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

Hardware Guide

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

Data code 19012181 A00

Preface

Introduction

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

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

This guide describes the system composition, technical specifications, components, dimensions, options (including mounting accessories, cables, and peripheral electrical devices), expansion cards, certifications, and standards of the AC drive.

More Documents

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

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

Revision history

Date	Version	Revision
March 2023	A00	First release

How to Obtain

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

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

Warranty Agreement

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

Within the Warranty period, you will also be charged for the damage caused by the following reasons:

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

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

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

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Product Model

Table –1 Relationship between product structures and models

Structure	Model (Three-Phase 525 V to 690 V)
S4	MD580-01S-07A4-7-B MD580-01S-09A9-7-B MD580-01S-14A3-7-B MD580-01S-0019-7-B MD580-01S-0023-7-B MD580-01S-0027-7-B MD580-01S-07A4-7-B-LCD MD580-01S-09A9-7-B-LCD MD580-01S-14A3-7-B-LCD MD580-01S-0019-7-B-LCD MD580-01S-0023-7-B-LCD MD580-01S-0027-7-B-LCD
S5	MD580-01S-0035-7 MD580-01S-0042-7 MD580-01S-0049-7 MD580-01S-0035-7-LCD MD580-01S-0042-7-LCD MD580-01S-0049-7-LCD
S6	MD580-01S-0061-7 MD580-01S-0084-7 MD580-01S-0061-7-LCD MD580-01S-0084-7-LCD
S7	MD580-01S-0098-7 MD580-01S-0119-7 MD580-01S-0098-7-LCD MD580-01S-0119-7-LCD
S8	MD580-01S-0142-7 MD580-01S-0174-7 MD580-01S-0142-7-LCD MD580-01S-0174-7-LCD
S9	MD580-01S-0210-7 MD580-01S-0271-7 MD580-01S-0210-7-LCD MD580-01S-0271-7-LCD

Fundamental Safety Instructions

Safety Disclaimer

- This chapter explains the safety precautions that need to be paid attention to when using this product correctly. Before operating the equipment, read through the guide and comprehend all the safety instructions. To ensure the safety of humans and equipment, follow the signs on the equipment and all the safety instructions in this user guide. Failure to comply may result in severe personal injuries or even death or equipment damage.
- The DANGER, WARNING and NOTICE messages in the user guide does not cover all the safety risks.
- Use this product in environments meeting the design and specification requirements; otherwise, a fault may occur. Noncompliance-caused malfunction or damage to parts are not covered in product quality warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions

Indicates that failure to comply with the notice can 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.

Safety Precautions

- Product illustrations in the user 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.
- Product illustrations in this guide are for reference only. Actual products may vary.

Unpacking
 • Do not install the equipment if you find any sign of damage, rust, or prior use on the equipment or accessories. • Do not install the equipment if you find any sign of water seepage or missing or damaged components. • Do not install the equipment if you find the packing list does not conform to the equipment you received.

CAUTION

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

Storage and Transportation

WARNING

- Allow only qualified professional personnel to carry large-scale or heavy products by using professional loading and unloading device. Failure to comply will result in injuries or product damage.
- Before you vertically lift the product, confirm that structural components of the product such as the front cover and terminal block have been firmly fixed with screws. Failure to comply will result in component drop-off, causing personnel injuries or product damage.
- Never stand or stay below the product when it is lifted by hoisting device.
- When you hoist the product with a steel rope, hoist it at even speed stably to protect the product against vibration or impact. Do not turn the product or hoist the product for a long period. Failure to comply may result in personal injuries or damage to the device.

CAUTION

- 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 this product in strict accordance with the storage and transportation requirements. Failure to comply may result in damage to the product.
- Do not store or transport the equipment in environments exposed to water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing this product 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

DANGER

- Installation must be carried out by the specialists who have received the necessary electrical training and understood enough electrical knowledge. Ensure no unprofessional person has access to the equipment.

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, ensure that the installation position has sufficient mechanical strength to support the weight of the device. Failure to comply will result in a mechanical danger.
- To avoid electric shock, do not wear loose clothes or accessories.
- When this equipment is installed in a cabinet or final equipment, 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 this equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When this product is installed in a cabinet or terminal device, protection measures such as a fireproof enclosure, an electrical enclosure, or a mechanical enclosure must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment onto flame retardant materials, such as metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.

- During installation, use a piece of cloth or paper to cover the top of the product to prevent metal chippings, oil, and water from entering into the product when drilling holes. Failure to comply will cause product malfunctions. After installation, remove the cloth or paper for effective ventilation and cooling.
- If the device running at a constant speed begins to run at variable speeds, resonance may occur. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring

- Only professionals are allowed to perform installation, wiring, maintenance, inspection or parts replacement on the equipment.
- Before wiring, cut off all the power supplies of the equipment. Wait as specified on the product warning sign before further operations because residual voltage exists after power-off. Measure the DC voltage of the main circuit and make sure that it is below the safety voltage. Failure to comply will result in an electric shock.
- Never perform wiring, remove the product cover, or contact the PCB at power-on. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.

- Do not connect the input power supply to the output end of the equipment. Failure to comply can result in equipment damage or even a fire.
- When connecting a drive to the motor, make sure the phase sequence of the drive and motor are consistent to prevent motor reverse 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.
- Fasten the terminal screws with the tightening torque specified in the manual. Insufficient or excessive tightening torque may result in overheat and damage of connecting parts, causing fires.
- Ensure that all cables are connected correctly. Cable sheath is not damaged, and no screw or washer is left inside the equipment. Otherwise, electric shock or equipment damage may occur.

- During wiring, follow the proper electrostatic discharge (ESD) procedure and wear an antistatic wrist strap. Failure to comply can result in damage to the equipment or internal circuits.
- In wiring the control circuit, use shielded twisted pair cable and connect the shield to the PE terminal. Otherwise, the equipment may not function properly.

Power-on

- Before power-on, check that the equipment is installed properly, the wiring is secure and the motor can be restarted.
- Before power-on, check that the power supply meets equipment requirements to prevent equipment damage or even a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment. Do not touch any wiring terminals, or remove any part of the equipment at power-on. Failure to comply will result in an electric shock.

- Perform a trial run after wiring and parameter setting to ensure that the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, ensure that the nominal voltage of the equipment is consistent with the power supply voltage. Improper power supply voltage will cause a fire.
- Before power-on, ensure that there are no people around the equipment, motor and other machines. Failure to comply will result in injuries or death.

Operation

- Only qualified professionals are allowed to run the equipment. Failure to comply can result in injury or death.
- Do not touch any wiring terminals or remove any part of the equipment during operation. Failure to comply will result in an electric shock.

- Do not touch the equipment enclosure, fan, or resistor to sense the temperature. Failure to comply may result in burns.
- Prevent metal or other objects from falling into the device during operation. Failure to comply may result in a fire or product damage.

Maintenance

- Only professionals are allowed to perform installation, wiring, maintenance, inspection or parts replacement on the equipment.
- Do not perform maintenance on the equipment with power ON. Failure to comply can result in the risk of electric shock.
- Before maintenance, cut off all power supplies of the device and wait for a period specified on the warning label of the device.
- When a PM motor rotates, its terminals will produce induced voltage even if the motor is powered 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

- Only professionals are allowed to perform installation, wiring, maintenance, inspection or parts replacement on the equipment.
- Do not repair the equipment after power-on. Failure to comply can result in the risk of electric shock.
- Before device inspection and repair, cut off all power supplies of the device and wait for a period specified on the warning label of the device.

- Submit the repair request according to the warranty agreement.
- When the fuse is blown, the circuit breaker trips, or the earth leakage circuit breaker (ELCB) trips, wait for a period specified on the warning label of the device before you energize or operate the device. Failure to comply may result in personnel injuries or damage to the device.
- When the device is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not operate damaged device. Failure to comply may result in personnel injuries or death or greater damage to the device.
- After replacing the equipment, perform wiring inspection and parameter settings again.

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

Safety labels

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

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

1 Product Information

1.1 Features

The MD580 series is a low-voltage high-performance engineering AC drive (690V).

Figure 1-1 Product appearance

The AC drive highlights the following:

- Adopting excellent dynamic characteristics and superior overload capability, the drive can drive three-phase AC asynchronous motors and three-phase AC permanent magnet motors.
- The drive is equipped with the high-performance vector control technology and features high torque output at low speed.
- Stable in performance, the drive provides rich and powerful combined functions, such as user programmable and software monitoring functions, and supports multiple communication buses and encoder types.

1.2 Model and Nameplate

Product model

MD580-01S-0271-7-B- LCD
① ② ③ ④ ⑤ ⑥

① **Product name** MD580: AC drive series	③ **Output current** 07A4: 7.4 A 09A9: 9.9 A ... 0271: 271 A	⑤ **Standard accessory** B: Reactor Null: /
② **Product series** 01S: AC drive (single-drive system)	④ **Voltage class** 7: 690 V	6 **Standard accessory** LCD: LCD operating panel Null: LED operating panel

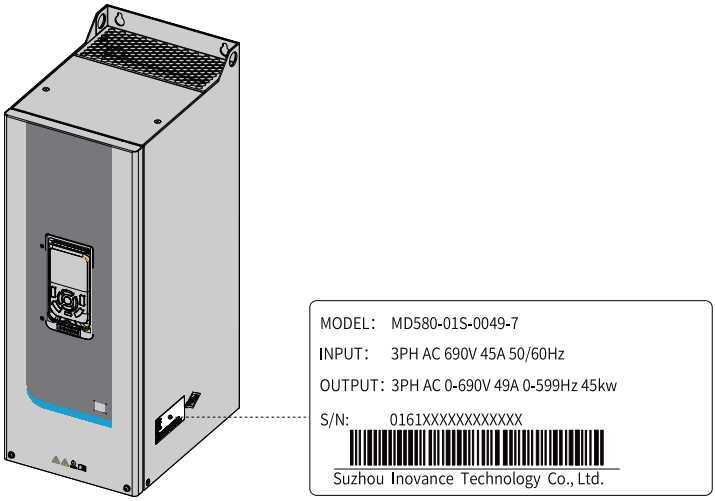


Figure 1-2 Nameplate description

Note

- The S4 model has a built-in braking unit. For S5 to S9 models, the braking unit is optional.
- Output current is the rated value without overload applications.

1.3 Technical Indicators

1.3.1 Electrical Specifications

- The data in the table below is measured at the input voltage of 690 VAC.
- The drive can automatically switch between the light overload mode and heavy overload mode based on the output current.

Table 1–1 Electrical specifications

Structure	AC Drive Model MD580-01S-XXXX	No-overload Application		Light Overload Application		Heavy Overload Application	
		Rated Current	Rated Power	Rated Current	Rated Power	Rated Current	Rated Power
		A	kW	A	kW	A	kW
S4	07A4-7-B(-LCD)	7.4	5.5	7	5.5	5.6	4
	09A9-7-B-(-LCD)	9.9	7.5	9.4	7.5	7.4	5.5
	14A3-7-B(-LCD)	14.3	11	13.6	11	9.9	7.5
	0019-7-B(-LCD)	19	15	18.1	15	14.3	11
	0023-7-B(-LCD)	23	18.5	21.9	18.5	19	15
	0027-7-B(-LCD)	27	22	25.7	22	23	18.5
S5	0035-7(-LCD)	35	30	33	30	26	22
	0042-7(-LCD)	42	37	40	37	35	30
	0049-7(-LCD)	49	45	47	45	42	37
S6	0061-7(-LCD)	61	55	58	55	49	45
	0084-7(-LCD)	84	75	80	75	61	55
S7	0098-7(-LCD)	98	90	93	90	84	75
	0119-7(-LCD)	119	110	113	110	98	90
S8	0142-7(-LCD)	142	132	135	132	119	110
	0174-7(-LCD)	174	160	165	160	142	132
S9	0210-7(-LCD)	210	200	200	200	174	160
	0271-7(-LCD)	271	250	257	250	210	200

1.3.2 Technical Specifications

Table 1–2 Technical specifications

Item		Specification
Basic parameters	Output frequency	Voltage/frequency (V/f) control: 0-599 Hz
		Vector control: 0-599 Hz
	Carrier frequency	0.8-8 kHz
	Input frequency resolution	Digital setting: 0.01 Hz
		Analog setting: Maximum frequency x 0.025%
	AC drive capacity	5.5–250 kW
	Input voltage	Three-phase 525 VAC to 690 VAC, with the offset from -15% to 10%, namely 446 VAC to 759 VAC
	Motor type and control mode	Three-phase asynchronous motors: V/f control, sensorless vector control (SVC), feedback vector control (FVC)
		Permanent magnet synchronous motors: SVC, FVC
	Speed regulation range	1: 50 (asynchronous motor in V/f control mode)
		1: 200 (asynchronous motor in SVC mode)
		1: 1000 (asynchronous motor in FVC mode)
	Speed control precision	±1.0% (V/f control)
		±0.5% (SVC)
		±0.02% (FVC)
	Speed fluctuation	±0.5% (SVC)
		±0.2% (FVC)
	Torque response time	< 20 ms (SVC)
		< 5 ms (FVC)
	Torque control mode	SVC, FVC
	Torque control precision	±5% (SVC)
		±3% (FVC)
	Overload capacity	Light overload: 110% for 1 minute every 5 minutes
		Heavy overload: 150% for 1 minute every 5 minutes
	Torque boost	Automatic torque boost; Manual torque boost: 0.1% to 30.0%
	V/f curve	Linear V/f, multi-point V/f, quadratic V/f, V/f complete separation, V/f incomplete separation

Item		Specification
Customized functions	Acceleration/ deceleration curve	Straight-line and arc acceleration/deceleration curve
	Built-in proportional–integral–derivative (PID)	One set of PID parameters to implement closed-loop process control
	Communication/bus	RS485 communication card: Supports the Modbus RTU protocol.
		DP communication card: Supports the PROFIBUS DP protocol.
		CANopen communication card: Supports the CANopen protocol.
		Ethernet communication card: Supports the Ethernet protocol.
		PROFINET IO communication card: Supports the PROFINET IO industrial Ethernet.
		Modbus TCP communication card: Supports the Modbus TCP industrial Ethernet.
	Running command channel	SOP-20-880, InoDriveStudio, LED operating panel, remote control, terminal
	Reference value channel	Two groups of reference value channels, including motorized potentiometer and multi-segment value reference
		Each group includes primary speed, additional speed, secondary speed, and the two groups of channels can be switched over.
HMI	Analog input (AI)	AI1: 0-10 V/0-20 mA input; 12-bit resolution; correction accuracy of 0.5%; PT100/ PT1000/PTC130/KTY84 supported
		AI2: 0-10 V/0-20 mA input; 12-bit resolution; correction accuracy of 0.5%
	Analog output (AO)	Two AOs: 0-10 V or 0-20 mA which is selected via jumper; 12-bit resolution; correction accuracy of 1%
	Digital input (DI)	Six normal DIs; PNP input method and NPN input method available
		One high-speed DI; PNP input method and NPN input method available; input frequency < 100 kHz
	Digital output (DO)	One DO supports normal output and high-speed output. When the DO is used as the normal DO, PNP and NPN output methods are available. When the DO is used as the high-speed DO, a maximum of 100 kHz frequency is supported.
		Three relay output terminals; programmable NO/NC contact
	Operating panel	LED operating panel as standard, external LCD operating panel as optional
Environment requirements	Operating location	Indoor location without direct sunlight, dust, corrosive gas, combustible gas, oil mist, water vapor, drip, or salt
	Altitude	Maximum altitude: 3000 m; ⩽ 1000 m: derating not required; > 1000 m: derate by 1% for every additional 100 m
	Operating temperature	-10°C to +50°C. When the temperature is higher than 40°C, derate by 1.5% for every additional 1°C.
	Storage temperature	-25°C to +70°C
	Overvoltage category	OVCIII
	Pollution degree	PD2
	IP rating	IP20 (open type, applicable to IEC-certified products)
	Power system	TT/TN (VDR and EMC screws required)
		IT

1.4 Components

1.4.1 Overview

The S4 to S9 AC drive models adopt the sheet metal structure.

Note

The quantity and positions of cooling fans vary with AC drive models.

- The S4 models provide two cooling fans at the bottom.
- The S5 models provide one cooling fan at the bottom.
- The S6 to S9 models provide two cooling fans at the bottom.

1.4.2 Components of S4 Models

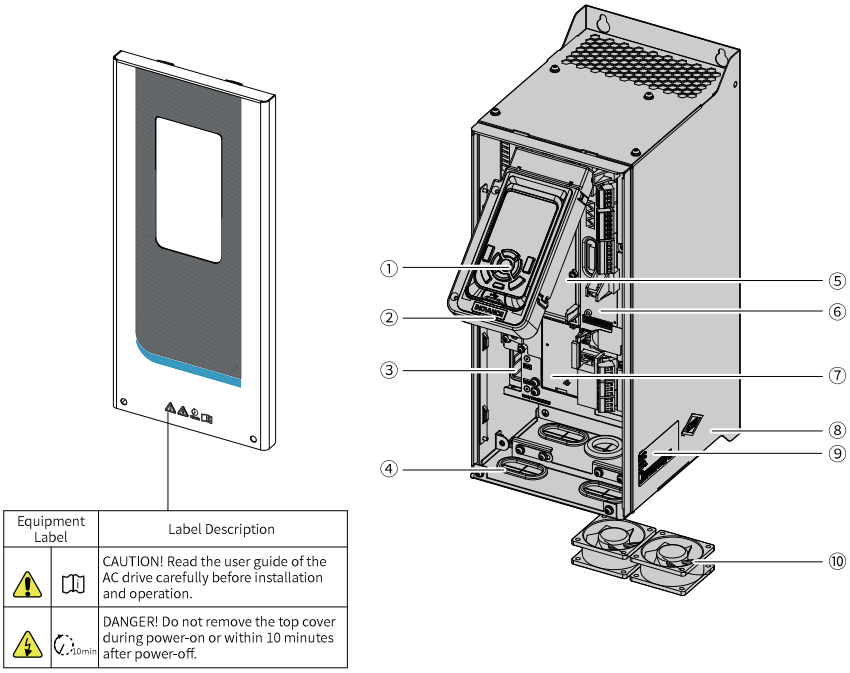


Figure 1-3 Components of S4 models

No.	Name
①	Operating panel
②	Logo

No.	Name
③	EMC and VDR ground screws
④	Protective ring
⑤	Encoder expansion card fixing base
⑥	Explosion-proof card fixing base
⑦	Communication expansion card fixing base
⑧	Enclosure
⑨	Nameplate
⑩	Cooling fan

1.4.3 Components of S5 Models

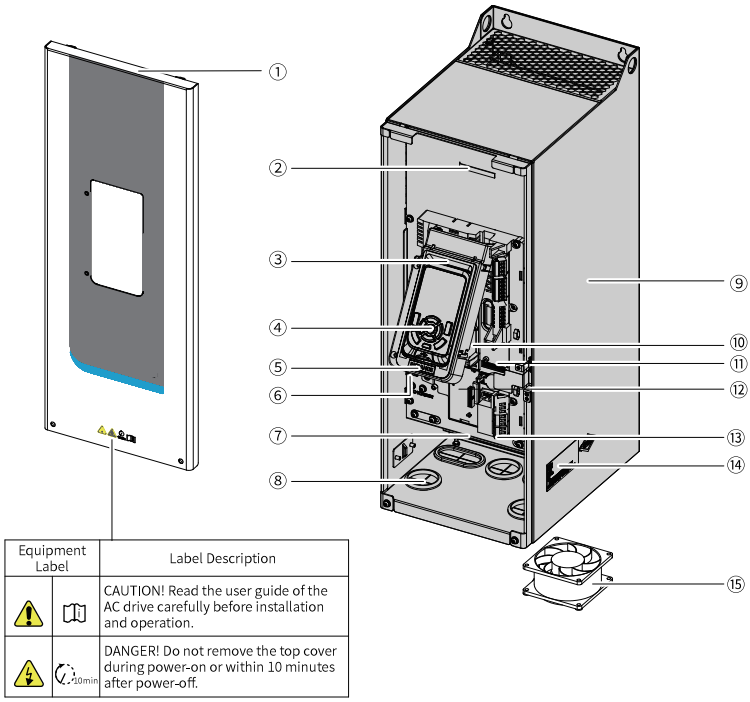


Figure 1-4 Components of S5 models

No.	Name
①	Front cover
②	AC drive bar code, allowing you to check the system code and model
③	Interface for external operating panel, which is exposed when the panel is removed

No.	Name
④	Operating panel
⑤	Logo
⑥	EMC and VDR ground screws
⑦	Main circuit terminals
⑧	Protective ring
⑨	Enclosure
⑩	Encoder expansion card fixing base
⑪	Explosion-proof card fixing base
⑫	Communication expansion card fixing base
⑬	Control circuit terminals
⑭	Nameplate
⑮	Cooling fan

1.4.4 Components of S6 and S7 Models

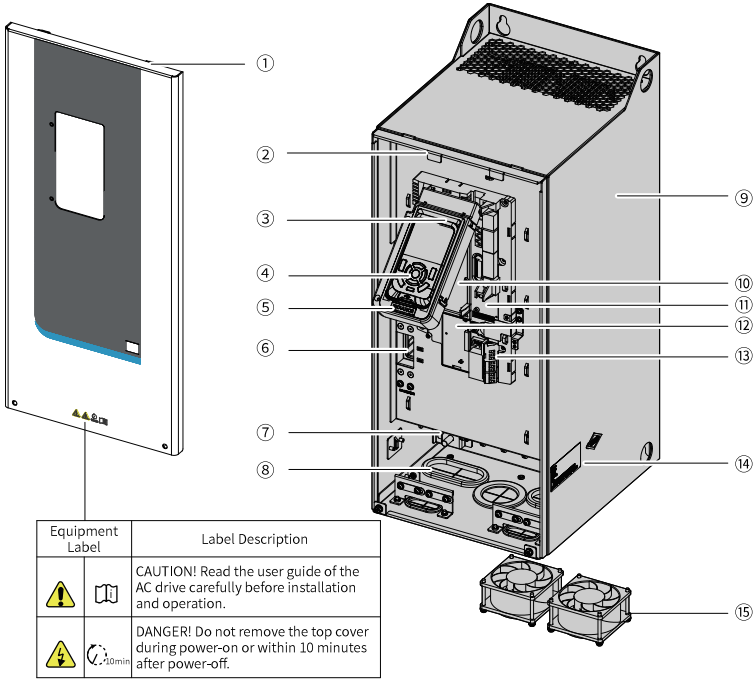


Figure 1-5 Components of S6 and S7 models

No.	Name
①	Front cover
②	AC drive bar code, allowing you to check the system code and model
③	Interface for external operating panel, which is exposed when the panel is removed
④	Operating panel
⑤	Logo
⑥	EMC and VDR ground screws
⑦	Main circuit terminals
⑧	Protective ring
⑨	Enclosure
⑩	Encoder expansion card fixing base
⑪	Explosion-proof card fixing base
⑫	Communication expansion card fixing base
⑬	Control circuit terminals
⑭	Nameplate
⑮	Cooling fan

1.4.5 Components of S8 and S9 Models

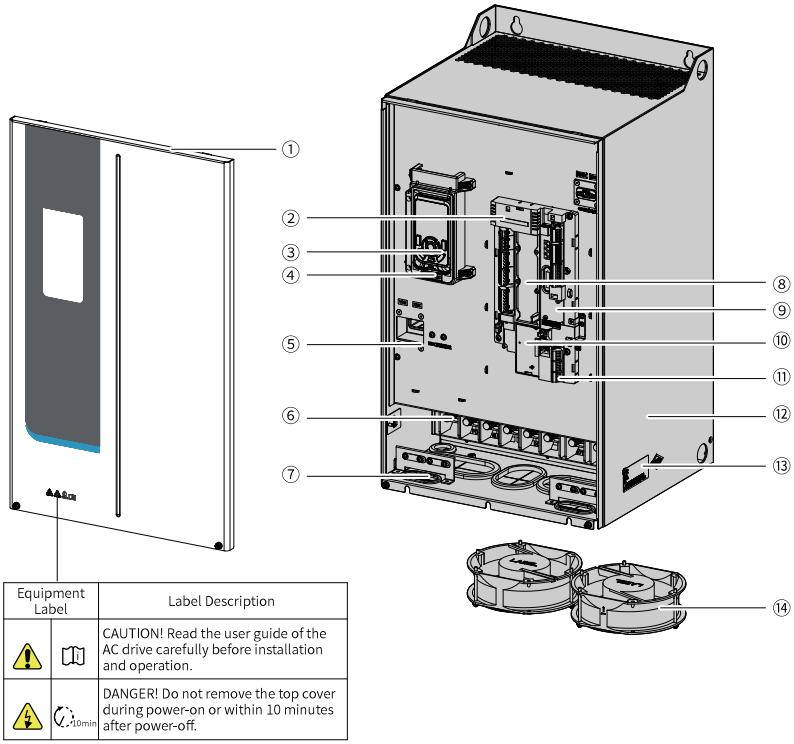


Figure 1-6 Components of S8 and S9 models

No.	Name
①	Front cover
②	AC drive bar code, allowing you to check the system code and model
③	Operating panel
④	Logo
⑤	EMC and VDR ground screws
⑥	Main circuit terminals
⑦	Protective ring
⑧	Encoder expansion card fixing base
⑨	Explosion-proof card fixing base
⑩	Communication expansion card fixing base
⑪	Control circuit terminals
⑫	Housing

No.	Name
⑬	Nameplate
⑭	Cooling fan

2 Mechanical Design

2.1 Installation Environment

Table 2–1 Environment requirements

Environment	Requirement
Installation location	Indoors
Grid overvoltage	Overvoltage category III (OVC III)
Temperature	Installation/Operation: –10°C to +50°C (–10°C to +40°C: no derating; over +40°C: derated by 1.5% for every additional 1°C) Storage/Transportation: –25°C to +70°C • For better reliability, use the AC drive in places without drastic temperature changes. • For use in an enclosed space such as a control cabinet, use a cooling fan or air conditioner to keep the temperature of air taken into the AC drive below 50°C. Failure to comply may result in overheating or fire. • Install the AC drive on a flame-retardant surface, with sufficient clearance reserved for heat dissipation. • Take measures to prevent the AC drive from being frozen.
Humidity	< 95% RH (non-condensing)
Environment	Pollution degree 2 or below Install the AC drive in a place that meets the following requirements: • Free from direct sunlight, dust, corrosive gas, combustible or explosive gas, oil mist, water vapor, drip, or salt • Insusceptible to vibration (away from equipment that may generate strong vibration, such as a punch press) • Free from unwanted objects such as metallic dust, oil, and water that may enter the AC drive • Free from radioactive materials, combustible materials, and hazardous gas and liquid, and salt corrosion • Away from combustible materials such as wood
Altitude	2000 m or below; derated by 1% for every additional 100 m when the altitude is above 1000 m; maximum altitude: 4000 m (TN, TT, or IT star grid, North America delta grid); isolation transformer required when the altitude is above 2000 m
Vibration resistance	• For transportation with packaging: compliant with class 2M3 in EN60721-3-2 • For installation with packaging removed: compliant with ISTA 1H

2.2 Cabinet Design

2.2.1 Cabinet Layout

S4 to S9 models

- Installing one AC drive

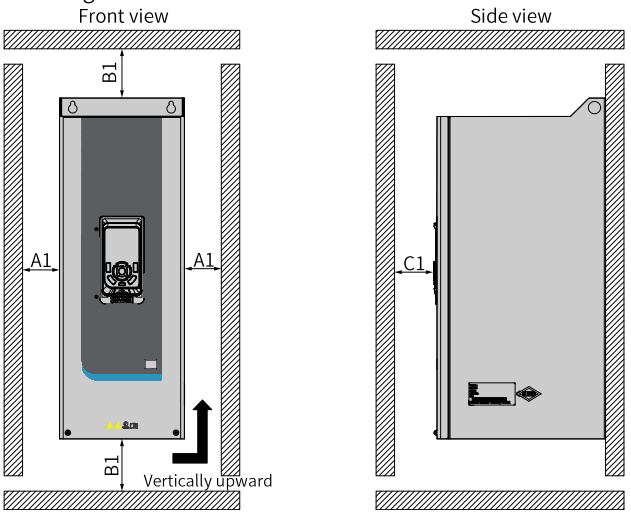


Figure 2-1 Clearance required for installing one AC drive

Table 2–2 Clearance required for installing one AC drive

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

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

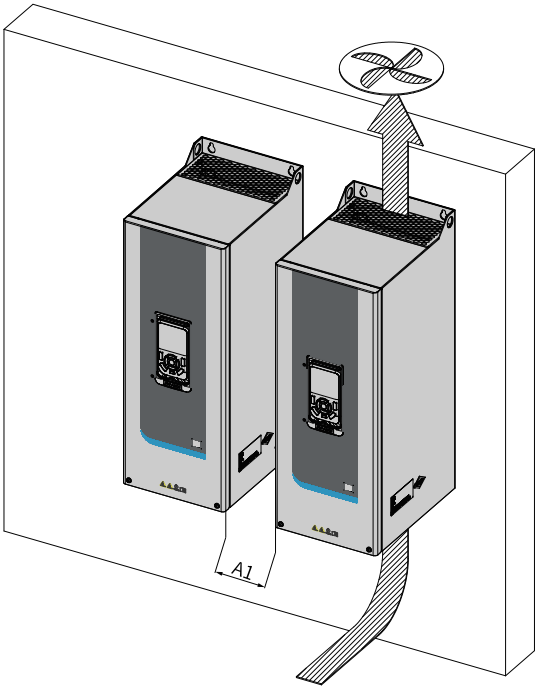


Figure 2-2 Clearance required for installing AC drives side by side

Table 2–3 Clearance required for installing AC drives side by side

Power Rating	Dimension (mm)
5.5–22 kW	A1 ⩾ 10
30–45 kW	A1 ⩾ 50
55–110 kW	A1 ⩾ 50
132-250 kW	A1 ⩾ 50

- Installing AC drives in dual-row mode
  If one drive needs to be installed above another one, install an air guide plate, as shown in the following figure. This can prevent the drive in the lower row from heating that in the upper row, causing overheat or overload faults.

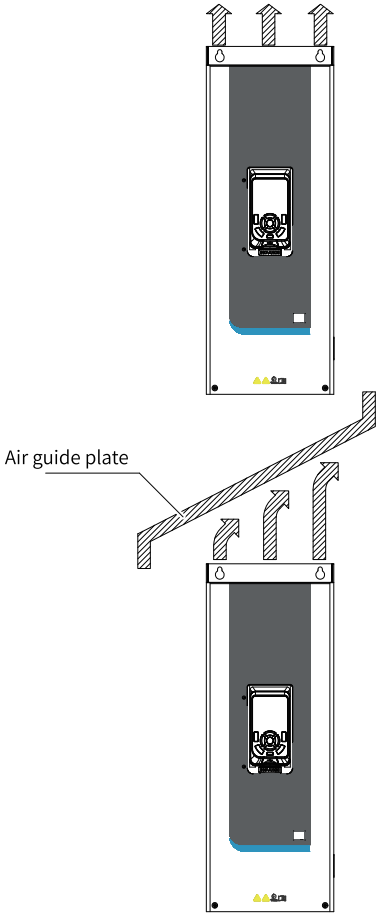


Figure 2-3 Requirements for dual-row installation

2.2.2 AC Drive Dimensions

S4 model dimensions

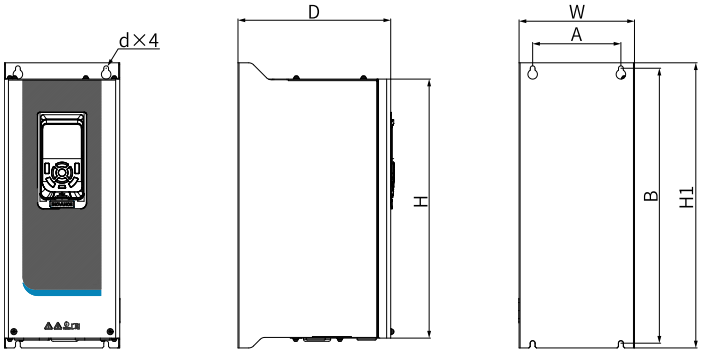


Figure 2-4 Outline dimensions and mounting dimensions of S4 models

Table 2–4 Outline dimensions and mounting dimensions of S4 models

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

S5 model dimensions

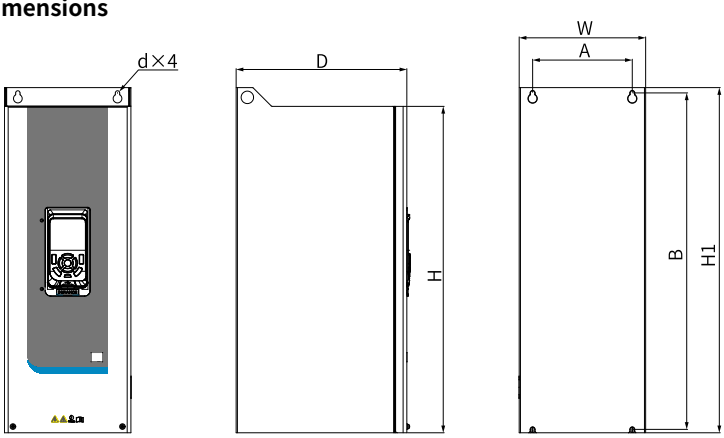


Figure 2-5 Outline dimensions and mounting dimensions of S5 models

Table 2–5 Outline dimensions and mounting dimensions of S5 models

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

Dimensions of S6 to S7 Models

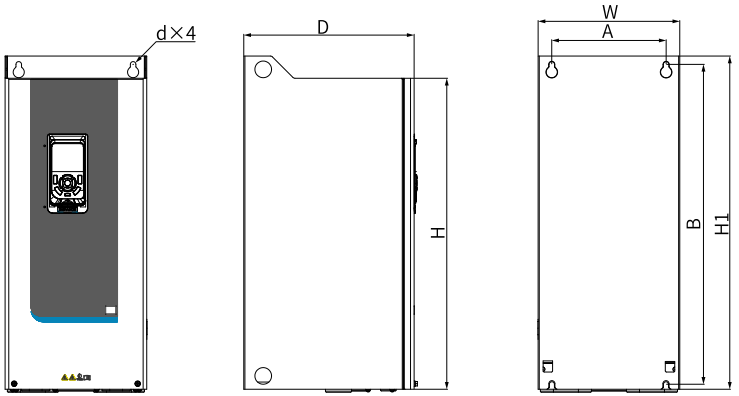


Figure 2-6 Outline dimensions and mounting dimensions of S6 to S7 models

Table 2–6 Outline dimensions and mounting dimensions of S6 to S7 models

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

Dimensions of S8 to S9 Models

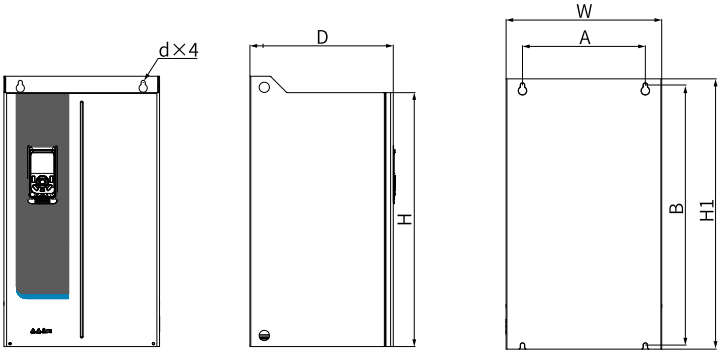


Figure 2-7 Outline dimensions and mounting dimensions of S8 to S9 models

Table 2–7 Outline dimensions and mounting dimensions of S8 to S9 models

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

2.3 EMC-Compliant Control Cabinet Design

- The fewer and smaller the holes in the cabinet, the better the anti-interference and anti-attenuation performance. The maximum diameter of a hole on the galvanic metal contact surface in the cabinet is 100 mm. Pay special attention to hole sizes on the grilles at the cold air inlet and outlet.
- Weld the steel panels together without holes to achieve excellent electrical connection between them. If welding is not possible, do not paint the panels and install special conductive EMC bars to realize galvanic connection. Generally, reliable conductive bars are made of flexible silicon with the surface covered by a metal mesh. Add conductive gaskets between the metal surfaces to tighten the metal surfaces better. The maximum distance between assembly screws is 100 mm.
- Ensure high-frequency multi-point grounding in the cabinet to avoid voltage differences and to form structures that can shield against radiation. Use short and flat low-inductance copper braids for excellent performance of high-frequency multi-point grounding. High-frequency one-point grounding cannot be used due to the long distances in the cabinet.

- Use of only conductive EMC shield gaskets is not enough to achieve protective grounding. To ensure electrical safety of the parts, a low-frequency grounding structure is required. Follow local regulations to design protective grounding.

2.4 Heat Dissipation Design

2.4.1 Heat Dissipation Design

Common heat dissipation methods include the following:

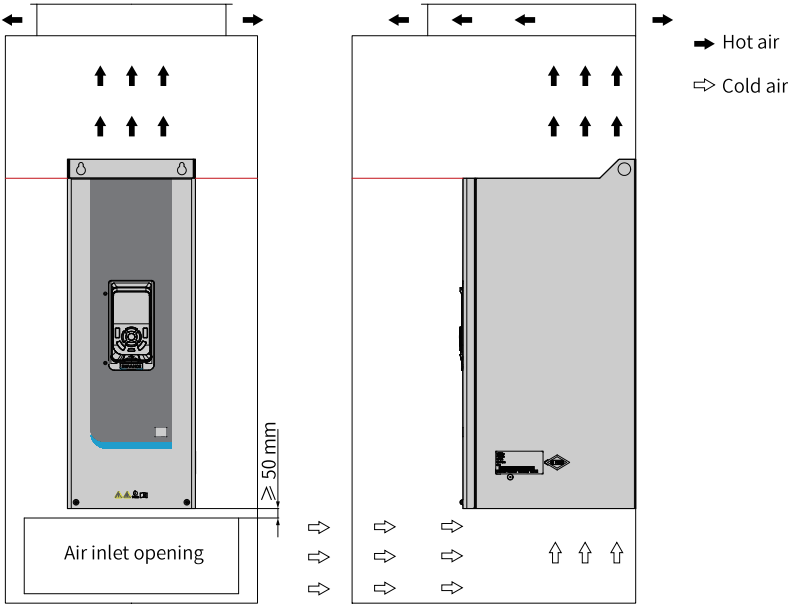
- Natural ventilation
- Forced air cooling
- Cooling device

2.4.2 Ventilation Requirements

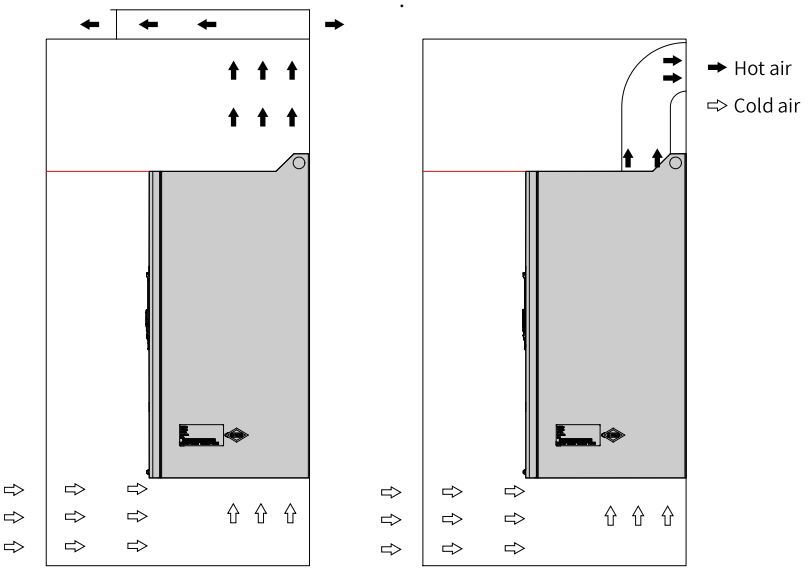
2.4.2.1 Air Inlet and Outlet Design

Naturally-ventilated cabinet

- Air inlet requirements
  - The air inlet of the cabinet must be at least 50 mm lower than that of the AC drive.
  - If multiple AC drives of different sizes are installed in the cabinet, the air inlet of the cabinet must be lower than the air inlet of the lowermost AC drive, as shown in the following figure.

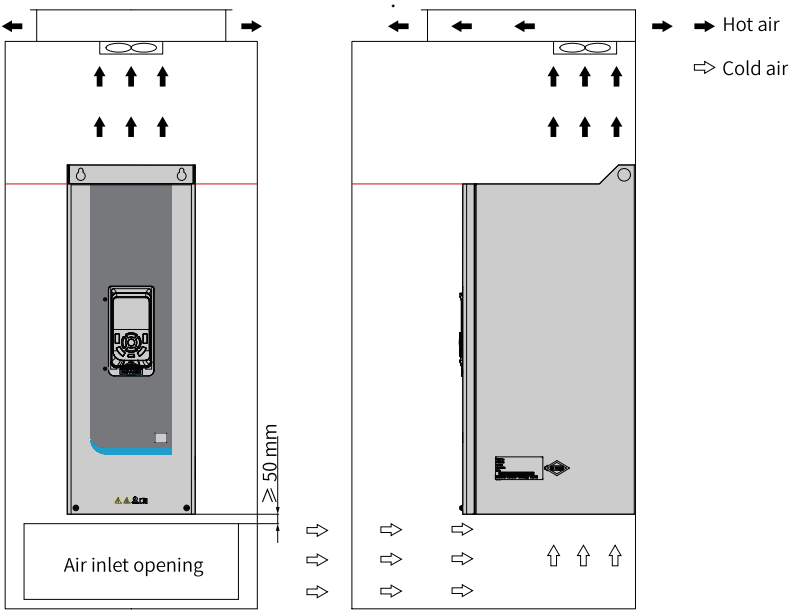


- Air outlet requirements
  The hot air flows upward. Therefore, open the air outlet at the top of the cabinet and make the outlet face the air outlet of the drive, so that hot air can be discharged from the cabinet. If exhaust ducts are used, the air outlet can be located around the cabinet, but must be higher than the air outlet of the drive, as shown in the following figure.

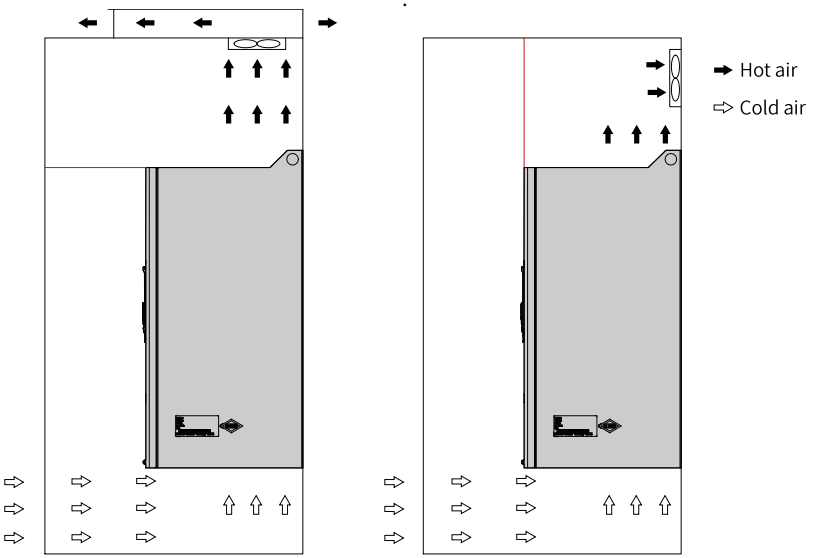


Forced air cooling cabinet

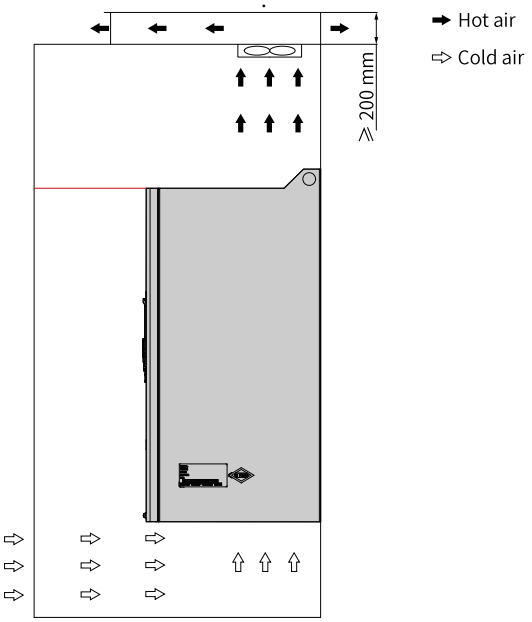
- Air inlet requirements
  - The air inlet of the cabinet must be at least 50 mm lower than that of the AC drive.
  - If multiple AC drives of different sizes are installed in the cabinet, the air inlet of the cabinet must be lower than the air inlet of the lowermost AC drive.
  - In most cases, if fans are installed at the air inlet, the fans will blow air into the cabinet, which causes abnormal air volume distribution of drives in the cabinet. Therefore, it is not recommended to install a fan at the air inlet to blow air into the cabinet, as shown in the following figure.



- Air outlet requirements
  Install the exhaust fan at the top of the cabinet or on the side near the top of the cabinet, and make the fan face the air outlet of the drive, as shown in the following figure.

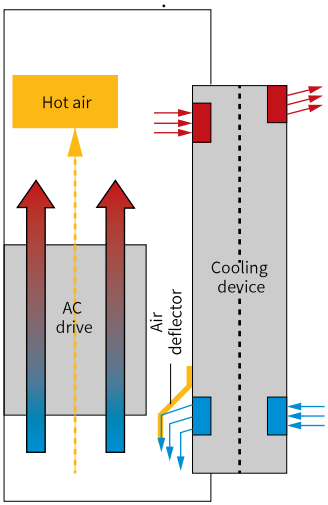


- If the air outlet top cover of the cabinet is too close to the air outlet of the exhaust fan, the performance of the fan will be degraded, resulting in significant increase in resistance and decrease in air volume. In this case, the air volume of the drive will be decreased and the drive will be heated up. Therefore, ensure that the air outlet top cover is at least 200 mm away from the air outlet of the exhaust fan, as shown in the following figure.

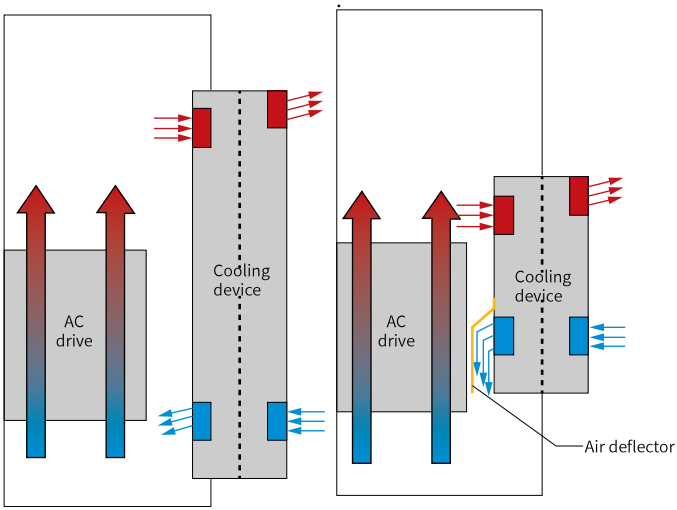


Cabinet with cooling device

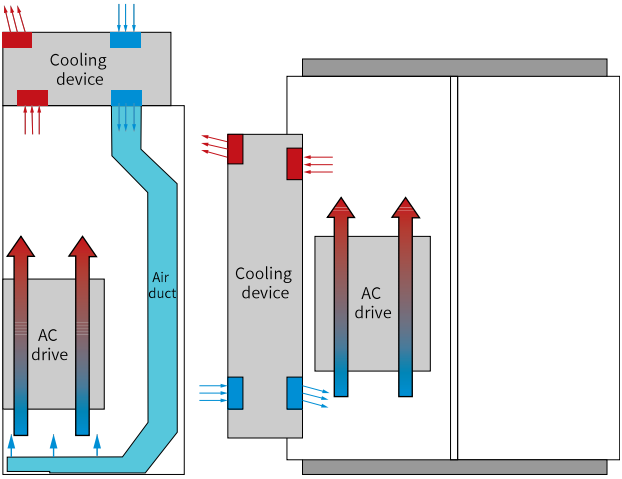
- When the drive is installed in the cabinet, the drive is cooled by natural convection or forced air cooling method. For both methods, the direction of the cold air must be opposite to the direction of gravity, dissipating heat from top to bottom, as shown in the following figure.

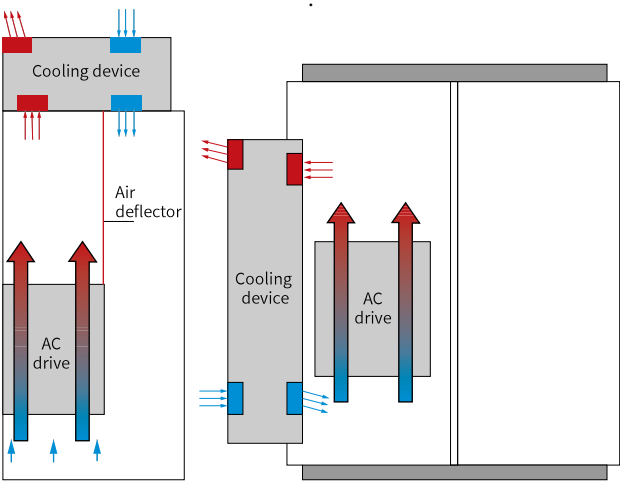


- The cooling device is installed on the cabinet door or on the side wall, so that the hot air from the air outlet of the drive can enter the internal circulation air inlet of the cooling device, and the cold air from the internal circulation air outlet of the cooling device can enter the air inlet of the drive, as shown in the following figure.

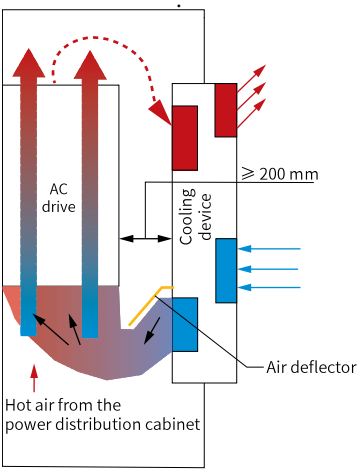


- Ensure that the air from the air outlet of the cooling device will not be blown into the air inlet directly. Install air ducts or air deflectors to isolate the cold air from the hot air if necessary, as shown in the following figure.





- The air circulated from the cooling device is damp and cold. In order to avoid condensation caused by directly entering of the damp and cold air, use the air deflector to keep the cooling device as least 200 mm away from the drive, as shown in the following figure.



2.4.2.2 Air Inlet and Outlet Area

Do not lay out cables (including power supply and communication cables) at the air inlet and outlet of the drive. Keep all vents unobstructed; otherwise, heat dissipation of the drive will be significantly affected. The space between the cable and the air inlet/outlet must be the same as B1 in *"Table 2–2 Clearance required for installing one AC drive" on page 26*.

- Air inlet and outlet requirements for naturally-ventilated cabinets:
  The effective area of the air inlet is as follows: $S=(1.5\text{-}2.0)(S_{Drive\ 1}+S_{Drive\ 2}+S_{Drive\ 3}+...+S_{Drive\ N})$.
  - S: Effective area of the cabinet air inlet with the unit of cm^2
  - S_{Drive}: Effective ventilation area of each drive with the unit of cm^2
  - Effective area of the cabinet air inlet: It indicates the actual through hole area of the opening area, which equals to area of the opening area x opening rate.

Table 2–8 Drive ventilation area

Structure	Ventilation Area (Unit: cm^2)
S4 (5.5 kW to 22 kW)	57
S5 (30 kW to 45 kW)	51
S6 to S7 (55 kW to 110 kW)	101
S8 to S9 (132 kW to 250 kW)	355

- Air inlet and outlet requirements for forced air cooling cabinets:
  - The air inlet area of the forced air cooling cabinet is the same as that of the naturally-ventilated cabinet.

- The total air volume of the fan used for the air outlet must be no less than the air volume required by all drives.

Table 2–9 Air volume required by drives

Structure	Cooling Air Volume (unit: CFM)
S4 (5.5 kW to 22 kW)	55
S5 (30 kW to 45 kW)	110
S6 to S7 (55 kW to 110 kW)	142
S8 to S9 (132 kW to 250 kW)	406

2.4.3 Hot Air Recirculation Prevention

Hot air back flow is the most common problem in the drive control cabinet. The mechanism of hot air back flow is as follows:

- Due to the suction of the fan, the air pressure at the control cabinet inlet is lowered down. However, the hot air discharged from the drive accumulates at the top of the control cabinet, causing the air pressure to rise.
- Due to the pressure difference between the inlet and outlet of the control cabinet, the air in the cabinet flows from the high pressure area to the low pressure area. The air speed is related to the area of the air inlet and outlet of the control cabinet and the air flow volume.

Note

If the hot air is not isolated from the cold air, the hot air discharged by the drive will again be drawn into the drive by the fan, heating the drive significantly.

The air deflector or exhaust duct can be used to prevent the back flow of hot air in the control cabinet. The main function of the air deflector or exhaust duct is to isolate the hot air discharged by the drive from the cold air at the drive inlet to ensure that the inlet air temperature of the drive is within the allowed range.

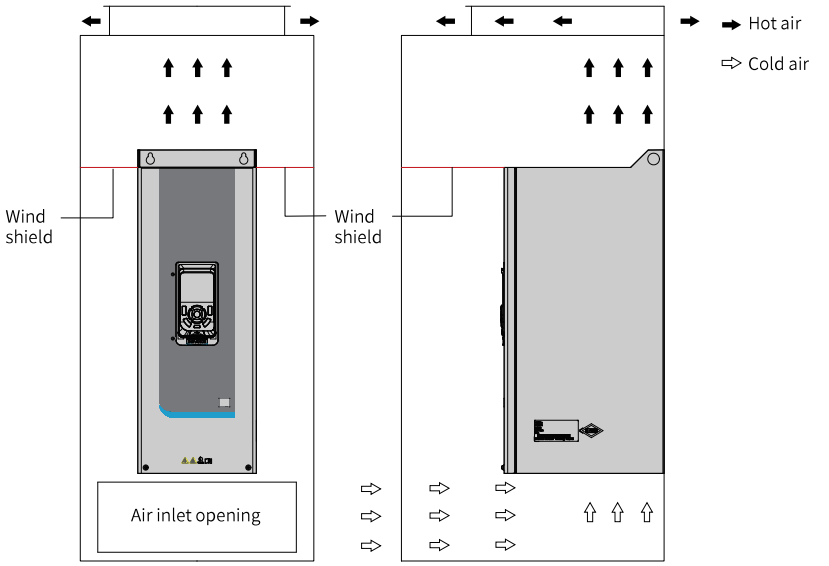


Figure 2-8 Using air deflector to prevent hot air recirculation

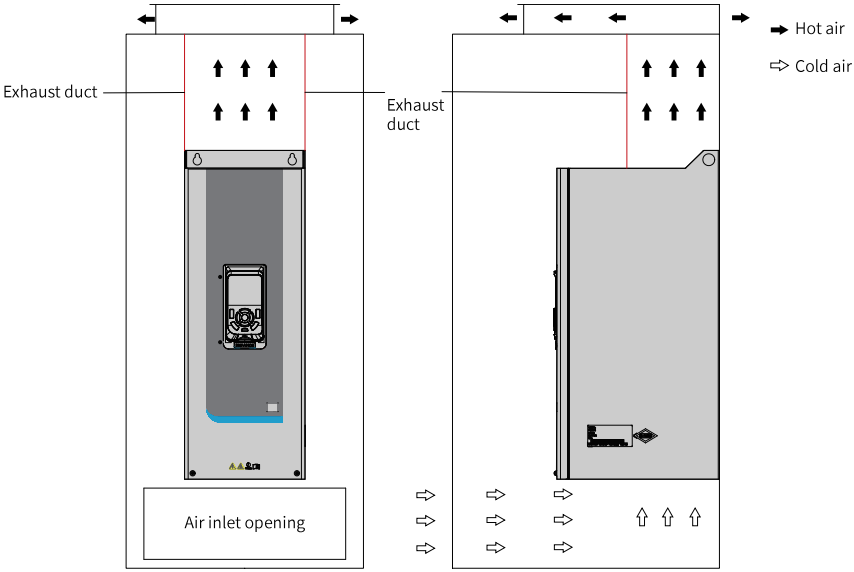


Figure 2-9 Using exhaust duct to prevent hot air recirculation

2.4.4 In-Cabinet Clearance

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

Table 2–10 Minimum clearance for multi-layer installation

Item	S4	S5	S6 and S7	S8 and S9
L1	⩾ 100 mm	⩾ 200 mm	⩾ 300 mm	⩾ 300 mm
L2	⩾ 100 mm	⩾ 200 mm	⩾ 300 mm	⩾ 300 mm
L3	⩾ 100 mm	⩾ 200 mm	⩾ 300 mm	⩾ 300 mm
L4	⩾ 100 mm	⩾ 200 mm	⩾ 300 mm	⩾ 300 mm

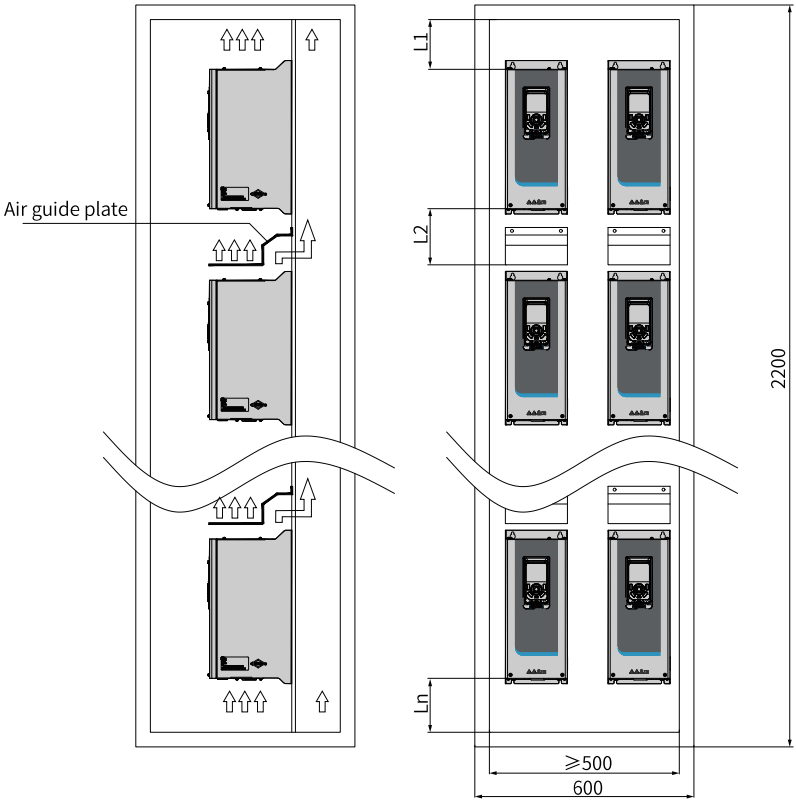


Figure 2-10 Minimum clearance for multi-layer installation

Note

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

3 Electrical Design

3.1 Basic Electrical Safety Precautions

3.1.1 Selecting Power Supply Isolation Devices

The drive comes with a master isolation device as standard. Depending on the capacity of the transmission device and the selected option, you can select an optional isolating switch or air circuit breaker as the power supply isolation device.

3.1.2 Selecting Main Contactors

Depending on the drive capacity, you can order optional main contactors.

3.1.3 Selecting Power Supply Transformers

Refer to the following guidelines when selecting power supply transformers.

- Calculate the apparent power of the transformer using the following formula:
  SN (kVA) = 1.6 x total power of the motor shaft (kW)
- Calculate the rated voltage of the transformer secondary winding based on the rated input voltage of the transmission equipment.
- Ensure that the transformer meets grid specifications defined for transmission.
  - Rated input voltage, allowable voltage change, and unbalance
  - Rated frequency and allowable change
  - Short circuit withstand strength (IEC) or current protection against short circuit (UL or CSA)

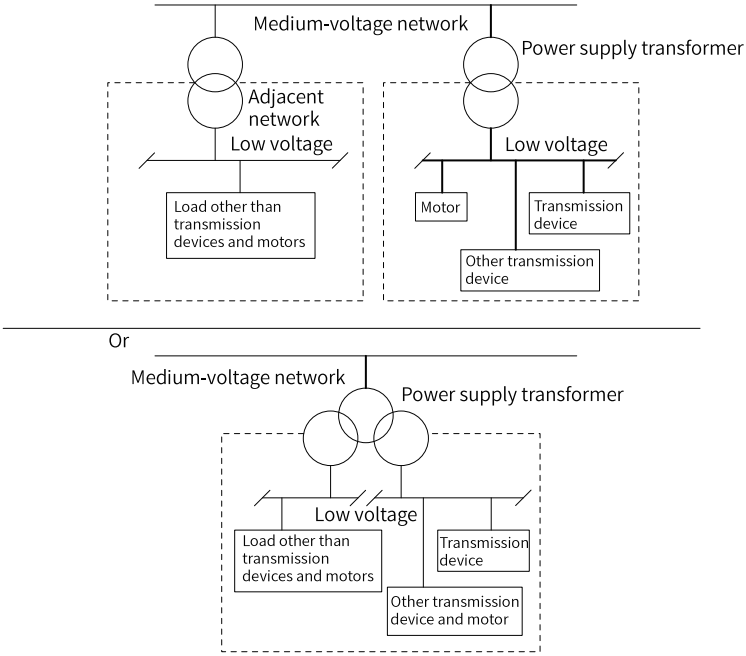


Figure 3-1 Selecting power supply transformers

Caution

If there are capacitive loads (such as lighting device, PC, PLC, and power factor compensation capacitors) in the same transmission network, resonance current may occur, which may damage components in the network.

3.1.4 Selecting Motors

After power-on, the motor generates heat continuously due to thermal effect of the current, heating the surroundings. When the generated heat exceeds the dissipated heat, the motor temperature rises, which will burn the motor.

The drive provides motor overload protection, but does not provide motor overheat protection. Therefore, select motors with overheating detection to meet NEC and CEC requirements.

Note

Use the dedicated motor for the drive. Failure to comply will result in short circuit due to ageing of the insulation layer.

3.1.5 Checking the Motor Compatibility

The AC drive can be used to drive one AC asynchronous induction motor, permanent magnet synchronous motor, or AC induction servo motor. Multiple induction motors can be connected to one shaft.

According to AC line voltage and motor load, select the motor capacity and drive type from section 1.3 Technical Specifications.

3.1.6 Using Permanent Magnet Synchronous Motors

Only one permanent magnet synchronous motor (PMSM) can be connected to the drive unit.

It is recommended to install a safety switch between the PMSM and the transmission equipment, which is used to safely disconnect the PMSM from the transmission equipment. According to safety instructions, you must ensure that the motor does not feed back power to the transmission equipment during maintenance.

3.1.7 Cabling Requirements

- Routing signal cables and power cables through different routes
  When using analog signals to remotely control the cabinet, route analog signal cables and power cables (such as power supply input, drive unit output, and braking resistor cables) through different routes and ensure that the distance is more than 50 cm. This can reduce the interference from the AC drive and other devices on the analog signal. Comply with the preceding wiring requirements even in the control cabinet.
- Analog signal cable
  Use shielded twisted pair (STP) cables for analog signal cables. Minimize the length of the stripped part of the cable (about 5–7 mm) and make the shield as close to the signal cable end as possible. Ground the shield at both ends of the cable properly. To prevent potential difference between the two ends of the shield, wrap the shield with insulation tape after stripping the cable.
- Motor cable
  Use shielded cables for motor cables. Minimize the distance between the cabinet and the motor. Route the motor cable independently of other cables, and avoid

long-distance parallel routing of the motor cables and other cables to reduce electromagnetic interference caused by rapid changes in the output voltage of the AC drive.

- Power cable
  Use shielded cables for power cables, or shield all the cables from the cabinet to the motor by using conduits.
- Control cable and power supply cable
  If the control cable and power supply cable must be intersected, make the intersection angle 90 degrees.

3.2 Main Circuit Cable

3.2.1 Main Circuit Terminals

Table 3–1 Main circuit terminals

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

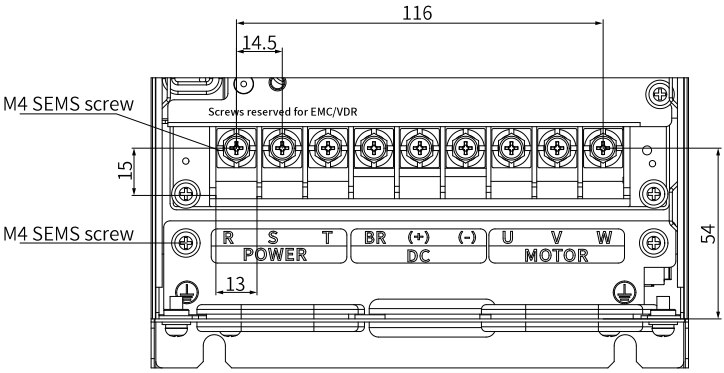


Figure 3-2 Layout of main circuit terminals of S4 models (mm)

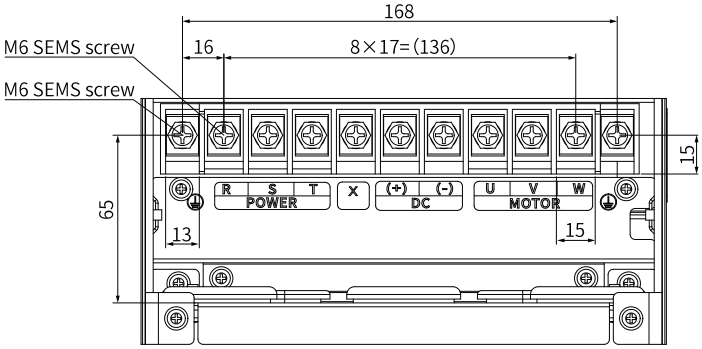


Figure 3-3 Layout of main circuit terminals of S5 models (mm)

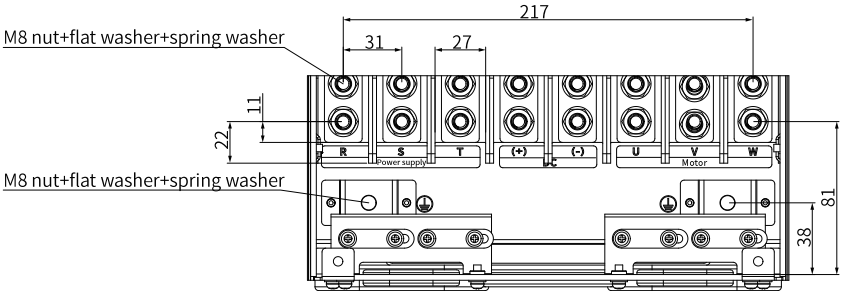


Figure 3-4 Layout of main circuit terminals of S6 and S7 models (mm)

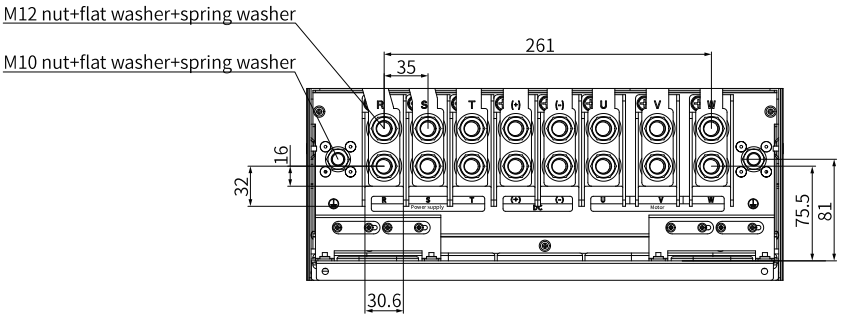


Figure 3-5 Layout of main circuit terminals of S8 and S9 models (mm)

3.2.2 Selection of Main Circuit Cables and Cable Lugs

Table 3–2 Recommended main circuit cables and cable lugs

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

Note

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

3.2.3 Main Circuit Wiring Requirements

Main circuit wiring requirements

- Terminals (-), (+) are used to connect options. Do not connect the terminals to the AC power supply.
- To protect the main circuit, avoid any possible contact with the main circuit.
- The control circuit is the internal safety extra-low voltage (SELV) circuit that must be strictly insulated and isolated from other circuits. Make sure that the control circuit is connected to the external SELV circuit.
- Never get any foreign objects into the terminal block.
- Do not solder the twisted conductors.
- The tightening torque of each terminal screw may be different. Tighten the screw according to the specified tightening torque using a torque screwdriver, ratchet, or wrench.
- When using an electric screwdriver to tighten terminal screws, set the electric screwdriver to low speed to prevent damage to the terminal screws.
- Tighten the terminal screws at an angle within 5 degrees. Failure to comply may result in screw damage.

Power cable selection requirements

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

- Compliant with EN 60204-1 and IEC 60364-5-52 standards
- PVC cables with copper conductors
- Working properly when the ambient temperature is equal to or lower than 40°C and the cable surface temperature is equal to or lower than 70°C (Note: When the ambient temperature exceeds 40°C, contact Inovance.)
- Sysmetric cable with copper-braided shield

Note

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

To comply with the EMC standards, use shielded cables. The shielded cables are divided into three-conductor cables and four-conductor cables, as shown below. If the conductivity of the three-conductor cable shield cannot meet requirements, add an independent PE cable. Alternatively, use a four-conductor cable with one conductor as the PE cable. To suppress radio frequency interference effectively, use the coaxial copper braid as the cable shield. To enhance the shielding and conductivity performance, ensure that the braided density is greater than 90%.

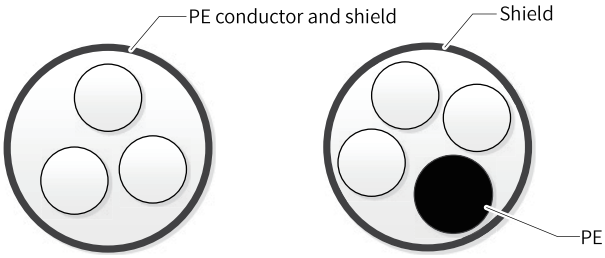


Figure 3-6 Recommended power cables

Main circuit cabling requirements

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

Cable ducts must be in good connection and well grounded. Aluminum cable ducts can ensure equipotentiality. The drive and motor must be in good contact with the system (machine or device). Spray the installation part for protection and ensure good contact of the conductive metal

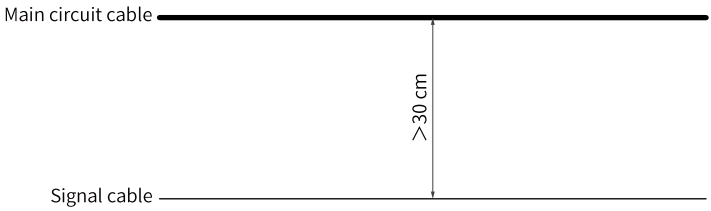


Figure 3-7 Routing cables

Motor cable shield requirements

Use shielded cables for motor output cables. Strip the cable to expose the shield, crimp the shield to the wire ferrule slot of the bracket with the wire ferrule, and crimp the lead wire of the shield to the PE terminal, as shown below.

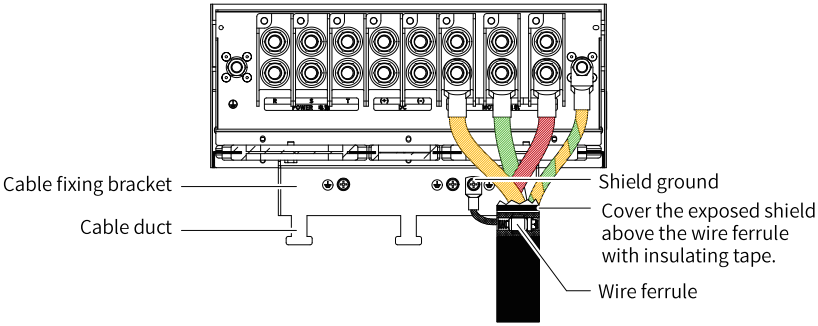


Figure 3-8 Shield wiring

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

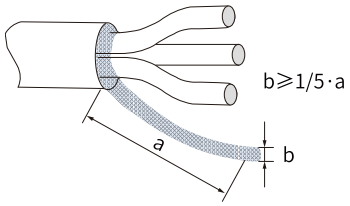


Figure 3-9 Lead wire of the motor cable shield

3.3 Selecting Control Cable

3.3.1 Control Circuit Terminals

"Figure 3–10 Layout of control circuit terminals" on page 53 shows the layout of control circuit terminals.

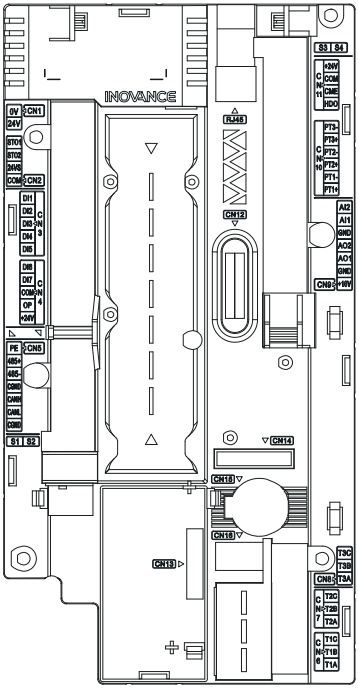


Figure 3-10 Layout of control circuit terminals

Table 3–3 Functions of control circuit terminals

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

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

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

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

Note

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

Table 3–4 External terminals

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

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

Note

CN14 is a reserved external interface.

3.3.2 Control Cable Selection

Note

Control circuit cables must be wired in accordance with EN 60204-1.

Selection requirement

To ensure that the control circuit will not be interfered by peripheries, use shielded cables with the shield for signal cables, and connect both ends of the shield to the drive 360 degrees with the shield bracket. Use different shielded cables for different analog signal cables and use shielded twisted pair cables for digital signal cables.

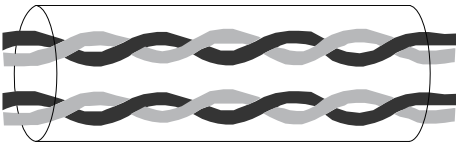


Figure 3-11 Shielded twisted pair cable

3.3.3 Control Circuit Wiring Requirements

Requirements on grounding the AI shield

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

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

Requirements on wiring encoder signal cables

Requirements on wiring encoder signal cables are as follows:

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

Requirements on wiring I/O signal cables

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

The following figure shows the recommended cabling.

Requirements on the wiring loop area

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

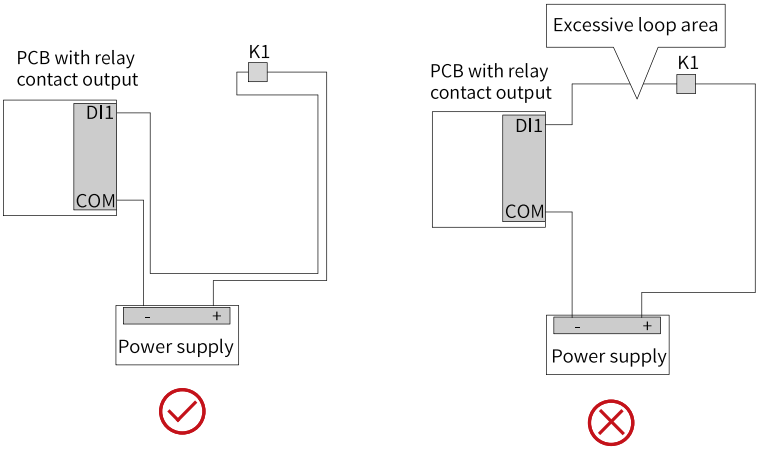


Figure 3-12 Recommended wiring loop area

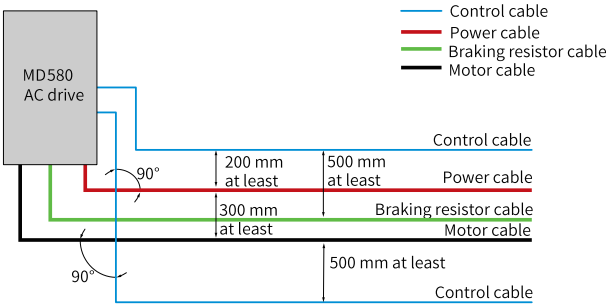


Figure 3-13 Routing of cables

3.4 Communicaton Cable

3.4.1 CANopen Communication Cable

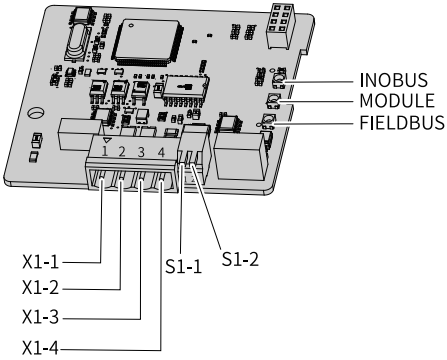


Figure 3-14 External connection of the MD580-SI-CAN1 module

Table 3–5 Terminal descriptions

Location Number	Name	Wiring	Description
X1-1	PE	Connected to the shield	Recommended cable specifications: Four-conductor shielded twisted pair cables Cross-sectional area: 0.3 mm ^{2} to 2.0 mm ^{2}
X1-2	CANH	Twisted pair cables	
X1-3	CANL		
X1-4	CGND	It is recommended to connect the terminal.	
S1-1	DIP switch 1	-	The terminals are used to determine whether the termination resistor is valid. When S1-1 and S1-2 are set to the ON position, the termination resistor is valid.
S1-2	DIP switch 2	-	

The following figure describes the terminal wiring.

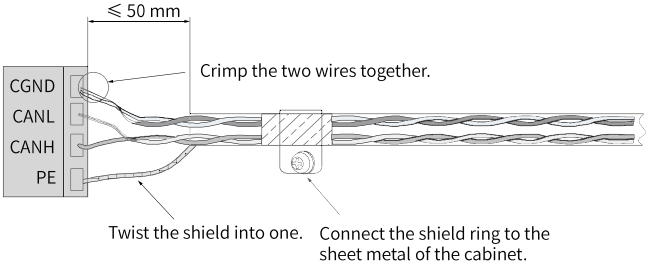


Figure 3-15 Terminal wiring

3.4.2 Modbus RTU Communication Cable

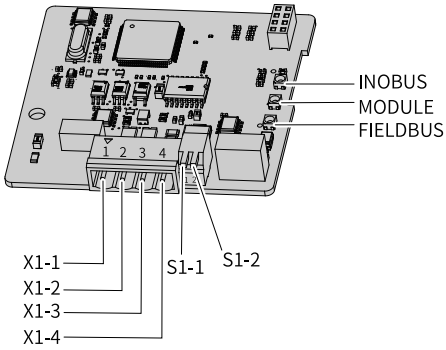


Figure 3-16 External connection of the MD580-SI-RS1 module

Table 3–6 Terminal descriptions

Location Number	Name	Wiring	Description
X1-1	Shield	Connected to the shield	Recommended cable specifications: Four-conductor shielded twisted pair cables Cross-sectional area: 0.3 mm ^{2} to 2.0 mm ^{2}
X1-2	485+	Twisted pair cables	
X1-3	485-		
X1-4	Grounding	It is recommended to connect the terminal.	
S1-1	DIP switch 1	-	The terminals are used to determine whether the termination resistor is valid. When S1-1 and S1-2 are set to the ON position, the termination resistor is valid.
S1-2	DIP switch 2	-	

The following figure describes the terminal wiring.

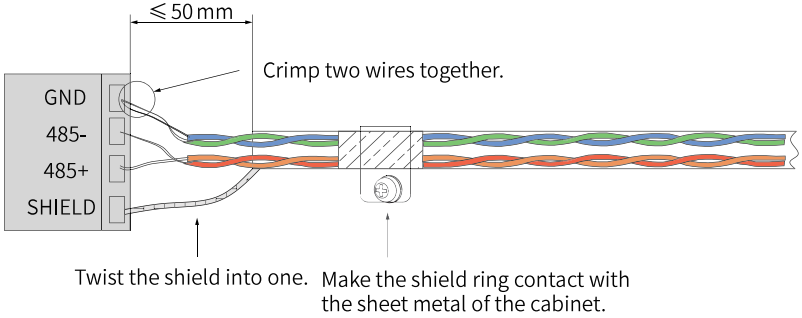


Figure 3-17 Terminal wiring

3.4.3 PROFIBUS DP Communication Cable

The PROFIBUS DP bus dedicated cable is recommended. The following table describes the cable parameters.

Table 3–7 Cable parameters

Parameter	Description
Conductor	One pair (2×22AWG) single-strand copper wire
Insulating sheath color	Green, Red
Shield	Aluminum plastic strip + tinned copper wire braid
Housing material	PVC
Operating temperature	-30°C to +70°C
Appearance	Purple

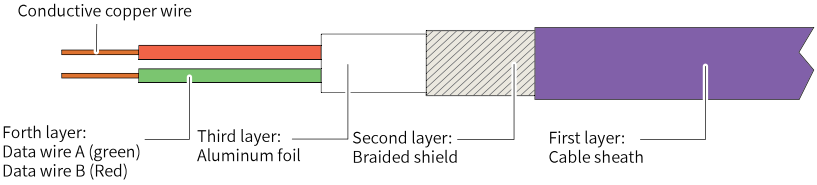


Figure 3-18 Bus cable internal structure

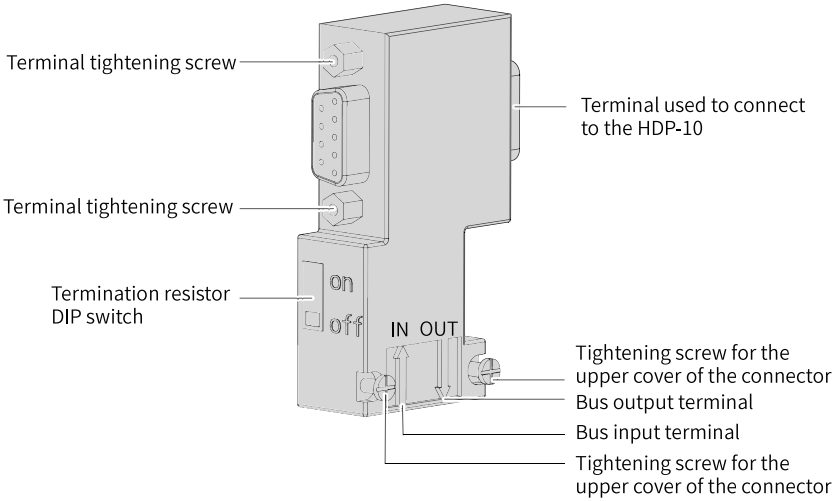


Figure 3-19 Bus connector structure

3.4.4 PROFINET IO Communication Cable

The MD580-SI-PN1 module is connected to the PROFINET master station using the standard Ethernet RJ45 socket. Definitions of the module pins are the same as those of the standard Ethernet pins. The module can be connected using crossover or straight-through cables.

Use shielded twisted pair Cat 5e cables, and protect the registered jack for crimping with an iron shell for the ground shield protection.

3.4.5 Modbus TCP Communication Cable

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

Use shielded twisted pair Cat 5e cables, and protect the registered jack for crimping with an iron shell for the ground shield protection.

3.5 Function Design

3.5.1 Start and Stop Function

The commands for the drive to start or stop motors are OFF1 commands and operation enabling commands. When the bit for the OFF1 command is set from 0 to 1,

the OFF1 start command is sent, and the S7 running preparation state is entered after the bus voltage becomes normal. When the bit for the operation enabling command is set form 0 to 1, the drives starts running. The signal must remain at high level for operation. If the OFF1 or operation enabling command signal is at the low level, the drive enters the stop state.

3.5.2 Emergency Stop

When an emergency stop command is received, the IGBT output is unconditionally blocked. In addition, the motor does not output torque but continues to rotate for a period of time because of inertia. You can configure OFF2 as the emergency stop command source. When an input switch signal is configured, you can press the switch to stop the device in the event of an emergency.

3.5.3 Brake Function

The relay output can be used as a control signal for the electrical circuit of the brake. The output signal source can be set to brake release and brake close. Parameters in group L1 are used to set the brake control logic conditions. For details, refer to the brake control section in *MD580 Series High-Performance Engineering AC Drive Function Guide*.

3.5.4 External Fault Report

The H0-00 and H0-01 provide two sources of external faults. For example, when an input switch signal is configured, turning on the switch can be used to report an external fault in an emergency or unexpected situation.

3.5.5 Safe Torque Off

Use the safe torque off (STO) function of the MD580 under the guidance of Inovance technical support engineers. The STO function can be used to control circuits to stop the AC drive for safety, or can be used for short-term maintenance without power supply interruption.

3.5.6 Protection for ATEX-Certified Explosion-Proof Motors

- The HSMT-10 detection card is used for safety temperature sampling of motors that match the MD580 series AC drive (including 400 V and 690 V models). After detecting a fault according to the motor PTC signal, the HSMT-10 detection card outputs two DO signals used to disable the STO.
- The HSMT-10 detection card also features short circuit detection and overheat warning for temperature sampling lines.
  - When the HSMT-10 detection card detects that the temperature sampling line is shorted, it cuts off the STO.

- When detecting a overheat warning sent by the PTC temperature sensor, the HSMT-10 detection card sends the overheat warning signal to the MD580 main control board. In this case, measures can be taken in advance (such as lowering down the carrier frequency and load power) to avoid shutdown caused by overheat.

3.5.7 Encoder Speed Measurement

The drive can be used with other functional modules. When the encoder speed measurement module is required, follow the encoder user guide for configuration.

Note

The encoder speed measurement module of the drive must match the motor encoder.

3.5.8 Motor Temperature Sensor Connection

The drive supports four temperature detection channels. You can enable the temperature detection function and set the temperature sensor type by parameters in F6 group. The temperature sensor is used to detect the motor temperature for motor protection. The following temperature sensors are supported: KTY84-130 , PT100 , PT1000, PTC130, and PTC130 (x3).

3.6 System Composition

When the AC drive is used to control asynchronous motors, you must install a variety of electrical devices on the input and output sides of the AC drive to ensure system safety and stability. The following figure shows the system composition of the three-phase 690 V AC drive with the power rating of 5.5 kW or above.

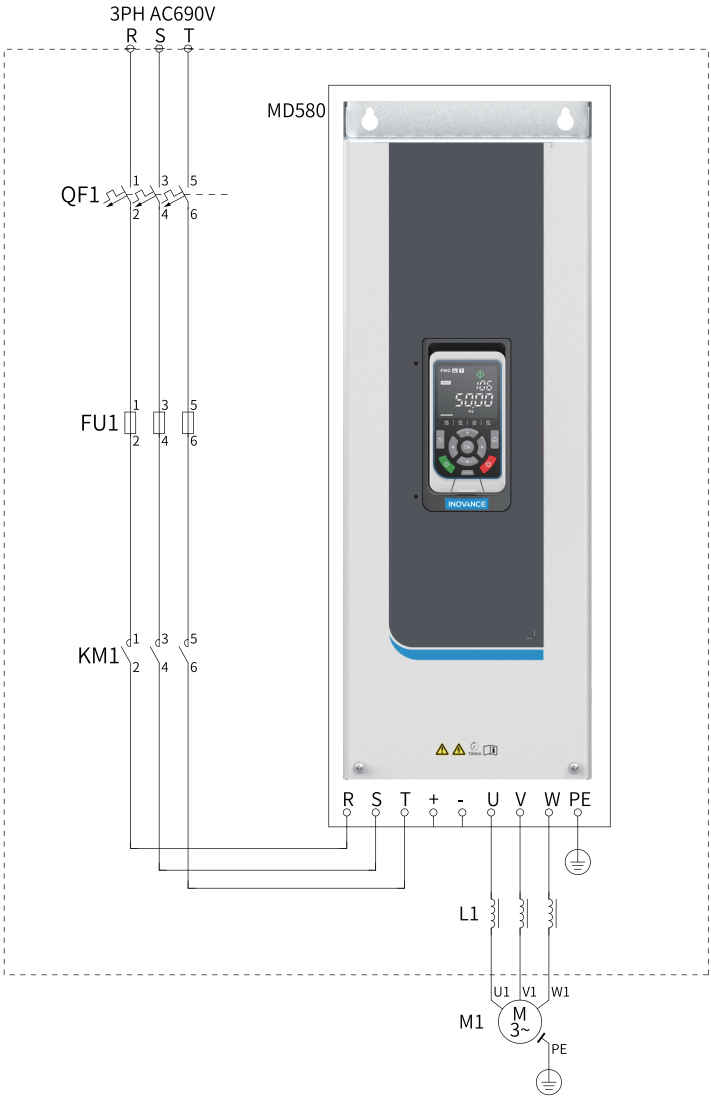


Figure 3-20 System composition

Note

The preceding figure is only for your reference. For details on the peripheral component selection, see the section of “Peripheral Electrical Components”.

Table 3–8 Description of peripheral electrical devices

Name	Position	Function
Circuit breaker	Between the power supply and the AC drive input side	Short circuit breaker: It cuts off the power supply when overcurrent occurs on downstream devices to prevent accidents.
		Earth leakage circuit breaker (ELCB): The drive may generate high-frequency leakage current during running. To prevent electric shock which may cause a fire, select a proper ELCB based on actual applications.
Fuse	Between the power supply and the AC drive input side	It provides protection in case of short circuit and protects downstream semiconductor components.
(Electromagnetic) contactor	Between the circuit breaker and the AC drive input side	It is used to power on or power off the AC drive. However, do not use the contactor to power on or power off the AC drive frequently (time interval must be longer than one hour), or use it to directly start the AC drive.
Braking resistor	On the braking unit	Braking resistors are optional for all models. The braking resistor consumes regenerative energy generated during motor deceleration.
Braking unit	+/- terminals of the bus	For S5 to S9 models, select the braking unit (MDBUN) with the recommended braking resistance manufactured by Inovance. The braking unit consumes regenerative energy generated during motor deceleration.
Output reactor	Between the AC drive output side and the motor and close to the AC drive	The output side of the AC drive usually has much high-order harmonics. When the motor is far from the AC drive, there is much distributed capacitance in the circuit. Subharmonics may generate resonance due to large distributed capacitance in the circuit, which causes the following adverse effects: • Degrades the motor insulation performance and damages the motor in the long run. • Generates large leakage current and causes frequent AC drive protection against trips.
Motor	Output side of the AC drive	Select an appropriate motor.

Note

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

3.7 Electrical Wiring

The following figure describes the typical electrical wiring.

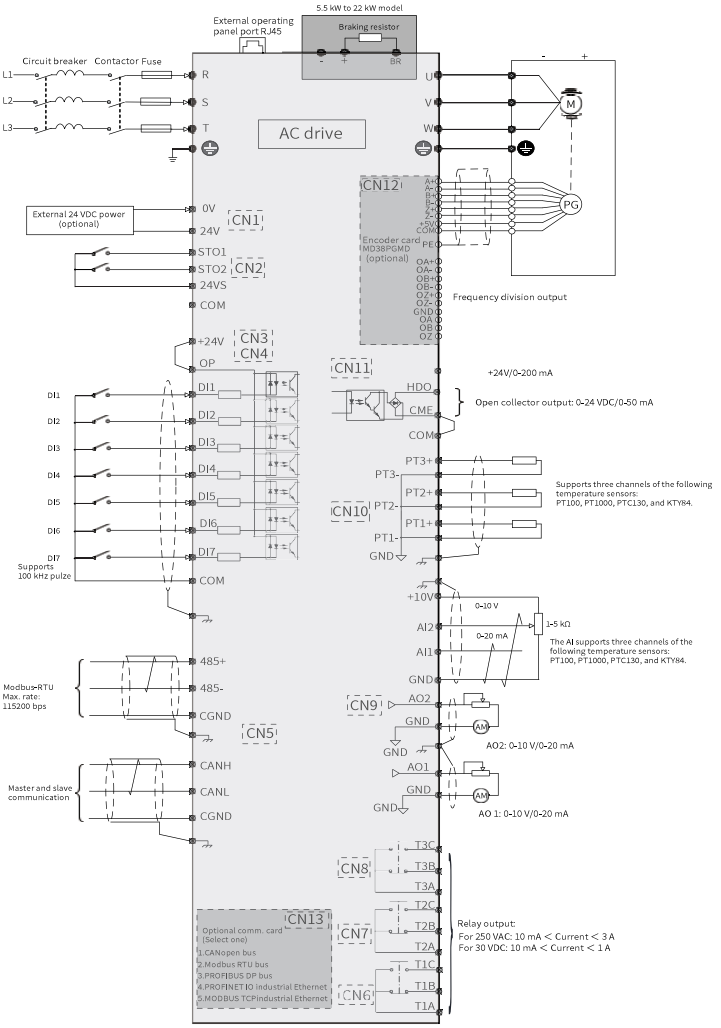


Figure 3-21 Typical electrical wiring

4 Option Selection

4.1 List of Options

Peripheral options include braking units, function expansion cards, and external operating panels, as shown in the following table. For detailed on how to use each option, see the corresponding user guide. If any of the following option is needed, specify it in your order.

Table 4–1 Option list

Name		Model	Applicable AC Drive Model	Function
Braking compo nent	Built-in braking unit	Model with the name containing letter "B"	S4	Standard for S4 models
	External braking unit	MDBUN-200-7T	S5 to S9 models	Optional for S5 to S9 models
Expansion card	CANopen communication card	MD580–SI-CAN1	Applicable to all models	CANopen bus adaptation card
	Modbus RTU communication card	MD580–SI-RS1	Applicable to all models	Modbus RTU adaptation card
	PROFIBUS DP communication card	MD580–SI-DP1	Applicable to all models	PROFIBUS DP adaptation card
	PROFINET IO communication card	MD580–SI-PN1	Applicable to all models	PROFINET IO industrial Ethernet card
	Modbus TCP communication card	MD580–SI-EM1	Applicable to all models	Modbus TCP industrial Ethernet card
	Resolver interface card	MD38PG4	Applicable to all models	The card is applicable to resolvers with the excitation frequency of 10 kHz and a DB9 interface.
	MD38PGMD multifunctional encoder card	MD38PGMD	Applicable to all models	The 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.
	SMT motor safety temperature detection card	MD580-SI-SMT	Applicable to all models	Motor safety temperature detection
Operating panel	LED operating panel	MDKE-10	Applicable to all models	The external LED operating panel is connected to the drive via the RJ45 port.
	External LCD operating panel	SOP-20-880	Applicable to all models	It can be used for parameter copy and download.

Name		Model	Applicable AC Drive Model	Function
Mounting accessory	SOP-20-880 mounting base	CP600-BASE1	Applicable to all models	The mounting base can be used to install the SOP-20-880 to the cabinet door.
	MDKE-10 mounting base	MD580-AZJ1	Applicable to all models	The mounting base can be used to MDKE-10 to the cabinet door.
	MDKE 10 bracket (optional)	MD580-AZJ1	Applicable to all models	It can be used to install the operating panel to the cabinet.
	SOP-20-880 bracket (optional)	CP600-BASE1	Applicable to all models	It can be used to install the LCD operating panel.
Cable	Extension cable	MDCAB	Applicable to all models	It is a standard eight-conductor, three-meter network cable that can be used to connect to the LED operating panel and LCD operating panel.
	Main circuit cable	-		It is recommended that the input/output main circuit cables and the power cables use symmetrical shielded cables. Compared with four-conductor cables, symmetrical shielded cables can reduce electromagnetic radiation in the whole transmission system.
	Control circuit cable	All control circuit cables must be shielded cables. Use a separate shielded cable for each type of analog signal, and use shielded twisted pair cables for digital signal cables.		
Peripheral components	Fuse, contactor, and circuit breaker	See *"4.2.1 Fuse, Contactor, and Circuit Breaker" on page 71* for specific models.		
	Output reactor	See *"4.2.2 Output Reactor Model" on page 72* for specific models.		
	Magnetic ring and ferrite clamp	See *"4.2.4 Magnetic Ring and Ferrite Clamp" on page 76* for specific models.		

4.2 Peripheral Electrical Components

4.2.1 Fuse, Contactor, and Circuit Breaker

To comply with EN 61800-5-1 and UL 61800-5-1 standards, install the fuse and the contactor, or install the circuit breaker on the input side to prevent accidents caused by short circuit in the internal circuit. The following tables list recommended fuses and circuit breakers manufactured by Bussmann.

Table 4–2 Fuse, contactor, and circuit breaker selection

Structure	AC Drive Model	Fuses Rated Current (A)/Model	Contactor Rated Current (A)	Circuit Breaker Rated Current (A)
S4	MD580-01S-07A4-7-B(-LCD)	15/FWP-15A	15	10
	MD580-01S-09A9-7-B(-LCD)	20/FWP-20A	15	15
	MD580-01S-14A3-7-B(-LCD)	30/FWP-30A	25	20
	MD580-01S-0019-7-B(-LCD)	35/FWP-35A	30	25
	MD580-01S-0023-7-B(-LCD)	40/FWP-40A	35	30
	MD580-01S-0027-7-B(-LCD)	50/FWP-50A	40	35
S5	MD580-01S-0035-7(-LCD)	60/FWP-60A	55	45
	MD580-01S-0042-7(-LCD)	70/FWP-70A	65	55
	MD580-01S-0049-7(-LCD)	90/FWP-90A	75	60
S6	MD580-01S-0061-7(-LCD)	100/FWP-100A	95	80
	MD580-01S-0084-7(-LCD)	150/FWP-150A	125	105
S7	MD580-01S-0098-7(-LCD)	200/FWP-200A	150	125
	MD580-01S-0119-7(-LCD)	200/FWP-200A	180	150
S8	MD580-01S-0142-7(-LCD)	250/FWP-250A	220	180
	MD580-01S-0174-7(-LCD)	275/FWP-275A	265	220
S9	MD580-01S-0210-7(-LCD)	350/FWP-350A	320	265
	MD580-01S-0271-7(-LCD)	450/FWP-450A	410	340

Note

- The cable that can withstand high temperature of 70 degrees (PVC) is recommended. The carrier current of cables with different temperature resistance grades is different.
- Generally, fuses, contactors, and circuit breakers that can be used at the room temperature below 40 degrees are recommended. Select them based on the actual usage environment.

4.2.2 Output Reactor Model

Whether to install an AC output reactor on the output side of the AC drive depends on actual situations. The cables connecting the AC drive and motor should not be too long. Overlong cables cause large distributed capacitance, which may result in high harmonic current. When the output cable is too long, install an output reactor.

With an output reactor installed on the output side of the drive, the excessive dV/dt can be reduced, lowering the voltage stress on the motor winding. This protects the motor winding, lowers the motor temperature, and prolongs the service life of the motor.

- If the length of the output cable is shorter than 300 m, no output reactor is required.
- If the length of the output cable ranges from 300 m to 400 m, install one output reactor.
- If the length of the output cable ranges from 400 m to 500 m, install two output reactors.

Structure	AC Drive Model	Output Reactor Model
S4	MD580-01S-07A4-7-B(-LCD)	MD-OCL-0007-EISC-E2M0
	MD580-01S-09A9-7-B(-LCD)	MD-OCL-0010-EISC-E1M4
	MD580-01S-14A3-7-B(-LCD)	MD-OCL-0015-EISC-EM93
	MD580-01S-0019-7-B(-LCD)	MD-OCL-0020-EISH-EM70
	MD580-01S-0023-7-B(-LCD)	MD-OCL-0030-EISH-EM47
	MD580-01S-0027-7-B(-LCD)	MD-OCL-0030-EISH-EM47
S5	MD580-01S-0035-7(-LCD)	MD-OCL-0040-EISH-EM35
	MD580-01S-0042-7(-LCD)	MD-OCL-0050-EISH-EM28
	MD580-01S-0049-7(-LCD)	MD-OCL-0050-EISH-EM28
S6	MD580-01S-0061-7(-LCD)	MD-OCL-0060-EISH-EM23
	MD580-01S-0084-7(-LCD)	MD-OCL-0090-EISH-EM17
S7	MD580-01S-0098-7(-LCD)	MD-OCL-0120-EISH-EM11
	MD580-01S-0119-7(-LCD)	MD-OCL-0120-EISH-EM11
S8	MD580-01S-0142-7(-LCD)	MD-OCL-0150-EISH-EM09A
	MD580-01S-0174-7(-LCD)	MD-OCL-0200-EISH-EM07A
S9	MD580-01S-0210-7(-LCD)	MD-OCL-0250-EISH-E55UA
	MD580-01S-0271-7(-LCD)	MD-OCL-0330-EISH-E42UA

4.2.3 Braking Components

Selection of braking resistor resistance

During braking, almost all the regenerative energy of the motor is consumed by the braking resistor. The resistance of the braking resistor is calculated according to the following equation:

U x U/R = Pb

Note

- U: It indicates the braking voltage used for stable system braking. The value of U varies with systems. The default braking voltage of the AC drive is 1126 V, which can be adjusted through F9-08.
- Pb: It indicates the braking power.
- R: It indicates the resistance.

Selection of braking resistor power

In theory, the power of the braking resistor is consistent with the braking power. However, in consideration of the derating value K, the relationship between the power of the braking resistor and the braking power is as follows: K x Pr = Pb x D

Note

- K: Set it to a value around 50%.
- Pr: Braking resistor power
- D: Braking frequency, which is the proportion of the regenerative process to the whole working process

The power of the braking resistor Pr can be calculated based on the following equations:

K x Pr = Pb x D = U x U/R x D

Pr = (U x U x D)/(R x K)

K is the derating factor of the braking resistor. A small K value ensures that the braking resistor does not get overheated. You can increase the value of K properly under favorable heat dissipation conditions of the braking resistor. However, keep the value of K no larger than 50%. Otherwise, the braking resistor will overheat, which may cause a fire.

The braking frequency D is determined based on actual applications. *"Table 4–3 Braking frequencies in common applications" on page 74* lists the typical values in common applications.

Table 4–3 Braking frequencies in common applications

Common Application	Elevator	Winding and unwinding	Centrifuge	Occasional braking load	General application
Braking Frequency	20% to 30%	20% to 30%	50% to 60%	5%	10%

Outline dimensions of the braking unit

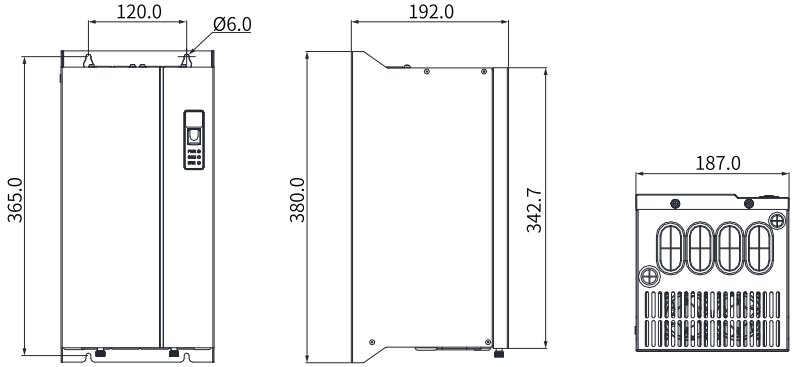


Figure 4-1 Outline dimensions of MDBUN-200-7T braking unit (unit: mm)

Braking unit models

Note

The braking resistance in the preceding table is obtained in the heavy load working condition where the braking usage ratio is 10% and the longest time for braking once is 10s.

Table 4–4 Selection of braking components (three phrase 380-480 V)

Model	Braking Unit		125% Braking Torque (10% ED; Max. 10s)		Min. Braking Resistance (Ω)
	Model	Quantity	Braking Resistor Specification	Qty. of Braking Resistors	
MD580-01S-07A4-7-B(-LCD)	Built-in, standard	1	740 W, 150 Ω	2	263
MD580-01S-09A9-7-B(-LCD)			1100 W, 100 Ω	2	193
MD580-01S-14A3-7-B(-LCD)			1500 W, 75 Ω	2	132
MD580-01S-0019-7-B(-LCD)			1500 W, 75 Ω	2	97
MD580-01S-0023-7-B(-LCD)			2200 W, 50 Ω	2	78
MD580-01S-0027-7-B(-LCD)			2200 W, 50 Ω	2	66
MD580-01S-0035-7(-LCD)	MDBUN-200-7T	1	3000 W, 30 Ω	2	48
MD580-01S-0042-7(-LCD)			4000 W, 32 Ω	2	39
MD580-01S-0049-7(-LCD)			4000 W, 32 Ω	2	32
MD580-01S-0061-7(-LCD)			4500 W, 27 Ω	2	26
MD580-01S-0084-7(-LCD)			7000 W, 16 Ω	2	19
MD580-01S-0098-7(-LCD)			9000 W, 13 Ω	2	16
MD580-01S-0119-7(-LCD)			11000 W, 10.5 Ω	2	13
MD580-01S-0142-7(-LCD)			11000 W, 10.5 Ω	2	11
MD580-01S-0174-7(-LCD)			11000 W, 10.5 Ω	2	9
MD580-01S-0210-7(-LCD)			21000 W, 4.1 Ω	2	7
MD580-01S-0271-7(-LCD)			27000 W, 3.2 Ω	2	6

Note

For details on how to install and use the MDBUN, see *MDBUN Series Braking Unit User Guide*.

4.2.4 Magnetic Ring and Ferrite Clamp

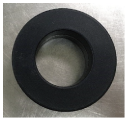
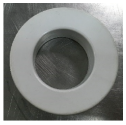
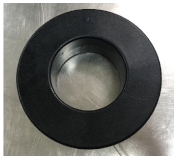
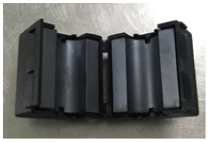
Model

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.

In applications with leakage current and signal cable interference, install a magnetic ring or a ferrite clamp.

- Amorphous magnetic ring: It features high magnetic conductivity when the frequency is within 1 MHz and can efficiently suppress interference of the AC drive. However, it is relatively expensive.
- Ferrite clamp: It features high magnetic conductivity when the frequency is above 1 MHz and can efficiently suppress interference of signal cables for low-power AC drives at a low cost.

Table 4–5 Appearance and model of magnetic rings and ferrite clamps

Category	Model	Appearance
Magnetic ring	DY644020H	
	DY805020H	
	DY1207030H	
Ferrite clamp	DYR-130-B	

Dimensions

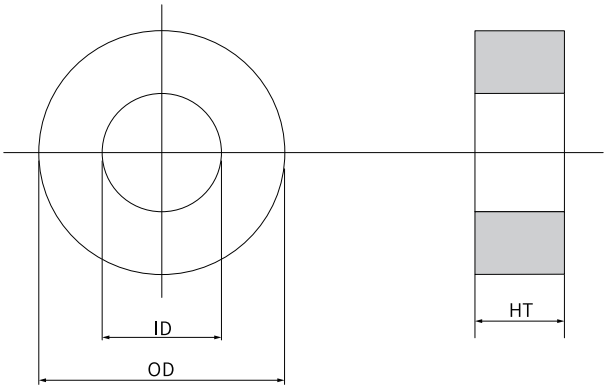


Figure 4-2 Magnetic ring dimensions (unit: mm)

Table 4–6 Magnetic ring dimensions

Model	Dimension (OD x ID x HT) (mm)
DY644020H	64 x 40 x 20
DY805020H	80 x 50 x 20
DY1207030H	120 x 70 x 30

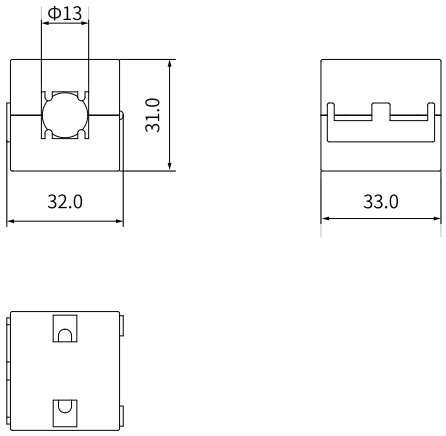


Figure 4-3 Ferrite clamp dimensions (unit: mm)

4.3 Accessary Installation

4.3.1 Grounding Bracket for Cable Shield

Use the shielded cable for the output motor cable. 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. The following figure takes the S8 and S9 models as an example to show how to install the shield grounding bracket. Shield grounding bracket installation of other modes is similar to that of the S8 and S9 models.

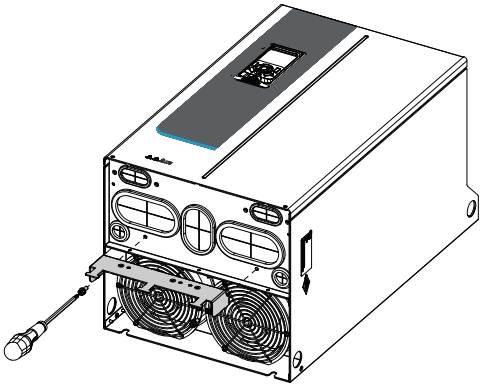


Figure 4-4 Installation of the shield grounding bracket

The following figure shows the shield wiring.

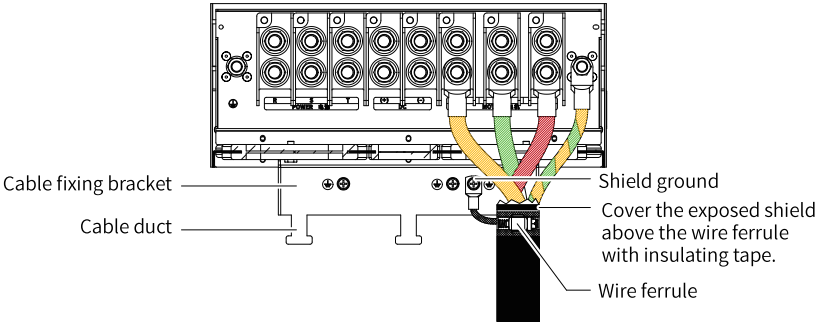
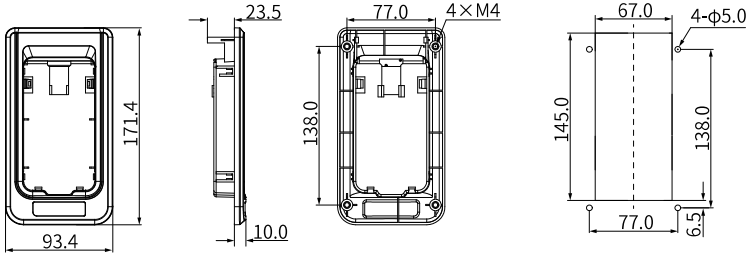


Figure 4-5 Shield wiring

4.3.2 MDKE 10 Bracket

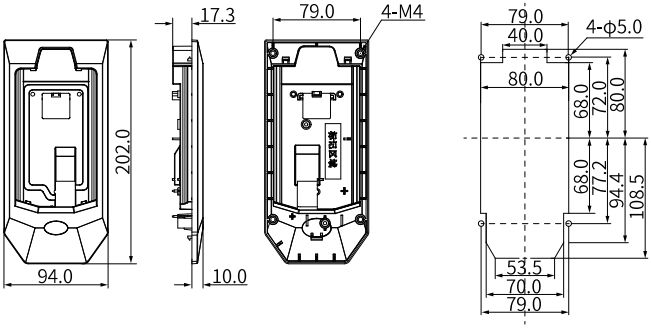


Dimensions for the mounting bracket

Hole dimensions

Figure 4-6 Bracket dimensions and hole sizes (mm) of the MDKE-10

4.3.3 SOP-20-880 Bracket



Dimensions of the mounting bracket

Hole dimensions

Figure 4-7 Bracket dimensions and hole sizes (mm) of the SOP-20-880

4.4 Operating Panel

Model	Type	Description	Appearance
MDKE-10	LED	Applicable to the MD580, it is an external LED operating panel to facilitate debugging, and can be operated in the same way as the operating panel of the AC drive. For dimensions, see *"Figure 4–8 Dimensions of MDKE-10 (unit: mm) " on page 81*.	
SOP-20-880	LCD	Convenient and easy to use, it is an option that supports parameter copy and download for easy parameter operation. For dimensions, see *"Figure 4–9 Dimensions of SOP-20-880 (unit: mm） " on page 82*.	

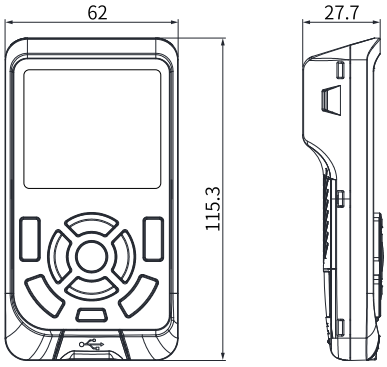


Figure 4-8 Dimensions of MDKE-10 (unit: mm)

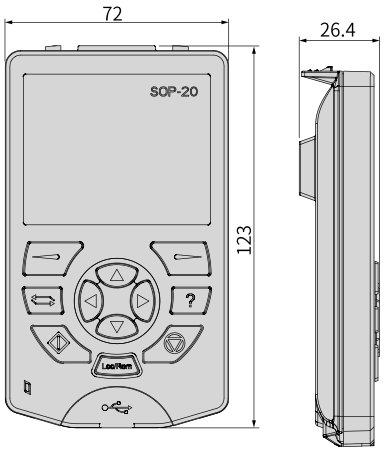


Figure 4-9 Dimensions of SOP-20-880 (unit: mm)

4.5 List of expansion cards

The MD580 series AC drive supports different types of expansion cards including communication cards and encoder cards. The communication cards are used to connect field buses for communication, and the encoder cards are used to connect encoders. All the expansion cards support secondary development.

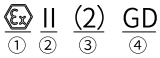
Table 4–7 List of expansion cards

Name	Model	Function	Remarks
CANopen communication card	MD580–SI-CAN1	CANopen bus adaptation	For details, see *HCAN-10 Field Bus Adaption Module User Guide.*
Modbus RTU communication card	MD580–SI-RS1	Modbus RTU bus adaptation	For details, see *HMBA-10 Modbus RTU Field Bus Adaption Module User Guide.*
PROFIBUS DP communication card	MD580–SI-DP1	PROFIBUS DP bus adaptation module	For details, see *HDP-10 PROFIBUS DP Field Bus Adaption Module User Guide.*

Name	Model	Function	Remarks
PROFINET IO communication card	MD580–SI-PN1	PROFINET IO industrial Ethernet	For details, see *HPFN-10 PROFINET IO Industrial Ethernet Adaption Module User Guide.*
Modbus TCP communication card	MD580–SI-EM1	Modbus TCP industrial Ethernet	For details, see *HMBT-10 Modbus TCP Adaption Module User Guide.*
SMT motor safety temperature detection card	MD580-SI-SMT	Motor safety temperature detection	For details, see *HSMT-10 Motor Temperature Detection Card User Guide.*

Name	Model	Function	Remarks
Resolver interface card	MD38PG4	• Applicable to the resolver with the excitation frequency pf 10 kHz and with the DB9 interface • To meet the MD38PG4 requirements, the excitation input DC resistance of the resolver must be greater than 17 Ω. Failure to comply will result in MD38PG4 exceptions. Select a resolver with a maximum of four pole pairs. Otherwise, the MD38PG4 card will be overloaded.	-
MD38PGMD multifunctional encoder card	MD38PGMD	• The card is an encoder interface card with the optional multiplied frequency division output function and supports 5 V or 15 V power supply. • The card supports differential input, collector input, and 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.	For details, see *MD38PGMD Multi-functional Encoder Expansion Card User Guide*.

4.6 Explosion-Proof Requirements on the HSMT-10 Motor Safety Temperature Detection Card



① **Types of applicable explosion-proof motors** Ex d: Explosion-proof type (IEC/EN 60079-1) Ex eb, Ex ec: Increased safety type (IEC/EN 60079-7)	3 **Equipment type** (2): The drive must be installed in the environment without potential explosion.
2 **Equipment** II: Ground industrial products (except mining applications)	4 **Working environment** GD: The motor can be used in the environment with gas, steam, or fog, or in the environment with explosive items such as dust.

Danger

- The HSMT-10 safe motor temperature detection card can be installed in safety zones only, rather than in atmospheres with explosive gases.
- Comply with the safety precautions on the AC drive. Failure to comply may result in equipment damage, physical injuries, or even death.
- The safety function described in this guide will not separate the power circuit or auxiliary circuit from the power supply. Do not work on the AC drive or motor cables or motor until the drive system is separated from all power supplies and no dangerous voltage is measured. Take the electrical safety measures before starting working.

Caution

The HSMT-10 safe motor temperature detection card only has the ATEX-complied motor thermal protection function. The ATEX-complied safe disconnection function can be provided only when the card is used with MD580 series products of Inovance.

Note

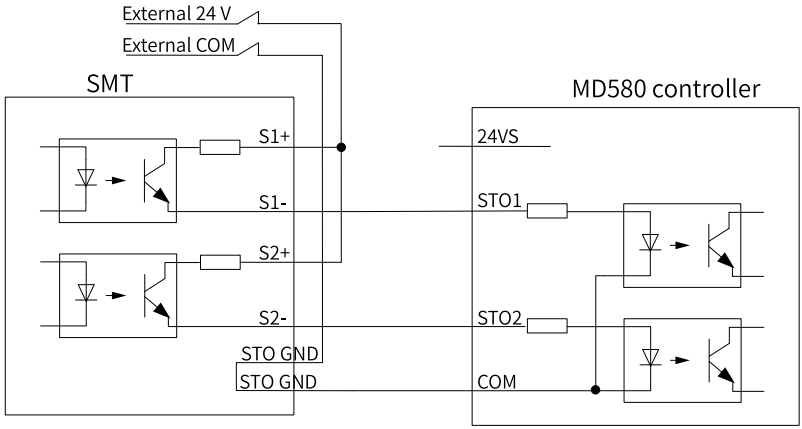
ATEX: Explosive environment

Complete the following steps for electrical safety before installation or maintenance.

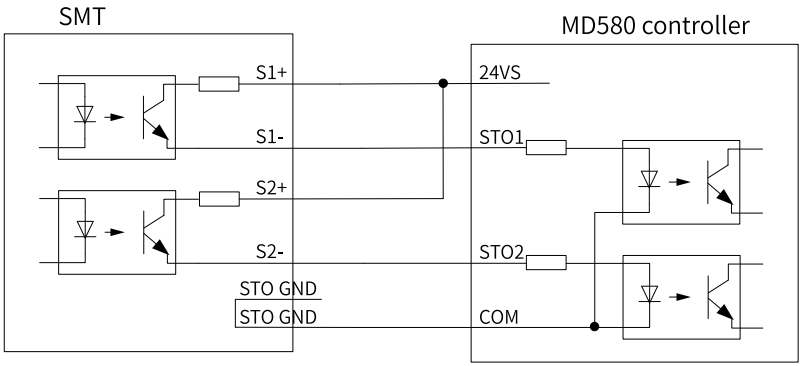
1. Obtain work authorization from the person responsible for electrical installation.
2. Clearly identify the workplace and equipment.
3. Disconnect all possible voltage sources and ensure that they cannot be reconnected. Lock the workplace and tag it during maintenance and service.
4. Avoid contact with any live parts in the workplace during maintenance and service.
5. Take special precautions when working near bare conductors.
6. Measure the voltage of the device to ensure that the device has been de-energized. When measuring the voltage, remove or disassemble shields or other cabinet structures in accordance with local laws and regulations for live work (including but not limited to electrical shock and arc protection).
7. Install temporary grounding as required by local code.

Safety SMT wiring example

- External 24 V connection example



- Internal 24 V connection example



The HSMT-10 motor safety temperature detection card has the motor thermal protection function in the explosive environment.

- Only qualified professionals can install, control, and maintain the motor thermal protection function that enables the card to be used in the explosive environment.
- Observe all safety instructions and safety regulations when the card is used with motors in 1/21 zone (equipment category 2) or 2/22 zone (equipment category 2 or 3).

Note

- When the cable length exceeds 100 m, short circuit detection is not supported. Disable short circuit detection by setting H1-46.
- The HSMT-10 detection card is SIL2 compliant.

5 Compliance List

5.1 Compliance List

The following table lists related certifications, directives, and standards. Certification marks on the product nameplate indicate the certifications acquired.

Certification	Directive		Standard
CE certification	EMC Directive	2014/30/EU	EN IEC 61800-3
	Low Voltage Directive (LVD)	2014/35/EU	EN 61800-5-1
	RoHS Directive	2011/65/EU	EN 50581

Note

The product complies with the latest version of the directive and standard of the CE certification.

5.2 CE Certification

5.2.1 Precautions for Compliance with European Standards

Figure 5-1 CE marking

- The CE mark is required for commercial trades (production, import,and sales) in Europe to indicate compliance with the directives for safety (LVD),electromagnetic compatibility (EMC), and environmental protection (RoHS).
- The CE mark is required for products in commercial trades (production, import, or sales) in Europe.
- The drive complies with the LVD, EMC, and RoHS directives and is labeled with the CE mark.
- Machines and devices integrated with the drive must also meet CE requirements when sold in Europe.
- When attaching the CE mark to the final assembly, customers who integrate the drive into the final assembly have the responsibility of ensuring that the final assembly complies with the CE certification.

5.2.2 EMC Directive Compliance

- The drive complies with EMC Directive 2014/30/EU and standard EN IEC 61800-3 and can be used in the first and second environment.

If the product is used in the first environment, it may generate radio interference. In addition to CE compliance requirements, measures should be taken to prevent interference when necessary.

- To enable the drive to comply with the EMC directive and standard, install an EMC filter on the input side and use shielded cables on the output side. Ground the filter and the shield of the output cable properly.

The system manufacturer who installs and integrates the AC drive to the system is responsible for compliance of the system with the European EMC Directive and standard EN IEC 61800-3 according to the system application environment.

Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices or systems to work properly in the electromagnetic environment without introducing electromagnetic interference that disturbs the operation of other local devices or systems. EMC includes the following requirements:

- The electromagnetic interference produced by the equipment during normal operation in its environment shall not exceed certain limit.
- The equipment has certain grade of immunity to the presence of electromagnetic interference in its operation environment.

EN IEC 61800-3 defines two types of environments:

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

According to the expected usage environment, products are divided into the following categories:

- C1 equipment: Power drive system (PDS) with the rated voltage less than 1000 V, intended for use in the first environment.
- C2 equipment: PDS with the rated voltage less than 1000 V, which is neither a plug-in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by professionals.
- C3 equipment: PDS with the rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment.
- C4 equipment: PDS with the rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

The MD580 belongs to C4 category based on the intended usage environment.

5.2.3 Low Voltage Directive Compliance

This product has been tested according to EN61800-5-1, and complies with the Low Voltage Directive (LVD). Observe the following requirements to enable machines and devices integrated with this drive to comply with the LVD.

Installation site

Install the drive in a place that meets requirements of overvoltage category III and pollution degree 1 or 2 as specified by IEC 60664-1.

Installation environment

For installation environment requirements, see *"2.1 Installation Environment" on page 25*.

Installation protection requirements

- The drive is installed in a cabinet as a part of a final system. The system must be equipped with a fireproof housing that provides electrical and mechanical protection. In addition, the system must conform to local and regional laws and regulations and relevant IEC standards.
- Drives (IP20) intended to be installed in the cabinet must be mounted in a structure that prevents intrusion of unwanted objects from the top and the front.

Wiring requirements for main circuit terminals

For details, see *"3.2.3 Main Circuit Wiring Requirements" on page 50*.

Requirements for protective devices

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

Use a fuse that matches the maximum input current of the AC drive. For selection of fuses, see *"4.2.1 Fuse, Contactor, and Circuit Breaker" on page 71*.

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