



MD800 Series AC Drive (Multidrive System) Design and Model Selection Guide



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit



Data code 19011492B02

Preface

Introduction

The MD800 series is a new generation of standard AC drive (multidrive system) designed for low-power multidrive applications in the traditional original equipment manufacturer (OEM) industry. It is widely applied in industries such as printing and packaging, woodworking machine tools, food and beverage, logistics and storage, textile printing and dyeing, fans, and water pumps.

This guide describes the system composition, technical specifications, dimensions, detailed specifications and selection of options (installation accessories, cables, and peripheral electrical components), common EMC problems and solutions, and compliant certifications and standards.

More Data

Name	Data Code	Description
MD800 Series AC Drive (Multidrive System) Quick Installation and Commissioning Guide	19011494	This guide describes the installation, wiring, quick commissioning, commissioning parameters, and commissioning troubleshooting of the product.
MD800 Series AC Drive (Multidrive System) Design and Model Selection Guide (this guide)	19011492	This guide describes the system composition, technical specifications, dimensions, detailed specifications and selection of options (installation accessories, cables, and peripheral electrical components), common EMC problems and solutions, and compliant certifications and standards.
MD800 Series AC Drive (Multidrive System) Maintenance and Repair Guide	19011495	This guide describes the routine maintenance, component replacement, and troubleshooting of the product.
MD800 Series AC Drive (Multidrive System) Function Guide	19011493	This guide describes the commissioning tools, system commissioning procedures, parameters, fault codes, and product functions and applications.
MD800 Series AC Drive (Multidrive System) Communication Guide	19011496	This guide describes the communication mode, communication networking, and communication configuration of the product.
MD800 Series AC Drive (Multidrive System) User Guide	PS00009036	This guide describes model selection, installation, wiring, commissioning, function description, fault handling, maintenance, and so on.

Revision History

Date	Version	Description
January 2024	B02	Modified the following content: Added the product models in the following sections: • "1.2 Product Model" on page 17 • "1.3.1 Electrical Specifications" on page 19 • "1.3.2 Technical Specifications" on page 28 • "1.4 Product Components" on page 32 • "2.3 Clearance Requirements" on page 43 • "Heat Dissipation Requirements" on page 45 • "3.1.4 Main Circuit Cable Selection" on page 63 • "Expansion Card Functions" on page 84 • "3.2.3 Wiring Descriptions of Control Circuit Terminals" on page 97 • "4.1.4 Braking Component" on page 129 • "4.1.5 Output Reactors" on page 131
March 2023	B01	Added the wiring description of the AI used for temperature input in 3.2.3 Descriptions of Expansion Circuit Terminal Wiring. Added the DO wiring in 3.2.3 Descriptions of Expansion Circuit Terminal Wiring. Added Ethernet/IP communication information in 3.3.3 Ethernet Wiring, 6.4.2 EtherCAT, PROFINET, and Ethernet/IP Communication Interference, and 3.2.2.6 Functions of Ethernet/IP Communication Expansion Cards (SI-EN). Updated the voltage class in 1.1 Nameplate and 1.3.1 Electrical Parameters. Added descriptions in 1.2 Product Model. Added the number of axes in table 1-12 Technical specifications of the power supply unit in 1.3.2 Technical Specifications.
September 2022	B00	Added MD800-2T models with the following sections updated: Front cover, back cover, preface, and fundamental safety instructions 1.1 Nameplate 1.2 Product Model 1.3.1 Electrical Specifications 1.5 System Components 2.4 Heat Dissipation Requirement 3.1.4 Cable Selection for Main Circuits 4.1.1 Fuse, Circuit Breaker, and Contactor 4.1.2 AC Input Reactor 4.1.3.1 EMC Filter 4.1.4 Braking Component 4.1.5 Output Reactor 7.1 Compliance List

Date	Version	Description
April 2022	A06	Updated general specifications in 1.3.2 Technical Specifications. Updated wiring descriptions of DIO1 to DIO4 and added DO wiring diagrams in 3.2.3 Descriptions of Control Circuit Terminal Wiring.
September 2021	A05	Updated the description of communication connection and networking diagrams in 3.3 Communication Connection.
August 2021	A04	Updated the IP rating in 1.3.1 Electrical Specifications. Updated the relative humidity for operating in 1.3.2 Technical Specifications. Updated the description of CN3 and CN4 terminal pins in 3.2.1 Descriptions of Control Circuit Terminals. Added 4.3 EMC Shield Bracket.
June 2021	A03	Updated the data code and version.
June 2021	A01	Supplemented the description of EMC shield bracket models in 1.6 List of Options. Updated EMC filter models in 4.1.3.1 EMC Filter. Updated the air flow requirements for the single-phase 220 V models in 1.3.1 Electrical Specifications. Updated the vibration description in technical specifications.
March 2021	A00	First release.

Access to the Guide

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

- Do keyword search under Service and Support at <http://www.inovance.com>.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install the app, where you can search for and download manuals.



Warranty Disclaimer

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

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

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

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

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Fundamental Safety Instructions

Safety Disclaimer

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

Safety Levels and Definitions



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



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



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

General Safety Instructions

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Users must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking **WARNING**

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

 CAUTION

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

Storage and Transportation **WARNING**

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

 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 the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the drive in the environment with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Installation

 DANGER

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

 WARNING

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

 CAUTION

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

Wiring

 DANGER

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

 WARNING

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

 CAUTION

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

Power-on

 DANGER

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

 WARNING

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

Operation

 DANGER

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

 WARNING

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

Maintenance

 DANGER

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

 WARNING • Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.
Repair
 DANGER • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Do not repair the equipment with power ON. Failure to comply will result in an electric shock. • Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
 WARNING • Submit the repair request according to the warranty agreement. • When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injury or equipment damage. • When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly. • Replace quick-wear parts of the equipment according to the replacement instructions. • Do not use damaged equipment. Failure to comply may result in death, personal injury, or severe equipment damage. • After the equipment is replaced, check the wiring and set parameters again.
Disposal
 WARNING • Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injury, or even death. • Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. 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 Nameplate

Note

The following nameplate is used as an example. The actual nameplate is subject to the product.

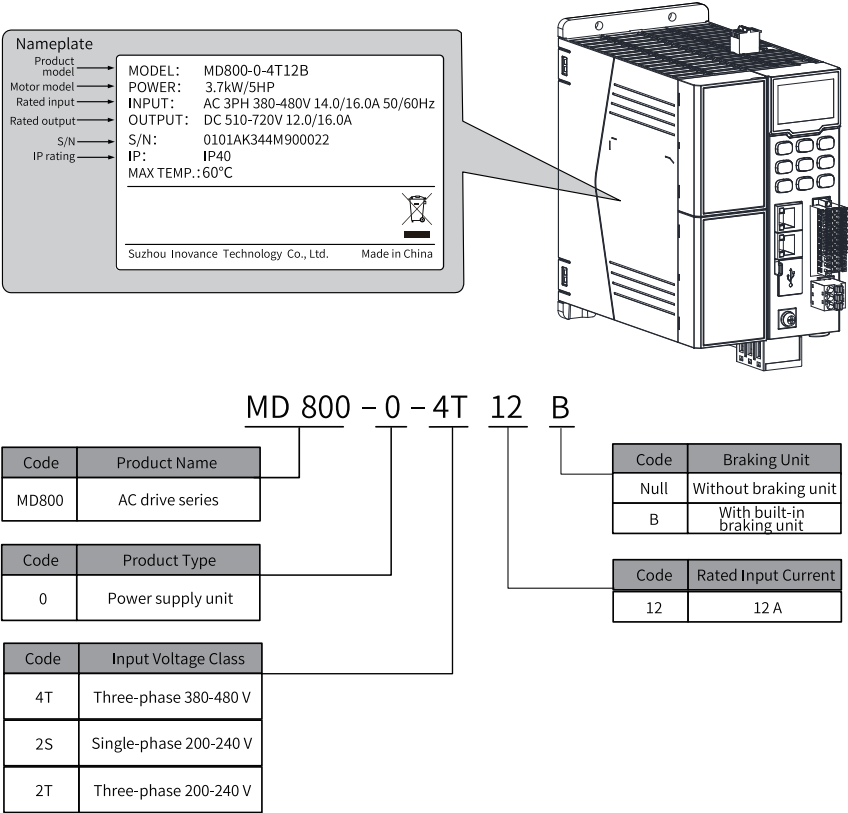


Figure 1-1 Naming rule and nameplate of the power supply unit

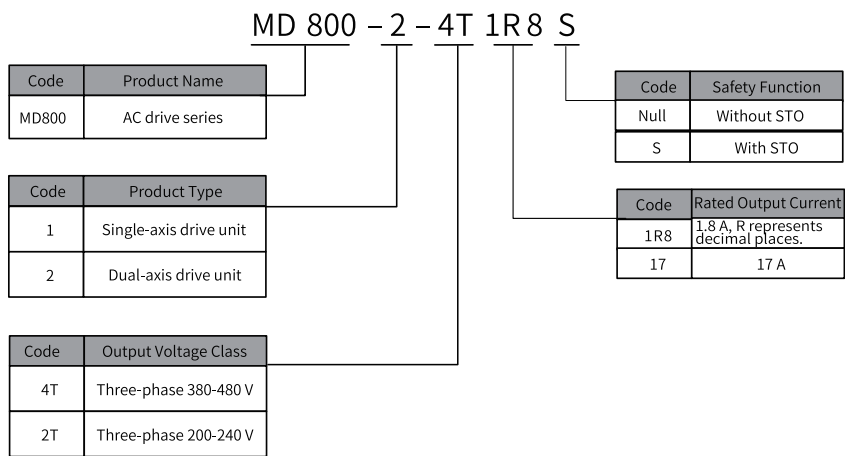
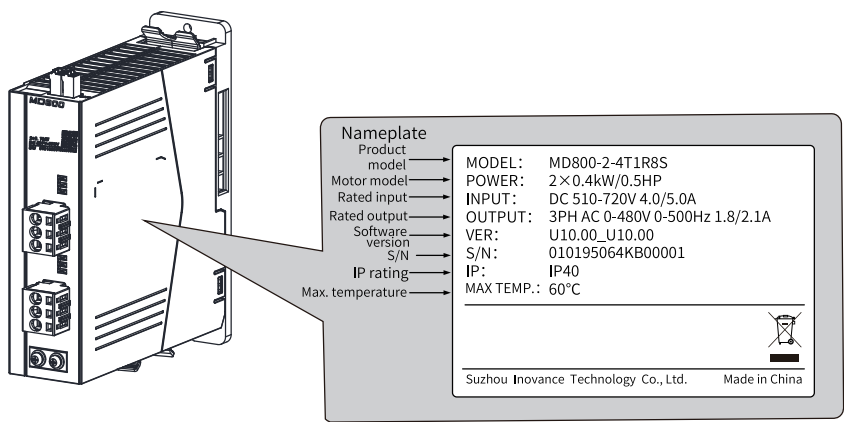


Figure 1-2 Naming rule and nameplate of the drive unit

Note

- The drive unit with the output voltage of three-phase 380 V to 480 V can match the power supply unit with the input voltage of three-phase 380 V to 480 V.
- The drive unit with the output voltage of three-phase 200 V to 240 V can match the power supply unit with the input voltage of three-phase 200 V to 240 V or single-phase 200 V to 240 V.

1.2 Product Model

Power supply unit model

Input Voltage Class	Power (kW)	Product Model
Three-phase 380 V to 480 V	3.7	MD800-0-4T12
		MD800-0-4T12B
	7.5	MD800-0-4T22
		MD800-0-4T22B
	15	MD800-0-4T41
		MD800-0-4T41B
Single-phase 200 V to 240 V	2.2	MD800-0-2S24
		MD800-0-2S24B
	3.7	MD800-0-2S40
		MD800-0-2S40B
Three-phase 200 V to 240 V	3.7	MD800-0-2T22B
	7.5	MD800-0-2T41B

Drive unit (single-axis) model

Output Voltage Class	Power (kW)	Product Model
Three-phase 380 V to 480 V	0.4	MD800-1-4T1R8
		MD800-1-4T1R8S
	0.75	MD800-1-4T3R4
		MD800-1-4T3R4S
	1.5	MD800-1-4T4R8
		MD800-1-4T4R8S
	2.2	MD800-1-4T5R5
		MD800-1-4T5R5S
	3.7	MD800-1-4T9R5
		MD800-1-4T9R5S
	5.5	MD800-1-4T13
		MD800-1-4T13S
	7.5	MD800-1-4T17
		MD800-1-4T17S

Three-phase 200 V to 240 V	0.2	MD800-1-2T1R7
		MD800-1-2T1R7S
	0.4	MD800-1-2T3
		MD800-1-2T3S
	0.75	MD800-1-2T5
		MD800-1-2T5S
	1.5	MD800-1-2T8
		MD800-1-2T8S
	2.2	MD800-1-2T11
		MD800-1-2T11S
	3.7	MD800-1-2T17
		MD800-1-2T17S

Drive unit (dual-axis) model

Output Voltage Class	Power (kW)	Product Model
Three-phase 380 V to 480 V	0.4	MD800-2-4T1R8
		MD800-2-4T1R8S
	0.75	MD800-2-4T3R4
		MD800-2-4T3R4S
	1.5	MD800-2-4T4R8
		MD800-2-4T4R8S
	2.2	MD800-2-4T5R5
		MD800-2-4T5R5S
	3.7	MD800-2-4T9R5
		MD800-2-4T9R5S
Three-phase 200 V to 240 V	0.2	MD800-2-2T1R7
		MD800-2-2T1R7S
	0.4	MD800-2-2T3
		MD800-2-2T3S
	0.75	MD800-2-2T5
		MD800-2-2T5S
	1.5	MD800-2-2T8
		MD800-2-2T8S
	2.2	MD800-2-2T11
		MD800-2-2T11S

Note

In the preceding table, the power of the drive unit (dual-axis) indicates the power of a single axis.

1.3 Technical Data

1.3.1 Electrical Specifications

Electrical specifications of the power supply unit

Table 1-1 Electrical specifications of the power supply unit (input voltage: three-phase 380 V to 480 V)

Item		Unit	Specification		
Model: MD800-0-4T__ (B)		-	12	22	41
Power (heavy load)		kW	3.7	7.5	15
Power (light load)		kW	5.5	11	18.5
Structure		-	S2		
Weight (gross/net)		kg	1.7/1.5	1.7/1.5	1.9/1.7
Input	Rated input current (heavy load)	A	12	22	41
	Rated input current (light load)	A	16	33	44
	Power supply capacity (heavy load)	kVA	10	18.3	34.1
	Power supply capacity (light load)	kVA	13.3	27.4	36.6
	Grid type	-	TN, TT, IT		
	Rated voltage/frequency	-	Three-phase 380 VAC to 480 VAC, 50/60 Hz		
	Voltage range	-	-15% to +10%, or 323 VAC to 528 VAC		
	Frequency range	-	±5%, or 47 Hz to 63 Hz		
Output	Output voltage	V	510 VDC to 720 VDC		
	Rated output current (heavy load)	A	12.2	22.4	41.8
	Rated output current (light load)	A	16	33	44.6
	Efficiency (heavy load)	-	99.2%	99.2%	99.3%
	Efficiency (light load)	-	99.2%	99.1%	99.3%
	Overload capacity	-	Heavy load: 60s at 150% of the rated current; light load: 60s at 110% of the rated current		

Item		Unit	Specification		
Heat dissipation design	Thermal power consumption (heavy load)	W	42	75	131
	Thermal power consumption (light load)	W	58	120	157
	Air exhaust volume	CFM	16	30	30
	Cooling mode	-	Forced air cooling		
Overvoltage category		-	OVC III		
Pollution degree		-	No conductive dust allowed Compliant with the following IEC 60721-3-3 standards: Chemical gas: class 3C3 Solid particle: class 3S2		
IP rating		-	IP40 (excluding the terminals and fans)		
Noise		dB (A)	33	60	60

Table 1-2 Electrical parameters of the power supply unit (input voltage: single-phase 200 V to 240 V)

Item		Unit	Specification	
Model: MD800-0-2S_ _ (B)		-	24	40
Power (heavy load)		kW	2.2	3.7
Power (light load)		kW	3	4.4
Structure		-	S2	
Weight (gross/net)		kg	1.7/1.5	1.9/1.7
Input	Rated input current (heavy load)	A	24	40
	Rated input current (light load)	A	27	44
	Power supply capacity (heavy load)	kVA	5.8	9.6
	Power supply capacity (light load)	kVA	6.5	10.6
	Grid type	-	TN, TT, IT	
	Rated voltage/frequency	-	Single-phase 200 VAC to 240 VAC, 50/60 Hz	
	Voltage range	-	-15% to +10%, or 170 VAC to 264 VAC	
	Frequency range	-	±5%, or 47 Hz to 63 Hz	

Item		Unit	Specification	
Output	Output voltage	V	270 VDC to 360 VDC	
	Rated output current (heavy load)	A	13.5	22.6
	Rated output current (light load)	A	15.1	24.8
	Efficiency (heavy load)	-	98.1%	98.1%
	Efficiency (light load)	-	98.7%	98.1%
	Overload capacity	-	Heavy load: 60s at 150% of the rated current Light load: 60s at 110% of the rated current	
Heat dissipation design	Thermal power consumption (heavy load)	W	59	94
	Thermal power consumption (light load)	W	65	110
	Air exhaust volume	CFM	25	30
	Cooling mode	-	Air cooling	
Overvoltage category		-	OVC III	
Pollution degree		-	No conductive dust allowed Compliant with the following IEC 60721-3-3 standards: Chemical gas: class 3C3 Solid particle: class 3S2	
IP rating		-	IP40 (excluding the terminals and fans)	
Noise		dB (A)	53	60

Table 1-3 Electrical parameters of the power supply unit (input voltage: three-phase 200 V to 240 V)

Item	Unit	Specification	
Model: MD800-0-2T_ _ (B)	-	22	41
Power (heavy load)	kW	3.7	7.5
Power (light load)	kW	5.5	11
Structure	-	S2	
Weight (gross/net)	kg	1.7/1.5	1.9/1.7

Item		Unit	Specification	
Input	Rated input current (heavy load)	A	22	41
	Rated input current (light load)	A	33	44
	Power supply capacity (heavy load)	kVA	18.3	34.1
	Power supply capacity (light load)	kVA	27.4	36.6
	Grid type	-	TN, TT, IT	
	Rated voltage/ frequency	-	Three-phase 200 VAC to 240 VAC, 50/60 Hz	
	Voltage range	-	-15% to +10%, or 170 VAC to 264 VAC	
	Frequency range	-	±5%, or 47 Hz to 63 Hz	
Output	Output voltage	V	270 VDC to 360 VDC	
	Rated output current (heavy load)	A	22.4	41.8
	Rated output current (light load)	A	33	44.6
	Efficiency (heavy load)	-	99.2%	99.3%
	Efficiency (light load)	-	99.1%	99.3%
	Overload capacity	-	Heavy load: 60s at 150% of the rated current Light load: 60s at 110% of the rated current	
Heat dissipation design	Thermal power consumption (heavy load)	W	75	131
	Thermal power consumption (light load)	W	120	157
	Air exhaust volume	CFM	30	30
	Cooling mode	-	Forced air cooling	
Overvoltage category		-	OVC III	
Pollution degree		-	No conductive dust allowed Compliant with the following IEC 60721-3-3 standards: Chemical gas: class 3C3 Solid particle: class 3S2	
IP rating		-	IP40 (excluding the terminals and fans)	
Noise		dB (A)	60	60

Electrical specifications of the drive unit (single-axis)

Table 1–4 Electrical specifications of the drive unit (single-axis; output voltage: three-phase 380 V to 480 V)

Item		Unit	Specification						
Model: MD800-1-4T_ _ (S)		-	1R8	3R4	4R8	5R5	9R5	13	17
Power (heavy load)		kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5
Power (light load)		kW	0.75	1.5	2.2	3.7	5.5	7.5	11
Structure		-	S1						
Weight (gross/net)		kg	1.1/ 0.9	1.1/ 0.9	1.1/ 0.9	1.1/ 0.9	1.1/ 0.9	1.1/ 0.9	1.1/ 0.9
Input	Rated input current (heavy load)	A	2.3	4.2	6	6.9	11.8	16.2	21.2
	Rated input current (light load)	A	2.6	5.7	6.7	11.2	16.1	21.1	26
	Input voltage	-	510 VDC to 720 VDC						
Applicable motor	Heavy load	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5
	Light load		0.75	1.5	2.2	3.7	5.5	7.5	11
	Heavy load	HP	0.5	1	2	3	5	7.5	10
	Light load		1	2	3	5	7.5	10	15
Output	Output voltage	V	0 to AC input voltage						
	Output frequency	Hz	0 to 600						
	Rated output current (heavy load)	A	1.8	3.4	4.8	5.5	9.5	13	17
	Rated output current (light load)	A	2.1	4.6	5.4	9	13	17	21
	Efficiency (heavy load)	-	96.2 %	97.0 %	98.0 %	98.4 %	98.6 %	98.7 %	98.7 %
	Efficiency (light load)	-	97.7 %	98.0 %	98.4 %	98.4 %	98.6 %	98.6 %	98.5 %
Heat dissipation design	Thermal power consumption (heavy load)	W	22	32	42	47	70	98	122
	Thermal power consumption (light load)	W	24	41	47	80	99	136	197
	Air exhaust volume	CFM	0	4	4	4	9.5	10	13
	Cooling mode	-	Natural ventilation	Forced air cooling					

Item	Unit	Specification						
Overvoltage category	-	OVC III						
Pollution degree	-	No conductive dust allowed Compliant with the following IEC 60721-3-3 standards: Chemical gas: class 3C3 Solid particle: class 3S2						
IP rating	-	IP40 (excluding the terminals and fans)						
Noise	dB (A)	0	33	33	33	47	51	59

Table 1-5 Electrical specifications of the drive unit (single-axis; output voltage: three-phase 200 V to 240 V)

Item		Unit	Specification					
Model: MD800-1-2T__ (S)		-	1R7	3	5	8	11	17
Power (heavy load)		kW	0.2	0.4	0.75	1.5	2.2	3.7
Power (light load)		kW	0.4	0.75	1.5	2.2	3.7	11
Structure		-	S1					
Weight (gross/net)		kg	1.1/0.9	1.1/0.9	1.1/0.9	1.1/0.9	1.1/0.9	1.1/0.9
Input	Rated input current (heavy load)	A	2.1	3.7	6.2	10	13.7	21.2
	Rated input current (light load)	A	2.4	4.4	10	12	22	26
	Input voltage	-	270 VDC to 360 VDC					
Applicable motor	Heavy load	kW	0.2	0.4	0.75	1.5	2.2	7.5
	Light load		0.4	0.75	1.5	2.2	3.7	11
	Heavy load	HP	0.3	0.5	1	2	3	10
	Light load		0.5	1	2	3	5	15
Output	Output voltage	V	0 to AC input voltage					
	Output frequency	Hz	0 to 600					
	Rated output current (heavy load)	A	1.7	3	5	8	11	17
	Rated output current (light load)	A	1.9	3.5	8	9.6	17.6	21
	Efficiency (heavy load)	-	97.1%	97.4%	97.6%	98.3%	98.2%	98.7%
	Efficiency (light load)	-	98.3%	98.3%	98.3%	98.5%	98.5%	98.5%

Item		Unit	Specification					
Heat dissipation design	Thermal power consumption (heavy load)	W	9	15	26	34	53	122
	Thermal power consumption (light load)	W	10	18	35	43	61	197
	Air exhaust volume	CFM	0	4	4	4	10	13
	Cooling mode	-	Natural ventilation	Forced air cooling				
Overvoltage category		-	OVC III					
Pollution degree		-	No conductive dust allowed Compliant with the following IEC 60721-3-3 standards: Chemical gas: class 3C3 Solid particle: class 3S2					
IP rating		-	IP40 (excluding the terminals and fans)					
Noise		dB (A)	0	33	33	33	33	59

Electrical specifications of the drive unit (dual-axis)

Table 1-6 Electrical specifications of the drive unit (dual-axis; output voltage: three-phase 380 V to 480 V)

Item		Unit	Specification				
Model: MD800-2-4T_ _ (S)		-	1R8	3R4	4R8	5R5	9R5
Power (heavy load)		kW	0.4	0.75	1.5	2.2	3.7
Power (light load)		kW	0.75	1.5	2.2	3.7	5.5
Structure		-	S1				
Weight (gross/net)		kg	1.3/1.1	1.3/1.1	1.3/1.1	1.3/1.1	1.3/1.1
Input	Rated input current (heavy load)	A	4.5	8.5	12	13.7	23.7
	Rated input current (light load)	A	5.3	11.5	13.5	22.4	29.8
	Input voltage	-	510 VDC to 720 VDC				
Applicable motor	Heavy load	kW	0.4	0.75	1.5	2.2	3.7
	Light load		0.75	1.5	2.2	3.7	5.5
	Heavy load	HP	0.5	1	2	3	5
	Light load		1	2	3	5	7.5

Item		Unit	Specification				
Output	Output voltage	V	0 to AC input voltage				
	Output frequency	Hz	0 to 600				
	Rated output current (heavy load)	A	1.8	3.4	4.8	5.5	9.5
	Rated output current (light load)	A	2.1	4.6	5.4	9	12
	Efficiency (heavy load)	-	96.1%	97.0%	97.9%	98.4%	98.6%
	Efficiency (light load)	-	97.7%	98.0%	98.4%	98.4%	98.6%
Heat dissipation design	Thermal power consumption (heavy load)	W	45	64	85	98	141
	Thermal power consumption (light load)	W	49	82	95	163	198
	Air exhaust volume	CFM	4	4	6	9.5	13
	Cooling mode	-	Forced air cooling				
Overvoltage category		-	OVC III				
Pollution degree		-	No conductive dust allowed Compliant with the following IEC 60721-3-3 standards: Chemical gas: class 3C3 Solid particle: class 3S2				
IP rating		-	IP40 (excluding the terminals and fans)				
Noise		dB (A)	33	33	44	47	59

Table 1-7 Electrical specifications of the drive unit (dual-axis; output voltage: three-phase 200 V to 240 V)

Item		Unit	Specification				
Model: MD800-2-2T_ _ (S)		-	1R7	3	5	8	11
Power (heavy load)		kW	0.2	0.4	0.75	1.5	2.2
Power (light load)		kW	0.4	0.75	1.5	2.2	3.7
Structure		-	S1				
Weight (gross/net)		kg	1.3/1.1	1.3/1.1	1.3/1.1	1.3/1.1	1.3/1.1
Input	Rated input current (heavy load)	A	4.3	7.5	12.5	20	27.5
	Rated input current (light load)	A	4.8	8.8	20	24	44
	Input voltage	-	270 VDC to 360 VDC				

Item		Unit	Specification				
Applicable motor	Heavy load	kW	0.2	0.4	0.75	1.5	2.2
	Light load		0.4	0.75	1.5	2.2	3.7
	Heavy load	HP	0.3	0.5	1	2	3
	Light load		0.5	1	2	3	5
Output	Output voltage	V	0 to AC input voltage				
	Output frequency	Hz	0 to 600				
	Rated output current (heavy load)	A	1.7	3	5	8	11
	Rated output current (light load)	A	1.9	3.5	8	9.6	17.6
	Efficiency (heavy load)	-	97.0%	97.4%	97.6%	98.3%	98.2%
	Efficiency (light load)	-	98.3%	98.3%	98.3%	98.5%	98.50%
Heat dissipation design	Thermal power consumption (heavy load)	W	18	29	51	69	109
	Thermal power consumption (light load)	W	20	35	69	87	122
	Air exhaust volume	CFM	4	4	7	7	13
	Cooling mode	-	Forced air cooling				
Overvoltage category		-	OVC III				
Pollution degree		-	No conductive dust allowed Compliant with the following IEC 60721-3-3 standards: Chemical gas: class 3C3 Solid particle: class 3S2				
IP rating		-	IP40 (excluding the terminals and fans)				
Noise		dB (A)	33	33	33	45	59

1.3.2 Technical Specifications

Table 1–8 General specifications

Item		Specification
Environment	Operating location	Indoor
	Grid overvoltage	OVC III
	Temperature	Installation/Ambient temperature: ● Applications without overload: (1) -20°C to +50°C: derating not required; (2) 50°C < temperature ≤ 60°C: derated by 2.5% for every additional 1°C; (3) > 60°C: not recommended for use ● Applications with overload: (1) -20°C to +40°C: derating not required; (2) 40°C < temperature ≤ 60°C: derated by 2.5% for every additional 1°C; (3) > 60°C: not recommended for use Storage/Transportation temperature: -40°C to +70°C (no freezing) ● To improve the reliability of the machine, use the drive in environments without dramatic temperature change. ● When installing the drive into an enclosed environment such as a control cabinet, use a cooling fan or air conditioner to keep the temperature of the inlet air below 50°C. Failure to comply will result in overheat 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	● Ambient relative humidity: 5% to 95% ● Storage relative humidity: 5% to 95% ● Transportation relative humidity: Below 95% at +40°C
	Environment	Pollution degree (PD): PD2 or below Install the drive in a location that meets the following descriptions. ● Free from direct sunlight, dust, corrosive gas, combustible or explosive gas, oil mist, water vapor, drip, or salt ● Install the drive in a place away from vibration. Keep the AC drive away from devices such as a punch press. ● Do not install any device generating electromagnetic waves or interference, such as transformers, around the drive. If such a device is required, install a shielding plate between the device and the drive. Otherwise, the drive will malfunction. ● The drive serves as a part of a final system. Install the drive as the system component in a fireproof cabinet that provides effective electrical and mechanical protection, and install it in accordance with local laws and regulations and relevant IEC standards.

Item		Specification
Environment	Maximum altitude	Power grid that adopts star connection: 4000 m (13123 ft.); power grid that adopts delta connection: 2000 m (6562 ft.) • ≤ 1000 m (3281 ft.): derating not required • > 1000 m (3281 ft.): derated by 1% for every additional 100 m (328.1 ft.)
	Vibration	• Usage scenario: Test according to IEC 60068-2-6. Amplitude at 5 Hz to 8.4 Hz: 3.5 mm; acceleration at 8.4 Hz to 200 Hz: 1 g; 10 cycles/axis • Transport scenario: Test according to IEC 60068-2-64. Power spectrum density at 5 Hz to 100 Hz: $0.01 \text{ g}^2/\text{Hz}$; power spectrum density at 200 Hz: $0.001 \text{ g}^2/\text{Hz}$; Grms: 1.14 g
	Dust	Compliant with class 3S2 in IEC 60721-3 (non-conductive dust)
	Chemically active substance	Compliant with class 3C3 in IEC 60721-3
	Shock	Usage/transportation scenario: Test according to IEC 60068-2-27. Acceleration: 15 g; pulse width; 11 ms; 18 times in directions of three axes
	IP rating	IP40 (excluding terminals and fans)

Table 1–9 Technical specifications of the power supply unit

Item		Specification
Protection function		Protection against overtemperature, power supply phase loss, and overvoltage, and shoot through detection of braking transistors
HMI	Communication/Bus	Modbus RTU: Supports the maximum baud rate of 115200 bps, the maximum number of 128 nodes, and the maximum distance of 1000 m CANopen: Supports the maximum baud rate of 1 Mbps, the maximum number of 127 nodes, and the maximum distance of 1000 m CANlink: Supports the maximum baud rate of 1 Mbps, the maximum number of 63 nodes, and the maximum distance of 1000 m PROFINET RT: Supports the maximum baud rate of 100 Mbps, the maximum number of 65535 nodes, the maximum distance of 100 m, and the full duplex mode EtherCAT: Supports the maximum baud rate of 100 Mbps, the maximum number of 65535 nodes, the maximum distance of 100 m, and the full duplex mode Ethernet/IP: Supports the maximum baud rate of 100 Mbps, the maximum number of 254 nodes, the maximum distance of 100 m, and the full duplex mode
	Analog input	AI1 to AI2: Programmable to support -10 V to +10 V or 0 mA to 20 mA; 12-bit resolution; correction accuracy of 0.3%; input impedance of 22 k Ω for voltage input and 500 Ω for current input; temperature detection supported by using PT100, PT1000, KTY-84-130, or PTC-130.
	Digital input/output	DI1 to DI4: ordinary DIs; response time: 10 ms; input frequency < 100 Hz; photocoupler isolation; compatible with bipolar input; input impedance: 3.3 k Ω ; effective level input voltage range: 15-30 V; high-speed pulse input not supported DIO1 to DIO4: normal multi-functional input or output terminals, which are determined by parameters. When they are used as DIs, their specifications are the same as those of DI1 to DI4. When they are used as DOs, they provide the common collector open-drain output function. DIO1 to DIO4 can be connected to the power supply only after a pull-up resistor is installed. The impedance of the pull-up resistor is determined by the load. The maximum output capacity is 24 VDC/50 mA.
	Relay output	TA-TB: normally closed; TA-TC: normally open; contact capacity: 30 VDC/3 A or 250 VAC/3 A ($\cos\phi=0.4$)
	Operating panel display	It supports LED display of 7 digital bits and multiple notations, and supports 9 functional keys. Two green bits indicate the axis number and five white bits indicate the content. The notations indicate units and status.
Number of axes		8 (The number of the drive units supported by one power supply unit must meet the following formula: number of single-axis drive units + 2 x number of dual-axis drive units $\leq$ 8)

Table 1–10 Technical specifications of the drive unit

Item		Specification
Basic parameters	Load type	Motor type: synchronous/asynchronous
	Output frequency resolution	Digital setting: 0.01Hz Analog setting: maximum frequency x 0.025%
	Carrier frequency	V/f control 0.8 kHz to 15 kHz Sensorless vector control (SVC): 2 kHz to 7 kHz The carrier frequency is automatically adjusted based on the heatsink temperature.
	Motor type and control mode	Three-phase asynchronous motor: V/f and SVC Permanent magnet synchronous motor: SVC and PMVVC
	Speed regulation range	1:50 (asynchronous motor in V/f control mode) 1:100 (asynchronous motor in SVC mode)
	Speed control accuracy	±1.0% (V/f) ±0.5% (SVC)
	Speed fluctuation	±0.5% (SVC)
	Torque response time	< 20 ms (SVC)
	Torque control accuracy	±5% (SVC; above 10 Hz)
	Torque control mode	SVC
	Overload capacity	1 hour at 115% of the rated current; 1 minute at 150% of the rated current; 2 seconds at 178% of the rated current
	Torque boost	Automatic torque boost; manual torque boost: 0.1 % to 30.0%
	V/f curve	Linear V/f, multi-point V/f, square V/f, complete V/f separation, and half V/f separation
Protection function		Supports protection against the following faults: short circuit to ground at power-on, inter-phase short circuit, motor overtemperature (PTC), drive overcurrent, drive overload (output power limit), motor overload, drive overvoltage, drive undervoltage, drive stall in SVC mode, drive overtemperature, output phase loss, communication fault, current detection fault, motor auto-tuning fault, EEPROM read/write operation fault, locked rotor, excessive speed deviation, and stall
Customized function	Acceleration/deceleration curve	Straight line, S-curve mode 1, S-curve mode 2
	Built-in PID	Two sets of PID parameters are provided, facilitating implementation of the closed-loop process control system.
	Command source	Three sources are available, including LED operating panel or external LCD operating panel, control terminal, and communication, which can be switched over in various ways.
	Frequency source	Eight frequency sources are available, including digital setting, voltage-type analogy setting, current-type analogy setting, communication, PID, multi-reference, and built-in simple PLC. Switchover and superposition of these sources can be implemented in multiple ways.
	Wobble	Multiple triangle wave frequency control functions are supported.

1.4 Product Components

Components of the power supply unit

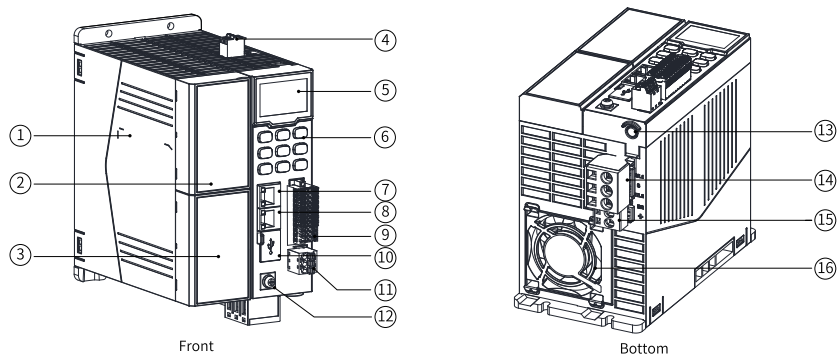


Figure 1-3 Components of the power supply unit

Table 1-11 Description of the power supply unit components

No.	Name	Description
1	Nameplate	It displays the product information.
2	Position of optional expansion card 1	It is the position where optional expansion card 1 is installed.
3	Position of optional expansion card 2	It is the position where optional expansion card 2 is installed. It is recommended that the Ethernet card be installed at this position.
4	24 V input terminal	External 24 V control power supply input With the external 24V power supply input, even after the main circuit is powered off, the control part can still work normally, without affecting the communication, parameter setting, fault information query, and other operations.
5	LED display on the operating panel	It displays the axis number, status, unit, and data.
6	Keys on the operating panel	It is used for operations through the operating panel.
7	Communication terminal (CN3)	CAN communication terminal, which can also be used to connect GP-InoLink for software upgrade and commissioning
8	Communication terminal (CN4)	CAN communication terminal, which can also be used to connect GP-InoLink or SOP-20 for software upgrade and commissioning.

No.	Name	Description
9	Control terminal (CN1)	It integrates Modbus communication, analog input, digital input, digital output, +24 V power supply output, and +10 V power supply output signals.
10	Type-C USB commissioning interface, termination resistor DIP switch (CN5)	It is used as the Type-C USB commissioning interface to connect the computer for software upgrade and commissioning. DIP switch for the Modbus communication (implemented through CN1) termination resistor; DIP switch for the CAN communication (implemented through CN3 and CN4) termination resistor
11	Relay terminal (CN2)	Relay output terminal
12	Grounding terminal	It is used for protective grounding.
13	Optional grounding screw	It is used for grounding (optional) of the control board.
14	R(L1)/S/T(L2) input terminals	The terminals are used to connect the three-phase or single-phase AC input power supply. R/ S/T are for three-phase power supply, and L1/L2 are for single-phase power supply.
15	Braking terminals BR and +	The terminals are used to connect the braking resistor. The terminals are not standard. You can identify whether the terminals are available by the product model: • With braking terminals: Power supply unit with the letter "B" at the end of the model (such as MD800-0-4T12B) • Without braking terminals: Power supply unit without the letter "B" at the end of the model (such as MD800-0-4T12)
16	Cooling fan	It is used for heat dissipation.

Components of the drive unit

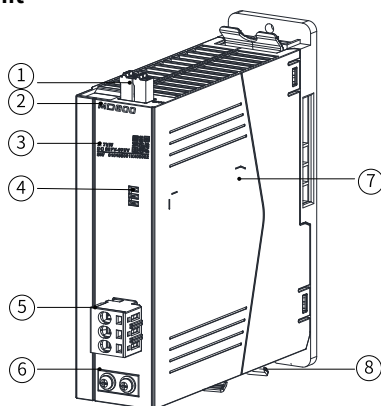


Figure 1-4 Components of the drive unit (single-axis)

Table 1-12 Description of the drive unit components (single-axis)

No.	Name	Description
1	STO terminal	The STO terminal is not standard. You can identify whether the terminal is available by the product model: - With the STO terminal: Single-axis drive unit with the letter "S" at the end of the model (such as MD800-1-4T1R8S) - Without the STO terminal: Single-axis drive unit without the letter "S" at the end of the model (such as MD800-1-4T1R8)
2	Product model	Used to display the product series.
3	Power, voltage class, QR code, serial number	Used to display the power, voltage class, QR code, and serial number of the product.
4	Indicator	Indicators of output terminals
5	U/V/W output terminals	Used to connect the three-phase motor.
6	2-M4 screw grounding terminal	Two grounding (PE) terminals used for protective grounding
7	Nameplate	It displays the product information.
8	Cooling fan	Cooling fan

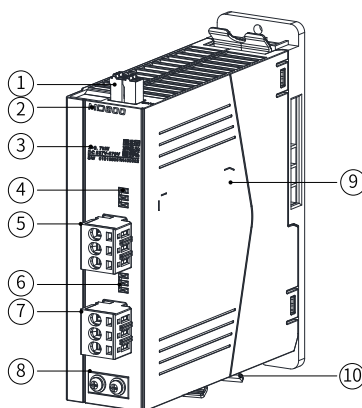


Figure 1-5 Components of the drive unit (dual-axis)

Table 1-13 Description of the drive unit components (dual-axis)

No.	Name	Description
1	STO terminal	The STO terminal is not standard. You can identify whether the terminal is available by the product model: • With the STO terminal: Dual-axis drive unit with the letter "S" at the end of the model (such as MD800-2-4T1R8S) • Without the STO terminal: Dual-axis drive unit without the letter "S" at the end of the model (such as MD800-2-4T1R8)
2	Product series	Used to display the product series.
3	Power, voltage class, QR code, serial number	Used to display the power, voltage class, QR code, and serial number of the product.
4	Indicator of output axis 1	Indicator of output terminal 1
5	U1/V1/W1, output terminals of axis 1	Used as output terminal 1 of the AC drive to connect the three-phase motor.
6	Indicator of output axis 2	Indicator of output terminal 2
7	U2/V2/W2, output terminal of axis 2	Used as output terminal 2 of the AC drive to connect the three-phase motor.
8	2-M4 screw grounding terminal	Two grounding (PE) terminals used for protective grounding
9	Nameplate	It displays the product information.
10	Cooling fan	It is used for heat dissipation.

Components of the filter unit

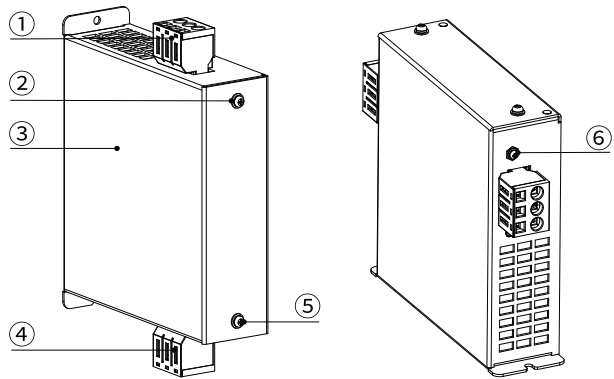


Figure 1-6 Components of the filter unit

Table 1-14 Description of the filter unit components

No.	Name	Description
1	R(L1)/S/T(L2) input terminals	Used for power supply input.
2	Input grounding screw	Used for input grounding.
3	Nameplate	Used to display the product information.
4	R'/L1', S', T'/L2' output terminals	Used to connect the input terminal of the power supply unit
5	Output M4 grounding screw	Output grounding
6	Optional EMC screw	Used for EMC grounding (optional)

1.5 System Composition

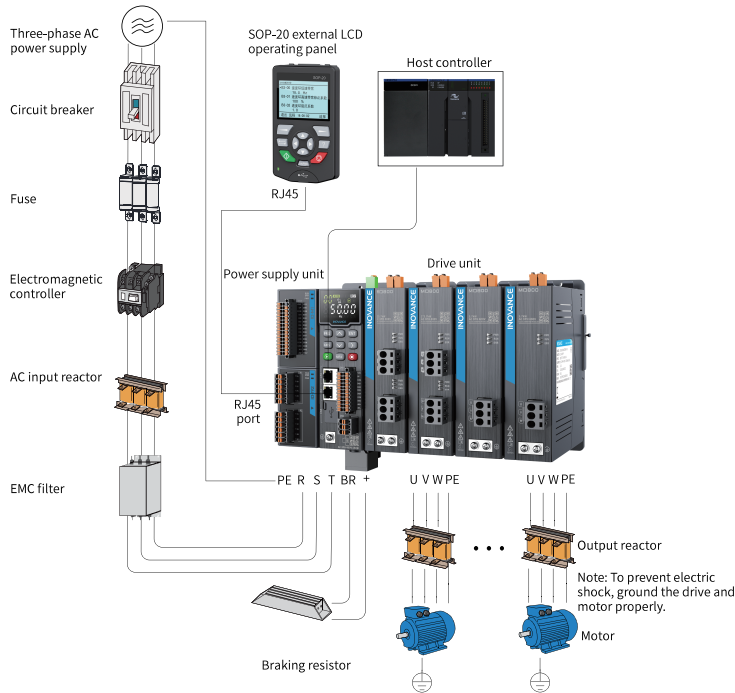


Figure 1-7 MD800 series system composition

Table 1-15 Function description of peripheral components for the MD800

Name	Installation Position	Function
Breaker	Between the power supply and the input side of the power supply unit	Circuit breaker for protection against short circuit: When overcurrent occurs on downstream devices, it cuts off the power supply to prevent incidents. Earth leakage circuit breaker (ELCB): Provides protection against potential leakage current during drive running to prevent electric shock and even a fire. Select proper ELCBs as needed.
Fuse	Between the power supply and the input side of the power supply unit	It protects semiconductor devices of the rear power supply unit in case of short circuit.
Electromag netic Contactor	Between the circuit breaker and input side of the power supply unit	It is used to power on or off the drive. Do not use the contactor to power on or off the drive frequently or use it to directly start the drive. Keep an interval of at least 1 hour between power-on and power-off.

Name	Installation Position	Function
AC input reactor	Input side of the power supply unit	It is used to effectively eliminate the high harmonics and improve the power factor of the input side.
EMC filter	Input side of the power supply unit	It reduces the conduction and radiation interference generated by the AC drive to external devices.
Braking resistor	Input side of the power supply unit	The braking resistor consumes regenerative energy generated during motor deceleration.
Output reactor	Between the output side of the drive unit and the motor, close to the drive	It is used to ensure motor insulation and prolong the service life of the motor.
Magnetic ring and ferrite clamp	Magnetic ring: At the output side inside the drive unit	It is used to reduce the interference and lower the bearing current.
	Ferrite clamp: At the signal cable side	It is used to improve the anti-interference performance of the signal.
Applicable motor	Output or input side of the drive	Use a proper motor.
SOP-20 external LCD operating panel	Connected to the CN4 interface through a network cable	It is used for commissioning and parameter settings.

1.6 List of Options

In some applications, the I/O resources may be insufficient, Ethernet buses may be required, and EMC problems related to leakage current, signal interference, and long cable applications may occur. To meet these requirements, you can select the following options.

Table 1–16 List of options

	Type	Applicable Unit Model	Option Model
Expansion card	Multi-functional card	All power supply units	IO-M1
	Single-contact relay expansion card	All power supply units	IO-R1
	Double-contact relay expansion card	All power supply units	IO-R2
	PROFINET communication expansion card	All power supply units	SI-PN
	EtherCAT communication expansion card	All power supply units	SI-ECAT
	Ethernet/IP communication expansion card	All power supply units	SI-EN
Operating panel	External LCD operating panel	All power supply units	SOP-20
	External LCD operating panel cable	All power supply units	C45590-GNCN-25003
	Mounting bracket of external LCD operating panel	All power supply units	CP600–BASE1
EMC shield bracket	EMC shield bracket for the power supply unit	All power supply units	MD800-PBJ100M-W1
	EMC shield bracket for the drive unit	All drive units	MD800-PBJ50M-W1
AC input reactor	AC input reactor	For details about the applicable power supply unit models and option models, see "4.1.2 AC Input Reactor" on page 119 .	
EMC filter	Schaffner C2 filter	For details about the applicable power supply unit models and option models, see "4.1.3.1 EMC Filter" on page 123 .	
	Inovance C2 filter	For details about the applicable power supply unit models and option models, see "4.1.3.1 EMC Filter" on page 123 .	
Output reactor	Output reactor (Schaffner)	For details about the applicable drive unit models and option models, see "4.1.5 Output Reactors" on page 131 .	
	Output reactor (Inovance)	For details about the applicable drive unit models and option models, see "4.1.5 Output Reactors" on page 131 .	
Magnetic ring	Magnetic ring	All drive units	DY644020H
		All drive units	DY805020H
		All drive units	DY1207030H
Ferrite clamp	Ferrite clamp	All weak-current signal cables	DYR-130–B

2 Mechanical Design

2.1 Mounting Dimensions

Power supply unit

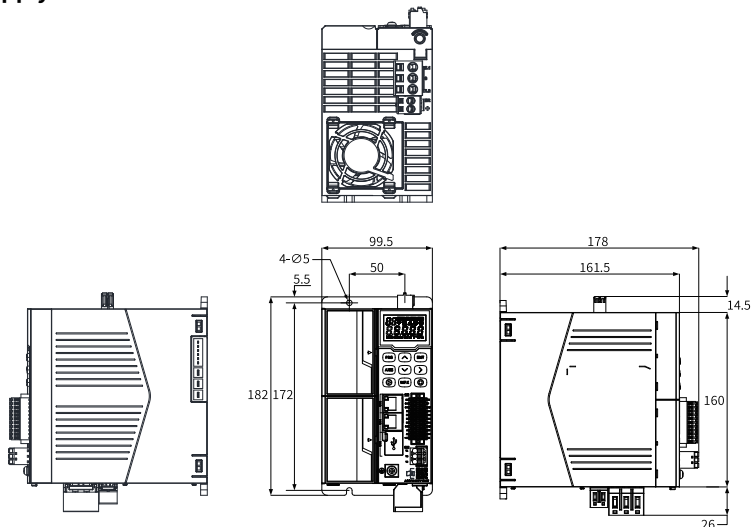


Figure 2-1 Overall and mounting dimensions of the power supply unit (unit: mm)

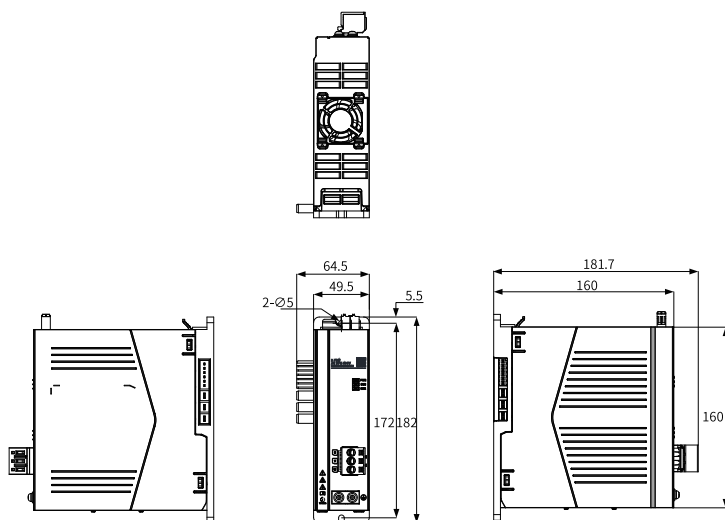
Drive unit (single-axis)

Figure 2-2 Overall and mounting dimensions of the single-axis drive unit (unit: mm)

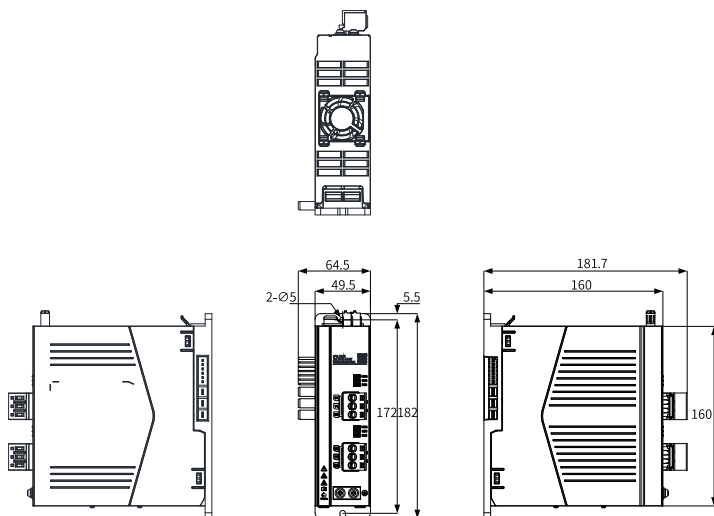
Drive unit (dual-axis)

Figure 2-3 Overall and mounting dimensions of the dual-axis drive unit (unit: mm)

Filter module

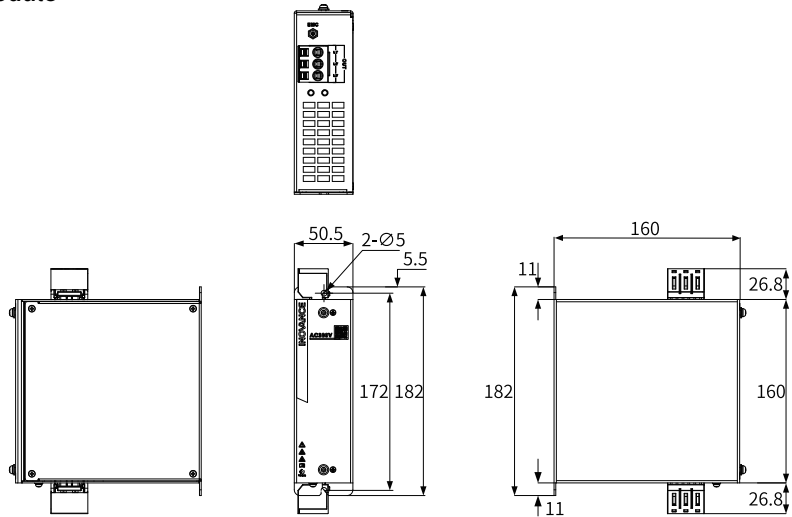


Figure 2-4 Overall and mounting dimensions of the filter unit (unit: mm)

2.2 Mounting-hole Dimensions

The units of the MD800 AC drive are with equal height and width. Therefore, to install the AC drive, drill equally-spaced mounting holes with the longitudinal spacing of 172 mm and the transverse spacing of 50 mm. To ensure excellent heat dissipation performance, leave clearance of at least 55 mm to the left and right, and of at least 200 mm to the top and bottom.

The following shows the example of mounting hole dimensions for the scenario where one power supply unit and five drive units are to be installed.

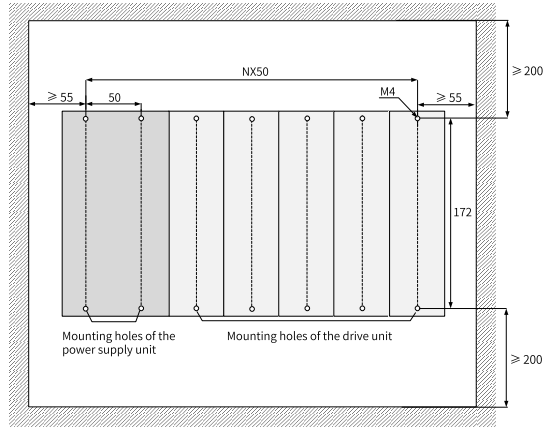


Figure 2-5 Mounting hole dimensions (unit: mm)

2.3 Clearance Requirements

The recommended installation methods of the MD800 include single-layer installation and multiple-layer installation.

- When only a single device is installed, reserve sufficient clearance around the device, as shown in the following figure.

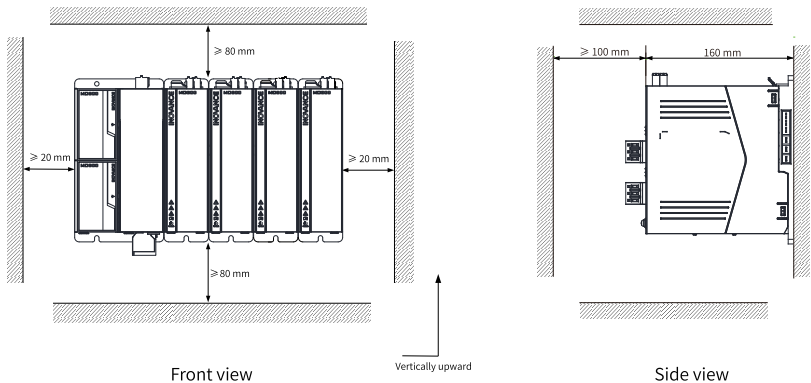


Figure 2-6 Clearance for installation of a single device

- When multiple devices are installed side by side, the minimum distance between two devices is 50 mm.

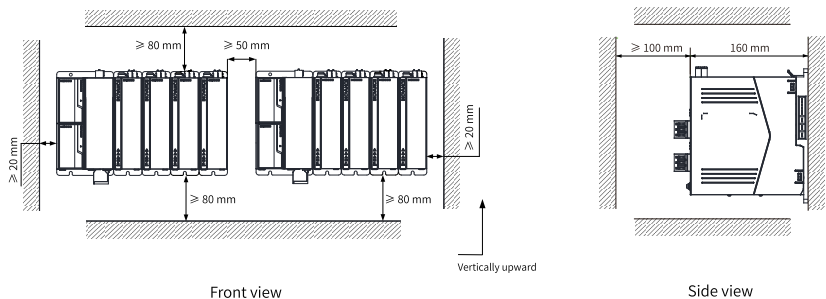


Figure 2-7 Side-by-side installation clearance

- When multiple devices are installed in various layers, the minimum distance between two layers is 200 mm.

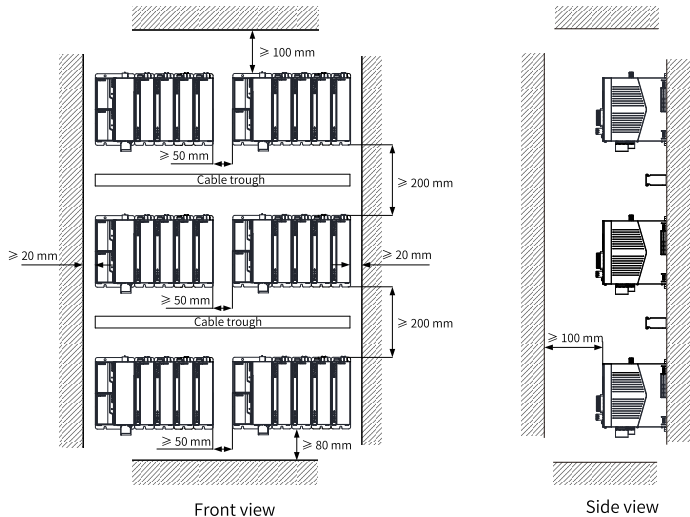


Figure 2-8 Clearance for device installation at different layers



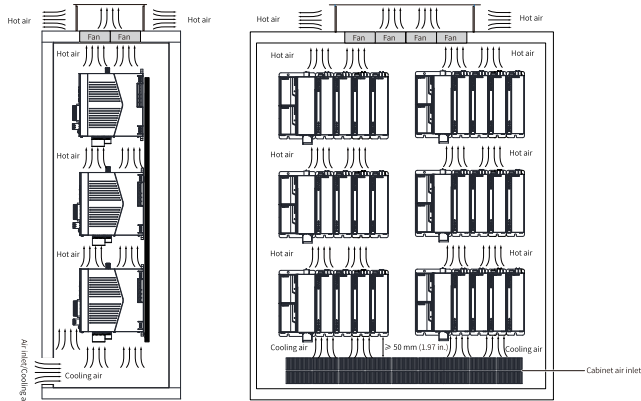
Caution

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.

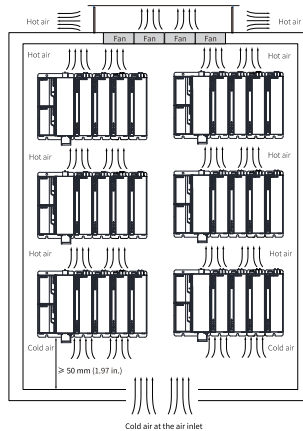
2.4 Heat Dissipation Requirements

The air flows from bottom to top after being heated. Therefore, the cabinet air inlet must be at least 50 mm lower than the air inlet of the drive unit, as shown below. Scenarios of typical cabinet air duct layout are as follows:

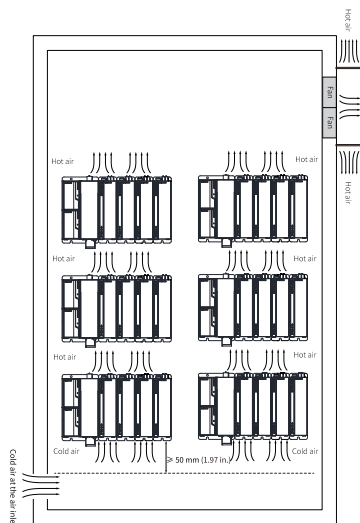
1. The air inlet is on the front door at the bottom of the cabinet and the air output is at the top of the cabinet.



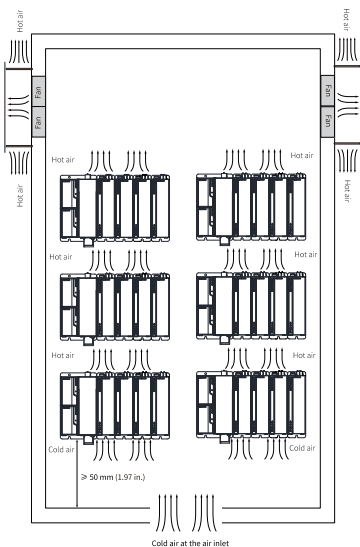
2. The air inlet is at the bottom of the cabinet and the air output is at the top of the cabinet.



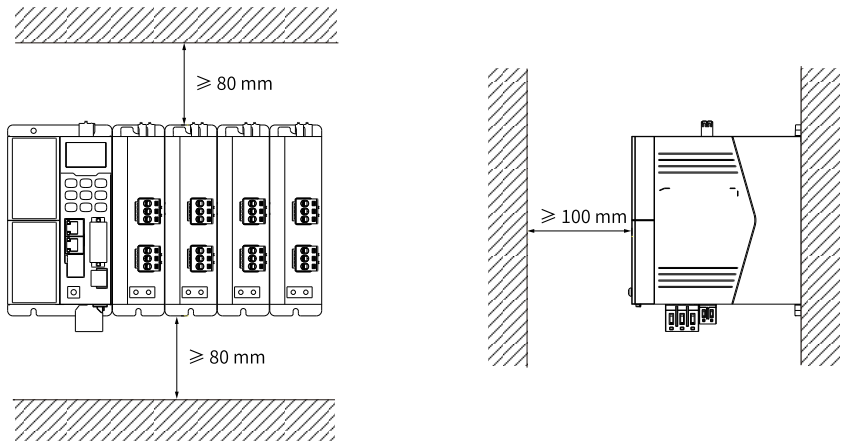
3. The air inlet is on the bottom side of the cabinet and the air outlet on the top side of the cabinet.



4. The air inlet is at the bottom of the cabinet and the air outlet is on the top side of the cabinet.



In addition, the air duct layout of the cabinet can be adjusted properly if the installation dimensions required in the following figure are met.



2.4.1 Air Inlet Design

The following table describes the minimum ventilation area of the cabinet air inlet after the power supply unit or drive unit is installed in the cabinet.

Table 2-1 Minimum ventilation area of the cabinet air inlet for the power supply unit or drive unit (three-phase 380 V to 480 V)

Module Type	Power (kW)	Quantity	Min. Ventilation Area of Air Inlet for Direct Ventilation Cabinet (cm ²) ^{Note 1}
Power supply unit	3.7	1	34.5
	7.5	1	34.5
	15	1	34.5
Drive unit (single-axis)	0.4	1	11.5
	0.75	1	11.5
	1.5	1	11.5
	2.2	1	11.5
	3.7	1	11.5
	5.5	1	11.5
	7.5	1	11.5
Drive unit (dual-axis)	0.4	1	11.5
	0.75	1	11.5
	1.5	1	11.5
	2.2	1	11.5
	3.7	1	11.5

Table 2-2 Minimum ventilation area of the cabinet air inlet for the power supply unit or drive unit (three-phase 200 V to 240 V)

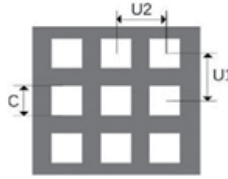
Module Type	Power (kW)	Quantity	Min. Ventilation Area of Air Inlet for Direct Ventilation Cabinet (cm ²) ^{Note 1}
Power supply unit	3.7	1	34.5
	7.5	1	34.5
Drive unit (single-axis)	0.2	1	11.5
	0.4	1	11.5
	0.75	1	11.5
	1.5	1	11.5
	2.2	1	11.5
	3.7	1	11.5
Drive unit (dual-axis)	0.2	1	11.5
	0.4	1	11.5
	0.75	1	11.5
	1.5	1	11.5
	2.2	1	11.5

Table 2-3 Minimum ventilation area of the cabinet air inlet for the power supply unit or drive unit (single-phase 200 V to 240 V)

Module Type	Power (kW)	Quantity	Min. Ventilation Area of Air Inlet for Direct Ventilation Cabinet (cm ²) ^{Note 1}
Power supply unit	2.2	1	34.5
	3.7	1	34.5
Drive unit (single-axis)	0.2	1	11.5
	0.4	1	11.5
	0.75	1	11.5
	1.5	1	11.5
	2.2	1	11.5
Drive unit (dual-axis)	0.2	1	11.5
	0.4	1	11.5
	0.75	1	11.5
	1.5	1	11.5
	2.2	1	11.5

Note 1: The ventilation area of the air inlet refers to the actual ventilation area instead of the gross opening area.

For example, on the plate shown in the following figure, the size of each hole is $C \times C$, and there are 9 holes. Therefore, the ventilation area of the air inlet is $9 \times C \times C$.



The preceding tables apply only to a single unit. For a cabinet containing multiple units, calculate the total ventilation area by adding the ventilation area of each unit according to the table.

For example, a cabinet contains the following units:

One power supply unit (15 kW), one single-axis drive unit (5.5 kW), two dual-axis drive units (1.1 kW), and one single-axis drive unit (0.4 kW)

The minimum ventilation area of the cabinet air inlet is calculated by the following: $34.5 + 11.5 + 11.5 \times 2 + 11.5 = 80.5 \text{ cm}^2$. For the air inlet installed with a filtering net, the air inlet resistance increases substantially. In this case, the minimum ventilation area of the air inlet must be increased to 1.2 to 1.5 times the value listed in the preceding table. The ventilation area in the preceding tables refers to the actual through-hole area of an opening. The ventilation area is calculated by the following: opening area $\times$ opening rate.

2.4.2 Air Outlet Design

Direct ventilation design

Table 2-4 Minimum ventilation area of the cabinet air outlet for the power supply unit or drive unit (three-phase 380 V to 480 V)

Module Type	Power (kW)	Quantity	Minimum Ventilation Area of Air Outlet (cm^2) ^{Note 1}
Power supply unit	3.7	1	55.2
	7.5	1	55.2
	15	1	55.2
Drive unit (single-axis)	0.4	1	18.4
	0.75	1	18.4
	1.5	1	18.4
	2.2	1	18.4
	3.7	1	18.4
	5.5	1	18.4
	7.5	1	18.4

Module Type	Power (kW)	Quantity	Minimum Ventilation Area of Air Outlet (cm ²) ^{Note 1}
Drive unit (dual-axis)	0.4	1	18.4
	0.75	1	18.4
	1.5	1	18.4
	2.2	1	18.4
	3.7	1	18.4

Table 2-5 Minimum ventilation area of the cabinet air outlet for the power supply unit or drive unit (three-phase 200 V to 240 V)

Module Type	Power (kW)	Quantity	Minimum Ventilation Area of Air Outlet (cm ²) ^{Note 1}
Power supply unit	3.7	1	55.2
	7.5	1	55.2
Drive unit (single-axis)	0.2	1	18.4
	0.4	1	18.4
	0.75	1	18.4
	1.5	1	18.4
	2.2	1	18.4
	3.7	1	18.4
Drive unit (dual-axis)	0.2	1	18.4
	0.4	1	18.4
	0.75	1	18.4
	1.5	1	18.4
	2.2	1	18.4

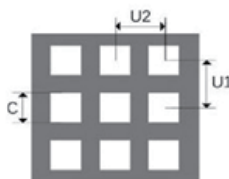
Table 2-6 Minimum ventilation area of the cabinet air outlet for the power supply unit or drive unit (single-phase 200 V to 240 V)

Module Type	Power (kW)	Quantity	Minimum Ventilation Area of Air Outlet (cm ²) ^{Note 1}
Power supply unit	2.2	1	55.2
	3.7	1	55.2
Drive unit (single-axis)	0.2	1	18.4
	0.4	1	18.4
	0.75	1	18.4
	1.5	1	18.4
	2.2	1	18.4

Module Type	Power (kW)	Quantity	Minimum Ventilation Area of Air Outlet (cm ²) ^{Note 1}
Drive unit (dual-axis)	0.2	1	18.4
	0.4	1	18.4
	0.75	1	18.4
	1.5	1	18.4
	2.2	1	18.4

Note 1: The ventilation area of the air outlet is the actual ventilation area instead of the gross opening area.

For example, on the plate shown in the following figure, the size of each hole is $C \times C$, and there are 9 holes. Therefore, the ventilation area of the air outlet is $9 \times C \times C$.



The preceding tables apply to only a single unit. When multiple units are installed in the cabinet, the total ventilation area is the sum of all the above-mentioned ventilation areas. For the air outlet installed with a filtering net, the air outlet resistance increases substantially. In this case, the minimum ventilation area of the air outlet must be increased to 1.2 to 1.5 times the value listed in the preceding table. The ventilation area in the preceding tables refers to the actual through-hole area of the opening. The ventilation area is calculated by the following: opening area $\times$ opening rate.

For example, a cabinet contains the following units:

One power supply unit (15 kW), one single-axis drive unit (5.5 kW), two dual-axis drive units (1.1 kW), and one single-axis drive unit (0.4 kW)

The minimum ventilation area of the cabinet air outlet is calculated by the following: $55.2 + 18.4 + 18.4 \times 2 + 18.4 = 128.8 \text{ cm}^2$.

Active air ventilation

To ensure sufficient heat dissipation of the drive unit, hot air in the cabinet must be exhausted to the outside. Use the active ventilation design for the cabinet. In the active air exhaust mode, a fan is installed on the top of the cabinet to draw hot air out of the cabinet. This is a commonly used ventilation mode. To ensure that the hot air can be exhausted to the outside, the total air volume of the fan cannot be smaller than that of all drives in the cabinet.

The cooling air volume required by the MD800 is listed in the following tables.

Table 2-7 Cooling air volume for the power supply unit and drive unit (three-phase 380 V to 480 V)

Module Type	Power (kW)	Quantity	Max. Air Volume Qmax (CFM) of the Fan at the Top of the Cabinet ^{Note 1}
Power supply unit	3.7	1	32
	7.5	1	60
	15	1	60
Drive unit (single-axis)	0.4	1	0
	0.75	1	8
	1.5	1	8
	2.2	1	8
	3.7	1	18
	5.5	1	19.1
	7.5	1	26
Drive unit (dual-axis)	0.4	1	8
	0.75	1	8
	1.5	1	12
	2.2	1	18
	3.7	1	26

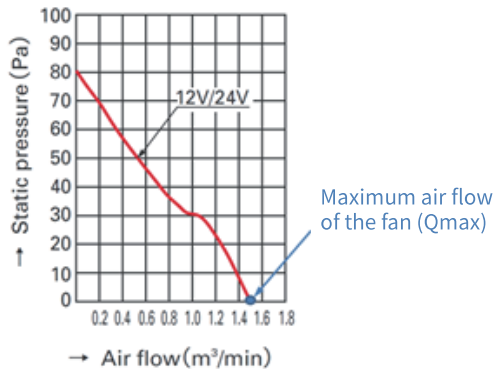
Table 2-8 Cooling air volume for the power supply unit and drive unit (three-phase 200 V to 240 V)

Module Type	Power (kW)	Quantity	Max. Air Volume Qmax (CFM) of the Fan at the Top of the Cabinet ^{Note 1}
Power supply unit	3.7	1	60
	7.5	1	60
Drive unit (single-axis)	0.2	1	0.0
	0.4	1	8.0
	0.75	1	8.0
	1.5	1	8.0
	2.2	1	20.0
	3.7	1	26
Drive unit (dual-axis)	0.2	1	8.0
	0.4	1	8.0
	0.75	1	14
	1.5	1	14
	2.2	1	26

Table 2-9 Cooling air volume for the power supply unit and drive unit (single-phase 200 V to 240 V)

Module Type	Power (kW)	Quantity	Max. Air Volume Q _{max} (CFM) of the Fan at the Top of the Cabinet ^{Note 1}
Power supply unit	2.2	1	50
	3.7	1	60
Drive unit (single-axis)	0.2	1	0.0
	0.4	1	8.0
	0.75	1	8.0
	1.5	1	8.0
	2.2	1	20.0
Drive unit (dual-axis)	0.2	1	8.0
	0.4	1	8.0
	0.75	1	14
	1.5	1	14
	2.2	1	26

Note 1: The maximum air volume Q_{max} is the maximum value of the point where the fan P-Q curve meets the abscissa, as shown in the following figure.



The preceding tables apply to only a single unit. When multiple units are installed in the cabinet, the total air volume of the cabinet is the sum of all the above-mentioned air volume.

For example, a cabinet contains the following units:

One power supply unit (15 kW), one single-axis drive unit (7.5 kW), one dual-axis drive unit (2.2 kW), and one dual-axis drive unit (0.75 kW).

The minimum ventilation air flow required by the cabinet is calculated by the following: $60 + 26 + 18 + 8 = 112$ (CFM).

Design of the cabinet fan

To select the fan for the cabinet, do as follows:

1. Calculate the sum of cooling air flow required by all the units based on *"Table 2-7 " on page 52* and *"Table 2-9 " on page 53*.
2. Determine the maximum air flow value (Q_{max}) of the cabinet fan.
3. Determine the specification and quantity of the fan based on the maximum air volume (Q_{max}).

Where:

The maximum air volume of the cabinet is 1.3 to 1.5 times the sum of the cooling air volume.

The maximum air volume of the cabinet is 1.6 to 2.2 times the sum of the cooling air volume if mesh filters, shutters, or other components are installed at the cabinet air outlet.

Note

- The air volume of the selected fan cannot be smaller than the maximum air volume Q_{max} . If a single fan cannot meet this requirement, multiple fans can be used.
 - 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.
-

3 Electrical Design

3.1 Main Circuit Wiring

3.1.1 Descriptions of Main Circuit Terminals

Terminal layout of the power supply unit

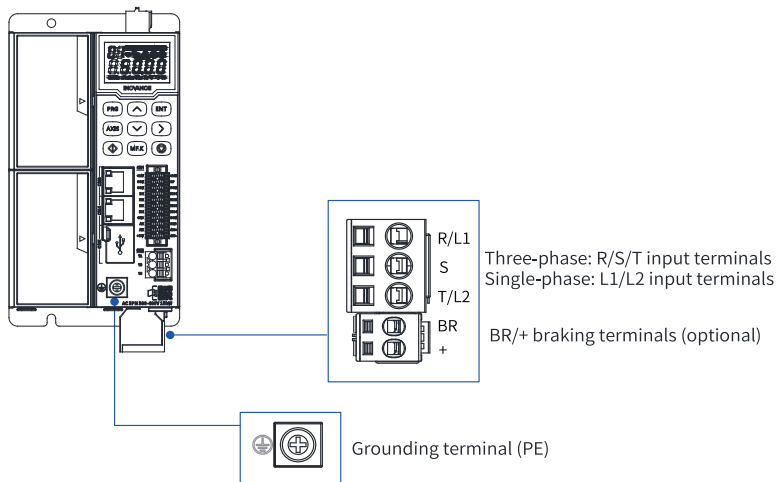


Table 3-1 Main circuit terminal description of the power supply unit

Terminal Mark	Terminal Name	Function Description
R, S, T	Input terminals of three-phase power supply	Used to connect the three-phase AC power supply.
L1, L2	Input terminals of single-phase power supply	Used to connect the single-phase AC input power supply.
BR, +	Braking resistor connection terminals	Used to connect the braking resistor.
	Grounding terminal (PE)	Used for protective grounding.

Terminal layout of the drive unit (single-axis)

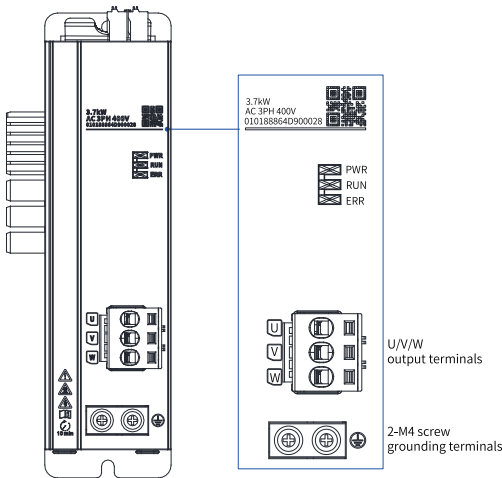


Table 3-2 Main circuit terminal description of the drive unit (single-axis)

Terminal Mark	Terminal Name	Function Description
U, V, W (single-axis drive unit)	Output terminals	Used to connect the three-phase motor.
	Grounding terminal (PE)	Used for protective grounding.

Table 3-3 Indicators of the drive unit (single-axis)

Indicator Mark	Indicator Name	Description
PWR (yellow)	Power supply indicator	Steady ON: powered on OFF: powered off
RUN (green)	Running indicator	Steady ON: running OFF: stopped Blinking: operated by the operating panel of the power supply unit
ERR (red)	Alarm indicator	Steady ON: fault OFF: normal Blinking: alarm

Terminal layout of the drive unit (dual-axis)

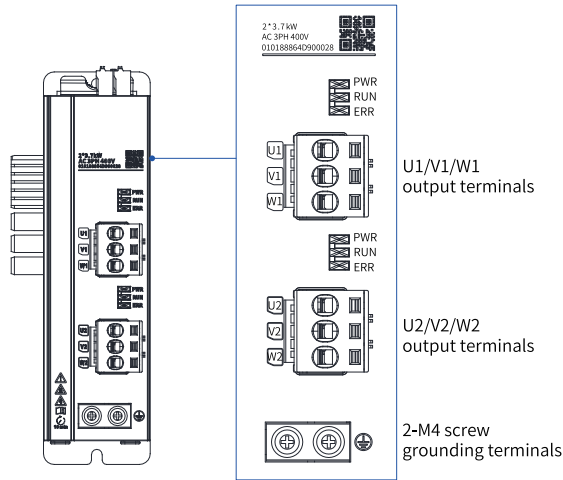


Table 3-4 Main circuit terminal description of the drive unit (dual-axis)

Terminal Mark	Terminal Name	Function Description
U1, V1, W1; U2, V2, W2	Output terminals	Used to connect the three-phase motor.
	Grounding terminal (PE)	Used for protective grounding.

Table 3-5 Indicators of the drive unit (dual-axis)

Indicator Mark	Indicator Name	Description
PWR (yellow)	Power supply indicator	Steady ON: powered on OFF: powered off
RUN (green)	Running indicator	Steady ON: running OFF: stopped Blinking: operated by the operating panel of the power supply unit
ERR (red)	Alarm indicator	Steady ON: fault OFF: normal Blinking: alarm

Terminal layout of the filter unit

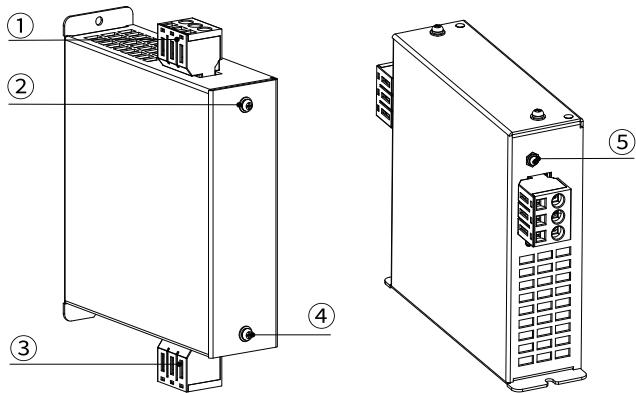


Table 3-6 Terminal description of the filter unit

No.	Terminal Name	Function Description
1	R(L1)/S/T(L2) input terminals	Used for power supply input.
2	Input M4 grounding screw	Used for input grounding.
3	R'/L1', S', T'/L2' output terminals	Used to connect the input terminal of the power supply unit.
4	Output M4 grounding screw	Used for output grounding.
5	Optional EMC screw	Used for EMC grounding (optional).

3.1.2 Main Circuit Wiring Requirements

Main circuit wiring requirements

- Terminals BR and (+) are used to connect options. Do not connect these terminals to an AC power supply.
- The cable for the braking unit cannot exceed 10 m. Use twisted pair cables or closely-paired cables for parallel connection.
- Do not connect a braking resistor directly to the DC bus. Failure to comply may result in damage to the AC drive or even fire.
- The specification and installation method of external main circuit cables must comply with local regulations and related IEC standards. Use proper copper drain wires for main circuit cables according to the recommended values.
- To protect the main circuit, separate it from all surfaces that may come into contact with it and provide covers as required.

- Do not connect any capacitor or surge protection device at the output side. Failure to comply will result in frequent triggering of the protection mechanism or even damage to the AC drive.
- An excessively long motor cable may result in electrical resonance due to the distributed capacitance. The generated electrical resonance may cause damage to motor insulation or high leakage current, triggering the overcurrent protection mechanism of the AC drive. When using a motor cable longer than 150 m, install an AC output reactor close to the AC drive.
- The control circuit is the internal safety extra-low voltage (SELV) circuit, which must be insulated and isolated from other circuits. Make sure that the control circuit is connected to an external SELV circuit.
- Prevent foreign matters from entering the wiring part of the terminal block.
- Do not solder the twisted conductors.
- The tightening torque may vary with terminals. Tighten terminal screws with the specified tightening torque. You can use the torque screwdriver, ratchet, or wrench. When using an electric screwdriver to tighten terminal screws, set a low speed to prevent damage to the terminal screws. Tighten the terminal screws at an angle within 5 degrees. Failure to comply may result in screw damage.

Requirements on main circuit routing

The power supply input cable of the AC drive and motor cable can generate strong electromagnetic interference. To avoid electromagnetic interference caused by long-distance parallel coupling between the strong disturbing cable and control circuit cable, ensure a distance longer than 30 cm between main circuit cables and signal cables when cabling. 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 and communication cable.

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

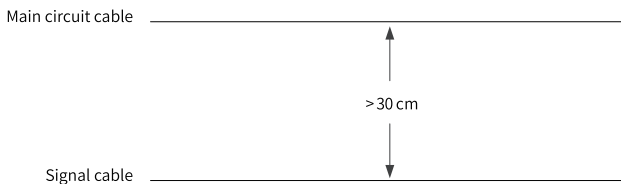


Figure 3-1 Cable layout

Length of motor cables

During operation of the AC drive, the quick on-off of the power switching transistor can lead to excessively large dU/dt on the output side. A long motor cable may result in excessive voltage stress on the motor winding, causing insulation breakdown. Use motors that comply with technical specifications in IEC60034-25 IVIC B or motors with high voltage resistance. In addition, when the cable length increases, the distributed capacitance of the cable increases linearly, resulting in high harmonic current.

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

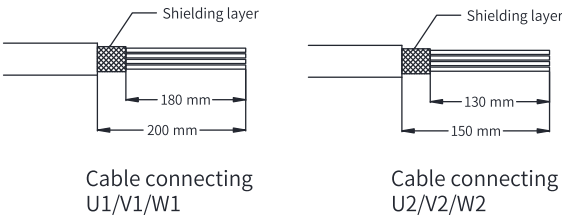
Table 3-7 Output reactor cable length and motor type

AC Drive Rated Power (kW)	Maximum Cable Length of Common Asynchronous Motor (m)	IEC60034-25 IVIC B Compliance	Common Asynchronous Induction Motor
0.4 to 3.7	150 m	Not required	Required
5.5	150 m	Not required	Required
7.5	150 m	Not required	Required

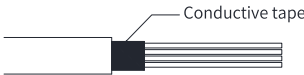
Motor output cable preparation requirements

Perform the following operations to prepare the motor output cable. The following section takes the MD800 dual-axis drive unit as an example.

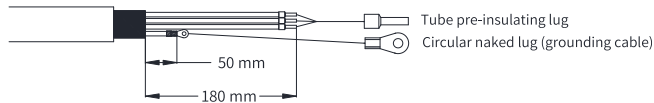
1. Strip the cable rubber jacket and shielding layer according to the following length requirements.



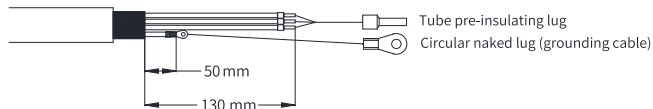
2. Turn the shielding layer outward or wrap the cable with the conductive tape for three turns.



3. Make lugs for U/V/W cable and grounding cable according to the following length requirements.



Cable connecting U1/V1/W1



Cable connecting U2/V2/W

3.1.3 Cable Lug Selection

It is recommended to use the lugs produced by Zhejiang KISE Terminal Co., Ltd., including tube pre-insulated lugs (TG-JT type) and circular naked lugs (TO type).

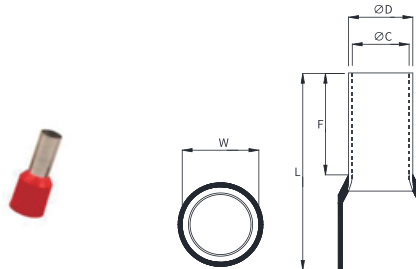


Figure 3-2 Appearance and dimensions of the tube pre-insulated lug (TG-JT type)

Table 3-8 Specifications and dimensions of the tube pre-insulated lugs (TG-JT type)

Cross Sectional Area	Model	Dimension (mm)					Insulation Sheath Color (1) For Germany (2) For France	Crimping Tool
		F	L	W	Dφ	Cφ		
22AWG 0.5 mm ²	E0512	12	18	2.7	1.3	1	(1) Orange (2) White	OPT AN-04WF
20AWG 0.75 mm ²	E7512	12	18	2.8	1.5	1.2	(1) White (2) Blue	OPT AN-04WF
18AWG 1.0 mm ²	E1012	12	18.5	2.9	1.7	1.4	(1) Yellow (2) Red	OPT AN-04WF

Cross Sectional Area	Model	Dimension (mm)					Insulation Sheath Color (1) For Germany (2) For France	Crimping Tool
		F	L	W	Dφ	Cφ		
16AWG 1.5 mm ²	E1512	12	18.5	3.5	2	1.7	(1) Red (2) Black	OPT AN-04WF
14AWG 2.5 mm ²	E2512	12	19.5	4.1	2.6	2.3	(1) Blue (2) Gray	OPT AN-04WF
12AWG 4.0 mm ²	E4012	12	19.5	4.5	3.15	2.8	(1) Gray (2) Orange	OPT AN-10WF
10AWG 6.0 mm ²	E6012	12	20	6.4	3.85	3.5	(1) Black (2) Green	OPT AN-10WF
8AWG 10 mm ²	E10-12	12	22.5	7.7	5.05	4.7	(1) Milk white (2) Brown	OPT AN-16WF

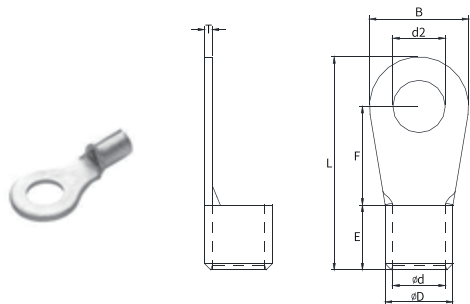


Figure 3-3 Appearance and dimensions of the circular naked lugs (TO type)

Table 3-9 Specifications and dimensions of the circular naked lugs (TO type)

Cross Sectional Area	Model	Dimension (mm)								Crimping Tool
		d2	B	F	L	E	D	d	T	
22AWG to 16AWG 0.5-1.5 mm ²	RNBS 1.25-4	4.3	6.5	6	14.5	5	3.5	2	0.75	IZUMI 5N18
16AWG to 14AWG 1.5-2.5 mm ²	RNBS 2-4	4.3	6.5	6	14.5	5	4	2.5	0.8	IZUMI 5N18
14AWG to 12AWG 2.5-4 mm ²	RNB 3.5-4	4.3	8	8	18	6	5	3	1	IZUMI 5N18
12AWG to 10AWG 4-6 mm ²	RNBS 5.5-4	4.3	7	6	16.5	7	5.5	3.5	1	IZUMI 5N18
8AWG 8 mm ²	RNB 8-4	4.3	8.8	10.5	23.5	8.5	7	5	1.2	IZUMI 5N18
6AWG 14 mm ²	RNB 14-4	4.3	12	13.5	29.5	10.5	9	6	1.4	OPT TP-150D

3.1.4 Main Circuit Cable Selection

Power cable selection requirements

For the selection of power cables, follow national or regional regulations. Requirements on IEC cable selection:

- Compliant with IEC 60204-1 and IEC 60364-5-52 standards. To meet UL requirements, use the 75°C copper cable that meets UL cable requirements.
- PVC insulated cables with copper conductors
- Ambient temperature of 40°C and cable surface temperature of 70°C (Remark: When the ambient temperature exceeds 40°C, contact Inovance.)

Note

If recommended cables for peripherals are outside the designed range of the product, contact Inovance.

To meet the EMC requirements, use the cable with the shield. 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. The shield of the shielded cable is comprised of coaxial cooper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

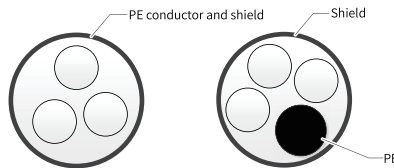


Figure 3-4 Recommended power cable

Recommended IEC cable specifications for the main circuit

Table 3–10 Recommended IEC cable specifications for the main circuit (three-phase 380 V to 480 V)

Type	Power (kW)	Input/Output Terminal (R/S/T, U/V/W)		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recom mended Cable Specifica tion (mm ²)	Recom mended Lug Specifica tion	Recom mended Cable Specifica tion (mm ²)	Recom mended Lug Specifica tion	Recom mended Cable Specifica tion (mm ²)	Recom mended Lug Specifica tion	Recommend ed Cable Specification (mm ²)	Recommend ed Lug Specification
Power supply unit	3.7	2.5	E2512	2.5	E2512	N/A	N/A	2.5	RNBS2-4
	7.5	6	E6012	4	E4012	N/A	N/A	6	RNBS5.5-4
	15	10	E10-12	6	E6012	N/A	N/A	10	RNB14-4

Type	Power (kW)	Input/Output Terminal (R/S/T, U/V/W)		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification
Drive unit	0.4	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.75	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	1.5	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	2.2	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Type	Power (kW)	Input/Output Terminal (R/S/T, U/V/W)		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification
Drive unit	3.7	1.5	E1512	-	-	1.5	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	5.5	2.5	E2512	-	-	2.5	RNBS2-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	7.5	4	E4012	-	-	4	RNB3.5-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Table 3–11 Recommended IEC cable specifications for the main circuit (three-phase 220 V to 240 V)

Type	Power (kW)	Input/Output Terminal (R/S/T, U/V/W)		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification
Power supply unit	3.7	6	E6012	4	E4012	N/A	N/A	6	RNBS5.5 - 4
	7.5	10	E10-12	6	E6012	N/A	N/A	10	RNB14-4
Drive unit	0.2	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.4	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.75	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Type	Power (kW)	Input/Output Terminal (R/S/T, U/V/W)		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification
Drive unit	1.5	1	E1012	-	-	1	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	2.2	1.5	E1512	-	-	1.5	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	3.7	4	E4012	-	-	4	RNB3.5-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Table 3-12 Recommended IEC cable specifications for the main circuit (single-phase 220 V to 240 V)

Type	Power (kW)	Input/Output Terminal (R/S/T, U/V/W)		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification
Power supply unit	2.2	6	E6012	2.5	E2512	N/A	N/A	6	RNB5.5-4
	3.7	10	E10-12	4	E4012	N/A	N/A	10	RNB14-4
Drive unit	0.2	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.4	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.75	0.75	E7512	-	-	0.75	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Type	Power (kW)	Input/Output Terminal (R/S/T, U/V/W)		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification
Drive unit	1.5	1	E1012	-	-	1	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	2.2	1.5	E1512	-	-	1.5	RNB S1.25-4	Same as the protective grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Note

6AWG cables can be connected to terminals directly without crimping lugs.

Recommended NEC cable specifications for the main circuit

Table 3–13 Recommended NEC cable specifications for the main circuit (three-phase 380 V to 480 V)

Type	Power (kW)	Input/Output Terminal		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification
Power supply unit	3.7	12	E4012	14	E2512	N/A	N/A	12	RNB3.5-4
	7.5	8	E10-12	10	E6012	N/A	N/A	8	RNB8-4
	15	6	-	10	E6012	N/A	N/A	6	RNB14-4
Drive unit	0.4	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.75	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	1.5	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	2.2	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Type	Power (kW)	Input/Output Terminal		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification
Drive unit	3.7	12	E4012	-	-	12	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	5.5	10	E6012	-	-	10	RNB S5.5-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	7.5	10	E6012	-	-	10	RNB S5.5-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Table 3-14 Recommended NEC cable specifications for the main circuit (three-phase 220 V to 240 V)

Type	Power (kW)	Input/Output Terminal		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification
Power supply unit	3.7	8	E10-12	10	E6012	N/A	N/A	8	RNB8-4
	7.5	6	-	10	E6012	N/A	N/A	6	RNB14-4
Drive unit	0.2	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.4	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.75	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Type	Power (kW)	Input/Output Terminal		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification
Drive unit	1.5	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	2.2	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	3.7	10	E6012	-	-	10	RNB S5.5-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Table 3–15 Recommended NEC cable specifications for the main circuit (single-phase 220 V to 240 V)

Type	Power (kW)	Input/Output Terminal		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification
Power supply unit	2.2	8	E10-12	14	E2512	N/A	N/A	8	RNB8-4
	3.7	6	-	12	E4012	N/A	N/A	6	RNB14-4

Type	Power (kW)	Input/Output Terminal		Braking Terminals BR and + (Optional)		Motor Grounding		Protective Grounding	
		Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specification (mm ²)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification	Recommended Cable Specifications (AWG)	Recommended Lug Specification
Drive unit	0.2	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.4	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	0.75	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	1.5	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications
	2.2	14	E2512	-	-	14	RNBS2-4	Same as the grounding cable specifications of the power supply unit in actual applications	Same as the protective grounding lug specifications of the power supply unit in actual applications

Note

The 6AWG cables can be directly connected to terminals without crimping lugs.

3.2 Control Circuit Wiring

3.2.1 Descriptions of Control Circuit Terminals

Control circuit terminals of the power supply unit

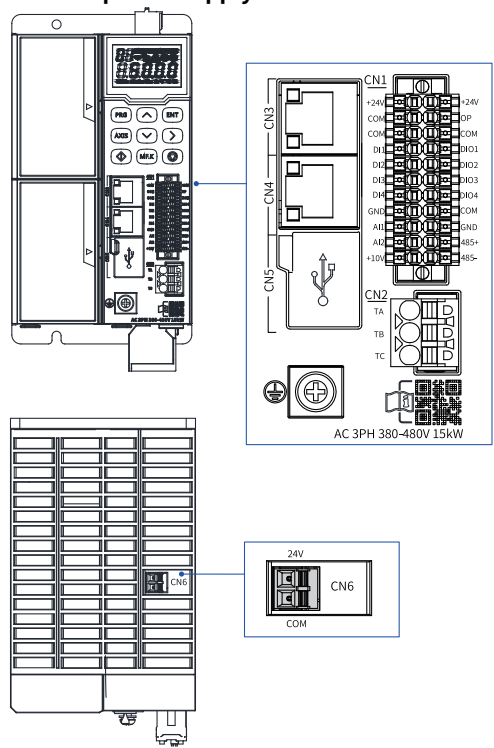
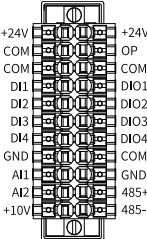


Figure 3-5 Control circuit terminal layout of the power supply unit

Table 3-16 Signal definitions of control terminals (CN1)

Appearance	Terminal type	Terminal Mark	Function Definition	Specification
	+24 V power supply output	+24V	+24 V power supply output	Maximum output current: 100 mA
	Digital common terminal	COM	+24 V output voltage reference terminal and digital common terminal	-
	Multi-functional input common terminal	OP	Multi-functional input common terminal	Internally isolated from COM and 24V
	+10V power supply output	+10V	+10 V voltage used by analog	Maximum output current: 10 mA
	Analog common terminal	GND	Analog common terminal	-
	Analog input	AI1	Analog input	AI1 and AI2 support voltage input, current input, or temperature input, which is set through parameters. When used as voltage/current input, AI1 and AI2 support -10 V to +10 V/0 mA to 20 mA. The resolution is 12-bit, correction accuracy is 0.3%, and input impedance is 22 k Ω for voltage input and 500 Ω for current input. Temperature detection is supported by using PT100, PT1000, KTY-84-130, or PTC-130.
		AI2	Analog input	
	Digital input	DI1	Digital input terminal 1	Ordinary DIs; input frequency < 100 Hz; photocoupler isolation; compatible with bipolar input; input impedance: 3.3 k Ω ; effective level input voltage range: 15-30 V; high-speed pulse input not supported
		DI2	Digital input terminal 2	
		DI3	Digital input terminal 3	
		DI4	Digital input terminal 4	

Appearance	Terminal type	Terminal Mark	Function Definition	Specification
Continued	Digital input and output	DIO1	DI/DO terminal 1	DIO1 to DIO4 are general multifunction input/output terminals, which can be set by parameters. When they are used as DIs, their specifications are the same as those of DI1 to DI4. When they are used as DOs, they provide the common collector open-drain output function and cannot be directly connected to the power supply. A pull-up resistor is required for connecting them to the power supply and the impedance is determined by the load requirements. The maximum output capacity is 24 VDC/50 mA.
		DIO2	DI/DO terminal 2	
		DIO3	DI/DO terminal 3	
		DIO4	DI/DO terminal 4	
	RS485 communication terminal	485+	Positive RS485 communication signal	Maximum baud rate: 115200 bps; maximum number of nodes: 128; supports Modbus; wired in the daisy chain mode
		485-	Negative RS485 communication signal	
		GND	Communication signal ground	

Table 3-17 Signal definitions of relay terminals (CN2)

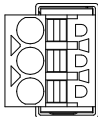
Appearance	Terminal Type	Terminal Mark	Function Definition	Specification
	Relay output	TA	Common terminal	TA-TB: normally closed TA-TC: normally open Contact capacity: 30 VDC/3 A 250 VAC/3 A (Cosφ = 0.4)
		TB	NC terminal	
		TC	NO terminal	

Table 3–18 Signal definitions of communication terminals and commissioning terminals (CN3, CN4, and CN5)

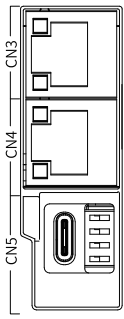
Appearance	Terminal Type	Terminal Mark	Function Definition	Specification
	RJ45 network port	CN3	1. CAN communication terminal 2. Used to connect GP-InoLink for software upgrade and commissioning	Supports CANopen/CANlink communication protocol; maximum baud rate: 1 Mbps; maximum number of nodes: 64; maximum distance: 1000 m; wired in the daisy chain mode
	RJ45 network port	CN4	1. CAN communication terminal 2. Used to connect GP-InoLink for software upgrade and commissioning 3. Used to connect the SOP-20 operating panel for commissioning	
	USB type C	CN5	Used to connect a computer for software upgrade and commissioning	USB 2.0

Table 3–19 Signal definitions of external 24 V input terminals (CN6)

Appearance	Terminal Type	Terminal Mark	Function Definition	Specification
	+24V power supply input (+)	24V	External 24 V power supply input	Maximum input current required: 1 A
	+24V power input (-)	COM		

Table 3–20 Signal definitions of the DIP switch

Appearance	Name	Function Description	Position
CN5  ON-OFF	DIP switch for connecting the RS485 termination resistor	Toggle positions 1 and 2 to ON: Termination resistor connected	
		Toggle positions 1 and 2 to OFF: Termination resistor not connected	
	DIP switch for connecting the CAN termination resistor	Toggle positions 3 and 4 to ON: Termination resistor connected	
		Toggle positions 3 and 4 to OFF: Termination resistor not connected	

Table 3–21 CN3 terminal pins

Pin No.	Pin Assignment	Pin Name	Pin Layout
1	CANH	CAN_H signal of CAN communication	 1 2 3 4 5 6 7 8
2	CANL	CAN_L signal of CAN communication	
3	CGND	CAN communication signal ground	
4	Reserved	Reserved	
5	Reserved	Reserved	
6	Reserved	Reserved	
7	Reserved	Reserved	
8	Reserved	Reserved	

Table 3-22 CN4 terminal pins

Pin No.	Pin Assignment	Pin Name	Pin Layout
1	CANH	CAN_H signal of CAN communication	 1 2 3 4 5 6 7 8
2	CANL	CAN_L signal of CAN communication	
3	CGND	CAN communication signal ground	
4	Reserved	Reserved	
5	Reserved	Reserved	
6	Reserved	Reserved	
7	Reserved	Reserved	
8	Reserved	Reserved	

Control circuit terminals of the drive unit (single-axis)

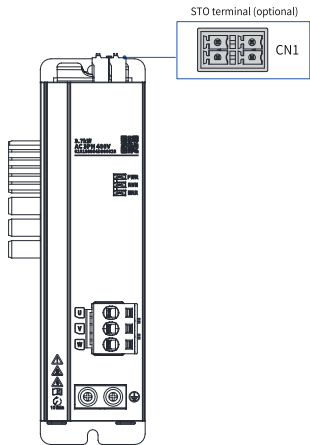
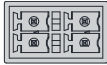


Figure 3-6 STO terminal layout of the drive unit (single-axis)

Table 3-23 STO terminal (optional) description of the drive unit (single-axis)

Appearance	Terminal Mark	Terminal Name	Specification
 ST02 2GND ST01 1GND	ST01	Power supply+ of STO channel 1	24 V input power supply
	1GND	Power supply- of STO channel 1	
	ST02	Power supply+ of STO channel 2	
	2GND	Power supply- of STO channel 2	

Control circuit terminals of the drive unit (dual-axis)

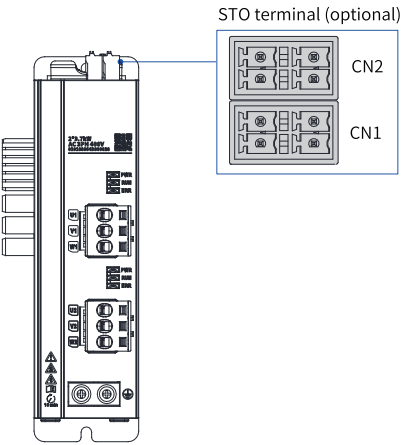
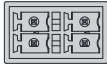


Figure 3-7 STO terminal layout of the drive unit (dual-axis)

Table 3-24 STO terminal (optional) description of the drive unit (dual-axis)

Appearance	Terminal Mark	Terminal Name	Specification
 ST02 2GND	ST01	Power supply+ of STO channel 1	24 V ($\pm 10\%$) voltage input
	1GND	Power supply- of STO channel 1	
	ST02	Power supply+ of STO channel 2	
	2GND	Power supply- of STO channel 2	

3.2.2 Expansion Card Functions

This section describes the terminal layout and definition of the expansion card. For details about the terminal wiring, see ["3.2.3 Wiring Descriptions of Control Circuit Terminals" on page 97](#).

3.2.2.1 Function Description of the Single-Contact Relay Output Card (IO-R1)

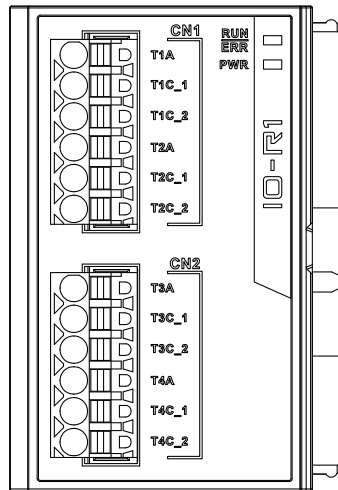


Figure 3-8 Terminal layout of the single-contact relay output card (IO-R1)

Table 3-25 Terminal functions of the single-contact relay output card (IO-R1)

Terminal Type	Terminal Mark	Function Definition	Specification
CN1	T1A	Common terminal 1	TA-TC: normally open Contact capacity: 30 VDC/3 A 250 VAC/3 A (Cosφ = 0.4)
	T1C_1	NO terminal 1_1	
	T1C_2	NO terminal 1_2	
	T2A	Common terminal 2	
	T2C_1	NO terminal 2_1	
	T2C_2	NO terminal 2_2	
CN2	T3A	Common terminal 3	
	T3C_1	NO terminal 3_1	
	T3C_2	NO terminal 3_2	
	T4A	Common terminal 4	
	T4C_1	NO terminal 4_1	
	T4C_2	NO terminal 4_2	

Table 3-26 Indicators of the single-contact relay output card (IO-R1)

	Indicator	Description	Solution
RUN/ERR	Steady green	The device is running properly.	/
	Flashing green	The expansion card is in the initialization state.	/
	Green indicator OFF	Waiting for initialization of the power supply unit	/
	Steady red	Hardware fault	Replace the expansion card.
	Flashing red	Data frame loss or communication disconnection with the power supply unit or drive unit	1. Check the hardware connection. 2. Check whether the power supply unit or drive unit is normal. 3. If the hardware connection, power supply unit, and drive unit are normal, replace the expansion card.
	Flashing red and green alternatively	Internal communication bus in the BUSOFF state, and communication restart in progress	Replace the expansion card if the state is not recovered.
PWR	Steady yellow	Power supply normal	/
	Yellow indicator OFF	Power supply abnormal	Replace the expansion card.

3.2.2.2 Function Description of the Dual-Contact Relay Output Card (IO-R2)

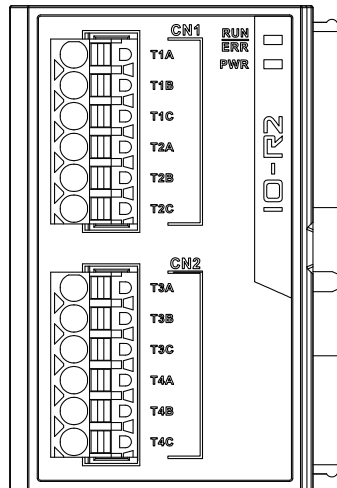


Figure 3-9 Terminal layout of the dual-contact relay output card (IO-R2)

Table 3-27 Terminal functions of the dual-contact relay output card (IO-R2)

Terminal Type	Terminal Mark	Function Definition	Specification
CN1	T1A	Common terminal 1	TA-TB: normally closed TA-TC: normally open Contact capacity: 30 VDC/3 A 250 VAC/3 A (Cosφ = 0.4)
	T1B	NC terminal 1	
	T1C	NO terminal 1	
	T2A	Common terminal 2	
	T2B	NC terminal 2	
	T2C	NO terminal 2	
CN2	T3A	Common terminal 3	
	T3B	NC terminal 3	
	T3C	NO terminal 3	
	T4A	Common terminal 4	
	T4B	NC terminal 4	
	T4C	NO terminal 4	

Table 3-28 Indicators of the dual-contact relay output card (IO-R2)

	Indicator	Description	Solution
RUN/ERR	Steady green	The device is running properly.	/
	Flashing green	The expansion card is in the initialization state.	/
	Green indicator OFF	Waiting for initialization of the power supply unit	/
	Steady red	Hardware fault	Replace the expansion card.
	Flashing red	Data frame loss or communication disconnection with the power supply unit or drive unit	1. Check the hardware connection. 2. Check whether the power supply unit or drive unit is normal. 3. If the hardware connection, power supply unit, and drive unit are normal, replace the expansion card.
	Flashing red and green alternatively	Internal communication bus in the BUSOFF state, and communication restart in progress	Replace the expansion card if the state is not recovered.
PWR	Steady yellow	Power supply normal	/
	Yellow indicator OFF	Power supply abnormal	Replace the expansion card.

3.2.2.3 Function Description of the Multi-functional Card (IO-M1)

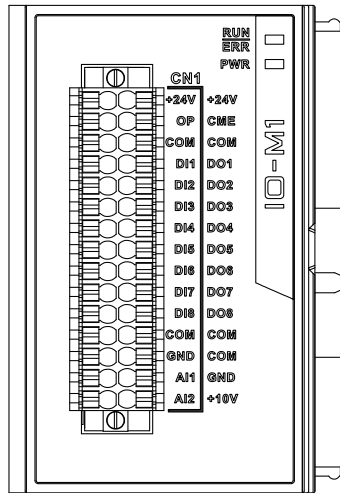


Figure 3-10 Terminal layout of the multi-functional card (IO-M1)

Table 3-29 Terminal functions of the multi-functional card (IO-M1)

Terminal Mark	Function Definition	Terminal Type	Specification
+24V	24 V power supply	-	24 V $\pm$ 10%; maximum current: 100 mA
OP	Multi-functional input common terminal	-	-
CME	Multi-functional output common terminal	-	-
COM	-	-	-
DI1	Digital input terminal 1	Digital input	Ordinary DIs; response time: 10 ms; high-speed pulse input not supported and photocoupler isolation supported; input frequency < 100 Hz; compatible with bipolar input Input impedance: 3.3 k Ω Effective level input voltage range: 15 V to 30 V
DI2	Digital input terminal 2		
DI3	Digital input terminal 3		
DI4	Digital input terminal 4		
DI5	Digital input terminal 5		
DI6	Digital input terminal 6		
DI7	Digital input terminal 7		
DI8	Digital input terminal 8		

Terminal Mark	Function Definition	Terminal Type	Specification
DO1	Digital output terminal 1	Digital output	DO1 to DO8 are ordinary isolated sink/source output terminals, which cannot be directly connected to the power supply. A pull-up resistor is required for connecting them to the power supply. The impedance is determined by the load requirements. The maximum output capacity is 24 VDC/50 mA.
DO2	Digital output terminal 2		
DO3	Digital output terminal 3		
DO4	Digital output terminal 4		
DO5	Digital output terminal 5		
DO6	Digital output terminal 6		
DO7	Digital output terminal 7		
DO8	Digital output terminal 8		
AI1	Analog input terminal 1	Analog input	AI1 and AI2 support voltage input, current input, or temperature input, which is set through parameters. When used as voltage/current input, AI1 and AI2 support -10 V to +10 V/0 mA to 20 mA. The resolution is 12-bit, correction accuracy is 0.3%, and input impedance is 22 k Ω for voltage input and 500 Ω for current input. Temperature detection is supported by using PT100, PT1000, KTY-84-130, or PTC-130.
AI2	Analog input terminal 2		
+10V	10 V power supply	10 V power supply	10 V $\pm$ 10%; maximum current: 10 mA
GND	Analog ground	Analog ground	

Table 3-30 Indicators of the multi-functional card (IO-M1)

	Indicator	Description	Solution
RUN/ERR	Steady green	The device is running properly.	/
	Flashing green	The expansion card is in the initialization state.	/
	Green indicator OFF	Waiting for initialization of the power supply unit	/
	Steady red	Hardware fault	Replace the expansion card.
	Flashing red	Data frame loss or communication disconnection with the power supply unit or drive unit	1. Check the hardware connection. 2. Check whether the power supply unit or drive unit is normal. 3. If the hardware connection, power supply unit, and drive unit are normal, replace the expansion card.
	Flashing red and green alternatively	Internal communication bus in the BUSOFF state, and communication restart in progress	Replace the expansion card if the state is not recovered.
PWR	Steady yellow	Power supply normal	/
	Yellow indicator OFF	Power supply abnormal	Replace the expansion card.

3.2.2.4 Function Description of the PROFINET Communication Expansion Card (SI-PN)

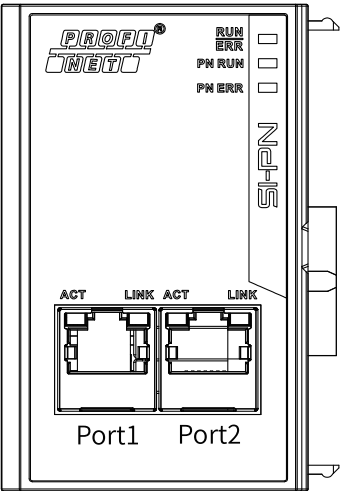


Figure 3-11 Terminal layout of the PROFINET communication expansion card (SI-PN)

The PROFINET communication expansion card (SI-PN) provides the standard Ethernet RJ45 port to connect to the PROFINET master station using crossover cables or straight-through cables. Definitions of the pin signals are the same as those of the standard Ethernet pin signals.

Table 3-31 Terminal functions of the PROFINET communication expansion card (SI-PN)

Terminal Mark	Terminal Name	Description
Port1	Network port 1	Wiring ports; Port1 for input and Port2 for output After installation, Port1 is on the left and Port2 is on the right from the front view of the card. It is recommended to use shielded Cat 5e twisted pair cables to ensure stable operation. To improve the anti-interference capability of communication, it is recommended to install the card in the expansion card slot 2.
Port2	Network port 2	

Table 3-32 Indicators of the PROFINET communication expansion card (SI-PN)

Indicator		Description	Solution
RUN/ERR	Steady green	Communication normal	/
	Steady red	Communication between the PROFINET expansion card and the node times out.	1. Restart the PROFINET card. 2. Eliminate field interference.
	Flashing red once per 500 ms	PROFINET expansion card internal communication timeout	
	Flashing red once per 1s	Communication between the PROFINET expansion card and the power supply unit times out.	
PN RUN	Steady on	PROFINET expansion card communication normal	/
PN ERR	Steady on	Communication with the master station is lost.	Check the wiring.
	Flashing	The master station sends the flashing request.	/

3.2.2.5 Function Description of the EtherCAT Communication Card (SI-ECAT)

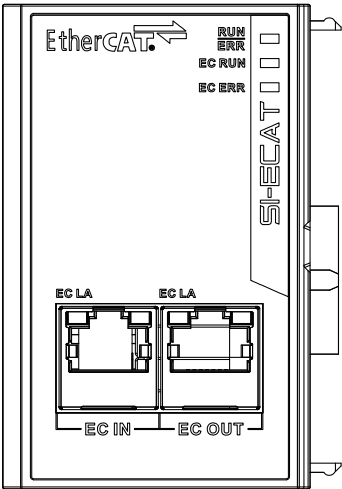


Figure 3-12 Terminal layout of the EtherCAT communication card (SI-ECAT)

The EtherCAT communication expansion card (SI-ECAT) provides the standard Ethernet RJ45 port to connect to the EtherCAT master station using crossover cables or straight-through cables. Definitions of the pin signals are the same as those of the standard Ethernet pin signals.

Table 3-33 Terminal functions of the EtherCAT communication expansion card (SI-ECAT)

Terminal Mark	Terminal Name	Function
EC IN	Input terminal	After installation, EC IN is on the left and EC OUT is on the right from the front view of the card. The two terminals must be connected correctly. The Cat 5e shielded twisted pair (STP) network cable must be used to ensure stability. To improve the anti-interference capability of communication, it is recommended to install the card in the expansion card slot 2.
EC OUT	Output terminal	

Table 3-34 Indicators of the EtherCAT communication expansion card (SI-ECAT)

Indicator		Description	Solution
RUN/ERR	Steady green	Communication normal	/
	Steady red	Communication between the EtherCAT communication expansion card and the node times out.	Check the connector for interference.
	Red indicator flashing slowly	Communication between the EtherCAT communication expansion card and the power supply unit times out.	1. Check that the communication expansion card is installed correctly. 2. Check whether the power supply unit is normal.
	Red indicator flashing quickly	The EtherCAT communication expansion card is faulty.	Troubleshoot the fault according to the fault code displayed on the operating panel of the power supply unit.
EC RUN	Green indicator flashing slowly	EtherCAT state machine status: disconnected	/
	Green indicator OFF	EtherCAT state machine status: INIT (initializing)	/
	Green indicator flashing quickly	EtherCAT state machine status: PREOP (pre-operational)	/
	Green indicator flashing once	EtherCAT state machine status: SAFEOP (safe operation)	/
	Steady green	EtherCAT state machine status: OP (operating)	/
EC ERR	Red indicator OFF	EtherCAT communication normal	/
	Steady red	EtherCAT communicate abnormal	Check the fault code on the operating panel of the power supply unit.
EC LA	Yellow indicator OFF	No connection with the previous EtherCAT device	/
	Steady yellow	Connected with the previous EtherCAT device	/
	Green indicator OFF	No data exchange with the network interface	/
	Flashing green	Data exchange with the network interface	/

3.2.2.6 Function Description of the EtherNet/IP Communication Card (SI-EN)

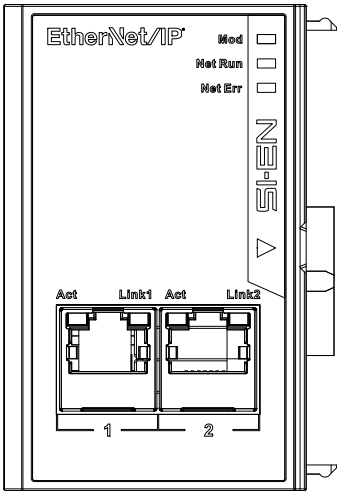


Figure 3-13 Terminal layout of the Ethernet/IP communication expansion card

The Ethernet/IP communication expansion card (SI-EN) provides the standard Ethernet RJ45 port to connect to the Ethernet/IP master station using crossover cables or straight-through cables. Definitions of the pin signals are the same as those of the standard Ethernet pin signals.

Table 3–35 Terminal functions of the Ethernet/IP communication expansion card (SI-EN)

Terminal Mark	Terminal Name	Function
1	Network port 1	Use any of the two ports to connect to the PLC. After installation, network port 1 is on the left and network port 2 is on the right from the front view of the expansion card. The Cat 5e shielded twisted pair (STP) network cable must be used to ensure stability. To improve the anti-interference capability of communication, it is recommended to install the card in the expansion card slot 2.
2	Network port 2	

Table 3-36 Indicators of the Ethernet/IP communication expansion card (SI-EN)

Indicator		Description	Solution
MOD RUN/ MOD ERR	Steady green	Communication normal	/
	Steady red	Communication between the SI-EN card and the node times out.	Check the connector for interference.
	Red indicator flashing slowly	Communication between the SI-EN card and the power supply unit times out.	1. Check that the communication card is installed correctly. 2. Check whether the power supply unit is normal.
	Red indicator flashing quickly	The SI-EN card is faulty.	Troubleshoot the fault according to the fault code displayed on the operating panel of the power supply unit.
NET RUN/ NET ERR	Steady green Off	The SI-EN card is connected.	/
	Flashing green Red indicator OFF	Wait for connection to the SI-EN card.	1. Check whether the network cable is connected properly and whether the master station is running. 2. The expansion card is in the static mode or DHCP mode. Assign an IP address to the expansion card using the parameter on the operating panel or BOOTP and DHCP.
	Flashing green Flashing red	The SI-EN card is disconnected or the connection times out.	1. Check whether the network cable is connected properly and whether the master station is online. 2. Check the fault code on the operating panel of the power supply unit and troubleshoot according to the fault description.
	Green indicator OFF Steady red	System fault	Check the fault code on the operating panel of the power supply unit and troubleshoot according to the fault description.

3.2.3 Wiring Descriptions of Control Circuit Terminals

Wiring of AI1 to AI2

The MD800 power supply unit and the expansion card IO-M1 provide AI1 and AI2. Each AI supports voltage, current, and temperature input, which can be selected through parameter.

- Parameters for input selection of AI1/AI2 on the power supply unit: A1-10/A1-11
- Parameters for input selection of AI1/AI2 when the IO-M1 expansion card is installed in slot 1: A2-10/A2-11
- Parameters for input selection of AI1/AI2 when the IO-M1 expansion card is installed in slot 2: A3-10/A3-11

The following section describes the wiring when AI1/AI2 is used for voltage, current, and temperature input.

- AI1/AI2 used for voltage/current input
Weak analog voltage signals are prone to suffer external interference. Therefore, use shielded cables and ensure that the cable length is no longer than 20 m (as short as possible). In applications where the analog signal suffers severe interference, install a filter capacitor or ferrite magnetic core at the analog signal source side.

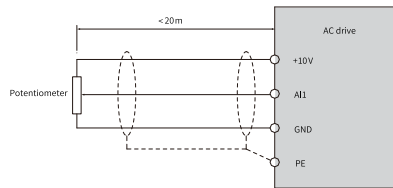


Figure 3-14 AI wiring (voltage/current input)

- AI1/AI2 used for temperature input
When AI1/AI2 is used for temperature input, the internal 10 V power supply can be used and the external 10 V power supply is not required. Therefore, you only need to connect the temperature sensor to AI1/AI2 and the GND terminal.

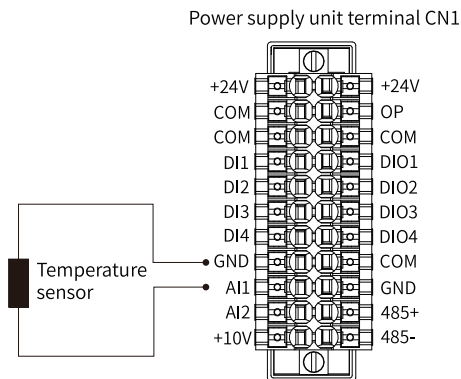


Figure 3-15 AI wiring (temperature input)

Wiring of DI1 to DI4

The DI can be wired in the sink mode (NPN) or source mode (PNP).

- Sink wiring mode

The internal 24 V power supply of the drive is the common wiring method. To use the internal 24 V power supply, short the OP and 24V terminals of the drive, and connect the COM terminal of the drive to the 0V terminal of the external controller, as shown in the following figure.

If an external 24 V power supply is used, remove the jumper between +24V and OP, connect the 24 V positive electrode of the external power supply to the OP terminal of the drive, and connect the 0V terminal of the external power supply to the corresponding DI of the drive through the controller contact.

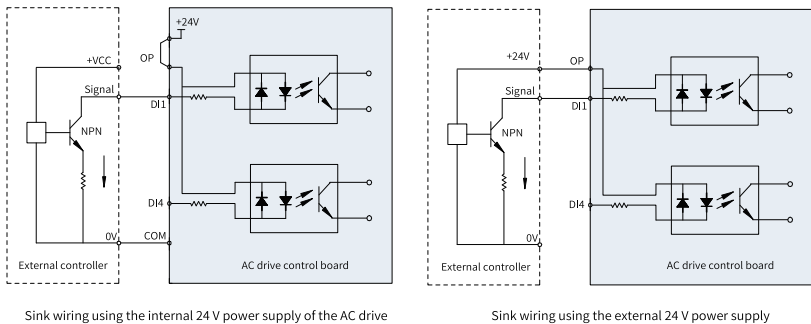


Figure 3-16 Sink wiring mode

The following figure shows parallel connection of DIs of multiple drives in the sink mode.

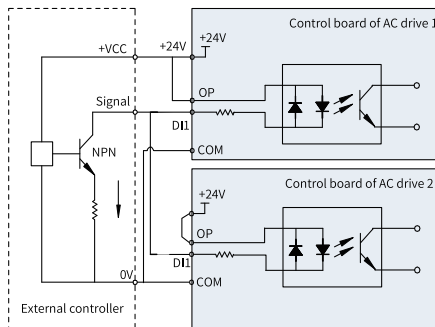


Figure 3-17 Parallel connection of DIs of multiple drives in the sink mode

- Source wiring mode

- To use the 24 V internal power supply of the drive, remove the jumper between the +24V and OP terminals, connect the OP terminal to the COM terminal, and connect the +24V terminal to the common terminal of the external controller, as shown in the following figure.
- To use an external power supply, remove the jumper between the +24V and the OP terminals, connect the OP terminal to the 0V terminal of the external power supply, and connect the positive electrode of the external 24 V power supply to a corresponding DI through the external controller contact.

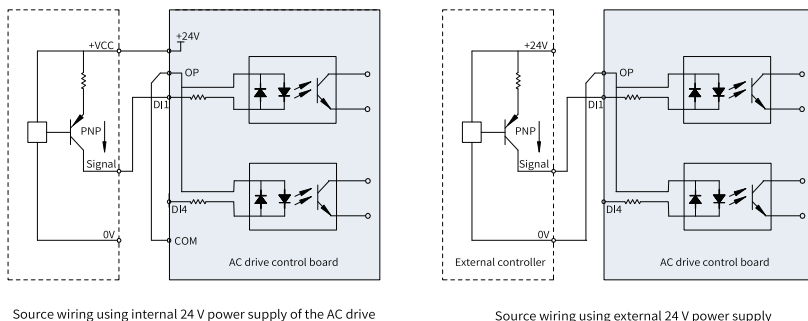


Figure 3-18 Source wiring mode

Wiring of DIO1 to DIO4

DIO1 to DIO4 can be used as DIs or DOs, which are set by the parameters in group F4 or group F5. If F4-00 is set to 5 (DIO1 used as DI), and parameters in group F5 are set to provide output functions, F5-00 cannot be set to 1 (DIO1 used as DO). DIO1 to DIO4 can be used as either the DI or the DO at the same time.

When DIO1 to DIO4 are used as DIs, the wiring mode of them is consistent with that of DI1 to DI4. For details, see ["Figure 3-16 " on page 99](#) to ["Figure 3-18 " on page 100](#) . When the DIO is used as the DO, the DO common terminal is COM and only the sink wiring mode is supported, as shown in the following figure. In this case, it is recommended that the DI common terminal OP of the DIO be connected to the 24V terminal. Do not connect the OP terminal to the COM terminal. If so, the customer's device will receive input signals before signals are output through the DIO.

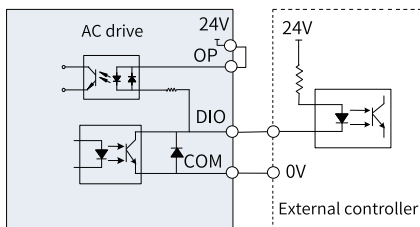


Figure 3-19 Wiring of the DIO1 to DIO4 used as the DO

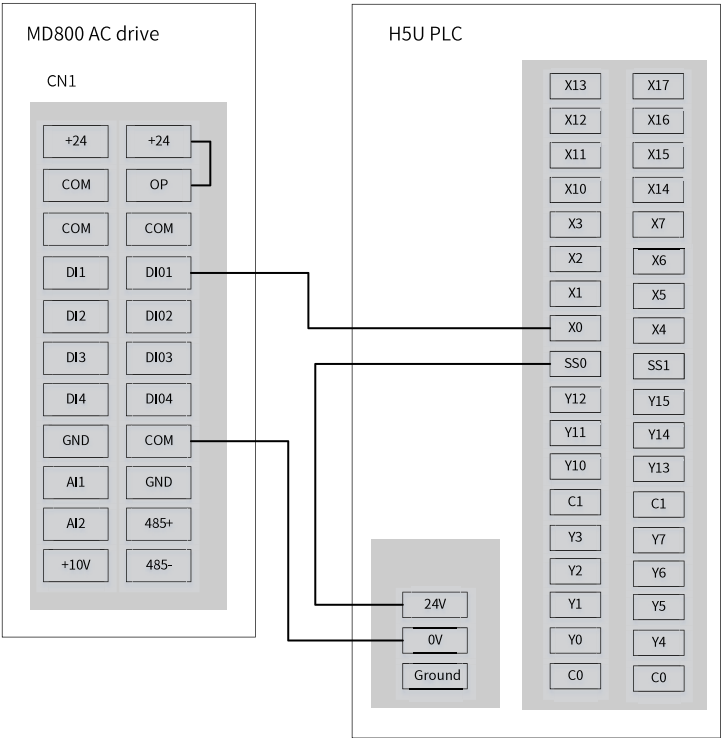


Figure 3-20 Wiring of the DIO1 to DIO4 used as the DO

Wiring of the DO

To use the DO, insert the IO-M1 expansion card to the AC drive.

When the DO needs to drive the relay, install a snubber diode at two sides of the relay coil. Otherwise, the 24 VDC power supply may be prone to be damaged. Ensure that the driving capacity does not exceed 50 mA.

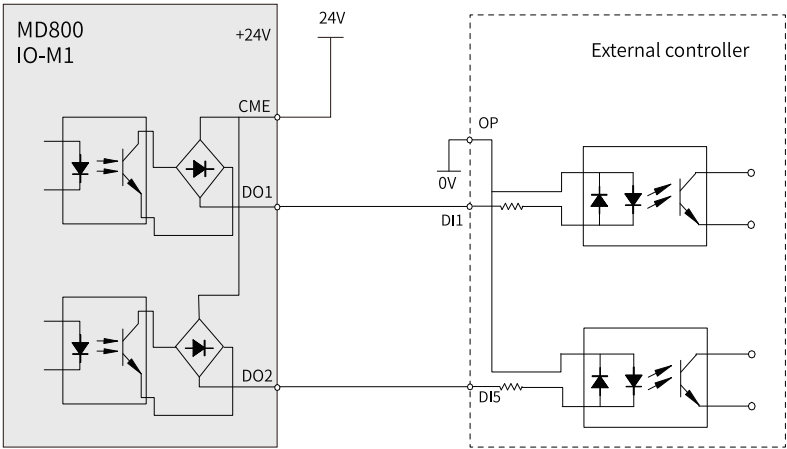


Figure 3-21 Source wiring (PNP)

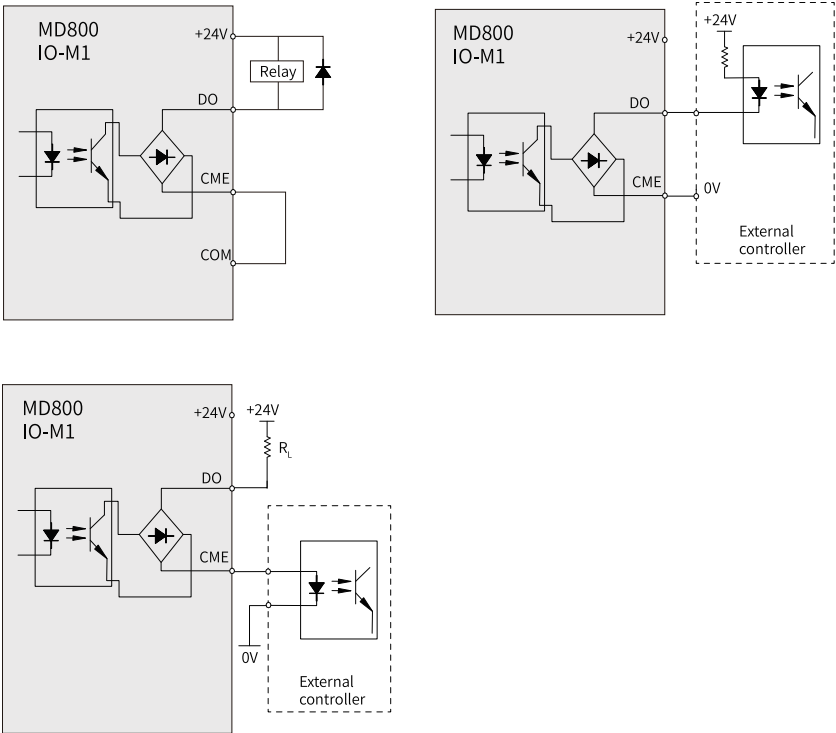


Figure 3-22 Sink wiring (NPN)

Note

In the preceding figure, $R_L \geq 450 \Omega$.

Wiring of the relay output terminal

The inductive load (relay, contactor, and motor) causes voltage peak after the current is disconnected. Use a voltage dependent resistor (VDR) at the relay contact for protection and install absorption circuits such as VDRs, RC absorption circuits, and diodes on the inductive load to minimize interference upon cutoff.

When a contactor and an intermediate relay are connected to 220 VAC, a VDR with a withstand voltage higher than 275 VAC must be paralleled at both ends of the drive coil of the contactor and intermediate relay. When a contactor and an intermediate relay are connected to the 24 VDC, a freewheel diode must be inversely paralleled at both ends of the drive coil of the contactor and intermediate relay. That is, the cathode and anode of the freewheel diode are connected to the 24 V side and non-24 V side of the drive coil, respectively.

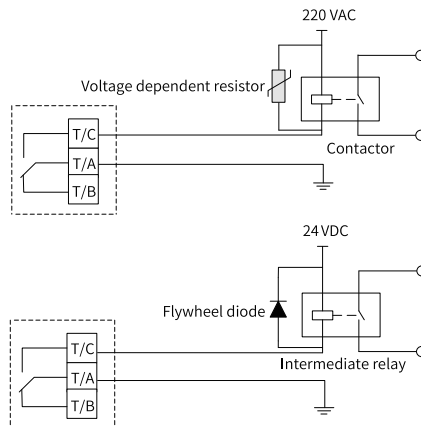


Figure 3-23 Anti-interference treatment for relay output terminals

Note

- If relay output terminals are connected to 220 V dangerous voltage, pay attention to distinguishing them from the surrounding safety extra-low voltage circuit terminals to ensure correct connection. The requirements for reinforced insulation must be taken into consideration during wiring.
- The external 220 V power supply connected to the relay must be used in an environment with overvoltage class II (OVC II).

3.2.4 Control Circuit Wiring Requirements

Note

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

Cable selection requirements for the control circuit

To ensure that the control circuit is not affected by strong external interference, it is recommended to use the shielded cable with the shield for the signal cable. Use the signal shield brackets at both ends of the shield to connect the shield to the drive in 360°. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables for digital signals.

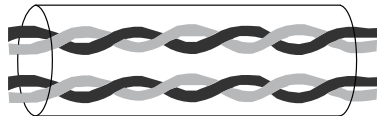


Figure 3-24 Shielded twisted pair cable

Table 3-37 Recommended specifications for the control circuit cable

Device Type	Terminal Type	Recommend ed IEC Cable Specification (mm ²)	Recommend ed NEC Cable Specification (AWG)	Recommended Lug Specification
Power supply unit and optional expansion card	Control signal terminal	0.5	22-20	IEC: 0.5 mm ² (E0512) 0.75 mm ² (E7512) 1 mm ² (E1012) 1.5 mm ² (E1512) NEC: 22AWG (E0512) 20AWG (E0512) 18AWG (E1012) 16AWG (E1512) For details about the lug specifications, see "3.1.3 Cable Lug Selection" on page 61.
	24 V input terminal	0.5-1.5	22-16	
	Relay terminal	0.5-1.5	22-16	
Drive unit	STO terminal (optional)	0.5	22-20	

Requirements on wiring of I/O signal cables

- I/O signals include analog input (AI) signals, analog output (AO) signals, digital input (DI) signals, digital output (DO) signals, and relay output signals. Before

wiring the I/O terminal, disconnect the main power supply and ensure that the danger indicator on the AC drive is off.

- To avoid interference to the I/O signals, separate the I/O signal cables at least 30 cm away from the main circuit cables (three-phase R/S/T and U/V/W, or single-phase L1/L2) and other power cables or power supply cables.
- To avoid malfunction of the AC drive and equipment, separate the relay output terminal cable at least 30 cm away from other I/O signal cables.

3.3 Communication Wiring

3.3.1 RS485 Communication Wiring

RS485 communication connection with PLC

Use a three-conductor shielded cable for the RS485 bus to connect to the 485+, 485-, and GND terminals of the AC drive. Use the shielded twisted pair cables to connect to 485+ and 485-, and use the shielding layer to connect to GND.

Table 3-38 Cable pin for the communication between the AC drive and PLC

AC Drive		PLC	
Communication Type	Signal Name	Communication Type	Signal Name
RS485	485+	RS485	485+
	485-		485-
	GND		GND

RS485 communication for connections of multiple AC drives in parallel

The following table specifies the cable pin for connections of multiple AC drives in parallel in RS485 communication networking.

Table 3-39 Cable pin for connections of multiple AC drives in parallel

AC Drive (Side A)		AC Drive (Side B)	
Communication Type	Signal Name	Communication Type	Signal Name
RS485	485+	RS485	485+
	485-		485-
	GND		GND

Use the daisy chain connection for the RS485 bus in case of a large number of nodes, as shown in the following figure. Connect the RS485 signal reference ground of all nodes (up to 128 nodes) together.

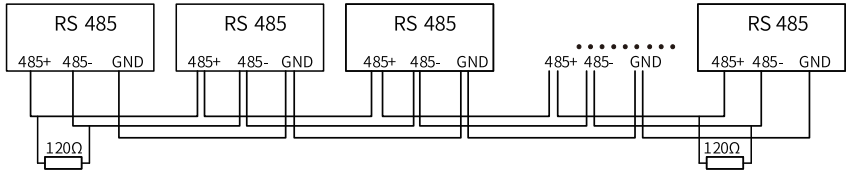


Figure 3-25 RS485 bus topology

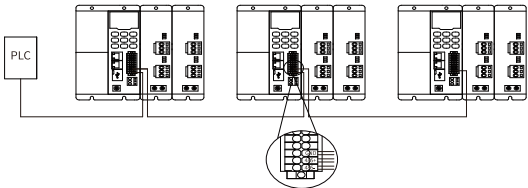


Figure 3-26 Daisy chain connection mode

Transmission distance

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

Table 3–40 Maximum number of nodes and transmission distance

Transmission Distance (m)	Baud Rate (kbps)	Number of Nodes	Cable Specification
100	115.2	128	26AWG
1000	19.2	128	26AWG

Termination resistor settings

Table 3–41 Termination resistor settings

Terminal Assignment		Pin Description
Pin No.	DIP Switch	
1	DIP switch for enabling/ disabling RS485 termination resistor	By default, the RS485 termination resistor is disabled. To enable the RS485 termination resistor, set pins 1 and 2 to ON.
2		

3.3.2 CAN Communication Wiring

CAN communication with the PLC

The power supply unit provides two RJ45 network ports for the CAN bus. Use the Cat 5e shielded network cable and connect a 120 Ω termination resistor at both ends of the bus to prevent CAN signals from reflecting.

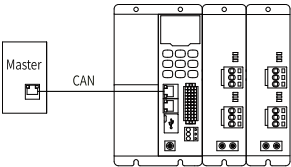


Figure 3-27 Topology of CAN communication with the PLC

CAN communication for connections of multiple AC drives in parallel

Use the Cat 5e shielded network cables to connect the AC drives in hand-in-hand mode, as shown in the following figure. A maximum of 64 nodes can be connected. To prevent CAN signals from reflecting, connect a 120 Ω termination resistor at both ends of the bus.

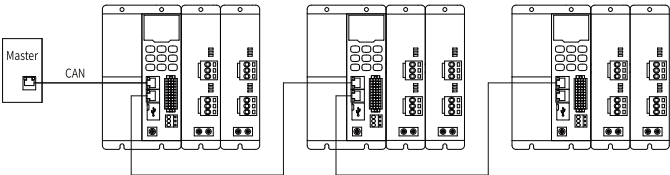


Figure 3-28 CAN bus topology

Transmission distance

The transmission distance of the CAN bus is directly related to the baud rate and the communication cable. The following table describes the relationship between the maximum bus length and the baud rate.

Table 3-42 Transmission distance and baud rate

Transmission Distance (m)	Baud Rate (kbps)	Number of Nodes
25	1000	64
95	500	64
560	100	64
1000	50	64

Termination resistor settings

Table 3-43 Termination resistor settings

Terminal Assignment		Pin Description
Pin No.	DIP Switch	
3	DIP switch for enabling/ disabling CAN termination resistor	By default, the CAN termination resistor is disabled. To enable the CAN termination resistor, set pins 3 and 4 to ON.
4		

3.3.3 Ethernet Wiring

Communication networking

The AC drive supports Ethernet bus, including PROFINET, Ethernet/IP, and EtherCAT. It provides the standard RJ45 network port and supports the standard RJ45 connector. Use the Cat 5e shielded twisted pair cable with the injection molded connector protected by iron shell to connect the Ethernet master station properly. With relevant communication settings, the AC drive can communicate with the Ethernet master station, thus realizing the networking function of the AC drive. The topological structures supported by Ethernet include bus, star, and tree topologies. Various networking can be realized with different switches.

- PROFINET connection topology

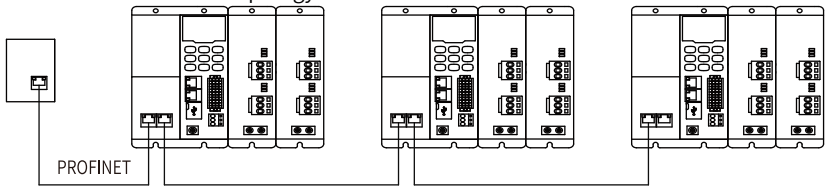


Figure 3-29 PROFINET bus topology

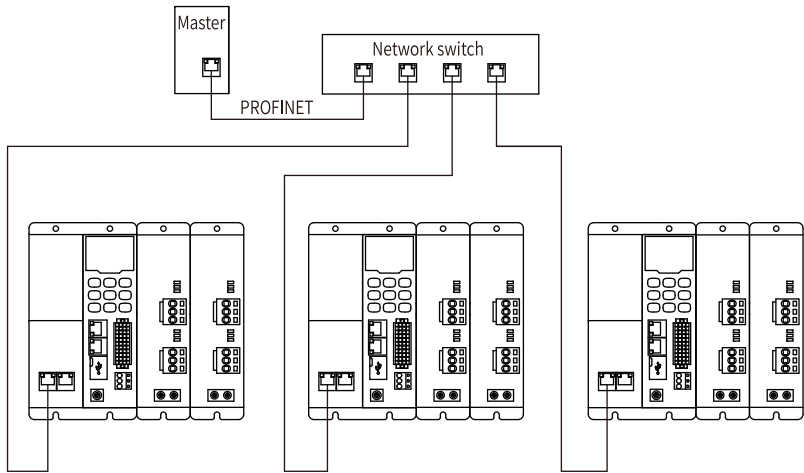


Figure 3-30 PROFINET star topology

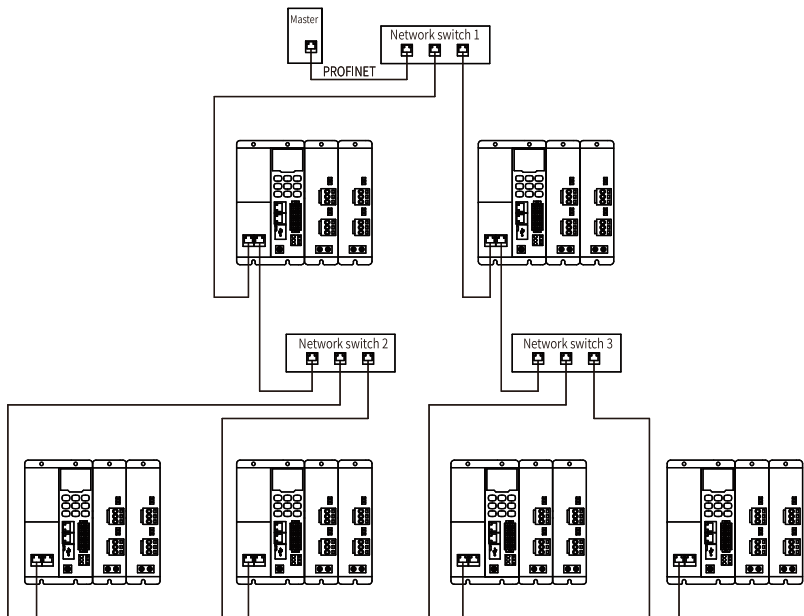


Figure 3-31 PROFINET tree topology

- EtherCAT connection topology

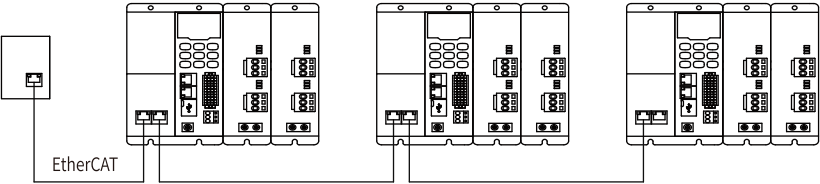


Figure 3-32 EtherCAT bus topology

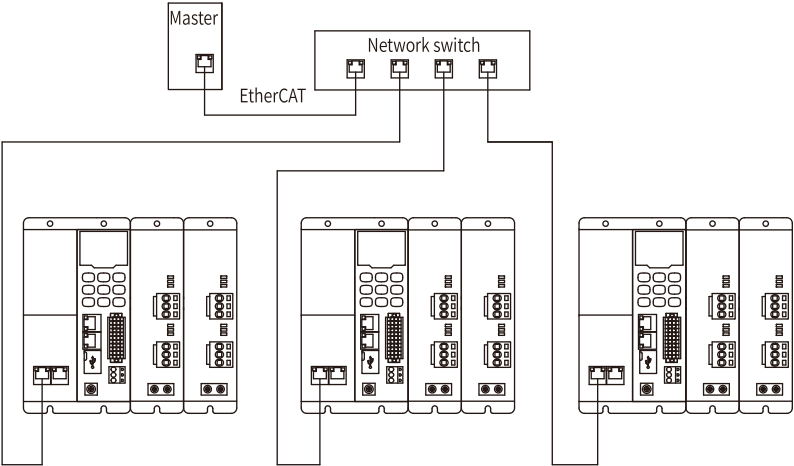


Figure 3-33 EtherCAT star topology

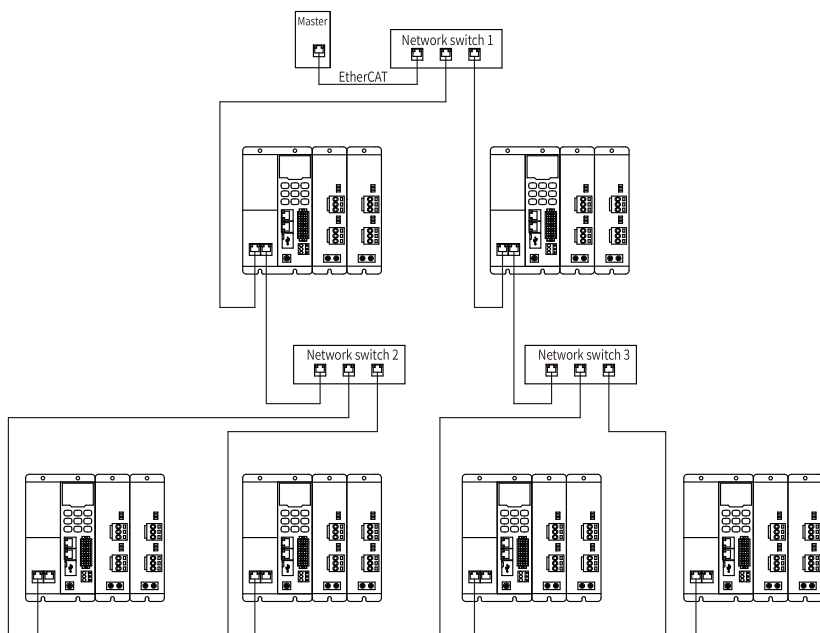


Figure 3-34 EtherCAT tree topology

- Ethernet/IP connection topology

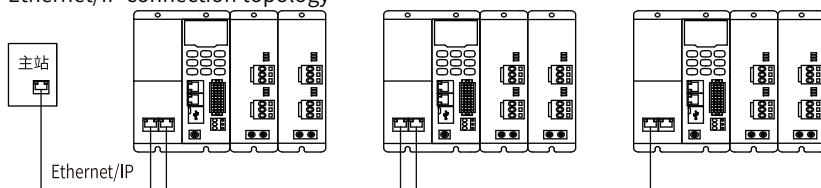


Figure 3-35 Ethernet/IP bus topology

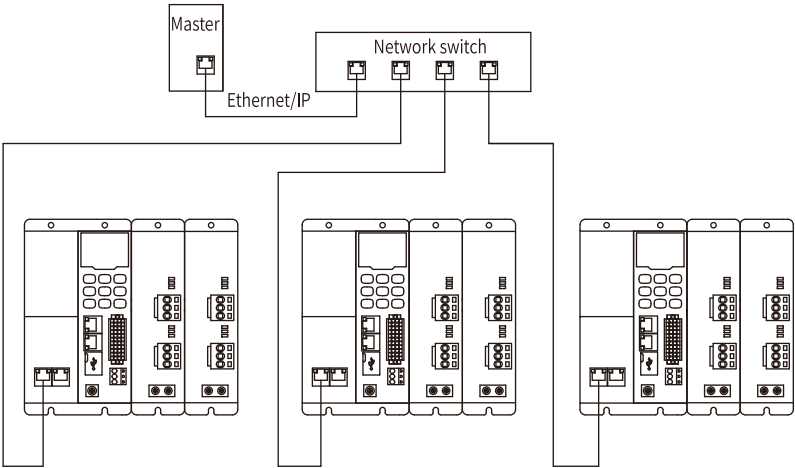


Figure 3-36 Ethernet/IP star topology

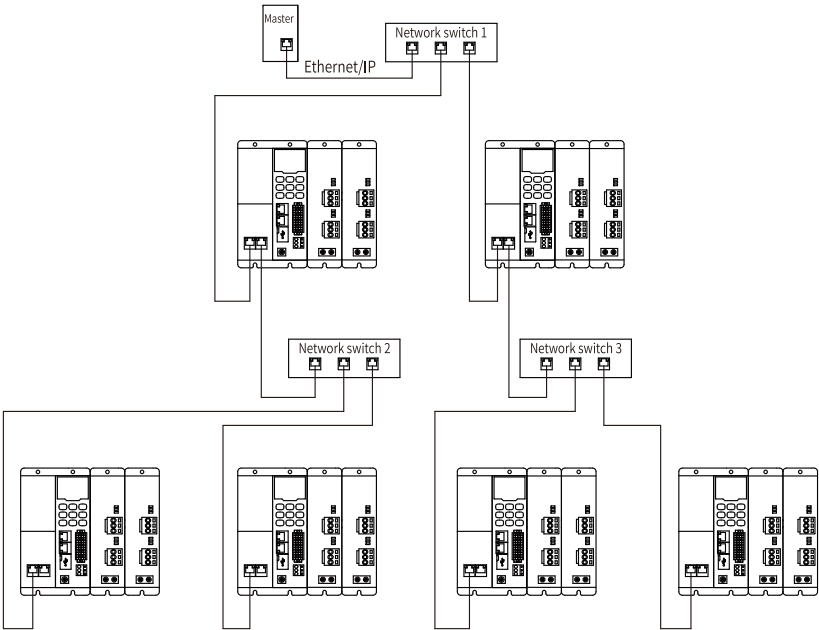


Figure 3-37 Ethernet/IP tree topology

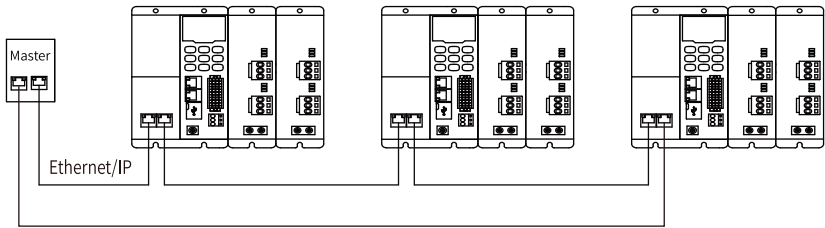


Figure 3-38 Ethernet/IP ring topology

Cable specifications

The Ethernet bus uses shielded cables for network data transmission. The following table lists the recommended specifications of network cables.

Table 3-44 Ethernet cable specifications

Item	Specification
Cable type	Elastic crossover cable (8P8C straight-through cable), S-FTP, Cat 5e
Standards compliance	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36
Cross sectional area	26AWG
Conductor type	Twisted pair
Number of pairs	4

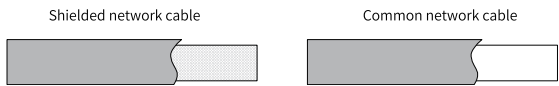


Figure 3-39 Shielded network cable

To connect the RJ45 network cable, hold the RJ45 connector of the cable and insert it into the RJ45 port of the communication module until you hear a "click" sound. To remove the RJ45 network cable, press down the clip of the RJ45 connector, and then pull it out along the direction parallel with the module.

To avoid the influence on the communication cable due to other stresses and ensure the stability of communication, secure the cable near the equipment before Ethernet communication.

Two ports on the AC drive can be used to realize ring topology or linear topology. You need to connect only one end of a cable to one of the two ports on the AC drive. Check that the cable between two nodes is no longer than 100 m in length.

Note

If the communication between the equipment and the controller needs to be maintained when the main power supply is cut off, connect the external 24 V power supply through CN6 (external 24 V power supply input terminal) to supply power to the AC drive.

3.4 Grounding

3.4.1 Main Circuit Grounding Requirements



Caution

- Ground the grounding terminal to avoid electric shocks. Comply with the relevant local electrical regulations for grounding.
 - To prevent electric shocks, ensure that the protective grounding conductor meets the technical specifications and local safety standards, and shorten the grounding cable length as much as possible. The leakage current of the product will exceed 3.5 mA, so copper cables with a cross-sectional area of at least 10 mm² must be used as protective grounding conductors according to EN 61800-5-1, or two protective grounding conductors of the same specification shall be used for connection.
 - When using multiple devices, follow the instructions for grounding all devices. Incorrect equipment grounding will lead to misoperation of equipment.
-

Main circuit grounding requirements:

- Use a yellow-green cable with copper conductors for the protective grounding conductor. Do not connect the protective grounding conductor to switching devices such as circuit breakers in series.
- Ground the grounding terminal properly. Improper grounding will lead to device malfunction or damage.
- Do not connect the grounding terminal to the N terminal of the neutral wire of the power supply.
- Install the drive on a conductive metal mounting surface. Ensure that the whole conductive bottom of the drive is attached properly to the mounting surface.
- Fasten the grounding screws using the recommended tightening torque to avoid loose or excessively tight protective grounding conductor.

3.4.2 Grounding the Control Board

By default, the control board is grounded. When grounding is not required, knock out the cover of the EMC grounding screw hole at ①, and remove the EMC screw with a Phillips screwdriver to disconnect the control board from grounding.

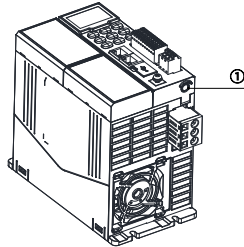


Figure 3-40 Position of the EMC grounding screw of the control board

3.4.3 Grounding a Single Device

Each unit (power supply unit, drive unit, and filter unit) must be well grounded. The power supply unit, drive unit, input reactor, filter (or filter module) are connected to the grounding copper busbar of the equipment cabinet in the star connection mode, and the output side of the drive unit is connected to the motor, as shown in the following figure.

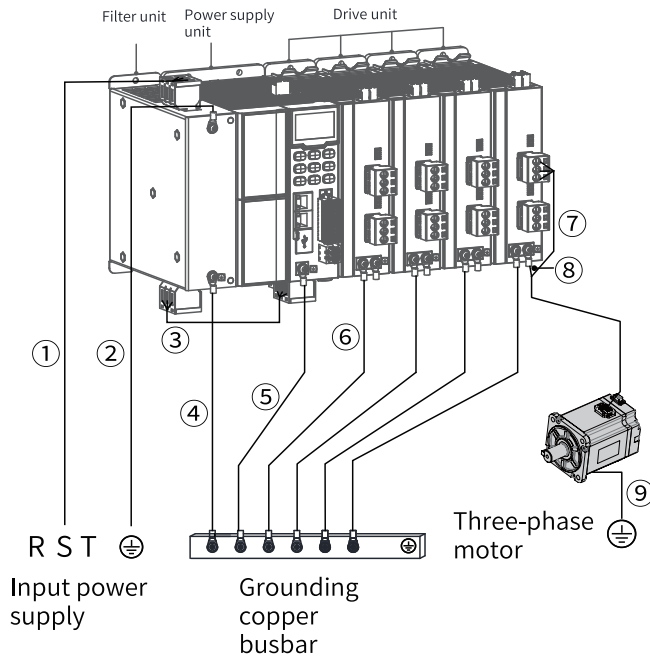


Figure 3-41 Grounding of the AC drive

No.	Description
①	Connect the input terminals of the filter module to the power supply input terminals R, S, and T.
②	Connect the input M4 grounding screw of the filter unit to the power ground.
③	Connect the output terminals of the filter module to the input terminals of the power supply unit. It is recommended to use shielded cables.
④	Connect the output M4 grounding screw of the filter module to the grounding copper busbar.
⑤	Connect the M4 grounding screw of the power supply unit to the grounding copper busbar.
⑥	Connect the M4 grounding screw of the drive unit to the grounding copper busbar.
⑦	Connect the output side of the drive unit to the input side of the motor.
⑧	Connect the motor output grounding cable of the drive unit to the grounding screw of the drive unit.
⑨	Ground the motor enclosure.

Note

In the preceding figure, the power supply unit is equipped with four dual-axis drive units. In the figure, only axis 1 of the rightmost drive unit is taken as an example to introduce the wiring of the drive unit. The wiring for other drive units is similar.

3.4.4 Grounding Multiple Devices

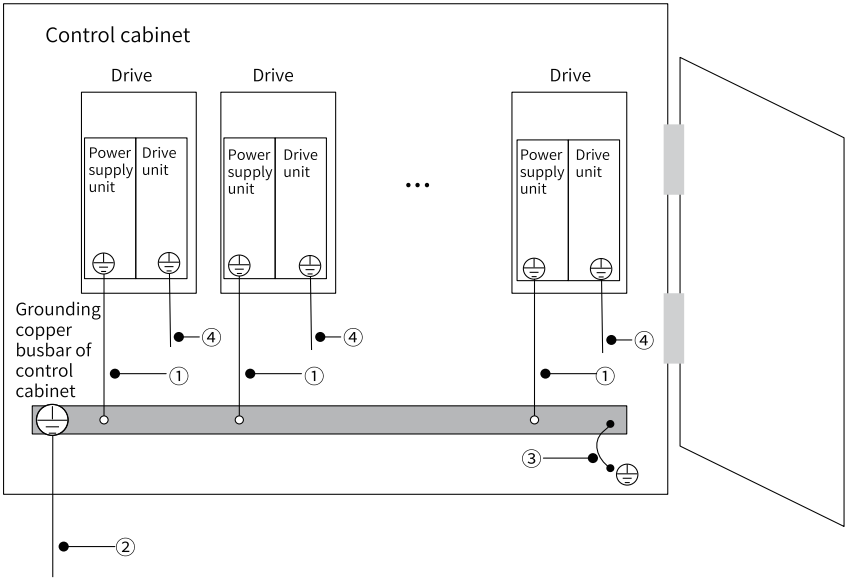


Figure 3-42 Grounding of paralleled drives

Table 3-45 Description for grounding of paralleled drives

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

3.4.5 Grounding the Cabinet System

The cost-effective method of suppressing interference in a cabinet is to isolate the interference source from the equipment that may be interfered with. It is necessary to divide the cabinet into multiple parts for EMC resistance based on interference intensity differences of sources. Install devices in the corresponding areas and wire according to the following table.

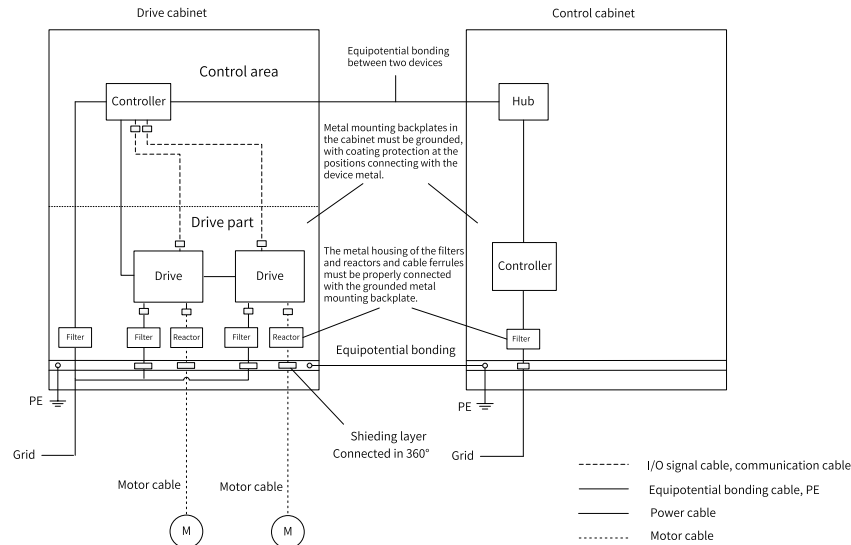


Figure 3-43 Recommended cabinet system grounding

Table 3-46 Requirements of cabinet system grounding

No.	Wiring requirements
1	Install the control devices and drive devices into two separate cabinets.
2	Use grounding cables with a cross-sectional area of at least 16 mm ² to connect different cabinets, therefore realizing equipotential between the cabinets.
3	Place the devices in different areas in the cabinet according to the device signal strength.
4	Carry out equipotential bonding for the devices in different areas of the cabinet.
5	Shield all communication (for example, RS485) and signal cables leading from the electrical cabinet.
6	Install the power supply input filter inside the cabinet to a place near the input interface of the cabinet.
7	Spray each grounding point in the cabinet.

4 Option Selection

4.1 Peripheral Electrical Components

4.1.1 Fuse, Circuit Breaker, and Contactor

To meet the requirements of European safety standard EN 61800-5-1 and North American safety standard UL61800-5-1, connect a fuse/circuit breaker on the input side to prevent accidents caused by internal short circuits.

The following table lists the recommended fuses, contactors, and circuit breakers.

Table 4–1 Model selection of fuses, contactors, and circuit breakers

Power Supply Unit Model	Rated Input Current (Heavy Load) (A)	Recommended Fuse			Recommend ed Contactor	Recommend ed circuit breaker
		Semiconductor Fuse (Bussmann)		Semiconduc tor Fuse (Class J)		
		Rated Current (A)	Model	Rated Current (A)	Rated Current (A)	Rated Current (A)
Single-phase 200 V to 240 V						
MD800-0-2S24 MD800-0-2S24B	24	40	FWP-40B	35	26	35
MD800-0-2S40 MD800-0-2S40B	40	60	FWP-60B	60	50	60
Three-phase 200 V to 240 V						
MD800-0-2T22B	22	50	FWP-50B	50	26	50
MD800-0-2T41B	41	60	FWP-60B	60	50	60
Three-phase 380 V to 480 V						
MD800-0-4T12 MD800-0-4T12B	12	25	FWP-25B	25	16	25
MD800-0-4T22 MD800-0-4T22B	22	50	FWP-50B	50	26	50
MD800-0-4T41 MD800-0-4T41B	41	60	FWP-60B	60	50	60

4.1.2 AC Input Reactor

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

Models and dimensions (Inovance)

The models and dimensions of the recommended Inovance AC input reactors are as follows.

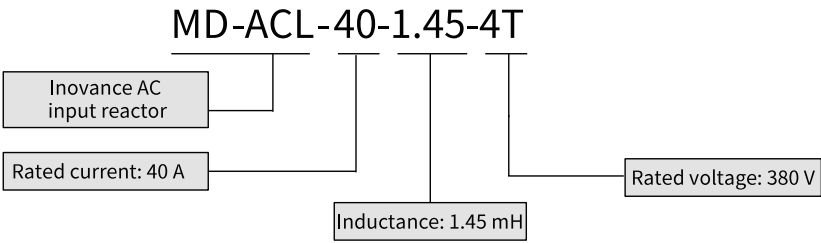


Figure 4-1 AC input reactor model

Table 4-2 Model selection of the AC input reactor (Inovance)

Power Supply Unit Model	Rated Input Current (Heavy Load) (A)	Reactor Model	Inductance (mH)	Loss (W)
Single-phase 200 V to 240 V				
MD800-0-2S24 MD800-0-2S24B	24	/	/	/
MD800-0-2S40 MD800-0-2S40B	40	/	/	/
Three-phase 200 V to 240 V				
MD800-0-2T22B	22	MD-ACL-30-0.93-4T-4%	0.93	/
MD800-0-2T41B	41	MD-ACL-50-0.56-4T-4%	0.56	/
Three-phase 380 V to 480 V				
MD800-0-4T12 MD800-0-4T12B	12	MD-ACL-15-1.9-4T-4%	1.9	-
MD800-0-4T22 MD800-0-4T22B	22	MD-ACL-30-0.93-4T-4%	0.93	-
MD800-0-4T41 MD800-0-4T41B	41	MD-ACL-50-0.56-4T-4%	0.56	-

Dimensions of the AC input reactor

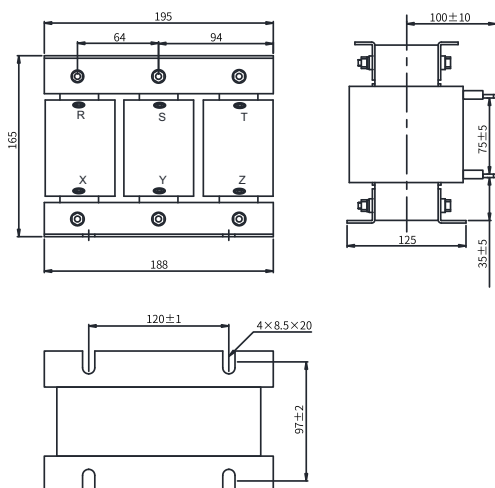


Figure 4-2 Dimensions of the AC input reactor (15 A)

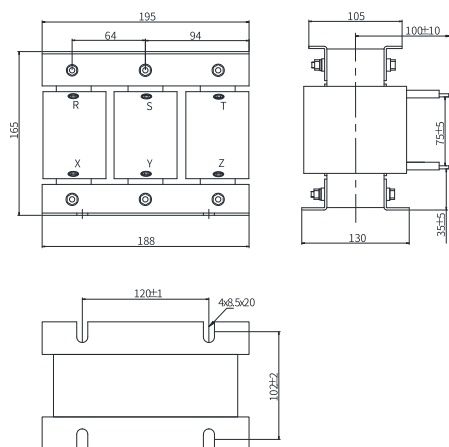


Figure 4-3 Dimensions of the AC input reactor (30 A)

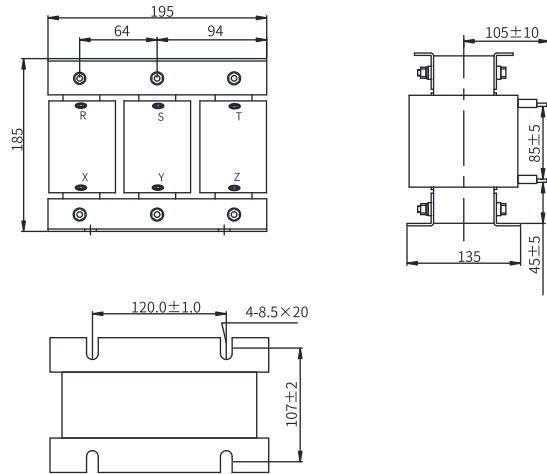


Figure 4-4 Dimensions of the AC input reactor (50 A)

Models and dimensions (Schaffner)

The models of the recommended Schaffner AC input reactors are as follows.

Table 4-3 Model selection of the AC input reactor (Schaffner)

Power Supply Unit Model	Rated Input Current (Heavy Load) (A)	Reactor Model	Inductance (mH)	Loss (W)
Single-phase 200 V to 240 V				
MD800-0-2S24 MD800-0-2S24B	24	/	/	/
MD800-0-2S40 MD800-0-2S40B	40	/	/	/
Three-phase 200 V to 240 V				
MD800-0-2T22B	22	RWK 3044-35-92-E0XXX	0.83	151
MD800-0-2T41B	41	RWK 3044-48-92-E0XXX	0.61	172
Three-phase 380 V to 480 V				
MD800-0-4T12 MD800-0-4T12B	12	RWK 3044-18-89-E0XXX	1.67	103
MD800-0-4T22 MD800-0-4T22B	22	RWK 3044-35-92-E0XXX	0.83	151
MD800-0-4T41 MD800-0-4T41B	41	RWK 3044-48-92-E0XXX	0.61	172

4.1.3 Input Filter

4.1.3.1 EMC Filter

To comply with the radiated and conducted emission requirements of EN IEC 61800-3, install the EMC filter listed in the following table. Inovance and Schaffner EMC filters can be used.

Appearance

Table 4–4 Standard EMC filter model and appearance

Filter Model		Appearance
Schaffner	FN3288 series	
Inovance	FIL800 series	

Model

Select the filter based on the rated input current of the drive, as shown in the following table.

Table 4–5 Schaffner filter model selection

Power Supply Unit Model	Rated Input Current (Heavy Load) (A)	Filter Model	Loss (W)
Three-phase 200 V to 240 V			
MD800-0-2T22B	22	FN3288-20-33-C..-R65	/
MD800-0-2T41B	41	FN3288-40-33-C..-R65	/
Three-phase 380 V to 480 V			

Power Supply Unit Model	Rated Input Current (Heavy Load) (A)	Filter Model	Loss (W)
MD800-0-4T12 MD800-0-4T12B	12	FN3288-16-44-C...-R65	/
MD800-0-4T22 MD800-0-4T22B	22	FN3288-20-33-C...-R65	/
MD800-0-4T41 MD800-0-4T41B	41	FN3288-40-33-C...-R65	/

Table 4-6 Inovance filter model selection

Power Supply Unit Model	Rated Input Current (Heavy Load) (A)	Filter Model	Loss (W)
Single-phase 200 V to 240 V			
MD800-0-2S24 MD800-0-2S24B	24	FIL800-2S-045	/
MD800-0-2S40 MD800-0-2S40B	40	FIL800-2S-045	/
Three-phase 200 V to 240 V			
MD800-0-2T22B	22	FIL800-4T-045	/
MD800-0-2T41B	41	FIL800-4T-045	/
Three-phase 380 V to 480 V			
MD800-0-4T12 MD800-0-4T12B	12	FIL800-4T-045	/
MD800-0-4T22 MD800-0-4T22B	22	FIL800-4T-045	/
MD800-0-4T41 MD800-0-4T41B	41	FIL800-4T-045	/

Dimensions

The filter dimensions are as follows.

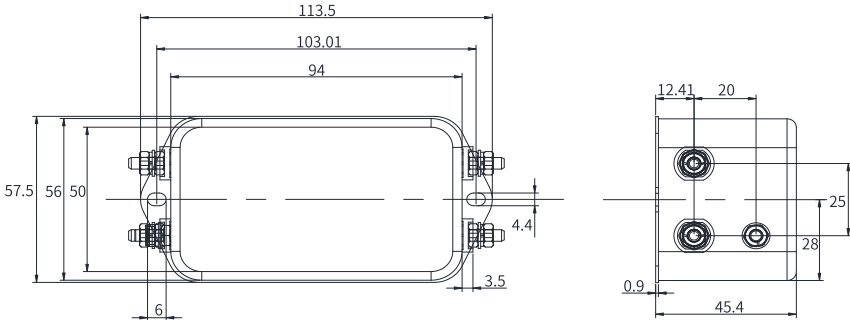


Figure 4-5 Schaffner filter dimensions (FN2010N-30-08) (unit: mm)

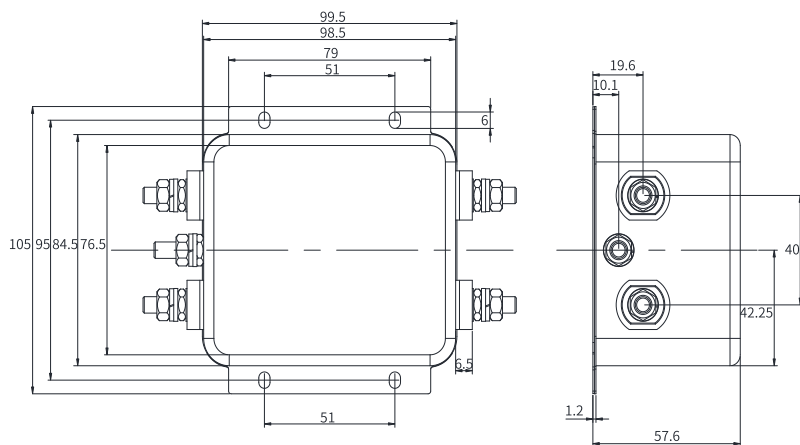


Figure 4-6 Schaffner filter dimensions (FN2010N-60-24) (unit: mm)

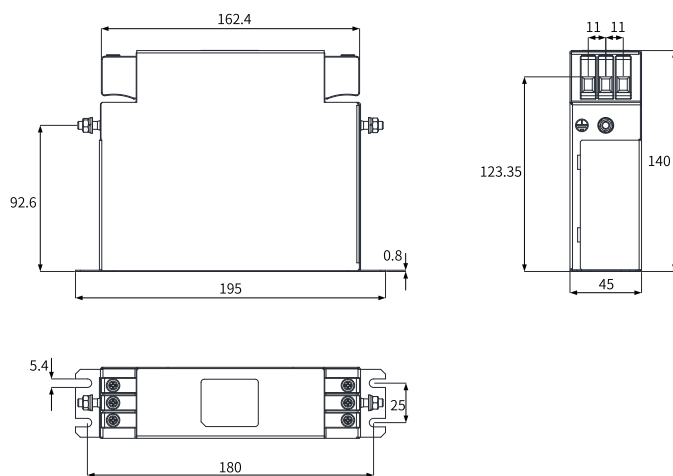


Figure 4-7 Schaffner filter dimensions (FN3288-16-44) (unit: mm)

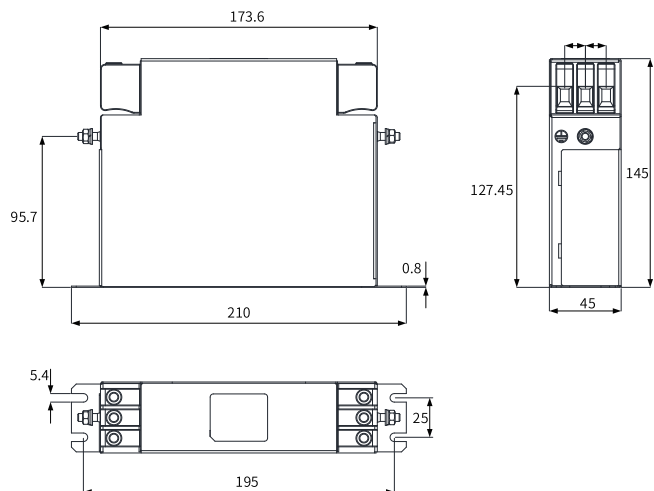


Figure 4-8 Schaffner filter dimensions (FN3288-20-25-33) (unit: mm)

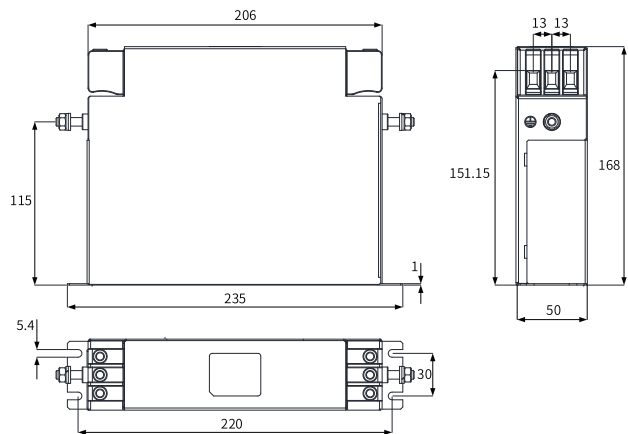


Figure 4-9 Schaffner filter dimensions (FN3288-40-33) (unit: mm)

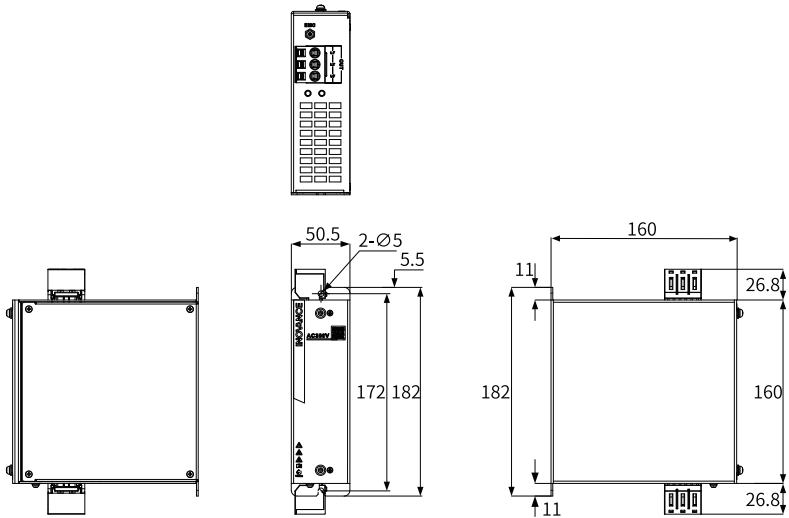


Figure 4-10 Inovance filter dimensions (FIL800) (unit: mm)

4.1.3.2 Simple Filter

The simple EMC filter effectively attenuates radio frequency noise from the power grid and running AC drive. In addition, for devices equipped with the earth leakage circuit breaker (ELCB), if the ELCB trips incorrectly, install a simple filter on the input side of the drive for suppression. For details, see ["Figure 4-12 " on page 128](#) .

Ground the simple filter properly and use a cable shorter than 30 cm to connect the filter and the drive. The grounding terminal of the simple filter must be connected to the grounding terminal of the drive, and the grounding cable must be as short as possible (shorter than 30 cm).

Dimensions

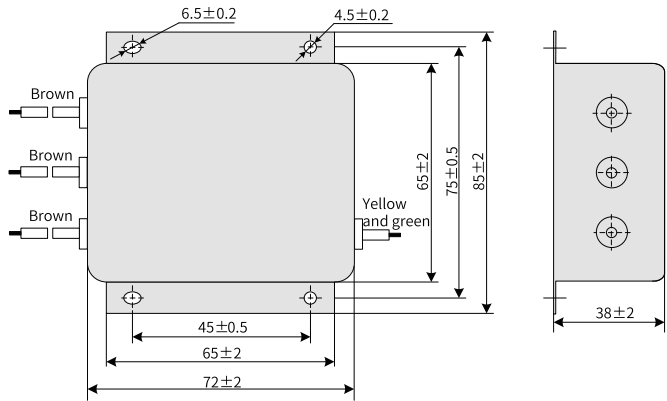


Figure 4-11 Dimensions of the simple filter

Table 4-7 Dimensions of the simple filter

Model	Code	Outline Dimension (Width × Depth x Height) (unit: mm)	Mounting Dimensions (Width x Depth) (unit: mm)
Cxy-1-1	11025018	85 x 72 x 38	45 x 75

Mounting method

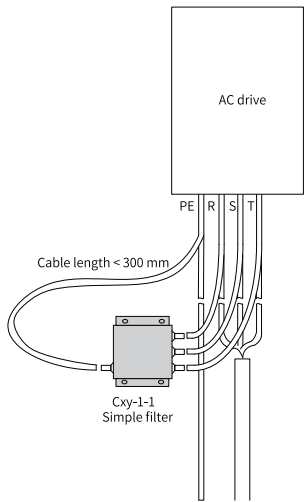


Figure 4-12 Simple filter installation

4.1.4 Braking Component

Resistance of braking resistors

During braking, almost all the regenerative energy of the motor is consumed by the braking resistor. The resistance of the braking resistor is calculated by the following formula: $U \times U/R = P_b$.

U indicates the braking voltage at system stable braking. The U value varies with systems. For three-phase 380 V to 480 V models, the default braking voltage of the drive is 760 V. For single-phase 200 V to 240 V models, the default braking voltage of the drive is 360 V. The braking voltage can be adjusted by parameter F1-02 of the power supply unit.

P_b indicates the braking power.

Power of braking resistors

In theory, the power of the braking resistor is the same as the braking power. However, in consideration of the derating coefficient K, the power of the braking resistor is calculated by the following formula: $K \times P_r = P_b \times D$.

K: about 50%

P_r : Power of the braking resistor

D indicates the braking frequency, that is, percentage of the regenerative process to the whole working process.

The following formulas can be generated based on the preceding equations:

$$K \times P_r = P_b \times D = U \times U/R \times D$$

$$P_r = (U \times U \times D)/(R \times K)$$

You can then calculate the power of the braking resistor.

K is the derating coefficient of the braking resistor. A small value of K prevents the braking resistor from overheating. You can increase the value of K properly if heat can be well dissipated, but in no case should K exceed 50%. Failure to comply may result in a fire due to braking resistor overheating.

The braking frequency D is determined based on actual applications. ["Table 4-8 " on page 129](#) lists the typical values in common applications.

Table 4-8 Typical braking frequencies in different applications

Common Application	General applications (such as translational conveying)	Vertical lifting	Machine tool spindle	Winding and unwinding
Braking frequency	10%	20% to 30%	30% to 50%	20% to 30%

Braking unit models

Table 4-9 Model selection of braking components

Power Supply Unit Model	Total Power of Drive Unit (kW)	Braking Unit	125% of Braking Torque (ED: 10% ; Max. 10s)		Minimum Braking Resistance (Ω)	Maximum Braking Current (A)	Braking Power (kW)
			Recommended Braking Resistor Specification	Quantity of Braking Resistors			
Single-phase 200 V to 240 V							
MD800-0-2S24 MD800-0-2S24B	2.2	Built-in, optional	450 W/66 Ω	1	40	10	2.8
MD800-0-2S40 MD800-0-2S40B	3.7		740 W/40 Ω	1	20	20	4.7
Three-phase 200 V to 240 V							
MD800-0-2T22B	3.7	Built-in, standard	740 W/40 Ω	1	32	25	4.7
MD800-0-2T41B	7.5		1500 W/20 Ω	1	20	40	9.4
Three-phase 380 V to 480 V							
MD800-0-4T12 MD800-0-4T12B	3.7	Built-in, optional	740 W/150 Ω	1	55	15	4.7
MD800-0-4T22 MD800-0-4T22B	7.5		1500 W/75 Ω	1	32	25	9.4
MD800-0-4T41 MD800-0-4T41B	15		3000 W/38 Ω	1	20	40	18.8

Note

- The braking resistance in the preceding table is calculated based on the braking usage rate (ED) of 10% and the longest time for single braking of 10s.
- When the grid voltage is different, you can adjust the initial braking voltage. If you increase the default initial braking voltage, you must also increase the resistance of the braking resistor. The default initial braking voltage is 760 V for three-phase 380 V to 480 V models and 360 V for single-phase 200 V to 240 V models.
- The data in the preceding table is only for reference. You can select the resistance and power of the braking resistor as required. (Note that the resistance cannot be lower than the recommended minimum value, whereas the power can exceed the recommended value.) The braking resistor model depends on the generation power of the motor in the actual system and is also related to the system inertia, deceleration time, and potential energy load. Select a proper braking resistor as required. Larger system inertia requires shorter deceleration time and more frequent braking. In this case, select a braking resistor with higher power and lower resistance.

4.1.5 Output Reactors

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

Models and dimensions (Inovance)

Models and dimensions of the recommended Inovance AC output reactors are as follows.

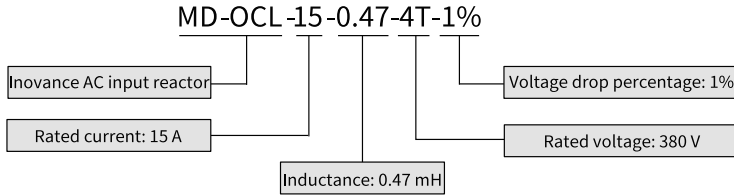


Figure 4-13 AC output reactor model

Table 4-10 Model selection of the AC output reactor (Inovance)

Drive Unit Model	Rated Output Current (Heavy Load) (A)	Motor Capacity (kW)	Reactor Model	Inductance (mH)	Loss (W)
Three-phase 200 V to 240 V					
MD800-1-2T1R7 MD800-1-2T1R7S MD800-2-2T1R7 MD800-2-2T1R7S	1.7	0.2	MD-OCL-5-1.4-4T-1%	1.4	15
MD800-1-2T3 MD800-1-2T3S MD800-2-2T3 MD800-2-2T3S	3.0	0.4	MD-OCL-5-1.4-4T-1%	1.4	15
MD800-1-2T5 MD800-1-2T5S MD800-2-2T5 MD800-2-2T5S	5.0	0.75	MD-OCL-5-1.4-4T-1%	1.4	15
MD800-1-2T8 MD800-1-2T8S MD800-2-2T8 MD800-2-2T8S	8.0	1.5	MD-OCL-10-0.7-4T-1%	1.4	15
MD800-1-2T11 MD800-1-2T11S MD800-2-2T11 MD800-2-2T11S	11.0	2.2	MD-OCL-15-0.47-4T-1%	1.0	20
MD800-1-2T17 MD800-1-2T17S	17	3.7	MD-OCL-20-0.35-4T-1%	0.35	32
Three-phase 380 V to 480 V					

Drive Unit Model	Rated Output Current (Heavy Load) (A)	Motor Capacity (kW)	Reactor Model	Inductance (mH)	Loss (W)
MD800-1-4T1R8 MD800-1-4T1R8S MD800-2-4T1R8 MD800-2-4T1R8S	1.8	0.4	MD-OCL-5-1.4-4T-1%	1.4	15
MD800-1-4T3R4 MD800-1-4T3R4S MD800-2-4T3R4 MD800-2-4T3R4S	3.4	0.75	MD-OCL-5-1.4-4T-1%	1.4	15
MD800-1-4T4R8 MD800-1-4T4R8S MD800-2-4T4R8 MD800-2-4T4R8S	4.8	1.5	MD-OCL-5-1.4-4T-1%	1.4	15
MD800-1-4T5R5 MD800-1-4T5R5S MD800-2-4T5R5 MD800-2-4T5R5S	5.5	2.2	MD-OCL-7-1.0-4T-1%	1.0	20
MD800-1-4T9R5 MD800-1-4T9R5S MD800-2-4T9R5 MD800-2-4T9R5S	9.5	3.7	MD-OCL-10-0.7-4T-1%	0.7	25
MD800-1-4T13 MD800-1-4T13S	13.0	5.5	MD-OCL-15-0.47-4T-1%	0.47	28
MD800-1-4T17 MD800-1-4T17S	17.0	7.5	MD-OCL-20-0.35-4T-1%	0.35	32

Dimensions of AC output reactors

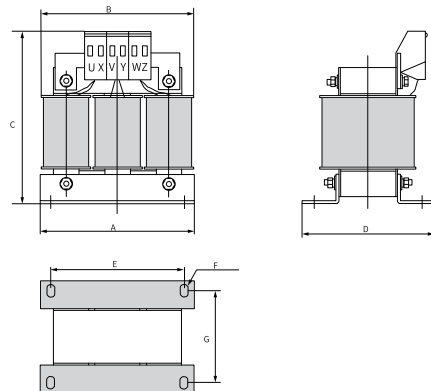


Figure 4-14 Dimensions of AC output reactors (5 A to 10 A)

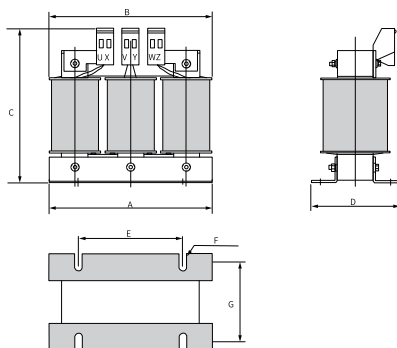


Figure 4-15 Dimensions of AC output reactors (15 A)

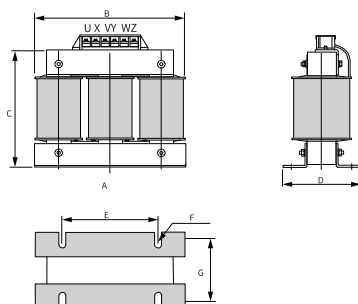


Figure 4-16 Dimensions of AC output reactors (20 A)

Table 4-11 Dimensions of AC output reactor (5 A to 20 A, unit: mm)

Rated Current (A)	A	B	C	D	E	F	G
5	105±1	110	130	84±2	91±1	4-6×11	65±2
7	105±1	110	130	84±2	91±1	4-6×11	65±2
10	105±1	110	130	84±2	91±1	4-6×11	65±2
15	148±1	155	140	76±2	95±1	4-6×15	61±2
20	148±1	155	165	76±2	95±1	4-6×15	61±2

Models and dimensions (Schaffner)

Models and dimensions of the recommended Schaffner AC output reactors are as follows.

Table 4-12 Model selection of the AC output reactor (Schaffner)

Drive Unit Model	Rated Output Current (Heavy Load) (A)	Motor Capacity (kW)	Reactor Model	Inductance (mH)	Loss (W)
Three-phase 200 V to 240 V					
MD800-1-2T1R7 MD800-1-2T1R7S MD800-2-2T1R7 MD800-2-2T1R7S	1.7	0.2	RWK 305-4-KL	1.47	22
MD800-1-2T3 MD800-1-2T3S MD800-2-2T3 MD800-2-2T3S	3.0	0.4	RWK 305-4-KL	1.47	22
MD800-1-2T5 MD800-1-2T5S MD800-2-2T5 MD800-2-2T5S	5.0	0.75	RWK 305-7.8-KL	0.754	25
MD800-1-2T8 MD800-1-2T8S MD800-2-2T8 MD800-2-2T8S	8.0	1.5	RWK 305-10-KL	0.588	30
MD800-1-2T11 MD800-1-2T11S MD800-2-2T11 MD800-2-2T11S	11.0	2.2	RWK 305-14-KL	0.42	34
MD800-1-2T17 MD800-1-2T17S	17	3.7	RWK 305-17-KL	0.184	55
Three-phase 380 V to 480 V					
MD800-1-4T1R8 MD800-1-4T1R8S MD800-2-4T1R8 MD800-2-4T1R8S	1.8	0.4	RWK 305-4-KL	1.47	22
MD800-1-4T3R4 MD800-1-4T3R4S MD800-2-4T3R4 MD800-2-4T3R4S	3.4	0.75	RWK 305-4-KL	1.47	22
MD800-1-4T4R8 MD800-1-4T4R8S MD800-2-4T4R8 MD800-2-4T4R8S	4.8	1.5	RWK 305-7.8-KL	0.754	25
MD800-1-4T5R5 MD800-1-4T5R5S MD800-2-4T5R5 MD800-2-4T5R5S	5.5	2.2	RWK 305-7.8-KL	0.754	25
MD800-1-4T9R5 MD800-1-4T9R5S MD800-2-4T9R5 MD800-2-4T9R5S	9.5	3.7	RWK 305-14-KL	0.42	34

Drive Unit Model	Rated Output Current (Heavy Load) (A)	Motor Capacity (kW)	Reactor Model	Inductance (mH)	Loss (W)
MD800-1-4T13 MD800-1-4T13S	13.0	5.5	RWK 305-17-KL	0.346	38
MD800-1-4T17 MD800-1-4T17S	17.0	7.5	RWK 305-17-KL	0.184	55

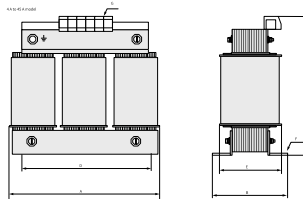


Figure 4-17 Dimensions of output reactors (4 A to 32 A)

Table 4-13 Dimensions of output reactors (4 A to 32 A, unit: mm)

Series	A	B	C	D	E	F	G
4 A and 7.8 A	100	Max. 60	Max. 115	56	34	4.8 x 9	2.5 mm ²
10 A	100	Max. 70	Max. 115	56	43	4.8 x 9	2.5 mm ²
14 A	125	Max. 70	Max. 135	100	45	5 x 8	2.5 mm ²
17 A	125	Max. 75	Max. 135	100	55	5 x 8	2.5 mm ²
32 A	155	Max. 95	Max. 170	130	56	85 x 12	2.5 mm ²

4.1.6 Magnetic Ring and Ferrite Clamp

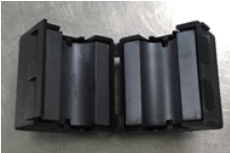
Model

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

The magnetic ring or ferrite clamp can also be used to suppress the leakage current or other signal cable interference in some applications.

- Amorphous magnetic ring: It features high permeability when the frequency is equal to or lower than 1 MHz and excellent suppression performance on interference generated by the drive. However, its cost is relatively high.
- Ferrite clamp: It can reduce noise of various signal cables when the frequency is higher than 1 MHz. In addition, it is cost-effective and easy to install.

Table 4-14 Appearance and models of the magnetic ring and ferrite clamp

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

Dimensions

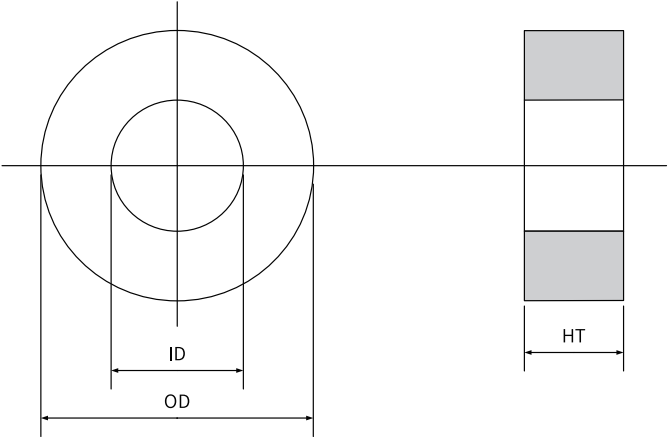


Figure 4-18 Dimensions of the magnetic ring

Table 4-15 Dimensions of the magnetic ring

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

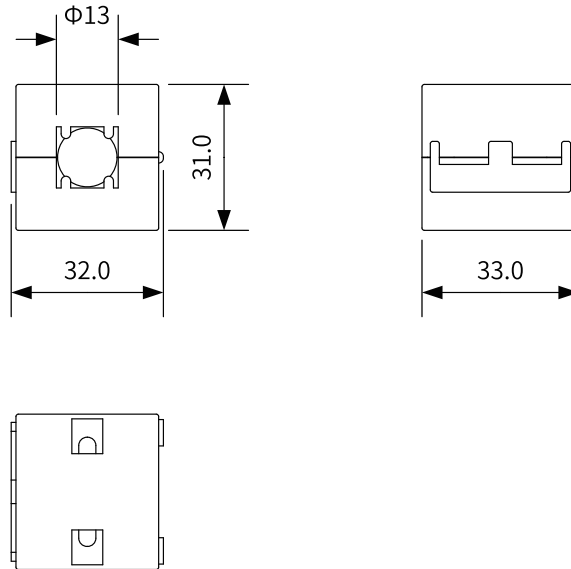


Figure 4-19 Dimensions of the ferrite clamp

Table 4-16 Dimensions of the ferrite clamp

Model	Dimension (Length x Outer Diameter x Inner Diameter) (mm)
74271225	32.8 x 28 x 13

4.1.7 Motor

To protect different load motors, set the motor overload protection gain based on the overload capacity of the motor. Generally, the default value of protection gain is used. However, it can be changed according to the actual motor heating conditions when any of the following conditions occurs:

- The motor works in the environment with high ambient temperature.
- The motor is in cyclic motion featuring a short motion cycle and frequent acceleration/deceleration.

The motor overload protection curve is an inverse time lag curve, as shown in the following figure.

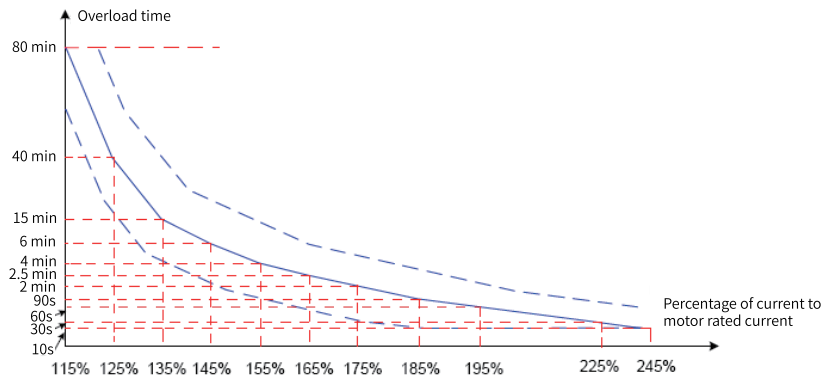


Figure 4-20 Motor overload protection curve

When the running current of the motor reaches 175% of the rated motor current and the motor runs at this level for 2 minutes, or when the running current of the motor reaches 115% of the rated motor current and the motor runs at this level for 80 minutes, the AC drive reports a motor overload alarm (E11.00).

Example 1: Assume that the rated motor current is 100 A.

If F9-01 is set to 1.00, when the motor runs at the current of 125 A (125% of the rated current 100 A) for 40 minutes, the AC drive reports E11.00 (motor overload). If F9-01 is set to 1.20, when the motor runs at the current of 125 A (125% of the rated current 100 A) for 48 minutes (40 x 1.2), the AC drive reports E11.00 (motor overload).

Note

The maximum overload time is 80 minutes and the minimum overload time is 10 seconds.

Example 2: The AC drive is required to report the overload fault when the motor runs at 150% of the rated current for two minutes.

As shown by the overload curve, 150% (I) of the rated motor current is between 145% (I1) and 155% (I2) of the rated motor current. The overload error reporting time for 145% of the rated motor current is 6 minutes (T1), and that for 155% of the rated motor current is 4 minutes (T2). Therefore, the overload error reporting time for 150% of the rated motor current in default settings can be calculated. The calculation formula is as follows:

$$T = T1 + (T2 - T1) \times (I - I1) / (I2 - I1) = 6 + (4 - 6) \times (150\% - 145\%) / (155\% - 145\%) = 5 \text{ (minute)}$$

Therefore, if the overload fault needs to be reported when the motor runs at 150% of the rated motor current for 2 minutes, set the motor overload protection gain F9-01 to 0.4 ($F9-01 = 2/5$).



Caution

Note: Set F9-01 (Motor overload protection gain) properly based on the actual overload capacity. If the value of F9-01 (Motor overload protection gain) is set too high, the motor may be damaged because the motor overheats but the AC drive does not report the alarm timely.

When the motor overload detection level reaches the value of F9-02 (motor overload warning coefficient), the DO or fault relay outputs the motor overload warning signal. The value of F9-02 is the percentage of the time duration during which the motor runs continuously at a certain overload point without reporting the overload fault.

On the condition that the motor overload protection gain is set to 1.00 and motor overload warning coefficient is set to 80%, when the motor running current reaches 145% of the rated motor current and the motor runs at this level for 4.8 min ($80\% \times 6$), the DO or fault relay outputs the motor overload warning signal.

The motor overload warning function is used to send a warning signal to the control system via the DO before the motor overload protection applies. The motor overload alarm coefficient is used to determine how early the alarm signal is sent before the motor overload protection applies. The higher the value is, the later the warning signal is sent. When the cumulative output current of the AC drive exceeds the product of multiplying the overload time (Y value of motor overload protection inverse time lag curve) and F9-02 (motor overload warning coefficient), the DO outputs an active motor overload warning signal.

When F9-02 is set to 100% and the warning advance value is 0, the motor overload warning and the motor overload protection are triggered simultaneously.

4.2 External LCD Operating Panel

SOP-20 is an external operating panel provided by Inovance for the AC drive. It adopts the LED display and has the same operation mode as the operating panel on the AC drive. It is optional and easy for commissioning. Its appearance and mounting dimensions are shown below.

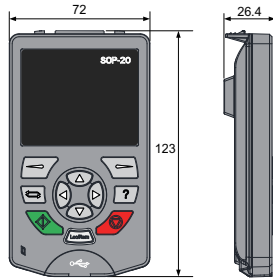


Figure 4-21 Overall dimensions of the external LCD operating panel (unit: mm)

4.3 EMC Shield Bracket

EMC shield brackets are optional. The EMC shield bracket for the power supply unit is installed at the input side of the power supply unit, and that for the drive unit is installed at the output side of the drive unit. EMC shield brackets can connect to the cable shield of the main circuit and ensure that the installed drives meet the EMC requirements. The accessory is used for re-fixing the power cable and stable grounding of the shield in 360°.

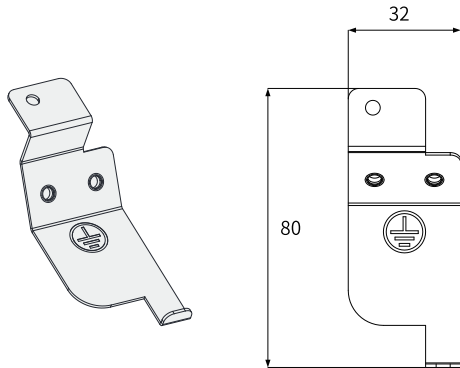


Figure 4-22 Dimensions of the EMC shield bracket for the power supply unit

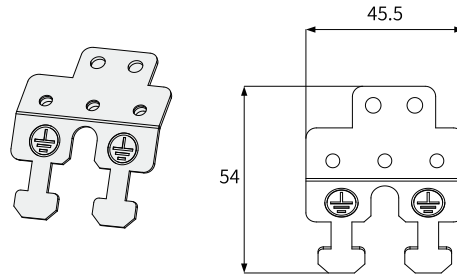


Figure 4-23 Dimensions of the EMC shield bracket for the drive unit

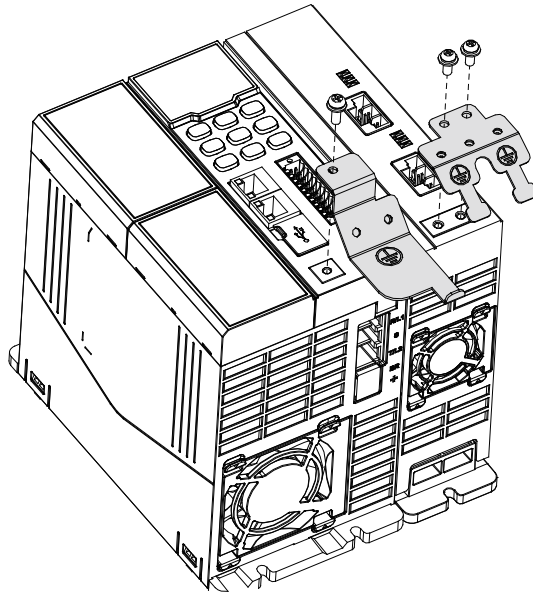


Figure 4-24 Mounting position of the EMC shield bracket

For installation details, see MD800 Series AC Drive (Multidrive System) Quick Installation and Commissioning Guide.

5 Installation Requirements on Options

5.1 AC Input Reactor

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

If an AC input reactor is required, ensure that sufficient installation space is reserved in the cabinet.

5.2 Output Reactor

With an output reactor installed at the output side of the AC 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.

5.3 Fuses, Contactors, and Circuit Breakers



Caution

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

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

5.4 EMC Filter

The optional EMC filter can meet the EN IEC 61800-3 C1/C2 emission requirements. Install the EMC filter according to the following requirements:

- Ground the EMC filter reliably.
- Install the EMC filter close to the input terminals, and keep the connection cable shorter than 30 cm.
- Connect the grounding terminal of the EMC filter to that of the AC drive, and install the EMC filter and the AC drive on the same conductive installation surface, which is connected to the main ground of the cabinet.

- Connect the LINE terminal of the EMC filter to the power grid, and the LOAD terminal to the AC drive.

5.5 Simple Filter

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

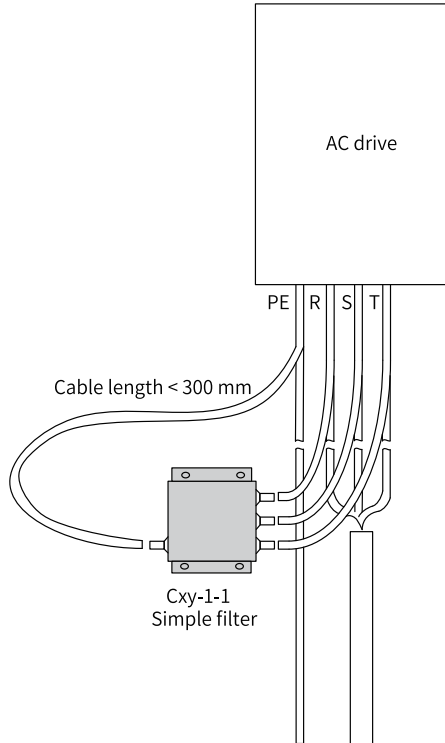


Figure 5-1 Installing a simple filter

5.6 Magnetic Ring and Buckle

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

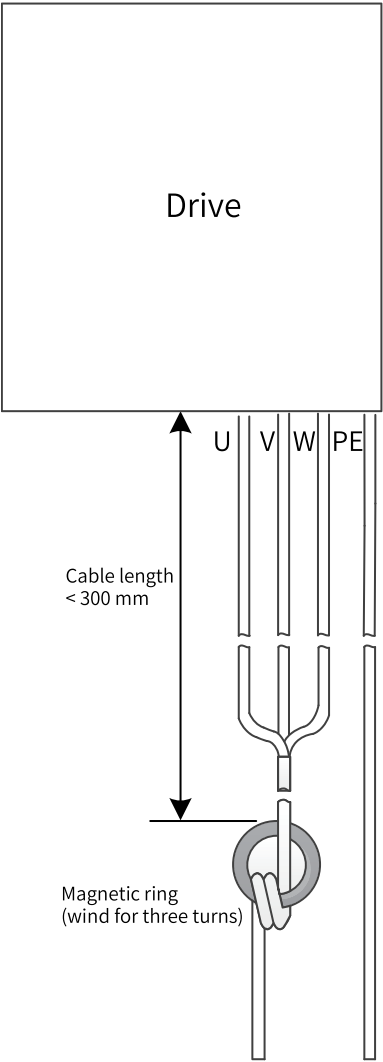


Figure 5-2 Installation of the magnetic ring

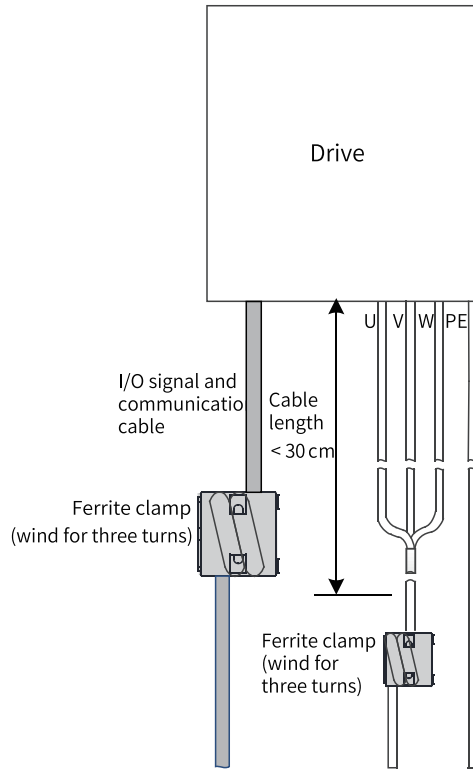


Figure 5-3 Installation of the magnetic buckle

Note

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

6 Solutions to Common EMC Problems

6.1 Residual Current Device Malfunction

Select a residual current device (RCD) according to the following requirements:

- The AC drive will generate certain high-frequency leakage current during operation. To avoid malfunction of the RCD, select a RCD with the action current of at least 100 mA for each AC drive.
- When multiple AC drives connected in parallel share one RCD, select a RCD with the action current not lower than 300 mA.
- Use recommended RCD brands like CHINT and SCHNEIDER.

When the RCD malfunctions, perform troubleshooting according to the following table.

Table 6-1 Troubleshooting for leakage current

Trip	Possible Cause	Solution
Trip upon power-on	The anti-interference performance of the RCD is poor.	1. Use a RCD from a recommended manufacturer. 2. Use a RCD with a higher tripping current. 3. Move the unbalanced load to the front end of the RCD. 4. If an EMC filter unit is installed, disconnect the EMC screws. 5. If an EMC filter is installed, disconnect the EMC filter.
	The action current of the RCD is too low.	
	Unbalanced load is connected to the back end of the RCD.	
	The capacitance to the ground at the front end of the AC drive is large.	
Trip during operation	The anti-interference performance of the RCD is poor.	1. Use a RCD from a recommended manufacturer. 2. Install an EMC filter unit or EMC filter. 3. Install a simple filter on the input side of the drive, and wind LN and RST cables through the magnetic ring near the RCD. 4. Use an RCD with a larger rated action current. 5. Reduce the carrier frequency while ensuring performance. 6. Use shorter motor cables.
	The action current of the RCD is too low.	
	Unbalanced load is connected to the back end of the RCD.	
	For motor cables and the motor, the distributed capacitance to ground is too high.	

6.2 Harmonic Suppression

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

6.3 Control Circuit Interference

6.3.1 Common I/O Signal Interference

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

Procedure	Solution
1	Use shielded I/O signal cables with the shield connected to the PE terminal.
2	Reliably connect the PE terminal of the motor to that of the AC drive, and connect the PE terminal of the AC drive to that of the power grid.
3	Add an equipotential bonding grounding cable between the host controller and the AC drive.
4	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables through the magnetic ring for two to four turns.
5	Increase the capacitor filter at the low-speed DI. The recommended maximum value is 0.1 μF . The required capacitor voltage withstanding level is 50 V or above.
6	Increase the capacitor filter at the AI. The recommended maximum value is 0.22 μF . The required capacitor voltage withstanding level is 50 V or above.
7	Install a ferrite clamp or a magnetic ring to the signal cable and wind the signal cable through the magnetic ring for one to two turns.
8	Use a shielded power cable and properly ground its shield.
9	Remove the grounding screw on the control board. For details, see "3.4.2 Grounding the Control Board" on page 115 .

6.4 Communication Interference

6.4.1 RS485 and CAN Communication Interference

In the case of interference, take the following rectification measures.

Procedure	Solution
1	Install a 120 Ω termination resistor at both ends of the bus.
2	Use multi-conductor shielded twisted pair cables and ground the shield at both ends.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	Adopt the daisy chain mode for multi-node communication.
5	For multi-node communication, add an equipotential bonding grounding cable between nodes.
6	Add a ferrite clamp at both ends of the communication cable or add a magnetic ring at both ends of the communication cable and wind the communication cable through the magnetic ring for one to two turns.
7	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables through the magnetic ring for two to four turns.
8	Use a shielded power cable and properly ground its shield.

6.4.2 EtherCAT, PROFINET, and Ethernet/IP Communication Interference

In the case of interference, take the following rectification measures.

No.	Step
1	Check that the communication network cables meet the specification requirements for shielded Cat 5e cables.
2	Check that the communication port is secure and in good contact.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	For multi-node communication, add an equipotential bonding grounding cable between nodes.
5	Check that the cable between two nodes is no longer than 100 m in length.
6	Install the ferrite clamp on both sides of the communication cable and wind the cable around the ferrite clamp by one or two turns.
7	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables through the magnetic ring for two to four turns.
8	Use a shielded power cable and properly ground its shield.
9	Install the EtherCAT, PROFINET, or Ethernet/IP communication expansion card to optional expansion card slot 2.

7 Certification and Standard Compliance

7.1 Compliance List

The following table lists the certifications, directives, and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

Certification Name	Directive Name		Standard
CE Certification	EMC Directive	2014/30/EU	EN IEC 61800-3
	LVD	2014/35/EU	EN 61800-5-1
	RoHS Directive	2011/65/EU	EN 50581
UL/cUL Certification	-		UL61800-5-1 C22.2 No.274-17
Safe Torque Off (STO) function	Machinery Directive	2006/42/EC	EN 61800-5-2 EN 62061:2005/A2 EN ISO 13849-1 EN 61508 ed.2
KC Certification	-		KN 61800-3

Note

The product meets the requirements of the latest instructions and standards of the CE/UL/cUL/STO certification.

7.2 CE Certification

7.2.1 Precautions for Compliance with European Standards



Figure 7-1 CE mark

- The CE mark indicates compliance with the Low Voltage Directive (LVD), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (RoHS) directives for commercial trades (production, import, and sales) in Europe.

- The CE mark is mandatory for engaging in commercial business (production, importation, and distribution) in Europe.
- The drive complies with the LVD, EMC, and RoHS directives and is labeled with the CE mark.
- The machinery and devices equipped with this product must also meet CE requirements when sold in Europe.
- The integrator who integrates this drive into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE certification.

7.2.2 Requirements for Compliance with EMC Directive

- The drive is applicable to the first environment and second environment and complies with EMC directive 2014/30/EU and standard EN IEC 61800-3.



Caution

If the product is used in the first environment, radio interference may be generated. 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 standards, install an EMC filter on the input side and use shielded cables on the output side. Ground the filter properly. Ground the shield of the output cable in 360 degrees.



Caution

The manufacturer of the system with the product installed must ensure that the system meets the requirements of the European EMC Directive, and ensure that the system meets the requirements of the standard EN IEC 61800-3 according to the application environment of the system.

EMC specifications

The drive complies with EN IEC 61800-3. The maximum length of the motor cable allowed by the conducted and radiated emission is shown in the following table.

Table 7-1 Maximum motor cable length allowed by conducted and radiated emission

Product Model	Maximum Cable Length Allowed by Conducted Emission				Maximum Cable Length Allowed by Radiated Emission			
	C1 class		C2 class		C1 class		C2 class	
	Built-in Filter	External EMC Filter	Built-in Filter	External EMC Filter	Built-in Filter	External EMC Filter	Built-in Filter	External EMC Filter
Single-phase model	-	10 m	-	25 m	-	-	-	25 m
Three-phase model	-	-	-	50 m	-	-	-	50 m

Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electronic and electrical devices or systems to work properly in the electromagnetic environment and not to generate electromagnetic interference that influences other local devices or systems. EMC includes the following requirements:

- The electromagnetic interference generated by a device during normal operation must be restricted within a certain limit.
- The device must have sufficient immunity to electromagnetic interference in the environment and can work properly in the environment with electromagnetic interference, which is described as electromagnetic sensitivity.

EN IEC 61800-3 defines the following two environments:

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

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

- C1 equipment: power drive system (PDS) with the rated voltage lower than 1000 V, which is intended for use in the first environment
- C2 equipment: PDS with the rated voltage lower than 1000 V, which is neither a plug-in device nor a movable device and is intended to be installed and commissioned only by professionals when used in the first environment.
- C3 equipment: PDS with the rated voltage lower than 1000 V, which is 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 higher than 1000 V or rated current equal to or higher than 400 A, or intended for use in complex systems in the second environment

7.2.3 Conditions for Compliance with the LVD

This product has been tested according to EN61800-5-1, and it complies with the Low Voltage Directive (LVD) completely. To enable machines and devices integrating this drive to comply with the LVD, the following requirements must be met.

Installation Location

Place this product in a location meeting OVC III and PD 2 or below, as specified in IEC 60664-1.

Installation Environment

For installation environment requirements, see "Installation Environment" in *Quick Start Guide (Installation & Commissioning)*.

Requirements on Installation and Protection

- This product must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations, and to relevant IEC requirements.
- When installing the product in a cabinet (IP20), install it in structures that cannot be accessed by foreign objects from the top and front.

Main Circuit Wiring Requirements

For details, see ["3.1.2 Main Circuit Wiring Requirements" on page 58](#).

Requirements on Protective Devices

To meet the requirements of EN 61800-5-1, a fuse/circuit breaker must be connected on the input side to prevent accidents caused by internal short circuits. For details about the selection of the fuse/circuit breaker, see ["4.1.1 Fuse, Circuit Breaker, and Contactor" on page 119](#).

7.3 UL or cUL Certification



Figure 7-2 UL/cUL Mark

- The UL/cUL mark is usually attached on products sold in USA and Canada. Products with UL/cUL mark have been inspected and assessed by the UL organization. To pass UL/cUL certification, main built-in components of electrical products must also be UL certified.

- This product has been tested in accordance with UL 61800-5-1 and CSA C22.2 No. 100-14 and has been confirmed to meet UL/CUL requirements. To enable machines and devices integrating this product to comply with UL/cUL standards, the following requirements must be met:

Installation Location

Install this product in a location meeting OVC III and PD 2 or below, as specified in UL61800-5-1.

Ambient Temperature

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

Ambient temperature for open type products: -20°C to +60°C

Requirements on Installation

This product is an open type product, which is installed in a cabinet. Its installation requirements are as follows:

This product must be installed in a fireproof final system that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations, and to relevant NEC requirements.

Main Circuit Wiring Requirements



Field installation is not allowed for output terminals BR, (-), and (+).

- Terminals BR and (+) are used to connect options. Do not connect them to the AC power supply.
- To protect the main circuit, separate it from the possible contact surface and provide covers as required.
- The control circuit is a safety extra-low voltage (SELV) circuit, which must be insulated and isolated from other circuits. Make sure that the control circuit is connected to the SELV circuit.
- Note that no foreign matter enters the wiring part of the terminal block.
- Do not carry out welding treatment when using stranded wires.
- The tightening torque of each terminal may be different. Tighten the screws according to the specified tightening torque using a torque screwdriver, ratchet, or wrench.
- If an electric tool is used to tighten the terminal screws, use a low speed setting to avoid damage to the terminal screws.

- Do not tighten the terminal screws at an angle of more than 5 degrees. Otherwise the terminal screws may be damaged.

Control Circuit Wiring Requirements

Wire the control circuit in accordance with UL61800-5-1.

Cable Selection Requirements for the Main Circuit

For the selection of wire dimensions, follow the requirements of National Electrical Code (NEC) and Part 1 of Canadian Electrical Code (CEC) and relevant local regulations.

- Copper wires must be used.
- The recommended cable size of the main circuit is 600V Class 2 heat-resistant indoor PVC cable with a continuous maximum allowable temperature of 75 °C. The following conditions are used as premises:

1. Ambient temperature: < 40°C
2. Normal operating ratings

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

Cable Selection

For details, see ["3.1.4 Main Circuit Cable Selection" on page 63](#).

Requirements on Protective Devices

- To meet the requirements of UL standards, a fuse/circuit breaker must be connected on the input side to prevent accidents caused by internal short circuits.
- Install adequate branch circuits for short circuit protection in accordance with applicable regulations and the requirements in this user guide. This product is suitable for circuits with a short circuit current lower than 100 kA, and the maximum voltage of 480 VAC (400 V). For details about the selection of the fuse/circuit breaker, see ["4.1.1 Fuse, Circuit Breaker, and Contactor" on page 119](#).

7.4 KC Certification



Applicant Suzhou Inovance Technology Co., Ltd.

AC Drive

Model MD800 series

Made In China

Manufacturer

Suzhou Inovance Technology Co.,Ltd.

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www.inovance.com

Suzhou Inovance Technology Co., Ltd.

www.inovance.com

Add.: Inovance Headquarters Tower, High-tech Industrial Park,
Guanlan Street, Longhua New District,
Shenzhen 518000, P.R. China

Tel: (0755) 2979 9595

Fax: (0755) 2961 9897

Add.: No.52, Tian'e Dang Road, Wuzhong District,
Suzhou 215104, P.R. China

Tel: (0512) 6637 6666

Fax: (0512) 6285 6720