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MD580 Series Low-Voltage High-Performance Engineering AC Drive

Installation Guide

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

Data code 19012111A02

Preface

Introduction

The MD580 series is a low-voltage high-performance engineering AC drive that can control three-phase AC permanent magnet synchronous motors and 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 programmable, software monitoring, and communication bus functions, and supports multiple encoder types.

This guide describes the composition, technical specifications, components, dimensions, options (including mounting accessories, cables, and peripheral electrical devices), expansions cards, troubleshooting of common EMC-related problems, certifications, and standards of the AC drive.

More documents

Name	Document Code	Description
MD580 Series Low-voltage High-performance Engineering AC Drive Hardware Guide	19011706	This guide describes the system composition, technical specifications, components, dimensions, options (including installation accessories, cables, and peripheral electrical components), expansion cards, routine inspection and maintenance, certifications, and standards of the AC drive.
MD580 Series Low-Voltage High-Performance Engineering AC Drive Safety Installation Guide.	19012111	This guide describes the installation dimensions, space design, specific installation steps, wiring requirements, routing requirements, option installation requirements, and troubleshooting of common EMC-related problems.
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, communication, 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, commissioning flowchart, and commissioning procedure.

Revision History

Date	Version	Description
August 2023	A02	• Added section 6.6.6 EtherNet/IP Industrial Ethernet Communication. • Added section 6.6.7 EtherCAT Industrial Ethernet Communication. • Added section 7.9 Safe Motor Temperature Detection Card. • Added section 7.10 I/O Card. • Added section 7.11 PG Card. • Updated section 6.4.1 Wiring of Control Circuit Terminals.
November 2022	A01	• Added the mechanical installation tools such as screws required for through-hole mounting in 1.3.1 Mechanical Installation Tools. • Added section 4.5 Through-hole Mounting. • Updated section 4.7 Installing the Grounding Bracket of the Cable Shield. • Added section 7.7 MDKE-10 Installation Bracket. • Added section 7.8 SOP-20-880 Installation Bracket.
March 2022	A00	First release

Access to the Guide

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

- Visit *http://www.inovance.com*, go to Support > Download, search by keyword, and then download the PDF file.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install the app, where you can search for and download manuals.

Warranty

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

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

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

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

For details, see the Product Warranty Card.

Table of Contents

Product Models

Table –1 Relationship between product structures and models

Structure	Model (Three-Phase 380 V to 480 V)
T1	MD580-4T2R1B MD580-4T3R1B MD580-4T3R8B MD580-4T5R1B MD580-4T7R2B MD580-4T9B
T2	MD580-4T13B MD580-4T17B
T3	MD580-4T25B MD580-4T32B
T4	MD580-4T37B
T5	MD580-4T45 MD580-4T45B MD580-4T60 MD580-4T60B
T6	MD580-4T75 MD580-4T75B MD580-4T91 MD580-4T91B
T7	MD580-4T112 MD580-4T112B MD580-4T150 MD580-4T150(B)
T8	MD580-4T176 MD580-4T176(B) MD580-4T210 MD580-4T253
T9	MD580-4T304 MD580-4T377
T10	MD580-4T426 MD580-4T426-L MD580-4T465 MD580-4T465-L
T11	MD580-4T520 MD580-4T520-L MD580-4T585 MD580-4T585-L
T12	MD580-4T650 MD580-4T650-L MD580-4T725 MD580-4T725-L MD580-4T820 MD580-4T820-L

Fundamental Safety Instructions

Safety Precautions

- This chapter presents essential safety instructions for a proper use of the equipment. Before using this product, read the user guide thoroughly and correctly understand the related safety precautions. 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.
- Users must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking

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

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

Storage and Transportation

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

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

Installation

- The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed.

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

- Do not connect the input power supply to the output end of the equipment. Failure to comply can result in equipment damage or even 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.

- Follow the proper electrostatic discharge (ESD) procedure and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or to the internal circuit of the product.
- 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

DANGER

- 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.

WARNING

- 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

DANGER

- 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.

WARNING

- 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

DANGER

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

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

Repair

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

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

Disposal

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

Safety label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the meaning 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 Requirements

1.1 Installation Flowchart

T1 to T19 models

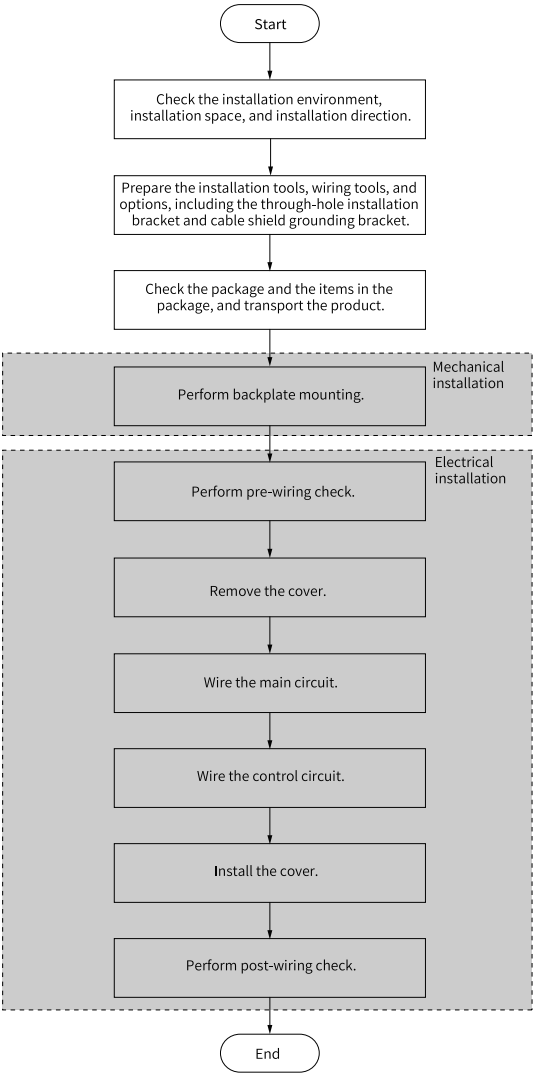


Figure 1-1 General installation process (T1 to T9 models)

T10 to T12 Models

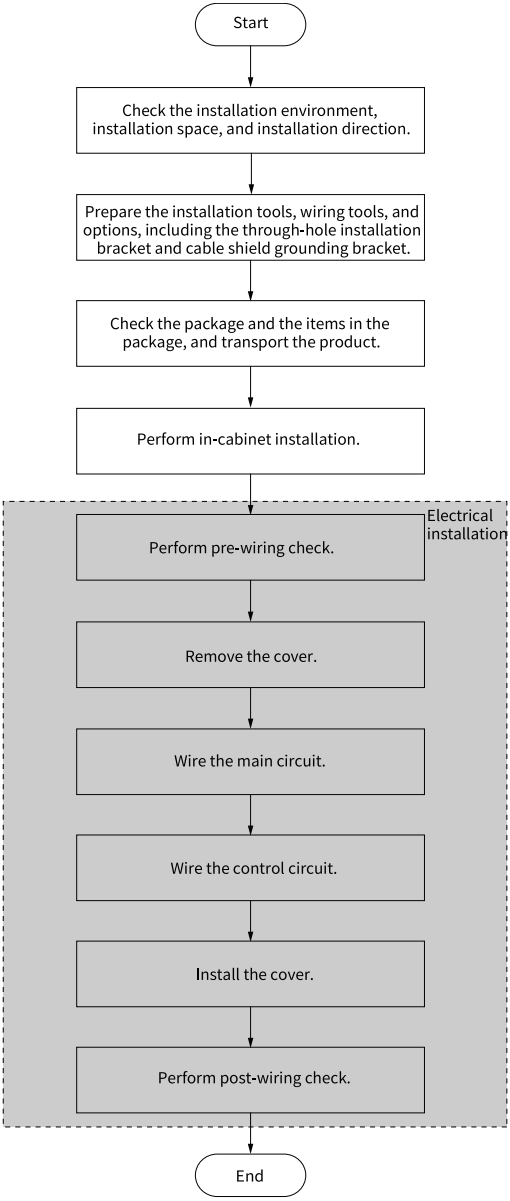


Figure 1-2 General installation process (T10 to T12 models)

1.2 Installation Site Inspection

1.2.1 Installation Environment

Table 1–1 Environmental requirements

Item	Requirement
Installation location	Indoors
Grid overvoltage	Overvoltage category (OVC): III
Temperature	Installation/Operation: –10°C to +50°C (–10°C to +40°C: no derating; over +40°C: Derate 1.5% for every additional 1°C) Storage/Transportation: –20°C to +60°C • For better reliability, use the AC drive in places without sharp 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 overtemperature or fire. • Install the AC drive on a flame retardant object, with sufficient clearance reserved for heat dissipation. • Avoid freezing of the AC drive.
Humidity	Below 95% RH (non-condensing)
Environment	Pollution degree: 2 or below Install the AC drive in a place: • without direct sunlight, dust, corrosive gas, combustible or explosive gas, oil mist, water vapor, drip, and salt. • without vibration, especially vibration caused by equipment such as punch presses. • without foreign objects such as metal powder, oil, and water that may enter the AC drive. • without radioactive materials, combustible materials, hazardous gas and liquid, and salt corrosion. • providing a support made of materials other than combustibles such as timber.
Altitude	• 1000 m and below: no derating. • Above 1000 m: Derate 1% for every additional 100 m. 0.75 kW to 3.7 kW models: maximum 2000 m. Consult Inovance for use above 2000 m. 3.7kW models and above: maximum 3000 m. Consult Inovance for use above 3000 m.
Vibration resistance	• Transportation with packaging: Class 2M3 requirements in EN 60721-3-2 • Installation without packaging: compliant with ISTA 1H

1.2.2 Installation Clearance

T1 to T9 models

- Installing one drive

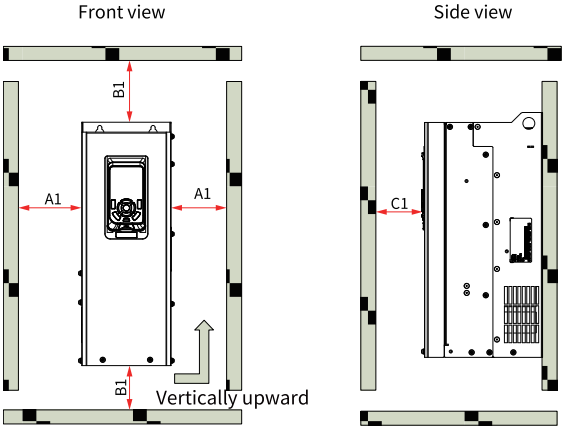


Figure 1-3 Clearance for installing one AC drive (T1 to T9 models)

Table 1–2 Installation clearance

Power Rating	Clearance (mm)		
0.75 kW to 18.5 kW	A1 ⩾ 10	B1 ⩾ 100	C1 ⩾ 40
22 kW to 30 kW	A1 ⩾ 10	B1 ⩾ 200	C1 ⩾ 40
37 kW to 45 kW	A1 ⩾ 50	B1 ⩾ 200	C1 ⩾ 40
55 kW to 200 kW	A1 ⩾ 50	B1 ⩾ 300	C1 ⩾ 40

- Installing multiple 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.

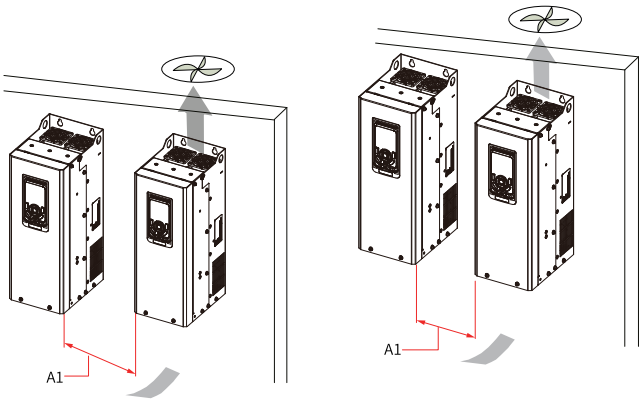


Figure 1-4 Installing multiple AC drives (T1 to T9 models) side by side

Table 1–3 Installation clearance

Power Rating	Clearance (mm)
0.75 kW to 18.5 kW	A1 ⩾ 10
22 kW to 30 kW	A1 ⩾ 10
37 kW to 45 kW	A1 ⩾ 50
55 kW to 200 kW	A1 ⩾ 50

- Dual-row installation
  If one drive needs to be installed above another one, install an air guide plate, as shown in *"Figure 1–5 Installing one above another (T1 to T9 models)" on page 20*. This can prevent the drive in the lower row from heating that in the upper row, causing overheat or overload faults.

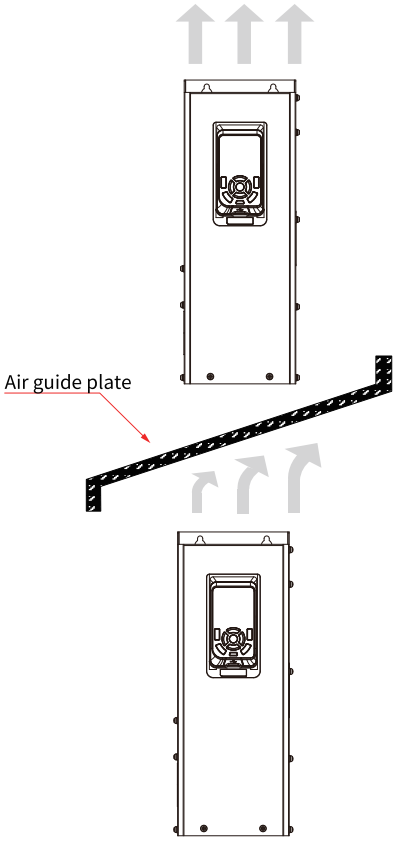


Figure 1-5 Installing one above another (T1 to T9 models)

T10 to T12 models

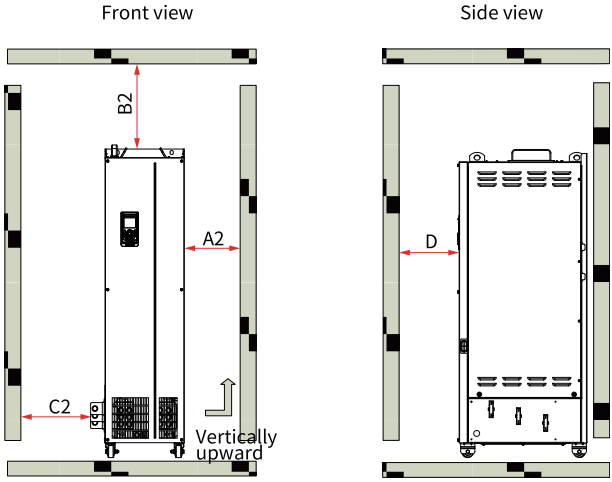


Figure 1-6 Installation clearance (T10 to T12 models)

Table 1–4 Installation clearance

Power Rating	Clearance (**mm**)			
220 kW to 450 kW	A2 ⩾ 10	B2 ⩾ 250	C2 ⩾ 20	D2 ⩾ 20

Note

T10 to T12 models can only be installed individually inside the cabinet. For installation needs, contact Inovance.

1.2.3 Direction

Install the AC drive vertically upward only, as shown in *"Figure 1–8 " on page 22* . Do not lie down the AC drive horizontally or by its side, or install it in the upside-down direction.

Do not stress on any side of the AC drive or place it on an inclined surface. The AC drive is large and heavy (close to 200 kg). If the inclination exceeds 5°, it may topple.

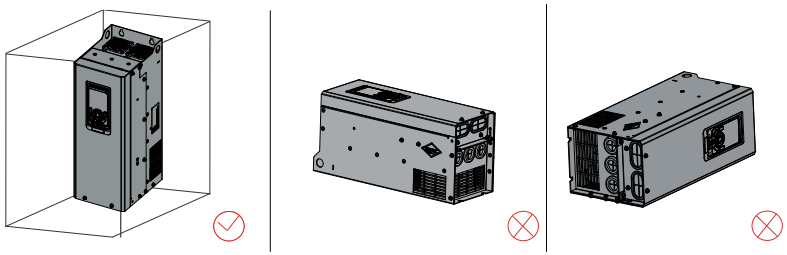


Figure 1-7 Installation direction (T1 to T9 models)

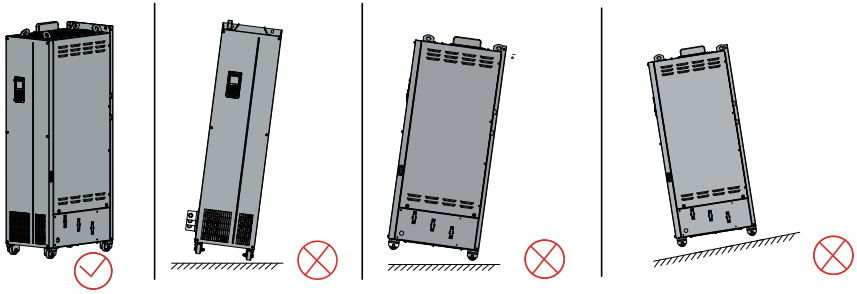


Figure 1-8 Installation direction (T10 to T12 models)

1.3 Installation Tool

1.3.1 Tools for Mechanical Installation

T1 to T9 models

"Table 1–5 Tools for mechanical installation" on page 22 lists the tools for mechanical installation.

Table 1–5 Tools for mechanical installation

Tool	Description
Electric drill with appropriate drilling bits	It is used to drill mounting holes on the mounting surface.
Nut wrench or socket wrench	It is used to tighten or loosen screws. Wrench sizes include 13 mm, 16 mm, and 18 mm.
Phillips and straight (2.5–6 mm) screwdrivers	It is 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.

Tool	Description
Crane	It is used to lift the equipment.
Tape measure	It is used to measure the installation dimensions of the equipment.
Gloves	It is used to prevent static electricity.
Bottom mounting bracket (standard)	When the AC drive is installed in a cabinet, a bottom mounting bracket is used to fix it in the cabinet.
Guide rails (optional)	When the AC drive is installed in a cabinet, the guide rails are connected to the bottom mounting bracket, allowing the AC drive to be smoothly pushed into the cabinet along the guide rails.
Screws	It is used to fix the equipment to the mounting surface.

"Table 1–6 Specifications and quantities of screws" on page 23 lists the specifications and quantities of screws required for mechanical installation.

Table 1–6 Specifications and quantities of screws

Installation Method	Specification	Quantity (PCS)	Description
Backplate mounting	Dependent on the mounting hole diameter (purchased by the user).	4	Used to fix the equipment onto the wall.
Through-hole mounting	Dependent on the mounting hole diameter (purchased by the user).	4	Used to fix the AC drive onto the backplate of the control cabinet.

T10 to T12 models

"Table 1–5 Tools for mechanical installation" on page 22 lists the tools for mechanical installation.

"Table 1–7 Specifications and quantities of screws" on page 24 lists the specifications and quantities of screws required for mechanical installation.

Table 1–7 Specifications and quantities of screws

Installation Method	Specification	Quantity (PCS)	Description
Installation in a cabinet	M5 self-tapping screw	6	Used to fix the bottom mounting bracket to the bottom of the cabinet.
	M5 x 12 SEMS screw	8	Used to assemble the guide rail.
	M6	2	Used to connect the guide rail assembly to the bottom mounting bracket.

1.3.2 Tools for Wiring

For wiring of main circuit terminals, use installation tools appropriate to terminal dimensions and secure the joints well. *"Table 1–8 Tools for wiring of main circuit terminals" on page 24* lists the tools required for wiring of the main circuit terminals.

Table 1–8 Tools for wiring of main circuit terminals

AC Drive Model	Recommended Fastener	Tool
T1 and T2	M4 SEMS screw	Phillips screwdriver (#3 slot)
T3 and T4	M5 SEMS screw	Phillips screwdriver (#3 slot)
T5 and T6	M6 SEMS screw	Phillips screwdriver (#3 slot)
T7	M8 nut, spring washer, and flat washer	Socket wrench (#13 socket)
T8 and T9	M12 nut, spring washer, and flat washer	Socket wrench (#19 socket) and socket wrench extension bar (150 mm)
T10 and T11	M12 bolt, spring washer, and flat washer	Socket wrench (#19 socket) and socket wrench extension bar (250 mm)
T12	M16 bolt, spring washer, and flat washer	Socket wrench (#24 socket) and socket wrench extension bar (250 mm)

1.4 Required Accessories

Peripheral accessories include braking units, function expansion cards, and external operators, as shown in the following table. For use of each accessory, see the corresponding user guide. If any option is required, specify it in your order.

Table 1–9 List of options for the AC drive

Name		Option Model	Supported AC Drive Model	Description
Braking components	Built-in braking unit	Models containing letter "B"	-	Standard for 0.4G/0.75P to 15G/18.5P models and optional for 18.5G/22P to 75G/90P models
	External braking unit	MDBUN-60-T	For 90G/110P models and above, multiple external braking units are connected in parallel.	External braking unit for 90G/110P models and above
		MDBUN-60-5T		
		MDBUN-90-T		
		MDBUN-90-5T		
		MDBUN-200-T		
		MDBUN-200-5T		
Expansion card	CANopen communication card	MD580–SI-CAN1	Available for all models	CANopen bus adaption
	Modbus RTU communication card	MD580–SI-RS1	Available for all models	Modbus RTU bus adaption
	PROFIBUS DP communication card	MD580–SI-DP1	Available for all models	PROFIBUS DP bus adaption
	PROFINET IO communication card	MD580–SI-PN1	Available for all models	PROFINET IO industrial Ethernet
	Modbus TCP communication card	MD580–SI-EM1	Available for all models	Modbus TCP industrial Ethernet
	EtherCAT communication card	MD580-SI-ECAT1	Available for all models	EtherCAT communication
	EtherNet/IP communication card	MD580-SI-EN1	Available for all models	EtherNet/IP communication
	Safe motor temperature detection card	MD580-HSMT-ATEX1	Applicable to T1-T3 models	When the PTC in the motor is overheated, the detection card will disable the DO and activate the STO.
		HSMT-10	Applicable to T4-T12 models	
	I/O expansion card	MD580-IO-RD1	Available for all models	It provides two AIs, two AOs, four DIs, and two ROs.
	ABZ and SSI dual-encoder card	MD580-PG-AR1	Available for all models	Supports full closed-loop control; supports TTL level ABZ encoder and SSI encoder; provides the DB15 interface.
	Sin-cos and SSI dual-encoder expansion card	MD580-PG-AS1	Available for all models	Supports full closed-loop control; supports ±1 Vpp sin-cos encoder and SSI encoder; provides the DB15 interface.
	Resolver interface card	MD38PG4	Available for all models	Applicable to the resolver with the excitation frequency of 10 kHz and with the DB9 interface

Name		Option Model	Supported AC Drive Model	Description
Expansion card	MD38PGMD multi-function encoder card	MD38PGMD	Available for all models	The MD38PGMD card supports differential input, collector input, push-pull input, as well as differential output and collector output; therefore, it can be used to connect to different encoders and supports A/B phase input of the host controller.
Cables	LED operating panel	MDKE-10	Available for all models	Connected through the RJ45 interface
	External LCD operating panel	SOP-20-880	Available for all models	Supports parameter copy and download
	SOP-20-880 mounting base	CP600-BASE1	Available for all models	The SOP-20-880 can be installed to the cabinet door by using the mounting base.
	MDKE-10 mounting base	MD580-AZJ1	Available for all models	The MDKE-10 can be installed to the cabinet door by using the mounting base.
	Extension cable	MDCAB	Available for all models	Standard 8-conductor network cable in the length of three meters, which can be connected to the LED/LCD operating panel
	Main circuit cable	Lugs manufactured by Suzhou Yuanli are recommended. For details on the lug selection, see the section main circuit cable selection in *MD580 Series Low-Voltage High-Performance Engineering AC Drive Hardware Guide*.	-	It is recommended that the input and output main circuit cables use symmetrical shielded cables. Compared with four-conductor cables, symmetrical shielded cables can reduce electromagnetic radiation in the whole transmission system. It is recommended that power cables also use symmetrical shielded cables.
	Control circuit cables	All control circuit cables must be shielded cables. Use a separate shielded cable for each type of analog signal. Use shielded twisted pair cables for digital signals.	-	-

Name		Option Model	Supported AC Drive Model	Description
Mounting accessories	Mounting rail	MD500-AZJ-A3T10	Optional (T10 to T12 models)	Used for installing the AC drive to the cabinet
	Grounding bracket of the control cable shield<1>	MD580-AZJ-A3T1	Optional (T1 to T9 models)	The accessory is used for re-fixing the control cable and stable grounding of the shield in 360°. It applies only to T1 to T9 models.
		MD580-AZJ-A3T2		
		MD580-AZJ-A3T3		
		MD580-AZJ-A3T4		
		MD580-AZJ-A3T5		
		MD580-AZJ-A3T6		
		MD580-AZJ-A3T7		
		MD580-AZJ-A3T8		
		MD580-AZJ-A3T9		
	Grounding bracket of power cable shield	MD580-AZJ-A1T1	Optional (T1 to T9 models)	The accessory is used for re-fixing the power cable and stable grounding of the shield in 360°. It applies only to T1 to T9 models.
		MD580-AZJ-A1T2		
		MD580-AZJ-A1T3		
		MD580-AZJ-A1T4		
		MD580-AZJ-A1T5		
		MD580-AZJ-A1T6		
		MD580-AZJ-A1T7		
		MD580-AZJ-A1T8		
		MD580-AZJ-A1T9		
Mounting accessories	U/V/W output copper busbar	MD500-TP-T10	T10	MD580 models excluding that with the base (-L) are delivered with the U/V/W output copper busbar.
		MD500-TP-T11	T11	
		MD500-TP-T12	T12	
	Through-hole mounting bracket	MD580-AZJ-A2T1	Optional (T1 to T9 models)	The bracket is used for through-hole mounting. It applies only to T1 to T9 models.
		MD580-AZJ-A2T2		
		MD580-AZJ-A2T3		
		MD580-AZJ-A2T4		
		MD580-AZJ-A2T5		
		MD580-AZJ-A2T6		
		MD580-AZJ-A2T7		
		MD580-AZJ-A2T8		
		MD580-AZJ-A2T9		
	MDKE10 bracket	MD580-AZJ1	Optional (applicable to all models)	The accessory can be used to install the operating panel to the cabinet. It is applicable to all models.
	SOP-20-880 bracket	CP600-BASE1	Optional (applicable to all models)	The accessory can be used to install the LCD operating panel. It is applicable to all models.

Note

<1>: See *"4.7 Installing the Grounding Bracket of the Cable Shield" on page 60* for related content.

2 AC Drive Dimensions

2.1 T1 to T9 Models

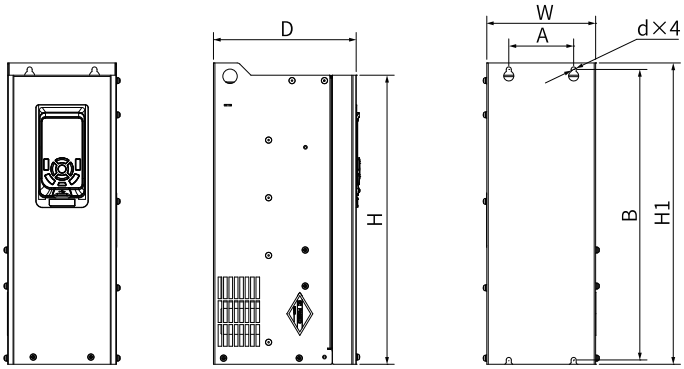


Figure 2-1 Installation dimensions of T1 to T6 models

Table 2–1 Dimensions of T1 to T6 models

Structure	Mounting Hole Spacing mm (in.)		Outline Dimensions mm (in.)				Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A	B	H	H1	W	D		
T1	90 (3.5)	380 (15.0)	381 (15.0)	395 (15.6)	151 (5.9)	175 (6.9)	Ø7 (0.3)	6.2 (13.6)
T2	90 (3.5)	380 (15.0)	381 (15.0)	395 (15.6)	151 (5.9)	181.5 (7.2)	Ø7 (0.3)	7 (15.4)
T3	90 (3.5)	403 (15.9)	404 (15.9)	418 (16.5)	151 (5.9)	198 (7.8)	Ø7 (0.3)	8.2 (18.0)
T4	120 (4.7)	427 (16.8)	427 (16.8)	442 (17.4)	185 (7.3)	203 (8.0)	Ø7 (0.3)	9.9 (21.8)
T5	170 (6.7)	468.5 (18.5)	460 (18.1)	486 (19.1)	210 (8.3)	224 (8.8)	Ø7 (0.3)	14.9 (32.8)
T6	200 (7.9)	438 (17.3)	429 (16.9)	455 (17.9)	250 (9.9)	252.5 (9.9)	Ø7 (0.3)	23.7 (51.9)

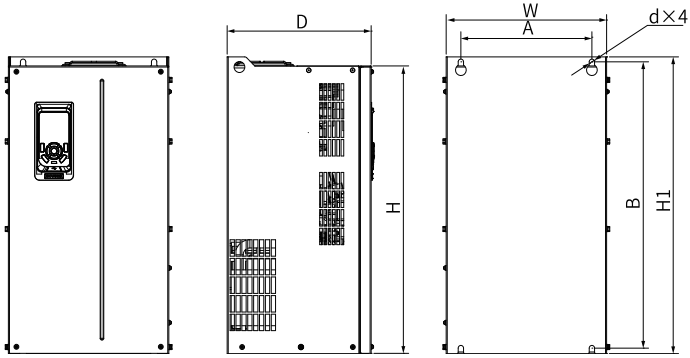


Figure 2-2 Installation dimensions of T7 to T9 models

Table 2–2 Dimensions of T7 to T9 models

Structure	Mounting Hole Spacing mm (in.)		Outline Dimensions mm (in.)				Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A	B	H	H1	W	D		
T7	245 (9.7)	523 (20.6)	525 (20.7)	542 (21.4)	300 (11.8)	269 (10.6)	Ø10 (0.4)	35 (77.2)
T8	270 (10.6)	560 (22.1)	554 (21.8)	580 (22.9)	338 (13.3)	309.4 (12.2)	Ø10 (0.4)	51.5 (113.5)
T9	320 (12.6)	890 (35.1)	874 (34.4)	915 (36.1)	400 (15.8)	314.6 (12.4)	Ø10 (0.4)	85 (187.4)

2.2 T10 to T12 Models (Without AC Output Reactor)

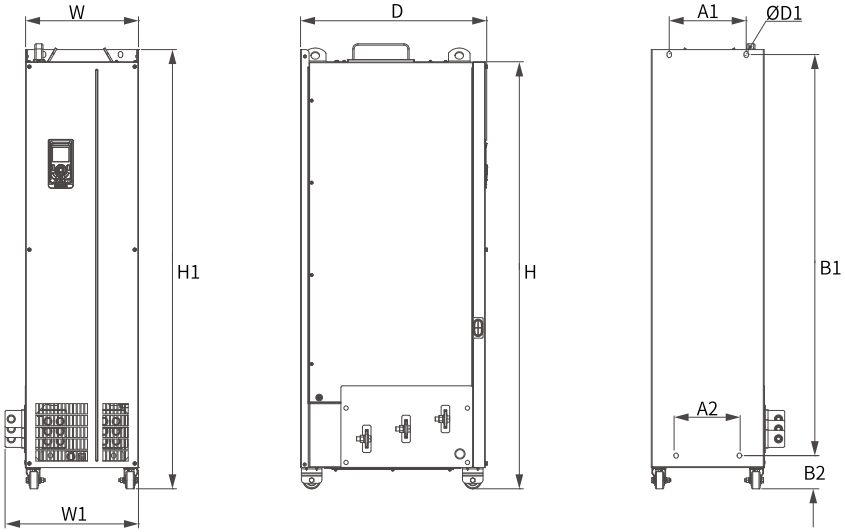


Figure 2-3 Outline dimensions and mounting dimensions of T10 to T12 models (without AC output reactor)

Table 2–3 Outline dimensions and mounting dimensions of T10 to T12 models (without AC output reactor)

Structure	Mounting Hole mm (in.)				Outline Dimensions mm (in.)					Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
T10	240 (9.5)	150 (5.9)	1035 (40.8)	86 (3.4)	1086 (42.8)	1134 (44.7)	300 (11.8)	360 (14.2)	500 (19.7)	ϕ13(0.5)	110 (242.5)
T11	225 (8.9)	185 (7.3)	1175 (46.3)	97 (3.8)	1248 (49.2)	1284 (50.6)	330 (13.0)	390 (15.4)	545 (21.5)	ϕ13(0.5)	155 (341.7)
T12	240 (9.5)	200 (7.9)	1280 (50.4)	101 (4.0)	1355 (53.4)	1405 (55.4)	340 (13.4)	400 (15.8)	545 (21.5)	ϕ16(0.6)	185 (407.9)

2.3 T10 to T12 Models (with AC Output Reactor)

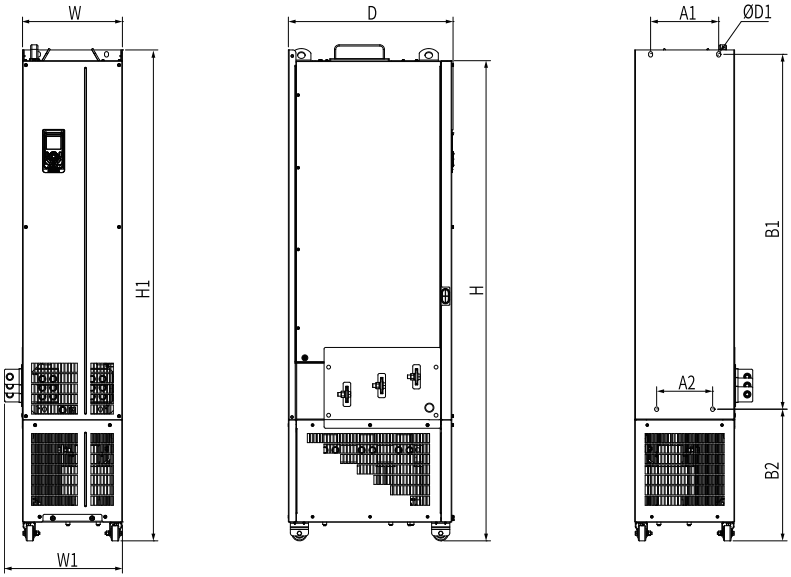


Figure 2-4 Installation dimensions of T10 to T12 models (with AC output reactor)

Table 2–4 Installation dimensions of T10 to T12 models (with AC output reactor)

Structure	Mounting Hole Spacing mm (in.)				Outline Dimensions mm (in.)					Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
T10	240 (9.5)	150 (5.9)	1035 (40.8)	424 (16.7)	1424 (56.1)	1472 (58.0)	300 (11.8)	360 (14.2)	500 (19.7)	ϕ13 (0.5)	160 (352.7)
T11	225 (8.9)	185 (7.3)	1175 (46.3)	435 (17.1)	1586 (62.5)	1622 (63.9)	330 (13.0)	390 (15.4)	545 (21.5)	ϕ13 (0.5)	215 (474.0)
T12	240 (9.5)	200 (7.9)	1280 (50.4)	432 (17.0)	1683 (66.3)	1733 (68.3)	340 (13.4)	400 (15.8)	545 (21.5)	ϕ16 (0.6)	245 (540.1)

3 Unpacking Inspection

3.1 Package Check

When receiving goods from the shipping company, check that you have received all the items specified on the delivery note. Notify the shipping company immediately of any missing components or damage. If necessary, seek support from the Inovance office or your local agent.

AC drives of different structural dimensions are different in size and weight, and hence are packed in different methods with different components incorporated.

Caution

The electrical safety performance of the drive may be affected if it is damaged during transportation. Perform professional high-voltage test on the drive before connection.

Packing list for T1 to T9 models

- T1 and T6 models are packed in cartons.
- T7 to T9 models are packed using cartons and plywood pallets.

The following shows the packing list.

- Packing list for T1 to T6 models

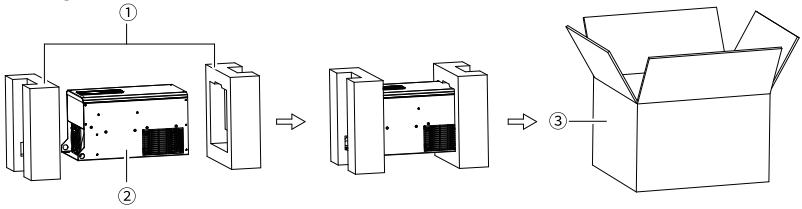


Figure 3-1 Packing list for T1 to T6 models

No.	Name
□	Cushion
□	AC drive
□	Carton

- Packing list for T7 to T9 models

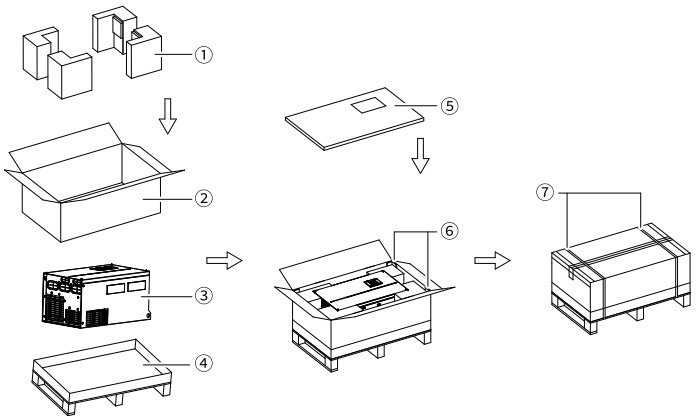


Figure 3-2 Packing list for T7 to T9 models

No.	Name
□	Cushion
□	Carton
□	AC drive
□	Plywood pallet
□	Honeycomb cardboard
□	Paper corner protector
□	Strapping band

Packing list for T10 to T12 models

- T10 to T11 models are packed using cartons and plywood pallets.
- T12 models are packed using wooden crates.

The following shows the packing list.

- Packing list for T10 models

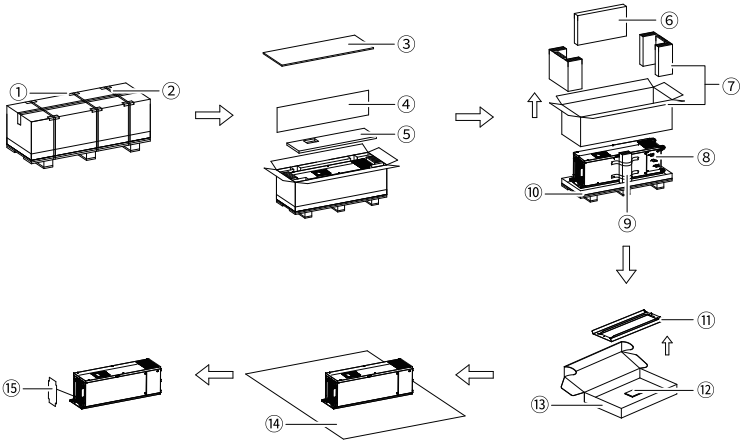


Figure 3-3 Packing list for T10 models

No.	Name
□	Paper corner protector
□	Strapping band
□	9 mm wooden board
□	Corrugated cardboard
□	Honeycomb cardboard
□	Bracket box
□	Carton
□	AC drive
□	Paper column
□	Wooden pallet
□	Bracket
□	User guide
□	Carton
□	Plastic bag
□	Corrugated cardboard

- Packing list for T11 model

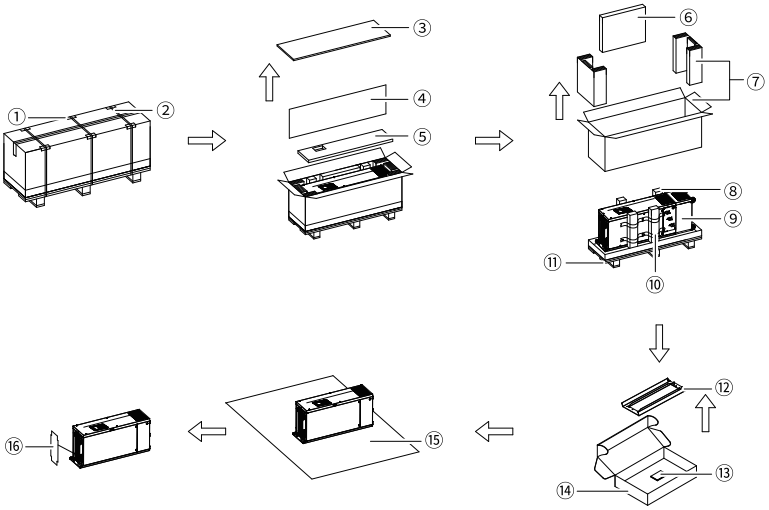


Figure 3-4 Packing list for T11 models

No.	Name
□	Paper corner protector
□	Strapping band
□	9 mm wooden board
□	Corrugated cardboard
□	Honeycomb cardboard
□	Bracket box
□	Carton
□	Paper column
□	AC drive
□	Paper column
□	Wooden pallet
12	Bracket
□	User guide
□	Carton
□	Plastic bag
□	Corrugated cardboard

- Packing list for T12 model

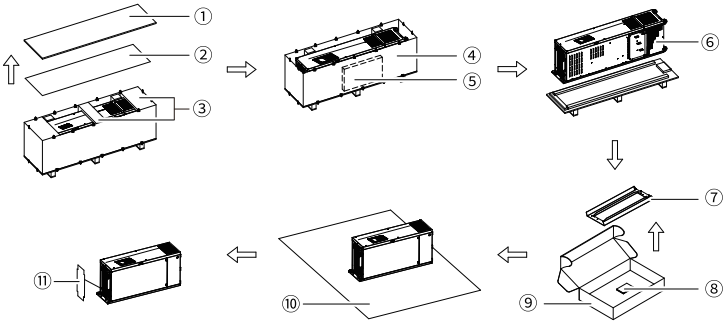


Figure 3-5 Packing list for T12 models

No.	Name
□	Cover
□	Corrugated cardboard
□	Expanded polyethylene foam
□	Wooden crate
□	Bracket box
□	AC drive
□	Bracket
□	User guide
□	Carton
□	Plastic bag
□	Corrugated cardboard

3.2 Storage

- Store the drive in a clean and dry space, with an ambient temperature ranging from –20°C to +60°C and a temperature change rate less than 1°C/min.
- For long time storage, cover the drive or take other appropriate measures to keep it from contamination and environmental influences.
- For storage, pack the drive with the original packing box provided by Inovance.
- Do not expose the drive to moisture, high temperature, or outdoor direct sunlight for an extended period.
- To avoid degradation of electrolytic capacitor during long-term storage, energize the drive once every six months, each time lasting at least 5 hours. Use a regulator to increase the input voltage gradually to the rated value. For any doubt, contact Inovance.

3.3 Transportation Before Unpacking

T1 to T12 models

Precautions for transportation of T1 to T12 models:

- T1 to T6 models are small and light and therefore can be handled manually. T7 to T12 models, however, must be transported with an appropriate lifting tool.
- Fix the drive to a wooden pallet when handling with a forklift. When handing with a crane, fix the drive to the pallet, as shown below.

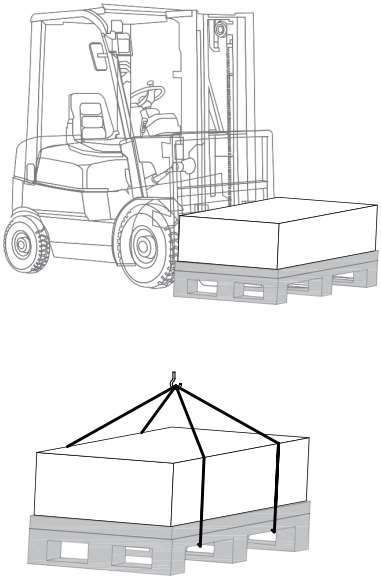


Figure 3-6 Lifting the drive

- T9 to T12 models are heavy with a high center of gravity. Therefore, avoid placing them on an inclined surface with an inclination greater than 5 degrees. The AC drive must be placed on a flat and firm ground that can bear its weight.
- Transport the AC drive only when it is upright as indicated on the packaging box, as shown in the following figure. Never turn it upside down or place it on its side.

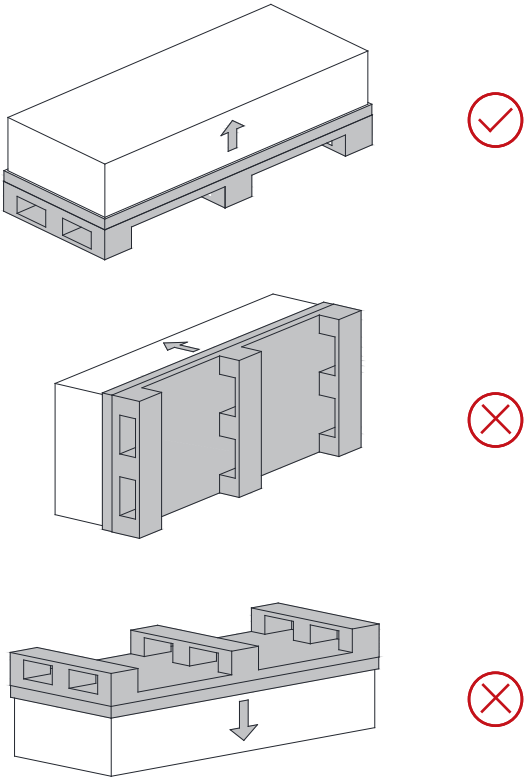


Figure 3-7 Placing the drive

3.4 Unpacking

T1 to T12 models

The documentation suite and accessories are placed in different partitions in the package. To unpack, follow these steps:

1. Remove all the strapping band and the cover of the package.
2. Remove all filler materials.
3. Take out the AC drive.
4. Cut and remove the plastic wrap around the AC drive.
5. Ensure there is no sign of damage.
6. Dispose of or recycle the packaging according to local regulations.

3.5 Handling and Hoisting After Unpacking

T1 to T6 models are small and light and therefore can be handled manually. T7 to T12 models, however, must be transported with an appropriate lifting tool.

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

Precautions for handling and hoisting:

- Handle the equipment in accordance with local laws and regulations.
- Avoid handling the AC drive by directly holding its upper cover or enclosure. Before moving it, check that all screws have been tightened. Failure to comply may result in AC drive fall-off, causing personal injury.
- For T10 to T12 models, when fastening the AC drive, ensure that the four backplate mounting holes on the back of the AC drive are securely connected to the fixing beam.
- Straighten the flat-lying equipment before further 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 can lead to personal injury.
- When lifting the AC drive with the lifting rope, avoid subjecting the AC drive to excessive vibration or impact. Failure to comply can lead to personal injury.
- When lifting the AC drive with the lifting rope, do not turn the AC drive or leave it suspended for long time. Failure to comply can lead to personal injury.

T1 to T9 models

To lift T1 to T9 models, do as follows:

1. Hook the lifting rope to the two auxiliary lifting lugs at the top of the drive.
   It is recommended that the lifting angle be greater than 45 degrees and the height fluctuation be no greater than 0.3 m.

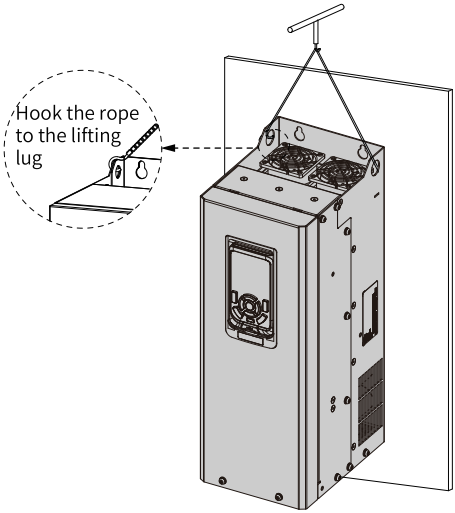


Figure 3-8 Hoisting diagram for T1 to T9 models

2. Roll up the lifting rope slowly with a crane. After the lifting rope is fully stressed, lift the drive up.
3. Lower the drive down slowly, with a pause at a certain height midway, then continue until the drive reaches the ground or mounting surface. Finally, install the drive to the control cabinet.

T10 to T12 Models

To lift T10 to T12 models, do as follows:

1. Hook the lifting lugs at the top of the drive and the lifting holes at the bottom of the drive, take out the AC drive from the packing box, and lay it flat on the floor. Ensure that there is no stress on the positive and negative bus terminals.

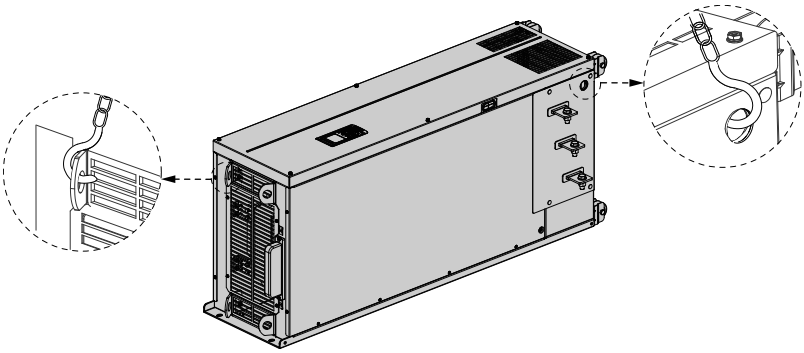


Figure 3-9 Hoisting diagram for T10 to T12 models

2. Hook the lifting rope to the lifting lugs diagonally placed at the top of the AC drive, slowly place the AC drive upright, and install it inside the cabinet.

Avoid applying stress on any side of the AC drive or placing it on an inclined surface. The AC drive is large and heavy (close to 200 kg). If the inclination angle exceeds 5°, it may topple.

4 Mechanical Installation (T1 to T9 Models)

4.1 Installation Method

T1 to T9 models can be installed by the backplate mounting or through-hole mounting method.

4.2 柜体设计

4.2.1 Overview

Before installing the AC drive in the cabinet, design the cabinet to ensure sufficient clearances for installation and heat dissipation. Take the following factors into consideration:

- Cabinet clearances
- Mounting backplate
- Cabinet heat dissipation

4.2.2 In-Cabinet Clearance

For T1 to T9 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 4–1 Minimum clearance for multi-layer installation

Item	T1 and T4	T5	T6	T7 and T9
S1	⩾ 100 mm	⩾ 200 mm	⩾ 200 mm	⩾ 300 mm
S2	⩾ 100 mm	⩾ 200 mm	⩾ 200 mm	⩾ 300 mm
...	⩾ 100 mm	⩾ 200 mm	⩾ 200 mm	⩾ 300 mm
Sn	⩾ 100 mm	⩾ 200 mm	⩾ 200 mm	⩾ 300 mm

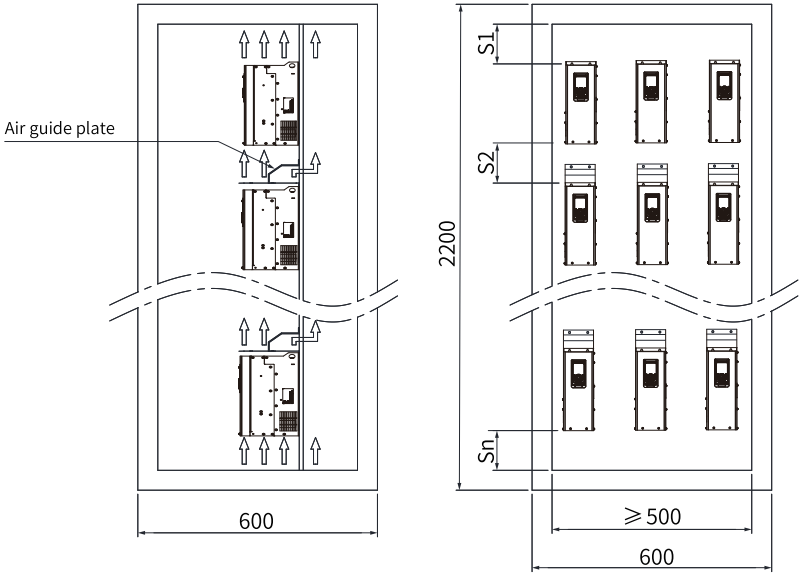


Figure 4-1 Minimum clearance for multi-layer installation

Note

Observe the ventilation direction when installing the fan to ensure smooth discharge of hot air. Failure to comply may cause failure in hot air exhaust, and over-temperature or damage to the AC drive. Ensure a distance of at least 200 mm between the air exhaust top cover and the fan outlet to avoid adverse effect on the cooling performance of the fan.

4.2.3 Mounting Backplate Requirements

Requirements of backplate thickness, dimensions, and stiffness

To avoid damage to the AC drive during transportation and ensure proper operation of the AC drive, use a mounting plate with excellent stiffness and strength performance, and a thickness of at least 2 mm. Reinforce the backplate where appropriate. For example, weld a lateral reinforcing beam on the back of the backplate, as shown in the following figure.

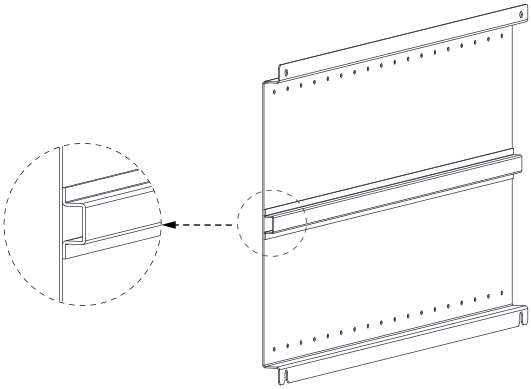


Figure 4-2 Welding a lateral reinforcing beam on the back of the backplate

Requirement on the mounting holes

- You can drill mounting holes on the backplate in advance. For detailed mounting hole dimensions, see *"2.2 T10 to T12 Models (Without AC Output Reactor)" on page 29*, *"2.3 T10 to T12 Models (with AC Output Reactor)" on page 30*, and *"2.1 T1 to T9 Models" on page 28*.
- To avoid damage to the AC drive during transportation, fix the drive to the mounting backplate by using screws. In addition, use self-clinching nuts or independent nuts on the back of the backplate to enhance screw-thread fitting and fastening effect.

4.2.4 Cabinet Heat Dissipation Design

Heat dissipation design for the cabinet door

The cabinet is forcibly cooled by a built-in fan. Therefore, to ensure that enough cooling air enters the cabinet, open an air inlet with an appropriate size 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 below.

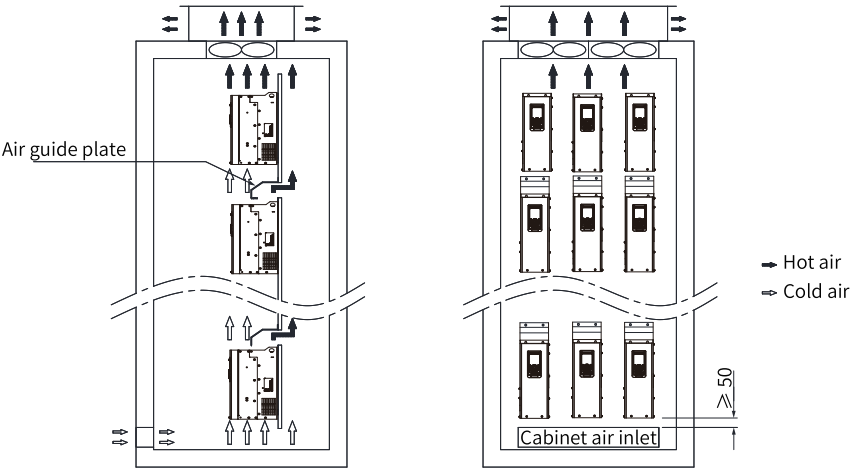


Figure 4-3 Position of the cabinet air inlet

Caution

Where multiple AC drives are installed in one cabinet, if the fan blows air into the air inlet from the outside, air distribution for the drives in the cabinet will be affected, resulting in poor cooling performance. Therefore, do not install a fan at the air inlet of the cabinet to blow air into the cabinet.

"Table 4–2 Minimum ventilation area of the cabinet air inlet" on page 45 describes the minimum ventilation area of the cabinet air inlet after the drive is installed in the cabinet.

Table 4–2 Minimum ventilation area of the cabinet air inlet

AC Drive	Minimum Ventilation Area of the Cabinet Air Inlet (cm^2)
T1	20
T2	25
T3 (7.5 kW)	
T3 (11 kW)	50
T4	
T5	60
T6 to T7	102
T8	204
T9	318

"Table 4–2 Minimum ventilation area of the cabinet air inlet" on page 45 applies to situations where only one AC drive is mounted in the cabinet. For a cabinet containing multiple AC drives, calculate the total ventilation inlet area by adding the ventilation area of each drive according to the table. For example, if a cabinet contains eight T3 models (7.5 kW), two T5 models, and one T9 model, the minimum ventilation area of the cabinet air inlet is 638 cm^2 (8 x 25 + 2 x 60 + 1 x 318).

If an air filter is installed at the air inlet, the air inlet resistance will rise significantly. Therefore, the ventilation area of the air inlet must be increased to 1.2 to 1.5 times the value indicated in the table.

The value in *"Table 4–2 Minimum ventilation area of the cabinet air inlet" on page 45* refers to the actual through-hole area of an opening. The ventilation area is calculated by the following formula: opening area x opening rate.

Top ventilation design

To ensure sufficient heat dissipation of the drive, hot air in the cabinet must be exhausted to the outside. The passive or active air ventilation mode can be adopted.

- Passive ventilation (self-ventilated)
  The air flows from bottom to top after being heated. In this mode, the hot air discharged by the drive is exhausted to outside from the air outlet at the top of the cabinet.

  This might cause accumulated hot air at the top of the cabinet, rising the air pressure. The air pressure at the cabinet air inlet is low due to suction of the fan for the drive. Therefore, there is an air pressure difference between the air outlet and air inlet of the cabinet to form an air flow in the cabinet. The air flow forces hot air at the air outlet to flow towards the air inlet so that it is absorbed into the drive again, causing a great temperature rise and an adverse effect on the performance of the drive.

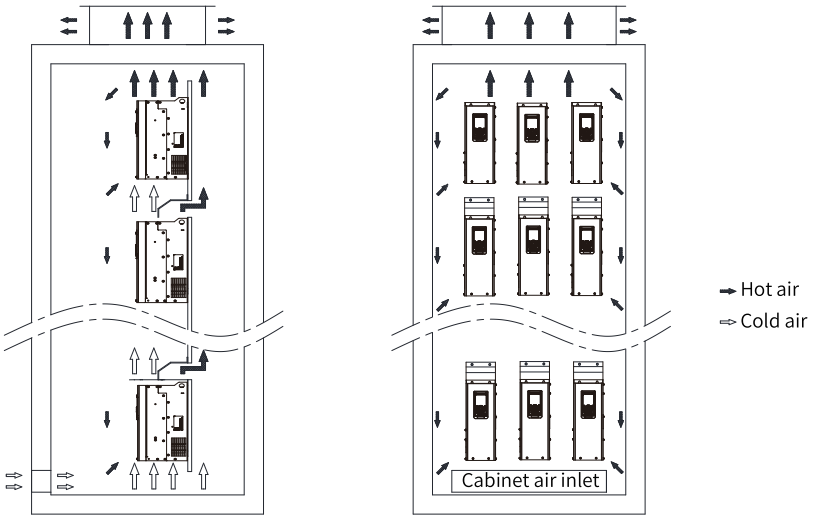


Figure 4-4 Backflow of hot air in a self-ventilated cabinet (without isolating devices)

Therefore, in passive air ventilation, use an isolating device in the cabinet to prevent backflow of hot air. An isolating device can be a plate or an exhaust duct.

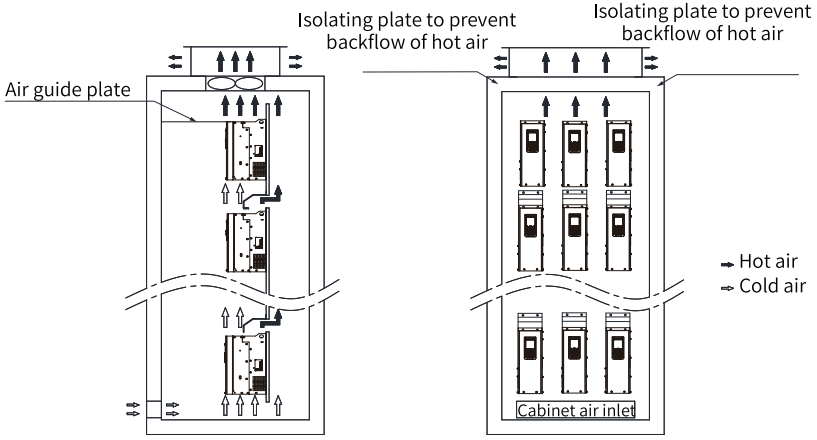


Figure 4-5 Backflow of hot air in a self-ventilated cabinet (with isolating devices)

The temperature at the air outlet of the drive is higher than that at the air inlet and the density at the air outlet is lower than that at the air inlet. To ensure that hot air in the cabinet can be exhausted to outside, the minimum effective ventilation areas of the cabinet air outlet must meet the requirements in *"Table 4–3 Minimum*

ventilation area of the air outlet for a self-ventilated cabinet" on page 48 when passive air ventilation is used.

Table 4–3 Minimum ventilation area of the air outlet for a self-ventilated cabinet

AC Drive	Minimum Ventilation Area of the Air Outlet for a Self-ventilated Cabinet (cm^2)
T1	32
T2	40
T3 (7.5 kW)	
T3 (11 kW)	80
T4	
T5	96
T6 to T7	163
T8	326
T9	509

"Table 4–3 Minimum ventilation area of the air outlet for a self-ventilated cabinet" on page 48 applies to situations where only one AC drive is mounted in the cabinet. For a cabinet containing multiple AC drives, calculate the total ventilation inlet area by adding the ventilation area of each drive according to the table.

If an air filter is installed at the outlet, the air outlet resistance will rise significantly. Therefore, the ventilation area must be increased to 1.2 to 1.5 times the value indicated in the table.

The value in *"Table 4–3 Minimum ventilation area of the air outlet for a self-ventilated cabinet" on page 48* refers to the actual through-hole area of an opening. The ventilation area is calculated by the following formula: opening area x opening rate.

- Active ventilation
  In the active ventilation mode, a fan is installed at the top of the cabinet to exhaust hot air to the outside of the cabinet. This is a commonly used ventilation mode.

  To ensure that the hot air can be exhausted to the outside, the total air volume of the fan cannot be smaller than that of all drives in the cabinet. *"Table 4–4 Total air flow of the AC drive" on page 48* lists the cooling air flow required by the drive.

Table 4–4 Total air flow of the AC drive

AC Drive Power	Total Air Flow of the AC Drive
0.4 kW to 3.0 kW	11
3.7 kW	20
5.5 kW	24
7.5 kW	29
11 kW to 15 kW	50
18.5 kW	52

AC Drive Power	Total Air Flow of the AC Drive
22 kW	58
30 kW	130
37 kW	102
45 kW to 55 kW	125
75 kW to 90 kW	225
110 kW	350
132 kW	541
160 kW	620
Note: 1 CFM = 0.02832 m^3/min	

Cabinet fan design

To select the cabinet fan, do the following:

1. Calculate the sum of the cooling air volume required by all AC drives based on *"Table 4–4 Total air flow of the AC drive" on page 48*.
2. Determine the maximum air volume (Qmax) of the cabinet.
3. Determine the specifications and quantity of fans according to the maximum air volume (Qmax).

Note that:

Maximum air volume of the cabinet = 1.3 to 1.5 times the sum of the cooling air volume

Maximum air flow of the cabinet = 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)

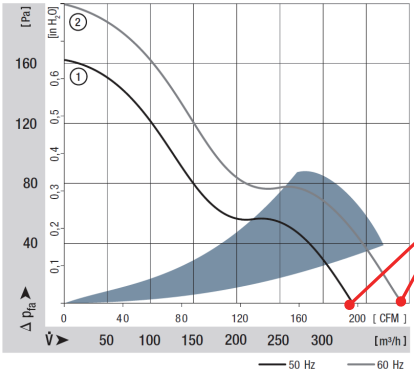
Note

Select a fan whose air volume is not smaller than the maximum air volume Qmax. Install multiple fans in parallel if one fan alone cannot meet the requirements.

The following figure shows typical specifications of fan air volume.

Air flow	Air flow	Nominal voltage	Frequency	Sound pressure level	Sound power level	Sintec sleeve bearings / Ball bearings	Power input	Nominal speed	Temperature range	Service life L_{10} at 40 °C	at T_{max}	Curve
m^3/h	CFM	V	Hz	dB(A)	Bel(A)	□/■	Watts	RPM	°C	Hours	Hours	
320	188,3	230	50	51	6,4	■	27,0	2 800	-25...+55	60 000 / 32 000		1
380	223,6	115	60	56	6,8	■	28,0	3 350	-25...+65	55 000 / 18 000		2

风扇规格中此列为该风扇
最大风量Qmax



风扇最大风量Qmax

Figure 4-6 Q_{max} of a system fan

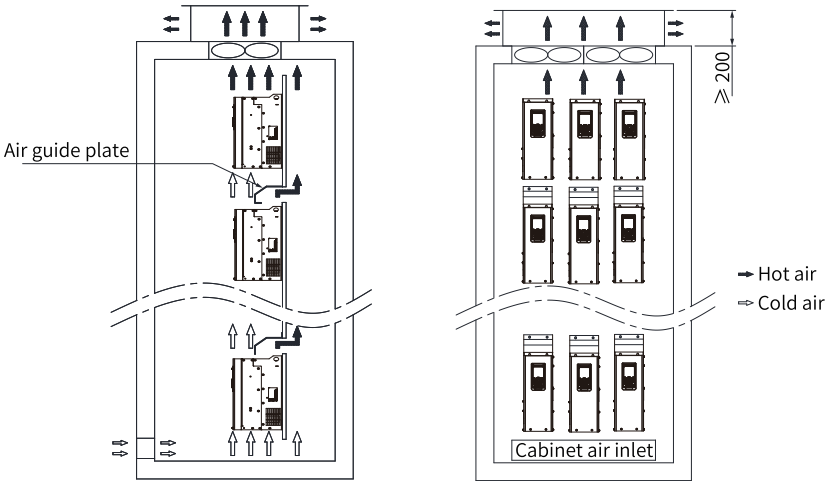


Figure 4-7 Cabinet ventilation system

Note

- When installing the fan, ensure a proper direction and smooth flow of hot air. Failure to comply may cause accumulation of hot air, leading to over-temperature or damage to the AC drive.
- Ensure a distance of at least 200 mm between the top vent and the fan outlet to avoid adverse effect on the cooling performance of the fan.

4.3 Installation Precautions

- Before installation, ensure that the mounting position has sufficient mechanical strength to bear the AC drive.
- Cover the top of the AC drive with cloth or paper during installation to prevent metal shavings, oil, and water from entering during drilling. Foreign objects entering may cause malfunction of the AC drive. Remove the cloth or paper after the installation is completed. Failure to comply may degrade ventilation and result in unexpected heat.
- Reserve sufficient clearance for heat dissipation, including the heat dissipation of other equipment in the cabinet. For details, see "Installing one alone" in *"1.2.2 Installation Clearance" on page 18*.
- Keep the equipment upright to help dissipate heat upward. To install multiple AC drives in one cabinet, arrange them side by side. Where up and down arrangement is required, install an air guide plate in between. For details, see "Installing one above another" in *"1.2.2 Installation Clearance" on page 18*.
- Use a mounting bracket that is flame retardant, where appropriate.
- For environments with metal dust, use a cabinet that can completely enclose the AC drive to isolate the AC drive from metal dust. In this case, as much space as possible should be provided in the fully sealed cabinet, and it is recommended that the radiator be installed outside the cabinet.
- Tighten all screws using the specified torque. Failure to comply may result in electric shock or fire.
- Keep combustible and explosive materials away from the AC drive.

4.4 Backplate Mounting

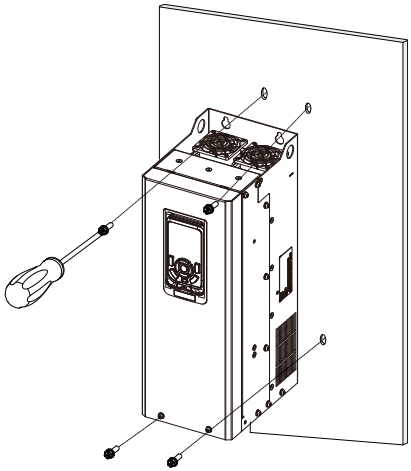


Figure 4-8 Backplate mounting (T1 to T6 models)

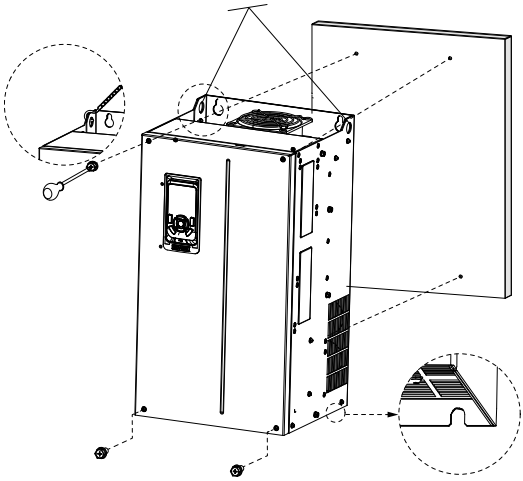


Figure 4-9 Backplate mounting (T7 to T9 models)

4.5 Through-Hole Mounting

Note

The through-hole mounting bracket is an option.

1. Fix the mounting brackets to both sides of the AC drive.

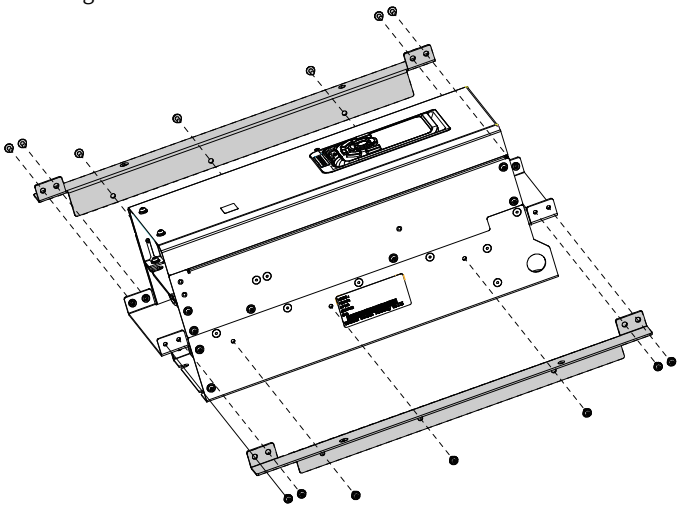


Figure 4-10 Installing the mounting brackets to the AC drive (T1 to T9 models)

2. The following figure shows an AC drive with brackets mounted.

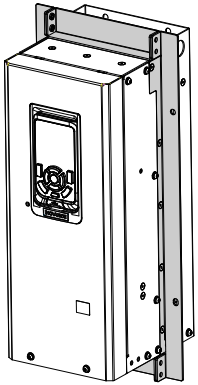


Figure 4-11 AC drive with brackets mounted (T1 to T9 models)

3. Fix the AC drive with brackets to the backplate of the control cabinet.

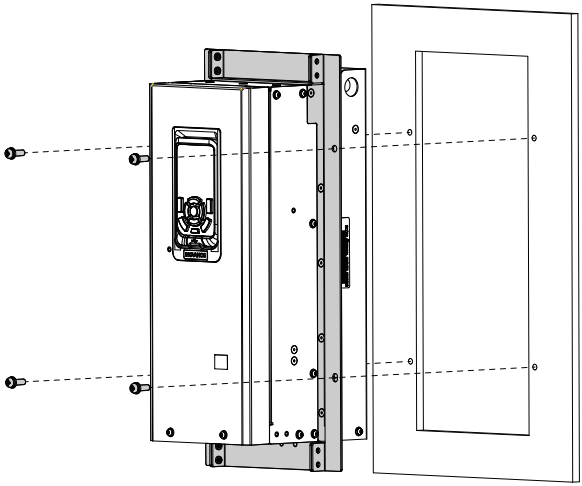


Figure 4-12 Through-hole mounting (T1 to T9 models)

4. The following figure shows an AC drive that is through-hole mounted.

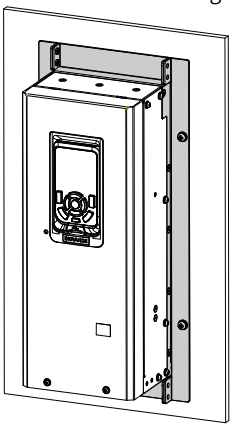


Figure 4-13 AC drive installed in the cabinet (T1 to T9 models)

4.6 Cover Removal and Installation

4.6.1 Removing the Cover

When wiring the control circuit, remove the cover first if a PG card or function expansion card needs to be connected. When removing the cover, hold the cover with your hands and carefully lift the lower part of the cover to prevent it from falling off. Failure to comply will result in equipment damage or personal injury.

Prerequisites

Before removing the cover, ensure that the machine has been powered off for over 10 minutes.

Context

The following figure shows the positions of the control board and expansion card with the cover removed.

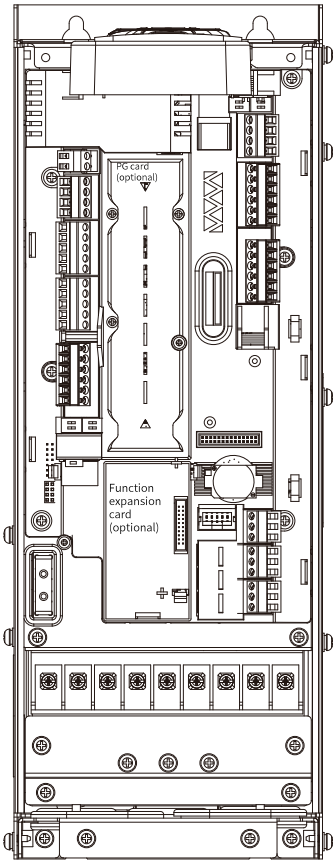
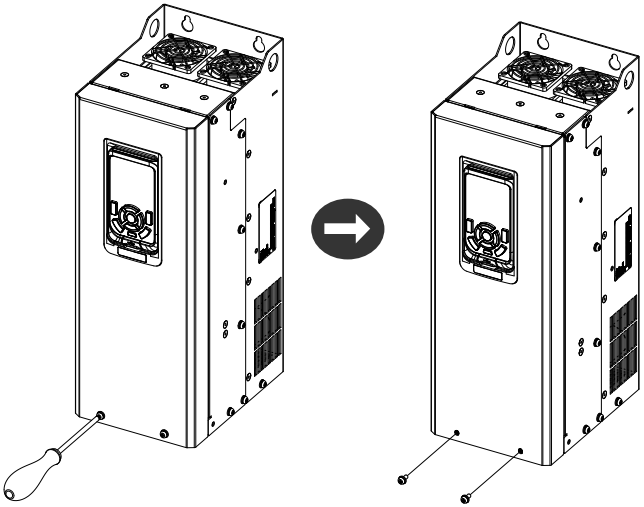
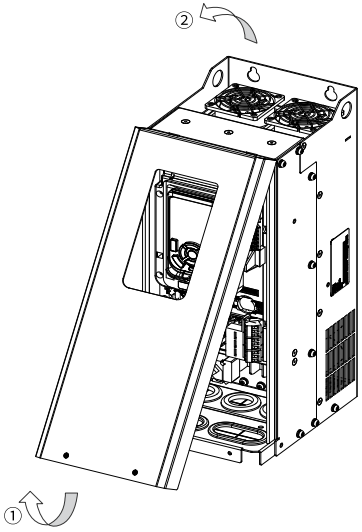


Figure 4-14 Control board position

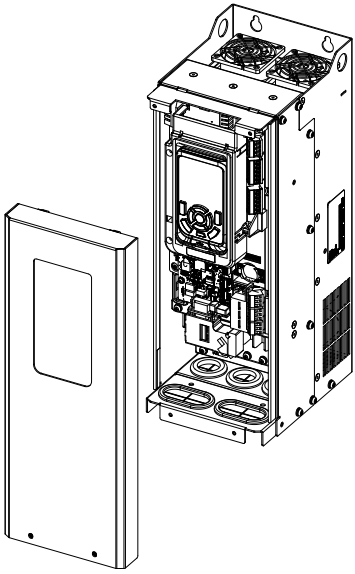
1. Remove the cover for T4 to T6 models.
   a. Use a screwdriver to remove the two fixing screws of the cover.



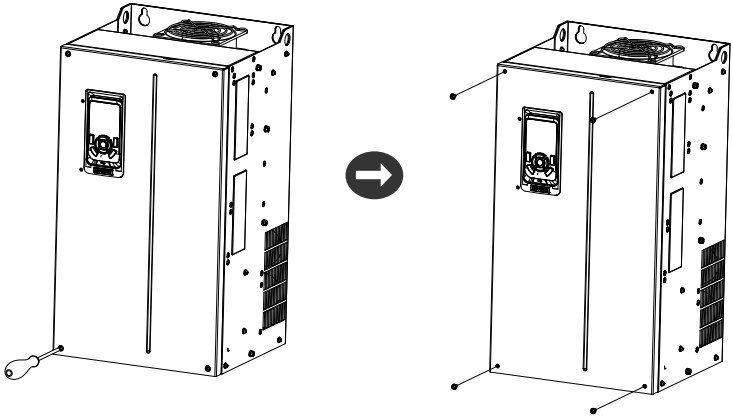
b. Hold the cover with your hands, lift the lower part of the cover (as shown in ①), push the cover upward, and lift the upper part of the cover (as shown in ②).



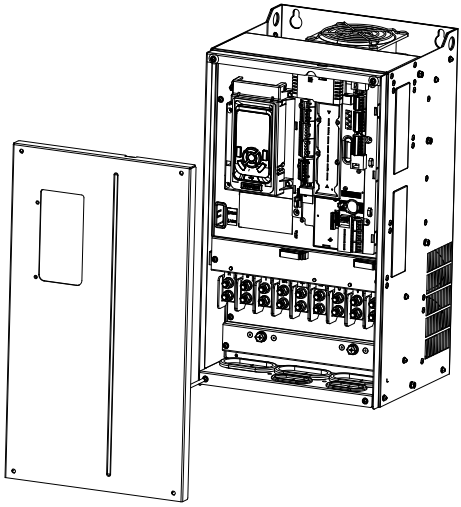
The following figure shows the drive without the cover.



2. Remove the cover for T7 to T9 models.
   a. Use a screwdriver to remove the four fixing screws of the cover.

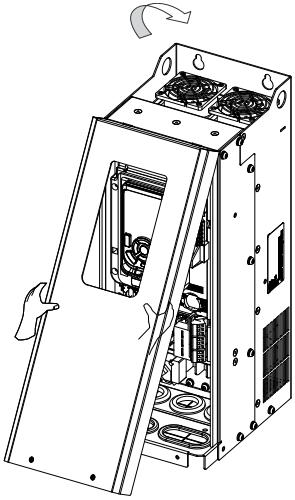


   b. Hold the cover with both hands and lift it up in the direction indicated by the arrow.

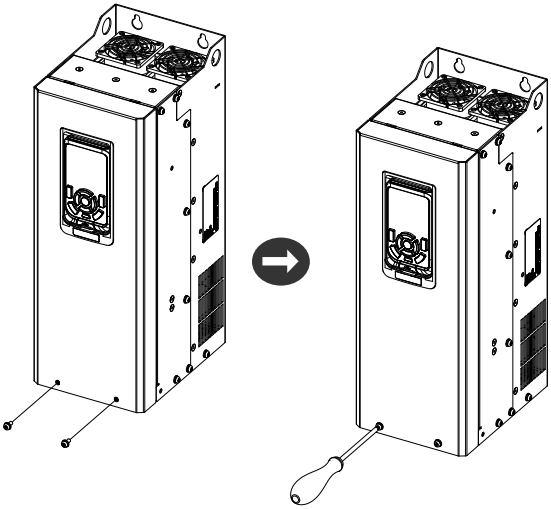


4.6.2 Installing the Cover

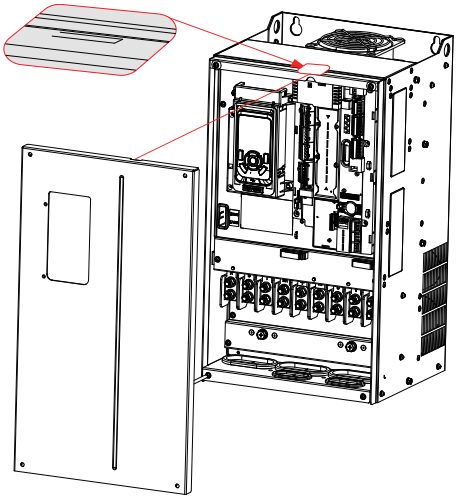
1. To install the cover of T1 to T6 models, do the following.
   a. Hold the cover with both hands and buckle the snap-fit joint at the top of the cover into the hole on the drive.



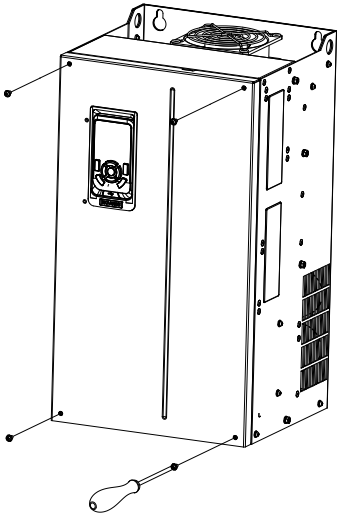
   b. After the cover is aligned, press down the lower part of the cover, and install the two fixing screws with a screwdriver.



2. To install the cover of T7 to T9 models, do the following.
   a. Hold the cover with both hands, align the cover with the upper edge snap-fit joint on the chassis, and snap them together, as shown in the following figure.



   b. Install the four fixing screws with a screwdriver.



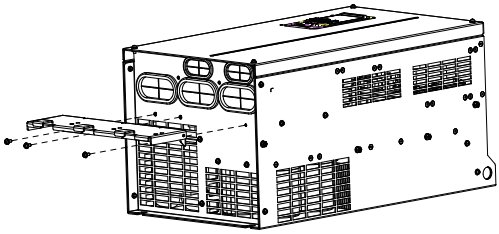
4.7 Installing the Grounding Bracket of the Cable Shield

The grounding bracket of the cable shield, applicable to T9 models and below, is optional and needs to be purchased separately.

Grounding bracket of the power cable shield

Installation

1. Install the grounding bracket of the cable shield to the AC drive housing.
2. Tighten three M4 x 12 SEMS screws at the positions shown in the following figure.



Wiring

1. 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 below.
2. The grounding bracket of the cable shield is provided with wire ferrule slots. Cover the exposed shield with the insulation tape above the wire ferrule. The following figure shows the wiring.

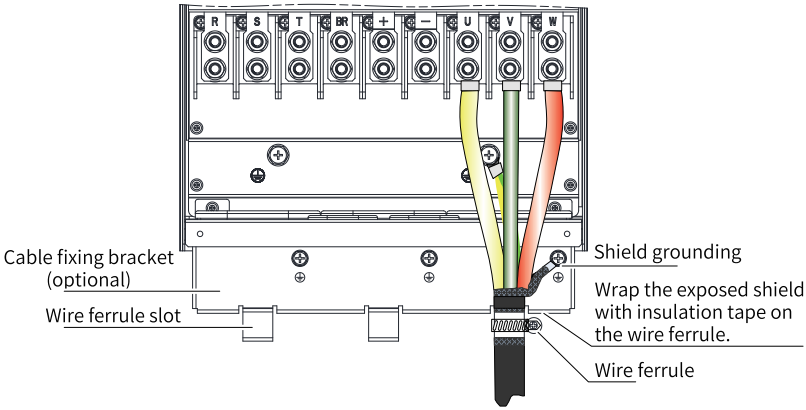
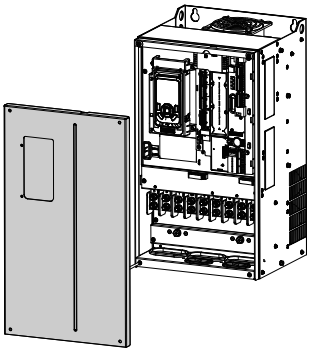


Figure 4-15 Wiring of the power cable shield

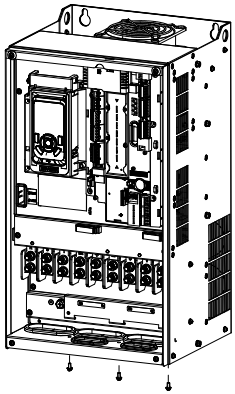
Grounding bracket of the control cable shield

Installation

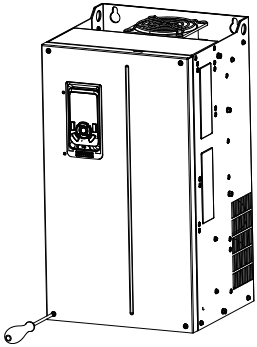
1. Remove the cover, as shown in the following figure.



2. Tighten three M4 x 12 SEMS screws at the positions shown in the following figure.



3. Install the cover.



Wiring

The bracket of the control cable shield is optional. Use of this option allows easy and efficient shield connection to improve the noise immunity of the drive I/O signals. The optional shield bracket is used for re-fixing I/O signal cables and stable grounding of the shield in 360°.

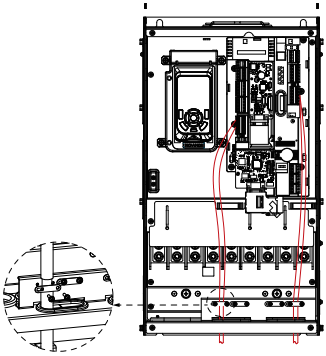


Figure 4-16 Wiring of the control cable shield

5 Mechanical Installation (T10 to T9 Models)

5.1 Installation Method

T10 to T12 models can be installed in a cabinet.

5.2 Pre-installation Precautions

- Before installing the AC drive, install the bottom mounting bracket and guide rails on the cabinet, and prepare fixing beams with mounting holes for retaining the AC drive. Reserve sufficient clearance in the cabinet for connecting side copper busbars.
- The guide rails in the cabinet and the four casters of the AC drive cooperate to help the AC drive move in or out of the cabinet. Align the casters with the guide rails before a push or pull. For safety, arrange two persons to pull or push the AC drive together.
- Reserve sufficient clearance for heat dissipation, including heat dissipation of other equipment in the cabinet.
- To push the AC drive into or pull it out of the cabinet, arrange two persons to work together. After pushing the AC drive into the cabinet, remove the baffle from the air outlet of the cabinet to avoid over-temperature caused by failure to exhaust hot air.
- Install an insulation barrier at the top of the cabinet to prevent the exhaust air from flowing back into the cabinet. Provide an air intake vent on the lower part of the cabinet door.
- The cabinet is 2200 mm x 800 mm x 600 mm (including a 200 mm cabinet ventilation top cover). The cabinet needs to be installed on a base that is 100 mm in height.
- When installing the AC drive in an enclosed environment, such as a cabinet or casing box, use a cooling fan or air conditioner to keep the inlet temperature below 50°C. Failure to comply may result in over-temperature or fire.
- Cover the top of the AC drive with cloth or paper during installation to prevent foreign objects, such as metal chippings, oil, and water, from entering the AC drive. Foreign objects may cause malfunction of the AC drive. Remove the cloth or paper after installation is completed. Failure to comply may degrade ventilation and result in over-temperature of the AC drive.
- Use a mounting bracket that is flame retardant, where appropriate.
- In environments with metal dust, use an enclosed cabinet that can completely isolate the AC drive from the metal dust. In this case, ensure the maximum possible space in the cabinet and install cooling devices outside the cabinet.
- Tighten all screws using the specified torque. Failure to comply may result in electric shock or fire.

- Keep combustible and explosive materials away from the AC drive.

5.3 Heat Dissipation Design

When installing T10 to T12 models in a cabinet, reserve sufficient space for heat dissipation. A self-ventilated cabinet has no fan on the top.

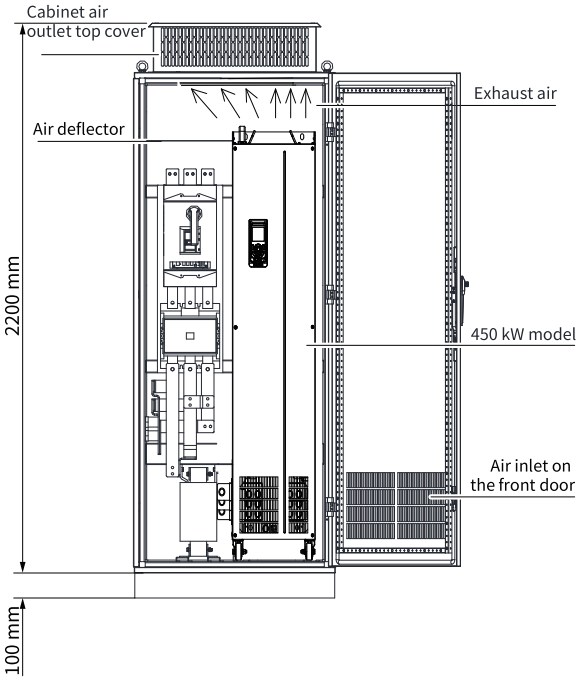


Figure 5-1 Self-ventilated cabinet

Table 5–1 Parameters of a self-ventilated cabinet

Model	Quantity of Fans	Total Air Volume (CFM)	Effective Area of the Cabinet Air Inlet (mm^2)	Effective Area of the Cabinet Air Outlet (mm^2)
T10 (220 kW)	2	586	31809	50894
T10 (250 kW)	2	722	31809	50894
T11 (280 kW)	3	789	47713	76341
T11 (315 kW)	3	882	47713	76341
T12 (355 kW)	3	644	47713	76341
T12 (400 kW)	3	796	47713	76341

Model	Quantity of Fans	Total Air Volume (CFM)	Effective Area of the Cabinet Air Inlet (mm^2)	Effective Area of the Cabinet Air Outlet (mm^2)
T12 (450 kW)	3	796	47713	76341

Note

- CFM = 0.0283 m^3/min
- "Actual Effective Area" indicates through-hole area.

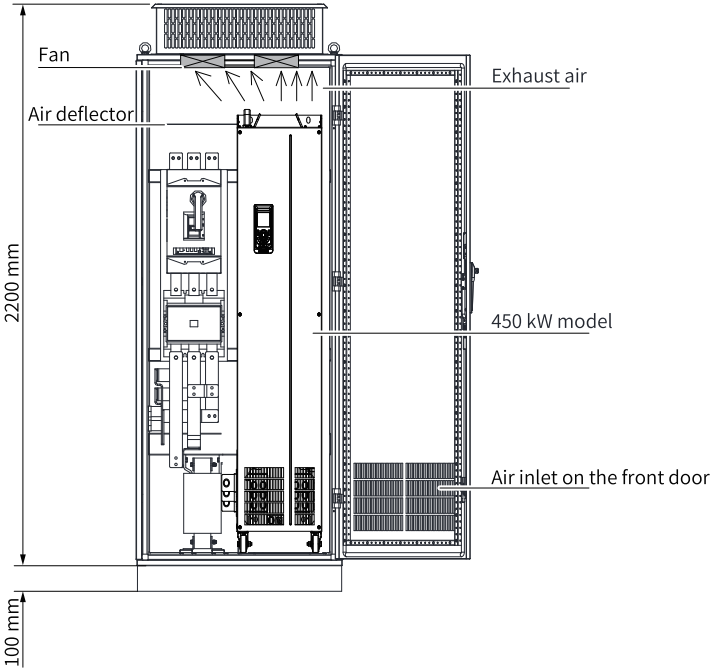


Figure 5-2 Forced-ventilated cabinet (with fans at the top of the cabinet)

Table 5–2 Parameters of a forced-ventilated cabinet

Model	Quantity of Fans	Total Air Volume (CFM)	Effective Area of the Cabinet Air Inlet (mm^2)	Max. Air Volume Required by the Fans (CFM)	Effective Area of the Cabinet Air Outlet (mm^2)
T10 (220 kW)	2	586	31809	703	
T10 (250 kW)	2	722	31809	866	
T11 (280 kW)	3	789	47713	947	
T11 (315 kW)	3	882	47713	1058	
T12 (355 kW)	3	644	47713	773	
T12 (400 kW)	3	796	47713	955	
T12 (450 kW)	3	796	47713	955	

Note

- CFM = 0.0283 m^3/min
- "Actual Effective Area" indicates through-hole area.

As shown in the following figure, the heat dissipation duct of the drive must be isolated in the cabinet to prevent the hot air from circulating in the cabinet. Use an air deflector for isolation to ensure that the hot air of the drive can be exhausted from the heat dissipation hole on the top of the cabinet.

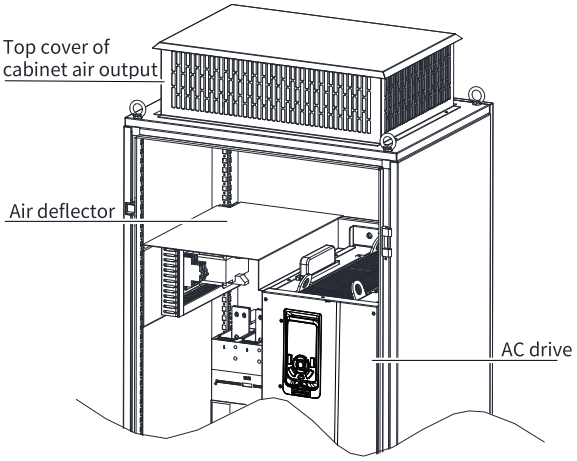


Figure 5-3 Insulation barrier in the cabinet

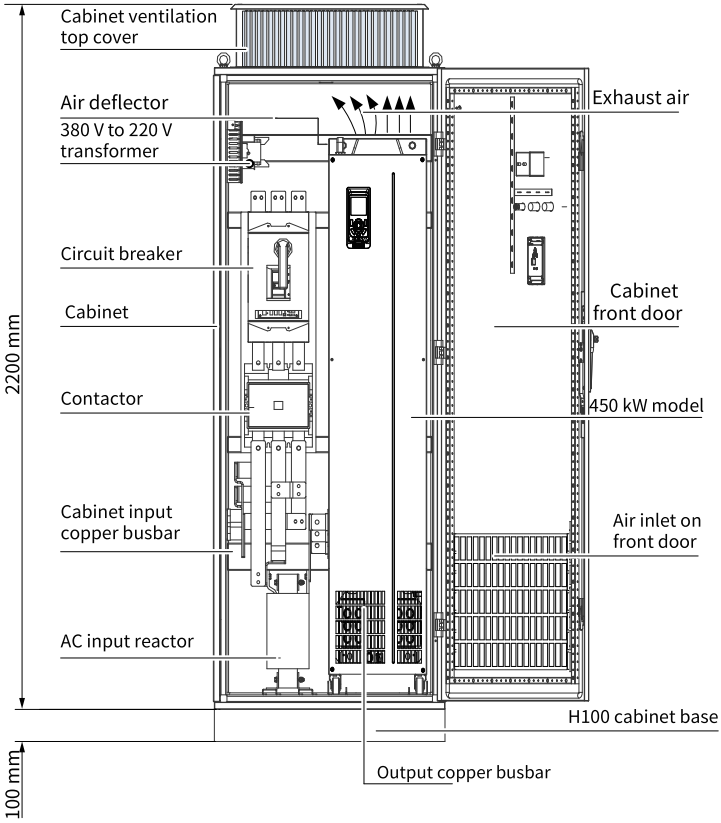


Figure 5-4 Recommended cabinet layout for T12 models

5.4 Installation Within the Cabinet

Procedure

1. In the nine-fold profile cabinet (PS cabinet), install the mounting beam for fixing the AC drive and reserve fixed holes.
   "Figure 5–5 Top view of a cabinet for T10 and T12 models" on page 68 shows the cross sectional area of the nine-fold profile.

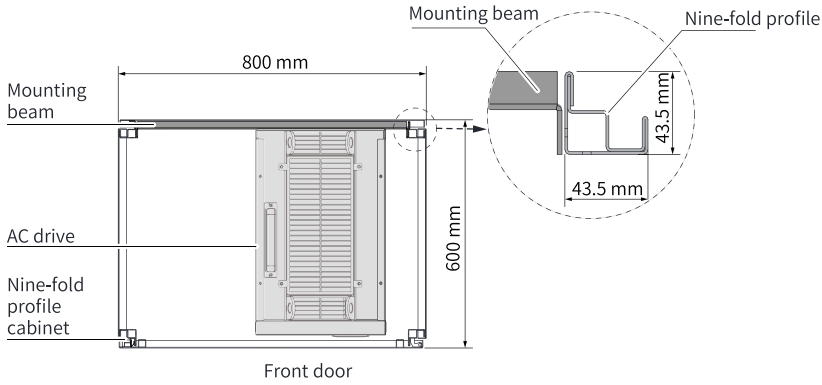


Figure 5-5 Top view of a cabinet for T10 and T12 models

To install T10 to T12 models into the nine-fold profile cabinet with the depth of 600 mm, bend the back mounting board inwards (not required for the cabinet with the depth of 800 mm), as shown in *"Figure 5–6 " on page 68* . However, if the cabinet with the depth of 600 mm has both front and back doors, the AC drive cannot be installed in this kind of cabinet. Instead, install the AC drive into the cabinet with the depth of 800 mm.

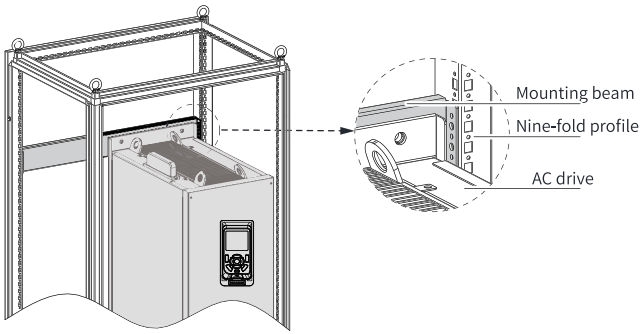


Figure 5-6 3D of a cabinet for T10 and T12 models

2. Fix the bottom mounting bracket in the nine-fold profile cabinet.
   Fix the mounting bracket to the base of the nine-fold profile cabinet by using six M5 self-tapping screws, as shown in *"Figure 5–7 " on page 69* .

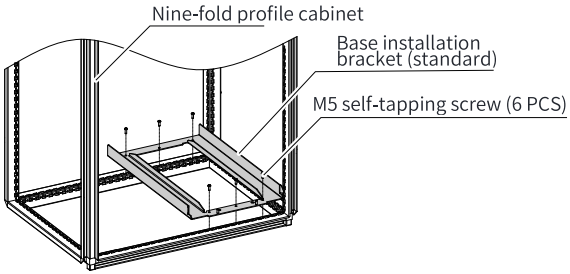


Figure 5-7 Installing the bottom mounting bracket

Note

If the cabinet used by the customer is not a nine-fold profile cabinet, the fixing holes of the mounting bracket need to be drilled and assembled on site.

3. Assemble the guide rails (model: MD500-AZJ-A3T10) and mount the guide rail assembly to the cabinet.
   a. Assemble the guide rail, as shown in *"Figure 5–8 " on page 69* .

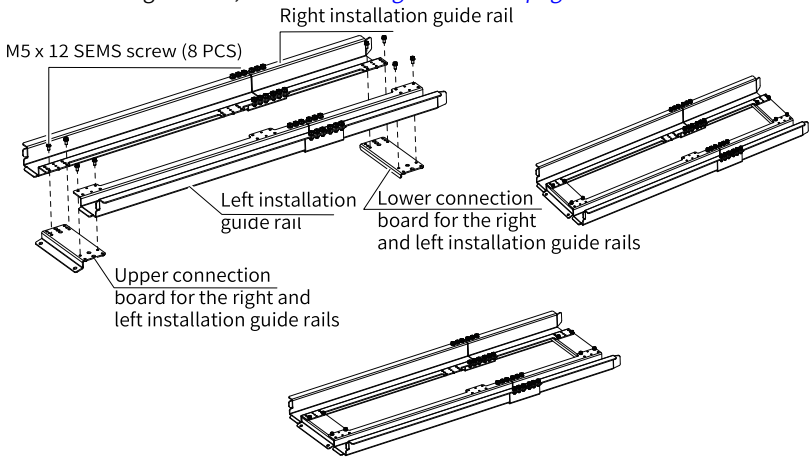


Figure 5-8 Assembling guide rails

   b. Align the two round holes at the front end of the mounting rail with the screws of the mounting bracket, and then lock the guide rail to the cabinet with two M6 nuts, as shown in *"Figure 5–9 " on page 70* .

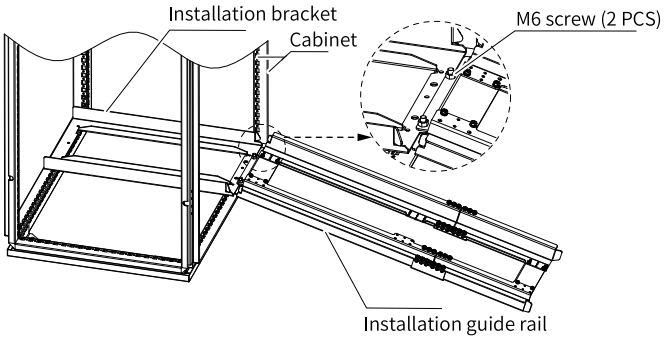


Figure 5-9 Mounting the guide rails on the cabinet

4. Remove the cover from the AC drive.
   For details about how to remove the cover, see "Removing the Cover". After the cover is removed, the auxiliary handle will be exposed.
5. Align the AC drive caster with the guide rail and push the drive slowly into the cabinet.
   During the push-in or pull-out process, use the auxiliary strap to prevent the drive from toppling over. It is recommended that two people work together.

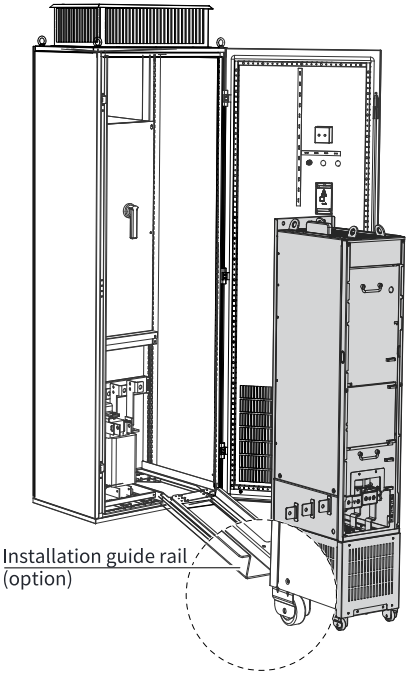


Figure 5-10 Aligning the AC drive caster with the guide rail

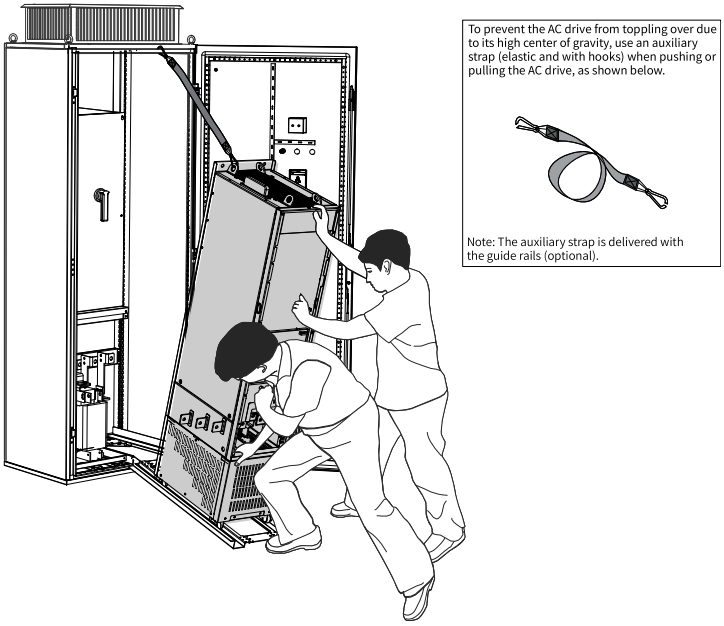


Figure 5-11 Pushing the AC drive into the cabinet

6. Remove the auxiliary strap, install the four screws on the back of the AC drive to fix it to the beam in the cabinet.

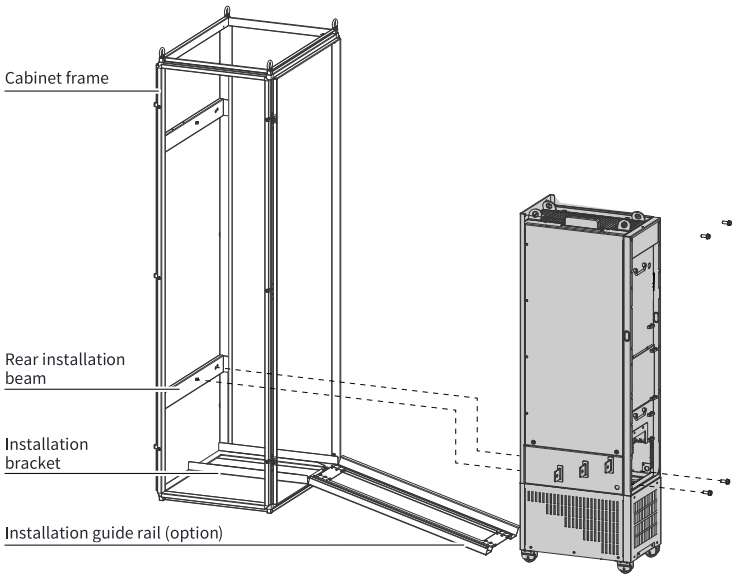


Figure 5-12 Installing the AC drive to the beam

7. After installation is done, remove the guide rail.
8. Remove the air filter paper board at the top of the AC drive. The air filter paper board is used to prevent foreign objects such as screws from falling into the air filter during installation of the AC drive into the cabinet.

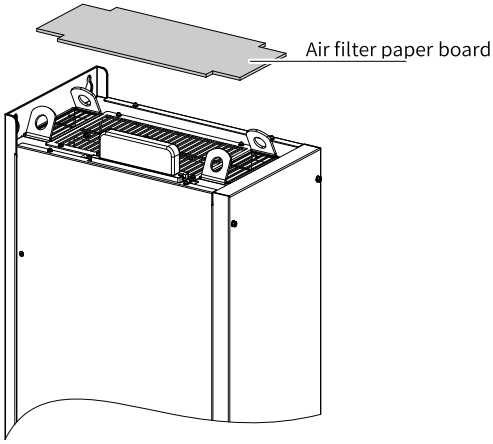


Figure 5-13 Removing the air filter paper board

5.5 Cover Removal and Installation

5.5.1 Removing the Cover

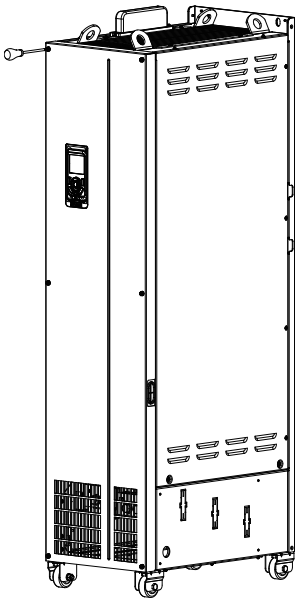
When wiring the control circuit, remove the cover from the AC drive before operating jumpers or connecting PG cards or expansion cards. When removing the cover, hold the cover with your hands and carefully lift the lower part of the cover to prevent it from falling off. Failure to comply will result in equipment damage or personal injury.

Prerequisites

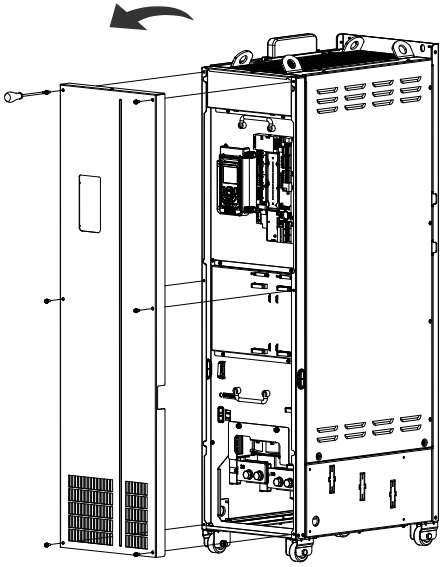
Before removing the cover, ensure that the machine has been powered off for over 10 minutes.

Procedure

1. Use a screwdriver to remove the six fixing screws of the cover.



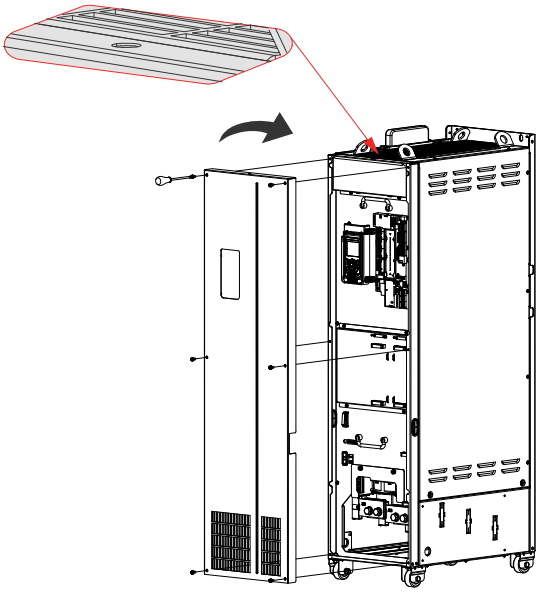
2. Hold the cover with both hands, and pull it in the arrow direction to remove it.



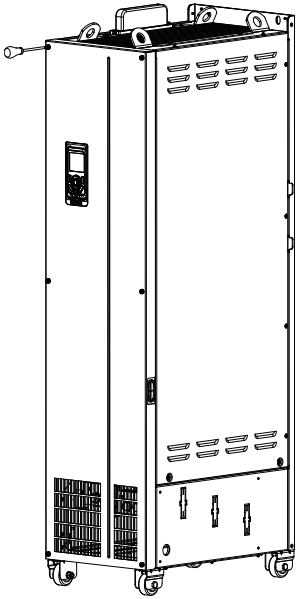
5.5.2 Installing the Cover

Procedure

1. Hold the cover with both hands, align the upper edge of the cover with the upper edge snap-fit joint on the chassis, and snap them together, as shown in the following figure. Then align the six screw mounting holes in the cover with the cover fixing holes in the chassis and press them tightly against each other.



2. Install six fixing screws into the holes with a screwdriver to fasten the cover.



6 Electrical Installation

6.1 Electrical Wiring Diagram

The following figure shows a typical wiring method.

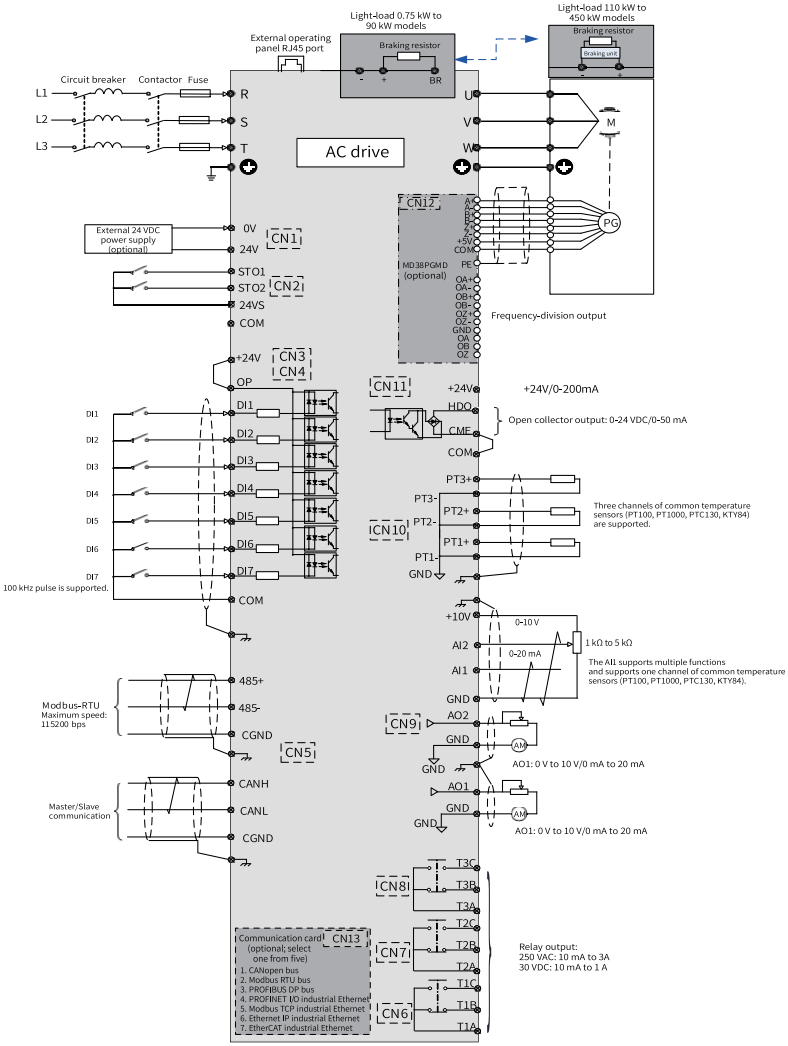


Figure 6-1 Standard wiring

6.2 Inspection Before Wiring

T1 to T12 models

- Never wire the drive when the power is on, and keep all circuit breakers in the OFF state. Failure to comply will result in electric shock.
- Only allow qualified professionals are allowed to operate the drive.
- 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 regulations on cable dimensions, fuses, grounding, open circuits, isolation, and overcurrent protection.
- When a branch fuse trips, the faulty current may have been cut off. To reduce the risk of fire and electric shocks, check the conductive parts and other components and replace the damaged ones. Find the cause of the tripping fuse and make sure the problem is solved.

6.3 Main Circuit Connection

6.3.1 Descriptions of Main Circuit Terminals

T1 to T19 models

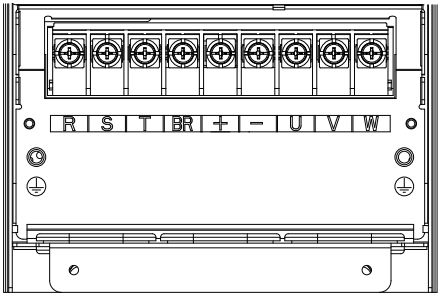


Figure 6-2 Layout of main circuit terminals for T1 to T4 models

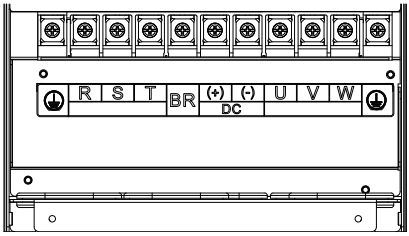


Figure 6-3 Layout of main circuit terminals for T5 to T8 models

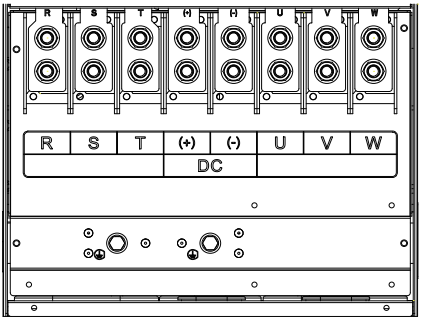


Figure 6-4 Layout of main circuit terminals for T9 models

Table 6–1 Descriptions of main circuit terminals

Terminal Silkscreen	Terminal Name	Function
R, S, T	Three-phase power supply input terminals	Connected to a three-phase AC input power supply
(+), (-)	Positive and negative terminals of the DC bus	Common DC busbar input; connected to the external braking unit of T9 models and above.
(+), BR	Braking resistor connection terminals	Used to connect to the braking resistor of T8 models and below
U, V, W	Output terminals	Connected to a three-phase motor
⏚	Grounding terminal (PE)	The terminal is used for protective grounding.

T10 to T12 models

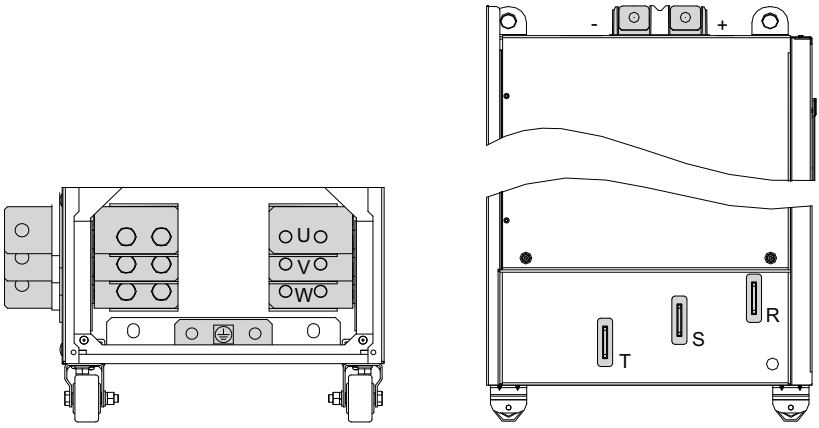


Figure 6-5 Layout of main circuit terminals for T10 to T12 models

Table 6–2 Descriptions of main circuit terminals

Terminal Silkscreen	Terminal Name	Function
R, S, and T	Three-phase power supply input terminals	Connected to a three-phase AC input power supply
+ and -	Positive and negative terminals of the DC bus	Common DC busbar input; connected to an external braking unit.
U, V, W	AC drive output terminals	Connected to a three-phase motor
⏚	Grounding terminal (PE)	The terminal is used for protective grounding.

6.3.2 Main Circuit Terminal Dimensions and Cable Selection

T1 and T2 models

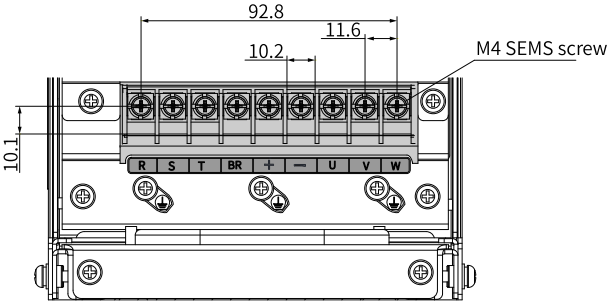


Figure 6-6 Main circuit terminal dimensions (mm) for T1 and T2 models

Table 6–3 Main circuit cable selection for T1 and T2 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T1	MD580-4T2R1B	1.8	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2 (10.6)
	MD580-4T3R1B	2.4						
	MD580-4T3R8B	3.7						
	MD580-4T5R1B	4.6						
	MD580-4T7R2B	6.3						
	MD580-4T9B	9.0	3 x 1	TNR1.25-4	1	TNR1.25-4	M4	1.2 (10.6)
T2	MD580-4T13B	11.4	3 x 1.5	TNR1.25-4	1.5	TNR1.25-4	M4	1.2 (10.6)
	MD580-4T17B	16.7	3 x 2.5	TNR2-4	2.5	TNR2-4	M4	1.2 (10.6)

T3 models

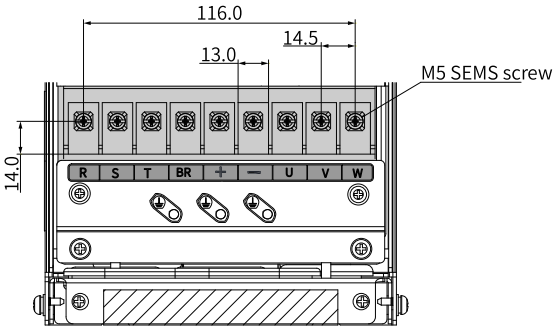


Figure 6-7 Main circuit terminal dimensions for T3 models (mm)

Table 6–4 Main circuit cable selection for T3 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T3	MD580-4T25B	21.9	3 x 4	TNR3.5-5	4	TNR3.5-5	M5	2.8 (24.8)
	MD580-4T32B	32.2	3 x 6	TNR5.5-5	6	TNR5.5-5	M5	2.8 (24.8)

T4 models

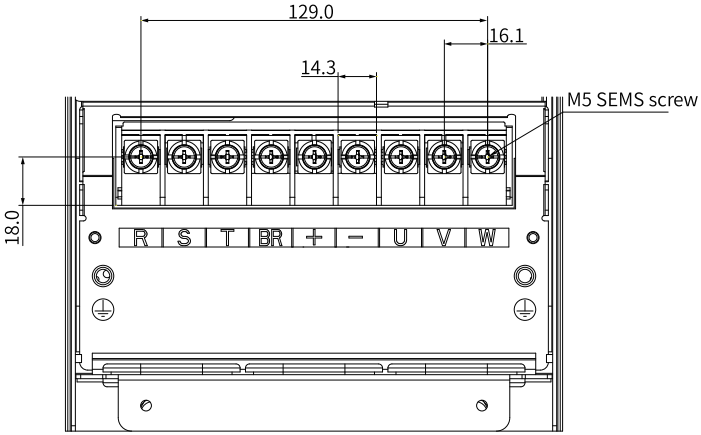


Figure 6-8 Main circuit terminal dimensions for T4 models (mm)

Table 6–5 Main circuit cable selection for T4 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T4	MD580-4T37B	41.3	3 x 10	TNR8-5	10	TNR8-5	M5	2.8 (24.8)

T5 models

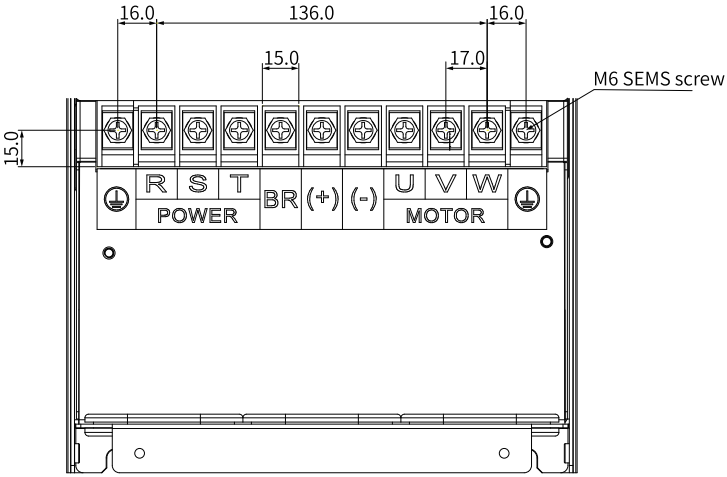


Figure 6-9 Main circuit terminal dimensions for T5 models (mm)

Table 6–6 Main circuit cable selection for T5 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T5	MD580-4T45(B)	49.5	3 x 10	GTNR10-6	10	GTNR10-6	M6	4.8 (45.2)
	MD580-4T60(B)	59.0	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8 (45.2)

T6 models

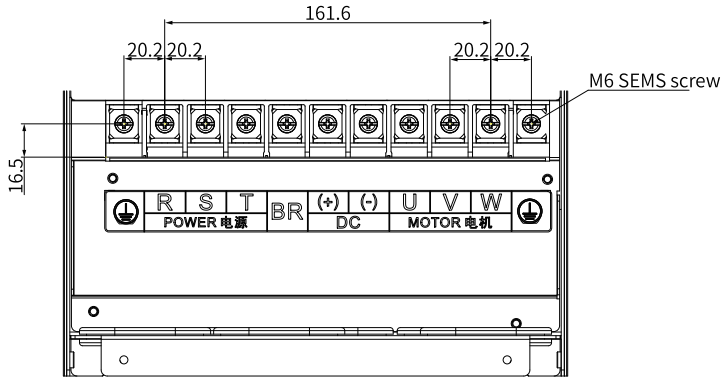


Figure 6-10 Main circuit terminal dimensions for T6 models (mm)

Table 6–7 Main circuit cable selection for T6 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T6	MD580-4T75(B)	57.0	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8 (45.2)
	MD580-4T91(B)	69.0	3 x 25	GTNR25-6	16	GTNR16-6	M6	4.8 (45.2)

T7 models

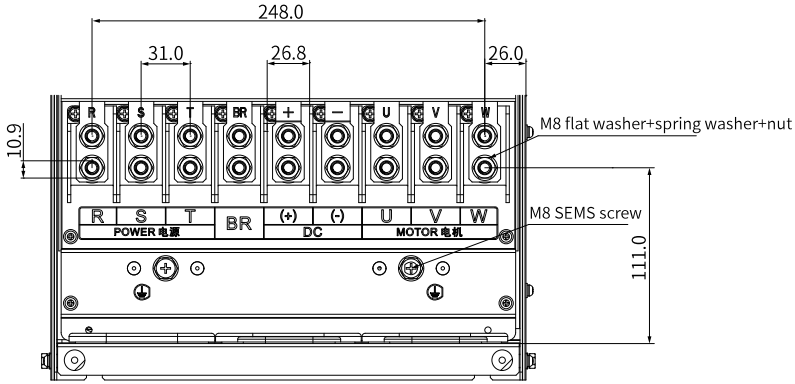


Figure 6-11 Main circuit terminal dimensions for T7 models (mm)

Table 6–8 Main circuit cable selection for T7 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T7	MD580-4T112 MD580-4T112B	89.0	3 x 35	GTNR35-8	16	GTNR16-8	M8	13.0 (115.2)
	MD580-4T150(B) MD580-4T150	106.0	3 x 50	GTNR50-8	25	GTNR25-8	M8	13.0 (115.2)

T8 models

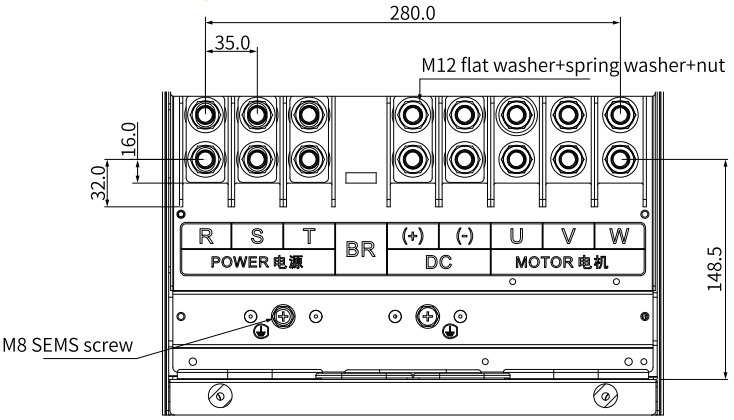


Figure 6-12 Main circuit terminal dimensions for T8 models (mm)

Table 6–9 Main circuit cable selection for T8 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T8	MD580-4T176B MD580-4T176	139.0	3 x 70	GTNR70-12	35	GTNR35-12	M12	35.0 (310.1)
	MD580-4T210	164.0	3 x 95	GTNR95-12	50	GTNR50-12	M12	35.0 (310.1)
	MD580-4T253	196.0	3 x 120	GTNR120-12	70	GTNR70-12	M12	35.0 (310.1)

T9 models

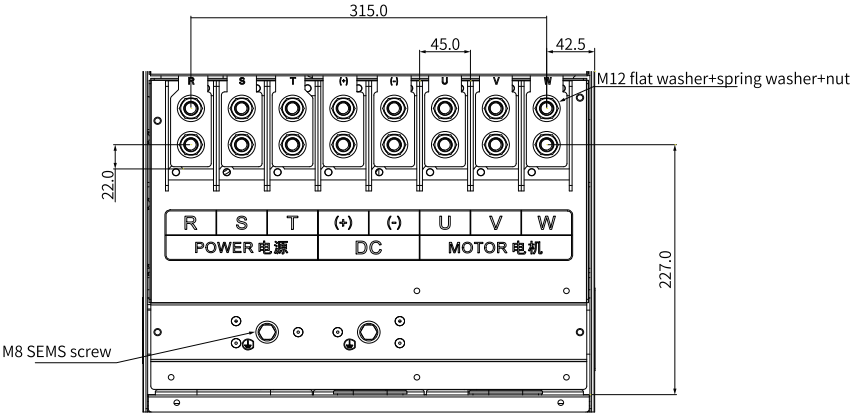


Figure 6-13 Main circuit terminal dimensions for T9 models (mm)

Table 6–10 Main circuit cable selection for T9 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T9	MD580-4T304	240.0	3 x 150	BC150-12	95	BC95-12	M12	35.0 (310.1)
	MD580-4T377	287.0	3 x 185	BC185-12	95	BC95-12	M12	35.0 (310.1)

T10 models

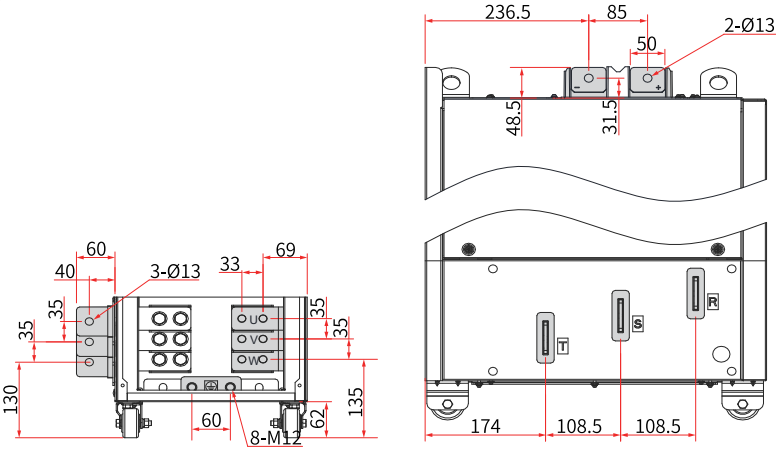


Figure 6-14 Main circuit terminal dimensions (mm) for T10 models without the output reactor

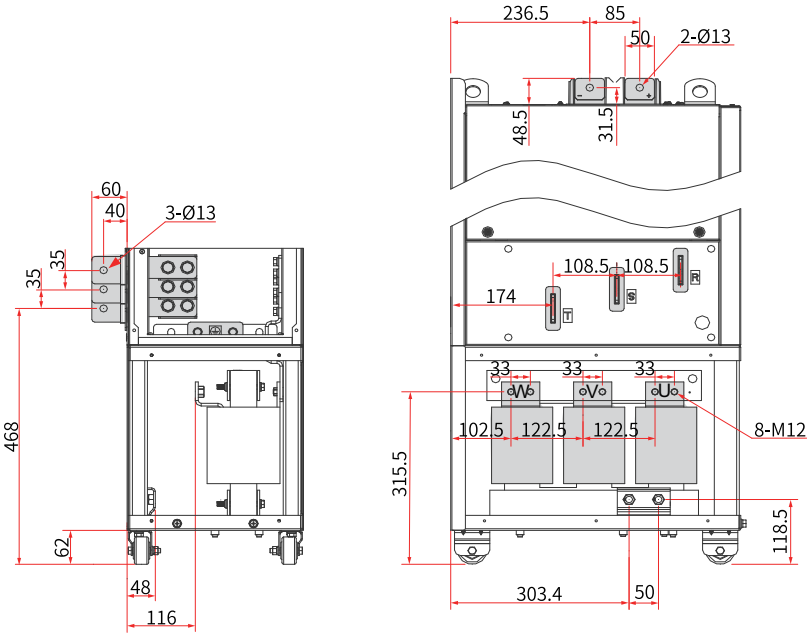


Figure 6-15 Main circuit terminal dimensions (mm) for T10 models with the output reactor

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

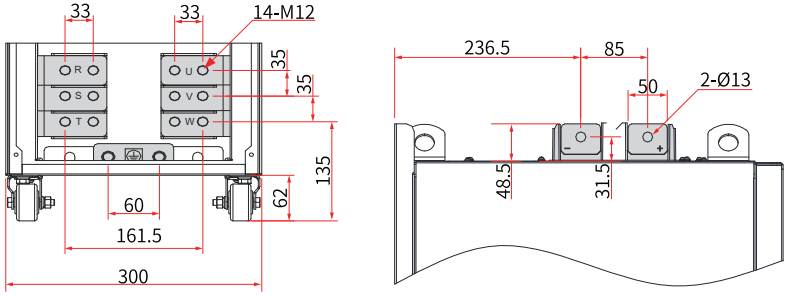


Figure 6-16 Main circuit terminal dimensions (mm) for T10 models (without copper busbar or output reactor)

Table 6–11 Main circuit cable selection for T10 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T10	MD580-4T426 MD580-4T426-L	365.0	2 x (3 x 95)	BC95-12	95	BC95-12	M12	35.0 (310.1)
	MD580-4T465 MD580-4T465-L	410.0	2 x (3 x 120)	BC120-12	120	BC120-12	M12	35.0 (310.1)

T11

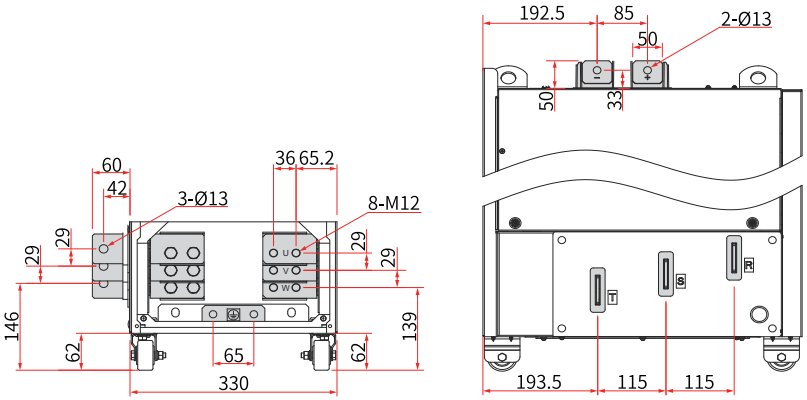


Figure 6-17 Main circuit terminal dimensions (mm) for T11 models without the output reactor

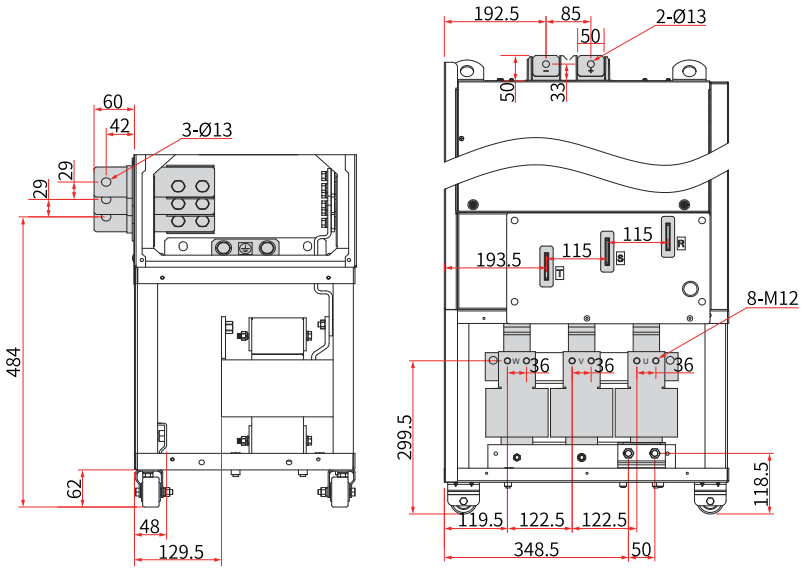


Figure 6-18 Main circuit terminal dimensions (mm) for T11 models with the output reactor

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

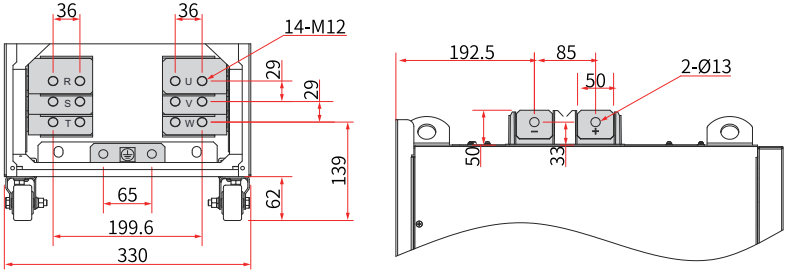


Figure 6-19 Main circuit terminal dimensions (mm) for T11 models (without copper busbar or output reactor)

Table 6–12 Main circuit cable selection for T11 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T11	MD580-4T520 MD580-4T520-L	441.0	2 x (3 x 120)	BC120-12	120	BC120-12	M12	35.0 (310.1)
	MD580-4T585 MD580-4T585-L	495.0	2 x (3 x 150)	BC150-12	150	BC150-12	M12	35.0 (310.1)

T12

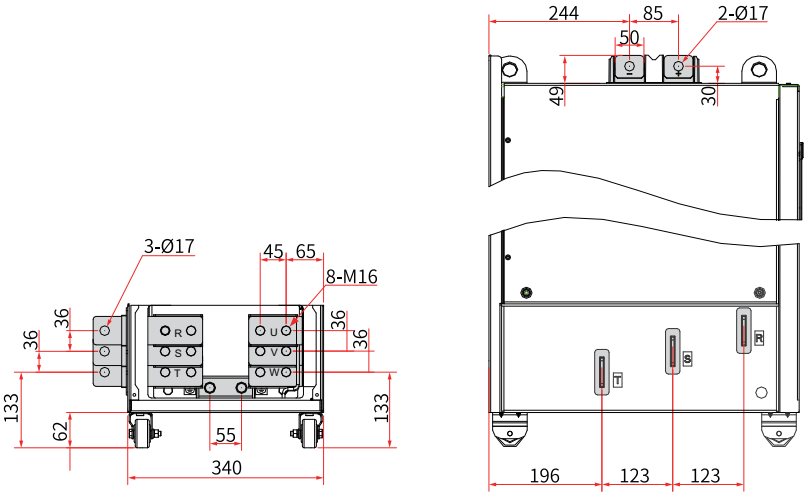


Figure 6-20 Main circuit terminal dimensions (mm) for T12 models without the output reactor

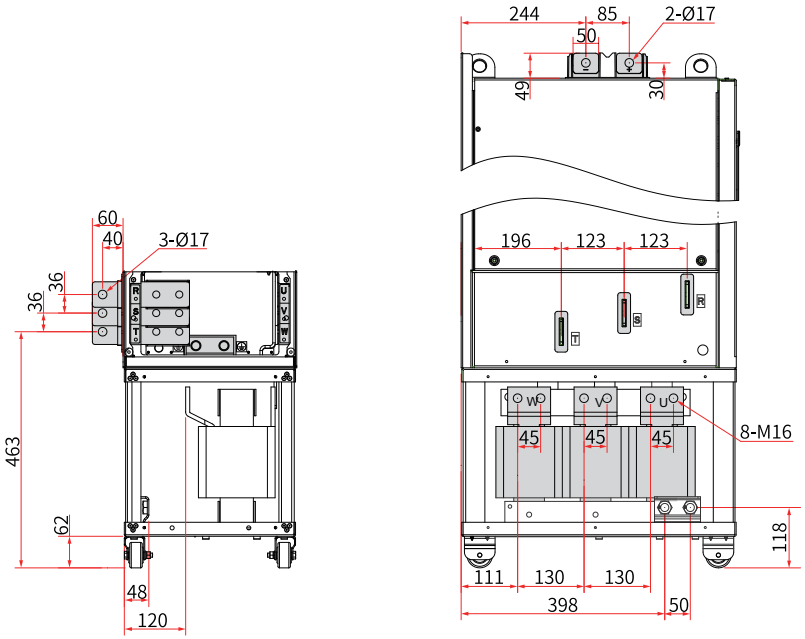


Figure 6-21 Main circuit terminal dimensions (mm) for T12 models with the output reactor

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

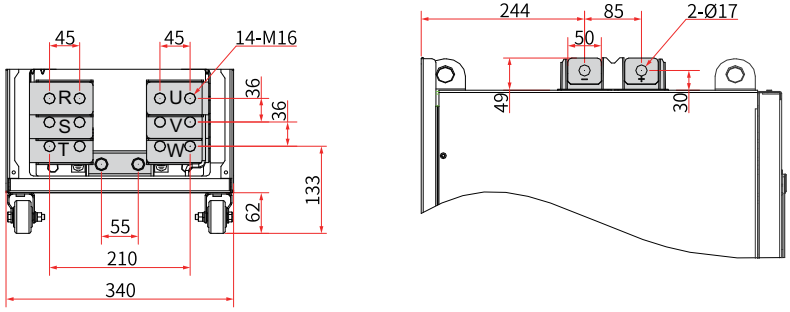


Figure 6-22 Main circuit terminal dimensions (mm) for T12 models (without copper busbar or output reactor)

Table 6–13 Main circuit cable selection of T12 models

Structure	AC Drive Model	Rated Input Current A	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque N·m (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T12	MD580-4T650 MD580-4T650-L	565.0	2 x (3 x 185)	BC185-16	185	BC185-16	M16	85.0 (753.1)
	MD580-4T725 MD580-4T725-L	617.0						
	MD580-4T820 MD580-4T820-L	687.0	2 x (3 x 240)	BC240-16	240	BC240-16	M16	85.0 (753.1)

6.3.3 Wiring Description of Main Circuit Terminals

This section specifies requirements for wiring of main circuit terminals. For requirements for selection, routing, and wiring of main circuit cables, see *"6.3.4 Main Circuit Wiring Requirements" on page 94*.

To prevent accidents caused by short circuit, install a fuse on the input side of the drive. For requirements of fuses and recommended fuse models, see "Conditions for Compliance with the LVD" in the *MD580 Series Low-Voltage High-Performance Engineering AC Drive Hardware Guide*.

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.
- The specification and installation method of external main circuit cables must comply with the local regulations and related IEC standards.
- 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. After the CHARGE indicator goes off, wait at least 10 minutes before operating the drive. Failure to comply will result in electric shock.
- When wiring an external braking component for a model with the power of 90 kW or above, ensure correct polarity (+)/(-). Failure to comply will result in damage to the AC drive and braking components or even fire.
- The cable length of the braking unit must not exceed 10 m. Use the twisted pair cables or closely-paired cables for parallel connection.
- Avoid connecting the braking resistor directly to the DC bus. Failure to comply will result in damage to the AC drive or even fire.

Output U/V/W

- The specification and installation method of external main circuit cables must comply with the local regulations and related IEC standards.
- Use copper lead cables with appropriate dimensions for main circuit cables.
- Do not connect any capacitor or surge protection device at 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 in turn 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.

Grounding terminal (PE)

For grounding requirements, see "7.5 Grounding".

6.3.4 Main Circuit Wiring Requirements

Main circuit wiring requirements

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

Power cable selection requirements

For the selection of power cables, follow national or regional regulations. Select IEC cables based on the following requirements:

- Compliant with IEC 60204-1 and IEC 60364-5-52 standards
- PVC insulated cables with copper conductors

- Heat resistance: ambient temperature of 40°C and cable surface temperature of 70°C (Remark: When the ambient temperature exceeds 40°C, contact Inovance.)
- Symmetrical cable with copper mesh shield

Note

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

To meet the EMC requirements, the cable with the shield must be used. The shielded cables are divided into three-conductor cables and four-conductor cables, as shown below. If the conductivity of three-conductor cable shield cannot meet requirements, add an independent PE cable. Alternatively, use a four-conductor cable with one conductor as the PE wire. The shield of the shielded cable is comprised of coaxial cooper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

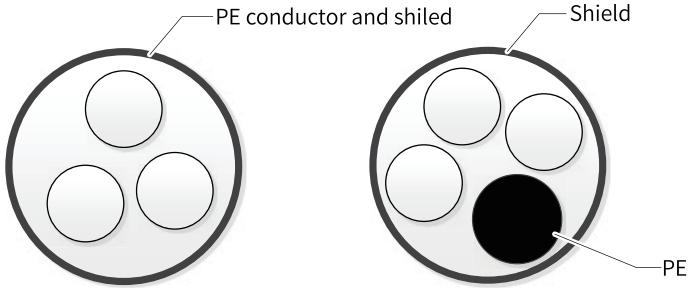


Figure 6-23 Recommended power cable

Main circuit routing requirements

The power supply input cable of the AC drive and motor cable can generate strong electromagnetic interference. To avoid electromagnetic interference caused by long-distance parallel coupling between the strong disturbing cable and control circuit cable, ensure a distance longer than 30 cm between main circuit cables and signal cables when cabling. Common main circuit cables include input R/S/T cables, output U/V/W cables, DC bus, and brake cables. Signal cables include I/O signal cables, communication cables, and encoder cables.

Cable ducts must be in good connection and well grounded. Use aluminum cable ducts to ensure equipotentiality of the drive. Connect the filter, AC drive, and motor to the system (machines or devices) properly. Protect all connections with spray coating and ensure good contact of conductive metal.

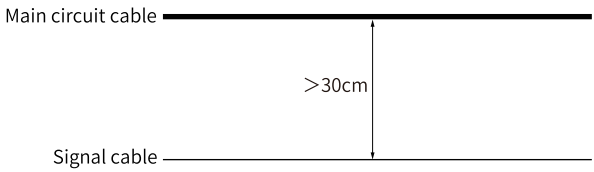


Figure 6-24 Cable layout

Wiring in an IT or delta grid system

Before wiring in an IT or angular grid system, disconnect the EMC grounding screw. Failure to comply will result in damage to the AC drive or even personal injury.

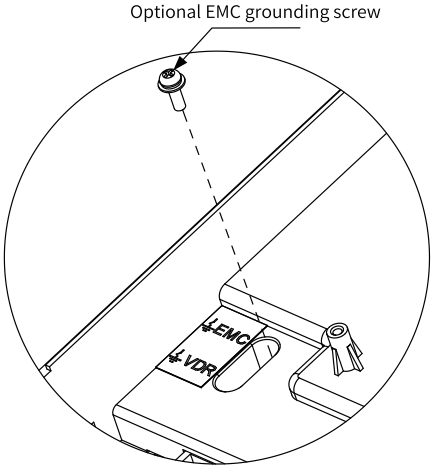


Figure 6-25 Disconnecting the optional EMC grounding screw

Shield of motor cables

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 below. The following figure shows wiring of the shield.

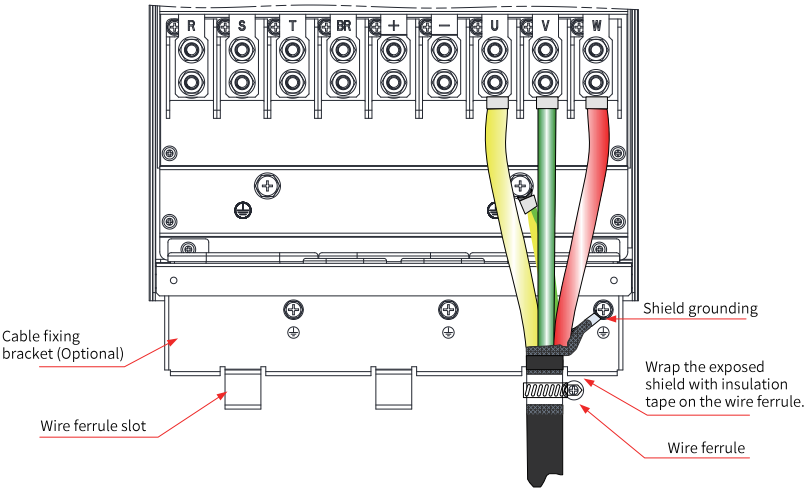


Figure 6-26 Wiring of the shield

Keep the drain wire of the motor cable shield as short as possible, with its width (b in the following figure) no shorter than 1/5 of its length (a in the following figure).

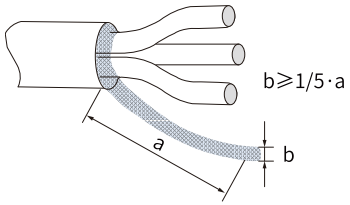


Figure 6-27 ""Drain wire of the motor cable shield

Length of motor cables

When the AC drive is working, the quick on-off of its power switch triode can lead to excessively large dU/dt at the output side. If the motor cable is too long, the motor winding will experience excessive voltage stress that may cause insulation breakdown. Use motors that comply with technical specifications in IEC 60034-25 IVIC B or motors with excellent insulation performance and high voltage resistance. In addition, with the increase of cable length, the distributed capacitance of the cable increases linearly, resulting in high-order harmonic current.

When the length of the motor cable is longer than the maximum length recommended in the following table, install an output reactor on the output side of the AC drive, or use a motor conforming to technical specifications in IEC 60034-25 IVIC B. The output reactor can reduce the voltage stress on the motor winding.

Table 6–14 Requirement for output reactor based on cable length and motor types

AC Drive Rated Power (kW)	Maximum Cable Length (m) of the Common Asynchronous Motor Without Output Reactor	Output Reactor Required (Motor Complying with IEC 60034-25 IVIC B)	Output Reactor Required (Common Asynchronous Induction Motor)
0.4 to 3.7	50 m	Not required	Required
5.5	70 m	Not required	Required
7.5	100 m	Not required	Required
11	110 m	Not required	Required
15	125	Not required	Required
18.5	135	Not required	Required
22	150	Not required	Required
⩾ 30	150	Not required	Required

Recommended cable lugs

The following table describes the appearances of the GTNR, TNR, and BC series cable lugs of Suzhou Yuanli.

Table 6–15 Appearance of cable lugs

Structure	Appearance
GTNR series	
TNR series	
BC series	

6.3.5 Protection Requirements

Main circuit cable protection requirements

Apply heat-shrink tubing to the copper lug and conductors of the cable, and ensure all conducting parts of the cable are properly wrapped, as shown in *"Figure 6–28 Applying heat-shrink tubing to conducting parts of the main circuit cable" on page 99*.

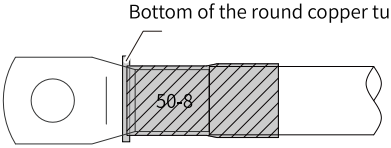


Figure 6-28 Applying heat-shrink tubing to conducting parts of the main circuit cable

Requirements for upstream protective devices

- Install appropriate protective devices on the power input side to provide overcurrent, short-circuit, and isolation protections.
- When selecting protective devices, take the following factors into consideration: current capacity of the main circuit cable, required system overload capacity, and short-circuit capacity of the upstream power input. Generally, select those recommended in the selection guide for peripheral electrical components.

6.4 Control Circuit Connection

6.4.1 Descriptions of Control Circuit Terminals

"Figure 6–29 " on page 100 shows the layout of control circuit terminals.

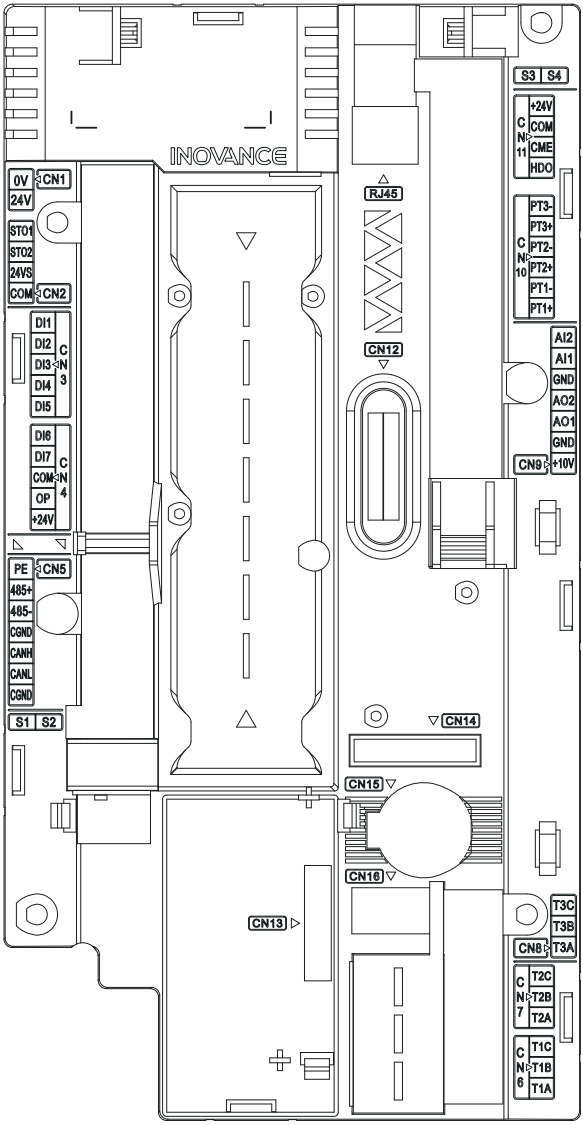


Figure 6-29 Layout of control circuit terminals

Table 6–16 Functions of control circuit terminals

External Interface	Terminal Type	Terminal Name	Description	Specification
CN3	Digital input terminal	DI1-OP	Common multi-function input terminals	Isolated sink/source input programmable terminal; input frequency: < 100 Hz; OP is internally isolated from COM and 24V, and externally shorted to +24V using a jumper by default.
		DI2-OP		
		DI3-OP		
		DI4-OP		
		DI5-OP		
CN4		DI6-OP		
		DI7-OP	Multi-function high-speed pulse input terminal	Maximum input frequency: 100 kHz; can be used as the common DI
CN11	Digital output terminal	HDO-CME	Programmable pulse frequency output	The internal emitter is connected to COM. It can be used as the common programmable open collector terminal that supports 24 VDC/50 mA. The maximum output frequency is 100 kHz. CME is isolated from COM and GND internally, and shorted to COM using a jumper by default.

External Interface	Terminal Type	Terminal Name	Description	Specification
CN9	Analog input terminal	AI1-GND	Analog single-ended input channel AI1	0 V to 10 V or 0 mA to 20 mA; 12-bit resolution; correction accuracy: ±1%; input impedance in voltage input mode: 22.1 kΩ; input impedance in current input mode: 500 Ω or 250 Ω AI1 supports input from the temperature sensor, including the PT100, PT1000, KTY84, and PTC. See parameters in group F and see function guide for detailed usage.
		AI2-GND	Analog single-ended 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 See parameters in group F and see function guide for detailed usage.
	Analog output terminal	AO1-GND	Analog single-ended output channel AO1	0 V to 10 V (default mode) or 0 mA to 20 mA; 12-bit resolution; correction accuracy: 1%; maximum load output current in voltage mode: 2 mA; load impedance in voltage mode: > 5 kΩ; load impedance in current mode: < 500 Ω
		AO2-GND	Analog single-ended output channel AO2	
	On-board power supply output terminal	+10V-GND	10 V analog voltage output	10 V ± 10%; maximum current: 10 mA; GND is isolated from COM and CME internally.
		+24V-COM	On-board 24 V to power external devices	24 V ± 10%; no-load voltage: ⩽ 30 V; maximum output current: 200 mA; internally isolated from OP/CME/GND
CN1	Terminal for input of external 24 V power supply	24V-0V	Terminal for input of external 24 V power supply	Terminal for input of external 24 V power supply; maximum input voltage: 30 V; used by the control board; minimum input current: 1 A; 0V is isolated from COM, CME, and GND internally.
CN2	STO terminal	STO1	STO2	Internal connection: By default, STO1 and STO2 are connected to +24VS by using a jumper upon factory delivery. External connection: STO1, STO2, and +24VS can be connected to an external 24 V power supply. See the STO function for the detailed wiring.
		STO2	STO2	
		+24VS	STO1 and STO2 power supply+	
		COM	STO1 and STO2 power supply ground	

External Interface	Terminal Type	Terminal Name	Description	Specification
CN6	Relay output	TA1/ TB1/ TC1	TA-TB: normally closed TA-TC: normally open	Contact capacity: 250 VAC/3 A (Cosϕ = 0.4)
CN7		TA2/ TB2/ TC2		
CN8		TA3/ TB3/ TC3		
CN5	RS-485 communication	C485+	RS-485 communication signal (+)	External RS-485 communication, standard Modbus RTU
		C485-	RS-485 communication signal (-)	
		CGND	RS-485 communication signal ground	
	CAN communication	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	
RJ45	Operating panel RS-485 communication	RS485+	RS-485 communication signal (+)	RS-485 internal bus, used for commissioning by using the LED operating panel, external LCD operating panel, or PC
		RS485-	RS-485 communication signal (-)	
		GND	RS485 communication signal ground	
CN10	Temperature sensor	PT1+, PT1-	Three-channel temperature sensor input	Three channels of common temperature sensors (PT100, PT1000, PTC, KTY84) supported; temperature display on the operating panel by setting parameters in group F; parameters related to temperature offset correction contained in group F
		PT2+, PT2-		
		PT3+, PT3-		

External Interface	Terminal Type	Terminal Name	Description	Specification
-	DIP switch	S1	Board-mounted RS-485 communication resistor switch	Connected by default
		S2	CANlink communication resistor switch	Connected by default
		S3	Operating panel RS-485 communication resistor switch	Connected by default
		S4	Operating panel CAN communication resistor switch	Connected by default; reserved
CN13	Communication expansion card terminal	J15	Communication expansion card terminal	The following communication expansion cards are supported: CANopen communication card MD580–SI-CAN1, Modbus RTU communication card MD580–SI-RS1, PROFIBUS DP communication card MD580–SI-DP1, PROFINET IO communication card MD580–SI-PN1, Modbus TCP communication card MD580–SI-EM1, EtherCAT communication card MD580-SI-ECAT1, and EtherNet/IP communication card MD580-SI-EN1.
CN14	I/O expansion card terminal	J3	I/O expansion card terminal	I/O expansion card MD580-IO-RD1 supported

Note

- If the ambient temperature exceeds 23°C, derate the output current by 1.8 mA for every additional 1°C. The maximum output current is 170 mA at 40°C. When OP is shorted to 24V, the DI terminal current must be considered.
- Based on the maximum output voltage of the signal source, select 500 Ω or 250 Ω impedance. For example, if 500 Ω is selected, keep the maximum output voltage not lower than 10 V so that AI2 can detect 20 mA current.

Table 6–17 Terminal descriptions

External Interface	Terminal Name	Terminal Type	Signal Type
CN1	J32	Pluggable terminal block	Terminal for input of external 24 V power supply
CN2	J33	Pluggable terminal block	Safety function
CN3	J34	Pluggable terminal block	Common digital input
CN4	J35	Pluggable terminal block	Common and high-speed digital input
CN5	J36	Pluggable terminal block	RS-485/CAN communication
CN6	J31	Pluggable terminal block	Relay 1
CN7	J30	Pluggable terminal block	Relay 2
CN8	J29	Pluggable terminal block	Relay 3
CN9	J40	Pluggable terminal block	AI, AO, 10 V output
CN10	J39	Pluggable terminal block	Temperature sensor
CN11	J38	Pluggable terminal block	HDO, 24 V output
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

6.4.2 Control Circuit Terminal Wiring

For details on the grounding bracket of the control cable shield, see section Installing the Grounding Bracket of the Cable Shield in *MD580 Series Low-Voltage High-Performance Engineering AC Drive Installation Guide*.

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 6–30 AI wiring" on page 106*. In scenarios where analog signals experience severe external interference, install a filter capacitor or a

ferrite magnetic core on the analog signal source. Connect the drain wire of the shield of the analog input cable to the PE terminal of the AC drive.

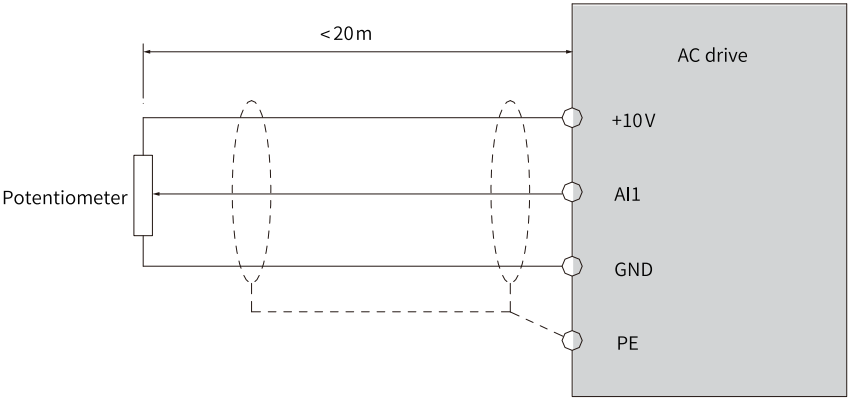


Figure 6-30 AI wiring

Wiring AI2/AI3

- 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.

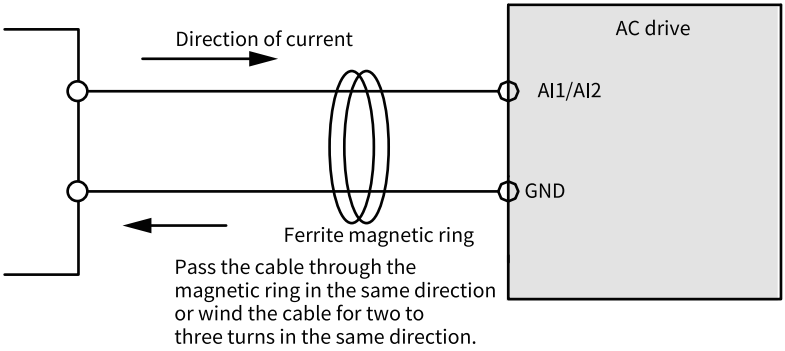
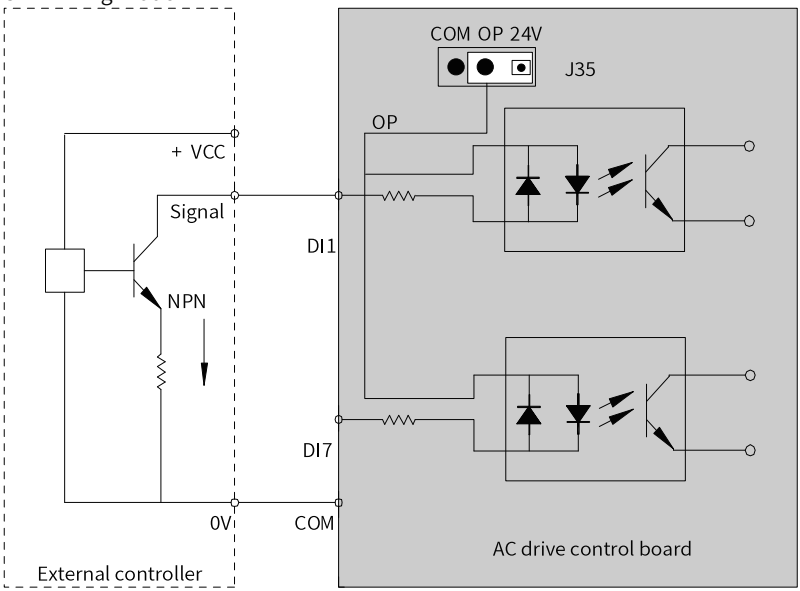


Figure 6-31 Wiring AI1/AI2

Wiring DI1 to DI7

- Sink wiring mode



Sink wiring mode when the internal 24 V power supply of the AC drive is used

Figure 6-32 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 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 following requirement: IF > 40 mA and VR > 40 V, as shown in *"Figure 6-33 Parallel connection of DIs of multiple AC drives in the sink mode" on page 108*.

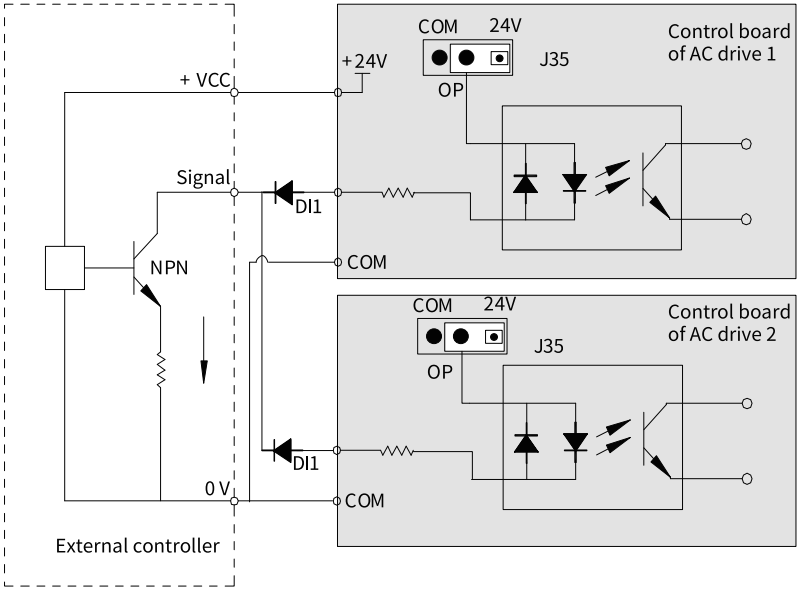


Figure 6-33 Parallel connection of DIs of multiple AC drives in the sink mode

- Source wiring mode

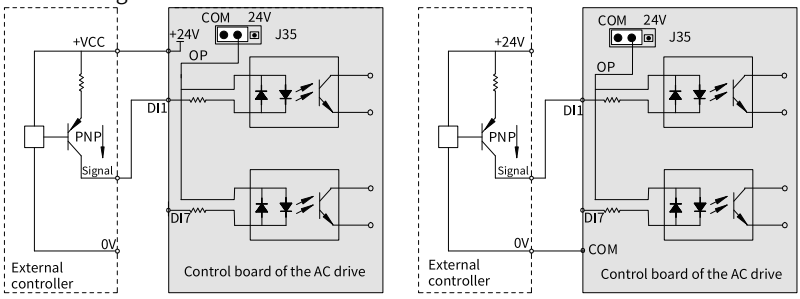


Figure 6-34 Source wiring mode

- 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 VDC power supply may be damaged. Ensure that the driving capacity does not exceed 50 mA.

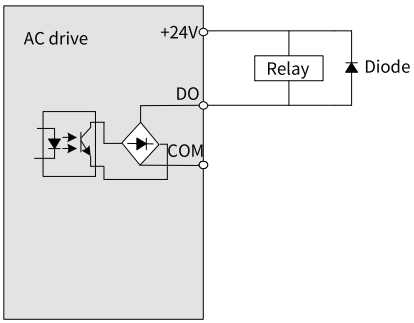


Figure 6-35 Wiring the DO

Note

Ensure correct direction of electrodes when installing the snubber diode. Failure to comply may result in burnout of the 24 VDC power supply upon output from the digital output terminal.

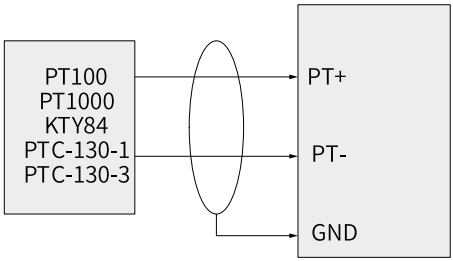


Figure 6-36 Wiring the PT temperature detector

Note

- The MD580 series AC drive supports simultaneous temperature sampling in four channels, each of which supports four types of temperature sensors.
- AI terminals have the multiplexing function. Set the parameters in group F6 for temperature detection. For specific parameter settings, see software-related chapters and sections.
- A temperature drift may be present due to device characteristics when the temperature sampling circuit works under high or low temperature.

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 6–37 Anti-interference processing of relay output terminals" on page 110*.

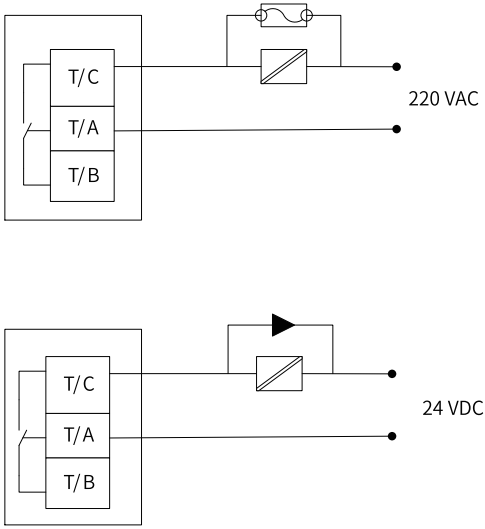


Figure 6-37 Anti-interference processing of relay output terminals

Note

Use a category 2 power supply for the control circuit. Failure to comply may degrade the operating performance of the AC drive.

Requirements on tubular terminals

Use tubular terminals with insulation sheath. Keep the exposed conductor of a single or twisted cable no longer than 6 mm, as shown in *"Figure 6–38 Requirements on tubular terminals of the control circuit cable" on page 111*.

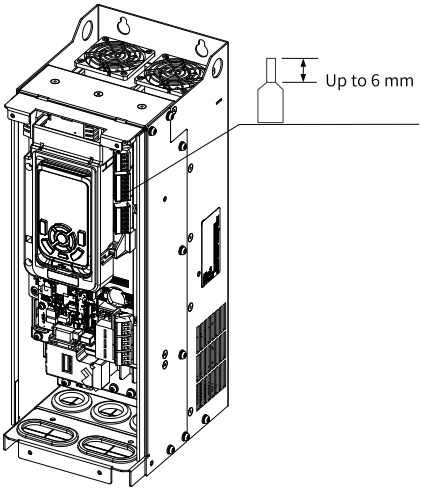


Figure 6-38 Requirements on tubular terminals of the control circuit cable

Table 6–18 Control circuit cable specifications

Single Cable mm^2 (AWG)	Twisted Cable mm^2 (AWG)	Tightening Torque (N · m)
0.2 to 0.75 (24AWG to 18AWG)		0.565

Note

- The diameter of single-conductor cables must be at least 18 AWG. The diameter of non-shielded twisted pair cables must be at least 20 AWG.
- The diameter of cables with three or more conductors must be at least 24 AWG.
- For cables thicker than 18 AWG, the crimped terminal conductor must be 6 mm to 8 mm in length, and no upper cover is allowed to avoid stress on the terminal and PCB.

6.4.3 Control Circuit Wiring Requirements

Note

Wire the control circuit cable according to EN 60204-1.

Selection requirements

To avoid the influence of strong external interference noise on the control circuit, it is recommended that the shielded cable with shield be used as the signal cable. The shield must be connected to the equipment in 360° with signal shielding brackets at both ends of the shield. Use a separate shielded cable for each type of analog signal. Use shielded twisted pair cables for digital signals.

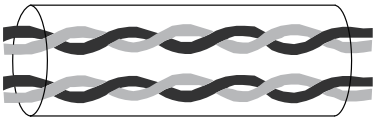


Figure 6-39 Shielded twisted pair

Requirements on shield grounding for analog terminals

Weak analog voltage signals are susceptible to external interference. Therefore, a shielded cable is typically required, and the wiring distance should be as short as possible (within 20 m). In scenarios where analog signals experience severe external interference, install a filter capacitor or a ferrite core on the analog signal source.

Use shielded cables together with a shield grounding bracket (optional) to achieve all-round grounding of the cable shield.

Wiring requirements for encoder signal cables

The AC drive is grounded as a whole in structure. When wiring the encoder after PG card installation, connect the encoder signal cable shield to the PE terminal of the PG card to complete shield grounding. Wire the encoder in accordance with the following requirements:

1. During on-site installation and commissioning, route the encoder cable and power cable in different cable ducts. Failure to comply may result in encoder interference.
2. It is recommended to use the shielded twisted pairs. For differential encoders, the cable shield must be connected to the PE terminal of the AC drive according to the differential pair wire.
3. In some scenarios with large-scale equipment, where the AC driver is far away from the motor (the motor cable may be as long as 10 m), the grounding impedance of the encoder cable shield is increased due to parasitic inductance of the cable. In this case, you can disconnect the encoder shield from the PE terminal of the driver.

Wiring requirements for I/O signal cables

- I/O signals include analog input (AI) signals, analog output (AO) signals, digital input (DI) signals, digital output (DO) signals, 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.
- Separate I/O signal cables from the main circuit cables (RST and UVW) and other power cables (or electric power cables) by at least 30 cm. Failure to comply may result in interference to I/O signals.
- Separate the cable connecting the relay output terminal from other I/O signal cables by a distance greater than 30 cm. Failure to comply may result in malfunction of the AC drive and equipment.

6.4.4 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 input, drive unit output, and braking resistor connection cables) by a distance above 50 cm to reduce interference from the AC drive and other equipment on analog signals. Comply with the preceding wiring requirements even in the control cabinet.
- Analog control signal cables
  Use shielded twisted pair cables for the analog control signal cables. Minimize the length of the stripped part of the cable (about 5–7 mm) and wrap the shield with the insulation tape to prevent the shield from coming into contact with other equipment and incurring interference.
- Motor cable
  Use shielded cables for motor cables. Minimize the distance between the cabinet module and the motor, and route the motor cables separately from other cables. Also, 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.
- Power cable
  Use shielded cables, or shield all the cables from the cabinet module to the motor by using conduits.
- Requirements of control cables and power supply cables
  If the power supply cables and control cables must be intersected, make the intersection angle 90 degrees.

6.4.5 Routing Recommendations

Routing disturbing cables and sensitive cables

During routing, route cables that transmit different types of signals through different routes. Separate the disturbing cables from sensitive cables 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.

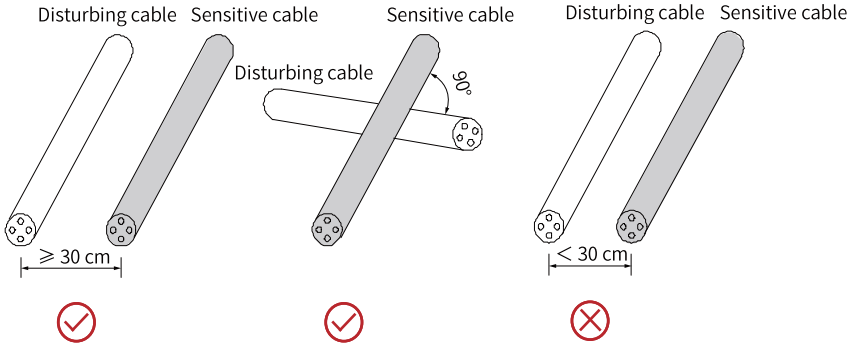


Figure 6-40 Routing disturbing cables and sensitive cables

Routing cables that transmit different types of signals

Route cables that transmit different types of signals through different routes and separate different types of signals with equipotential signals. 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.

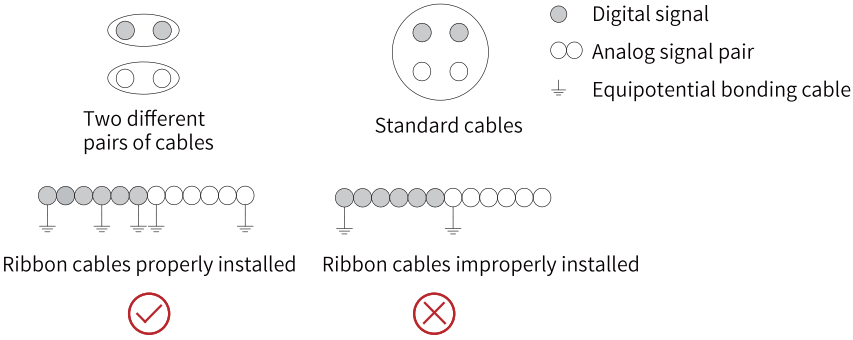


Figure 6-41 Routing cables that transmit different types of signals

Routing multi-conductor cables

For multi-conductor cables, use one cable to transmit one type of signals. To use one cable to transmit multiple types of signals, use a cable with internal conductor shields, as shown in the following figure.

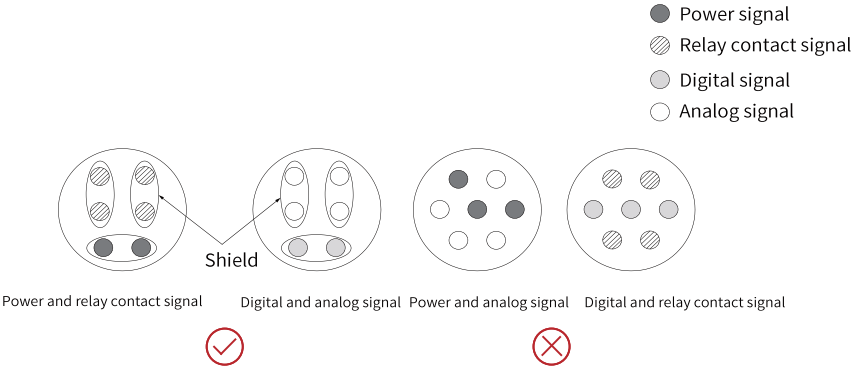


Figure 6-42 Routing multi-conductor cables

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

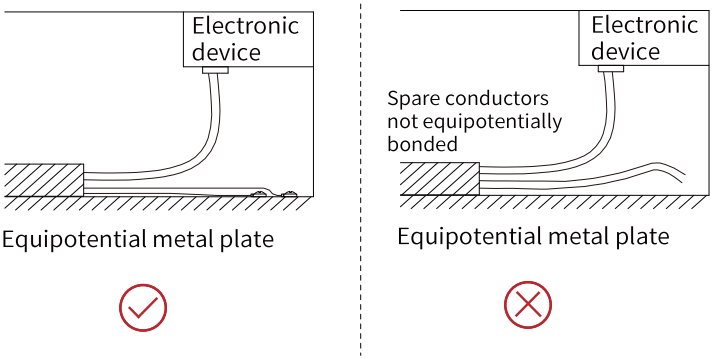


Figure 6-43 Handling reserved or unused conductors of multi-conductor cables

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 large loop area. Use twisted pair cables for analog signals. Lay digital signal cables close to each other.

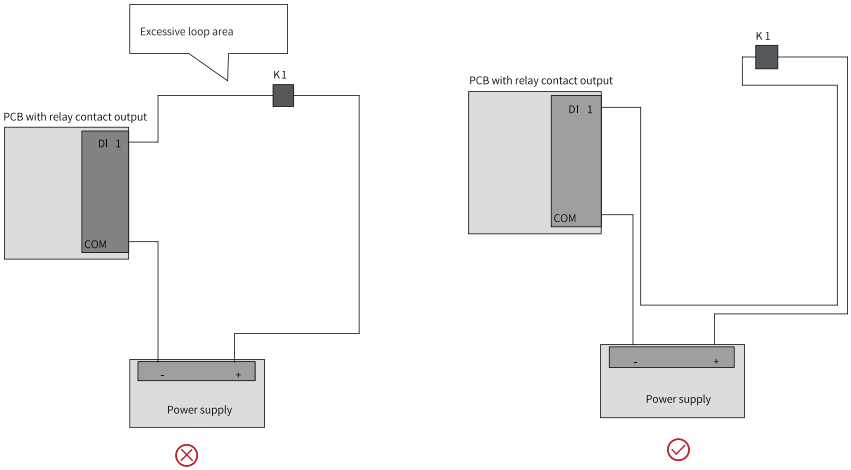


Figure 6-44 Recommended wiring loop area

Laying multiple types of cables

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 (recommended) in the same metal (zinc-iron or stainless steel) duct.

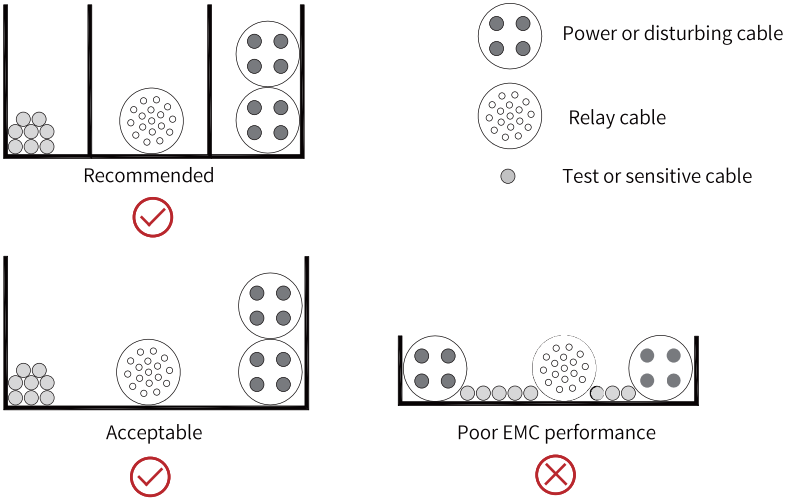


Figure 6-45 Routing multiple types of cables

Requirements on treatment of shielded cables

Minimize the length of the unshielded part of a shielded cable, and connect the shield to the nearest PE terminal. A long unshielded part makes signals, especially encoder signals, susceptible to interference.

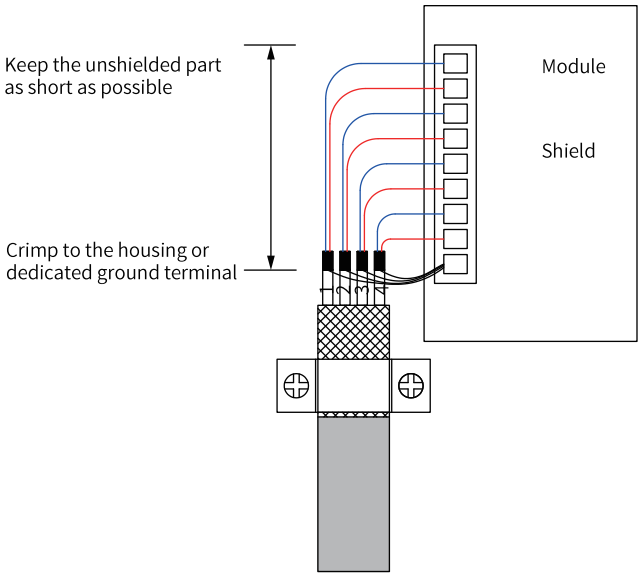


Figure 6-46 Shielded cable requirements

6.5 接地

6.5.1 Main Circuit

To correctly ground the AC drive, observe the following requirements:

Caution

- Ground the grounding terminal to avoid electric shock. Comply with the relevant local electrical regulations for grounding.
- To prevent electric shocks, check that the protective grounding conductor meets the technical specifications and local safety standards, and use a shortest possible grounding cable. The leakage current of the AC drive can be over 3.5 mA. Use a copper wire with a cross-sectional area of at least 10 mm^2 for the protective grounding, or use two protective grounding conductors of the same specifications for connection according to EN 61800-5-1.
- Follow the instructions for grounding every AC drive when multiple AC drives are installed. Incorrect grounding may lead to malfunction of AC drives.
- Disconnect the optional grounding screw of VDR (available on the AC drive) before the voltage resistance test. Failure to comply may fail the test.

- Use a proper yellow-green copper cable as the protective grounding conductor, and avoid connecting it to switchgears such as circuit breakers in series.
- Reliably ground the grounding terminal. Failure to comply may result in abnormal operation of the AC drive and even damage.
- Avoid connecting the grounding (PE) terminal to the N terminal of the neutral wire of the power supply.
- Mount the equipment onto a conductive metal surface (recommended) to ensure well connection between the entire conductive bottom of the equipment and the mounting surface.
- Fasten the grounding screws using the recommended tightening torque to avoid loose or excessively tight protective grounding conductor.

6.5.2 Grounding the Control Board

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

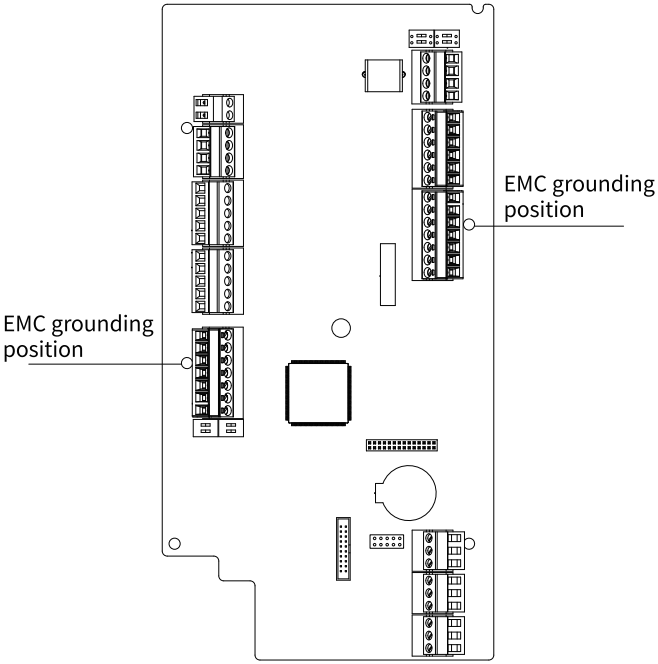


Figure 6-47 Control board grounding

6.5.3 Grounding a Single Device

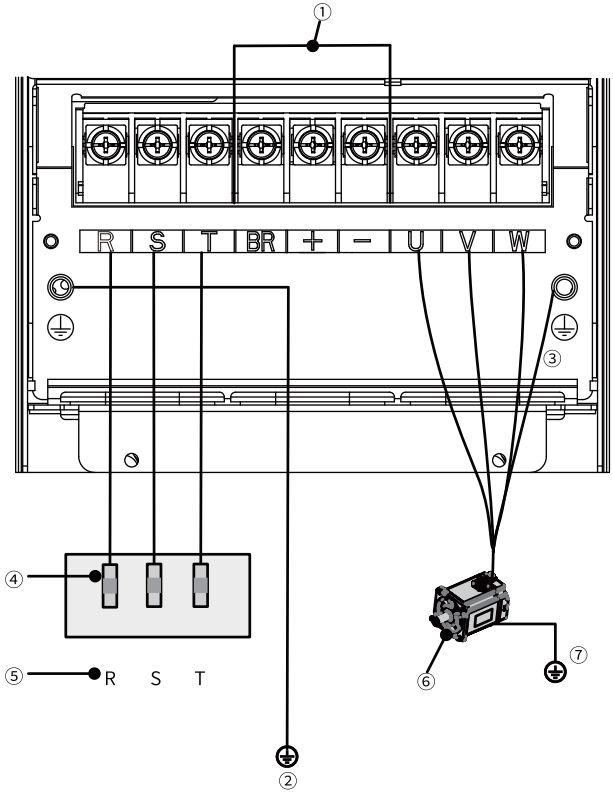


Figure 6-48 Main circuit grounding

Table 6–19 Description of the grounding of the main circuit

No.	Description
①	Avoid grounding the DC bus terminal and braking resistor terminal.
②	Connect the PE terminal on the input power supply side to the PE terminal on the input side of the AC drive.
③	Connect the PE terminal on the output side of the AC drive to the motor output cable shield.
④	Input protection (fuse with its lower part connected to the filter)
⑤	Power supply
⑥	Three-phase motor
⑦	Ground the motor enclosure.

Note

Arrangement of the main circuit terminals varies with models.

6.5.4 Multiple AC Drives

The following figure shows the grounding when multiple AC drives are installed in the cabinet side by side.

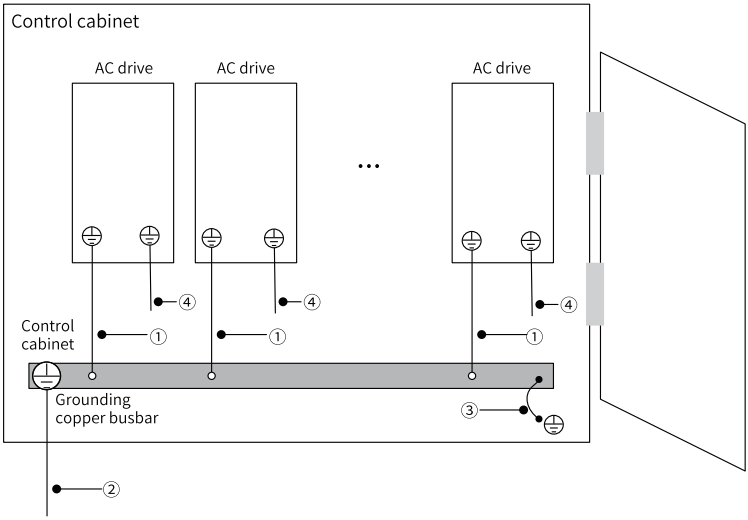


Figure 6-49 Grounding multiple AC drives installed side by side

Table 6–20 Grounding multiple AC drives installed side by side

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

6.5.5 Grounding the Cabinet System

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

Table 6–21 Wiring requirements

No.	Wiring Requirement
1	Install the control devices and the drive devices in two different cabinets.
2	Use grounding cables with a cross-sectional area of at least 16 mm^2 to connect different cabinets, therefore realizing equipotential between the 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.

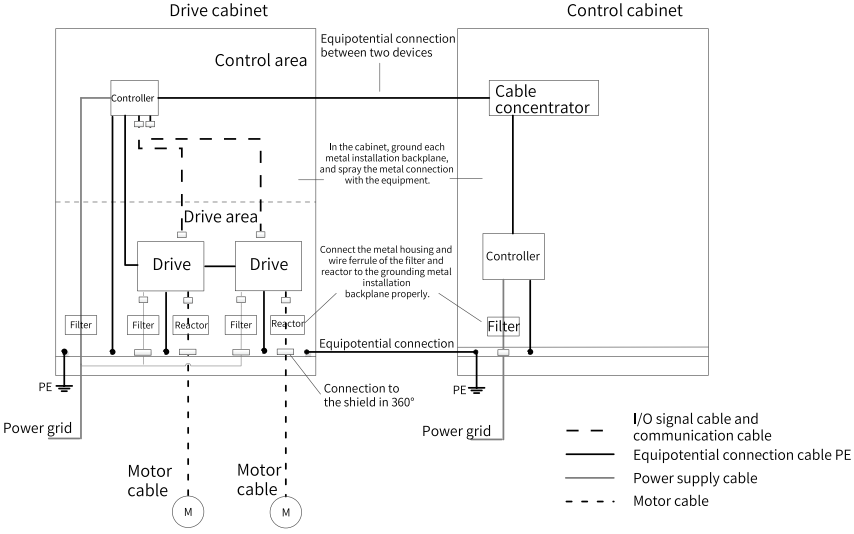


Figure 6-50 Recommended wiring for the cabinet system

6.6 通信连接

6.6.1 CANopen Communication

6.6.1.1 Overview

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

Features:

- With the Node Guard protocol supported, the master can read equipment status.
- With the Heartbeat protocol supported, the slave reports its current status to the master regularly.
- MD580-SI-CAN1 supports transmission of PDO data which is 16-bit.
- The SDO can be transmitted only via acceleration transmission mechanism. At most four channel's data can be transmitted per each frame.
- The CANIDs of all commands are default values of connections defined in CANopen DS301.
- MD580-SI-CAN1 is installed in the expansion slot of the MD580 without the external power supply.

6.6.1.2 Electrical Connection

Terminals and indicators

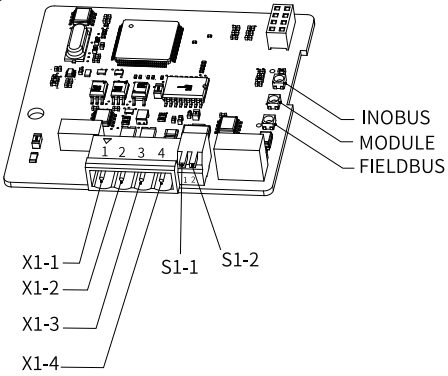


Figure 6-51 External connection diagram of MD580-SI-CAN1 module

Table 6–22 Terminal description

Terminal Pin	Name	Wiring	Description
X1-1	PE	For connection to the shield	Recommended cable: four-conductor shielded twisted pair cable Cross-sectional area: 0.3 mm^2 to 2.0 mm^2
X1-2	CANH	Twisted pair	
X1-3	CANL		
X1-4	CGND	Connection is recommended	
S1-1	DIP switch 1	/	Termination resistor selection Valid when S1-1 and S1-2 are all set to ON
S1-2	DIP switch 2	/	

The following figure shows the terminal wiring.

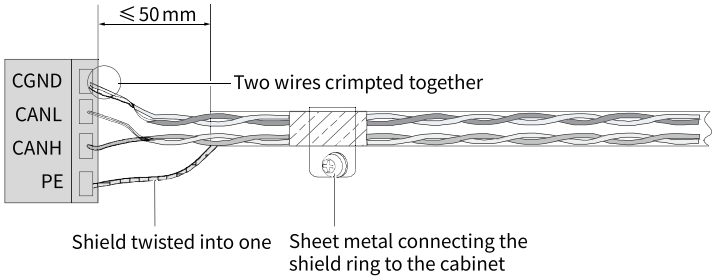


Figure 6-52 Terminal wiring

Bus topology

The CAN bus supports a maximum of 63 nodes (excluding the master). The following figure shows the networking. Set the termination resistors of the master and the last node to ON.

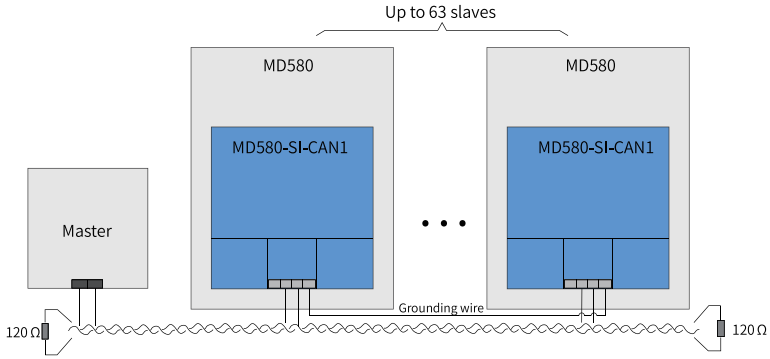


Figure 6-53 Networking diagram

Bus transmission distance

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

No.	Transmission Distance	Rate	Number of Nodes	Cable Diameter
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

6.6.2 Modbus RTU Communication

6.6.2.1 Overview

Features of the fieldbus adaption module MD580-SI-RS1:

- MD580-SI-RS1 is a new-generation fieldbus adaption module of Inovance. It is used together with the MD580 to realize networking and remote control of the multi-drive system through the Modbus RTU communication network.
- MD580-SI-RS1 features good compatibility. It can be used with different series of MD580 AC drives, and is compatible with MD880 series products.

6.6.2.2 Electrical Connection

Terminals and indicators

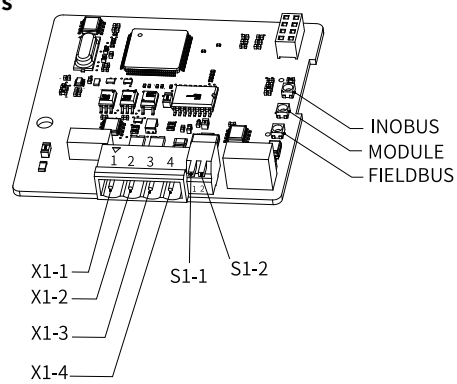


Figure 6-54 External connection diagram of MD580-SI-RS1 module

Table 6–23 Terminal description

Terminal Pin	Name	Wiring	Description
X1-1	SHIELD	For connection to the shield	Recommended cable: four-conductor shielded twisted pair cable Cross-sectional area: 0.3 mm^2 to 2.0 mm^2
X1-2	485+	Twisted pair	
X1-3	485–		
X1-4	GND	Connection is recommended	
S1-1	DIP switch 1	-	Termination resistor selection Valid when S1-1 and S1-2 are all set to ON
S1-2	DIP switch 2	-	

The following figure shows the terminal wiring.

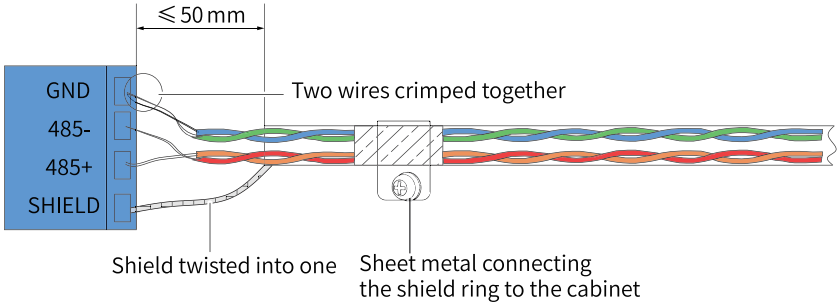
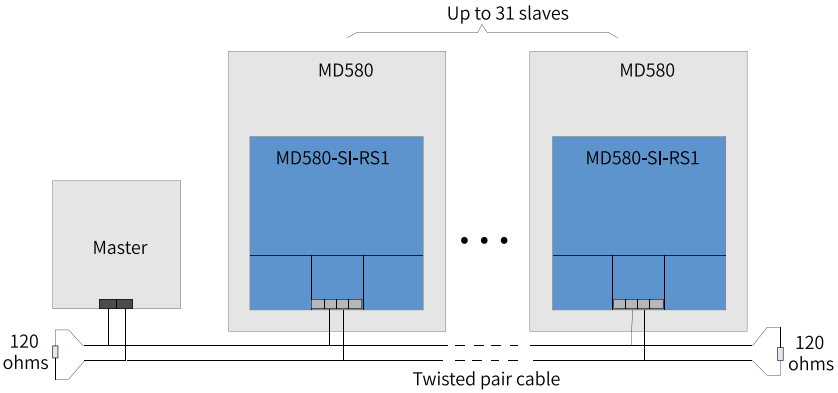


Figure 6-55 Terminal wiring

Bus topology

The Modbus RTU bus supports a maximum of 31 nodes (excluding the master). Set the termination resistors of the master and the last node to ON. The following figure shows the networking. If the number of nodes for networking exceeds 31, use a repeater.



6.6.3 PROFIBUS DP Communication

6.6.3.1 Overview

MD580–SI-DP1, a PROFIBUS-DP fieldbus adapter module, must be used with the MD580 AC drive of Inovance and fixed in the extension slot (CN13 slot) of the AC drive. It communicates with the bus master using the PROFIBUS-DP communication protocol.

Features:

- Automatically identifies the bus baud rate; supports the communication rate ranges of 9.6 kbps to 12 Mbps.
- In the bus topology, connects up to 32 nodes (including the master) when no repeater is used, or up to 122 nodes when repeaters are used (each segment comprising 31 nodes and one repeater).
- Complies with the EMS standard EN 61800-3:2004.
- Supports DPV0 and DPV1 for data exchange with the master.
- Be powered by the AC drive, without requiring an external power supply.

6.6.3.2 Electrical Connection

Bus cable description

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

Table 6–24 Cable specifications

Parameter	Description
Conductor	One pair (2 x 22AWG) of single-strand copper conductors
Insulating sheath color	Green, red
Shield	Aluminum plastic tape + tinned copper braid

Parameter	Description
Sheath material	PVC
Operating temperature	-30°C to +70°C
Appearance	Purple

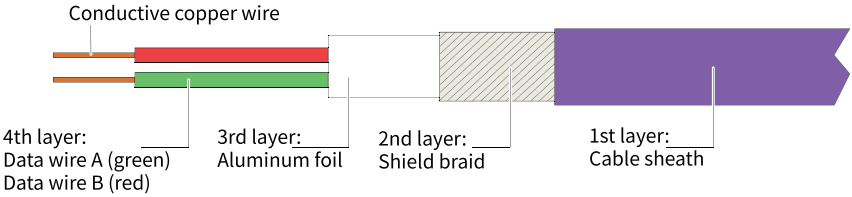


Figure 6-56 Internal layer of the bus

Bus terminal

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

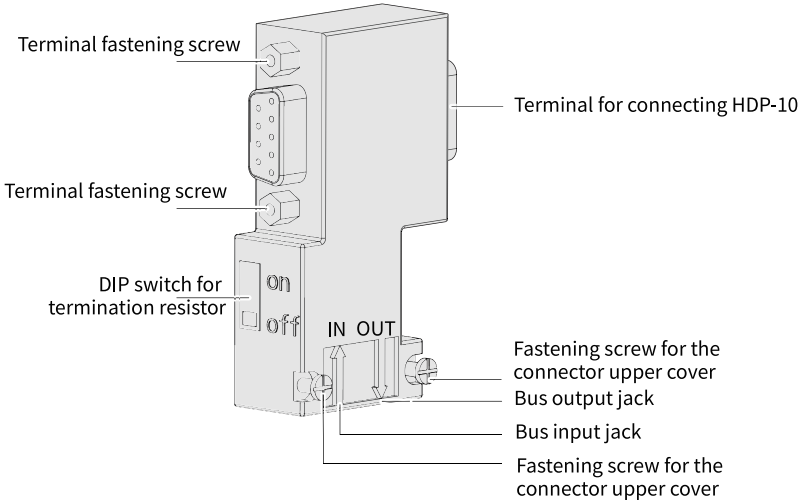


Figure 6-57 Bus connector

Bus connection procedure

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

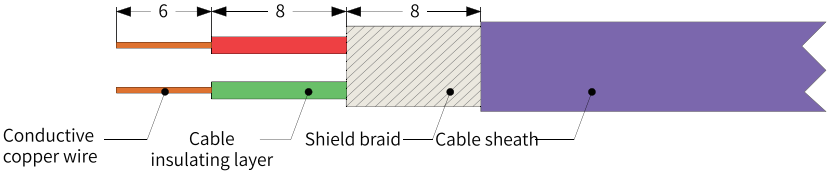
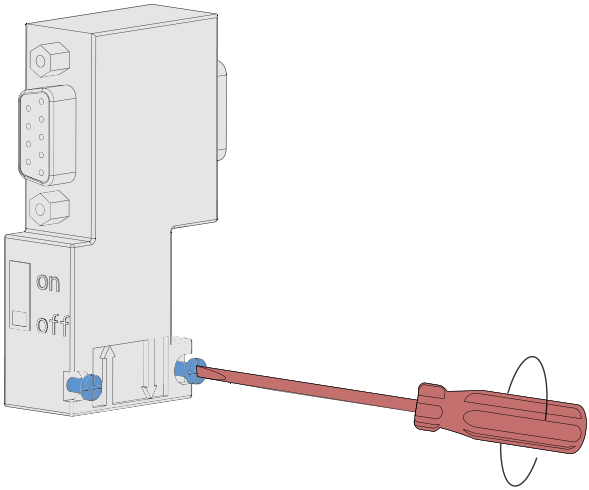
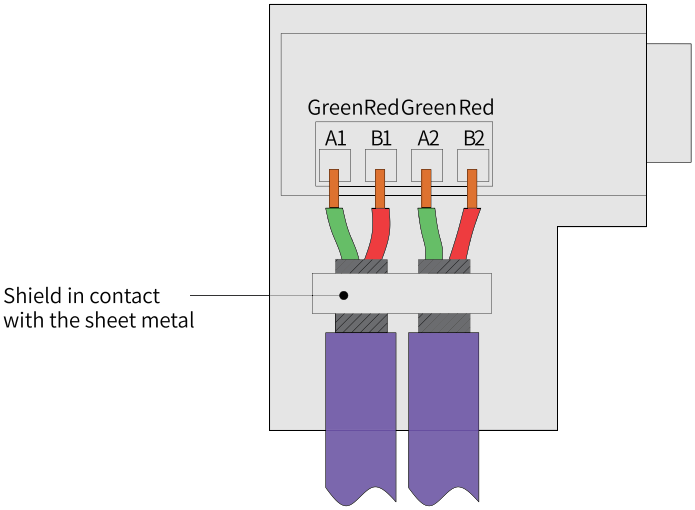


Figure 6-58 Length of each layer of the bus cable (unit: mm)

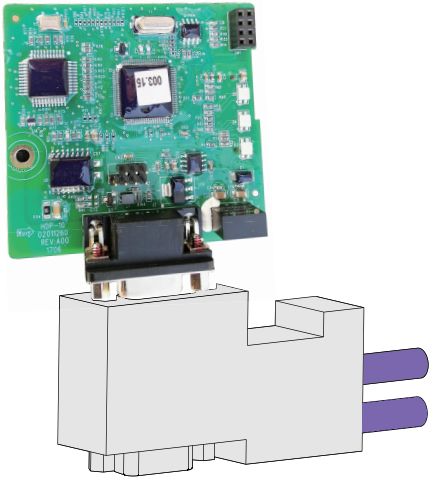
2. Open the bus connector terminal cover using the 1# straight screwdriver.



3. Secure the cable to the connector installation position using the 1# straight screwdriver. Ensure that the shield is in close contact with the shield 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 multi-drive system connection without any repeater, connect termination resistors to the first and last AC drives, as shown in *"Figure 6–59 Multi-drive system connection without any repeater" on page 131*.

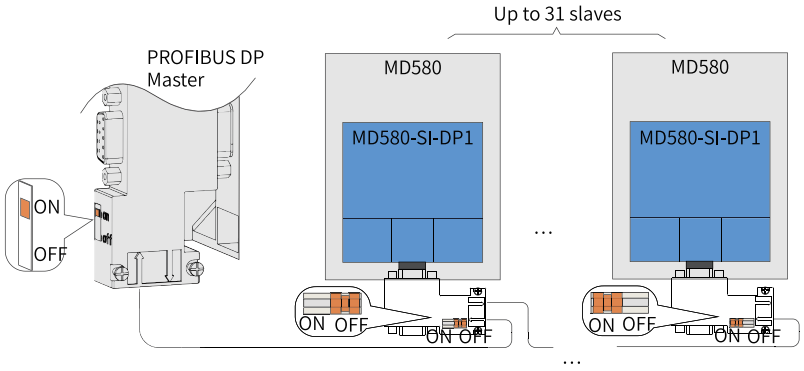


Figure 6-59 Multi-drive system connection without any repeater

- For multi-drive system connection with repeaters, connect termination resistors to the first and last AC drives, and connect the termination resistor of the repeater, as shown in *"Figure 6–60 Multi-drive system connection with repeaters" on page 132*.

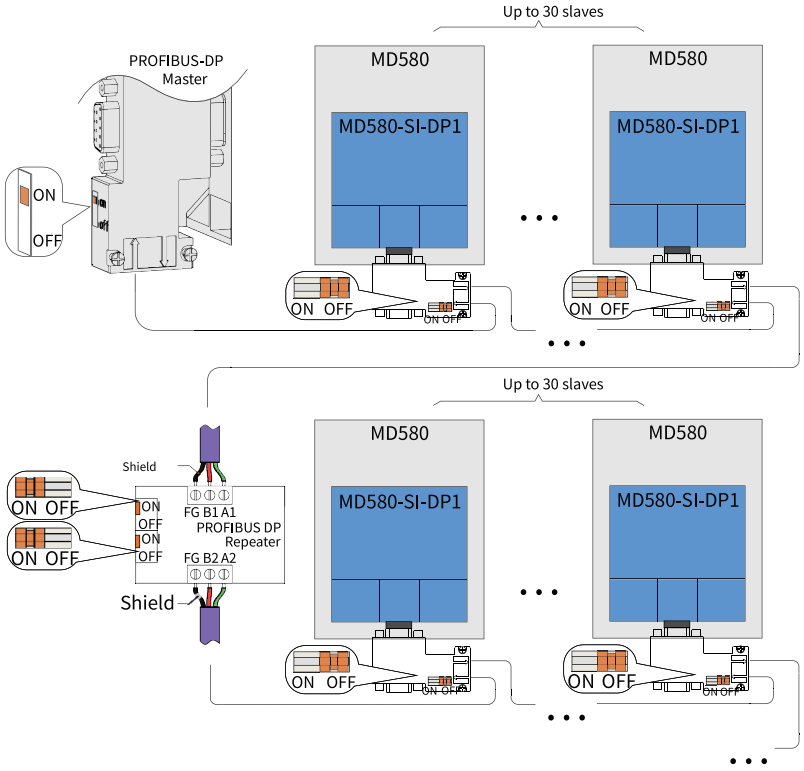


Figure 6-60 Multi-drive system connection with repeaters

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 distances in the preceding table are distances without using any repeater.

6.6.4 PROFINET IO Industrial Ethernet Communication

6.6.4.1 Overview

The PROFINET I/O Industrial Ethernet adapter module (MD580-SI-PN1 for short) meets international PROFINET I/O Industrial Ethernet standards. The module is used on the MD580 series AC drive, so that the AC drive can work as a slave on the PROFINET I/O Industrial Ethernet and be controlled by a PROFINET I/O Industrial Ethernet master. This effectively improves system communication efficiency and enriches the networking functions of the MD580 series AC drive.

Features:

- Supports up to 100 Mbit/s bus communication rate. The communication period is short.
- Provides flexible networking and supports almost all types of topologies: chain, bus, tree, and star.
- Uses a distributed clock and exchanges data using a pure-hardware mechanism, effectively the timing accuracy of data exchange.
- Supports direct installation in the extension slot of the MD580 AC drive without requiring an external power supply, which is convenient.

6.6.4.2 Electrical Connection

The MD580-SI-PN1 uses a standard Ethernet RJ45 socket for connection to a PROFINET master. The pin signal definitions are the same as those of the standard Ethernet pins. It supports both crossover and straight-through cabling modes.

Electrical connection for chain networking

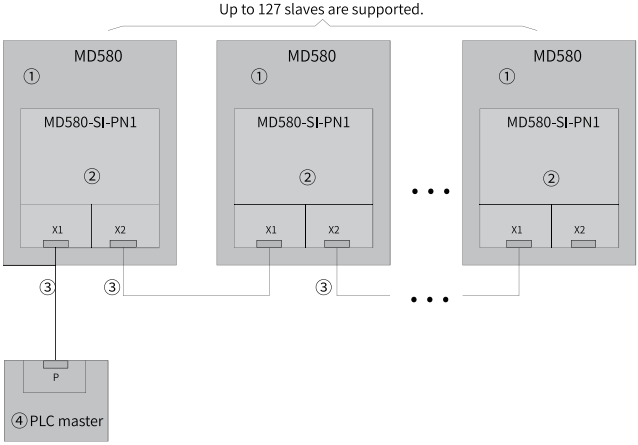


Figure 6-61 Electrical connection diagram for chain networking

No.	Name
①	MD580 AC drive
②	MD580-SI-PN1 Industrial Ethernet module
③	Network cable
④	PLC master

Electrical connection for star networking

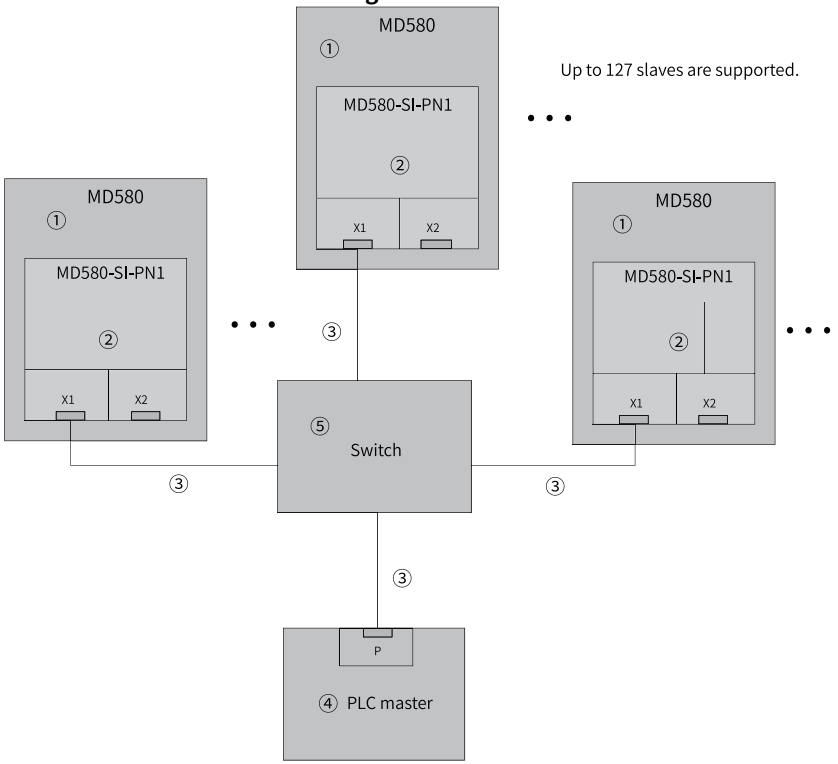


Figure 6-62 Electrical connection diagram for star networking

No.	Name
①	MD580 AC drive
②	MD580-SI-PN1 Industrial Ethernet module
③	Network cable
④	PLC master
⑤	Switch

6.6.5 Modbus TCP Communication

6.6.5.1 Overview

The Modbus TCP Industrial Ethernet adapter module (MD580–SI-EM1 for short) meets international Modbus TCP Industrial Ethernet standards. The module is used on the MD580 series AC drive, so that the AC drive can work as a server on the Modbus TCP Industrial Ethernet and be controlled by a Modbus TCP Industrial Ethernet client. This

effectively improves system communication efficiency and enriches the networking functions of the MD580 series AC drive.

Features:

- Supports switch networking.
- Does not support IP address allocation using DPCH.
- Supports the minimum HMBT communication period of 6 ms.
- Supports reading of up to 124 parameters per time.
- Supports connection of up to two Modbus TCP clients. The minimum communication period is doubled to 12ms when two clients are connected.
- Supports up to 100 m node-to-node transmission distance.

6.6.5.2 Electrical Connection

The MD580-SI-EM1 uses a standard Ethernet RJ45 socket for connection to the PC background. The pin signal definitions are the same as those of the standard Ethernet pins. It supports both crossover and straight-through cabling modes.

Single-module electrical connection

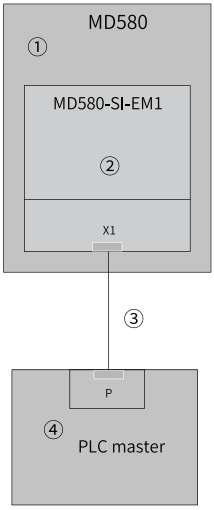


Figure 6-63 Single-module electrical connection diagram

No.	Name
①	MD580 AC drive
②	MD580-SI-EM1 Industrial Ethernet module
③	Network cable
④	PC master

Multi-module electrical connection

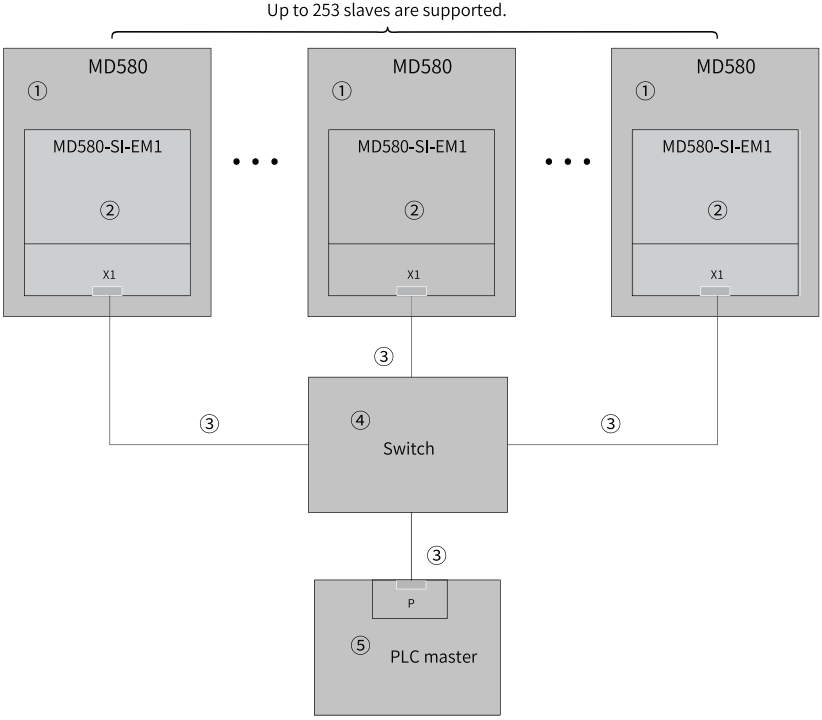


Figure 6-64 Multi-module electrical connection diagram

No.	Name
①	MD580 AC drive
②	MD580-SI-EM1 Industrial Ethernet module
③	Network cable
④	Switch
⑤	PC master

6.6.6 EtherNet/IP Industrial Ethernet Communication

6.6.6.1 Overview

The EtherNet/IP module (hereinafter referred to as MD580-SI-EN1) confirms to the Ethernet industrial protocol bus standard. It features high efficiency, flexible topology, and easy operation. When the MD580 is used together with the MD580-SI-EN1, the MD580 can serve as the EtherNet/IP adapter to be controlled by the EtherNet/IP scanner. This improves the communication efficiency and enriches the networking functions of the MD580.

Features:

- It supports various types of topology structures with the switch.
- It supports full duplex networks with the bandwidth of 100 MHz.
- It can be used together with the InoDriveStudio to implement commissioning functions.
- It is powered by the MD580 without external power supply required.
- A minimum of communication cycle of 1 ms is supported.

6.6.6.2 Electrical Connection

Ethernet/IP supports various topology structures, including bus, star, and tree types. Diversified networking modes can be implemented by using switches.

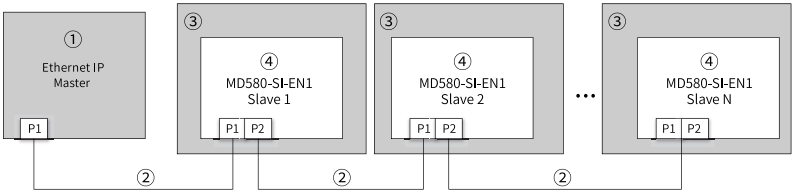


Figure 6-65 Bus topology

No.	Name
①	Ethernet/IP master
②	Network cable (It is recommended to use shielded twisted pair Cat 5e Ethernet cable, and the registered jack used for crimping must have a metal shell for earth shield protection.)
③	MD580 AC drive
④	MD580-SI-EN1 communication expansion card

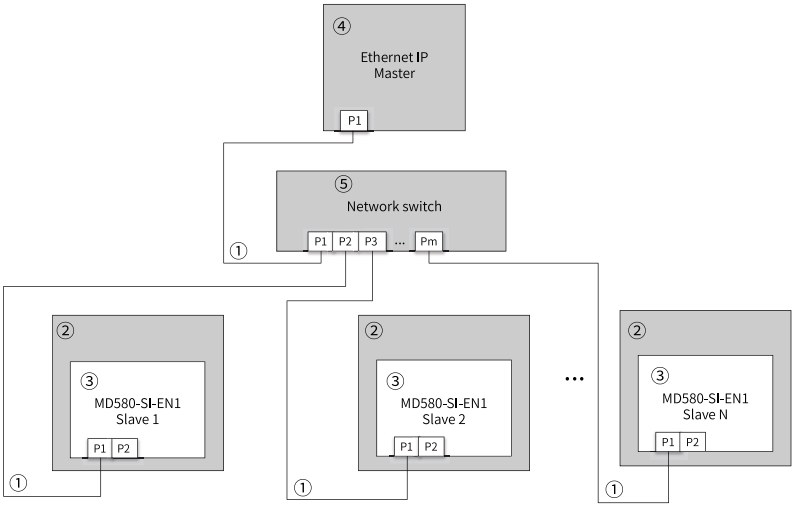


Figure 6-66 Star-type topology

No.	Name
①	Network cable (It is recommended to use shielded twisted pair Cat 5e Ethernet cable, and the registered jack used for crimping must have a metal shell for earth shield protection.)
②	MD580 AC drive
③	MD580-SI-EN1 communication expansion card
④	Ethernet/IP master
⑤	Switch

6.6.7 EtherCAT Industrial Ethernet Communication

6.6.7.1 Overview

The MD580-SI-EtherCAT industrial Ethernet bus module conforms to common EtherCAT industrial Ethernet standards. The module is mainly used together with the MD580 series AC drive. With the module, the MD580 can serve as the EtherCAT slave station and can be controlled by the EtherCAT master station. This effectively improves the communication efficiency and enriches the networking function of the MD580.

Features:

- It passes the Conformance Test Tool (CTT) test.
- It supports up to 16 RXPDOs and 16 TXPDOs, and supports dynamic configuration of PDOs.

- The DC synchronous clock mode is supported.
- The CoE protocol (PDO+SDO) is supported.
- A minimum of communication cycle of 125 us is supported.
- It supports various topology structures, including chain, bus, tree, and star types.
- The module is installed in the slot of the communication expansion card (CN13) without the external power supply.

6.6.7.2 Electrical Connection

EtherCAT supports various topology structures, including chain, bus, tree, and star types. This section describes the chain and star types.

Chain networking

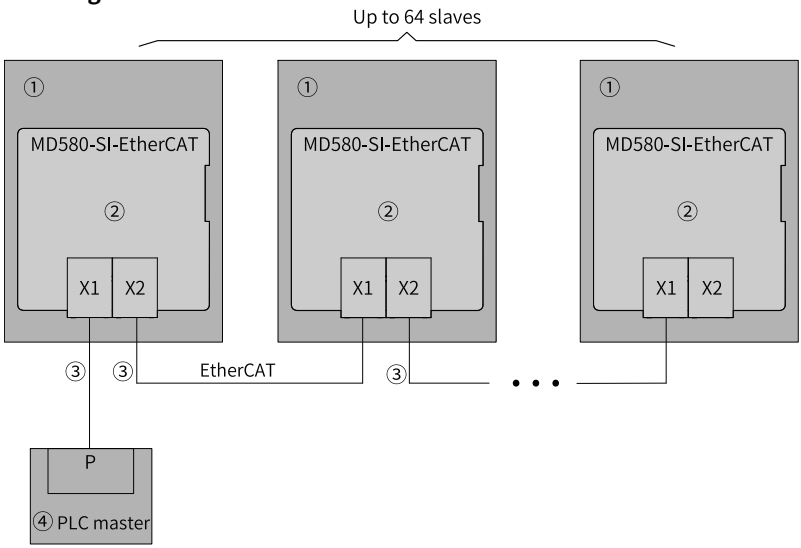


Figure 6-67 Chain networking topology

Table 6–25 Description of chain networking topology

No.	Name
①	MD580 AC drive
②	MD580-SI-EtherCAT industrial Ethernet module
③	Network cable (It is recommended to use shielded Cat 5e Ethernet cable, and the registered jack used for crimping must have a metal shell for earth screen protection.)
④	PLC master

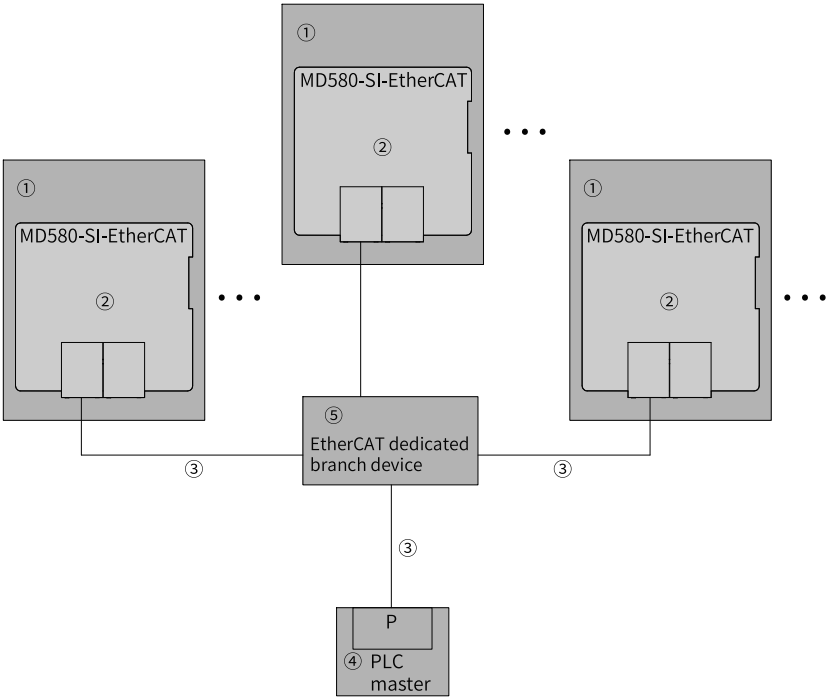


Figure 6-68 Chain networking topology

Table 6–26 Description of star networking topology

No.	Name
①	MD580 AC drive
②	MD580-SI-EtherCAT industrial Ethernet module
③	Network cable (It is recommended to use shielded Cat 5e Ethernet cable, and the registered jack used for crimping must have a metal shell for earth screen protection.)
④	PLC master
⑤	EtherCAT dedicated branch device

6.7 Inspection After Wiring

After the wiring is completed, check the items in the following checklist one by one and put a tick for compliance.

Table 6–27 Wiring checklist

No.	Checklist	Compliance
1	The power input is connected to the R, S, and T terminals properly.	
2	The motor input cable is connected to the U, V, and W terminals properly.	
3	The diameter of the main circuit cable meets the requirement.	
4	Heat-shrink tubing is applied to the copper lug and conductors of the main circuit cable and the tubing completely wraps the conducting parts of the cable.	
5	Motor output cable does not exceed 50 m, or the carrier frequency (F0-15) is reduced for a motor output cable exceeding 50 m.	
6	The AC drive is properly grounded.	
7	The output terminals and control cable terminals are connected securely and reliably.	
8	Where applicable, the braking resistor and braking unit used are wired properly with proper resistance values.	
9	Shielded twisted pair cables are used as control circuit signal cables.	
10	Optional cards are properly connected.	
11	The control circuit cable and main circuit power cable are routed separately.	

7 Installation Requirements for Options

7.1 AC Input Reactor

An AC input reactor is used to suppress harmonic waves in the input current. Install an AC reactor for applications with strict requirements on harmonic suppression to meet the requirements in IEC/EN 61000-3-2/12.

To install an AC input reactor, ensure sufficient space in the cabinet.

7.2 Output Reactor

An output reactor installed on the output side of the AC drive can reduce dV/dt and voltage stress on the motor winding, protecting the motor winding, reducing the motor temperature, and prolonging the motor service life.

7.3 Fuses, Contactors, and Circuit Breakers

If the fuse is blown or the circuit breaker trips, wait for at least a period of time specified on the equipment warning label before energizing the AC drive or operating any peripheral equipment. Failure to comply may result in equipment damage, personal injury, or even death.

To meet the requirements in IEC/EN 61800-5-1 and UL61800-5-1, install a fuse or circuit breaker on the input side to prevent accidents caused by internal short circuits.

7.4 EMC Filter

The optional EMC filter can meet the EN IEC 61800-3 C2 emission requirements. For details about models and dimensions, see the related *Selection Guide*. Install the EMC filter according to the following requirements:

- Install the EMC filter close to the input terminals, and keep the connection cable shorter than 30 cm.
- Connect the grounding terminal of the EMC filter to that of the drive, install the EMC filter and the drive on the same conductive surface, and connect the surface to the main ground of the cabinet.
- Connect the LINE terminal of the EMC filter to the power grid, and the LOAD terminal to the drive.

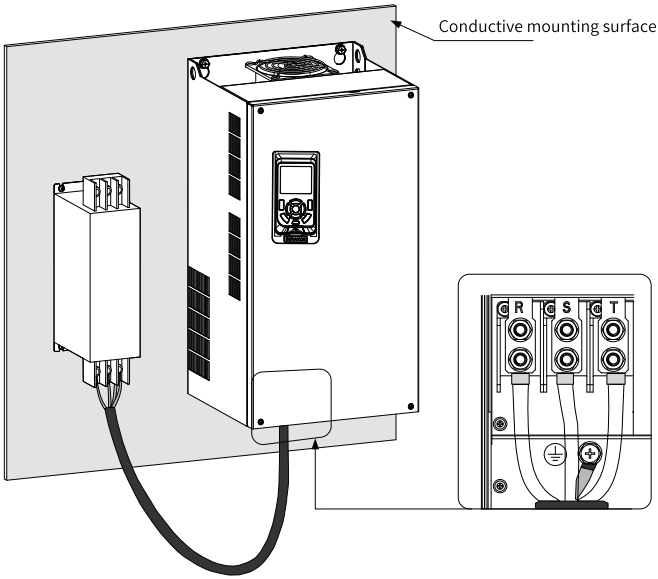


Figure 7-1 EMC filter installation

7.5 Simple Filter

Using a simple filter (capacitor box) instead of a standard EMC filter can also suppress RF electromagnetic noise from the grid and generated by the AC drive during operation. Reliably ground the simple filter and ensure that the cable between the filter and the AC drive is shorter than 30 cm.

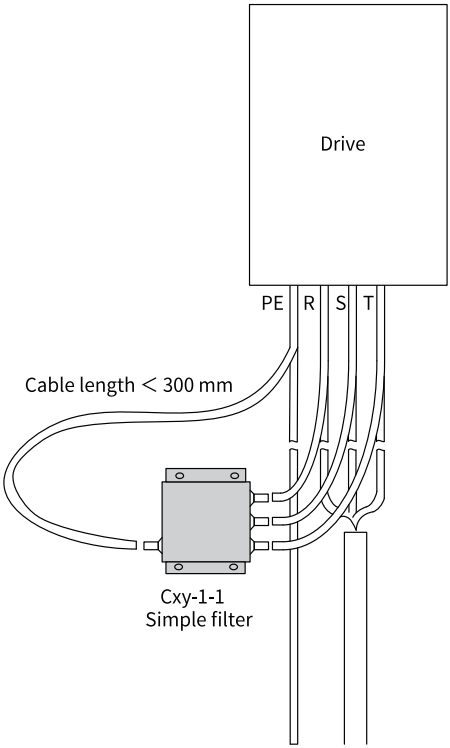


Figure 7-2 Installing a simple filter

7.6 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.

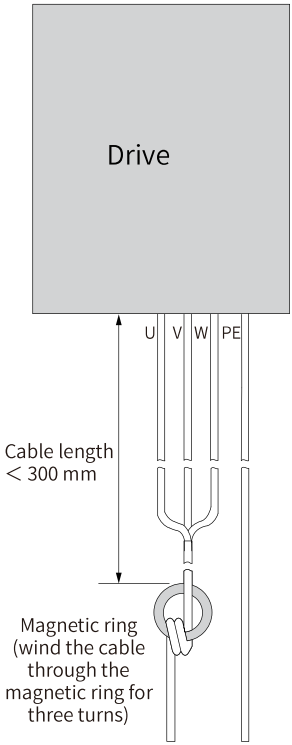


Figure 7-3 Magnetic ring installation

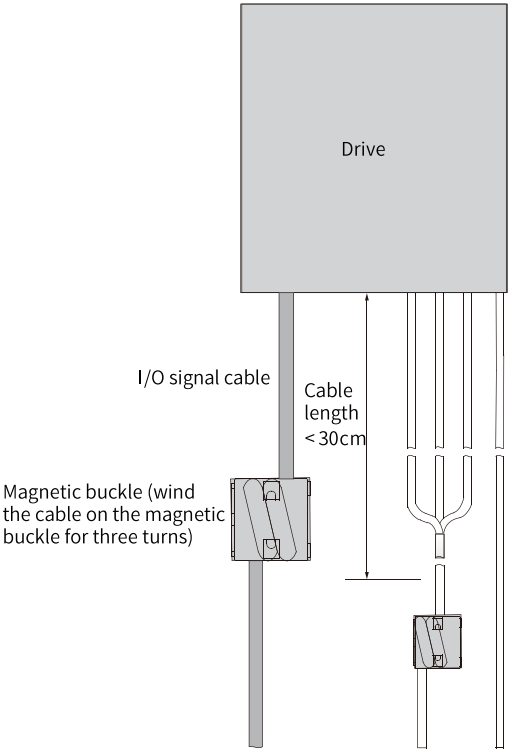
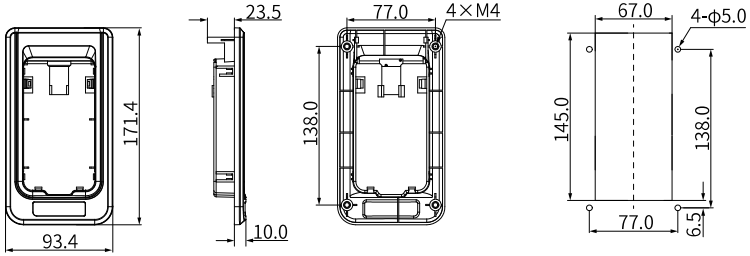


Figure 7-4 Magnetic buckle installation

Note

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

7.7 MDKE-10 Bracket Installation



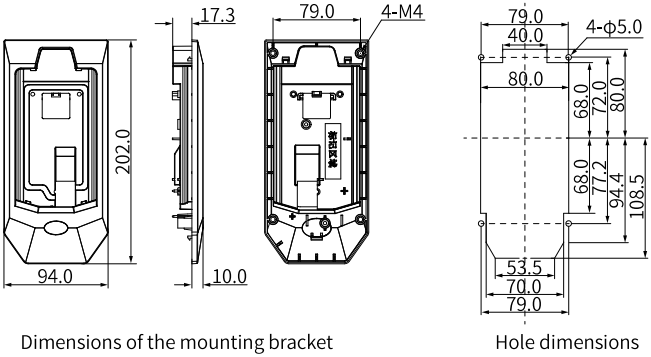
Dimensions for the mounting bracket　　Hole dimensions

Figure 7-5 Bracket dimensions and hole sizes (mm) of the MDKE-10

Note

If the thickness of the door is 1.5 mm, no bolts are required.

7.8 SOP-20-880 Bracket Installation



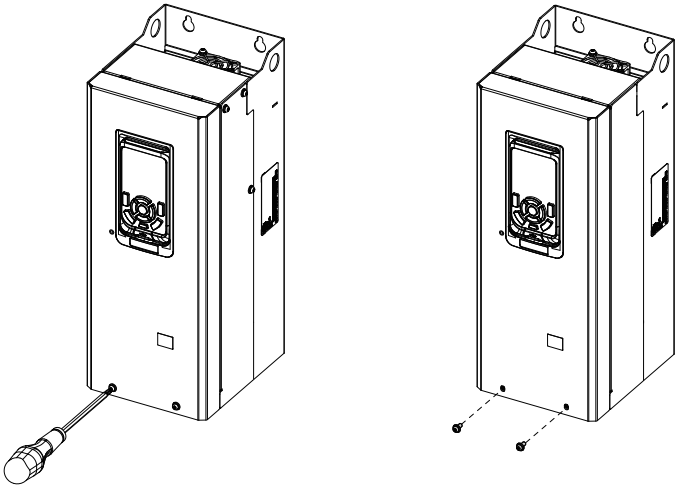
Dimensions of the mounting bracket　　Hole dimensions

Figure 7-6 Bracket dimensions and hole sizes (mm) of the SOP-20-880

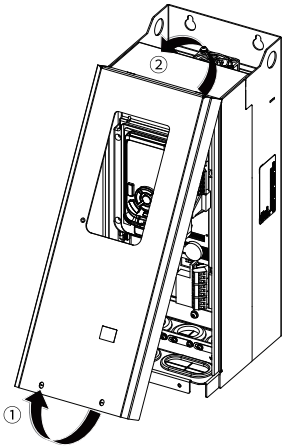
7.9 Safe Motor Temperature Detection Card

This section uses the T1 model of the MD580 series AC drive (400 V) as an example to illustrate the installation process.

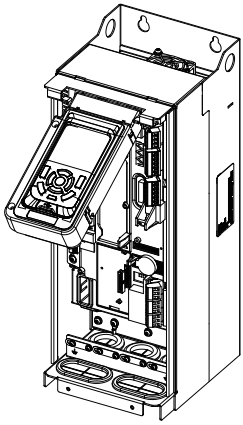
1. Use a screwdriver to remove the two fixing screws of the cover.



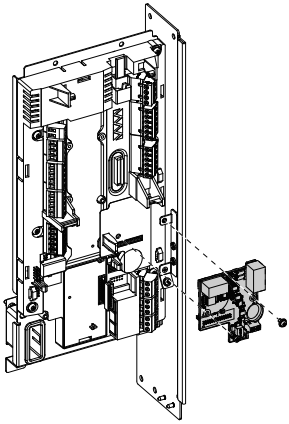
2. Hold the cover with your hands, lift the lower part of the cover (as shown in ①), push the cover upward, and lift the upper part of the cover (as shown in ②).



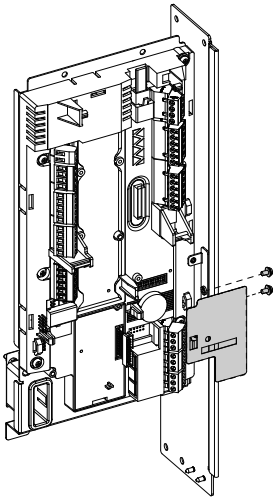
3. (Optional) For T6 models and below, remove the operating panel.



4. Locate the safe motor temperature detection card, as shown below.

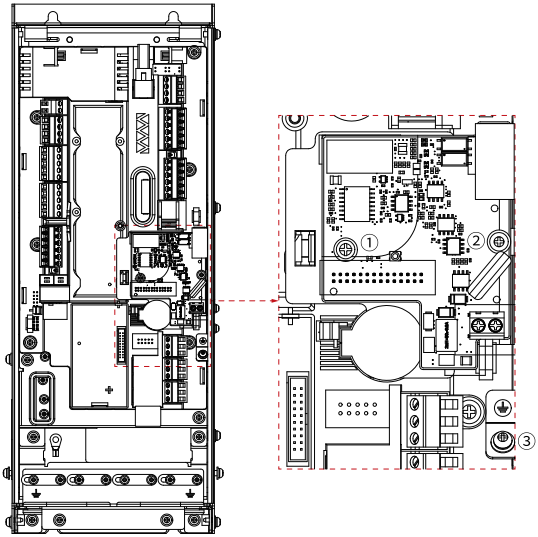


a. Insert the square hole of the insulating paper into the AC drive along the left support column.



b. Use the Phillips screwdriver to install the cross recessed SEMS screw M3X6 with spring and flat washers to fix the ground sheet metal of the card.

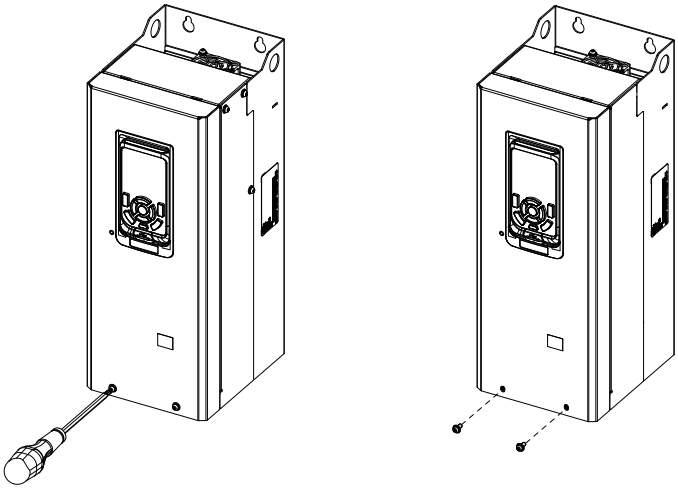
5. Use the Phillips screwdriver to install the self-tapping screw PT3X6 at ① and cross recessed M3x6 SEMS screw with spring and flat washers at ② to secure the card, and install the cross recessed M3x6 SEMS screw with spring and flat washers at ③ to secure the shield of the PTC sampling cable.



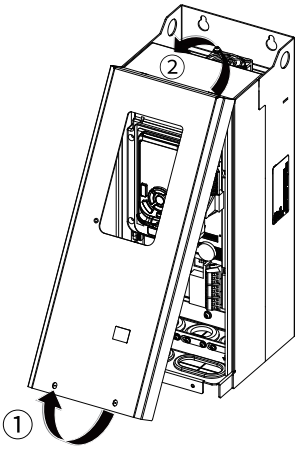
7.10 I/O Card

This section uses the T1 model of the MD580 series AC drive (400 V) as an example to illustrate the installation process.

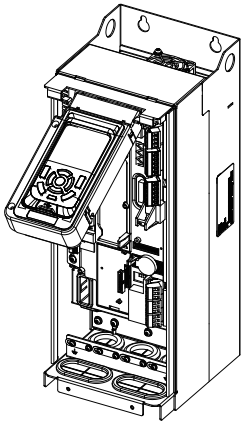
1. Use a screwdriver to remove the two fixing screws of the cover.



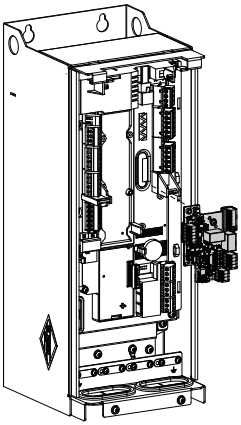
2. Hold the cover with your hands, lift the lower part of the cover (as shown in ①), push the cover upward, and lift the upper part of the cover (as shown in ②).



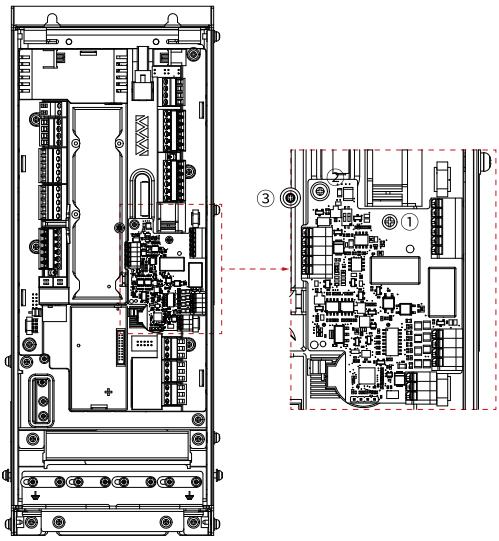
3. (Optional) For T6 models and below, remove the operating panel.



4. Locate the I/O card, as shown below.



5. Use the Phillips screwdriver to install the self-tapping screw PT3X6 at ① to fix the I/O card. Use the cross recessed pan head screw M3X8 to fix one end of the grounding cable at ② and the other end at ③.

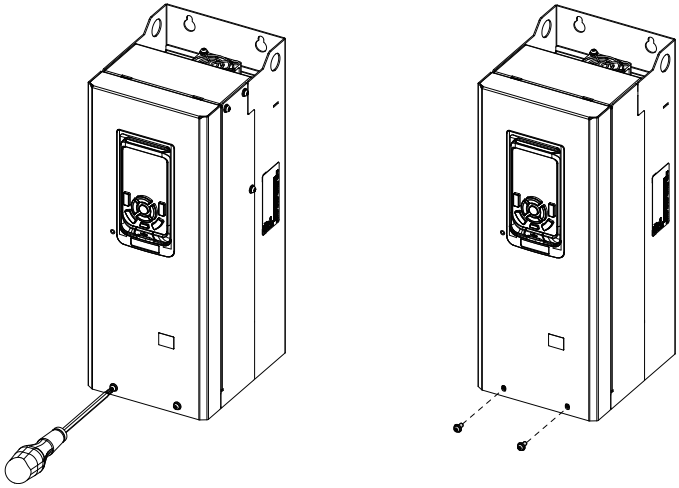


7.11 PG Card

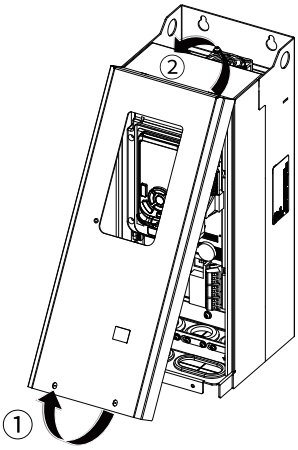
7.11.1Sin-Cos and SSI Dual-Encoder Expansion Card

This section uses the T1 model of the MD580 series AC drive (400 V) as an example to illustrate the installation process.

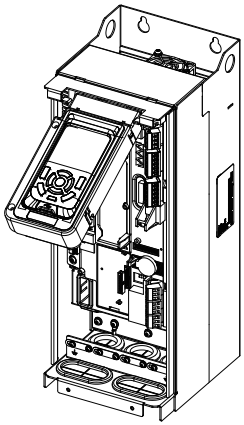
1. Use a screwdriver to remove the two fixing screws of the cover.



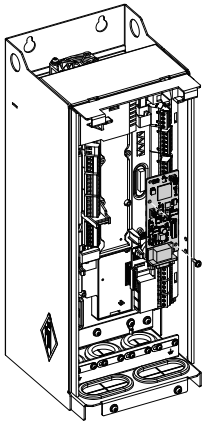
2. Hold the cover with your hands, lift the lower part of the cover (as shown in ①), push the cover upward, and lift the upper part of the cover (as shown in ②).



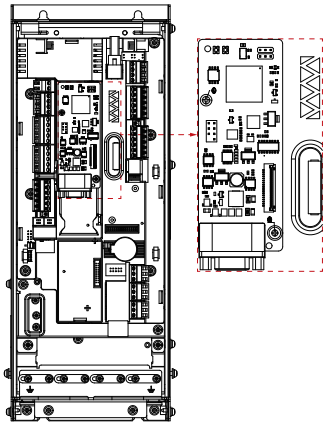
3. (Optional) For T6 models and below, remove the operating panel.



4. Locate the sin-cos and SSI dual-encoder detection module, as shown below.



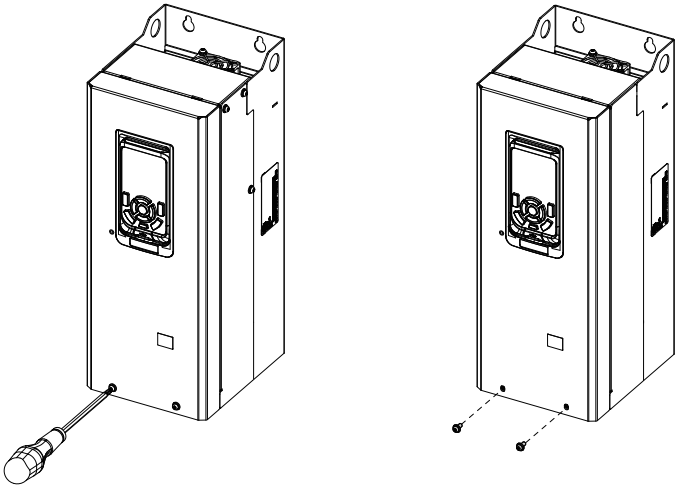
5. Use the Phillips screwdriver to install the self-tapping screw PT3X8 at ①, and the cross recessed SEMS screw M3X8 with spring and flat washers at ② to secure the sin-cos and SSI dual-encoder detection module.



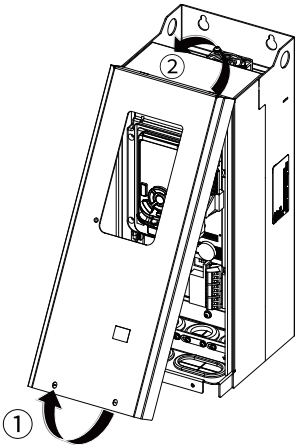
7.11.2ABZ and SSI Dual-Encoder Expansion Card

This section uses the T1 model of the MD580 series AC drive (400 V) as an example to illustrate the installation process.

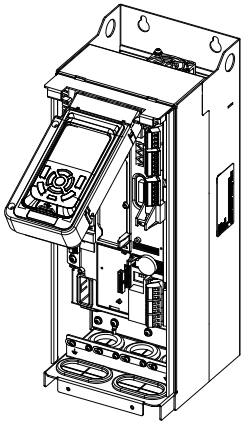
1. Use a screwdriver to remove the two fixing screws of the cover.



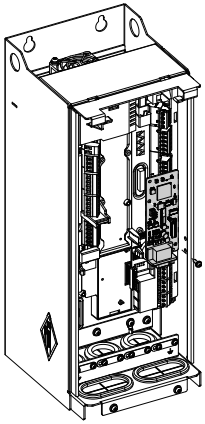
2. Hold the cover with your hands, lift the lower part of the cover (as shown in ①), push the cover upward, and lift the upper part of the cover (as shown in ②).



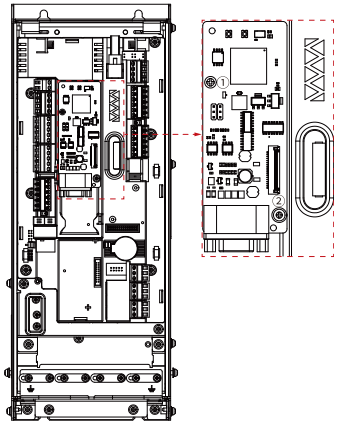
3. (Optional) For T6 models and below, remove the operating panel.



4. Locate the ABZ and SSI dual-encoder detection module, as shown below.



5. Use the Phillips screwdriver to install the self-tapping screw PT3X8 at ①, and the cross recessed SEMS screw M3X8 with spring and flat washers at ② to secure the ABZ and SSI dual-encoder detection module.



8 Solutions to Common EMC Problems

8.1 Leakage Current Suppression

The drive outputs high-speed pulse voltage, which may easily incur high-frequency leakage current. The leakage current generated by each drive is higher than 100 mA. The rated action current of the earth leakage circuit breaker (ELCB) therefore must be above 100 mA. The drive may generate DC leakage current in the protective conductor, a B-type (delay-time) ELCB therefore must be used.

If multiple drives are used, install an ELCB to each drive. The factors that affect the leakage current are as follows:

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

When leakage current causes the circuit breaker to trip, you should:

- Increase the rated operating current of the circuit breaker.
- Replace the circuit breaker with a new one with high-frequency suppression.
- Reduce the carrier frequency.
- Shorten the output drive cable.
- Install a current leakage suppression device.
- Use a circuit breaker from recommended manufacturers such as Chint Electric and Schneider.

8.2 Earth leakage Circuit Breaker Malfunction

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

Table 8–1 Troubleshooting for leakage current

Trip	Possible Cause	Solution
Trip upon power-on	The anti-interference performance of the earth leakage circuit breaker is poor.	1. Use the recommended earth leakage circuit breaker. 2. Use an earth leakage circuit breaker with greater operating current. 3. Move the unbalanced load to the front end of the earth leakage circuit breaker. 4. 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.	
	Unbalanced load is connected to the back end of the earth leakage circuit breaker.	
	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.	1. Use the recommended earth leakage circuit breaker. 2. For a single AC drive, tighten the EMC screw. For multiple AC drives, disconnect the optional EMC grounding screw, as shown in *"Figure 8–1 Disconnecting the optional EMC grounding screw" on page 162*. 3. Install a simple filter on the input side of the AC drive, and wind the LN/RST cable through a magnetic ring near the earth leakage circuit breaker, as shown in *"Figure 8–2 Installing a simple filter and magnetic ring on the input side" on page 162*. 4. Use an earth leakage circuit breaker with greater rated operating current. 5. Reduce the carrier frequency while ensuring performance. 6. Use shorter motor cables.
	The operating current of the earth leakage circuit breaker is too low.	
	Unbalanced load is connected to the back end of the earth leakage circuit breaker.	
	The distributed capacitance to the ground of the motor cable and motor is too large.	

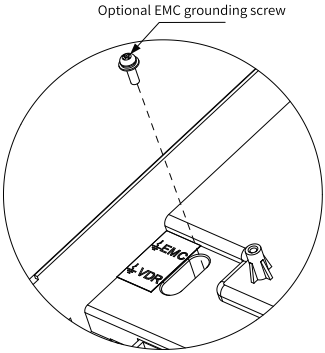


Figure 8-1 Disconnecting the optional EMC grounding screw

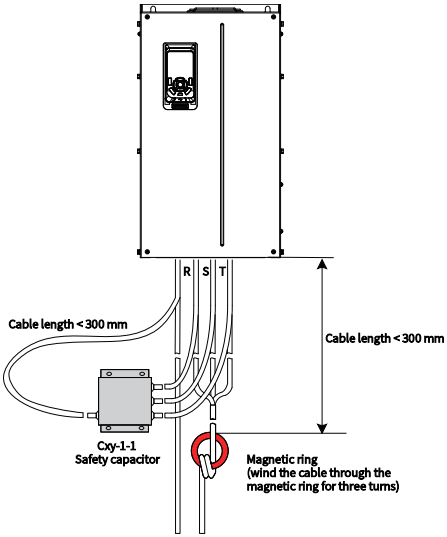


Figure 8-2 Installing a simple filter and magnetic ring on the input side

8.3 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.

8.4 控制回路干扰

8.4.1 High-speed Pulse Interference

Take the following measures to eliminate interference.

Step	Measure
1	Used shielded twisted pairs and ground both ends.
2	Connect the motor enclosure to the PE terminal of the drive.
3	Connect the PE terminal of the drive to that of the power grid.
4	Add equipotential bonding grounding cables between the host controller and drive.
5	Route signal cables and power cables through different routes at a distance of at least 30 cm.
6	Install the magnetic buckle to the signal cable or wind the signal cable around the magnetic ring for one or two turns.
7	Install the magnetic ring to the U, V, and W cables of the drive, and wind the cables around the magnetic ring for two to four turns.
8	Use shielded power cables with the shield grounded properly.

8.4.2 Common I/O Signal Interference

The drive generates strong interference during operation, which may interfere with other devices due to improper wiring or grounding. When the drive interferes with or is interfered by other devices, adopt the following measures.

No.	Solution
1	Use shielded I/O signal cables with the shield connected 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 AC drive.
4	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables through the magnetic ring for two to four turns.
5	Increase the capacitance at the low-speed DI. A maximum of 0.1 uF capacitance is recommended.
6	Increase the capacitance at the AI. A maximum of 0.22 uF is recommended.
7	Install a ferrite clamp or a magnetic ring to the signal cable and wind the signal cable for one to two turns.
8	Use a shielded power cable and ground the shield securely.

8.5 通信干扰

8.5.1 RS-485 and CAN Communication Interference

Take the following measures to eliminate interference.

Step	Measure
1	Install resistors with the resistance of 120 Ω at both end of the bus.
2	Use the multi-conductor shielded twisted pairs and ground both ends of the shield.
3	Route communication cables and power cables through different routes at a distance of at least 30 cm.
4	Use the daisy chain connection mode for multi-node communication.
5	Add equipotential bonding grounding cables between nodes in the multi-node communication mode.
6	Install the magnetic buckle at both ends of the communication cable or wind the communication cable around the magnetic ring for one or two turns.
7	Install the magnetic ring to the U, V, and W cables of the drive, and wind the cables around the magnetic ring for two to four turns.
8	Use shielded power cables with the shield grounded properly.

8.5.2 PROFINET Communication Interference

Follow the following table for troubleshooting.

No.	Step
1	Check that the communication network cables meet the specification requirements for Cat 5e shielded 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 not longer than 100 m in length.
6	Add a magnetic buckle at both ends of the communication cable and wind the communication cable for one to two turns.
7	Add a magnetic ring to the output U, V, and W cables at the drive side and wind the cables for two to four turns.
8	Use a shielded power cable and ensure that the shield is well-grounded.

8.6 Encoder Feedback Signal Errors

Follow the following table for troubleshooting.

No.	Description
1	Route the encoder cable and power cable through different cable routes.
2	When the AC drive is far away from the motor (the motor cable is 10 m), disconnect the grounding (PE) terminal of the encoder shield on the AC drive side.
3	Install a magnetic ring or buckle for the encoder signal cable close to the AC drive.
4	Install a magnetic ring to the output U, V, and W cables at the drive side and wind the cables for two to four turns.
5	Use a shielded power cable and ensure that the shield is well-grounded.

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