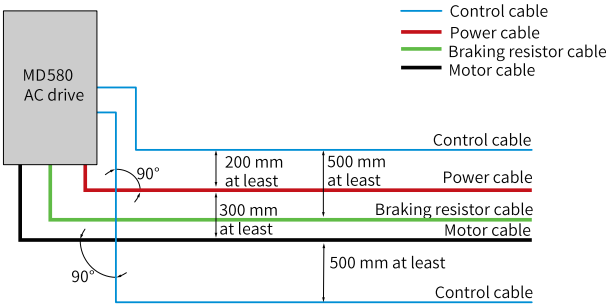


Figure 5-18 Routing of cables

5.4.4 Cable Routing Requirements

- Route signal cables and power cables through different routes. When analog signals are used for remote control on the cabinet module, separate signal cables from high-voltage circuits (power supply input, drive unit output, and braking resistor connection cables) by a distance of above 50 cm. This can reduce interference from the AC drive and other equipment on analog signals. Comply with the preceding requirement even in the control cabinet.
- Use shielded twisted pair cables for analog control signal cables. Minimize the length of the stripped part of the cable (about 5–7 mm) and make the shield as close to the signal cable end as possible. To prevent potential difference between the two ends of the shield, ground the shield at both ends of the cable properly. Wrap the shield with insulation tape after stripping the cable.

- Use shielded cables for motor cables. Minimize the distance between the cabinet module and the motor. Route the motor cable independently of other cables, and avoid long-distance parallel routing of the motor cables and other cables to reduce electromagnetic interference caused by rapid changes in the output voltage of the AC drive.
- Use shielded cables for power cables, or shield all the cables from the cabinet module to the motor by using conduits.
- If the power cables and control cables must be intersected, make the intersection angle 90 degrees.

5.4.5 Routing Recommendations

- During routing, route cables that transmit different types of signals through different routes. Separate the disturbing cable cable from the sensitive cable by a distance of 30 cm wherever possible. When two types of cables must be intersected, the intersection angle must be 90 degrees to avoid interference, as shown in the following figure.

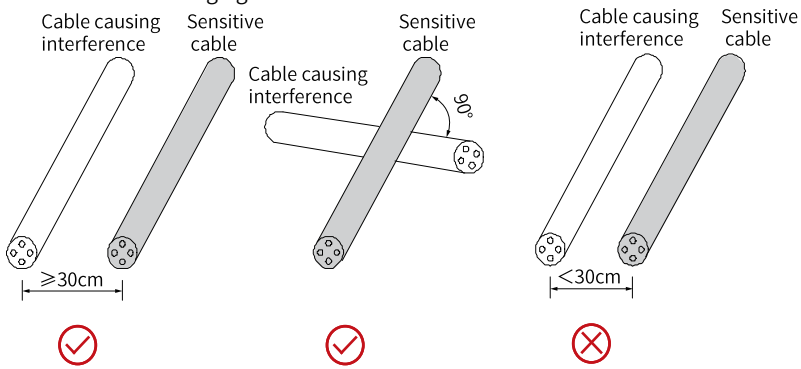


Figure 5-19 Routing for disturbing cables and sensitive cable

- Route cables that transmit different types of signals through different routes and separate them with equipotential signal cables. When routing cables that transmit the same type of signals, lay equipotential signal cables at the outer layer and lay equipotential signal cables as many as possible in the middle, as shown in the following figure.

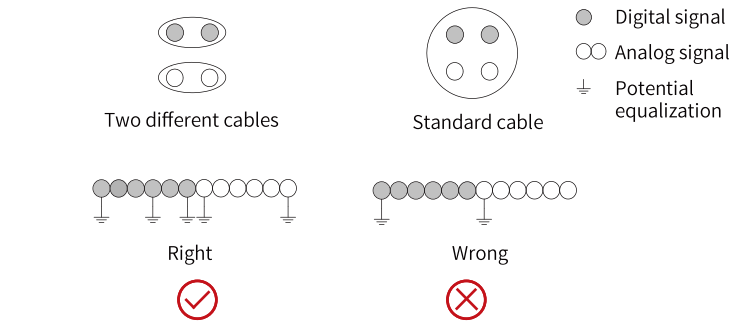


Figure 5-20 Routing for cables that transmit different types of signals

- Use one multi-conductor cable to transmit one type of signals. If you need to use the multi-conductor cable to transmit different types of signals, isolate the conductors that transmit one type of signals, as shown in the following figure.

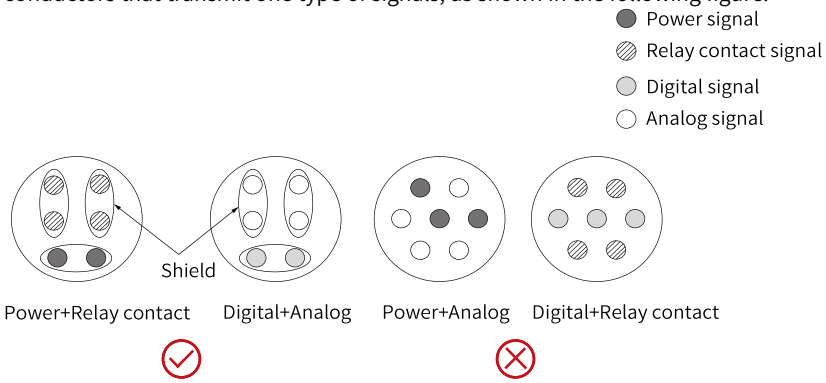


Figure 5-21 Routing of multi-conductor cables

- If certain conductors in a multi-conductor cable are reserved or unused, connect these conductors to the equipotential bonding point, as shown below.

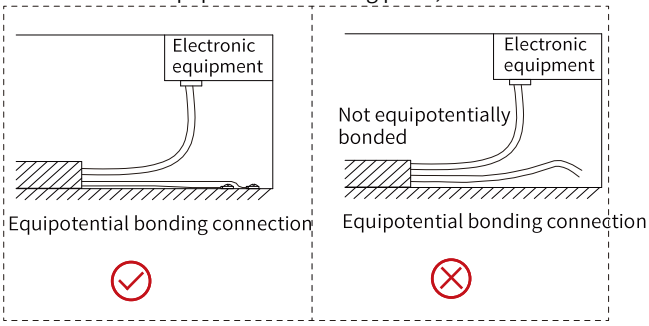


Figure 5-22 Handling of unused or reserved conductors in a multi-conductor cable

- For cables of different types, route the cables along the equipotential metal plate. To enhance the internal EMC performance, separate different types of cables or separate cables with metal separators in the same metal (zinc-iron or stainless steel) duct. The latter is recommended.

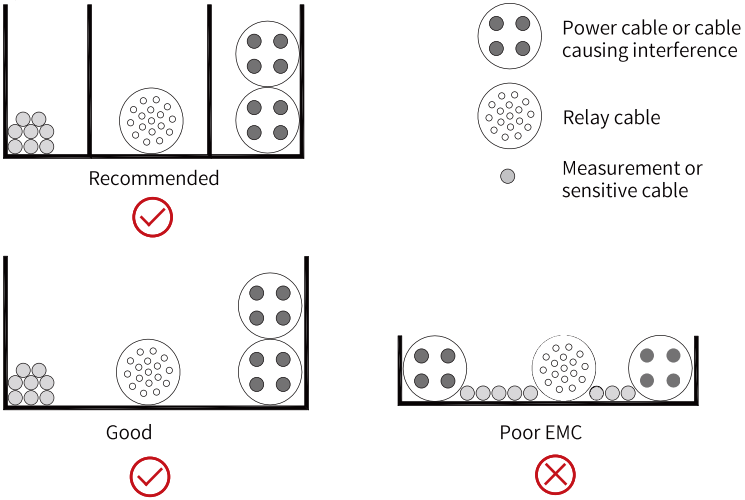


Figure 5-23 Routing of multiple types of cables

- Minimize the length of the unshielded part of a shielded cable, and connect the shield to the nearest PE terminal. If the unshielded part is too long, the cable conductor is prone to signal interference, especially important signals such as encoder signals.

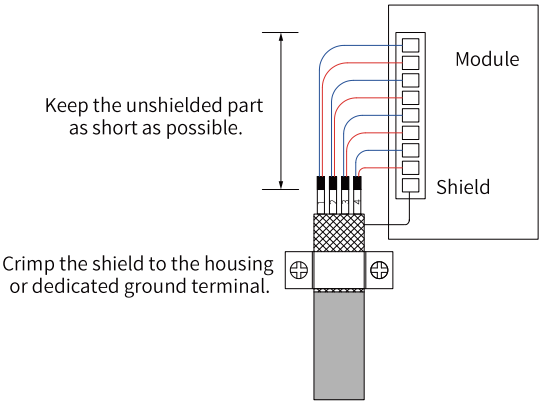


Figure 5-24 Shielded cable requirements

5.5 Communication Connection

5.5.1 CANopen Communication

MD580-SI-CAN1 is a new-generation fieldbus module of Inovance. It is used together with the MD580 to realize networking and remote control of the drive system through the CANopen fieldbus communication network.

Terminal descriptions

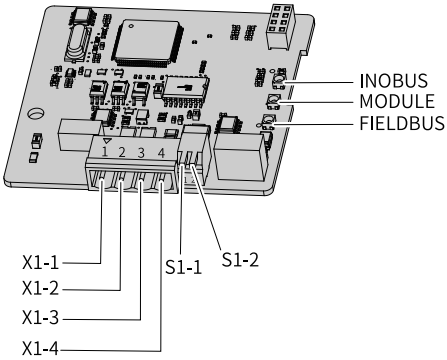


Figure 5-25 MD580-SI-CAN1 terminals

Table 5–5 Terminal descriptions

Terminal	Name	Wiring	Description
X1-1	PE	Connected to the shield	Recommended cable specification: four-conductor shielded twisted pair (STP) cables Cross-sectional area: 0.3 mm^2 to 2.0 mm^2
X1-2	CANH	Twisted pair	
X1-3	CANL		
X1-4	CGND	It is recommended to connect the terminal.	
S1-1	DIP switch S1	-	Termination resistor selection The termination resistor is available when S1-1 and S1-2 are set to ON.
S1-2	DIP switch S2	-	

The following figure describes the terminal wiring.

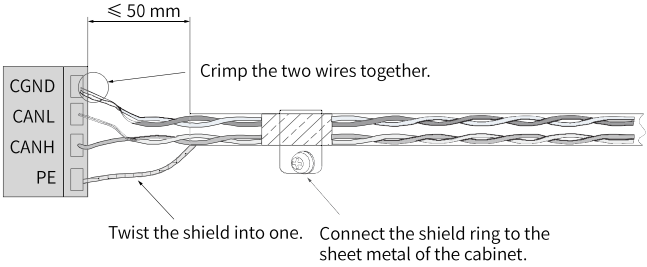


Figure 5-26 Terminal wiring

Bus topology

The CAN bus supports a maximum of 63 nodes (excluding the master), as shown in the following figure. The termination resistors of the master and the last node need to be set to ON.

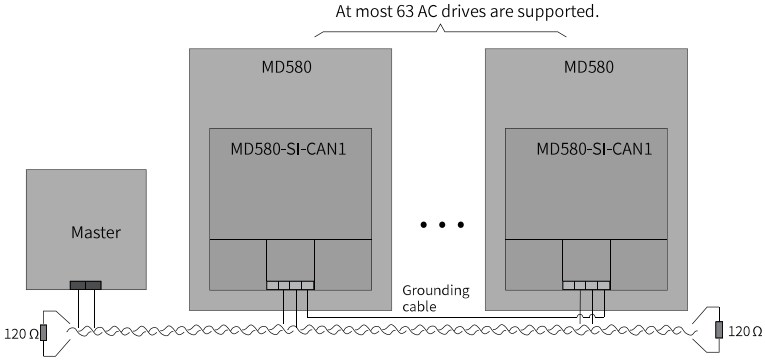


Figure 5-27 Networking

Bus transmission distance

The transmission distance of the CAN bus is related to the baud rate and communication cable, as described in the following table.

No.	Transmission Distance	Baud Rate	Number of Nodes	Cable Cross-sectional Area
1	25 m	1 Mbps	64	0.34 mm^2
2	95 m	500 kbps	64	0.34 mm^2
3	560 m	100 kbps	64	0.50 mm^2
4	1100 m	50 kbps	64	0.75 mm^2

5.5.2 Modbus RTU Communication

MD580-SI-RS1 is a new-generation fieldbus module of Inovance. It is used together with the MD580 to realize networking and remote control of the multidrive system through the Modbus RTU communication network.

Terminal descriptions

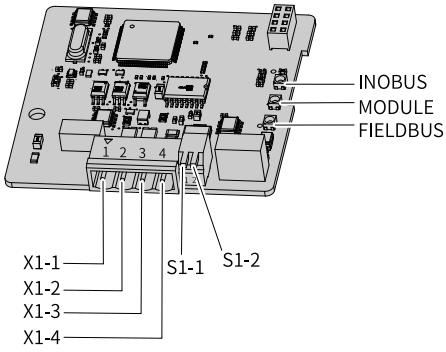


Figure 5-28 MD580-SI-RS1 terminals

Table 5–6 Terminal descriptions

Terminal	Name	Wiring	Description
X1-1	SHIELD	Connected to the shield	Recommended cable specification: four-conductor shielded twisted pair (STP) cables Cross-sectional area: 0.3 mm^2 to 2.0 mm^2
X1-2	485+	Twisted pair	
X1-3	485-		
X1-4	GND	It is recommended to connect the terminal.	
S1-1	DIP switch S1	-	Termination resistor selection The termination resistor is available when S1-1 and S1-2 are set to ON.
S1-2	DIP switch S2	-	

The following figure describes the terminal wiring.

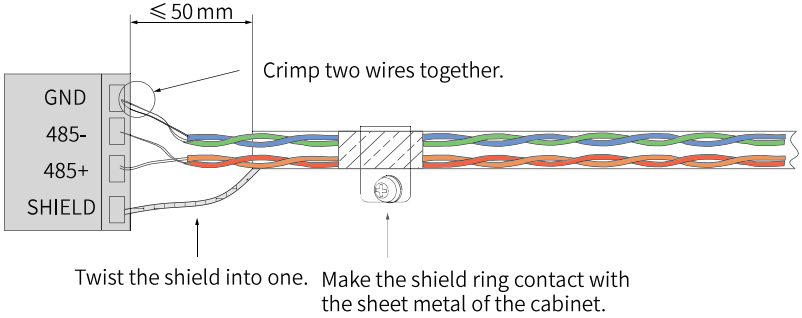
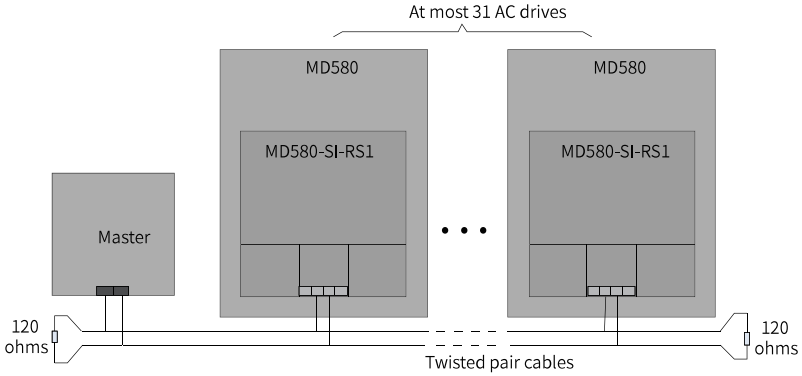


Figure 5-29 Terminal wiring

Bus topology

- The Modbus RTU supports a maximum of 31 nodes (excluding the master), as shown in the following figure. The termination resistors of the master and the last node need to be set to ON.
- If the number of nodes on the network exceeds 31, repeaters are required.



5.5.3 PROFIBUS DP Communication Cable

The MD580-SI-DP1 is a PROFIBUS DP fieldbus module. It is installed in the expansion slot CN13 of the MD580 and used together with the MD580. The MD580 communicates with the bus master through the PROFIBUS DP communication protocol.

Bus cable

The following table describes the dedicated cable for the PROFIBUS DP bus.

Table 5–7 Cable specifications

Item	Description
Conductor	One pair of copper conductors (2 x 22AWG)
Insulating sheath color	Green, red
Shield	Aluminum plastic belt + tinned copper braid
Sheath material	PVC
Operating temperature	–30°C to +70°C
Appearance	Purple

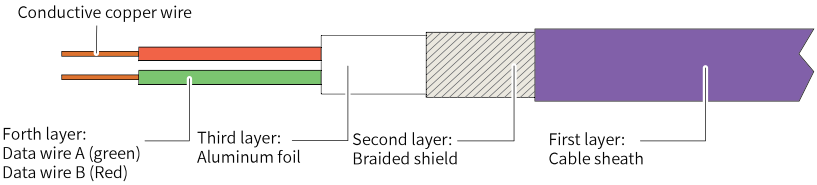


Figure 5-30 Internal layer of the bus

Bus terminal

Siemens dedicated PROFIBUS DP connector 6ES7 972-0BB12-0XA0 is recommended.

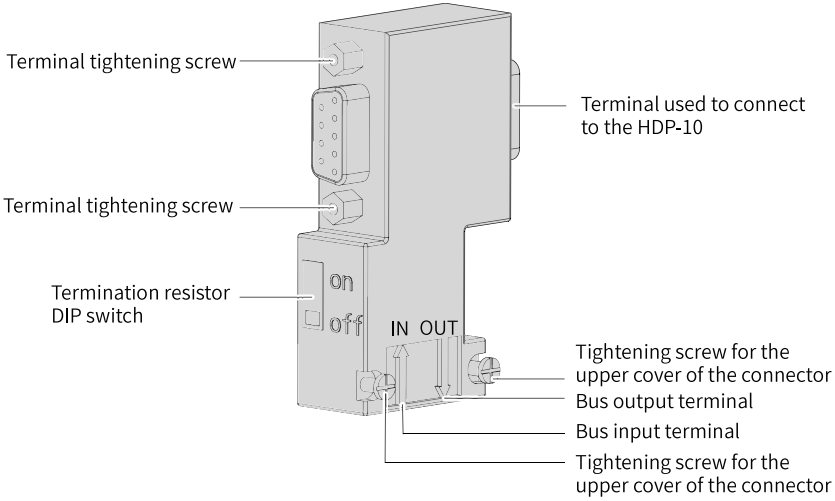


Figure 5-31 Bus connector

Bus cable connection procedure

1. Strip the cable sheathe and reverse the length as specified in the following figure.

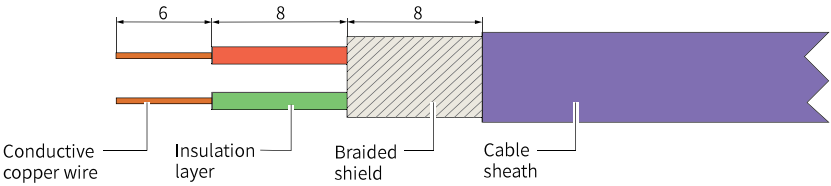
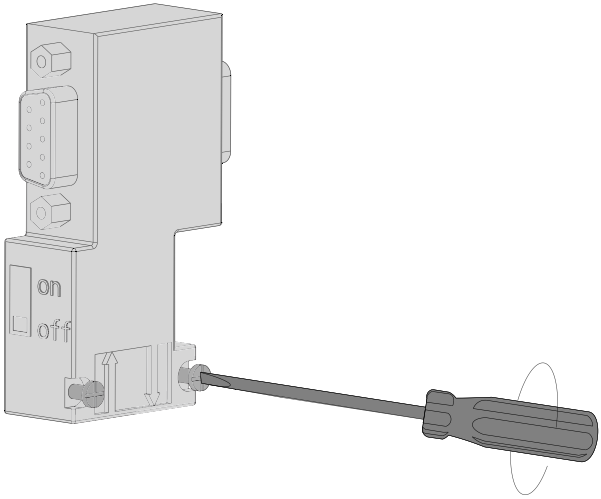
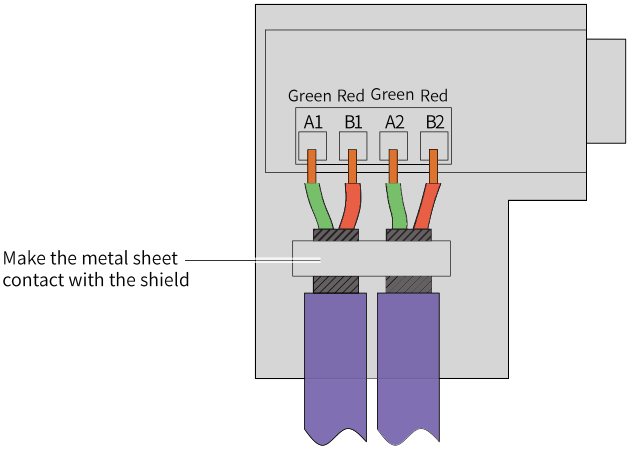


Figure 5-32 Length of each layer of the bus cable (unit: mm)

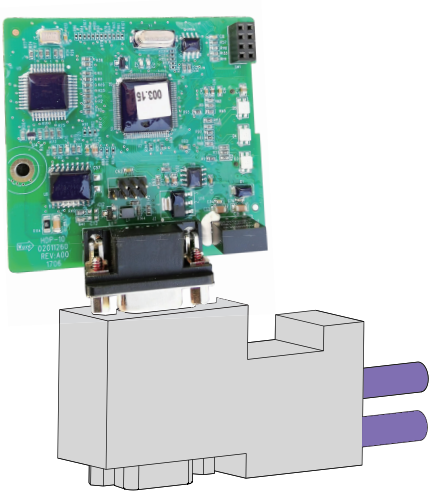
2. Open the bus connector terminal cover using the 1# straight screwdriver.



3. Secure the cable to the connector installation position using the 1# straight screwdriver. Ensure that the shield is in close contact with the metal sheet. Connect the green cable to the A terminal and the red cable to the B terminal, as shown in the following figure.



4. After you close the connector cover and tighten the screws on the cover, insert the connector to the DB9 port of the MD580-SI-DP1 module, and use a screwdriver to tighten the screws on both sides.



Note

When installing the PROFIBUS DP bus, ensure that the studs on both sides of the Siemens terminals are securely connected to the MD580-SI-DP1 module. Otherwise, the communication may fail or the communication quality may deteriorate.

Bus topology

- For the multi-drive system without repeaters, termination resistors need to be connected to the first and last AC drives, as shown in *"Figure 5–33 Connection of the multi-device system without repeaters" on page 75*.

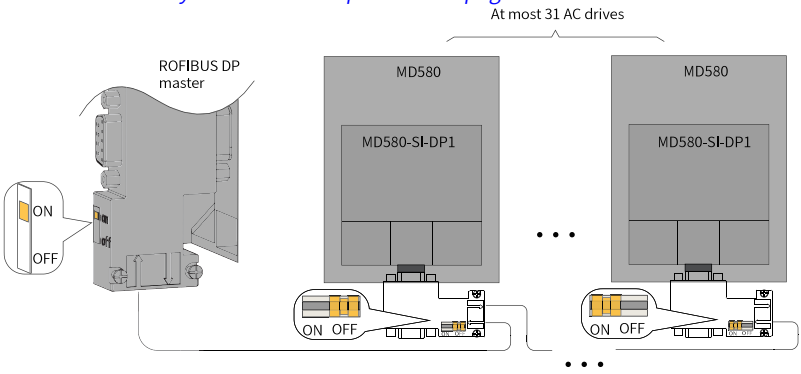


Figure 5-33 Connection of the multi-device system without repeaters

- For the multi-device system without repeaters, termination resistors need to be connected to the first and last AC drives, and the termination resistor of the repeater also needs to be connected, as shown in *"Figure 5–34 Connection of the multi-device system with repeaters" on page 76*.

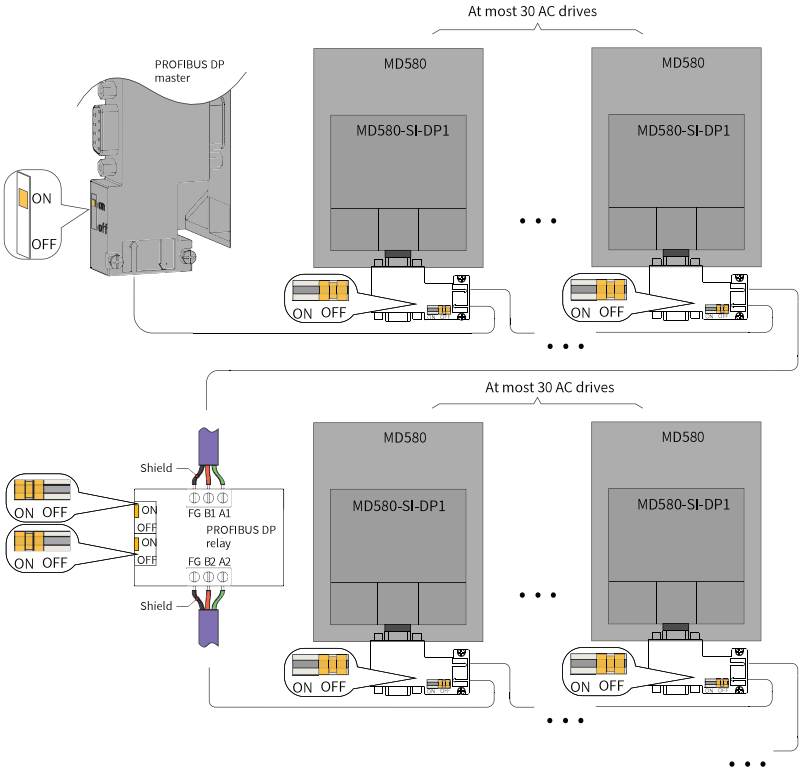


Figure 5-34 Connection of the multi-device system with repeaters

Baud rate and communication distance

Baud Rate (kbps)	9.6	19.2	93.75	187.5	500	1500	3000	12000
Transmission Distance (m)	1200	1200	1200	1200	400	200	100	100

Note

The transmission distance in the preceding table refers to the distance without the repeater installed.

5.5.4 Modbus TCP Industrial Ethernet Communication

The Modbus TCP industrial Ethernet communication module (hereinafter referred to as MD580–SI-EM1 module) conforms to the Modbus TCP industrial Ethernet communication standard. When the MD580-SI-EN1 module is installed on the MD580, the MD580 can serve as the Modbus TCP industrial Ethernet server to be controlled by the Modbus TCP industrial Ethernet client. This improves the communication efficiency and enriches the networking functions of the MD580.

The MD580-SI-EM1 module is connected to the PLC using the standard Ethernet RJ45 socket. The signal definitions of the module pins are the same as those of the standard Ethernet pins. The module can be connected using crossover cables or straight-through cables.

Electrical connection for one module

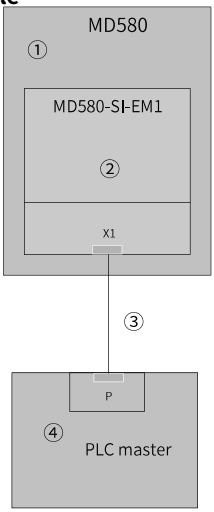


Figure 5-35 Electrical connection for one module

No.	Name
①	MD580
②	MD580-SI-EM1 module
③	Network cable
④	PLC master

Electrical connection for multiple modules

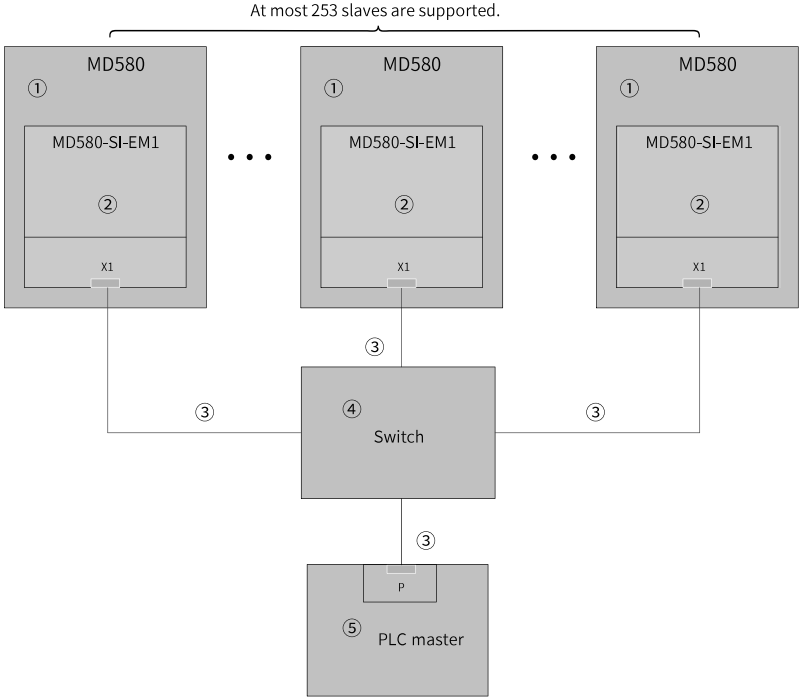


Figure 5-36 Electrical connection for multiple modules

No.	Name
①	MD580
②	MD580-SI-EM1 module
③	Network cable
④	Switch
⑤	PLC master

5.5.5 PROFINET IO Industrial Ethernet Communication

The PROFINET IO industrial Ethernet module (hereinafter referred to as MD580-SI-PN1 module) conforms to the PROFINET IO industrial Ethernet communication standard. When the MD580-SI-PN1 module is installed on the MD580, the MD580 can serve as the PROFINET IO industrial Ethernet slave to be controlled by the PROFINET IO industrial Ethernet master. This improves the communication efficiency and enriches the networking functions.

The MD580-SI-PN1 module is connected to the PROFINET master using the standard Ethernet RJ45 socket. The signal definitions of the module pins are the same as those

of the standard Ethernet pins. The module can be connected using crossover cables or straight-through cables.

Electrical connection of the chain network

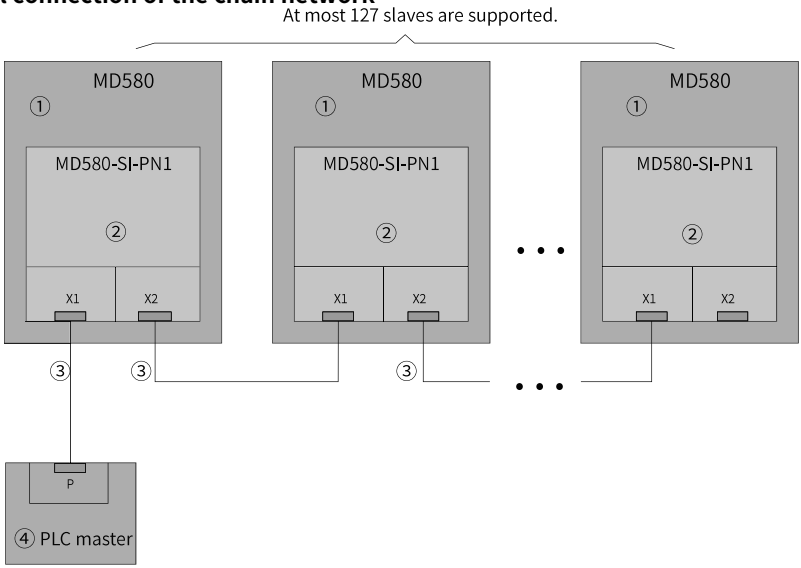


Figure 5-37 Electrical connection of the chain network

No.	Model
①	MD580
②	MD580-SI-PN1 module
③	Network cable
④	PLC master

Electrical connection of the star network

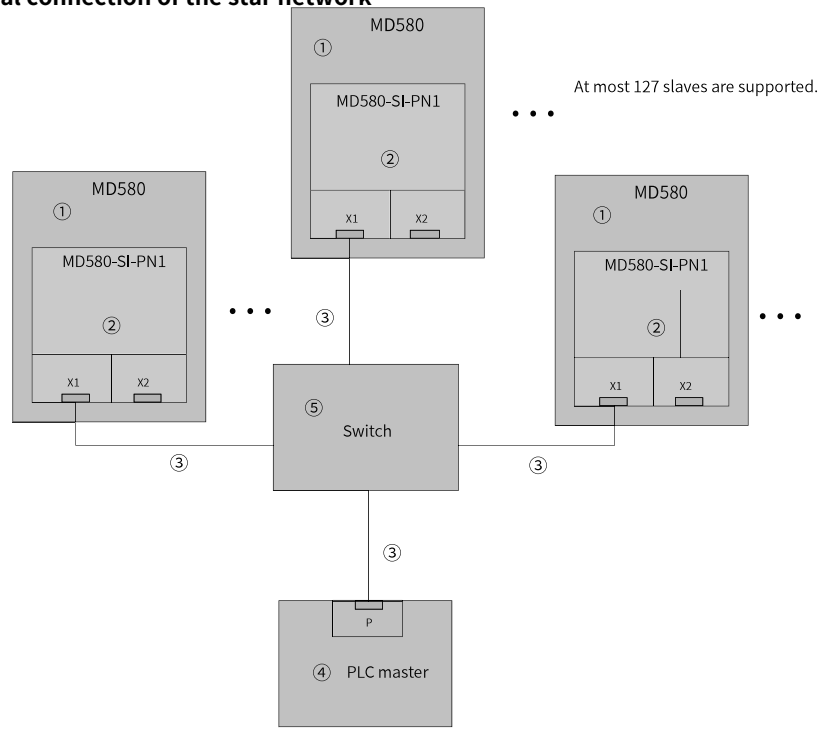


Figure 5-38 Electrical connection of the star network

No.	Model
①	MD580
②	MD580-SI-PN1 module
③	Network cable
④	PLC master
⑤	Switch

5.6 Grounding

5.6.1 Grounding the Main Circuit

To properly ground the product, observe the following precautions.

Caution

- Ground the grounding terminal to avoid electric shocks. Comply with the relevant national and local electrical regulations for grounding.
- To prevent electric shocks, ensure that the protective grounding conductor meets the technical specifications and local safety standards, and shorten the grounding cable length as much as possible. The leakage current of the product will exceed 3.5 m. According to EN 61800-5-1, use the copper cable that the cross-sectional area of its protective grounding conductor is at least 10 mm^2, or use two protective grounding conductors with the same specification for connection.
- When multiple devices are used, ground all the devices. Incorrect grounding will cause misoperation of equipment.
- This product is equipped with the optional VDR ground screw. Before performing a voltage test, disconnect the optional VDR ground screw; otherwise, the test may fail.

- Use a yellow-green copper wire for the protective grounding conductor, and do not connect the conductor to switches such as circuit breakers in series.
- The grounding terminal must be reliably grounded. Failure to comply will result in abnormality of the AC drive or even damage to the AC drive.
- Do not connect the grounding terminal to the N terminal of the power supply.
- It is recommended that the AC drive be installed on a conductive metal surface to ensure that the entire conductive bottom of the AC drive is properly overlapped with the installation surface.
- The grounding screw must be fixed with the recommended tightening torque to avoid loose or tight fixing of the protective grounding conductor.

5.6.2 Grounding the Control Board

The control board is grounded by default. The following figure shows the position of the grounding screw on the control board.

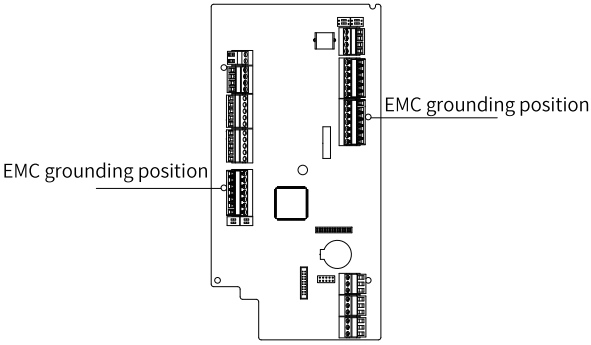


Figure 5-39 Control board grounding

5.6.3 Grounding a Single Device

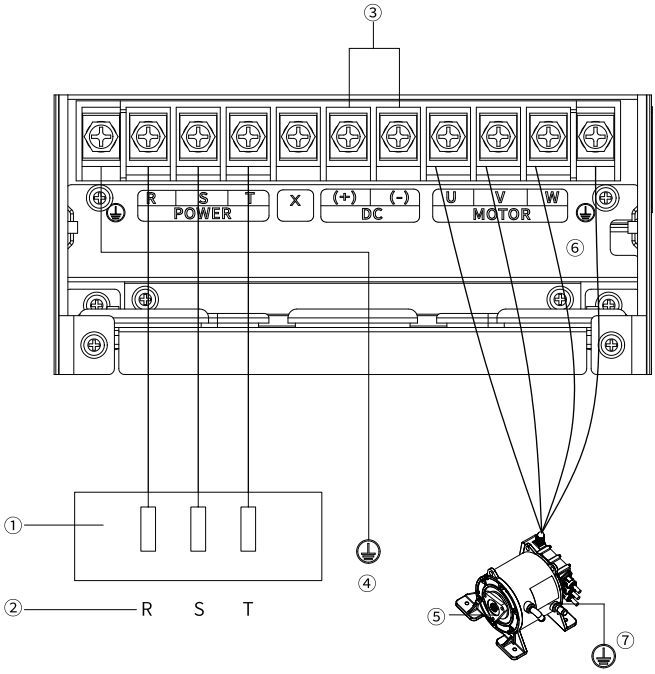


Figure 5-40 Main circuit grounding

Table 5–8 Description of main circuit grounding

No.	Wiring Description
①	Input protection device (fuse, connected to the filter)
②	Input power supply

No.	Wiring Description
③	DC bus or braking resistor terminals. Do not ground the terminals.
④	Connect the PE cable of the input power supply to the input PE terminal of the AC drive.
⑤	Three-phase motor
⑥	Connect the output PE terminal of the AC drive to the output cable shield of the motor.
⑦	Ground the motor housing.

Note

The layout of main circuit terminals varies with different models.

5.6.4 Grounding Multiple Devices

When multiple devices are installed in the cabinet in parallel, the wiring of the devices is shown below.

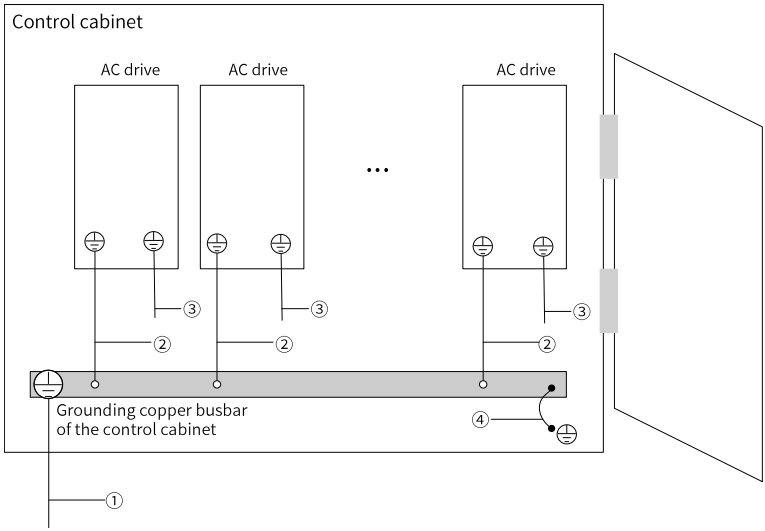


Figure 5-41 Grounding in parallel connection

Table 5–9 Grounding description for parallel connection

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

5.6.5 Grounding the Cabinet System

The most economical and effective measure to suppress interference in the cabinet is to isolate the interference source from the equipment that may be interfered during installation. According to the strength of interference, devices must be installed in different EMC areas or cabinets. The following table describes the installation requirements.

Table 5–10 Wiring principle

No.	Wiring Principle
1	Install the devices for control and the devices for drive in two different cabinets.
2	When devices are installed in different cabinets, use grounding cables with the cross-sectional area of at least 16 mm^2 to connect the cabinets, therefore realizing equipotential between cabinets.
3	Place the devices in different areas in the cabinet according to the device signal strength.
4	Carry out equipotential bonding for the devices in different areas of the cabinet.
5	Shield all communication (such as RS-485) signal cables leading from the cabinet.
6	Install the power input filter close to the cabinet input interface.
7	Spray each grounding point in the cabinet.

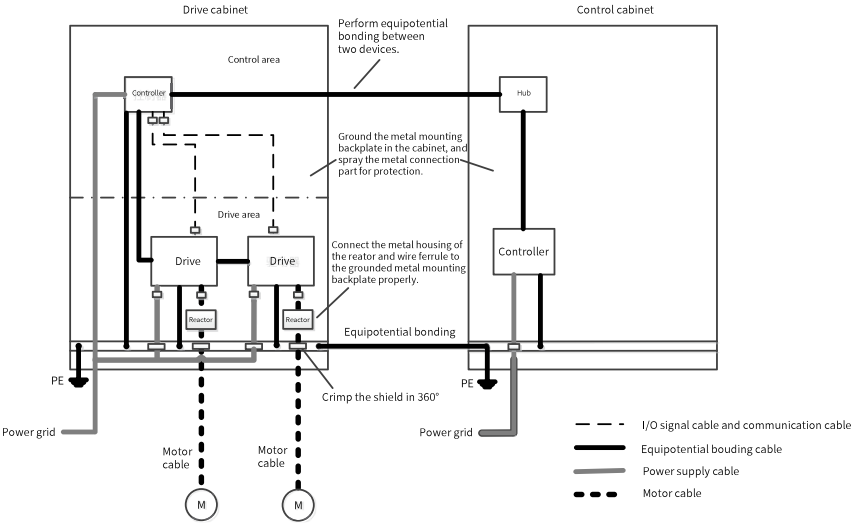
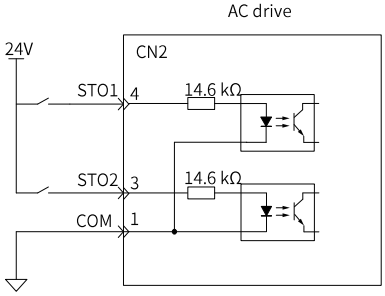


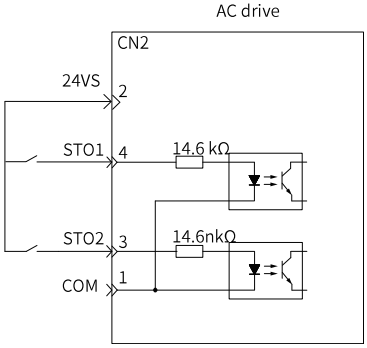
Figure 5-42 Recommended cabinet system wiring

5.7 STO Security Design and Wiring

- External 24 V power supply



- Internal 24 V power supply



5.8 Inspection After Wiring

Table 5–11 Wiring checklist

☑	No.	Check That
☐	1	The power supply input cables are connected to the R, S, and T terminals.
☐	2	The motor input cables are connected to the U, V, and W terminals.
☐	3	The cross-sectional area of the main circuit cable meets requirements.
☐	4	The heat-shrink tubing is applied to copper tube lugs and conductors of main circuit cables, and completely covers the cable conductors.
☐	5	The ground cables are connected correctly.
☐	6	The output terminals and control signal terminals are securely fastened.
☐	7	The optional cards are connected correctly.
☐	8	The control circuit cables and main circuit cables are routed separately.

6 Installation of Peripheral Electrical Components

6.1 Fuse, Contactor, and Circuit Breaker

When the fuse is damaged or the circuit breaker trips, do not immediately energize the product or operate the peripheral equipment. Wait at least for the time specified on the warning label to prevent personal injury and equipment damage.

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

6.2 Output Reactor

With an output reactor installed on the output side of the drive, the excessive dV/dt can be reduced. This can reduce the voltage stress on the motor winding to protect it, lower the motor temperature, and prolong the service life of the motor.

6.3 Magnetic Ring and Buckle

The magnetic ring can be used on the input or output side of the AC drive. Install it as close to the AC drive as possible. When installed on the input side, the magnetic ring can suppress the noise in the input power supply system of the drive. When installed on the output side, the magnetic ring can suppress interference generated by the AC drive to external devices and reduce the bearing current.

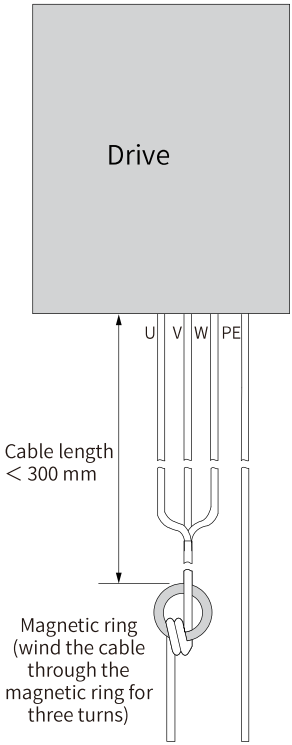


Figure 6-1 Magnetic ring installation

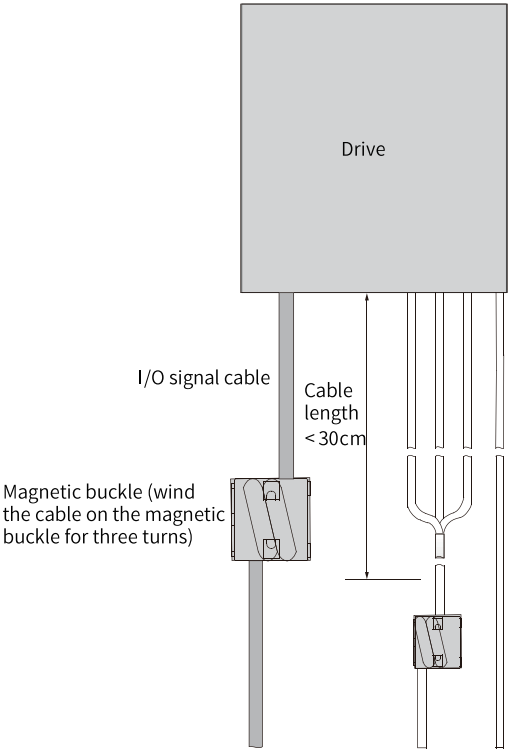


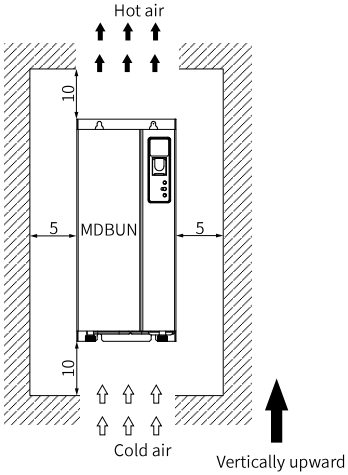
Figure 6-2 Magnetic buckle installation

Note

The R/S/T or U/V/W cables must pass through the same ferrite core to suppress the common mode noise.

6.4 Braking Unit

Install the braking unit only vertically upward to facilitate heat dissipation from the lower part to the upper part. In addition, reserve sufficient clearance between the braking unit and other electrical devices, as specified in the following figure (unit: cm).



1. Unfasten two screws (①) of the braking unit.
2. Lift the cover of the braking unit upward (②).
3. Remove the cover of the braking unit (④). The mechanical mounting holes of the braking unit are shown by callout ③.

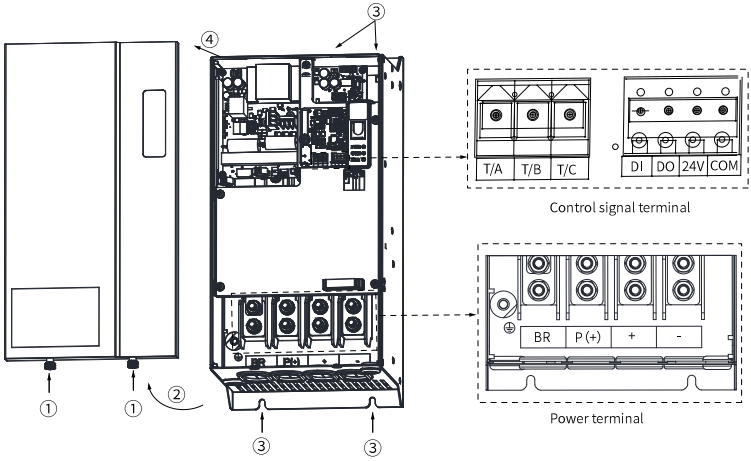


Figure 6-3 Terminal layout of the MDBUN-200-7T braking unit

After removing the braking unit cover, you can wire the main circuit and control circuit, as shown in the preceding right figure.

Table 6–1 Description of power terminals

Screenprint	Terminal Name	Function
+, -	Positive and negative terminals of the DC bus	The terminals are used to connected to the common DC bus.
P(+), BR	Braking resistor terminals	The terminals are used to connected to the braking resistor.
	Grounding terminal	It is used for protective grounding.

The polarity of the bus terminals (+), (-) cannot be reversely or incorrectly connected; otherwise, the AC drive and the braking unit will be damaged.

Note

- The polarity of the bus terminals (+), (-) cannot be reversely or incorrectly connected; otherwise, the AC drive and the braking unit will be damaged.
- Do not connect the grounding terminal  to the N terminal of the power supply.
- This grounding terminal must be reliably grounded with the grounding resistance smaller than 4 Ω.
- The length of the cable between the braking unit and the AC drive should not exceed 5 m, and twisted pair cables must be used. The length of the cable between the braking unit and the braking resistor should not exceed 10 m.

Table 6–2 Description of control signal terminals

Screenprint	Terminal name	Function
DI	Digital input	In the master mode, it is used to stop input upon an external fault. In the slave mode, it is used to input the operation or stop signal of the braking unit.
DO	Digital output	It is used to output the operation or stop signal.

Screenprint	Terminal name	Function
TA/TB/TC	Relay output upon a fault	The TA and TB are normally closed and the TA and TC are normally open. When a fault occurs on the braking unit, the TA, TB, and TC terminals act accordingly.
24V, COM	Power supply and reference ground	24V is the I/O auxiliary power supply terminal and COM is the reference ground terminal.

7 Solutions to Common EMC Interference Problems

7.1 Solutions to Current Leakage

The output of the AC drive is high-speed pulse voltage, thus high-frequency leakage current is produced during running of the AC drive. Each AC drive produces more than 100 mA leakage current. Therefore, select an earth leakage circuit breaker with the rated operating current larger than 100 mA. The AC drive generates DC leakage current in protective conductor. In this case, select a B-type (delay type) earth leakage circuit breaker.

If multiple AC drives are installed, install an earth leakage circuit breaker for each AC drive. The factors that influence the leakage current are as follows:

- Capacity of the AC drive
- Carrier frequency
- Type and length of the motor cable
- EMI filter

When the leakage current causes the action of the earth leakage circuit breaker, do the following:

- Increase the rated operation current of the earth leakage circuit breaker.
- Replace the earth leakage circuit breaker with a B-type or delay-type one that features high-frequency suppression.
- Reduce the carrier frequency.
- Shorten the length of the output drive cable.
- Install a leakage current suppression device.
- Use earth leakage circuit breakers of Chint Electric and Schneider.

7.2 Earth Leakage Circuit Breaker Malfunction

When the earth leakage circuit breaker malfunctions, perform troubleshooting according to the following table.

Table 7–1 Troubleshooting for leakage current

Trip	Possible Cause	Solution
Trip upon power-on	The anti-interference performance of the earth leakage circuit breaker is poor.	• Use an earth leakage circuit breaker of the recommended manufacturers. • Use an earth leakage circuit breaker with a large operating current. • Move the unbalanced load to the front end of the earth leakage circuit breaker. • Remove the EMC screw or disconnect the grounding terminal of the external EMC filter to reduce the capacitance of the input end to the ground.
	The operating current of the earth leakage circuit breaker is too low.	
	The back end of the earth leakage circuit breaker is connected with an unbalanced load.	
	The capacitance to the ground at the front end of the AC drive is large.	
Trip during operation	The anti-interference performance of the earth leakage circuit breaker is poor.	• Use an earth leakage circuit breaker of the recommended manufacturers. • For a single AC drive, tighten the EMC screw. For multiple AC drives, disconnect the optional EMC grounding screw, as shown in *"Figure 7–1 Disconnecting the EMC grounding screw" on page 95*. • Use an earth leakage circuit breaker with a large rated operating current. • Reduce the carrier frequency properly without affecting the performance. • Reduce the length of the motor cable.
	The operating current of the earth leakage circuit breaker is too small.	
	The back end of the earth leakage circuit breaker is connected with an unbalanced load.	
	The distributed capacitance to the ground of the motor cable and motor is too large.	

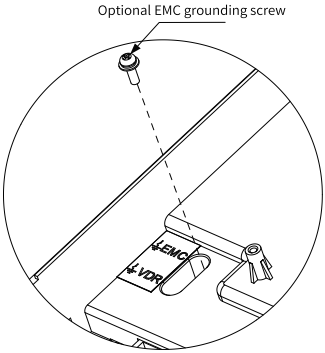


Figure 7-1 Disconnecting the EMC grounding screw

7.3 Harmonic Suppression

To suppress harmonics of the AC drive and improve the power factor, install an AC input reactor on the input side of the AC drive to meet standard requirements.

7.4 Control Circuit Interference

7.4.1 High-speed Pulse Interference

Obverse the following steps for troubleshooting.

No.	Step
1	Use the shielded twisted pair (STP) cable and ground the STP cable at both ends.
2	Connect the motor housing to the PE of the AC drive.
3	Connect the PE of the AC drive to the PE of the mains power supply.
4	Add an equipotential bonding grounding cable between the host controller and the AC drive.
5	Separate the signal cable and power cable by a distance of at least 30 cm.
6	Add a ferrite clamp to the signal cable, or add a magnetic ring and wind the signal cable on it for one to two turns.
7	Add a magnetic ring to the U, V, and W output cables at the drive side and wind the cables for two to four turns.
8	Use a shielded power cable and ground the shield securely.

7.4.2 Common I/O Signal Interference

Due to improper wiring or grounding, the drive might generate strong interference during use. When the drive interferes with other equipment, observe the following steps for troubleshooting.

No.	Step
1	Use the shielded cables as the I/O signal cables, and connect the shield to the PE terminal.
2	Connect the PE terminal of the motor to that of the drive, and connect the PE terminal of the drive to that of the power grid.
3	Add an equipotential bonding grounding cable between the host controller and the drive.
4	Add a magnetic ring to the U, V, and W output cables at the drive side and wind the cables for two to four turns.
5	Increase the capacitance at the low-speed DI. A maximum of 0.1 uF capacitance is suggested.
6	Increase the capacitance at the AI. A maximum of 0.22 uF capacitance is suggested.
7	Add a ferrite clamp to the signal cable, or add a magnetic ring and wind the signal cable on it for one to two turns.
8	Use a shielded power cable and ground the shield securely.

7.5 Communication Interference

7.5.1 RS-485 and CAN Communication Interference

Obverse the following steps for troubleshooting.

Step	Action
1	Add a 120 Ω termination resistor at both ends of the bus.
2	Use the multi-core shielded twisted pair (STP) cable, and ground the shield at both ends.
3	Separate the communication cable from the power cable by a distance of at least 30 cm.
4	For multi-node communication, adopt the daisy chain mode.
5	For multi-node communication, add an equipotential bonding grounding cable between nodes.
6	Add a ferrite clamp at both ends of the communication cable and wind the communication cable for one to two turns.
7	Add a magnetic ring to the U, V, and W output cables at the drive side and wind the cables for two to four turns.
8	Use a shielded power cable and ground the shield securely.

7.5.2 PROFINET Communication Interference

Observe the following steps for troubleshooting.

No.	Step
1	Check that the communication network cables meet the specification requirements for shielded Cat 5e cables.
2	Check that the communication port is not loose or in poor contact.
3	Separate the communication cable from the power cable by a distance of at least 30 cm.
4	For multi-node communication, add an equipotential bonding grounding cable between nodes.
5	Check that the cable between two nodes is no longer than 100 m in length.
6	Add a ferrite clamp at both ends of the communication cable and wind the communication cable for one to two turns.
7	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables for two to four turns.
8	Use a shielded power cable and ground the shield securely.

7.6 Encoder Feedback Signal Error

If an encoder feedback signal error occurs, observe the following steps for troubleshooting.

No.	Step
1	Route the encoder cable and power cable through different cable routes.
2	When the AC drive is far away from the motor (with a 10-meter cable), disconnect the grounding terminal (PE) of the encoder shield from the AC drive side.
3	Install a magnetic ring or ferrite clamp to the encoder signal cable near the AC drive.
4	Install a magnetic ring to the U, V, and W output cables of the drive and wind the cables for two to four turns.
5	Use a shielded power cable and ground the shield securely.

8 Appendix

8.1 AC Drive Dimensions

S4 model dimensions

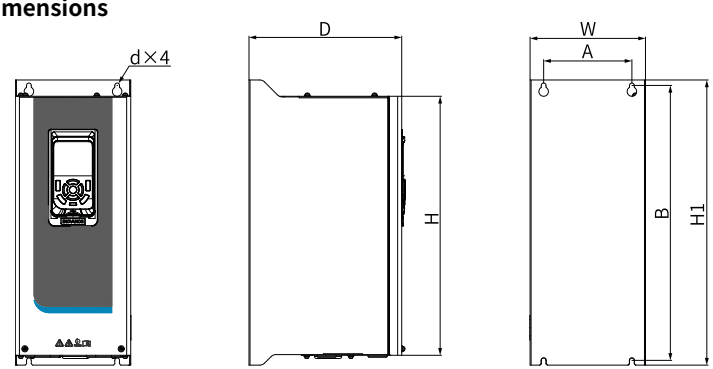


Figure 8-1 Outline dimensions and mounting dimensions of S4 models

Table 8–1 Outline dimensions and mounting dimensions of S4 models

Structure	Mounting Hole mm (in.)	Outline Dimension mm (in.)					Mounting Hole d mm (in.)	Net weight kg (lb)	Gross Weight kg (lb)	Packing Box Size mm
	A	B	H	H1	W	D				L x H x W
S4	130 (5.1)	405 (16)	381.5 (15)	420 (16.5)	170 (6.7)	225 (8.9)	Ø7 (0.3)	11 (24.2)	12 (26.5)	560 x 305 x 270

S5 model dimensions

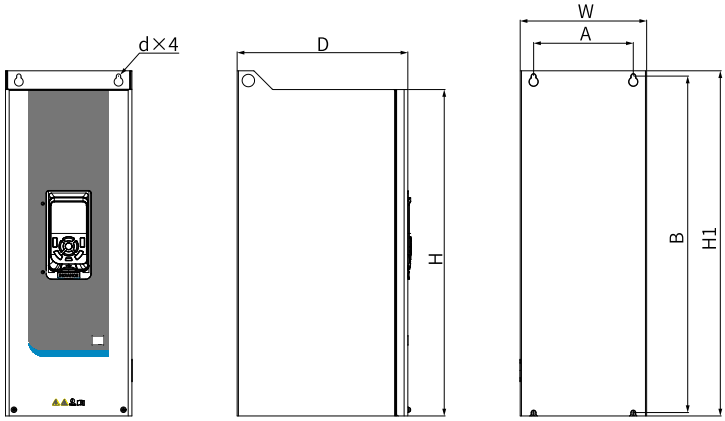


Figure 8-2 Outline dimensions and mounting dimensions of S5 models

Table 8–2 Outline dimensions and mounting dimensions of S5 models

Structure	Mounting Hole mm (in.)	Outline Dimension mm (in.)					Mounting Hole d mm (in.)	Net weight kg (lb)	Gross Weight kg (lb)	Size of packing box mm
	A	B	H	H1	W	D				L x H x W
S5	160 (6.3)	540 (21.3)	524 (20.6)	554 (21.8)	203 (8.0)	274 (10.8)	Ø7 (0.3)	20 (44.1)	22.5 (49.6)	675 x 385 x 295

Dimensions of S6 to S7 Models

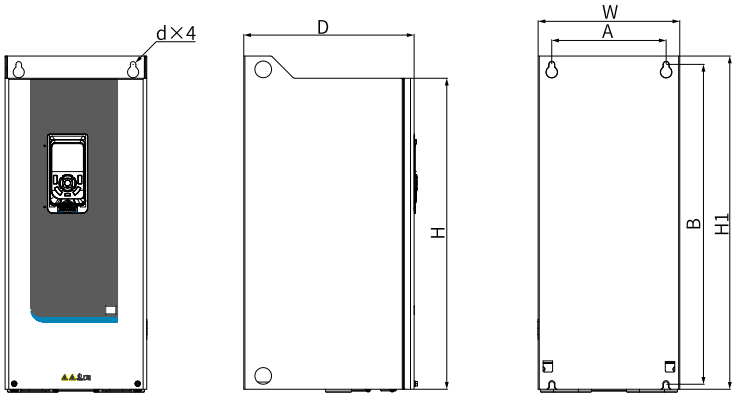


Figure 8-3 Outline dimensions and mounting dimensions of S6 to S7 models

Table 8–3 Outline dimensions and mounting dimensions of S6 to S7 models

Structure	Mounting Hole mm (in.)	Outline Dimension mm (in.)					Mounting Hole d mm (in.)	Net weight kg (lb)	Gross Weight kg (lb)	Size of packing box mm
	A	B	H	H1	W	D				L x H x W
S6 S7	206 (8.1)	576 (22.7)	560 (22.0)	600 (23.6)	255 (10.0)	307 (12.1)	Ø10 (0.4)	34 (74.9)	37 (81.6)	760 x 460 x 340

Dimensions of S8 to S9 Models

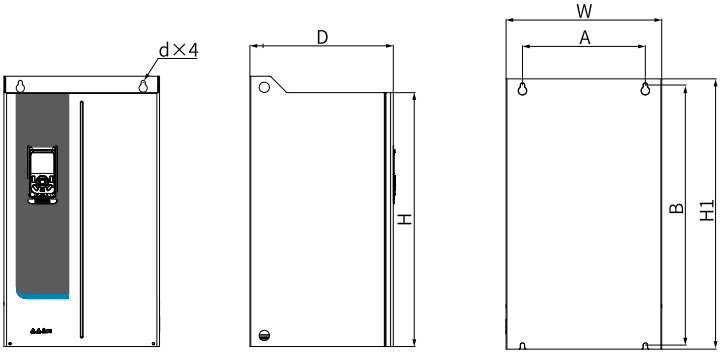


Figure 8-4 Outline dimensions and mounting dimensions of S8 to S9 models

Table 8–4 Outline dimensions and mounting dimensions of S8 to S9 models

Structure	Mounting Hole mm (in.)	Outline Dimension mm (in.)					Mounting Hole d mm (in.)	Net weight kg (lb)	Gross Weight kg (lb)	Size of packing box mm
	A	B	H	H1	W	D				L x H x W
S8 S9	300 (11.8)	635 (25)	620 (24.4)	660 (26)	380 (15)	350 (13.8)	Ø10 (0.4)	62 (136.7)	67 (147.7)	750 x 510 x 440

8.2 System Composition

When the AC drive is used to control asynchronous motors, you must install a variety of electrical devices on the input and output sides of the AC drive to ensure system safety and stability. The following figure shows the system composition of the three-phase 690 V AC drive with the power rating of 0.4 kW and above.

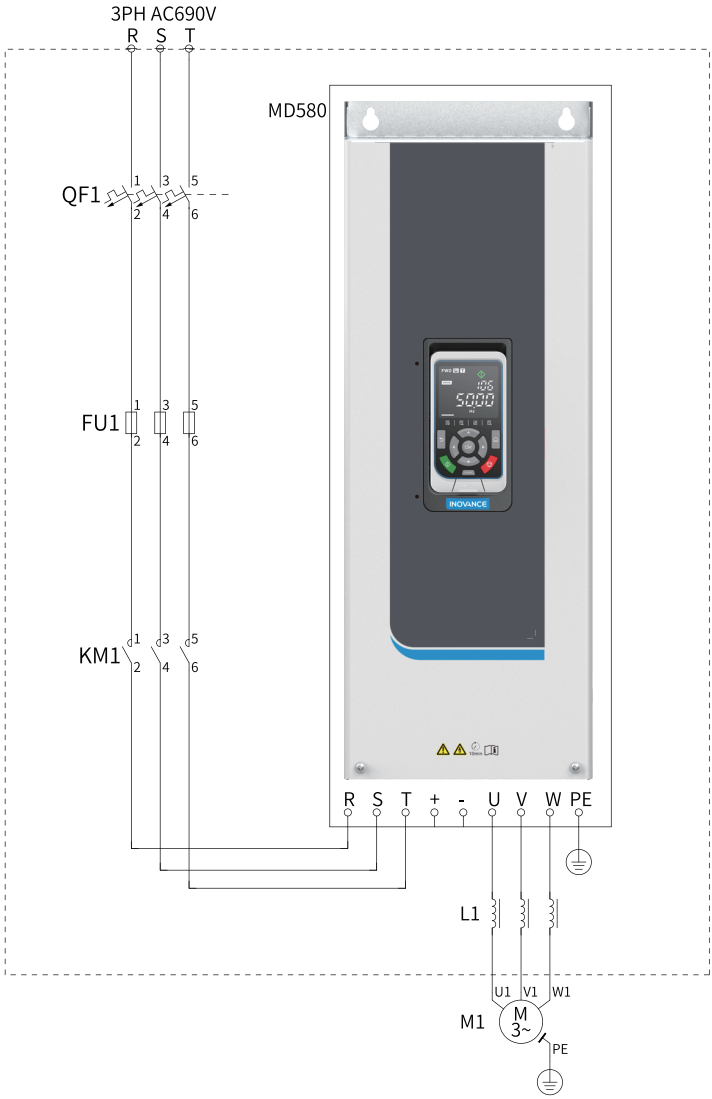


Figure 8-5 System composition

Note

The preceding figure is only for your reference. For details on the external devices, see the external electrical component section in *MD580 Series Low-Voltage High-Performance Engineering Hardware Guide (690 V)*.

Table 8–5 Descriptions of peripheral electrical devices

Name	Position	Description
Circuit breaker	Between the power supply and AC drive input side	Short circuit breaker: It cuts off power supply when overcurrent occurs on downstream devices, so as to prevent accidents.
		Earth leakage circuit breaker: It provides protection against potential high-frequency leakage current during AC drive running to prevent electric shock and even a fire. Select proper earth leakage circuit breakers as needed.
Fuse	Between the power supply and AC drive input side	It protects downstream semiconductor components in case of short circuit.
Electromagnetic contactor	Between the breaker and AC drive input side	It is used to power on or off the AC drive. Do not use the contact to power on or off the AC drive frequently (time interval is at least one hour) or use it to directly start the AC drive.
Braking resistor	Connecting to the BR and DC(+) terminals	Use a braking resistor for S4 models. It consumes regenerative energy during motor deceleration.
Braking unit	Connecting to the DC(+) and DC(-) terminals	For S5 to S9 models, use the braking unit MDBUN of Inovance and the recommended braking resistor. The braking unit or braking resistor consumes regenerative energy during motor deceleration.
Output reactor	Between the AC drive output side and motor and close to the AC drive	Generally, the AC drive generates much high-order harmonics at the output side. When a motor is far away from the AC drive, much distributed capacitance exists in the circuit. Certain harmonics may cause resonance in the circuit, which brings the following adverse effects: • Degrades the motor insulation performance and damages the motor in the long time. • Generates large leakage current and causes frequent AC drive protection trips.
Output magnetic ring	AC drive output side and close to the AC drive	It is used to reduce bearing current.
Motor	AC drive output side	Select an applicable motor.

Note

Do not install a capacitor or surge protection device (SPD) on the output side of AC drive. Otherwise, the AC drive, capacitor, or SPD may be damaged.

8.3 Electrical Wiring

The following figure describes the typical electrical wiring.

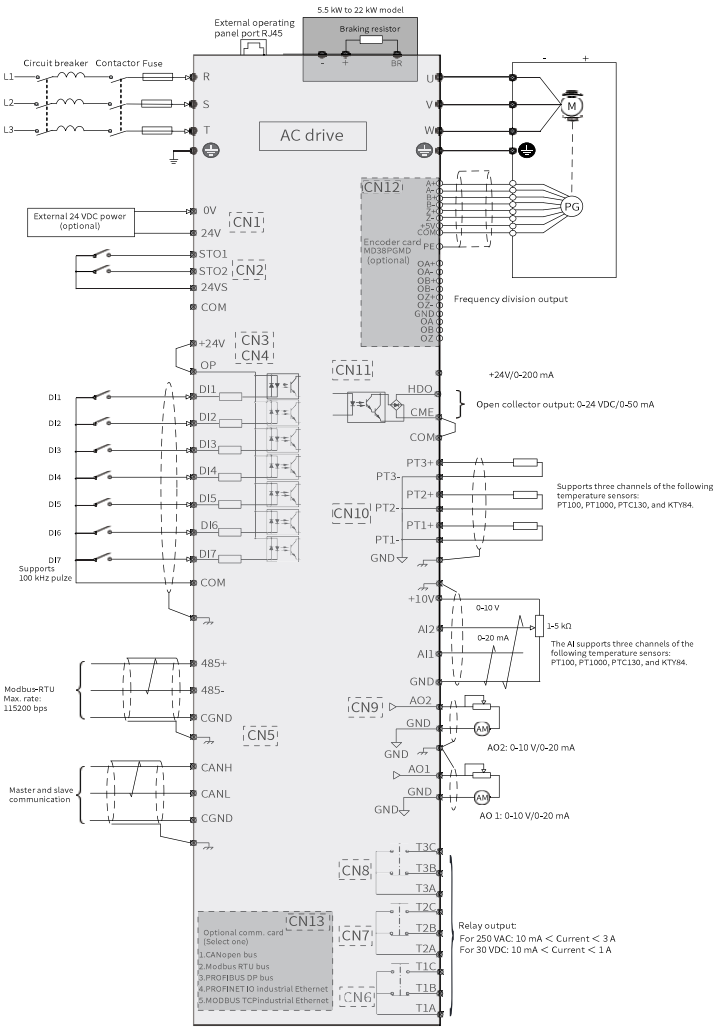


Figure 8-6 Typical electrical wiring

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