



## MD810 Series Standard Drive (Multidrive System) Hardware Guide



Industrial  
Automation



Intelligent  
Elevator



New Energy  
Vehicle



Industrial  
Robot



Rail  
Transit



Data code 19011960 A00

# Preface

## About This Guide

The MD810 series is a new-generation low-voltage multidrive system. It is also a common DC bus drive system consisting of the power supply unit and the drive unit, which can meet requirements of a single mechanical device with multiple drive points and continuous production line system. It is widely used in metal products, printing and packaging, textile printing and dyeing, chemical fiber and plastics, small-sized papermaking, hoisting and other industries.

This guide introduces the product information, mechanical design, electrical design, optional accessories, EMC FAQs, certifications, and other information of the MD810 series.

## More Data

Data Name	Data Code	Description
MD810 Series Standard Drive (Multidrive System) Hardware Guide	19011960	Describes the product information, mechanical design, electrical design, options, EMC FAQs, and certifications.
MD810 Series Standard Drive (Multidrive System) Installation Guide	19011961	Describes the installation and wiring of the drive, including pre-installation preparations, unpacking and transportation, mechanical installation, and electrical installation.
MD810 Series Standard Drive (Multidrive System) Maintenance Guide	19011962	Describes the routine product maintenance, component replacement, and troubleshooting.
MD810 Series Standard Drive (Multidrive System) Commissioning Guide	19011964	Describes the quick commissioning procedure, commissioning parameter list, and commissioning troubleshooting.
MD810 Series Standard Drive (Multidrive System) Communication Guide	19011965	Describes the communication mode, communication networking, and communication configuration.
MD810 Series Standard Drive (Multidrive System) Function Guide	19011963	Describes the commissioning tools, system commissioning steps, parameters, fault codes, and product functions and applications.

## Revision History

Date	Version	Revision
May 2022	A00	First release.

## How to Obtain

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

Log in to Inovance's website (<http://en.inovance.cn/>), choose **Support > Download**, search by keyword, and then download the PDF file.

# Table of Contents

Preface .....	1
Fundamental Safety Instructions .....	6
1 Product Information .....	12
1.1 Nameplate and Model .....	12
1.1.1 Power Supply Unit Nameplate and Model .....	12
1.1.2 Drive Unit Nameplate and Model .....	13
1.2 Product Model List .....	14
1.3 Technical Specifications .....	15
1.3.1 Technical Specifications of the Power Supply Unit .....	15
1.3.2 Technical Specifications of the Drive Unit .....	17
1.4 Components .....	21
1.4.1 Components of the Power Supply Unit .....	21
1.4.2 Components of the Drive Unit .....	22
1.5 System Architecture .....	24
1.6 List of Options .....	26
1.7 System Selection .....	29
1.7.1 System Selection Flow .....	29
1.7.2 Load and Motor Selection .....	30
1.7.3 Drive Unit Selection .....	30
1.7.4 Power Supply Unit Selection .....	30
1.7.5 System Combination and Arrangement .....	31
2 Mechanical Design .....	34
2.1 Layout and Dimension .....	34
2.1.1 Layout and Dimension of the Power Supply Unit .....	34
2.1.2 Layout and Dimension of the Drive Unit (Single-Axis) .....	35
2.1.3 Layout and Dimension of the Drive Unit (Dual-Axis) .....	37
2.2 Cabinet Design .....	39
2.2.1 Clearance Requirements .....	39
2.2.2 Mounting Backplate Design Requirements .....	41
2.2.3 Cabinet Cooling Design .....	44
3 Electrical Design .....	53
3.1 Electrical Wiring .....	53
3.2 Layout and Description of Main Circuit Terminals .....	55
3.2.1 Layout and Description of Main Circuit Terminals for the Power Supply Unit .....	55
3.2.2 Layout and Description of Main Circuit Terminals for the Drive Unit (Single-Axis) .....	57
3.2.3 Layout and Description of Main Circuit Terminals for the Drive Unit (Dual-Axis) .....	59
3.3 Wiring Descriptions of Main Circuit Terminals .....	60
3.4 Cable Selection for Main Circuits .....	63

3.5	Layout and Description of Control Circuit Terminals . . . . .	67
3.5.1	Layout and Description of Control Circuit Terminals for the Power Supply Unit . . . . .	67
3.5.1.1	Relationship Between Power Supply Unit Models and Control Circuit Terminals . . . . .	67
3.5.1.2	Layout of Control Circuit Terminals for the Power Supply Unit . . . . .	68
3.5.1.3	Descriptions of Control Circuit Terminals for the Power Supply Unit. . . . .	70
3.5.2	Layout and Description of Control Circuit Terminals for the Drive Unit (Single-Axis) . . . . .	74
3.5.2.1	Relationship Between Drive Unit (Single Axis) Models and Control Circuit Terminals . . . . .	74
3.5.2.2	Layout of Control Circuit Terminals for the Drive Unit (Single-Axis) . . . . .	76
3.5.2.3	Descriptions of Control Circuit Terminals for the Drive Unit (Single-Axis) . . . . .	80
3.5.3	Layout and Description of Control Circuit Terminals for the Drive Unit (Dual-Axis) . . . . .	87
3.5.3.1	Relationship Between Drive Unit (Dual-axis) Models and Control Circuit Terminals . . . . .	87
3.5.3.2	Layout of Control Circuit Terminals for the Drive Unit (Dual-Axis) . . . . .	89
3.5.3.3	Descriptions of Control Circuit Terminals for the Drive Unit (Dual-Axis) . . . . .	92
3.6	Cable Selection and Wiring Requirements for Control Circuits . . . . .	98
3.7	I/O Signal Terminal Wiring . . . . .	99
3.7.1	Wiring the DI . . . . .	99
3.7.2	Wiring the DIO1 and DIO2 . . . . .	100
3.7.3	Wiring the AI . . . . .	101
3.7.4	Wiring the AO . . . . .	104
3.7.5	Wiring the Relay Output Terminal . . . . .	104
3.8	Communication Connection . . . . .	106
3.8.1	RS485 Communication Connection . . . . .	106
3.8.2	CAN Communication Connection . . . . .	109
3.8.3	PROFIBUS DP and PROFIBUS DP-to-CAN Communication Connection. . . . .	114
3.8.4	PROFINET-to-CAN Communication Connection . . . . .	117
3.8.5	EtherCAT Communication Connection . . . . .	119
3.9	Encoder Signal Connection . . . . .	121
3.9.1	Wiring ABZ Encoders . . . . .	121
3.9.1.1	Encoder Terminals and Specifications . . . . .	121
3.9.1.2	Differential Input Wiring . . . . .	122
3.9.1.3	Collector Input Wiring . . . . .	125
3.9.1.4	Push-Pull Input Wiring . . . . .	126
3.9.1.5	Distinguishing Collector Output Encoders from Push-Pull Output Encoders. . . . .	127
3.9.2	Wiring Resolver Encoders . . . . .	128
3.9.3	Wiring Sin-Cos Encoders . . . . .	130
3.9.4	Wiring Inovance 23-Bit Communication Encoders . . . . .	131
3.9.5	Wiring SSI Encoders . . . . .	133
3.9.6	Incremental Frequency Division Output . . . . .	136
3.9.7	Selecting Filter Modes . . . . .	137
3.10	Wiring STO Terminals . . . . .	138
3.11	Grounding . . . . .	140
3.11.1	Grounding the Control Board . . . . .	140
3.11.2	Grounding a Single Device. . . . .	141
3.11.3	Grounding of Multiple Devices . . . . .	142

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3.11.4 Grounding the Cabinet System . . . . .	143
4 Option Selection . . . . .	145
4.1 Co-bus External Power Terminal . . . . .	145
4.2 Through-hole Mounting Bracket. . . . .	145
4.3 Air Guide Plate . . . . .	146
4.4 Shield Bracket. . . . .	146
4.5 External LCD Operating Panel . . . . .	147
4.6 DC Soft Charge Unit . . . . .	148
4.7 Braking Component . . . . .	151
4.8 PROFIBUS DP Bus Adapter . . . . .	153
4.9 Peripheral Components . . . . .	154
4.9.1 List of Peripheral Components . . . . .	154
4.9.2 Fuse, Contactor, and Circuit Breaker . . . . .	156
4.9.3 Cable Lug. . . . .	156
4.9.4 Bus Fuse. . . . .	159
4.9.5 DC Circuit Breaker . . . . .	160
4.9.6 AC Input Reactor. . . . .	160
4.9.7 AC Output Reactor . . . . .	165
4.9.8 EMC Filter. . . . .	174
4.9.9 Simple Filter . . . . .	179
4.9.10 Magnetic Ring and Buckle . . . . .	180
5 Troubleshooting of Common EMC Problems . . . . .	184
5.1 RCD Selection and Measurement Against Leakage . . . . .	184
5.2 Harmonic Suppression . . . . .	185
5.3 Common I/O Signal Interference . . . . .	185
5.4 Communication Interference . . . . .	185
5.4.1 RS485 and CAN Communication Interference. . . . .	185
5.4.2 EtherCAT and PROFINET Communication Interference. . . . .	186
6 Certification and Standard Compliance . . . . .	187
6.1 Compliance List . . . . .	187
6.2 CE Certification . . . . .	187
6.2.1 Precautions for Compliance with European Norms . . . . .	187
6.2.2 Requirement for Compliance with EMC Directive. . . . .	188
6.2.3 Requirements for Compliance with the LVD . . . . .	190
6.3 UL or cUL Certification . . . . .	190
6.4 KC certification . . . . .	193
Appendix Requirements for Coolant and Circulation System of Water-Cooled Models . . . . .	194

# Fundamental Safety Instructions

## Safety Precautions

1. This chapter presents essential safety instructions for a proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to comply with the safety instructions may result in death, severe personal injuries, or equipment damage.
2. "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.
3. Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
4. Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

## Safety Levels and Definitions



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



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



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

## General Safety Instructions

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

### Unpacking



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



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

### Storage and Transportation



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



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

### Installation



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



 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 devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.

 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 shavings, 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 will result in equipment damage or even a fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in a fire.
- After wiring is done, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in an electric shock or equipment damage.

**CAUTION**

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

**Power-on****DANGER**

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

**WARNING**

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

**Operation****DANGER**

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

**WARNING**

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

#### Maintenance



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



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

#### Repair



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




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

**Disposal****WARNING**

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

**Safety Labels**

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. The following table describes the safety label.

Safety Label	Description
	<ul style="list-style-type: none"> <li>• Read through the safety instructions before operating the equipment. Failure to comply may result in death, personal injuries, or equipment damage.</li> <li>• 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.</li> </ul>

# 1 Product Information

## 1.1 Nameplate and Model

### 1.1.1 Power Supply Unit Nameplate and Model

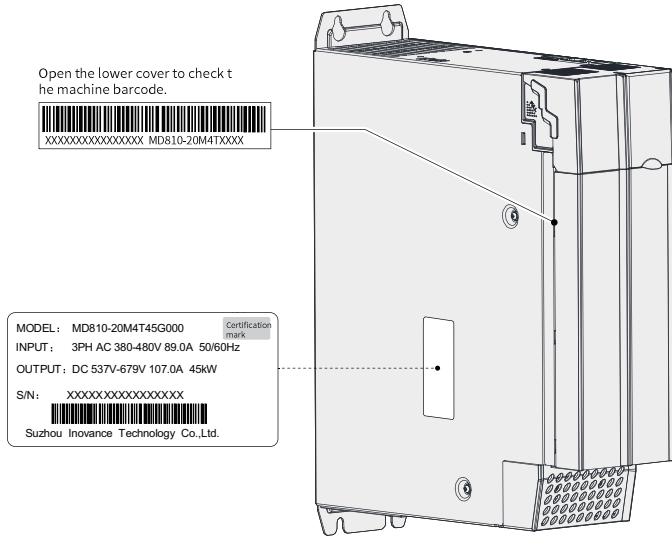


Figure 1-1 Power supply unit nameplate

### MD810 - 20M 4T 45 G 0 0 0 W

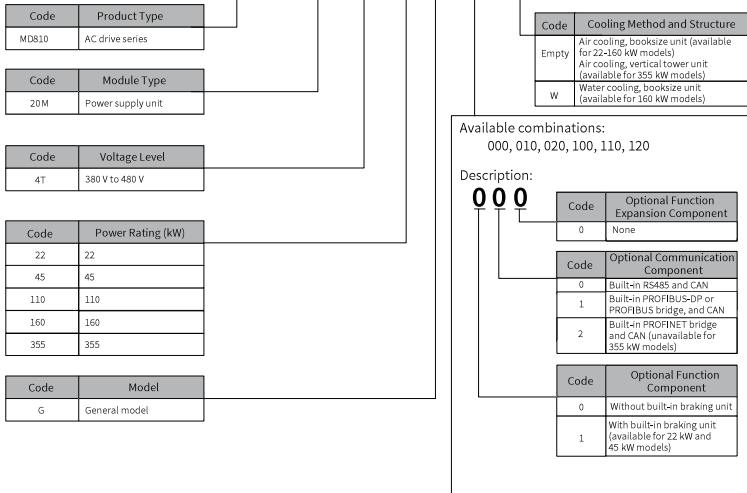


Figure 1-2 Power supply unit model

### 1.1.2 Drive Unit Nameplate and Model

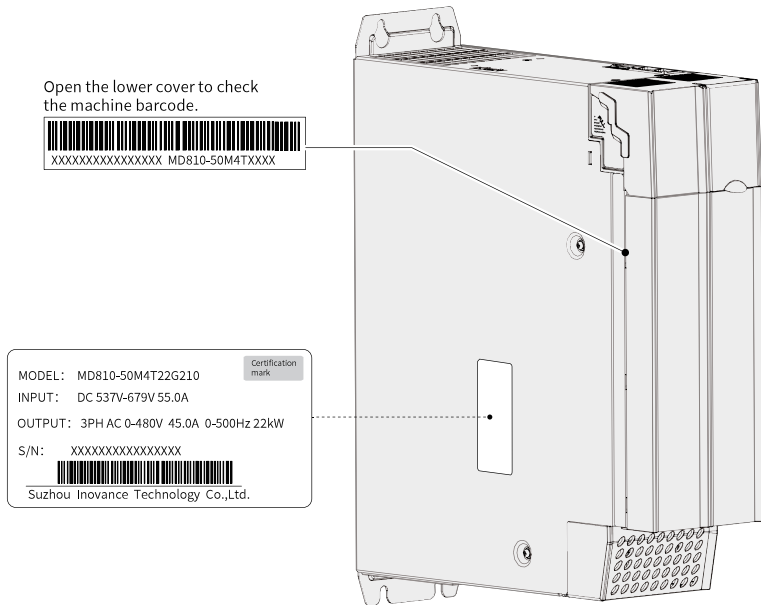


Figure 1-3 Drive unit nameplate

### MD810- 50M 4T D 45 G 0 0 0 W

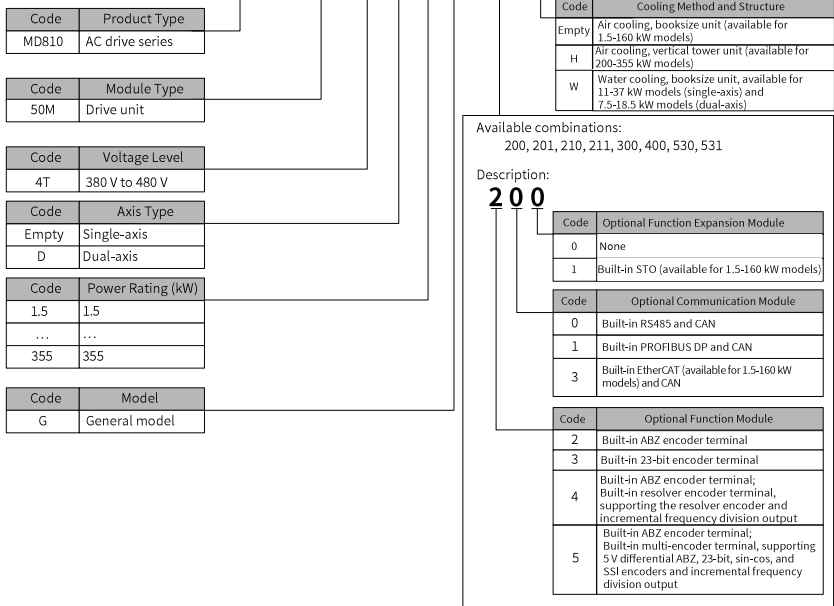


Figure 1-4 Drive unit model

## 1.2 Product Model List

Component	Structure	Width	Power	Model
Power supply unit	Booksize	50 mm	22 kW	MD810-20M4T22GXXX
		100 mm	45 kW	MD810-20M4T45GXXX
		200 mm	110 kW	MD810-20M4T110GXXX
		300 mm	160 kW	MD810-20M4T160GXXX (W)
	Vertical tower	180 mm	355 kW	MD810-20M4T355G000 MD810-20M4T355G010
Drive unit (single-axis)	Booksize	50 mm	1.5–7.5 kW	MD810-50M4T1.5GXXX
				MD810-50M4T2.2GXXX
				MD810-50M4T3.7GXXX
				MD810-50M4T5.5GXXX
				MD810-50M4T7.5GXXX
	Booksize	100 mm	11–37 kW	MD810-50M4T11GXXX (W)
				MD810-50M4T15GXXX (W)
				MD810-50M4T18.5GXXX(W)
				MD810-50M4T22GXXX (W)
				MD810-50M4T30GXXX (W)

Component	Structure	Width	Power	Model	
		200 mm	45–75 kW	MD810-50M4T37GXXX (W)	
				MD810-50M4T45GXXX	
				MD810-50M4T55GXXX	
				MD810-50M4T75GXXX	
		300 mm	90–160 kW	MD810-50M4T90GXXX	
				MD810-50M4T110GXXX	
				MD810-50M4T132GXXX	
	Vertical tower	230 mm	200–355 kW	MD810-50M4T160GXXX	
				MD810-50M4T200G200H	
				MD810-50M4T200G210H	
				MD810-50M4T250G200H	
				MD810-50M4T250G210H	
				MD810-50M4T315G200H	
				MD810-50M4T315G210H	
	Drive unit (dual-axis)	Booksize	50 mm	1.5–5.5 kW	MD810-50M4TD1.5GXXX
					MD810-50M4TD2.2GXXX
					MD810-50M4TD3.7GXXX
MD810-50M4TD5.5GXXX					
			100 mm	7.5–18.5 kW	MD810-50M4TD7.5GXXX(W)
					MD810-50M4TD11GXXX (W)
					MD810-50M4TD15GXXX (W)
					MD810-50M4TD18.5GXXX(W)

## 1.3 Technical Specifications

### 1.3.1 Technical Specifications of the Power Supply Unit

Table 1–1 Rated specifications

Power Supply Unit Model	Rated Power (kW)	Power Capacity (kVA)	Input Current AC (A)	Output Current DC (A)	Braking Unit	Thermal Power (W)
Three-phase 380-480 V, 50 Hz/60 Hz (47-63 Hz)						
MD810-20M4T22GXXX	22	45	49	56	Optional built-in braking unit	176
MD810-20M4T45GXXX	45	81	89	107	Optional built-in braking unit	290



Power Supply Unit Model	Rated Power (kW)	Power Capacity (kVA)	Input Current AC (A)	Output Current DC (A)	Braking Unit	Thermal Power (W)
Three-phase 380-480 V, 50 Hz/60 Hz (47-63 Hz)						
MD810-20M4T110GXXX	110	179	196	240	Optional external MDBUN series	590
MD810-20M4T160GXXX(W)	160	267	292	358	Optional external MDBUN series	880
MD810-20M4T355GXXX	355	566	619	759	Optional external MDBUN series	1525

Table 1-2 Technical specifications

Item		Specification
Basic parameters	Mains voltage	Three-phase 380-480 VAC; 323-528 VAC (-15% to +10%)
	Power range	22 kW, 45 kW, 110 kW, 160 kW, 355 kW
	Mains type	TN, TT, and IT star topologies
	Input frequency	50 Hz/60 Hz (47-63 Hz)
	Braking	The braking module and braking resistor are used for braking.
Customized functions	Communication/Bus	<p>Different models support different communication protocols. For details, see the optional communication components in <a href="#">"Figure 1-2" on page 13</a>.</p> <p>Communication protocols are described as follows:</p> <ul style="list-style-type: none"> <li>● Modbus-RTU: Maximum baud rate of 115200; 128 nodes, maximum distance of 1000 m</li> <li>● PROFIBUS DP: Baud rate of 12 Mbps; 32 nodes; maximum distance of 100 m</li> <li>● CANopen: Baud rate of 1 Mbps; 64 nodes; maximum distance of 40 m</li> <li>● CANlink: Baud rate of 1 Mbps; 18 nodes; maximum distance of 20 m</li> <li>● PROFINET: Baud rate of 100 Mbps; 65535 nodes; maximum distance of 100 m</li> </ul>
HMI	DI and DO	1 common multi-functional input terminal; programmable; isolated sink/source input; operating voltage range: 9-30 V; invalid voltage: < 5 V; input impedance: 3 kΩ; meeting the requirements for 100 Hz frequency input 3 relay output terminals; programmable NO/NC contacts
	Operating panel and display	Standard 5-digit LED display, 5 keys
Environment	Ambient temperature	Operating temperature: -10°C to +50°C; temperature change rate: < 0.5°C/min; temperature above 40°C: The rated current is derated by 1.5% for every additional 1°C.
		Storage temperature: -25°C to +70°C
		Transportation temperature: -25°C to +70°C
	Relative humidity	Relative humidity for operation: 5% to 95%
		Relative humidity for storage: 5% to 95%
		Relative humidity for transportation: lower than 95% at +40 °C
Altitude	Star power grid: maximum 3000 m	

Item	Specification
	$\leq 1000$ m (3281 ft): derating not required $> 1000$ m (3281 ft): derated by 1% for every additional 100 m (328.1 ft)
Protection functions	Protection for overtemperature, power phase loss, unbalance detection of three-phase input voltage, overvoltage, braking circuit overcurrent, braking resistor short circuit, and braking transistor direct connection detection
IP rating	IP20
Cooling modes	Air cooling or water cooling Different models support different cooling modes. For details, see "Figure 1-2" on page 13.

### 1.3.2 Technical Specifications of the Drive Unit

Table 1-3 Rated specifications of the drive unit (single-axis)

Drive Unit Model	Rated Power kW	Input Current DC (A)	Output current AC (A)	Applicable Motor		Thermal Loss (W)
				kW	HP	
537-679 VDC (operating range: 350-800 VDC); output voltage: 0-480 VAC						
MD810-50M4T1.5GXXX	1.5	4.9	3.8	1.5	2	47
MD810-50M4T2.2GXXX	2.2	7	5.1	2.2	3	59
MD810-50M4T3.7GXXX	3.7	12	9	3.7	5	76
MD810-50M4T5.5GXXX	5.5	17	13	5.5	7.5	127
MD810-50M4T7.5GXXX	7.5	22	17	7.5	10	155
MD810-50M4T11GXXX (W)	11	31	25	11	15	249
MD810-50M4T15GXXX (W)	15	40	32	15	20	294
MD810- 50M4T18.5GXXX(W)	18.5	46	37	18.5	25	343
MD810-50M4T22GXXX (W)	22	55	45	22	30	425
MD810-50M4T30GXXX (W)	30	73	60	30	40	526
MD810-50M4T37GXXX (W)	37	90	75	37	50	669
MD810-50M4T45GXXX	45	105	91	45	60	817
MD810-50M4T55GXXX	55	129	112	55	70	1033
MD810-50M4T75GXXX	75	172	150	75	100	1379
MD810-50M4T90GXXX	90	205	184	90	125	1434
MD810-50M4T110GXXX	110	245	224	110	150	1801
MD810-50M4T132GXXX	132	290	262	132	180	2178
MD810-50M4T160GXXX	160	335	304	160	220	2405
MD810- 50M4T200GXXXH	200	420	377	200	270	3342

Drive Unit Model	Rated Power kW	Input Current DC (A)	Output current AC (A)	Applicable Motor		Thermal Loss (W)
				kW	HP	
537-679 VDC (operating range: 350-800 VDC); output voltage: 0-480 VAC						
MD810-50M4T250GXXXH	250	515	465	250	330	5109
MD810-50M4T315GXXXH	315	650	585	315	420	6143
MD810-50M4T355GXXXH	355	725	650	355	475	7912

Table 1-4 Technical specifications of the drive unit (dual-axis)

Drive Unit Model	Rated Power kW	Input Current DC (A)	Output current AC (A)	Applicable Motor		Thermal Loss (W)
				kW	HP	
537-679 VDC (operating range: 350-800 VDC); output voltage: 0-480 VAC						
MD810-50M4TD1.5GXXX	1.5	10	3.8	1.5	2	91
MD810-50M4TD2.2GXXX	2.2	14	5.1	2.2	3	116
MD810-50M4TD3.7GXXX	3.7	24	9	3.7	5	151
MD810-50M4TD5.5GXXX	5.5	34	13	5.5	7.5	252
MD810-50M4TD7.5GXXX(W)	7.5	44	17	7.5	10	307
MD810-50M4TD11GXXX(W)	11	62	25	11	15	483
MD810-50M4TD15GXXX(W)	15	80	32	15	20	573
MD810-50M4TD18.5GXXX(W)	18.5	92	37	18.5	25	672

Table 1-5 Technical specifications of the drive unit

Item		Specification
Basic parameters	Mains voltage	Three-phase 380-480 VAC; 323-528 VAC (-15% to +10%)
	Power range	Drive unit (single-axis): 1.5-355 kW Drive unit (dual-axis): 1.5-18.5 kW
	Mains type	TN, TT, and IT star topologies
	Input voltage	537-679 VDC (operating range: 350-800 VDC)
	Input frequency	0-500 Hz
	Input frequency resolution	Digital setting: 0.01 Hz Analog setting: maximum frequency x 0.025%.

Item	Specification		
Carrier frequency	V/f control: 0.8-12 kHz SVC and FVC: 2-6 kHz The carrier frequency is automatically adjusted based on heatsink temperature.		
Output frequency	VF/f control: 0-600 Hz SVC and FVC: 0-600 Hz		
Braking	The braking module and braking resistor are used for braking.		
Motor type and control mode	Three-phase asynchronous motor: V/f control, SVC, and FVC Permanent magnet synchronous motor (PMSM): SVC and FVC		
Speed regulation range	1:50 (asynchronous motor in V/f control mode) 1:100 (asynchronous motor in SVC mode) 1:1000 (asynchronous motor in FVC mode)		
Speed control accuracy	±1.0% (V/f control) ±0.5% (SVC) ±0.02% (FVC)		
Speed fluctuation	±0.5% (SVC) ±0.2% (FVC)		
Torque response time	< 20 ms (SVC) < 5 ms (FVC)		
Torque control accuracy	±5% (SVC, above 10 Hz) ±3% (FVC)		
Torque control mode	SVC and FVC		
Overload capability	115% the rated load: 1 hour 150% the rated load: 1 minute 178% the rated load: 2 seconds		
Torque boost	Automatic boost; manual boost: 0.1 % to 30.0 %.		
V/f curve	Straight-line V/f curve, multi-point V/f curve, square V/f curve, complete V/f separation, half V/f separation		
Customized functions	Acceleration/Deceleration curve		
	Built-in PID		
	Communication/Bus		
	Running command source		
Straight line, S curve mode 1, S curve mode 2.	Two sets of PID parameters, implementing the process closed-loop control system.	Different models support different communication protocols. For details, see <a href="#">"Figure 1-4" on page 14</a> . Communication protocols are described as follows: <ul style="list-style-type: none"> <li>● Modbus-RTU: Maximum baud rate of 115200; 128 nodes; maximum distance of 1000 m</li> <li>● PROFIBUS DP (model dependent): Baud rate of 12 Mbps; 32 nodes; maximum distance of 100 m</li> <li>● CANopen: Baud rate of 1 Mbps; 64 nodes; maximum distance of 40 m</li> <li>● CANlink: Baud rate of 1 Mbps; 18 nodes; maximum distance of 20 m</li> <li>● EtherCAT: Baud rate of 100 Mbps; 65535 nodes; maximum distance of 100 m</li> </ul>	3 sources, including the LED operating panel or external LCD operating panel, the control terminal, and serial communication port The sources can be switched in various ways.

Item		Specification
	Frequency source	8 frequency sources, including the digital setting, voltage type analog setting, current type analog setting, pulse setting, communication setting, PID, multi-speed, and built-in simple PLC The sources can be switched or superposed in various ways.
	Wobble	Various triangular wave frequency control functions are provided.
	Distance- or time-based control	Operation distance- or operation time-based control is implemented.
HMI	AI	AI1: 0 V to 10 V and -10 V to +10 V available; 12-bit resolution; correction accuracy error: $\pm 3\%$ ; input impedance: 22.1 k $\Omega$ AI2: 0 V to 10 V and 0 mA to 20 mA available; 12-bit; correction accuracy error: $\pm 0.3\%$ ; input impedance in voltage input mode: 22.1 k $\Omega$ ; input impedance in current input mode: 500 $\Omega$ or 250 $\Omega$ .
	AO	0 V to 10 V and 0 mA to 20 mA available; 12-bit resolution; correction accuracy error: $\pm 0.5\%$ ; maximum load output current in voltage mode: 2 mA; load impedance in voltage mode: > 5 k $\Omega$ ; load impedance in current mode: < 500 $\Omega$
	DI and DO	Single-axis: <ul style="list-style-type: none"> <li>2 DIs, PNP or NPN input method available</li> <li>2 DI/DOs. When the DI/DO is used as the DI, the PNP or NPN input method is available. When the DI/DO is used as the DO, only the NPN input method is available. When DIO1 is used as the DI, the maximum input frequency is 100 Hz. When DIO2 is used as the DO, the maximum output frequency is 100 Hz.</li> <li>1 relay output terminal; programmable normally open (NO)/normally closed (NC) contact</li> </ul> Dual-axis: <ul style="list-style-type: none"> <li>1 DI per axis, PNP or NPN input method available</li> <li>1 DI/DO for each axis. When the DI/DO is used as the DI, the PNP or NPN input mode method is available, and the maximum input frequency is 100 Hz. When DI/DO is used as the DO, only the NPN input method is available.</li> <li>1 relay output terminal; programmable NO/NC contact; shared by axis 1 and axis 2</li> </ul>
	Operating panel and display	Standard 5-digit LED display, 5 keys
	Environment	Ambient temperature Operating temperature: $-10^{\circ}\text{C}$ to $+50^{\circ}\text{C}$ ; temperature change rate: $< 0.5^{\circ}\text{C}/\text{min}$ ; temperature above $40^{\circ}\text{C}$ : The rated current is derated by 1.5% for every additional $1^{\circ}\text{C}$ . Storage temperature: $-25^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ Transportation temperature: $-25^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ Relative humidity Relative humidity: 5% to 95%. Standard models are not suitable for an environment with corrosive gases. In the environment, select the model with a corrosion-resistant enclosure with a protective coating. Relative humidity for storage: 5% to 95%. Relative humidity for transportation: lower than 95% at $+40^{\circ}\text{C}$ Altitude Star power grid: maximum 3000 m $\leq 1000$ m (3281 ft): derating not required $> 1000$ m (3281 ft): derated by 1% for every additional 100 m (328.1 ft)
IP rating	Drive unit (single-axis): 1) 1.5-75 kW: IP20; 2) 90-160 kW: IP20; 3) 200-355 kW: IP00 Drive unit (dual-axis) with the power of 1.5-18.5 kW: IP20	

Item	Specification
Protection functions	Protection for short circuit to ground upon power-on, phase-to-phase short circuit, motor overheating (PT100, PT1000), drive overcurrent, drive overload (output power limit), motor overload, drive overvoltage, drive undervoltage, drive SVC stall, drive overheating, output phase loss, communication fault, current detection fault, motor auto-tuning fault, encoder fault detection, EEPROM read and write fault, buffer relay fault, locked-rotor, excessive speed deviation, and stall alarm.
Cooling modes	Air cooling or water cooling Different models support different cooling modes. For details, see " <a href="#">Figure 1-4</a> " on <a href="#">page 14</a> .

## 1.4 Components

### 1.4.1 Components of the Power Supply Unit

The following figure shows the components of the power supply unit. Different power supply units have different control circuit terminals. For details, see "[3.5.1.2 Layout of Control Circuit Terminals for the Power Supply Unit](#)" on [page 68](#).

Installation hole

External 24 V power supply input

Overlapping busbar

Built-in busbar

Upper cover

Machine barcode

Cable tie

Lower cover

Cover buckle

R, S, and T terminals

RJ45 communication terminal

Bus protective board

Operating panel

Shield grounding screw

Control terminal

Unit

DB9 terminal

Power terminal cover

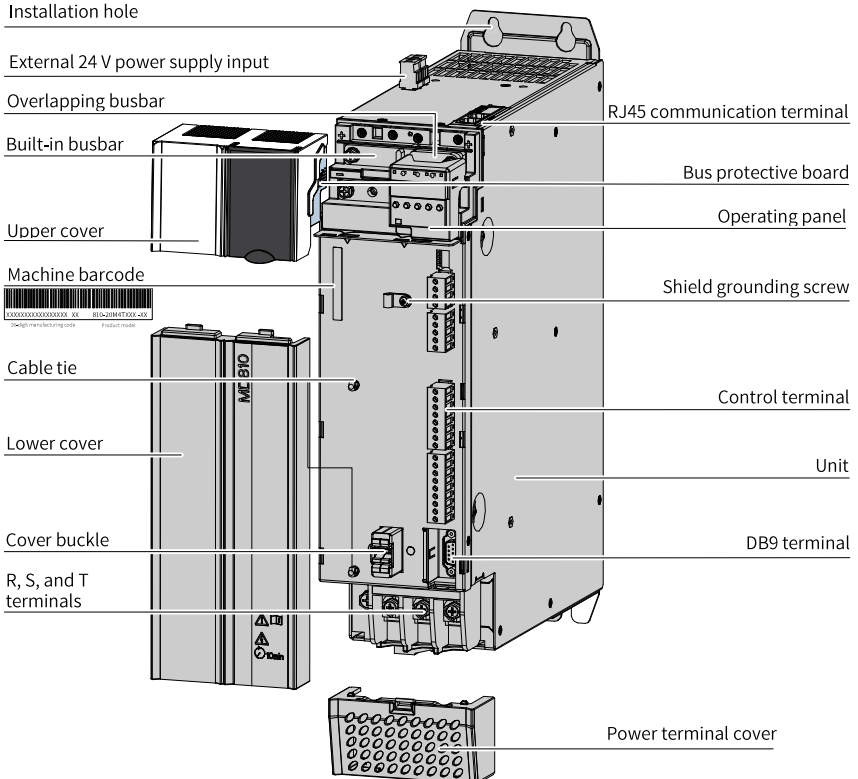


Figure 1-5 Components of the power supply unit

## 1.4.2 Components of the Drive Unit

The following figure shows the components of the drive unit (single-axis). Different drive units (single-axis) have different control circuit terminals. For details, see ["3.5.2.2 Layout of Control Circuit Terminals for the Drive Unit \(Single-Axis\)" on page 76](#).

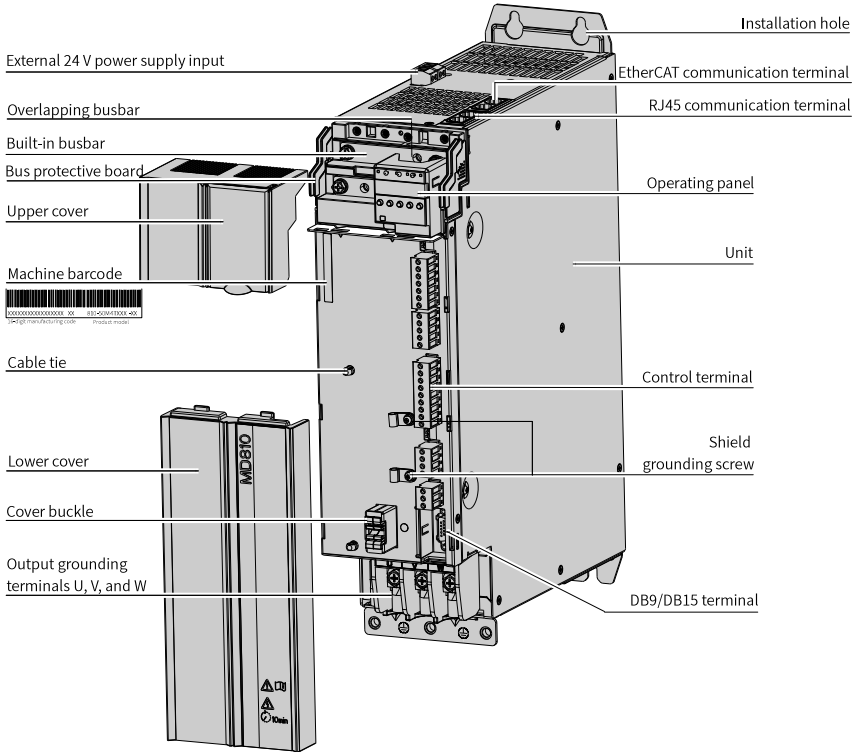


Figure 1-6 Components of the drive unit (single-axis)

The following figure shows the components of the drive unit (dual-axis). Different drive units (dual-axis) have different control circuit terminals. For details, see ["3.5.3.2 Layout of Control Circuit Terminals for the Drive Unit \(Dual-Axis\)" on page 89](#).

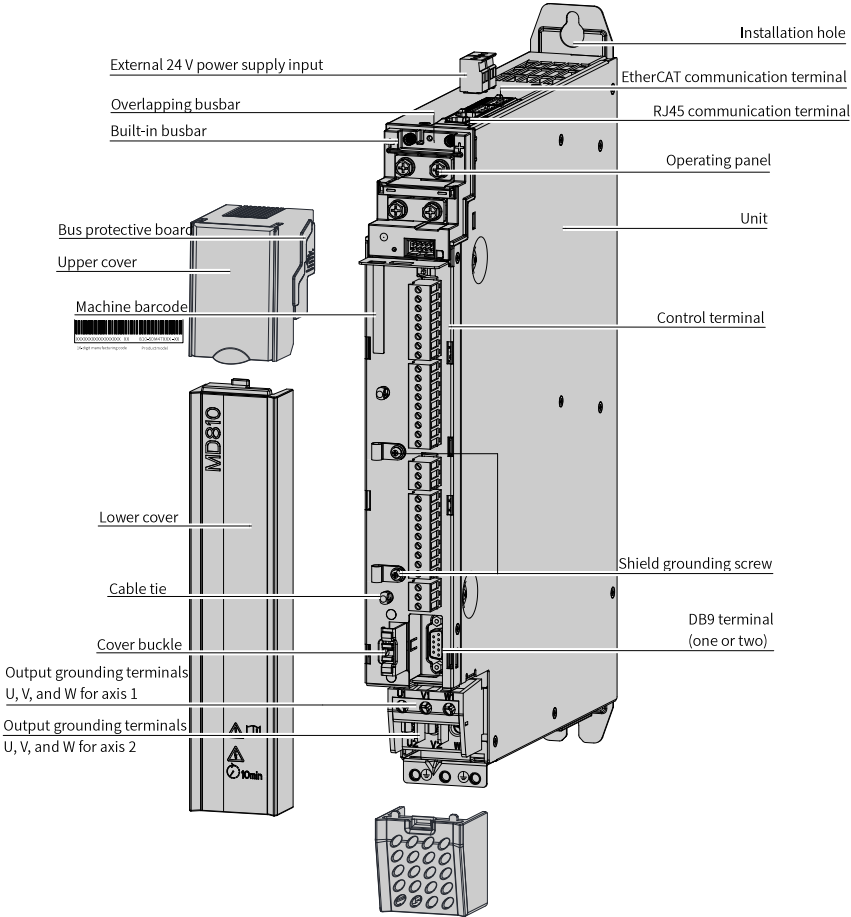


Figure 1-7 Components of the drive unit (dual-axis)



## 1.5 System Architecture

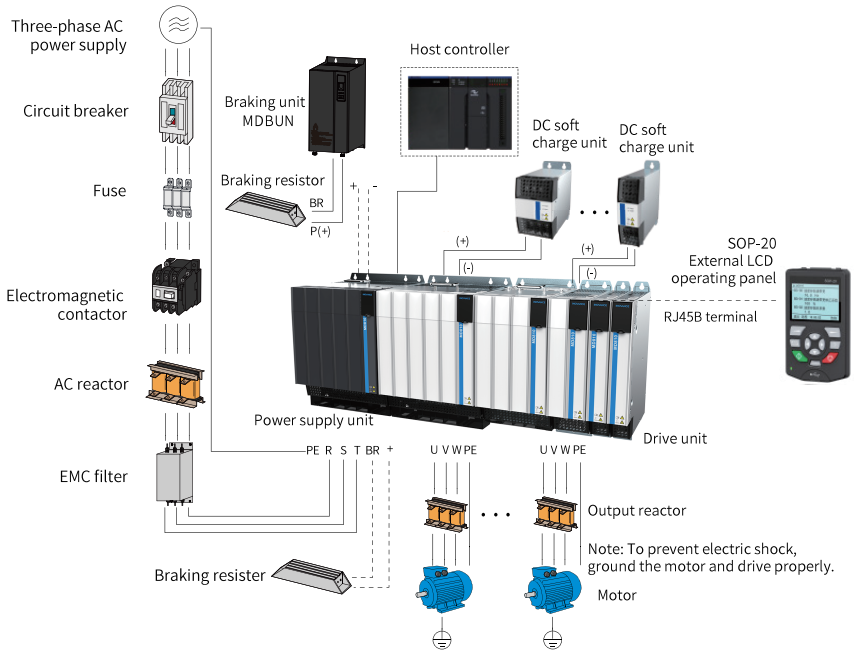


Figure 1-8 System architecture

Table 1-6 Function description of peripheral components for the MD810 series

Component Name	Installation Position	Function Description
Circuit breaker	Between the power supply and the input side of the power supply unit	It is the circuit breaker for protection against short circuit. When overcurrent occurs on downstream devices, it cuts off the power supply to prevent incidents.
Fuse	Between the power supply and the input side of the power supply unit	It protects semiconductors of the downstream power supply unit in case of short circuit.
Electromagnetic contactor	Between the circuit breaker and the input side of the power supply unit	It is used to switch 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.

Component Name	Installation Position	Function Description
Input reactor	Input side of the power supply unit	It provides the following functions: <ul style="list-style-type: none"> <li>• Improves the input-side power factor.</li> <li>• Eliminates high-order harmonics at the input side effectively and prevents other devices from being damaged caused by distortion of voltage waveform.</li> <li>• Eliminates input current unbalance caused by unbalance between the power supply phases.</li> </ul> Generally, for high pollution and low quality power grids, it is recommended to install input reactors.
EMC filter	Input side of the power supply unit	It provides the following functions: <ul style="list-style-type: none"> <li>• Reduces external conduction and radiation interference of the drive.</li> <li>• Decreases conduction interference flowing from the power supply to the drive and improves the anti-interference capacity of the drive.</li> </ul>
Bus fuse	Between the power supply unit and the drive unit	It protects semiconductors of the upstream power supply unit and prevent further damage to the system in case of short circuit.
Braking resistor	22/45 kW power supply unit	For the 22/45 kW power supply unit, use a braking resistor, which consumes regenerative energy during motor deceleration.
Braking unit	Power supply unit with the power rating of 110 kW or above	For the power supply unit with the power rating of 110 kW or above, use the braking unit (MDBUN) of Inovance and the recommended braking resistor. It is used to consume regenerative energy during motor deceleration.
Output reactor	Between the output side of the drive unit and the motor; close to the drive	The output side of the drive generally has many high-order harmonics. When the motor is far from the drive, there is high distributed capacitance in the circuit, and certain harmonics may cause resonance in the circuit. This will cause the following effects: <ul style="list-style-type: none"> <li>• Degrades the motor insulation performance and damages the motor in the long run.</li> <li>• Generates large leakage current, thereby activating frequent protection trips of the drive.</li> </ul> If the distance between the drive and the motor is longer than 100 m, it is recommended that an AC output reactor be installed.
Output magnetic ring	Output side in the drive unit	It is used to reduce bearing current.
Motor	Output side of the drive	Select an appropriate motor.

Component Name	Installation Position	Function Description
DC soft charge unit	Between the power supply unit and the drive unit	With the DC soft charge unit, you can replace the drive unit without powering off the power supply unit (bus voltage keeps normal).
DC circuit breaker	Between the DC soft charge unit and the power supply unit	If the DC soft charge unit is installed, install a DC circuit breaker in front of the DC soft charge unit.
SOP-20 external LCD operating panel	Inserting the network cable of the SOP-20 into the RJ45B port.	It is used for commissioning and parameter settings.

## Note

Do not install the capacitor or surge suppressor on the output side of the drive; otherwise, the drive will fail or the capacitor and surge suppressor will be damaged.

The input/output (main circuit) side of the drive contains harmonics that might interfere with communication equipment connected to the drive. Therefore, install an interference filter to minimize the interference.

## 1.6 List of Options

Name		Applicable Unit	Model	Code
Co-bus external power terminal	100 A co-bus external power terminal	Power supply unit: 22 kW Drive unit: ● 1.5-7.5 kW (single-axis) ● 1.5-5.5 kW (dual-axis)	MD810-CON1	1040014
	200 A co-bus external power terminal	Power supply unit: 45 kW, 110 kW, and 160 kW Drive unit: ● 11-160 kW (single-axis) ● 7.5-18.5 kW (dual-axis)	MD810-CON2	1040015
Through-hole mounting bracket	Through-hole mounting bracket with the width of 50 mm	Power supply unit: 22 kW Drive unit: ● 1.5-7.5 kW (single-axis) ● 1.5-5.5 kW (dual-axis)	MD810-AZJ50M-W1	1040039
	Through-hole mounting bracket with the width of 100 mm	Power supply unit: 45 kW Drive unit: ● 11-37 kW (single-axis)	MD810-AZJ50M-W2	1040040

Name		Applicable Unit	Model	Code
		● 7.5-18.5 kW (dual-axis)		
	Through-hole mounting bracket with the width of 200 mm	Power supply unit: 110 kW	MD810-AZJ20M-W3	1040042
		Drive unit: 45-75 kW (single-axis)	MD810-AZJ50M-W3	1040041
	Through-hole mounting bracket with the width of 300 mm	Power supply unit: 160 kW Drive unit: 90-160 kW (single-axis)	MD810-AZJ20M-W4	1040043
Air guide plate	Air guide plate with the width of 50 mm	Power supply unit: 22 kW Drive unit: 1.5-7.5 kW (single-axis) 1.5-5.5 kW (dual-axis)	MD810-DLB-W1	1040044
	Air guide plate with the width of 100 mm	Power supply unit: 45 kW Drive unit: ● 11-37 kW (single-axis) ● 7.5-18.5 kW (dual-axis)	MD810-DLB-W2	1040045
	Air guide plate with the width of 200 mm	Power supply unit: 110 kW Drive unit: 45-75 kW (single-axis)	MD810-DLB-W3	1040046
	Air guide plate with the width of 300 mm	Power supply unit: 160 kW Drive unit: 90-160 kW (single-axis)	MD810-DLB-W4	1040047
Shield bracket (Including the hose clamp)	Shield bracket with the width of 50 mm	Power supply unit: 22 kW Drive unit: ● 1.5-7.5 kW (single-axis) ● 1.5-5.5 kW (dual-axis)	MD810-PBJ50M-W1	1040048
	Shield bracket with the width of 100 mm	Power supply unit: 45 kW	MD810-PBJ20M-W2	1040204
		Drive unit: ● 11-37 kW (single-axis) ● 7.5-18.5 kW (dual-axis)	MD810-PBJ50M-W2	1040049
	Shield bracket with the width of 200 mm	Power supply unit: 110 kW Drive unit: 45-75 kW (single-axis)	MD810-PBJ50M-W3	1040050
	Shield bracket with the width of 300 mm	Drive unit: 90-160 kW (single-axis)	MD810-PBJ50M-W4	1040105
External LCD operating panel	SOP-20 external LCD operating panel	Full series	SOP-20-MD	1040028
Network cable for the external LCD operating panel	3 m network cable	Full series	C45590-GNCN-C25003	1040020
DC soft charge unit		Drive unit: 1.5-7.5 kW (single-axis) 1.5-5.5 kW (dual-axis)	INOV-SU-30 (width of 50 mm)	1040024

Name		Applicable Unit	Model	Code
		Drive unit: 11-22 kW (single-axis) 7.5-11 kW (dual-axis)	INOV-SU-60 (width of 100 mm)	1040056
		Drive unit: 30-37 kW (single-axis) 15-18.5 kW (dual-axis)	INOV-SU-100 (width of 100 mm)	1040025
		Drive unit (single-axis): 45-75 kW	INOV-SU-170 (width of 200 mm)	1040026
Braking component		MD810-20M4T110GXXX	MDBUN-60-T	01013133
			MDBUN-60-5T	0101AR57
		MD810-20M4T160GXXX (W)	MDBUN-90-T	01013126
			MDBUN-90-5T	0101AR58
		MD810-20M4T355GXXX	MDBUN-200-T	01040104
			MDBUN-200-5T	01040160
Peripheral component	Fuse, contactor, and circuit breaker	For details, see <a href="#">"4.9.2 Fuse, Contactor, and Circuit Breaker" on page 156.</a>		-
	Bus fuse	For details, see <a href="#">"4.9.4 Bus Fuse" on page 159.</a>		-
	DC breaker	For details, see <a href="#">"4.9.5 DC Circuit Breaker" on page 160.</a>		-
	AC input reactor	MD810-20M4T22GXXX	MD-ACL-60-0.24-4T-2%	11024097
		MD810-20M4T45GXXX	MD-ACL-120-0.12-4T-2%	11024044
		MD810-20M4T110GXXX	MD-ACL-250-0.056-4T-2%	11024046
		MD810-20M4T160GXXX(W)	MD-ACL-330-0.042-4T-2%	11024041
		MD810-20M4T355GXXX	MD-ACL-800-0.017-4T-2%	11024095
	AC output reactor	For details, see <a href="#">"4.9.7 AC Output Reactor" on page 165.</a>		-
	EMC filter	For details, see <a href="#">"4.9.8 EMC Filter" on page 174.</a>		-
	Simple filter	For details, see <a href="#">"4.9.9 Simple Filter" on page 179.</a>		-
	Magnetic ring	For details, see <a href="#">"4.9.10 Magnetic Ring and Buckle" on page 180.</a>	DY644020H	11013031
			DY805020H	11013032
			DY1207030H	11013033
Magnetic buckle	For details, see <a href="#">"4.9.10 Magnetic Ring and Buckle" on page 180.</a>	DYR-130-B	11013046	
PROFIBUS DP bus adapter	For details, see <a href="#">"4.8 PROFIBUS DP Bus Adapter" on page 153.</a>		-	
Network cable	250 mm network cable	Applicable to the model with the width of 50 mm	C45590-GNCN-C2500024	1040038
	250 mm network cable	Applicable to the model with the width of 100 mm	C45590-GNCN-C2500025	1040018
	350 mm network cable	Applicable to the model with the width of 200 mm	C45590-GNCN-C2500035	1040019
	430 mm network cable	Applicable to the model with the width of 300 mm	C45590-GNCN-C2500043	1040021

Name	Applicable Unit	Model	Code
800 mm network cable	Applicable to the model with the width of 180 mm	C45590-GNCN-C2500080	1040016

## 1.7 System Selection

### 1.7.1 System Selection Flow

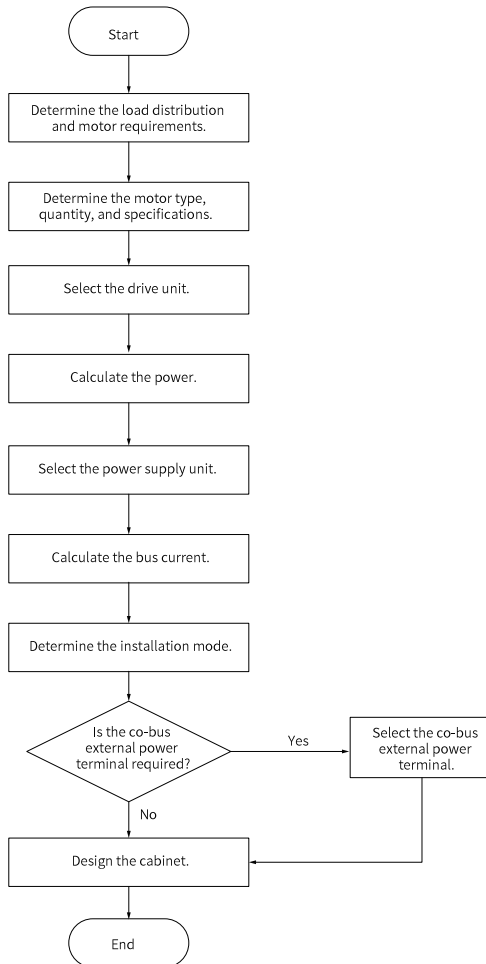


Figure 1-9 System selection flow

## 1.7.2 Load and Motor Selection

1. Determine the motor type and quantity according to the load and operating mode of the mechanical equipment.
2. Determine the requirements of the mechanical equipment for the power, torque, speed, startup, speed regulation, braking, overload, heating, and temperature rise of the motor.
3. Select the rated power, rated voltage, and rated speed of the motor in the motor product catalog.
4. Select the motor capacity on the premise that the motor can meet the requirements of the mechanical equipment load.

$$P_n = \sqrt{3} \times U_n \times I_n \times \cos\theta \times \eta$$

Where:

- $P_n$ : Rated power
- $U_n$ : Rated voltage
- $I_n$ : Rated current
- $\cos\theta$ : Power factor
- $\eta$ : Efficiency

## 1.7.3 Drive Unit Selection

1. Refer to "[1.3.2 Technical Specifications of the Drive Unit](#)" on page 17, and then select the power and model of the drive unit according to the rated power of the motor.
2. Determine the drive unit quantity according to the motor quantity. The single-axis drive unit can drive one motor, and the dual-axis drive unit can drive two motors.

## 1.7.4 Power Supply Unit Selection

1. Calculate the sum of the rated power of all selected drive units.
2. The power of the power supply unit must be greater than or equal to 80% of the sum of the rated power of all drive units.

$$P \geq 80\% (P_1 + P_2 + P_3 + P_4 + P_5 + \dots)$$

where  $P$  is the power of the power supply unit and  $P_1, P_2, P_3, P_4, P_5$ , etc. are the rated power of drive units.

3. Select a power supply unit model based on "[1.3.1 Technical Specifications of the Power Supply Unit](#)" on page 15. When one power supply unit cannot meet the power requirements, multiple power supply units in parallel connection can be used.

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## Note

- In general, the configuration coefficient of the power supply unit and the drive unit is 80%. When the requirement for the equipment overload capacity is high, the configuration coefficient needs to be adjusted to 100% to 150%; when the requirement for the equipment overload capacity is low, the configuration coefficient can be adjusted to 60% to 80%.
  - Only power supply units with the same power rating can be paralleled. The maximum number of paralleled power supply units cannot exceed four.
  - For details on braking unit selection, see ["4.7 Braking Component" on page 151](#).
- 

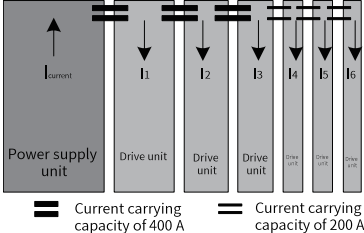
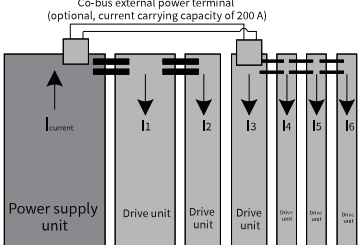
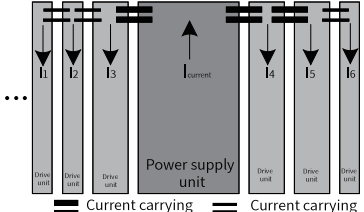
### 1.7.5 System Combination and Arrangement

The MD810 series supports single-rack or dual-rack installation, and the power supply unit can be installed in the middle or on the left side.

#### Single-rack installation

If the cabinet has enough space, it is recommended to install units on a single rack, with the power supply unit placed on the left or in the middle. The following table describes the typical arrangement modes of single-rack installation.



Arrangement Mode	Example	Bus Current Calculation
<p>Power supply unit placed on the left</p>	 <p> <math>I_{\text{current}}</math>              Power supply unit              Drive unit              Drive unit              Drive unit              Drive unit              Drive unit              Drive unit              ...              Current carrying capacity of 400 A              Current carrying capacity of 200 A         </p>	<p> <math>I_{\text{power supply unit}} \geq 80\% \times (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots)</math>  <math>I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots \leq 400 \text{ A}</math>  <math>I_4 + I_5 + I_6 + \dots \leq 200 \text{ A}</math> </p>
<p>Power supply unit placed on the left (co-bus external power terminal used)</p>	 <p>             Co-bus external power terminal (optional, current carrying capacity of 200 A)  <math>I_{\text{current}}</math>              Power supply unit              Drive unit              Drive unit              Drive unit              Drive unit              Drive unit              Drive unit              ...              Current carrying capacity of 400 A              Current carrying capacity of 200 A         </p>	<p> <math>I_{\text{power supply unit}} \geq 80\% \times (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots)</math>  <math>I_1 + I_2 \leq 400 \text{ A}</math>  <math>I_3 + I_4 + I_5 + I_6 + \dots \leq 200 \text{ A}</math>  <math>I_4 + I_5 + I_6 + \dots \leq 200 \text{ A}</math> </p>
<p>Power supply unit placed in the middle</p>	 <p> <math>I_{\text{current}}</math>              Drive unit              Drive unit              Drive unit              Power supply unit              Drive unit              Drive unit              Drive unit              ...              Current carrying capacity of 400 A              Current carrying capacity of 200 A         </p>	<p> <math>I_{\text{power supply unit}} \geq 80\% \times (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots)</math>  <math>I_1 + I_2 + I_3 + \dots \leq 400 \text{ A}</math>  <math>I_4 + I_5 + I_6 + \dots \leq 400 \text{ A}</math>  <math>I_1 + I_2 + \dots \leq 200 \text{ A}</math>  <math>I_6 + \dots \leq 200 \text{ A}</math> </p>

## Dual-rack installation

If space in the cabinet is limited, dual-rack installation can be performed. In the dual-rack installation mode, the power supply unit is generally placed on the left. If there are two power supply units, install one power supply unit on each rack. If there are more than two power supply units, it is recommended to install them in different cabinets. The co-bus external power terminal is used.

The following table describes the typical arrangement modes of dual-rack installation.

Arrangement Mode	Schematic Diagram of Combination and Arrangement	Bus Current Calculation
<p>One power supply unit (placed on the left)</p>		<p> <math>I</math> power supply unit <math>\geq 80\% \times (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots)</math>  <math>I_1 + I_2 + \dots \leq 400 \text{ A}</math>  <math>I_3 + I_4 + I_5 + I_6 + \dots \leq 200 \text{ A}</math>  <math>I_4 + I_5 + I_6 + \dots \leq 200 \text{ A}</math> </p>
<p>One power supply unit (placed in the middle)</p>		<p> <math>I</math> power supply unit <math>\geq 80\% \times (I_1 + \dots + I_2 + \dots + I_3 + I_4 + I_5 + I_6 + \dots)</math>  <math>I_1 + \dots \leq 400 \text{ A}</math>  <math>I_2 + \dots \leq 400 \text{ A}</math>  <math>I_3 + I_4 + I_5 + I_6 + \dots \leq 200 \text{ A}</math>  <math>I_4 + I_5 + I_6 + \dots \leq 200 \text{ A}</math> </p>
<p>Two power supply units (placed on the left)</p>		<p> <math>I</math> power supply unit 1 + <math>I</math> power supply unit 2 <math>\geq 80\% \times (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots)</math>  <math>I_1 + I_2 + I_3 + I_4 + \dots \leq 400 \text{ A}</math>  <math>I_2 + I_3 + I_4 + \dots \leq 200 \text{ A}</math>  <math>I_5 + I_6 + \dots \leq 400 \text{ A}</math>  <math>I_6 + \dots \leq 400 \text{ A}</math>  <math>I</math> power supply unit 1 / <math>I</math> power supply unit 2 <math>\approx (I_1 + I_2 + I_3 + I_4 + \dots) / (I_5 + I_6 + \dots)</math> </p>
<p>Two power supply units (placed in the middle)</p>		<p> <math>I</math> power supply unit 1 + <math>I</math> power supply unit 2 <math>\geq 80\% \times (I_1 + I_2 + \dots + I_3 + I_4 + \dots + I_5 + \dots + I_6 + \dots)</math>  <math>I_1 + I_2 + \dots \leq 400 \text{ A}</math>  <math>I_2 + \dots \leq 200 \text{ A}</math>  <math>I_3 + I_4 + \dots \leq 400 \text{ A}</math>  <math>I_3 + \dots \leq 200 \text{ A}</math>  <math>I_5 + \dots \leq 400 \text{ A}</math>  <math>I_6 + \dots \leq 400 \text{ A}</math>  <math>I</math> power supply unit 1 / <math>I</math> power supply unit 2 <math>\approx (I_1 + I_2 + \dots + I_3 + I_4 + \dots) / (I_5 + \dots + I_6 + \dots)</math> </p>

## 2 Mechanical Design

### 2.1 Layout and Dimension

#### 2.1.1 Layout and Dimension of the Power Supply Unit

The power supply unit can be classified into the booksize unit with equal width and height and the vertical tower unit. The booksize drive unit has the width of 50 mm, 100 mm, 200 mm, and 300 mm, and the vertical tower drive unit has the width of 180 mm. Except for the 355 kW power supply units, which are vertical tower units, the power supply units of other power ratings are all booksize units.

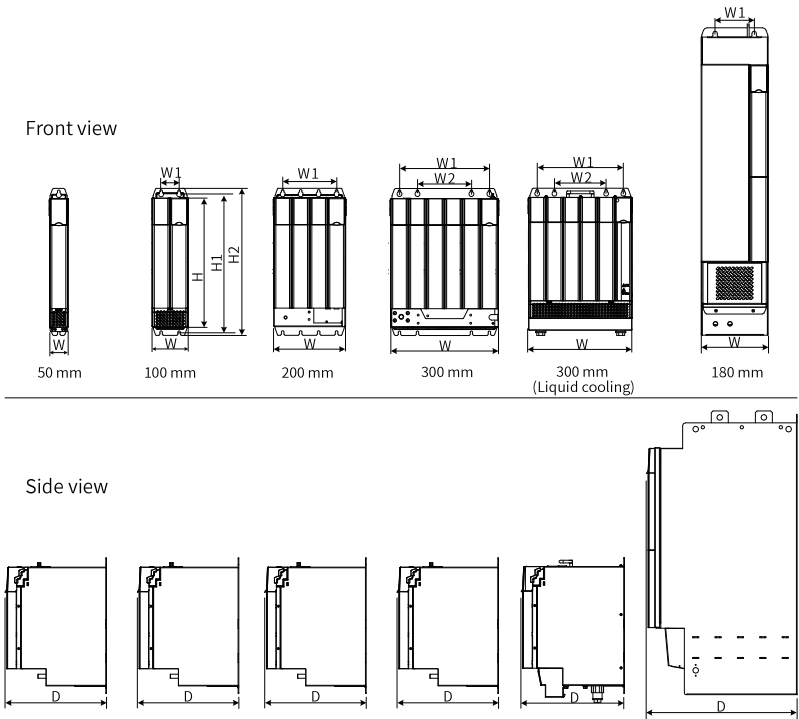


Figure 2-1 Layout and dimension of the power supply unit

Power Supply Unit Model	Dimension (mm)				Mounting Hole (mm)			Mounting Hole Size (mm)	Weight (kg)
	H2	H	W	D	W1	W2	H1		
MD810-20M4T22GXXX	400	350	50	305	-	-	384	Φ7	3.8
MD810-20M4T45GXXX	400	350	100	305	50	-	384	Φ7	8

Power Supply Unit Model	Dimension (mm)				Mounting Hole (mm)			Mounting Hole Size (mm)	Weight (kg)
	H2	H	W	D	W1	W2	H1		
MD810-20M4T110GXXX	400	350	200	305	150	-	384	Φ7	23
MD810-20M4T160GXXX	400	350	300	305	250	150	384	Φ7	38
MD810-20M4T160GXXXW	426.5	350	300	305	250	150	384	Φ7	38
MD810-20M4T355GXXX	832	800	180	445	105	-	795	Φ12	65

### 2.1.2 Layout and Dimension of the Drive Unit (Single-Axis)

The drive unit (single-axis) can be classified into the booksize unit with equal width and height and the vertical tower unit. The booksize drive unit has the width of 50 mm, 100 mm, 200 mm, and 300 mm, and the vertical tower drive unit has the width of 230 mm. Except for the 200 kW to 355 kW drive units, which are vertical tower units, the drive units of other power ratings are all booksize units.

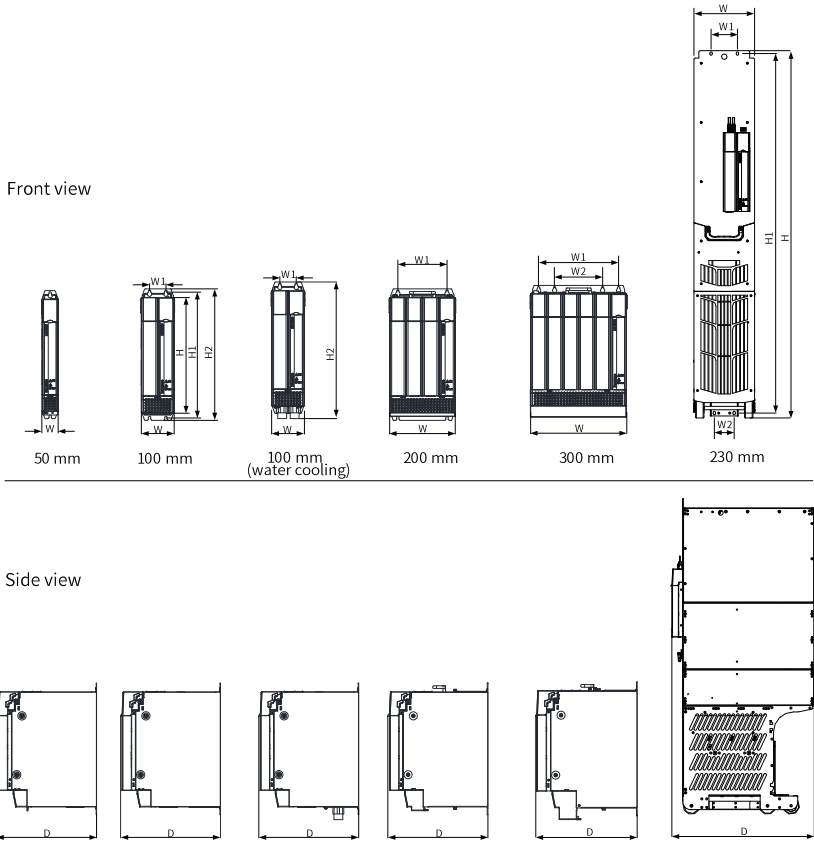


Figure 2-2 Layout and dimension of the drive unit (single-axis)

Table 2-1 Layout and dimension of the drive unit (single-axis)

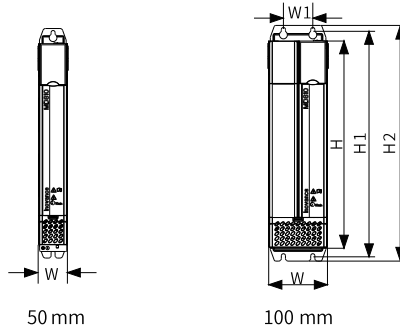
Drive Model	Dimension (mm)				Mounting Hole (mm)			Mounting Hole Size (mm)	Weight (kg)
	H2	H	W	D	W1	W2	H1		
MD810-50M4T1.5GXXX	400	350	50	305	-	-	384	Φ7	3.8
MD810-50M4T2.2GXXX	400	350	50	305	-	-	384	Φ7	3.8
MD810-50M4T3.7GXXX	400	350	50	305	-	-	384	Φ7	3.8
MD810-50M4T5.5GXXX	400	350	50	305	-	-	384	Φ7	3.8
MD810-50M4T7.5GXXX	400	350	50	305	-	-	384	Φ7	4
MD810-50M4T11GXXX	400	350	100	305	50	-	384	Φ7	7.5
MD810-50M4T15GXXX	400	350	100	305	50	-	384	Φ7	7.5
MD810-50M4T18.5GXXX	400	350	100	305	50	-	384	Φ7	8
MD810-50M4T22GXXX	400	350	100	305	50	-	384	Φ7	8.5

Drive Model	Dimension (mm)				Mounting Hole (mm)			Mounting Hole Size (mm)	Weight (kg)
	H2	H	W	D	W1	W2	H1		
MD810-50M4T30GXXX	400	350	100	305	50	-	384	Φ7	9.4
MD810-50M4T37GXXX	400	350	100	305	50	-	384	Φ7	9.4
MD810-50M4T45GXXX	400	350	200	305	150	-	384	Φ7	18.4
MD810-50M4T55GXXX	400	350	200	305	150	-	384	Φ7	18.4
MD810-50M4T75GXXX	400	350	200	305	150	-	384	Φ7	19.5
MD810-50M4T90GXXX	400	350	300	305	250	150	384	Φ7	24.2
MD810-50M4T110GXXX	400	350	300	305	250	150	384	Φ7	24.2
MD810-50M4T132GXXX	400	350	300	305	250	150	384	Φ7	25.2
MD810-50M4T160GXXX	400	350	300	305	250	150	384	Φ7	25.2
MD810-50M4T200GXXXH	-	1395	230	633	100	75	1365	Φ9	≤ 130
MD810-50M4T250GXXXH	-	1395	230	633	100	75	1365	Φ9	≤ 130
MD810-50M4T315GXXXH	-	1395	230	633	100	75	1365	Φ9	≤ 130
MD810-50M4T355GXXXH	-	1395	230	633	100	75	1365	Φ9	≤ 130

### 2.1.3 Layout and Dimension of the Drive Unit (Dual-Axis)

The drive unit (dual-axis) is the booksize unit with equal width and height. It is classified into two structures with the width of 50 mm and 100 mm.

Front view



Side view

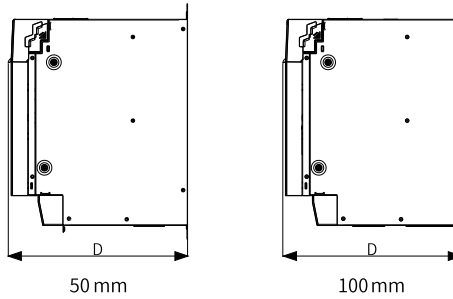


Figure 2-3 Layout and dimension of the drive unit (dual-axis)

Table 2-2 Layout and dimension of the drive unit (dual-axis)

Drive Model	Dimension (mm)				Mounting Hole (mm)			Mounting Hole Diameter (mm)	Weight (kg)
	H2	H	W	D	W1	W2	H1		
MD810-50M4TD1.5GXXX	400	350	50	305	-	-	384	Φ7	4.5
MD810-50M4TD2.2GXXX	400	350	50	305	-	-	384	Φ7	4.5
MD810-50M4TD3.7GXXX	400	350	50	305	-	-	384	Φ7	4.5
MD810-50M4TD5.5GXXX	400	350	50	305	-	-	384	Φ7	4.5
MD810-50M4TD7.5GXXX	400	350	100	305	50	-	384	Φ7	6.5
MD810-50M4TD11GXXX	400	350	100	305	50	-	384	Φ7	9.5

Drive Model	Dimension (mm)				Mounting Hole (mm)			Mounting Hole Diameter (mm)	Weight (kg)
	H2	H	W	D	W1	W2	H1		
MD810-50M4TD15GXXX	400	350	100	305	50	-	384	Φ7	9.5
MD810-50M4TD18.5GXXX	400	350	100	305	50	-	384	Φ7	9.5

## 2.2 Cabinet Design

### 2.2.1 Clearance Requirements

The power supply unit and drive unit of the MD810 series are classified into booksize and vertical tower structures. The booksize unit features the width of 50 mm, 100 mm, 200 mm, and 300 mm, and the vertical tower unit features the width of 180 mm (power supply unit only) and 230 mm (drive unit only).

The recommended installation methods include single-rack installation and dual-rack installation. For dual-rack installation, install the air guide plate for the units on the lower rack. The following table describes the minimum clearance between two racks.

Table 2-3 Minimum clearance between units

No.	Booksize Unit				Vertical Tower Unit	
	Unit with Width of 50 mm	Unit with Width of 100 mm	Unit with Width of 200 mm	Unit with Width of 300 mm	Unit with Width of 180 mm (Power Supply Unit Only)	Unit with Width of 230 mm (Drive Unit Only)
S1	≥ 300 mm	≥ 300 mm	≥ 300 mm	≥ 300 mm	≥ 300 mm	≥ 300 mm
S2	≥ 300 mm	≥ 300 mm	≥ 300 mm	≥ 300 mm	≥ 500 mm	≥ 500 mm
S3	≥ 300 mm	≥ 300 mm	≥ 300 mm	≥ 300 mm	-	-



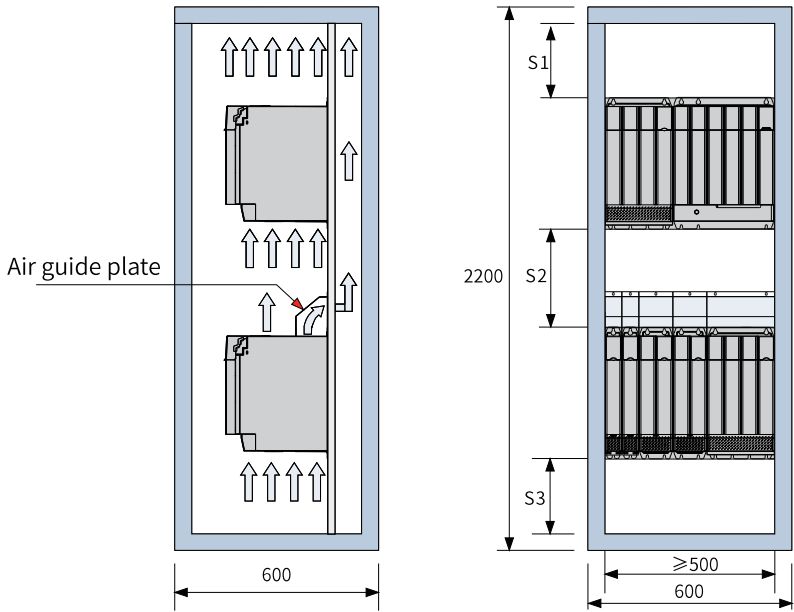


Figure 2-4 Clearances for installing the booksized unit in dual-rack mode

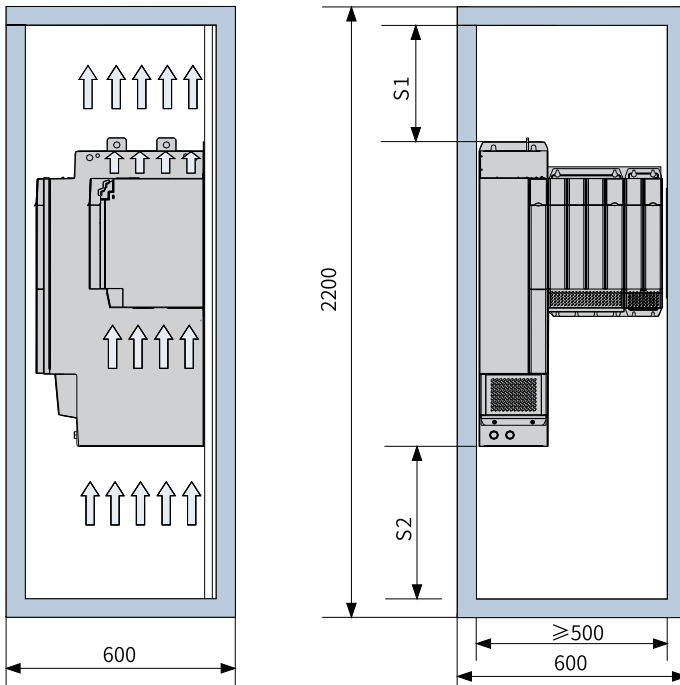


Figure 2-5 Clearances for installing the vertical tower unit

## Note

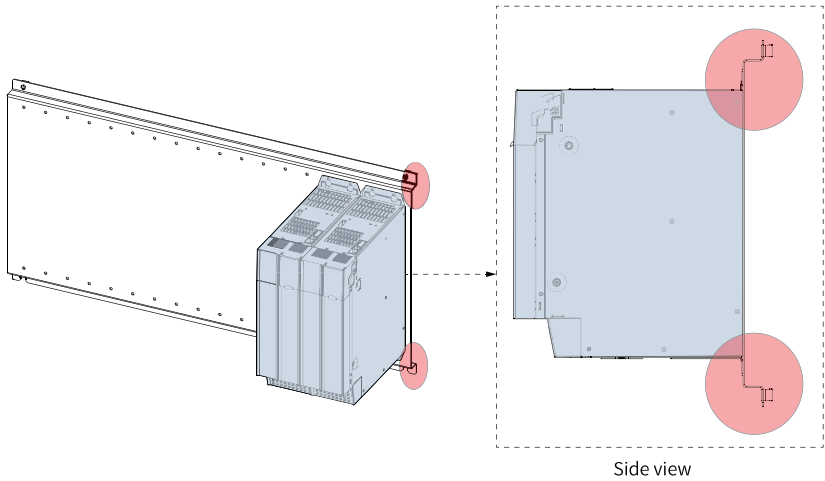
It is recommended that the power supply unit and drive unit be installed vertically.

## 2.2.2 Mounting Backplate Design Requirements

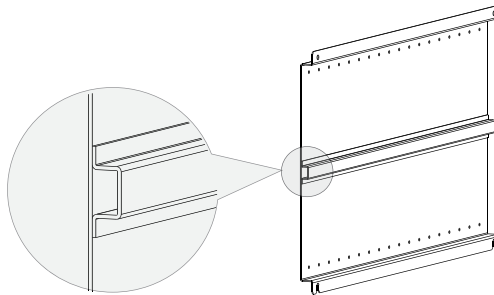
### Thickness and stiffness reinforcement principles

To avoid damage to the unit during transportation and ensure its normal operation, the mounting backplate of the unit must feature excellent stiffness and strength performance and a thickness of not less than 2 mm. Reinforcement must be performed at the top and bottom mounting feet. The recommended reinforcement scheme is as follows:

- Scheme 1: Reinforcing the lateral bending of the backplate



- Scheme 2: Welding a lateral reinforced beam on the back of the backplate



### Mounting hole principles

- The booksize unit is characterized by equal height and equal spacing of mounting holes of 50 mm. Drill mounting holes on the backplate in advance for convenient installation.
- To avoid damage to the unit during transportation, tap the screw on the installation backplate, and then use self-clinching nuts or independent nuts on the back of the backplate to enhance screw-thread fitting and fastening effect.

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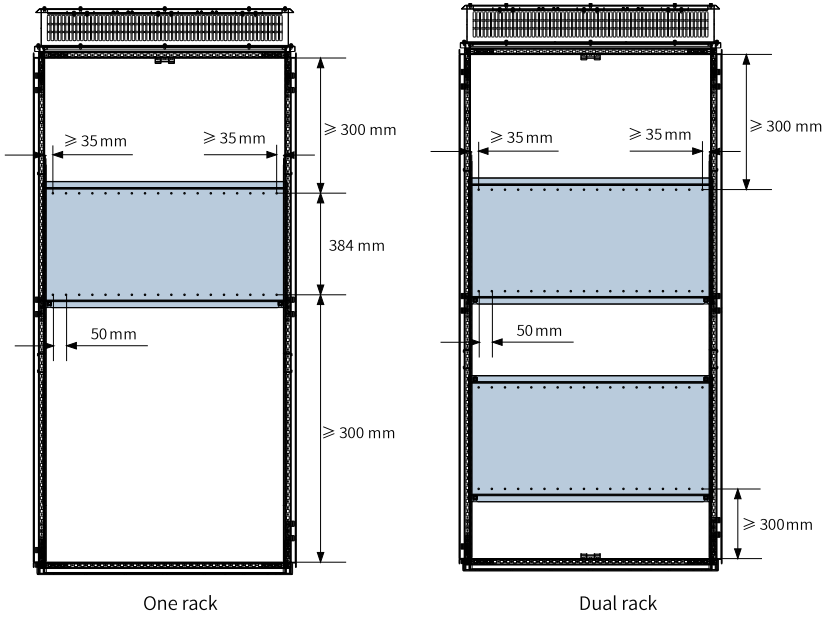
### Note

To ensure reliable connection of the built-in DC busbar of the unit, the relative position of the unit mounting holes must be accurate. Therefore, it is recommended that the mounting holes be drilled when the backplane is processed.

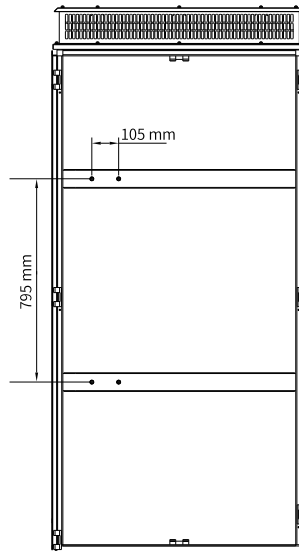
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### Mounting hole dimensions

- Dimensions of mounting holes for the booksize units



- Dimensions of mounting holes for the vertical tower units



## 2.2.3 Cabinet Cooling Design

### Cabinet door cooling design

The unit is forcedly air cooled with a built-in fan. To ensure that enough cooling air enters the cabinet, the air inlet on the cabinet door must be large enough.

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 unit, as shown below.

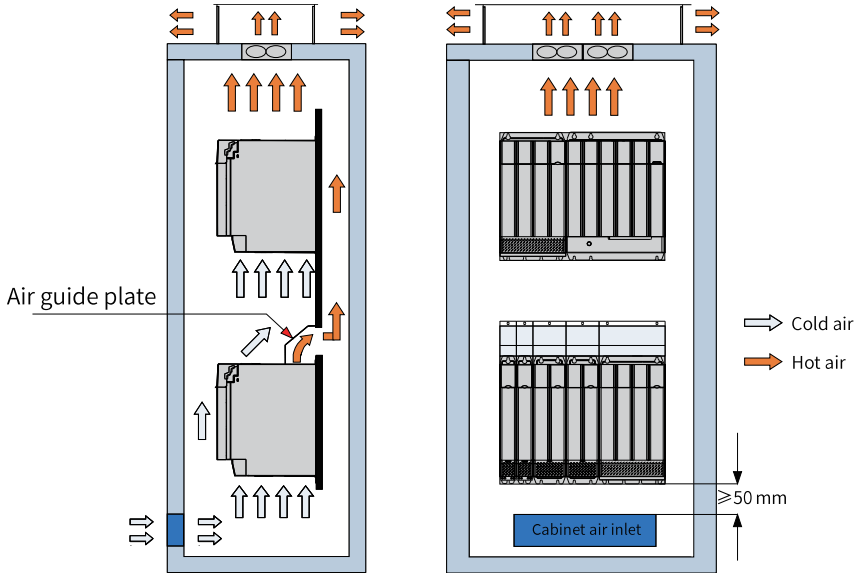


Figure 2-6 Position of the cabinet air inlet

### Note

Where multiple units are installed in one cabinet, if air is blown into the air inlet with a fan from outside to inside, air distribution of drive units in the cabinet will be affected, resulting in poor cooling performance. Therefore, do not install the fan at the cabinet air inlet to blow air into the cabinet.

After the unit is installed in the cabinet, the minimum effective ventilation area of the air inlet is as follows.

Table 2-4 Minimum effective ventilation area of the cabinet air inlet for the power supply unit

Power Supply Unit Model	Minimum Effective Ventilation Area of the Cabinet Air Inlet (cm <sup>2</sup> )
MD810-20M4T22GXXX	15
MD810-20M4T45GXXX	50
MD810-20M4T110GXXX	90
MD810-20M4T160GXXX (W)	150
MD810-20M4T355GXXX	150

Table 2-5 Minimum effective ventilation area of the cabinet air inlet for the drive unit

Drive Unit model	Minimum Effective Ventilation Area of the Cabinet Air Inlet (cm <sup>2</sup> )
MD810-50M4T1.5GXXX	15
MD810-50M4T2.2GXXX	15
MD810-50M4T3.7GXXX	15
MD810-50M4T5.5GXXX	15
MD810-50M4T7.5GXXX	15
MD810-50M4T11GXXX (W)	45
MD810-50M4T15GXXX (W)	45
MD810-50M4T18.5GXXX(W)	45
MD810-50M4T22GXXX(W)	70
MD810-50M4T30GXXX (W)	70
MD810-50M4T37GXXX(W)	70
MD810-50M4T45GXXX	90
MD810-50M4T55GXXX	90
MD810-50M4T75GXXX	90
MD810-50M4T90GXXX	147
MD810-50M4T110GXXX	147
MD810-50M4T132GXXX	147
MD810-50M4T160GXXX	147
MD810-50M4T200GXXXH	1400
MD810-50M4T250GXXXH	1400
MD810-50M4T315GXXXH	1400
MD810-50M4T355GXXXH	1400
MD810-50M4TD1.5GXXX	15
MD810-50M4TD2.2GXXX	15
MD810-50M4TD3.7GXXX	15
MD810-50M4TD5.5GXXX	45
MD810-50M4TD7.5GXXX(W)	45
MD810-50M4TD11GXXX (W)	70

Drive Unit model	Minimum Effective Ventilation Area of the Cabinet Air Inlet (cm <sup>2</sup> )
MD810-50M4TD15GXXX (W)	70
MD810-50M4TD18.5GXXX(W)	70

## Note

- The preceding table applies only to one single unit in the cabinet. When multiple units are installed in the cabinet, the total required ventilation area is the sum of all the above-mentioned ventilation areas. For example, if there are eight 7.5 kW drive units (single-axis), two 22 kW drive units (single-axis), and one 160 kW power supply unit in the cabinet, the minimum effective ventilation area of the cabinet air inlet will be calculated by the following formula:  $8 \times 15 + 2 \times 70 + 1 \times 150 = 410$  cm<sup>2</sup>.
- If an air filter is installed at the inlet, the air inlet resistance will rise significantly. Therefore, the ventilation area must be increased to 1.2 to 1.5 times the values indicated in the tables.
- The ventilation area indicated in the preceding table is the through-hole area in the hole zone, that is, the ventilation area equals to the hole zone area multiplied by the hole ratio.

## Air outlet design at the top of the cabinet

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

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

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

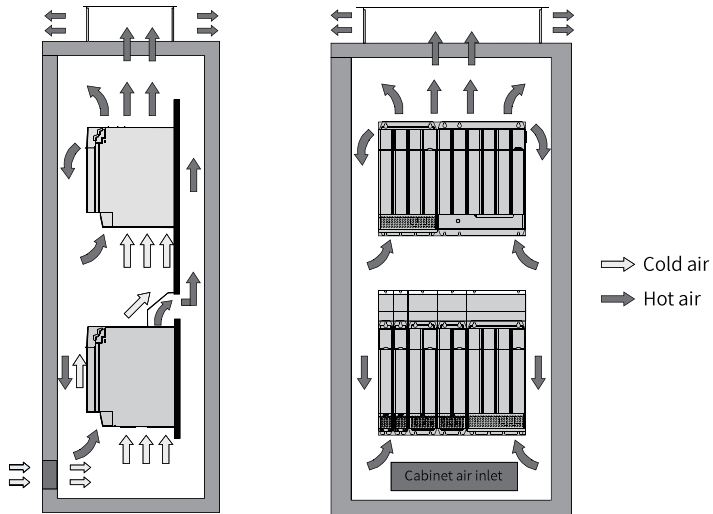


Figure 2-7 Backflow of hot air in the cabinet in passive air ventilation mode (without any isolating device)

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

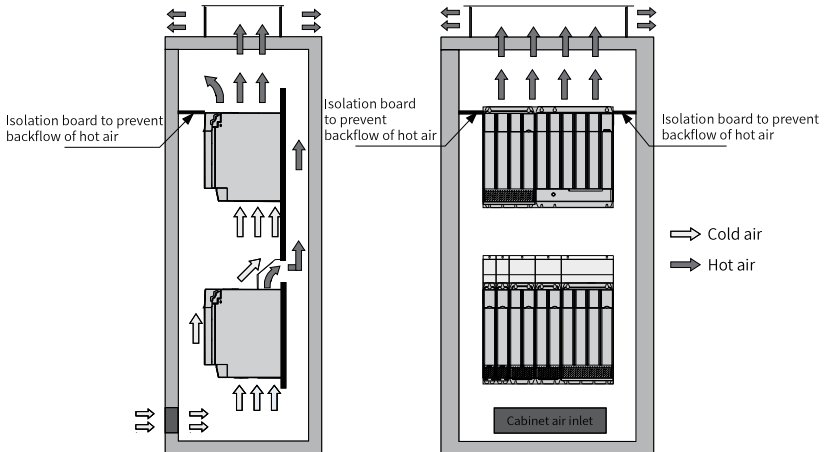


Figure 2-8 Backflow of hot air in the cabinet in passive air ventilation mode (with an isolating device)

The temperature at the air outlet of the power supply unit and the drive unit is high and the density at the air outlet is lower than that at the air inlet. To ensure



that hot air can be exhausted to the outside of the cabinet, the minimum effective ventilation areas of the cabinet air outlet must meet the following requirements when passive air ventilation is used.

Table 2-6 Minimum effective ventilation area of the cabinet air inlet for the power supply unit

Power Supply Unit Model	Minimum Effective Ventilation Area of the Cabinet Air Outlet (cm <sup>2</sup> )
MD810-20M4T22GXXX	24
MD810-20M4T45GXXX	80
MD810-20M4T110GXXX	145
MD810-20M4T160GXXX	240
MD810-20M4T355GXXX	240

Table 2-7 Minimum effective ventilation area of the cabinet air inlet for the drive unit

Drive Unit Model	Minimum Effective Ventilation Area of the Cabinet Air Outlet (cm <sup>2</sup> )
MD810-50M4T1.5GXXX	24
MD810-50M4T2.2GXXX	24
MD810-50M4T3.7GXXX	24
MD810-50M4T5.5GXXX	24
MD810-50M4T7.5GXXX	24
MD810-50M4T11GXXX	72
MD810-50M4T15GXXX	72
MD810-50M4T18.5GXXX	72
MD810-50M4T22GXXX	112
MD810-50M4T30GXXX	112
MD810-50M4T37GXXX	112
MD810-50M4T45GXXX	145
MD810-50M4T55GXXX	145
MD810-50M4T75GXXX	145
MD810-50M4T90GXXX	235.1
MD810-50M4T110GXXX	235.1
MD810-50M4T132GXXX	235.1
MD810-50M4T160GXXX	235.1
MD810-50M4T200GXXXH	2100
MD810-50M4T250GXXXH	2100
MD810-50M4T315GXXXH	2100
MD810-50M4T355GXXXH	2100
MD810-50M4TD1.5GXXX	24
MD810-50M4TD2.2GXXX	24
MD810-50M4TD3.7GXXX	24
MD810-50M4TD5.5GXXX	72
MD810-50M4TD7.5GXXX	72
MD810-50M4TD11GXXX	112

Drive Unit Model	Minimum Effective Ventilation Area of the Cabinet Air Outlet (cm <sup>2</sup> )
MD810-50M4TD15GXXX	112
MD810-50M4TD18.5GXXX	112

## Note

- "Table 2-6" on page 48 and "Table 2-7" on page 48 apply only to one single unit in the cabinet. When multiple units are installed in the cabinet, the total required ventilation area is the sum of all the above-mentioned ventilation areas.
  - If an air filter is installed at the outlet, the air outlet resistance will rise significantly and the ventilation area must be increased to 1.2 to 1.5 times the values indicated in the tables.
  - The ventilation area indicated in the preceding table is the through-hole area in the hole zone, that is, the ventilation area equals to the hole zone area multiplied by the hole ratio.
- 
- Active air ventilation  
In the active air exhaust mode, a fan is installed at the top of the cabinet to exhaust hot air to the outside of the cabinet. This is a commonly used ventilation mode.

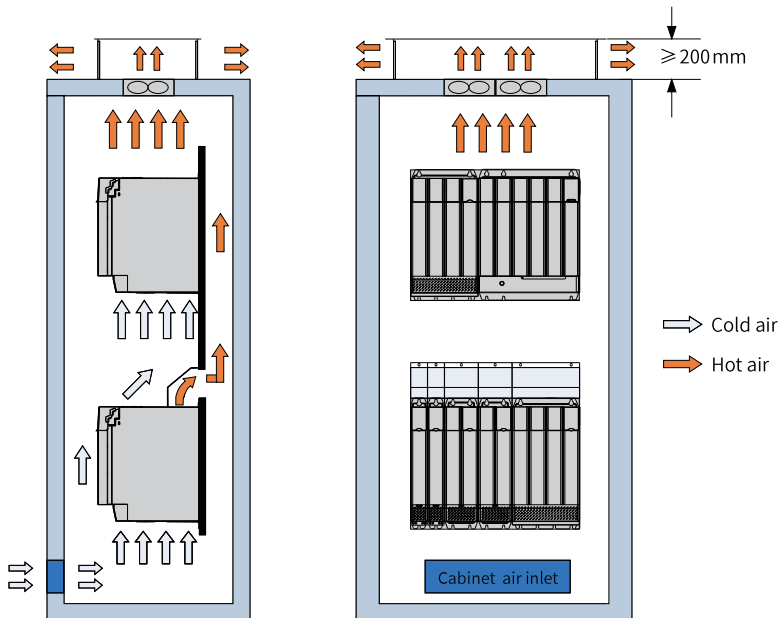


Figure 2-9 Cabinet ventilation system

## Note

- When installing the fan, ensure that the hot air can be exhausted from the cabinet to outside, avoiding the overheating of or damage to the power supply unit or the drive unit.
- The distance between the top cover of the air outlet and the fan outlet must be at least 200 mm to improve the fan cooling performance.

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 units in the cabinet. ["Table 2-8 " on page 50](#) and ["Table 2-9 " on page 50](#) describe the cooling air volume required for the power supply unit and power unit.

Table 2-8 Cooling air volume of the power supply unit

Power Supply Unit Model	Cooling Air Volume (CFM)
MD810-20M4T22GXXX	15
MD810-20M4T45GXXX	40
MD810-20M4T110GXXX	100
MD810-20M4T160GXXX	285
MD810-20M4T355GXXX	310

Table 2-9 Cooling air volume of the drive unit

Drive Unit Model	Cooling Air Volume (CFM)
MD810-50M4T1.5GXXX	10
MD810-50M4T2.2GXXX	10
MD810-50M4T3.7GXXX	10
MD810-50M4T5.5GXXX	10
MD810-50M4T7.5GXXX	10
MD810-50M4T11GXXX	40
MD810-50M4T15GXXX	40
MD810-50M4T18.5GXXX	55
MD810-50M4T22GXXX	65
MD810-50M4T30GXXX	75
MD810-50M4T37GXXX	105
MD810-50M4T45GXXX	130
MD810-50M4T55GXXX	175
MD810-50M4T75GXXX	195
MD810-50M4T90GXXX	145
MD810-50M4T110GXXX	311
MD810-50M4T132GXXX	270
MD810-50M4T160GXXX	270
MD810-50M4T200GXXXH	265
MD810-50M4T250GXXXH	353

Drive Unit Model	Cooling Air Volume (CFM)
MD810-50M4T315GXXXH	447
MD810-50M4T355GXXXH	706
MD810-50M4TD1.5GXXX	11
MD810-50M4TD2.2GXXX	11
MD810-50M4TD3.7GXXX	11
MD810-50M4TD5.5GXXX	16
MD810-50M4TD7.5GXXX	21
MD810-50M4TD11GXXX	39
MD810-50M4TD15GXXX	37
MD810-50M4TD18.5GXXX	104
Note: 1 CFM = 0.02832 m <sup>3</sup> /min	

### Cabinet fan selection

To select a cabinet fan, do as follows:

1. Calculate the cooling air volume required for all drive units according to "Table 2-8" on page 50 and "Table 2-9" on page 50.
2. Determine the maximum air volume (Q<sub>max</sub>) of the cabinet fan.
3. Determine the fan specifications and quantity according to the maximum air volume (Q<sub>max</sub>).

Note that:

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

Maximum air volume of the cabinet = (1.6 to 2.2 times) the sum of cooling air volume (if the components such as dry nets and shutters are installed at the cabinet air outlet)

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### Note

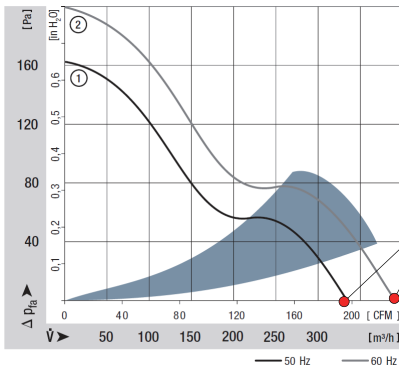
The air volume of the selected fan cannot be smaller than the maximum air volume Q<sub>max</sub>. If a single fan cannot meet this requirement, multiple fans can be used.

---

The following figure shows typical specifications of fan air volume.

Air flow		Nominal voltage	Frequency	Sound pressure level	Sound power level	Sinter sleeve bearings Ball bearings	Power input	Nominal speed	Temperature range	Service life L <sub>10</sub> at 40 °C		Curve
m <sup>3</sup> /h	CFM									Hours	Hours	
320	188,3	230	50	51	6,4	■	27,0	2 800	-25...+55	60 000 / 32 000	1	
380	223,6	115	60	56	6,8	■	28,0	3 350	-25...+65	55 000 / 18 000	2	

Maximum air volume (Q<sub>max</sub>)



Maximum air volume (Q<sub>max</sub>)

Figure 2-10 Q<sub>max</sub> of a system fan

## 3 Electrical Design

### 3.1 Electrical Wiring

If a drive unit fails, you need to power off the faulty drive unit and the power supply unit, replace with a new drive unit, and then power on the power supply unit and the new drive unit. To ensure that the power supply unit can operate without power-off during this case, you can install a DC soft charge unit for each drive unit. For details, see ["Figure 3-2" on page 54](#).

#### Warning

- The drive unit has a built-in fuse. Never power on the drive unit independently without a DC soft charge unit installed. Otherwise, the drive unit will be damaged. ["Figure 3-1" on page 53](#) describes the correct and incorrect wiring methods.
- In the application of common DC bus, never connect electrical switches, such as air switches or circuit breakers, in series in the bus to individually control the power-on and power-off of the drive unit. Otherwise, when the system is powered on, the drive unit will be powered on directly. This will damage the drive unit due to excessive inrush current.

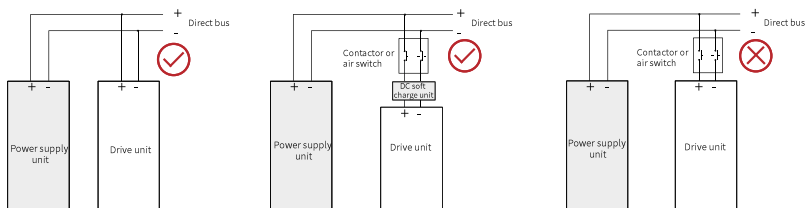


Figure 3-1 DC bus wiring

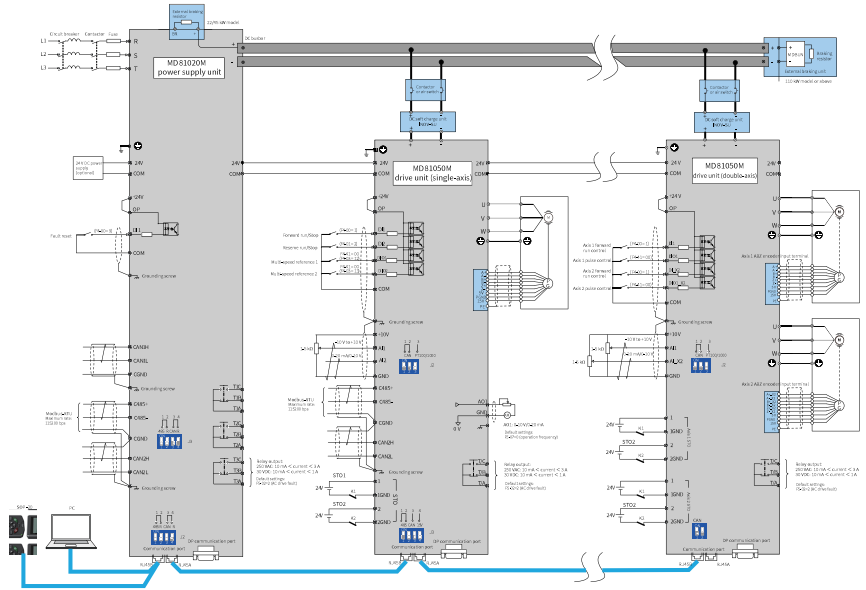


Figure 3-2 Electrical connection

## 3.2 Layout and Description of Main Circuit Terminals

### 3.2.1 Layout and Description of Main Circuit Terminals for the Power Supply Unit

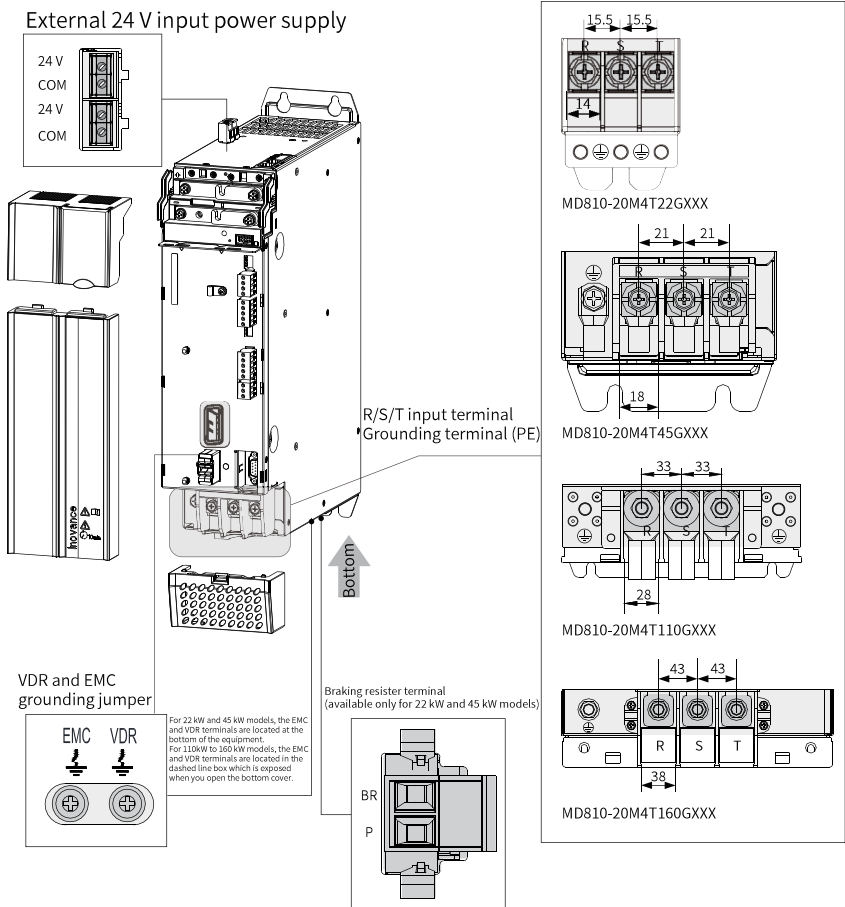


Figure 3-3 Layout and dimensions (mm) of main circuit terminals for the booksize power supply unit



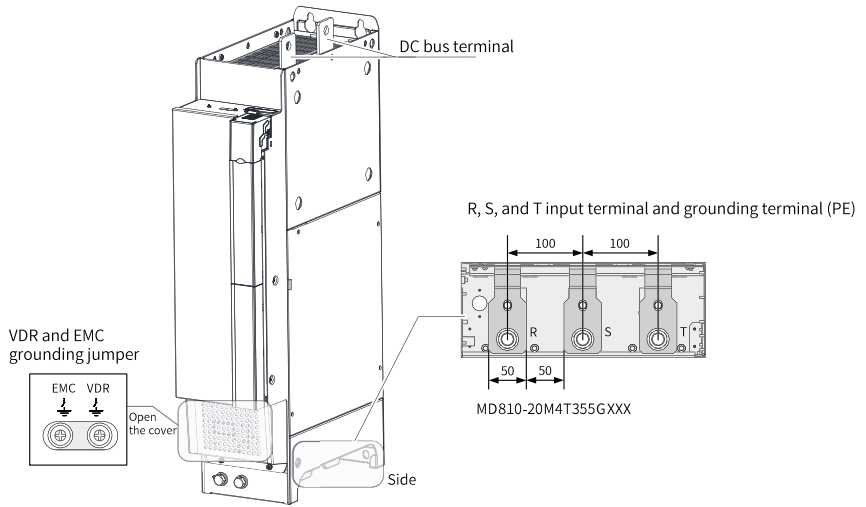



Figure 3-4 Layout and dimensions (mm) of main circuit terminals for the vertical tower power supply unit

Table 3-1 Descriptions of main circuit terminals

Mark	Name	Description
R, S, T	Three-phase AC input input terminals	Used to connect the three-phase AC input power supply.
(+), (-)	DC bus terminal	-
	Grounding terminal (PE)	Used for protective grounding.
BR, P	Braking resistor terminals	Used to connect the braking resistor.
24V, COM	Terminal for external 24 V power supply input	External power 24 V power input for the internal control module with the minimum current of 1 A
EMC, VDR	VDR and EMC grounding jumper	-

### 3.2.2 Layout and Description of Main Circuit Terminals for the Drive Unit (Single-Axis)

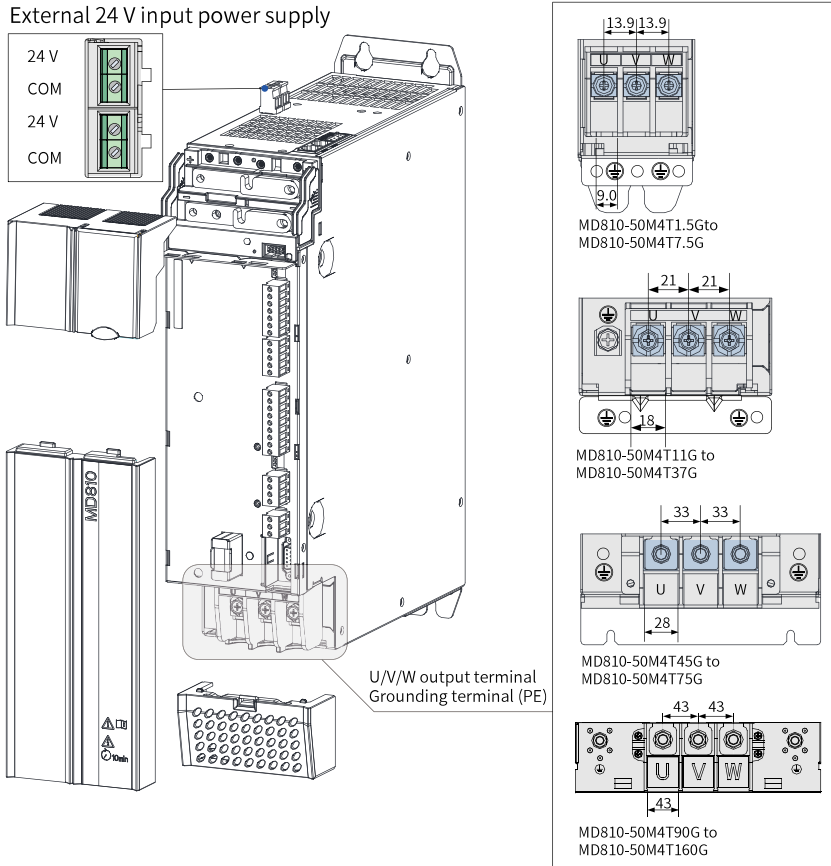


Figure 3-5 Layout and dimensions (mm) of main circuit terminals for the booksize drive unit (single-axis)

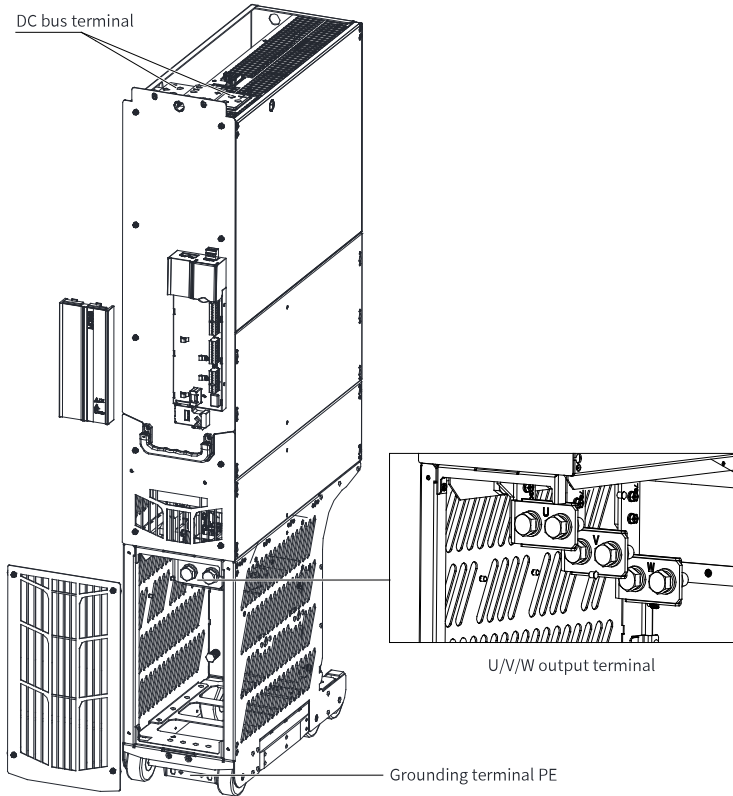


Figure 3-6 Layout and dimensions (mm) of main circuit terminals for the vertical tower drive unit (single-axis)

Table 3-2 Descriptions of main circuit terminals

Mark	Name	Description
U, V, W	Three-phase AC output terminals	Used to connect a three-phase motor.
(+), (-)	DC bus terminal	-
	Grounding terminal (PE)	Used for protective grounding.
24V, COM	Terminal for external 24 V power supply input	External 24 V power supply input for internal control module with the minimum current of 1 A

### 3.2.3 Layout and Description of Main Circuit Terminals for the Drive Unit (Dual-Axis)

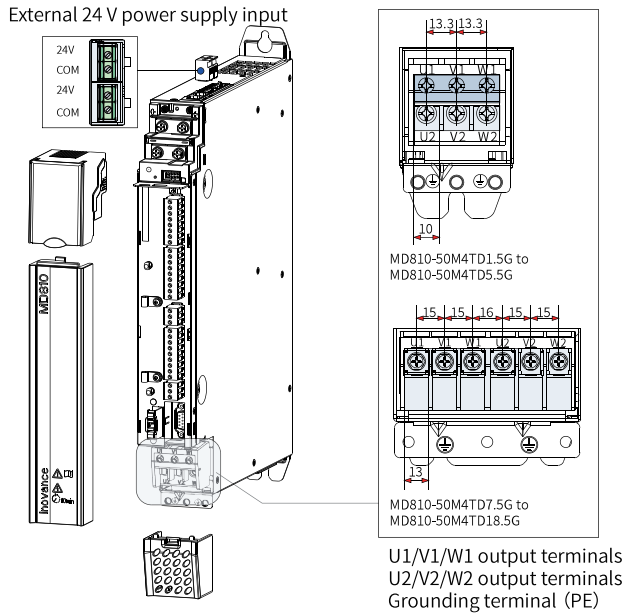



Figure 3-7 Layout and dimensions of main circuit terminals

Table 3-3 Descriptions of main circuit terminals

Mark	Name	Description
U1, V1, W1 U2, V2, W2	Three-phase AC output terminals	Used to connect a three-phase motor.
(+), (-)	DC bus terminal	-
	Grounding terminal (PE)	Used for protective grounding.
24V, COM	Terminal for external 24 V power supply input	External 24 V power supply input for internal control module with the minimum current of 1 A

### 3.3 Wiring Descriptions of Main Circuit Terminals

#### Three-phase AC input terminals R, S, and T (power supply unit input side)

- The cable connection on the input side of the power supply unit has no requirements on the phase sequence.
- The specifications and installation method of external power cables must comply with local regulations and related IEC requirements.
- Use copper conductors of a proper size as power cables according to the recommended values in *"Table 3-4" on page 64*.
- Install the filter close to the input terminals of the power supply unit, and keep the cable shorter than 30 cm. Connect the grounding terminal of the filter and that of the power supply unit, and install the filter and the power supply unit on the same conductive installation surface, which is connected to the main ground of the cabinet.

#### DC bus terminals + and -

- After the drive is switched off, terminals (+) and (-) of the DC bus have residual voltage. After the CHARGE indicator goes off, wait at least 10 minutes before operating the drive. Failure to comply may result in electric shock.
- When using external braking components for 110 kW, 160 kW, and 355 kW power supply units, ensure that + and - terminals must be connected correctly. Failure to comply will damage the power supply unit and the braking components or even lead to fire.
- The cable length of the braking unit cannot be longer than 100 m. Use the twisted pair cables or closely-paired cables for parallel connection.
- Do not connect the braking resistor directly to the DC bus. Failure to comply may result in damage to the drive and even fire.

#### Three-phase AC output terminals U, V, W (drive unit output side)

- The specifications and installation method of external power cables must comply with local regulations and related IEC requirements.
- Do not connect a capacitor or surge absorber to the output side of the drive unit. Otherwise, it will frequently activate the protection mechanism or even damage the drive.
- If the motor cable is too long, electrical resonance will be generated due to the impact of distributed capacitance. This will damage the motor insulation or generate higher leakage current, activating the overcurrent protection mechanism of the drive. If the motor cable length is longer than 100 m, an AC output reactor must be installed close to the drive.
- It is recommended to use the shielded cable for the output motor cable. Use the optional shield bracket to fix the shield, as shown in the figure below. Or use the

power cable fixing bracket to connect the shield in 360°, and crimp the shield drain wire to the PE terminal.

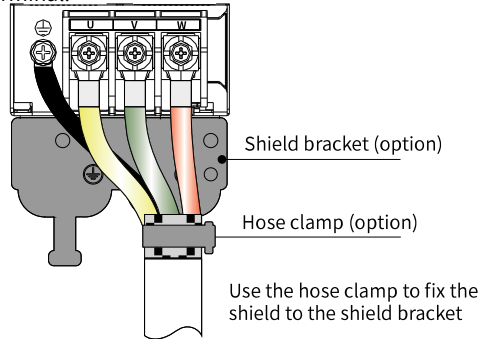


Figure 3-8 Installation of the shield bracket

- Keep the shield drain wire of the motor cable as short as possible, and ensure that the the wire length is equal to or shorter than 5 times the diameter, as shown in the figure below.

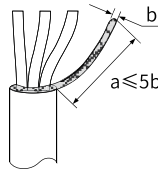


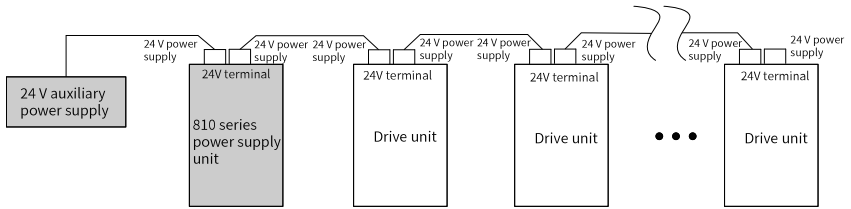
Figure 3-9 Shield drain wire of the motor cable

## Note

For details on shield bracket selection, see ["4.4 Shield Bracket" on page 146](#).

## Input terminal for external 24 V power supply

The product consists of an external 24 V power supply connected via a 24 V terminal at the top and the cascaded power supply and drive units. After the power supply unit and the drive units are connected, the control part can normally operate without any strong current added. You can set parameters and query faults, improving security greatly.



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## Note

- The external 24 V power supply provides each unit with current of 1 A.
  - The external 24 V power supply is optional without affecting normal use of the unit.
- 

## Braking resistor connection terminals BR and P

- For the selection of braking resistors, refer to the recommended value and keep the cable length shorter than 5 m. Failure to comply may result in damage to the power supply unit.
- Keep the braking resistor away from combustibles. Avoid igniting the surrounding components due to overheating of the braking resistor.
- After connecting the braking resistor, set F1–02 according to the actual load.

## Grounding terminal (PE)

- Ground the terminal reliably. Failure to comply may result in operation abnormality and even damage to the product.
- Do not connect the grounding terminal to the N terminal of the power supply.
- Select the size of the protective grounding conductor according to ["Table 3-4 " on page 64.](#)
- Use yellow and green cables for protective grounding conductor.
- Install the power supply unit and the drive unit on a conductive metal mounting surface to ensure that the entire conductive bottom of the unit is properly overlapped with the installation surface.
- Install the filter, the reactor, and the power supply unit on the same installation surface to ensure performance of the filter and the reactor.

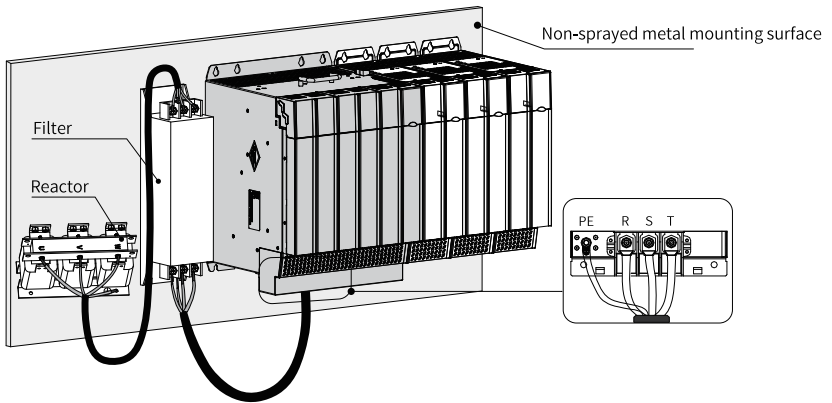


Figure 3-10 Protective grounding connection of main circuit terminals

### VDR and EMC grounding jumper

- The drive is applicable to power grid systems with neutral grounding. If the drive is used in IT power system (where the neutral point is not grounded), remove the VDR and EMC grounding jumpers. In addition, do not install the filter. Failure to comply may result in personal injury or damage to the drive.
- Where a residual current circuit breaker is configured, if leakage protector is tripped during startup, remove the screw of the EMC grounding jumper.

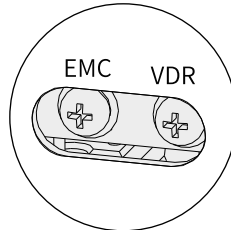


Figure 3-11 VDR and EMC grounding jumper

## 3.4 Cable Selection for Main Circuits

### Requirements for main circuit cables

It is recommended that the input main circuit cable use a symmetrical shielded cable. Compared with four-conductor cables, symmetrical shielded cables can reduce electromagnetic radiation in the whole transmission system.

To comply with the EMC standards, use shielded cables. The shielded cables are divided into three-conductor cables and four-conductor cables, as shown below. If the conductivity of the three-conductor cable shield cannot meet requirements, add an independent PE cable. For the four-conductor cable, one conductor is used as the



PE cable. To suppress radio frequency interference effectively, use the coaxial copper braid as the cable shield. Ensure that the braided density is greater than 90% to enhance the shielding performance and conductivity.

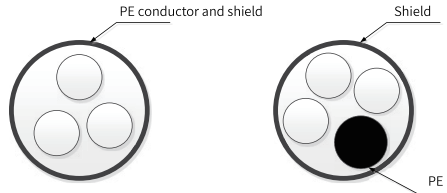


Figure 3-12 Recommended main circuit cable types

### Specifications for main circuit cables

Table 3–4 Cable specifications and tightening torque of main circuit cables of the power supply unit

Power Supply Unit Model	Input Terminals R, S, and T			Grounding Terminal PE		
	Recommended IEC Cable Specification (mm <sup>2</sup> )	Screw	Tightening Torque N·m	Recommended IEC Cable Specification (mm <sup>2</sup> )	Screw	Tightening Torque N·m
MD810-20M4T22GXXX	10	M6	3	10	M5	2.8
MD810-20M4T45GXXX	25	M5	2.8	25	M6	4.8
MD810-20M4T110GXXX	95	M10	20	95	M10	20
MD810-20M4T160GXXX (W)	150	M12	35	150	M12	35
MD810-20M4T355GXXX	2 x 185	M16	85	2 x 185	M12	35

Table 3–5 Cable specifications and tightening torque of main circuit cables of the drive unit

Drive Unit Model	Output Terminals (U, V, W)			Grounding Terminal PE		
	Recommended IEC Cable Specification (mm <sup>2</sup> )	Screw	Tightening Torque N·m	Recommended IEC Cable Specification (mm <sup>2</sup> )	Screw	Tightening Torque N·m
MD810-50M4T1.5GXXX	0.75	M5	2.8	0.75	M5	2.8
MD810-50M4T2.2GXXX	0.75	M5	2.8	0.75	M5	2.8
MD810-50M4T3.7GXXX	1	M5	2.8	1	M5	2.8
MD810-50M4T5.5GXXX	1.5	M5	2.8	1.5	M5	2.8

Drive Unit Model	Output Terminals (U, V, W)			Grounding Terminal PE		
	Recommended IEC Cable Specification (mm <sup>2</sup> )	Screw	Tightening Torque N·m	Recommended IEC Cable Specification (mm <sup>2</sup> )	Screw	Tightening Torque N·m
MD810-50M4T7.5GXXX	2.5	M5	2.8	2.5	M5	2.8
MD810-50M4T11GXXX(W)	4	M5	2.8	4	M6	4.8
MD810-50M4T15GXXX(W)	6	M5	2.8	6	M6	4.8
MD810-50M4T18.5GXXX(W)	10	M5	2.8	10	M6	4.8
MD810-50M4T22GXXX(W)	10	M5	2.8	10	M6	4.8
MD810-50M4T30GXXX(W)	16	M6	4.8	16	M6	4.8
MD810-50M4T37GXXX(W)	25	M6	4.8	16	M6	4.8
MD810-50M4T45GXXX	35	M10	20	16	M10	20
MD810-50M4T55GXXX	50	M10	20	25	M10	20
MD810-50M4T75GXXX	70	M10	20	35	M10	20
MD810-50M4T90GXXX	95	M12	35	50	M10	20
MD810-50M4T110GXXX	120	M12	35	70	M10	20
MD810-50M4T132GXXX	150	M12	35	95	M10	20
MD810-50M4T160GXXX	185	M12	35	95	M10	20
MD810-50M4T200GXXXH	2 x 95	M10	20	95	M8	13
MD810-50M4T250GXXXH	2 x 120	M10	20	120	M8	13
MD810-50M4T315GXXXH	2 x 185	M10	20	185	M8	13
MD810-50M4T355GXXXH	2 x 185	M10	20	185	M8	13
MD810-50M4TD1.5GXXX	0.75	M5	2.8	0.75	M5	2.8
MD810-50M4TD2.2GXXX	0.75	M5	2.8	0.75	M5	2.8
MD810-50M4TD3.7GXXX	1	M5	2.8	1	M5	2.8

Drive Unit Model	Output Terminals (U, V, W)			Grounding Terminal PE		
	Recommended IEC Cable Specification (mm <sup>2</sup> )	Screw	Tightening Torque N·m	Recommended IEC Cable Specification (mm <sup>2</sup> )	Screw	Tightening Torque N·m
MD810-50M4TD5.5GXXX	1.5	M5	2.8	1.5	M5	2.8
MD810-50M4TD7.5GXXX(W)	2.5	M5	2.8	2.5	M6	4.8
MD810-50M4TD11GXXX(W)	4	M5	2.8	4	M6	4.8
MD810-50M4TD15GXXX(W)	6	M5	2.8	6	M6	4.8
MD810-50M4TD18.5GXXX(W)	10	M5	2.8	10	M6	4.8

**Recommended cable lug**

The cable lugs manufactured by Suzhou Yuanli are recommended, as shown below.



GTNR series



TNR series



TNS series

**Note**

For details on cable lug selection, see ["4.9.3 Cable Lug" on page 156](#).

### 3.5 Layout and Description of Control Circuit Terminals

#### 3.5.1 Layout and Description of Control Circuit Terminals for the Power Supply Unit

##### 3.5.1.1 Relationship Between Power Supply Unit Models and Control Circuit Terminals

Terminal Type	Terminal Mark	Terminal Name	Power Supply Unit Model (MD810-20M4TXXGXXX)			Terminal Definition
			G000, G100	G010, G110	G020, G120	
Communication terminal	CN1	CAN1 communication terminal	One	One	One	<a href="#">"Table 3-6 " on page 70</a>
	CN2	External CAN2/RS485 communication terminal	One	-	One	<a href="#">"Table 3-7 " on page 70</a>
	None (DB9)	PROFIBUS DP communication terminal (DB9)	-	One	-	<a href="#">"Table 3-10 " on page 71</a>
	RJ45A/RJ45B	RJ45 communication terminal	One	One	One	<a href="#">"Table 3-11 " on page 71</a>
	ProfinetA and ProfinetB	PROFINET communication terminal	-	-	One	<a href="#">"Table 3-12 " on page 72</a>
I/O terminal	CN3	Digital input terminal	One	One	One	<a href="#">"Table 3-8 " on page 70</a>
	CN4	Relay terminal	One	One	One	<a href="#">"Table 3-9 " on page 71</a>
DIP switch	S1	S1 DIP Switch	One	One	One	<a href="#">"Table 3-13 " on page 73</a>
	S2	S2 DIP Switch	One	-	One	<a href="#">"Table 3-14 " on page 73</a>
Terminal layout						
-			Power Supply Unit Model (MD810-20M4TXXGXXX)			-
			G000, G100	G010, G110	G020, G120	
Terminal layout			<a href="#">"Figure 3-13 " on page 68</a>	<a href="#">"Figure 3-14 " on page 69</a>	<a href="#">"Figure 3-15 " on page 69</a>	-

## Note

"One" indicates that the model has one terminal of this type. "-" indicates that the model does not have the terminal of this type.

### 3.5.1.2 Layout of Control Circuit Terminals for the Power Supply Unit

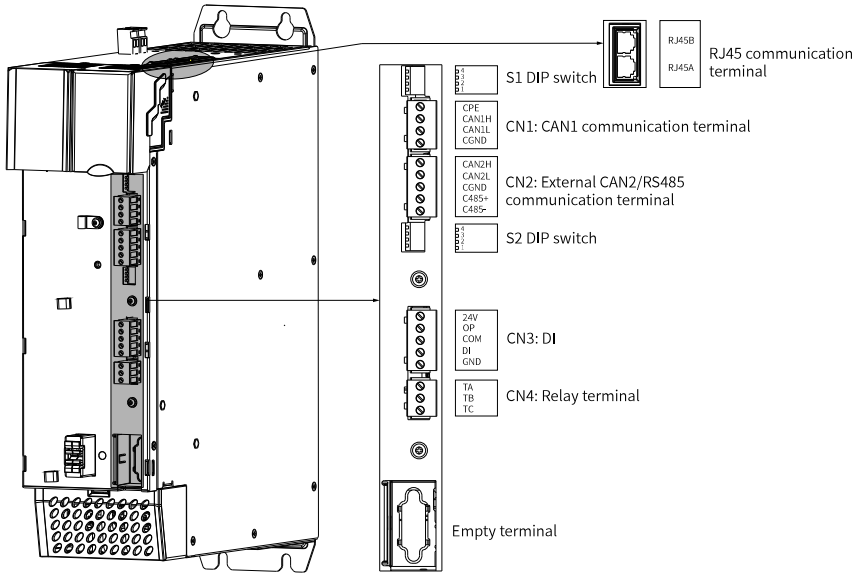


Figure 3-13 Control circuit terminals of MD810-20M4TXXG000 and MD810-20M4TXXG100

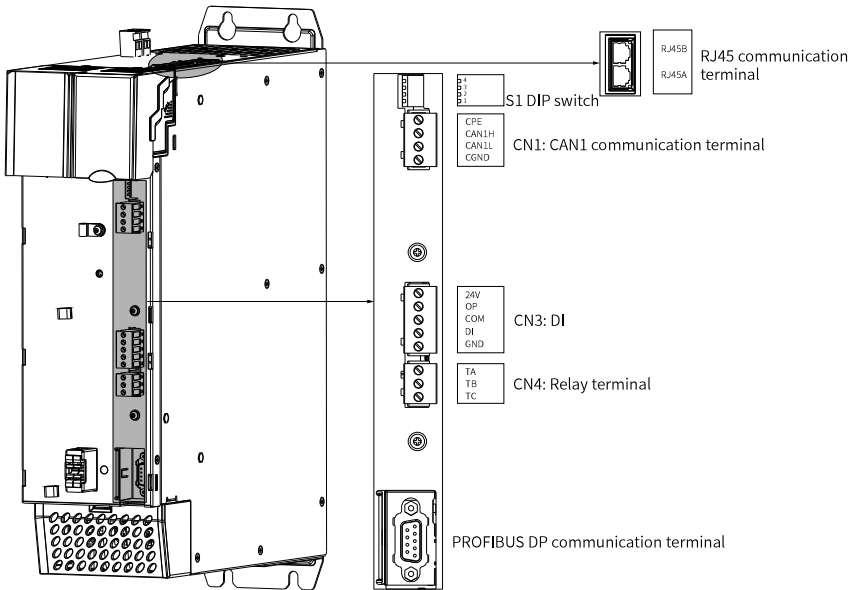


Figure 3-14 Control circuit terminals of MD810-20M4TXXG10 and MD810-20M4TXXG110

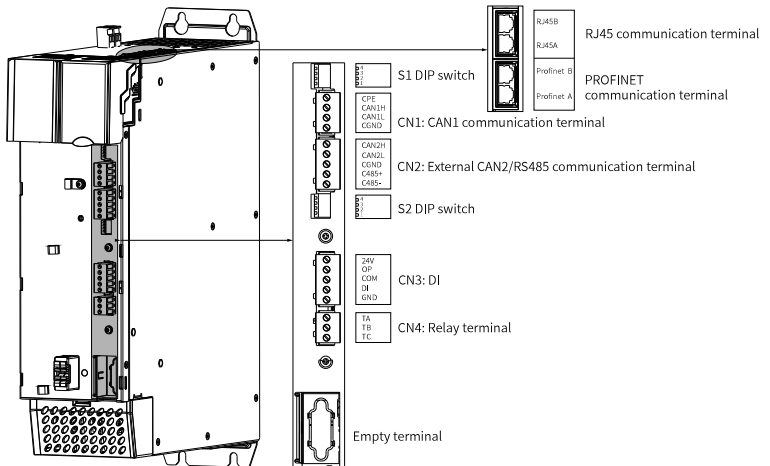


Figure 3-15 Control circuit terminals of MD810-20M4TXXG20 and MD810-20M4TXXG120

### 3.5.1.3 Descriptions of Control Circuit Terminals for the Power Supply Unit

Table 3-6 CAN1 communication terminal CN1

Pin Mark	Pin Definition	Specification
CAN1H	CAN_H signal of CAN communication	CANopen/CANlink is supported. The external terminal of CAN1 is used for communication with the host controller
CAN1L	CAN_L signal of CAN communication	
CGND	Communication common ground	
CPE	Network cable shield	

Table 3-7 External CAN2/RS485 communication terminal CN2

Pin Mark	Pin Definition	Specification
C485+	External RS485 communication positive signal	Used to communicate with the host controller (such as PLC) based on RS485
C485-	External RS485 communication negative signal	
CAN2H	CAN_H signal of CAN communication	CAN communication signal dedicated for synchronous control
CAN2L	CAN_L signal of CAN communication	
CGND	Communication common ground	-

Table 3-8 Digital input terminal CN3

Pin Mark	Pin Definition	Specification
DI	Common multi-function input terminal	Programmable terminal for isolated sink/source input; operating voltage range: 9-30 V; ineffective voltage: < 5 V; input impedance: 3 k $\Omega$ ; response time: meeting the requirements for 100 Hz frequency input
OP	Multi-functional input common terminal	Internally isolated from COM and 24V; shorted to 24V using a U-type jumper
24V	Internal 24 V power supply	24 V $\pm$ 10%; no-load voltage: $\leq$ 30 V; maximum output current: 200 mA; internally isolated from OP/CGND/GND.
COM	Internal 24 V ground	Internally isolated from CGND and GND.
GND	Reference ground of power supply	-

Table 3-9 Relay terminal CN4

Pin Mark	Pin Definition	Specification
TA/TB/TC	TA-TB: Normally closed TA-TC: Normally open	Contact capacity: 250 VAC/3 A ( $\text{Cos}\phi = 0.4$ )

Table 3-10 PROFIBUS DP communication terminal DB9

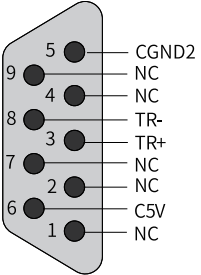

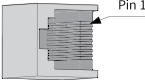
Pin Mark	Pin Definition	Specification
Unconnected	/	
Unconnected	/	
TR+	PROFIBUS DP bus positive end	
Unconnected	/	
CGND	PROFIBUS DP bus power supply ground	
C5V	PROFIBUS DP bus power supply	
Unconnected	/	
TR-	PROFIBUS DP bus negative end	
Unconnected	/	

Table 3-11 RJ45 communication terminals RJ45A/ RJ45B

Pin Mark		Pin Definition	Specification	
RJ45A	1	CAN1H	CAN_H signal of CAN communication	CANopen/ CANlink supported; used for communication with the host controller and internal commissioning
	2	CAN1L	CAN_L signal of CAN communication	
	3	CGND	Communication signal ground	
	4	RS485+	RS485 positive communication signal	Internal bus, used only for the external operating panel and PC commissioning
	5	RS485-	RS485 negative communication signal	
	6	Unconnected	/	
	7	Unconnected	/	
	8	CGND	Communication signal ground	
				



Pin Mark		Pin Definition	Specification	
RJ45B	1	CAN1H	CAN_H signal of CAN communication	CANopen/ CANlink supported; used for communication with the host controller and internal commissioning
	2	CAN1L	CAN_L signal of CAN communication	
	3	CGND	Communication signal ground	
	4	RS485+	RS485 positive communication signal	Internal bus, used only for the external operating panel and PC commissioning
	5	RS485-	RS485 negative communication signal	
	6	C7V	Used to power the external LCD operating panel	Power supply of the external LCD operating panel
	7	C7V	Used to power the external LCD operating panel	
	8	CGND	Communication signal ground	Communication signal ground



 **Caution**

There is no power supply output for PN models. Connect the external LCD operating panel to the RJ45B port on the drive unit if needed.

Table 3-12 PROFINET communication terminals ProfinetA and ProfinetB

Pin Mark	Pin Definition	Specification	
1	TX+	Data transmitting+	The yellow indicator indicates that the link has been established. The green indicator indicates that the signal is normal.
2	TX-	Data transmitting-	
3	RX+	Data receiving+	
6	RX-	Data receiving-	

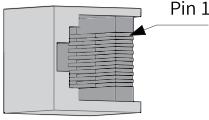


Table 3–13 DIP switch S1

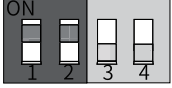
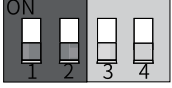
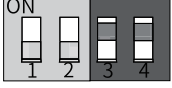

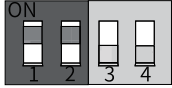
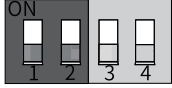
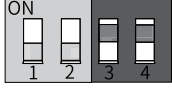
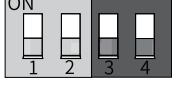
Description		DIP Switch Position
RS485 termination resistor (during RS485 communication through terminals RJ45A/RJ45B)	1 and 2 set to ON: Termination resistor enabled	
	1 and 2 set to OFF: Termination resistor disabled	
CAN1 termination resistor (during CAN communication through terminals RJ45A/RJ45B)	3 and 4 set to ON: Termination resistor enabled	
	3 and 4 set to OFF: Termination resistor disabled	

Table 3–14 DIP switch S2

Description		DIP Switch Position
RS485 termination resistor selection (during RS485 communication through external CAN2/RS485 communication terminals marked by CN2)	1 and 2 set to ON: Termination resistor enabled	
	1 and 2 set to OFF: Termination resistor disabled	
CAN2 termination resistor (during CAN communication through external CAN2/RS485 communication terminals marked by CN2)	3 and 4 set to ON: Termination resistor enabled	
	3 and 4 set to OFF: Termination resistor disabled	

## 3.5.2 Layout and Description of Control Circuit Terminals for the Drive Unit (Single-Axis)

### 3.5.2.1 Relationship Between Drive Unit (Single Axis) Models and Control Circuit

#### Terminals

Terminal Type	Terminal Code	Terminal Name	Drive Unit Model (MD810-50M4TXXGXXX)								Terminal Definition
			G200	G201	G210	G211	G300	G400	G530	G531	
Communication terminal	CN4	External CAN2/RS485 communication terminal	One	One	One	One	One	One	-	-	<a href="#">"Table 3-18 " on page 82</a>
	RJ45A/RJ45B	RJ45 communication terminal	One	One	One	One	One	One	One	One	<a href="#">"Table 3-25 " on page 85</a>
	ECT-IN/ECT-OUT	EtherCAT communication terminal	-	-	-	-	-	-	One	One	<a href="#">"Table 3-26 " on page 86</a>
	None (DB9 terminal)	PROFIBUS DP communication terminal	Empty terminal	-	One	One	-	-	-	-	<a href="#">"Table 3-21 " on page 82</a>
Encoder terminal	CN3	ABZ encoder terminal	One	One	One	One	Reserved	One	One	One	<a href="#">"Table 3-17 " on page 81</a>
	None (DB9 terminal)	23-bit encoder	-	-	-	-	One	-	-	-	<a href="#">"Table 3-22 "</a>

Terminal Type	Terminal Code	Terminal Name	Drive Unit Model (MD810-50M4TXGXXX)								Terminal Definition	
			G200	G201	G210	G211	G300	G400	G530	G531		
		terminal										<a href="#">on page 83</a>
	None (DB15 terminal)	Resolver encoder terminal	-	-	-	-	-	-	One	-	-	<a href="#">"Table 3-23" on page 83</a>
	None (DB15 terminal)	Multi-encoder terminal	-	-	-	-	-	-	-	One	One	<a href="#">"Table 3-24" on page 84</a>
I/O terminal	CN1	DI/DO terminal	One	One	One	One	One	One	One	One	One	<a href="#">"Table 3-15" on page 80</a>
	CN2	AI/AO terminal	One	One	One	One	One	One	One	One	One	<a href="#">"Table 3-16" on page 81</a>
	CN5	Relay terminal	One	One	One	One	One	One	One	One	One	<a href="#">"Table 3-20" on page 82</a>
STO terminal	CN4	STO terminal	-	-	-	-	-	-	-	Reserved	One	<a href="#">"Table 3-19" on page 82</a>
	STO	STO terminal	-	One	Reserved	One	Reserved	Reserved	Reserved	-	-	
DIP switch	S1	S1 DIP Switch	One	One	One	One	One	One	One	One	One	<a href="#">"Table 3-27" on page 86</a>
	S2	S2 DIP Switch	One	One	One	One	One	One	One	One	One	<a href="#">"Table 3-28" on page 86</a>
Terminal layout												

Terminal Type	Terminal Code	Terminal Name	Drive Unit Model (MD810-50M4TXXGXXX)							Terminal Definition	
			G200	G201	G210	G211	G300	G400	G530		G531
-			Drive Unit Model (MD810-50M4TXXGXXX)							-	
			G200	G201	G210	G211	G300	G400	G530		G531
Terminal layout			"Figure 3-16" on page 76	"Figure 3-17" on page 77	"Figure 3-18" on page 77	"Figure 3-19" on page 78	"Figure 3-20" on page 78	"Figure 3-21" on page 79	"Figure 3-22" on page 79	"Figure 3-23" on page 80	-

**Note**

- "One" indicates that the model has one terminal of this type.
- "-" indicates that the model does not have the terminal of this type.
- "Reserved" indicates that the model has the terminal of this type without electrical connection.
- "Empty terminal" indicates that the position is reserved without the terminal or electrical connection.

**3.5.2.2 Layout of Control Circuit Terminals for the Drive Unit (Single-Axis)**

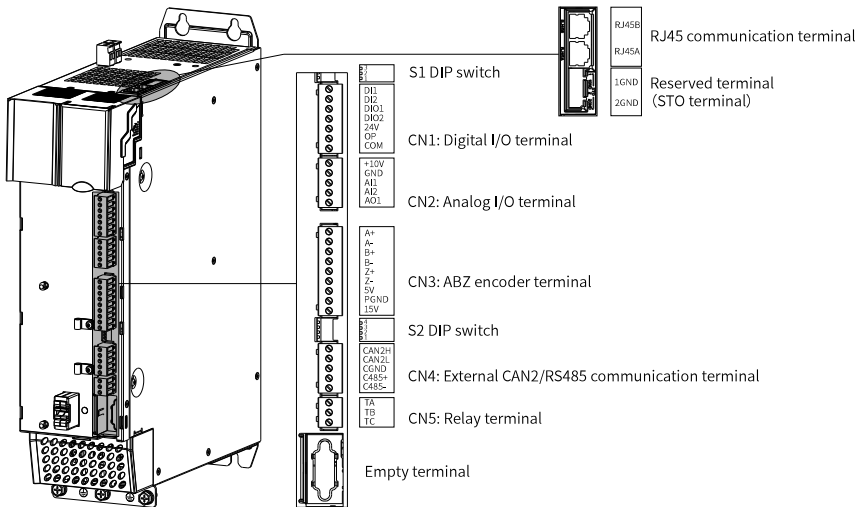


Figure 3-16 MD810-50M4TXXG200 control circuit terminals

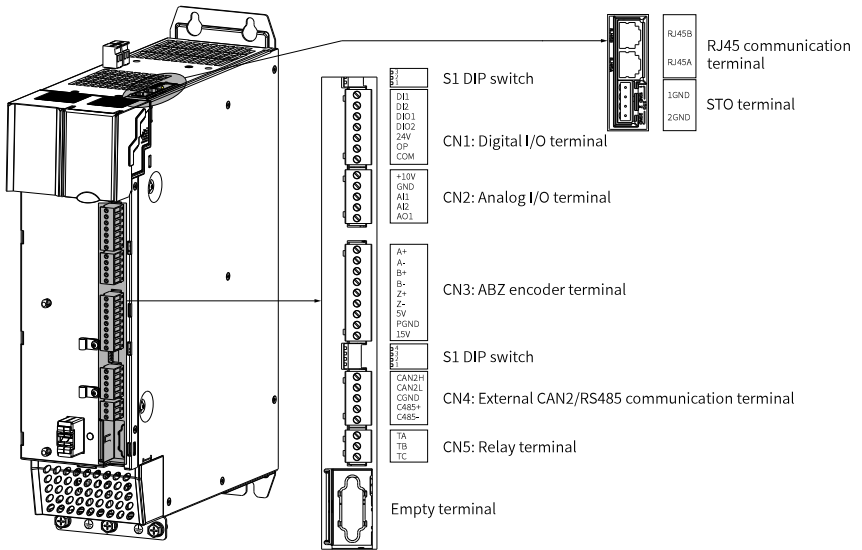


Figure 3-17 MD810-50M4TXXG201 control circuit terminals

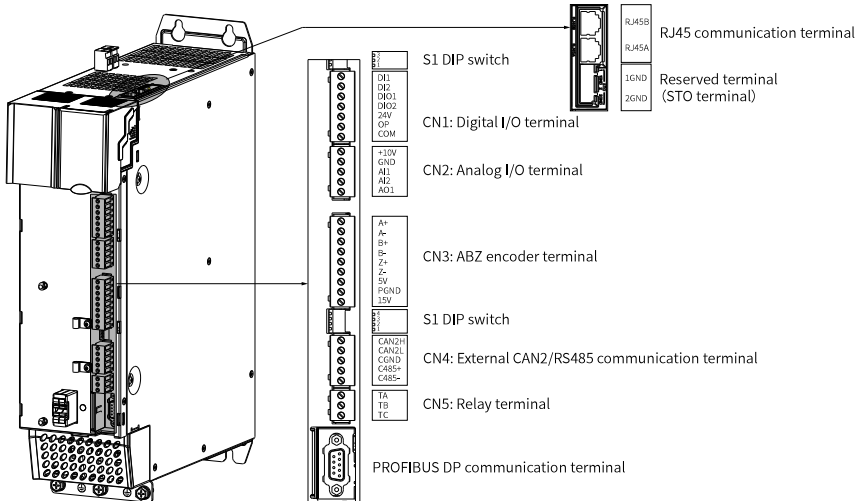


Figure 3-18 MD810-50M4TXXG210 control circuit terminals

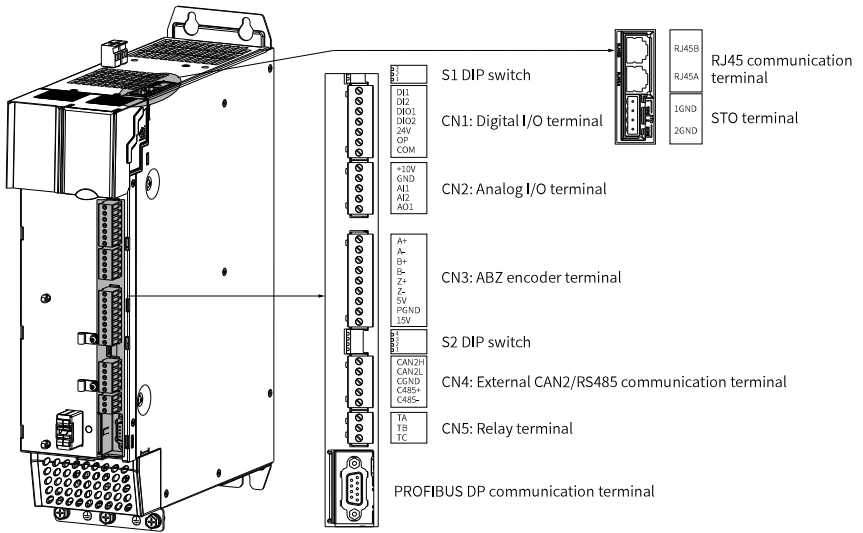


Figure 3-19 MD810-50M4TXXG211 control circuit terminals

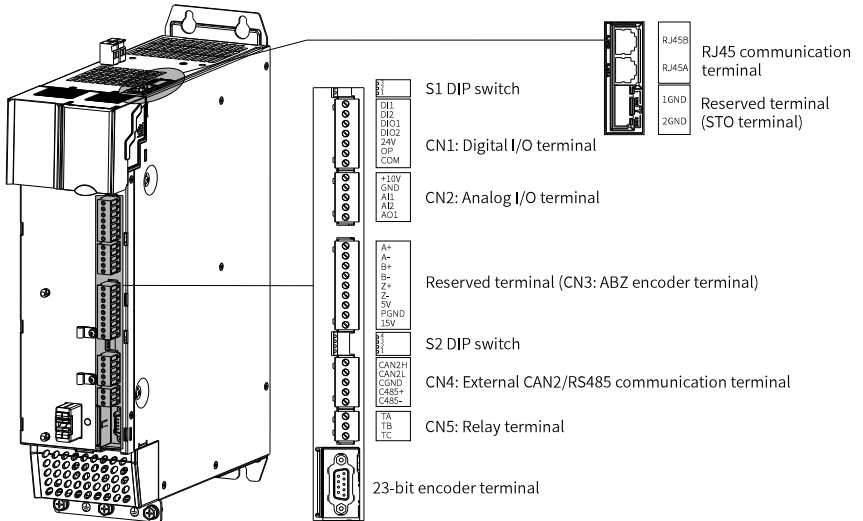


Figure 3-20 MD810-50M4TXXG300 control circuit terminals

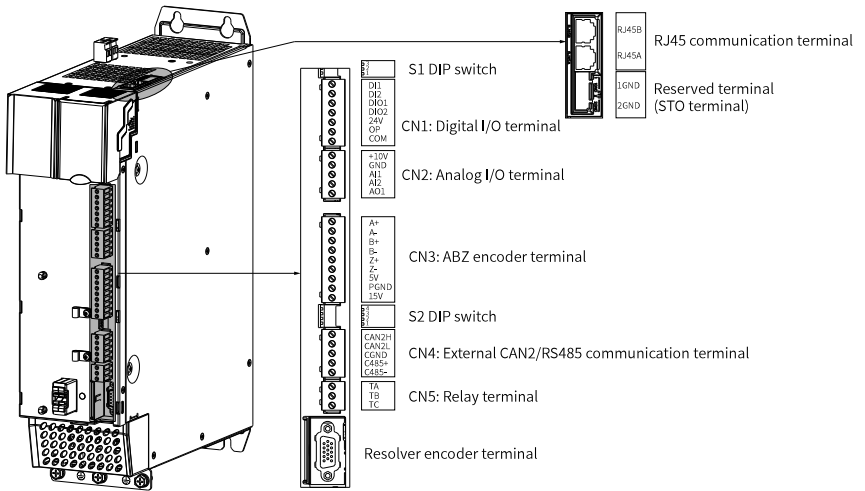


Figure 3-21 MD810-50M4TXXG400 control circuit terminals

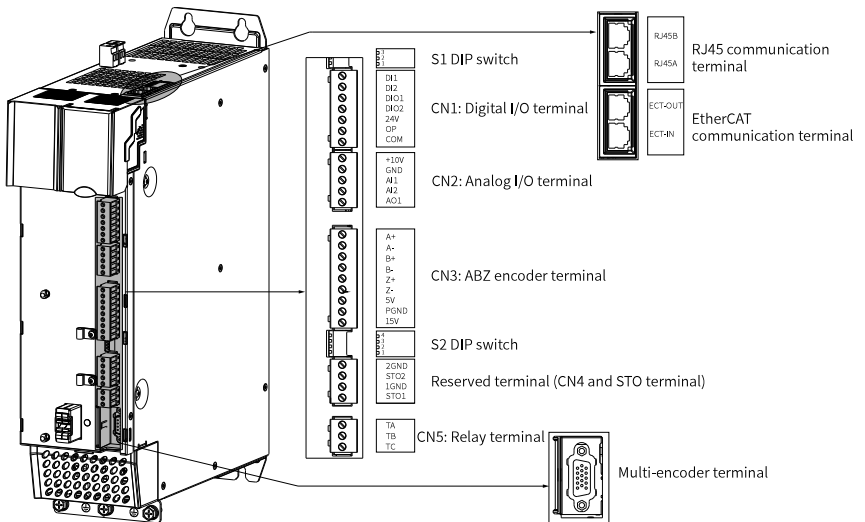


Figure 3-22 MD810-50M4TXXG530 control circuit terminals



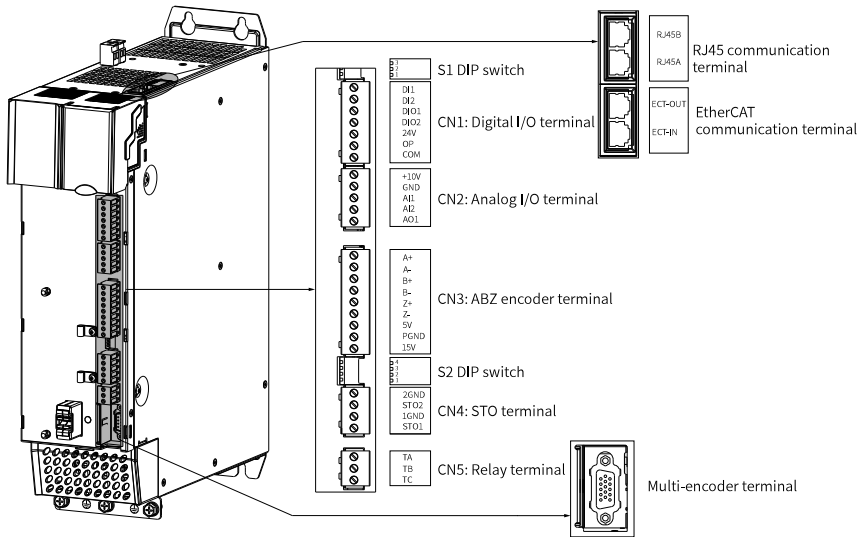


Figure 3-23 MD810-50M4TXG531 control terminals

### 3.5.2.3 Descriptions of Control Circuit Terminals for the Drive Unit (Single-Axis)

Table 3-15 DI/DO terminals (CN1)

Pin Mark	Pin Definition	Specification
DI1-DI2	Common multi-function input terminal	Isolated sink/source input programmable terminal; input frequency: < 100 Hz
DI01	High-speed pulse input terminal/Common multi-functional output terminal	Isolated programmable I/O terminal; maximum input frequency as DI: 100 kHz; maximum output capability as DO: 24 VDC/50 mA
DI02	Common multi-functional input terminal/High-speed pulse output terminal	Isolated programmable I/O terminal; input frequency as DI: < 100 Hz; maximum output frequency as DO: 100 kHz; drive capability as DO: 24 VDC/50 mA
OP	Multi-functional input common terminal	Internally isolated from COM and 24V; shorted to 24V using a U-type jumper by default
24V	Internal 24 V power supply provided by the drive unit	24 V ± 10%; no-load voltage: ≤ 30 V; maximum output current: 200 mA; internally isolated from OP/CGND/GND
COM	Internal 24 V grounding terminal provided by the drive unit	Internally isolated from CGND and GND

Table 3–16 AI/AO terminals (CN2)

Pin Mark	Pin Definition	Specification
AI1	Analog input channel AI1	0 V to 10 V and -10 V to +10 V available; 12-bit resolution, correction accuracy error: $\pm 3\%$ ; input impedance: 22.1 k Temperature sensors PT100 and PT1000 (switched over by sub-switch 3 of DIP switch S1) are supported.
AI2	Analog input channel AI2	0 V to 10 V and 0 mA to 20 mA available; 12-bit resolution; correction accuracy error: $\pm 0.3\%$ ; input impedance in voltage input mode: 22.1 k $\Omega$ ; input impedance in current input mode: 500 $\Omega$ or 250 $\Omega$
AO	Analog output	0 V to 10 V and 0 mA to 20 mA available; 12-bit resolution; correction accuracy error: $\pm 0.5\%$ ; maximum load output current in voltage mode: 2 mA; load impedance in voltage mode: > 5 k $\Omega$ ; load impedance in current mode: < 500 $\Omega$
+10V	10 V analog voltage output	10 V $\pm$ 10%, maximum current: 10 mA
GND	Analog ground	Internally isolated from COM and CGND

Table 3–17 ABZ encoder terminal (CN3)

Pin Mark	Pin Definition	Specification
A+	Differential encoder positive A signal	Differential, collector, and push-pull encoders are supported. Differential encoders are powered by 5 V power supply, and collector and push-pull encoders are powered by 15 V power supply. Sub-switch 4 of DIP switch S2 is used to switch between 5 V and 15 V.
A-	Differential encoder negative A signal/collector or push-pull encoder A signal	
B+	Differential encoder positive B signal	
B-	Differential encoder negative B signal/collector or push-pull encoder B signal	
Z+	Differential encoder positive Z signal	
Z-	Differential encoder negative Z signal/collector or push-pull encoder Z signal	
5V	Power supply for the encoder	
15V	Power supply for the encoder	
PGND	Power supply ground for the encoder	

Table 3–18 External CAN2/RS485 communication terminal (CN4)

Pin Mark	Pin Definition	Specification
C485+	External RS485 communication positive signal	Used to communicate with the host controller (such as PLC) based on RS485
C485-	External RS485 communication negative signal	
CAN2H	CAN_H signal of CAN communication	As the CAN communication internal bus, it can be used for synchronous control among drive units after they are connected through the terminal
CAN2L	CAN_L signal of CAN communication	
CGND	CAN communication signal ground	

Table 3–19 STO terminals CN4 and STO

Pin Mark	Pin Definition	Specification
STO1	STO channel 1 power supply+	24 V input power supply
1GND	STO channel 1 power supply-	
STO2	STO channel 2 power supply+	
2GND	STO channel 2 power supply-	

Table 3–20 Relay terminal (CN5)

Pin Mark	Pin Definition	Specification
TA/TB/TC	TA-TB: Normally closed TA-TC: Normally open	Contact capacity: 250 VAC/3 A (Cosφ = 0.4)

Table 3–21 PROFIBUS DP communication terminal (DB9)

Pin Mark	Pin Definition	Specification
Unconnected	-	
Unconnected	-	
TR+	PROFIBUS DP bus positive end	
Unconnected	-	
CGND2	PROFIBUS DP bus power supply ground	
C5V	PROFIBUS DP bus power supply	
Unconnected	-	
TR-	PROFIBUS DP bus negative end	
Unconnected	-	

Table 3–22 23-bit encoder terminal (DB9)

Pin Mark	Pin Definition	Specification	
PS+	Bus communication signal+		
PS-	Bus communication signal-		
Unconnected	-		
Unconnected	-		
Unconnected	-		
Unconnected	-		
+5V	Encoder +5 V power supply		
GND	Encoder +5 V power supply ground		
Unconnected	-		Note that when the DB9 terminal is used as the 23-bit encoder terminal, the CN3 (ABZ encoder terminal) is invalid.

Table 3–23 Resolver encoder terminal (DB15)

Pin Mark	Pin Definition	Specification
EXC+	Excitation output signal+	
EXC-	Excitation output signal-	
SIN+	Feedback sine signal+	
SIN-	Feedback sine signal-	
COS+	Feedback cosine signal+	
COS-	Feedback cosine signal-	
COM	Power supply ground of the frequency division circuit	
COM	Power supply ground of the frequency division circuit	
OA+	Output positive A signal for frequency division	
OA-	Output negative A signal for frequency division	
OB+	Output positive B signal for frequency division	
OB-	Output negative B signal for frequency division	
OZ+	Output positive Z signal for frequency division	
OZ-	Output negative Z signal for frequency division	

Pin Mark	Pin Definition	Specification
PVCC	Power supply (5–30 V) for the frequency division circuit	

Table 3–24 Multi-encoder terminal (DB15)

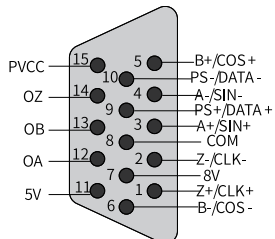
Pin Mark	Pin Definition	Specification
Z+/CLK+	Z-phase positive signal or SSI clock output positive signal for incremental or sin-cos encoders	 <p>The multi-encoder terminal can be used to connect the 5 V differential ABZ, 23-bit communication, sine-cosine, and SSI encoders, and supports incremental frequency division output.</p>
Z-/CLK-	Z-phase negative signal or SSI clock output signal signal for incremental and sine-cosine encoders	
A+/SIN+	A-phase positive signal or sine-cosine input positive signal for 5 V incremental encoders	
A-/SIN-	A-phase negative signal or sine-cosine input negative signal for 5 V incremental encoders	
B+/COS+	B-phase positive signal or sine-cosine input positive signal for 5 V incremental encoders	
B-/COS-	B-phase negative signal or cosine-cosine input negative signal for 5 V incremental encoders	
12V	12 V power supply for encoders	
COM	Power supply ground for encoders	
PS+/DATA+	Communication positive signal or SSI data positive signal for Inovance 23-bit encoders	
PS-/DATA-	Communication negative signal or SSI data negative signal for Inovance 23-bit encoders	
5V	5 V power supply for encoders	
OA	A-phase signal for frequency division output	
OB	B-phase signal for frequency division output	
OZ	C-phase signal for frequency division output	
PVCC	Power supply (5–30 V) for frequency division output	

Table 3–25 RJ45 communication terminals RJ45A/ RJ45B

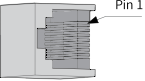

Pin Mark		Pin Definition		Specification	
RJ45A	1	CAN1H	CAN_H signal of CAN communication	CANopen/ CANlink supported; used for communica tion with the host controller and internal commissioning	
	2	CAN1L	CAN_L signal of CAN communication		
	3	CGND	Communication signal ground		
	4	RS485+	RS485 positive communication signal	Internal bus, used only for the external operating panel and PC commissioning	
	5	RS485-	RS485 negative communication signal		
	6	Unconnect ed	-		
	7	Unconnect ed	-		
8	CGND	Communication signal ground			
RJ45B	1	CAN1H	CAN_H signal of CAN communication	CANopen/ CANlink supported; used for communica tion with the host controller and internal commissioning	
	2	CAN1L	CAN_L signal of CAN communication		
	3	CGND	Communication signal ground		
	4	RS485+	RS485 positive communication signal	Internal bus, used only for the external operating panel and PC commissioning	
	5	RS485-	RS485 negative communication signal		
	6	C7V	Used to power the external LCD operating panel	Power supply of the external LCD operating panel	
	7	C7V	Used to power the external LCD operating panel		
	8	CGND	Communication signal ground	Communica tion signal ground	

Table 3–26 EtherCAT communication terminals ECT-IN and ECT-OUT

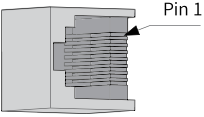
Pin Mark		Pin Definition	Specification	
1	TX+	Data transmitting+	The yellow indicator indicates that the link has been established. The green indicator indicates that the signal is normal.	
2	TX-	Data transmitting-		
3	RX+	Data receiving+		
6	RX-	Data receiving-		

Table 3–27 DIP switch S1

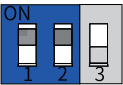
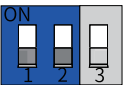
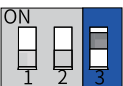
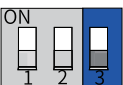
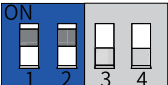
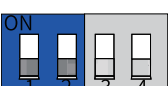
Terminal Name	Description	DIP Switch Position
CAN1 termination resistor (during CAN communication through terminals RJ45A/RJ45B)	1 and 2 set to ON: Termination resistor enabled	
	1 and 2 set to OFF: Termination resistor disabled	
AI1 function	3 set to ON: Temperature detection by the PT100/PT1000 enabled	
	3 set to OFF: analog input	

Table 3–28 DIP switch S2

Terminal Name	Description	DIP Switch Position
C485 termination resistor (during RS485 communication through external CAN2/RS485 communication terminals marked by CN4)	1 and 2 set to ON: Termination resistor enabled	
	1 and 2 set to OFF: Termination resistor disabled	

Terminal Name	Description	DIP Switch Position
CAN2 termination resistor (during CAN communication through external CAN2/RS485 communication terminals marked by CN4)	3 set to ON: Termination resistor enabled	
	3 set to OFF: Termination resistor disabled	
Power supply for the ABZ encoder terminal	4 set to ON: 5 V power supply output	
	4 set to OFF: 15 V power supply output	

### 3.5.3 Layout and Description of Control Circuit Terminals for the Drive Unit (Dual-Axis)

#### 3.5.3.1 Relationship Between Drive Unit (Dual-axis) Models and Control Circuit

##### Terminals

Terminal Type	Terminal Code	Terminal Name	Drive Unit Model (MD810-50M4TDXGXXX)					Terminal Definition
			G200	G201	G210	G211	G300	
Communication terminal	CN4	External CAN2/RS485 communication terminal	-	-	-	-	One	<i>"Table 3-32 on page 94"</i>
	CN6	External CAN2/RS485 communication terminal	One	One	-	-	-	
	RJ45A/ RJ45B	RJ45 communication terminal	One	One	One	One	One	<i>"Table 3-36 on page 95"</i>



Terminal Type	Terminal Code	Terminal Name	Drive Unit Model (MD810-50M4TDXXGXXX)					Terminal Definition
			G200	G201	G210	G211	G300	
	None (DB9 terminal)	PROFIBUS DP communication terminal	-	-	One	One	-	<a href="#">"Table 3-34 on page 95"</a>
Encoder terminal	CN2	ABZ encoder terminal for axis 1	One	One	One	One	-	<a href="#">"Table 3-30 on page 93"</a>
	CN4	ABZ encoder terminal for axis 2	One	One	One	One	-	
	None (DB9 terminal)	23-bit encoder terminal	-	-	-	-	Two	<a href="#">"Table 3-35 on page 95"</a>
I/O Terminal	CN1	Common terminal and axis 1 analog/digital I/O terminal	One	One	One	One	One	<a href="#">"Table 3-29 on page 92"</a>
	CN3	Analog/digital I/O terminal for axis 2	One	One	One	One	One	<a href="#">"Table 3-31 on page 94"</a>
	CN5	Relay terminal	One	One	One	One	One	<a href="#">"Table 3-33 on page 94"</a>
STO terminal	STO	Axis 1 STO terminal, axis 2 STO terminal	Reserved	One	Reserved	One	-	<a href="#">"Table 3-37 on page 96"</a>
DIP switch	S1	S1 DIP Switch	One	One	One	One	One	<a href="#">"Table 3-38 on page 97"</a>
	S2	S2 DIP Switch	One	One	-	-	One	<a href="#">"Table 3-39 on page 97"</a>
Terminal Arrangement								
-			Drive Unit Model (MD810-50M4TDXXGXXX)					-
			G200	G201	G210	G211	G300	
Terminal arrangement			<a href="#">"Figure 3-24 on page 89"</a>	<a href="#">"Figure 3-25 on page 90"</a>	<a href="#">"Figure 3-26 on page 90"</a>	<a href="#">"Figure 3-27 on page 91"</a>	<a href="#">"Figure 3-28 on page 92"</a>	-

## Note

- "One" indicates that the model has one terminal of this type.
- "Two" indicates that the model has two terminals of this type.
- "-" indicates that the model does not have the terminal of this type.
- "Reserved" indicates that the model has the terminal of this type without electrical connection.
- "Empty terminal" indicates that the position is reserved without the terminal or electrical connection.

### 3.5.3.2 Layout of Control Circuit Terminals for the Drive Unit (Dual-Axis)

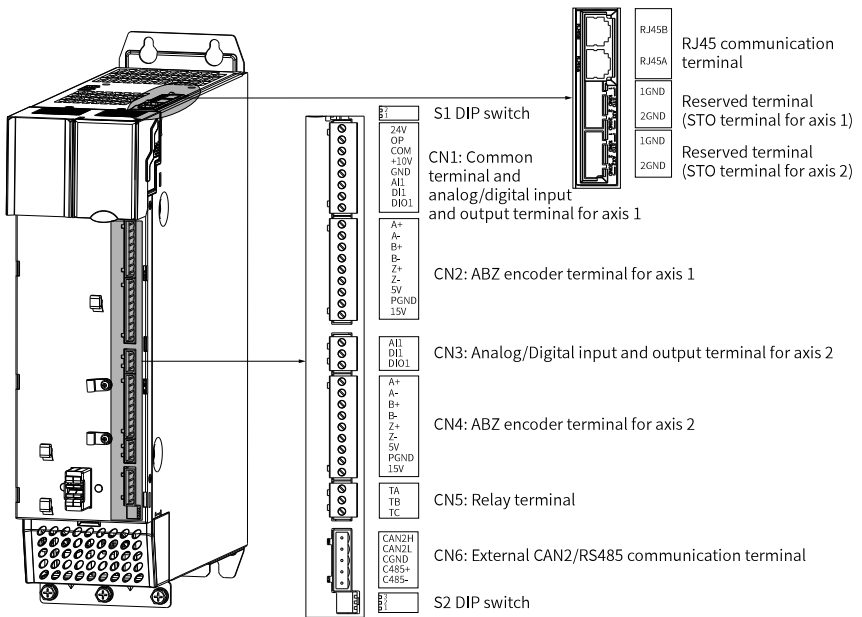


Figure 3-24 MD810-50M4TDXXG200 control circuit terminals

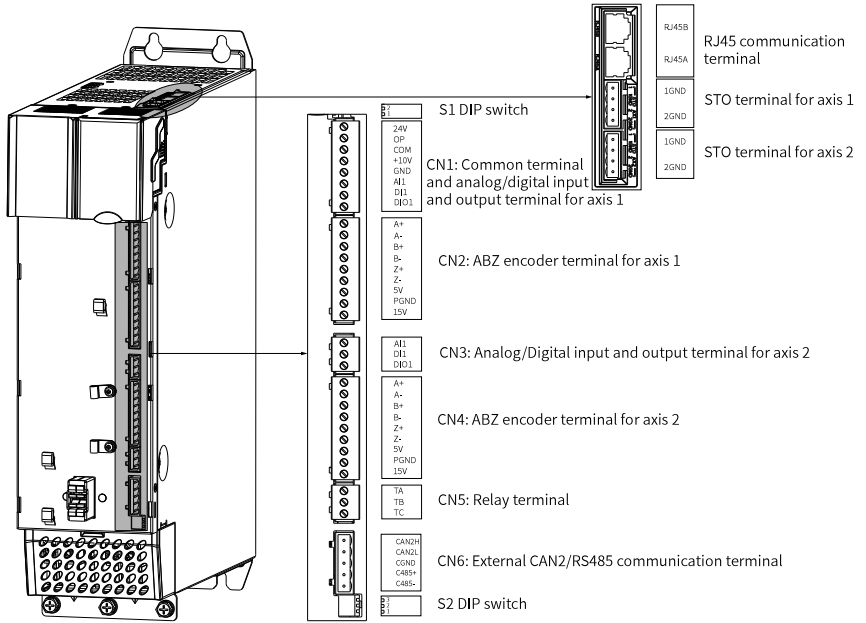


Figure 3-25 MD810-50M4TDXXG201 control circuit terminals

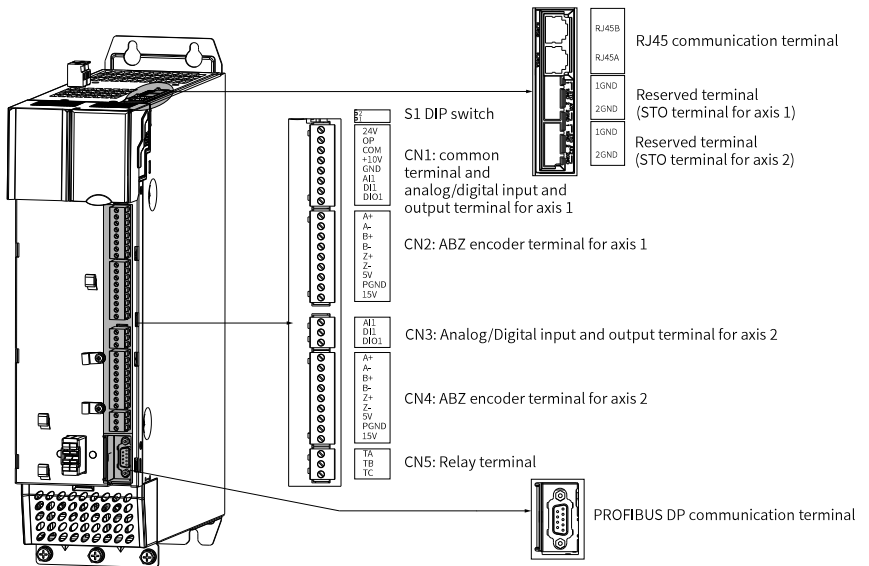


Figure 3-26 MD810-50M4TDXXG210 control circuit terminals

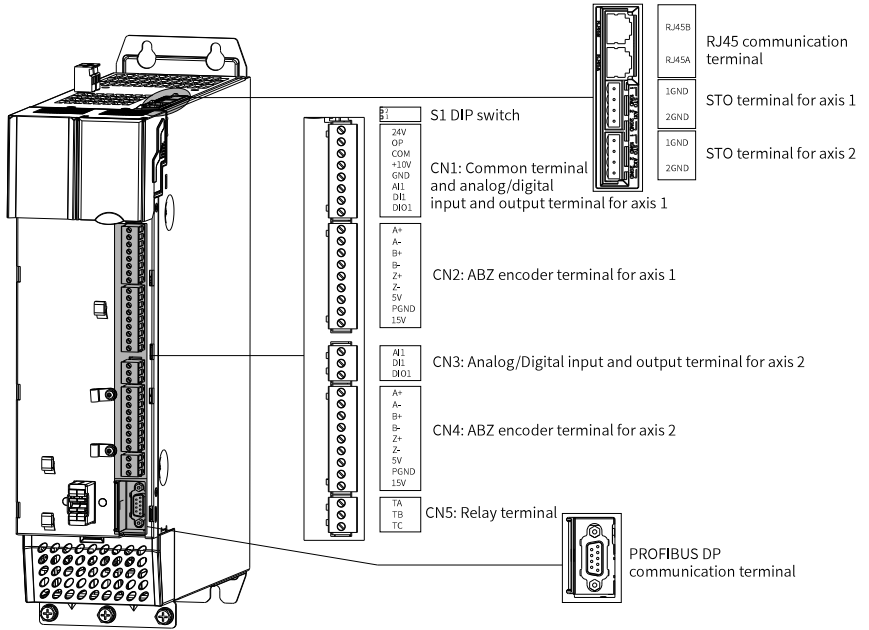


Figure 3-27 MD810-50M4TDXXG211 control circuit terminals

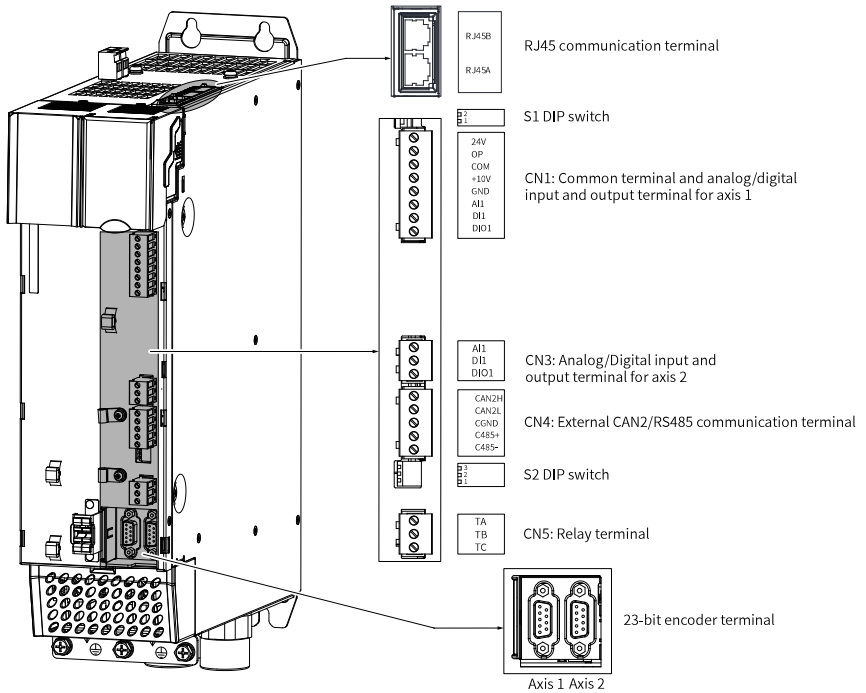


Figure 3-28 MD810-50M4TDXXG300 control circuit terminals

### 3.5.3.3 Descriptions of Control Circuit Terminals for the Drive Unit (Dual-Axis)

Table 3-29 Common terminal and axis 1 analog/digital I/O terminal (CN1)

Pin Mark	Pin Definition	Specification
24V	Internal 24 V power supply provided by the drive unit	24 V $\pm$ 10%; no-load voltage: $\leq$ 30 V; maximum output current: 200 mA; internally isolated from OP/CGND/GND
OP	Multi-functional input common terminal	Internally isolated from COM and 24V; shorted to 24V using a U-type jumper by default
COM	Internal 24 V grounding terminal provided by the drive unit	Internally isolated from CGND and GND
+10V	10 V analog voltage output	10 V $\pm$ 10%, maximum current: 10 mA
GND	Analog ground	Internally isolated from COM and CGND
AI1	Analog input channel AI1	0 V to 10 V, -10 V to +10 V, and 0 mA to 20 mA available; 12-bit resolution, correction

Pin Mark	Pin Definition	Specification
		accuracy error: $\pm 3\%$ ; input impedance in voltage mode: 22.1 k; input impedance in current mode: 250 $\Omega$ or 500 $\Omega$ Temperature sensors PT100 and PT1000 (F9-56) are supported.
DI1	Common multi-function input terminal	Isolated sink/source input programmable terminal; input frequency: < 100 Hz
DIO1	High-speed pulse input terminal/Common multi-functional output terminal	Isolated programmable I/O terminal; maximum input frequency as DI: 100 kHz; maximum output capability as DO: 24 VDC/ 50 mA

Table 3-30 Axis 1 ABZ encoder terminal (CN2) and axis 2 ABZ encoder terminal (CN4)

Pin Mark	Pin Definition	Specification
A+	Differential encoder positive A signal	Differential, collector, and push-pull encoders are supported. Differential encoders are powered by 5 V power supply, and collector and push-pull encoders are powered by 15 V power supply. F1-25 is used to switch between 5 V and 15 V.
A-	Differential encoder negative A signal/ collector or push-pull encoder A signal	
B+	Differential encoder positive B signal	
B-	Differential encoder negative B signal/ collector or push-pull encoder B signal	
Z+	Differential encoder positive Z signal	
Z-	Differential encoder negative Z signal/ collector or push-pull encoder Z signal	
5V	Power supply for the encoder	
15V	Power supply for the encoder	
PGND	Power supply ground for the encoder	

Table 3–31 Axis 2 analog/digital I/O terminal (CN3)

Pin Mark	Pin Definition	Specification
AI1	Analog input channel AI1	0 V to 10 V, -10 V to +10 V, and 0 mA to 20 mA available; 12-bit resolution, correction accuracy error: $\pm 3\%$ ; input impedance in voltage mode: 22.1 k; input impedance in current mode: 250 $\Omega$ or 500 $\Omega$ Temperature sensors PT100 and PT1000 (F9-56) are supported.
DI1	Common multi-function input terminal	Isolated sink/source input programmable terminal; input frequency: < 100 Hz
DIO1	High-speed pulse input terminal/Common multi-functional output terminal	Isolated programmable I/O terminal; maximum input frequency as DI: 100 kHz; maximum output capability as DO: 24 VDC/ 50 mA

Table 3–32 External CAN2/RS485 communication terminals CN4 and CN6

Pin Mark	Pin Definition	Specification
C485+	External RS485 communication positive signal	Used to communicate with the host controller (such as PLC) based on RS485
C485-	External RS485 communication negative signal	
CAN2H	CAN_H signal of CAN communication	The internal CAN bus can be used as synchronous control among drive units after they are connected through the terminal.
CAN2L	CAN_L signal of CAN communication	
CGND	CAN communication signal ground	

Table 3–33 Relay terminal (CN5)

Pin Mark	Pin Definition	Specification
TA/TB/TC	TA-TB: Normally closed TA-TC: Normally open Shared by axis 1 and axis 2	Contact capacity: 250 VAC/3 A (Cos $\phi$ = 0.4)

Table 3–34 PROFIBUS DP communication terminal (DB9 terminal)

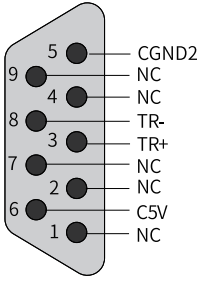
Pin Mark	Pin Definition	Specification
Unconnected	-	
Unconnected	-	
TR+	PROFIBUS DP bus positive end	
Unconnected	-	
CGND2	PROFIBUS DP bus power supply ground	
C5V	PROFIBUS DP bus power supply	
Unconnected	-	
TR-	PROFIBUS DP bus negative end	
Unconnected	-	

Table 3–35 23-bit encoder terminal (DB9)

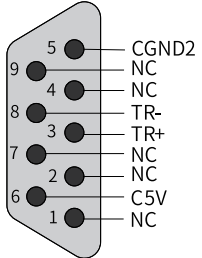
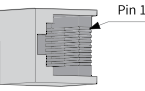
Pin Mark	Pin Definition	Specification
PS+	Bus communication signal+	
PS-	Bus communication signal-	
Unconnected	-	
Unconnected	-	
Unconnected	-	
Unconnected	-	
+5V	Encoder +5 V power supply	
GND	Encoder +5 V power supply ground	
Unconnected	-	

Table 3–36 RJ45 communication terminals RJ45A/ RJ45B

Pin Mark		Pin Definition	Specification	
RJ45A	1	CAN1H CAN_H signal of CAN communication	CANopen/ CANlink supported; used for communication with the host controller and internal commissioning	
	2	CAN1L CAN_L signal of CAN communication		
	3	CGND Communication signal ground		



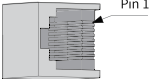
Pin Mark		Pin Definition		Specification	
	4	RS485+	RS485 positive communication signal	Internal bus, used only for the external operating panel and PC commissioning	
	5	RS485-	RS485 negative communication signal		
	6	Unconnected	-		
	7	Unconnected	-		
	8	CGND	Communication signal ground		
RJ45B	1	CAN1H	CAN_H signal of CAN communication	CANopen/ CANlink supported; used for communication with the host controller and internal commissioning	
	2	CAN1L	CAN_L signal of CAN communication		
	3	CGND	Communication signal ground		
	4	RS485+	RS485 positive communication signal	Internal bus, used only for the external operating panel and PC commissioning	
	5	RS485-	RS485 negative communication signal		
	6	C7V	Used to power the external LCD operating panel	Power supply of the external LCD operating panel	
	7	C7V	Used to power the external LCD operating panel		
	8	CGND	Communication signal ground	Communication signal ground	

Table 3-37 Axis 1 STO terminal and axis 2 STO terminal

Pin Mark	Pin Definition	Specification
STO1	STO channel 1 power supply positive	24 V input power supply
1GND	STO channel 1 power supply negative	
STO2	STO channel 2 power supply positive	

Pin Mark	Pin Definition	Specification
2GND	STO channel 2 power supply negative	

Table 3–38 DIP switch S1



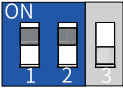
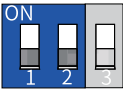
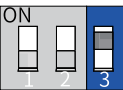
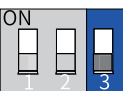
Terminal Name	Description	DIP Switch Position
CAN1 termination resistor (during CAN communication through terminals RJ45A/ RJ45B)	1 and 2 set to ON: Termination resistor enabled	
	1 and 2 set to OFF: Termination resistor disabled	

Table 3–39 DIP switch S2

Terminal Name	Description	DIP Switch Position
C485 termination resistor (during RS485 communication through external CAN2/RS485 communication terminals marked by CN4)	1 and 2 set to ON: Termination resistor enabled	
	1 and 2 set to OFF: Termination resistor disabled	
CAN2 termination resistor (during CAN communication through external CAN2/ RS485 communication terminals marked by CN4)	3 set to ON: Termination resistor enabled	
	3 set to OFF: Termination resistor disabled	

### 3.6 Cable Selection and Wiring Requirements for Control Circuits

#### Control circuit cable selection

- All control cables must be shielded cables.
- It is recommended that digital signal cables use shielded twisted pair (STP) cables.

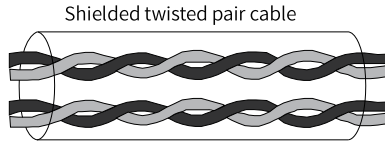


Figure 3-29 STP

#### Control circuit wiring

- Lay the motor cable far from all control circuit cables.
- Route the motor cable, the input power cable, and the control circuit cable through different routes. Avoid long-distant parallel routing of the motor cable and control circuit cable, thereby reducing electromagnetic interference caused by coupling.
- If intersection of the control circuit cable and the drive cable is necessary, ensure that the angle is 90°.

The following figure shows the recommended cabling.

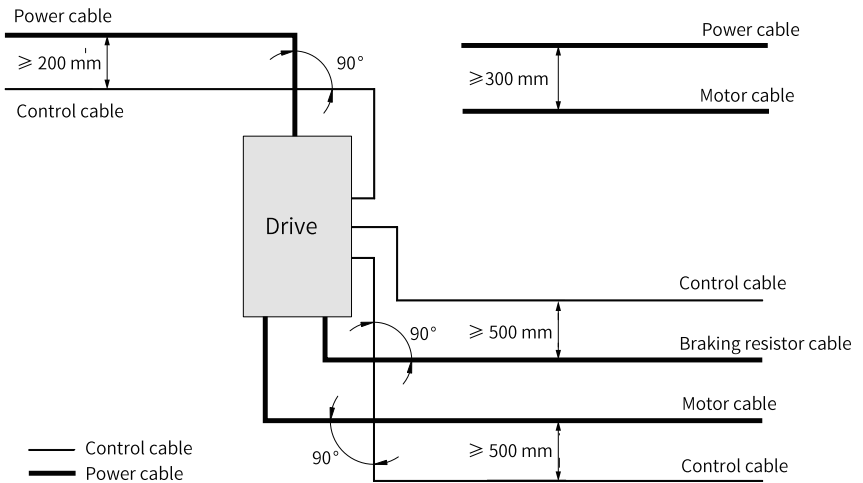


Figure 3-30 Recommended cabling

## 3.7 I/O Signal Terminal Wiring

### 3.7.1 Wiring the DI

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

#### Sink wiring mode

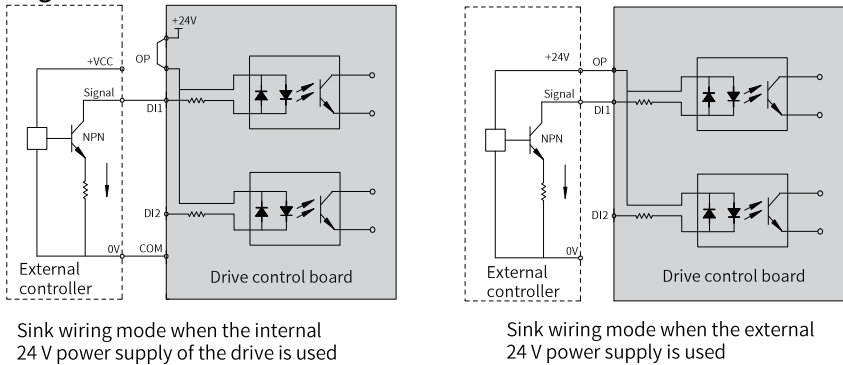


Figure 3-31 Sink wiring mode

- To use the internal 24 V power supply of the drive, which is the most commonly used method, short the OP terminal and +24V terminal of the drive, and connect the COM terminal of the drive to the 0V terminal of the external controller.
- To use the external 24 V power supply, remove the jumper on the +24V and OP terminals of the drive, connect the positive electrode of the external 24 V power supply to the OP terminal of the drive, and connect the external 0 V power supply to the DI through the external controller contact or switch.

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

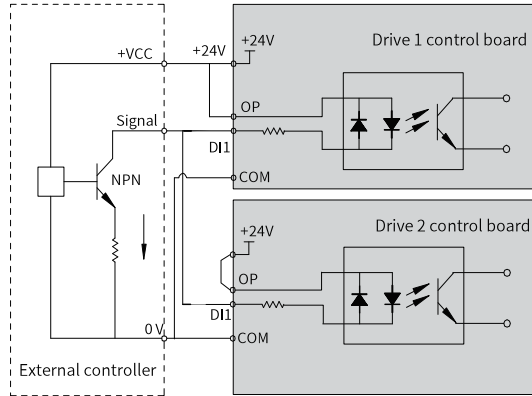
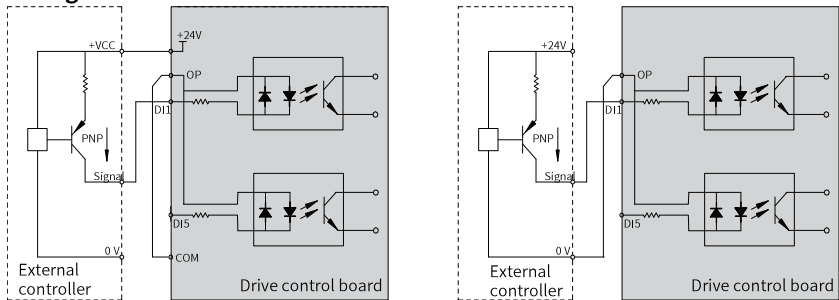


Figure 3-32 Parallel connection of DI terminals of multiple drives in the sink mode

**Source wiring mode**



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

Source wiring mode when the external 24 V power supply is used

Figure 3-33 Source wiring mode

- To use the internal 24 V power supply of the drive, remove the jumper on the +24V terminal and the OP terminal of the drive, connect the OP terminal and the COM terminal, and connect the +24V terminal of the drive to the common terminal of the external controller.
- To use the external 24 V power supply, remove the jumper on the +24V terminal and the OP terminal of the drive, connect the OP terminal of the drive to the external 0 V power supply, and connect the positive electrode of the external 24 V power supply to the DI through the external controller contact or switch.

**3.7.2 Wiring the DIO1 and DIO2**

DIO1 and DIO2 can be used as the DI or the DO, which is determined by F4-41. By default, DIO1 and DIO2 are used as the DI.



## Caution

DIO1 and DIO2 can be used as either the DI or the DO at the same time.

- When DIO1 and DIO2 are used as the DI, the wiring method is the same as that of DI1 and DI2.
- When DIO1 and DIO2 are used as the DO, the DO common terminal is COM and only the sink wiring mode is supported, as shown in the following figure. If the DI common terminal OP of the DIO1 and DIO2 is connected to COM and the DIO1 and DIO2 has no output, the user equipment will receive the input signal by mistake. To avoid this situation, connect the DI common terminal OP of the DIO1 and DIO2 to 24V.

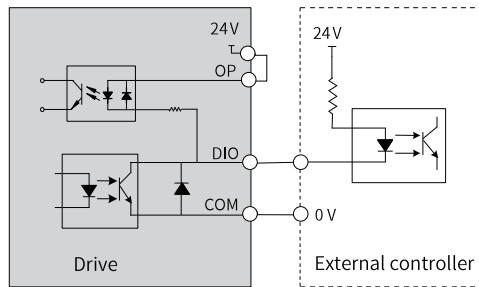


Figure 3-34 Wiring of the DIO1 and DIO2 used as the DO

## 3.7.3 Wiring the AI

### Wiring AI1

AI1 supports 0 V to 10 V input, -10 V to +10 V input, and PT100/PT1000 temperature sensor input. To enable AI1 to be used for temperature sensor input, set sub-switch 3 of DIP switch S1 to "ON", switch AI1 from the analog circuit to the PT100/PT1000 temperature sensor detection circuit, and set F9-56 to the corresponding sensor.

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), as shown in ["Figure 3-35 " on page 102](#) and ["Figure 3-36 " on page 102](#) . In occasions where analog signals are seriously interfered, install a filter capacitor or a ferrite magnetic core on the analog signal source side, as shown in ["Figure 3-37 " on page 103](#) .

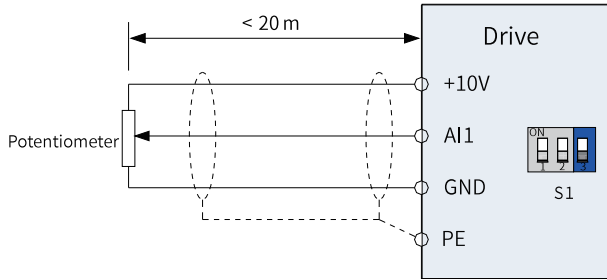


Figure 3-35 Wiring when AI1 used for analog input

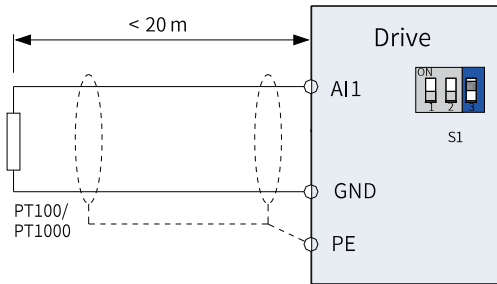


Figure 3-36 Wiring when AI1 used for temperature sensor input

Connect the drain wire of the AI shield to the PE terminal on the drive side.

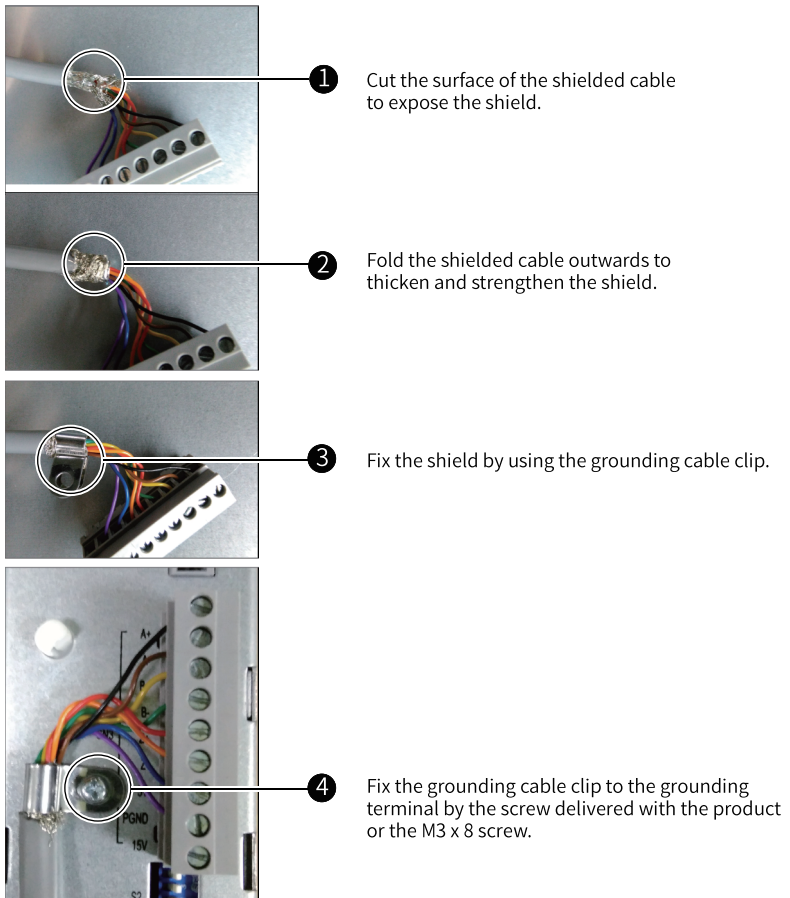


Figure 3-37 Grounding of the AI shield

## Wiring AI2

AI2 supports 0 V to 10 V input and 0 mA to 20 mA input.

- When F4-40 is set to 0, AI2 adopts the voltage input mode. The wiring description of AI2 is the same as that of AI1.
- When F4-40 is set 1, AI2 adopts the current input mode with the input impedance of 500  $\Omega$ . The current flows to AI2 and flows from GND.



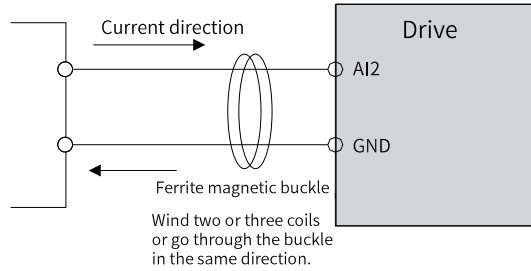


Figure 3-38 Wiring AI2

### 3.7.4 Wiring the AO

The AO supports 0 V to 10 V and 0 mA to 20 mA output, which can be selected by F5-23 (AO mode selection).

- When the AO adopts the voltage output mode, set F5-23 to 0. In this case, the load resistance must be larger than or equal to 5 k $\Omega$ , and the driving current must be smaller than 2 mA.
- When the AO adopts the current output mode, set F5-23 to 1. In this case, the load resistance must be smaller than or equal to 500  $\Omega$ ; otherwise, the linearity of the AO output will be distorted.

To avoid external interference to the analog voltage signal, use shielded cables, and ensure that the wiring distance does not exceed 20 m, as shown in the figure below. In applications where the analog signal suffers severe interference, install a filter capacitor or ferrite magnetic core at the analog signal source side.

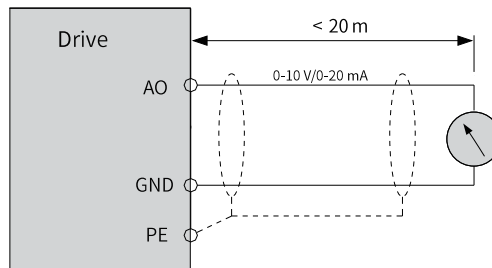


Figure 3-39 Wiring the AO

### 3.7.5 Wiring the Relay Output Terminal

The inductive load (relay, contactor, and motor) causes voltage peak after the current is removed. Therefore, use a voltage dependent resistor (VDR) at the relay contact for protection and absorption circuits such as VDRs, RC absorption circuits, and diodes on the inductive load to ensure minimum interference during cutoff.

- When a contactor and an intermediate relay are connected to 220 VAC, parallel a VDR with a withstand voltage higher than 275 VAC at both ends of the drive coil of the contactor and the intermediate relay.
- When a contactor and an intermediate relay are connected to 24 VDC, inversely parallel a freewheel diode 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.

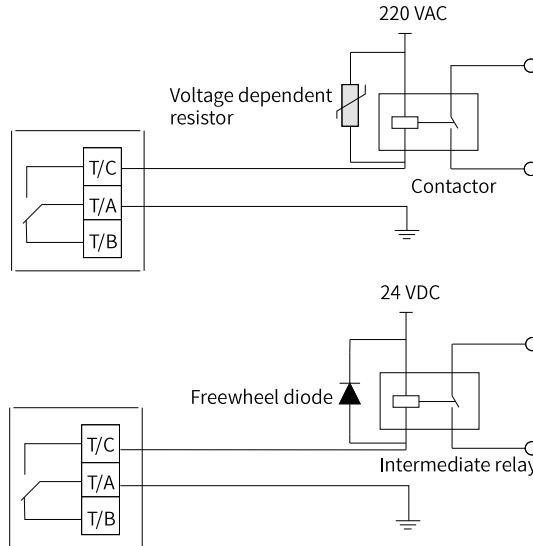


Figure 3-40 Anti-interference processing of relay output terminals

### Warning

- The relay will be connected to 220 V upon output. Do not wrongly connect to the surrounding safety extra-low voltage circuit terminal. The cable must meet the requirements of reinforced insulation.
- The external 220 V power supply of the relay must be used in an overvoltage class II (OVCI) environment.
- Changes of relay output are invalid without connection to the high-voltage power supply.

## 3.8 Communication Connection

### 3.8.1 RS485 Communication Connection

#### Product models and communication terminals

The power supply unit and the drive unit communicate with the PLC through the external CAN2/RS485 communication terminals (CN2 for the power supply unit and CN4 or CN6 for the drive unit). The following table describes the power supply unit models and the drive unit models that can communicate with the PLC based on the RS485 protocol and the communication terminals.

Terminal Mark	Terminal Name	Power Supply Unit Model (MD810-20M4TXXGXXX)						Terminal Definition
		G000, G100			G020, G120			
CN2	External CAN2/RS485 communication terminal	One			One			"Table 3-7" on page 70
Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)						Terminal Definition
		G200	G201	G210	G211	G300	G400	
CN4	External CAN2/RS485 communication terminal	One	One	One	One	One	One	"Table 3-18" on page 82
Terminal Mark	Terminal Name	Drive Unit (Dual-axis) Model (MD810-50M4TDXXGXXX)						Terminal Definition
		G200		G201		G300		
CN4	External CAN2/RS485 communication terminal	-		-		One		"Table 3-32" on page 94
CN6	External CAN2/RS485 communication terminal	One		One		-		

## Note

- "One" indicates that the model has one terminal of this type.
- "-" indicates that the model does not have the terminal of this type.

## Network topology

- The power supply unit and the drive unit communicate with the PLC through the external CAN2/RS485 communication terminals (CN2 for the power supply unit and CN4 or CN6 for the drive unit).
- The power supply unit and the drive unit function as the slave, and the PLC as the master.
- It is recommended that RS485 bus use the shielded twisted pair (STP) cables. Connect the reference ground of RS485 signals for all nodes, and connect the 120  $\Omega$  termination resistor at both ends of the bus to prevent signal reflection. A maximum of 128 nodes can be connected, and the distance between two nodes must be shorter than 3 m.

The following figure describes the RS485 bus connection.

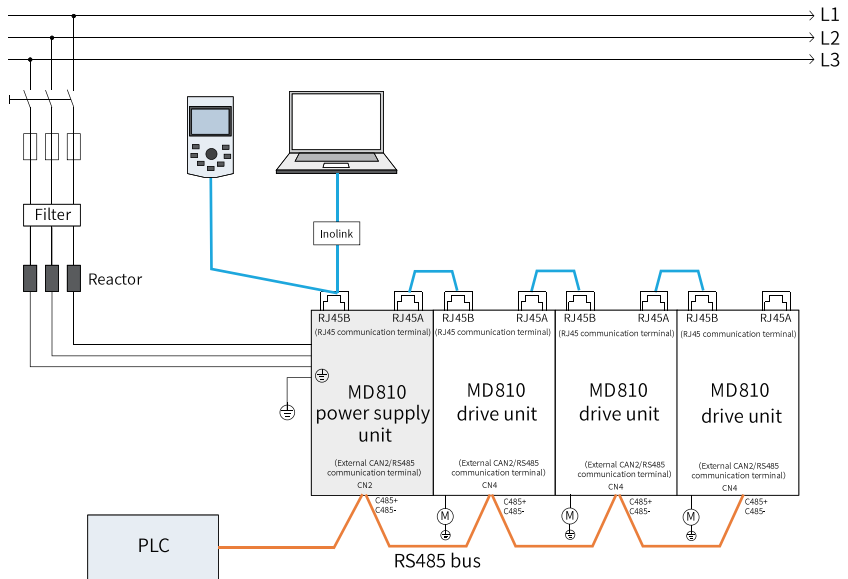


Figure 3-41 RS485 bus connection

### Transmission distance

The following table describes the maximum number of nodes and the maximum transmission distance supported at different baud rates.

Transmission Distance (m)	Baud Rate (kbps)	Number of Nodes	Cross-sectional Area of Cable
1000	19.2	Without repeater: < 32; with repeater: 128 at most	AWG26
100	115.2	Without relay: < 32; with relay: 128 at most	AWG26

### Termination resistor

Table 3-40 Settings of termination resistors for the power supply unit

Terminal Mark	Description		DIP Switch Position
DIP switch S1	RS485 termination resistor selection (during RS485 communication through terminals RJ45A/RJ45B)	1 and 2 set to ON: Termination resistor enabled	
		1 and 2 set to OFF: Termination resistor disabled	
DIP switch S2	C485 termination resistor selection (during RS485 communication through external CAN2/RS485 communication terminals marked by CN2)	1 and 2 set to ON: Termination resistor enabled	
		1 and 2 set to OFF: Termination resistor disabled	

Table 3-41 Settings of termination resistors for the drive unit (single-axis)

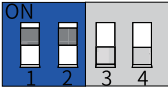
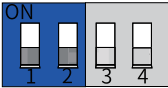
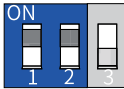
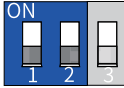
Terminal Mark	Description		DIP Switch Position
DIP switch S2	C485 termination resistor selection (during RS485 communication through external CAN2/RS485 communication terminals marked by CN4)	1 and 2 set to ON: Termination resistor enabled	
		1 and 2 set to OFF: Termination resistor disabled	

Table 3-42 Settings of termination resistors for the drive unit (dual-axis)

Terminal Mark	Description		DIP Switch Position
DIP switch S2	C485 termination resistor selection (during RS485 communication through external CAN2/RS485 communication terminals marked by CN4)	1 and 2 set to ON: Termination resistor enabled	
		1 and 2 set to OFF: Termination resistor disabled	

## 3.8.2 CAN Communication Connection

### Product models and communication terminals

For the MD810 series drive, only the power supply unit can communicate with the PLC based on the CAN protocol, and the drive unit receives control signals of the PLC through the power supply unit.

The power supply unit and the PLC communicate with each other through the CAN communication terminal CN1. The following table describes the power supply unit models that can communicate with the PLC based on the CAN protocol and the communication terminals.

Terminal Mark	Terminal Name	Power Supply Unit Model (MD810-20M4TXXGXXX)			Terminal Definition
		G000, G100	G010, G110	G020, G120	
CN1	CAN1 communication terminal	One	One	One	<i>"Table 3-6" on page 70</i>

---

## Note

"One" indicates that the model has one communication terminal of this type.

---

## Network topology

CAN communication bus connection is described as follows:

- The power supply unit and the PLC communicate with each other through the CAN communication terminal CN1.
- The power supply unit functions as the slave, and the PLC as the master.
- The power supply unit and the drive unit are cascaded by CAN bus through the RJ45 communication terminals (RJ45A/RJ45B).
- The drive can be commissioned through the external operating panel and the RJ45 terminals RJ45A and RJ45B.

To facilitate wiring, install the power supply unit at the start or end of the CAN bus. CAN communication bus connection is described in the figure below.

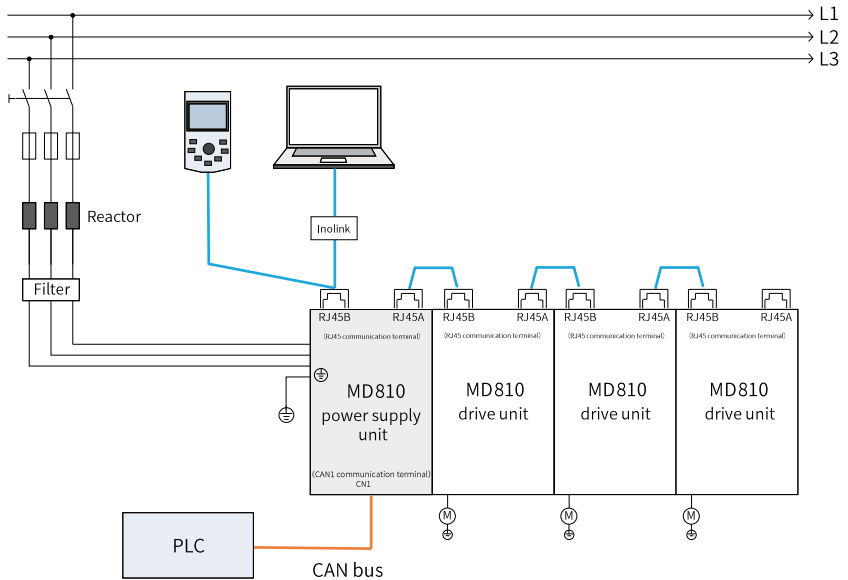


Figure 3-42 CAN communication bus connection (with the power supply unit installed at the start or end of the CAN bus)

If the power supply unit is in the middle of the CAN bus, do not connect to the PLC through the CAN connection terminal of the power supply unit. Instead, connect to the PLC through the RJ45 communication terminal of the drive unit at the start or end of the CAN bus. The following figure describes the CAN bus connection.



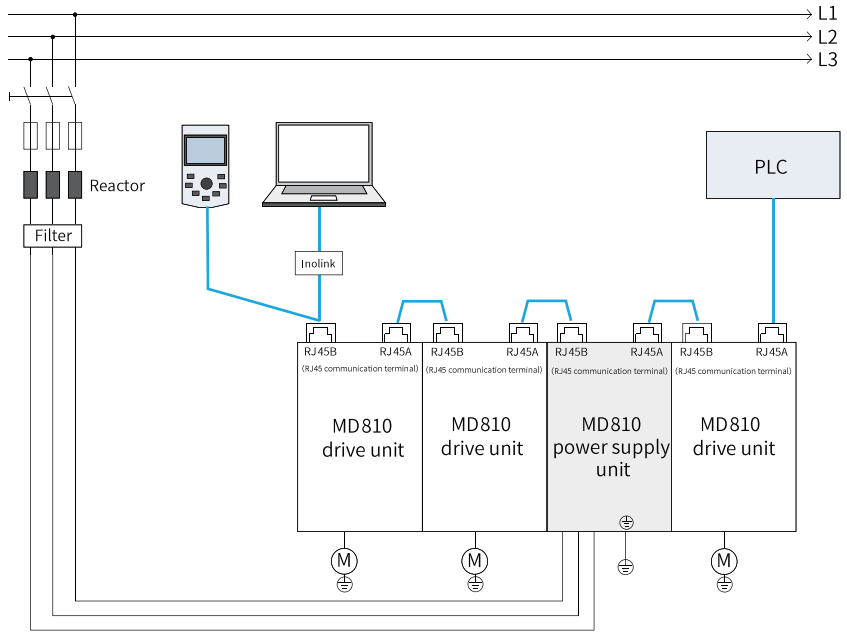


Figure 3-43 CAN communication bus connection (with the power supply unit installed at the middle of the CAN bus)

### Transmission distance

The following table describes the maximum transmission distance supported at different baud rates.

Baud Rate (bps)	Length (m)
1 M	25
500 k	100
250 k	250
125 k	500
100 k	500
50 k	1000
20 k	1000

## Termination resistor

Table 3-43 Settings of termination resistors for the power supply unit

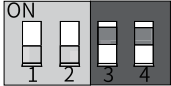
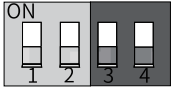
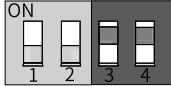
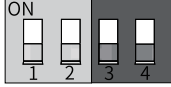
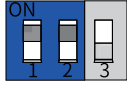

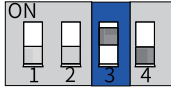
Terminal Mark	Description		DIP Switch Position
DIP switch S1	CAN1 termination resistor (during CAN communication through terminals RJ45A/RJ45B)	3 and 4 set to ON: Termination resistor enabled	
		3 and 4 set to OFF: Termination resistor disabled	
DIP switch S2	CAN2 termination resistor selection (during CAN communication through external CAN2/RS485 communication terminals marked by CN2)	3 and 4 set to ON: Termination resistor enabled	
		3 and 4 set to OFF: Termination resistor disabled	

Table 3-44 Settings of termination resistors for the drive unit (single-axis)

Terminal Mark	Description		DIP Switch Position
DIP switch S1	CAN1 termination resistor (during CAN communication through terminals RJ45A/RJ45B)	1 and 2 set to ON: Termination resistor enabled	
		1 and 2 set to OFF: Termination resistor disabled	
DIP switch S2	CAN2 termination resistor (during CAN communication through external CAN2/RS485 communication terminals marked by CN4)	3 set to ON: Termination resistor enabled	

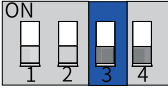



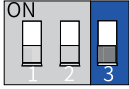
		3 set to OFF: Termination resistor disabled	
--	--	---	---

Table 3-45 Settings of termination resistors for the drive unit (dual-axis)

Terminal Mark	Description		DIP Switch Position
DIP switch S1	CAN1 termination resistor (during CAN communication through terminals RJ45A/RJ45B)	1 and 2 set to ON: Termination resistor enabled	
		1 and 2 set to OFF: Termination resistor disabled	
DIP switch S2	CAN2 termination resistor (during CAN communication through external CAN2/RS485 communication terminals marked by CN4)	3 set to ON: Termination resistor enabled	
		3 set to OFF: Termination resistor disabled	

### 3.8.3 PROFIBUS DP and PROFIBUS DP-to-CAN Communication Connection

#### Product models and communication terminals

The power supply unit and the drive unit communicate with the PLC through the PROFIBUS DP communication terminal (DB9). The following table describes the power supply unit and the drive unit models that can communicate with the PLC based on the PROFIBUS DP protocol and the communication terminals.

Terminal Mark	Terminal Name	Power Supply Unit Model (MD810-20M4TXXGXXX)	Terminal Definition
		G010, G110	
None (DB9)	PROFIBUS DP communication terminal (DB9)	One	<a href="#">"Table 3-10" on page 71</a>
Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)	Terminal Definition

Terminal Mark	Terminal Name	Power Supply Unit Model (MD810-20M4TXXGXXX)		Terminal Definition
		G010, G110		
		G210	G211	
None (DB9 terminal)	PROFIBUS DP communication terminal	One	One	<a href="#">"Table 3-21 " on page 82</a>
Terminal Mark	Terminal Name	Drive Unit (Dual-axis) Model (MD810-50M4TDXXGXXX)		Terminal Definition
		G210	G211	
None (DB9)	PROFIBUS DP communication terminal	One	One	<a href="#">"Table 3-34 " on page 95</a>

---

## Note

"One" indicates that the model has one communication terminal of this type.

---

### Network topology (PROFIBUS DP communication)

When both the power supply unit and the drive unit support PROFIBUS DP communication, communication bus connection is described as follows:

- The power supply unit and the drive unit communicate with the PLC through the PROFIBUS DP communication terminal (DB9).
- The power supply unit and the drive unit function as the slave, and the PLC as the master.
- If there are more than 32 nodes, a repeater must be installed. A maximum of 32 nodes (including the repeater) can be connected between two repeaters.

The following figure describes PROFIBUS DP communication bus connection.

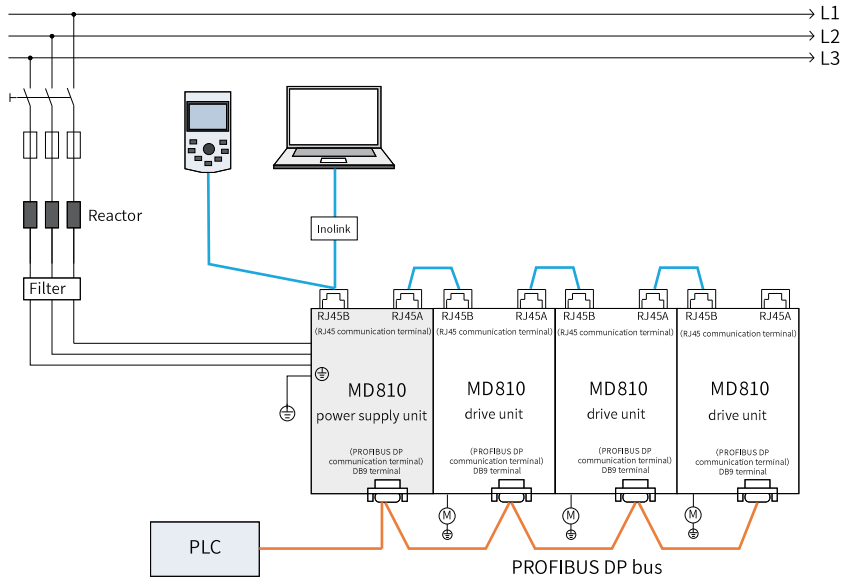


Figure 3-44 PROFIBUS DP communication bus connection

### Network topology (PROFIBUS DP-to-CAN communication)

When only the power supply unit supports PROFIBUS DP communication, the drive unit can receive control signals of the PLC through the power supply unit.

Communication bus connection is described as follows:

- The power supply unit and the PLC communicate with each other through the PROFIBUS DP communication terminal (DB9).
- The power supply unit functions as the slave, and the PLC as the master.
- The power supply unit and the drive unit are cascaded by CAN bus through the RJ45 communication terminals (RJ45A/RJ45B).
- If there are more than 32 nodes, a repeater must be installed. A maximum of 32 nodes (including the repeater) can be connected between two repeaters.

The following figure describes PROFIBUS DP-to-CAN communication bus connection.

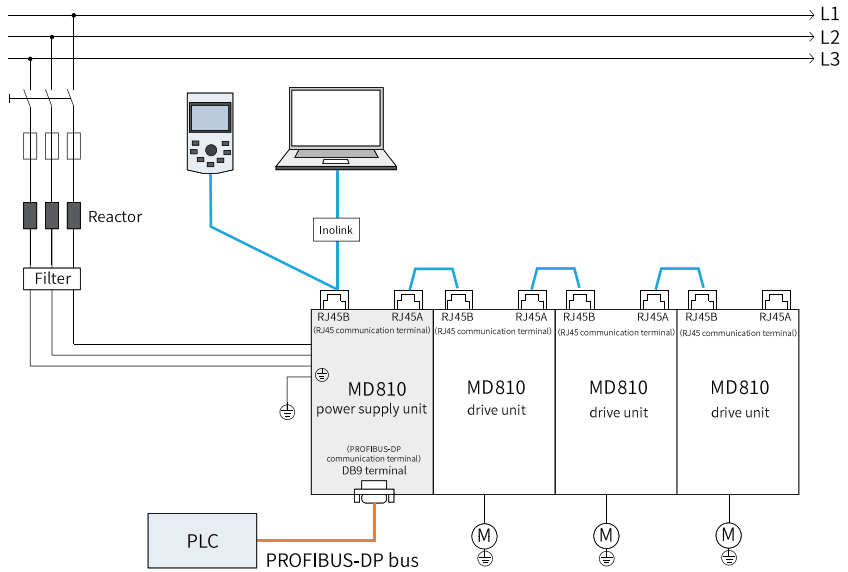


Figure 3-45 PROFIBUS DP-to-CAN communication bus connection

### Transmission distance

The following table describes the maximum transmission distance supported at different baud rates.

Baud Rate (bps)	Maximum Length of Cable Type A (m)	Maximum Length of Cable Type B (m)
9.6	1200	1200
19.2	1200	1200
187.5	600	600
500	200	200
1500	100	70
3000	100	Not supported
6000	100	
12000	100	

## 3.8.4 PROFINET-to-CAN Communication Connection

### Product models and communication terminals

For the MD810 series drive, only the power supply unit can communicate with the PLC based on the PROFINET protocol, and the drive unit receives control signals of the PLC through the power supply unit.

The power supply unit communicates with the PLC through PROFINET communication terminals ProfinetA and ProfinetB. The following table describes the power supply unit models that can communicate with the PLC based on the PROFINET protocol and the communication terminals.

Terminal Mark	Terminal Name	Power Supply Unit Model (MD810-20M4TXXGXXX)	Terminal Definition
		G020, G120	
ProfinetA and ProfinetB	PROFINET communication terminal	One	<i>"Table 3-12" on page 72</i>

### Note

"One" indicates that the model has one communication terminal of this type.

### Network topology

PROFINET communicate bus connection is described as follows:

- The power supply unit communicates with the PLC through PROFINET communication terminals ProfinetA and ProfinetB.
- The power supply unit functions as the slave, and the PLC as the master.
- The power supply unit and the drive unit are cascaded by CAN bus through the RJ45 communication terminals (RJ45A/RJ45B).

The following figure describes PROFINET-to-CAN communication bus connection.

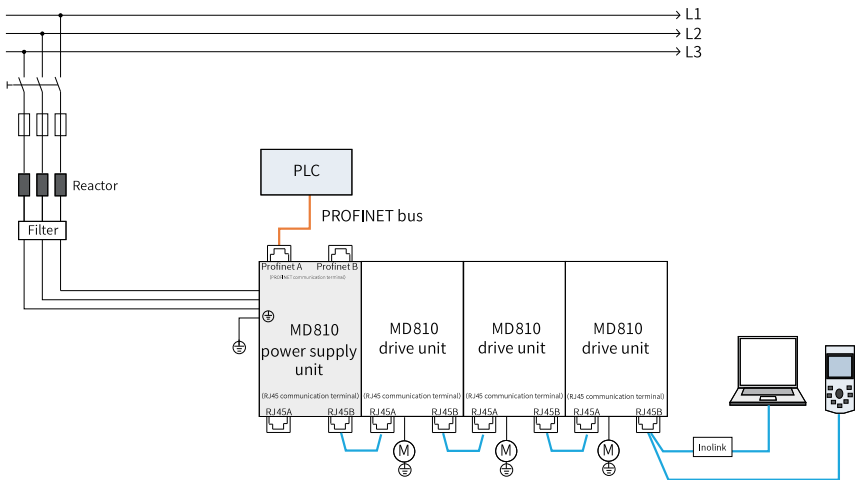


Figure 3-46 PROFINET-to-CAN communication bus connection (single power supply unit)

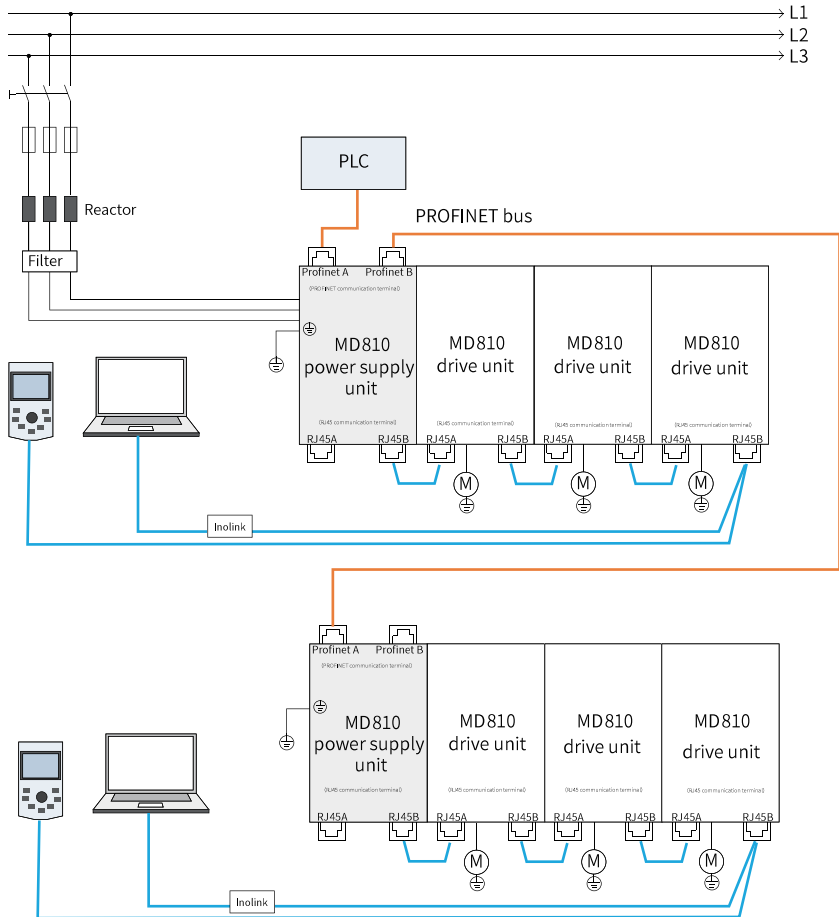


Figure 3-47 PROFINET-to-CAN communication bus connection (multiple power supply units)

### 3.8.5 EtherCAT Communication Connection

#### Product models and communication terminals

For the MD810 series drive, only the drive unit can communicate with the PLC based on the EtherCAT protocol, and the power supply unit receives control signals of the PLC through the drive unit.

The drive unit communicates with the PLC through the EtherCAT communication terminals ECT-IN and ECT-OUT. The following table describes the drive unit models



that can communicate with the PLC based on the EtherCAT protocol and the communication terminals.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)		Terminal Definition
		G530	G531	
ECT-IN/ECT-OUT	EtherCAT communication terminal	One	One	<i>"Table 3-26 " on page 86</i>

### Note

"One" indicates that the model has one communication terminal of this type.

### Network topology

EtherCAT communication bus connection is described as follows:

- The drive unit communicates with the PLC through the EtherCAT communication terminals ECT-IN and ECT-OUT.
- The drive unit functions as the slave, and the PLC as the master.
- The power supply unit and the drive unit are cascaded by CAN bus through the RJ45 communication terminals (RJ45A/RJ45B).

The following figure describes the EtherCAT communication bus connection.

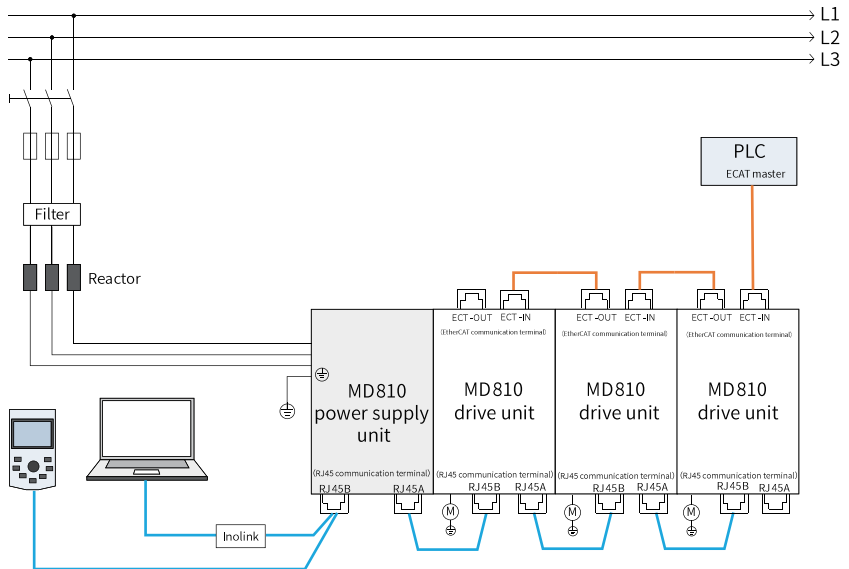


Figure 3-48 EtherCAT communication bus connection

## 3.9 Encoder Signal Connection

### 3.9.1 Wiring ABZ Encoders

#### 3.9.1.1 Encoder Terminals and Specifications

##### Product models and encoder terminals

The following table describes the drive unit models that support ABZ encoders and the encoder terminals.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)							Terminal Definition	Terminal Description	
		G200	G201	G210	G211	G400	G530	G531			
CN3	ABZ encoder terminal	One	One	One	One	One	One	One	One	"Table 3-17 " on page 81	Differential, collector, and push-pull encoders are supported. Differential encoders are powered by 5 V power supply, and collector and push-pull encoders are powered by 15 V power supply. Sub-switch 4 of DIP switch S2 is used to switch between 5 V and 15 V.
None (DB15 terminal)	Multi-encoder terminal	-	-	-	-	-	One	One	One	"Table 3-24 " on page 84	If the multi-encoder terminal is used to connect to the ABZ encoder, only 5 V differential ABZ encoders are supported.
Terminal Mark	Terminal Name	Drive Unit (Dual-axis) Model (MD810-50M4TDXXGXXX)				Terminal Definition	Terminal Description				
		G200	G201	G210	G211						
CN2	ABZ encoder terminal for axis 1	One	One	One	One	"Table 3-30 " on page 93	Differential, collector, and push-pull encoders are supported. Differential encoders are powered by 5 V power supply, and collector and push-pull encoders are powered by 15 V power supply. F1-25 is used to switch between 5 V and 15 V.				
CN4	ABZ encoder terminal for axis 2	One	One	One	One						

---

## Note

- "One" indicates that the model has one terminal of this type.
  - "-" indicates that the model does not have the terminal of this type.
- 

### Encoder specifications

Power supply	5 V/200 mA, 15 V/100 mA
Maximum Input Frequency	Differential: 500 kHz; collector: 50 kHz; push-pull: 100 kHz
Cable Specification	16AWG to 26AWG
Terminal Gap	5.08 mm
Terminal Screw	Cross head

#### 3.9.1.2 Differential Input Wiring

The procedure is as follows:

1. Connect the output signal cables of the encoder to A+/A-, B+/B-, Z+/Z-, 5V/15V, and PGND of the ABZ encoder terminal. MD810-50M4TXXG530/MD810-50M4TXXG531 models (hereinafter referred to as 530/531 single-axis drive unit) supports transmission of differential ABZ encoder signals by the multi-encoder terminal (DB15).
2. Set the encoder power supply to 5 V by setting the sub-switch 4 of DIP switch S2 to ON.
3. Connect the shield of the encoder cable to the PE terminal next to the ABZ encoder terminal.
4. Select the filtering function according to the application by setting F1-29 or F1-42 (for 530/531 single-axis drive units).

---

## Note

For 530/531 models of the single-axis drive units, the multi-encoder terminal (DB15) of the models is used to connect to the differential ABZ encoder. In this case, set F1-23 to 0 and set F1-43 to select a proper filter.

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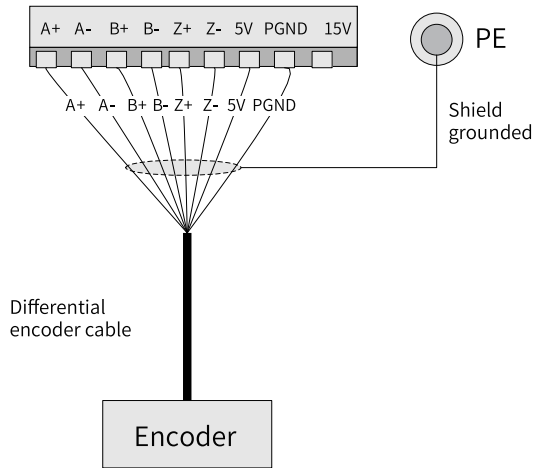


Figure 3-49 Wiring the differential encoder through the ABZ encoder terminal

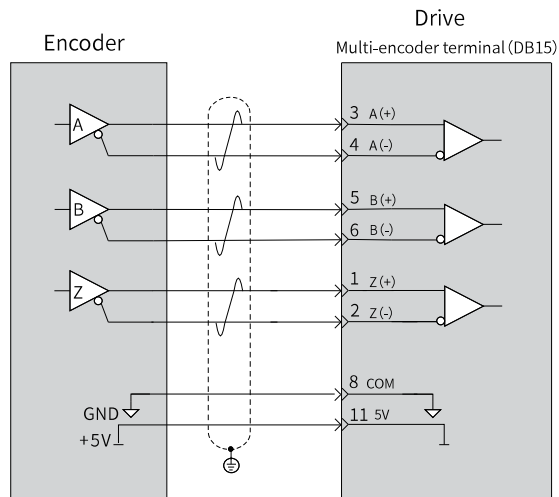


Figure 3-50 Wiring the differential encoder through the multi-encoder terminal (DB15)

**Note**

- The power supply of the differential ABZ encoder only supports 5 V. However, the ABZ encoder terminal supports the power supply of 5 V and 15 V. Therefore, before power-on, set sub-switch 4 of DIP switch S2 to ON to select 5 V output. Otherwise, the encoder will be damaged due to high power supply voltage.
- If the encoder has no Z+/Z- signal, connect Z+ of the multi-encoder terminal (DB15) to 5V, and Z- to the COM terminal. Otherwise, the encoder disconnection fault will be reported.
- It is recommended to use shielded twisted pair cables (as shown in "Figure 3-51 " on page 124 ) for differential encoders. Wire cables according to the difference, and select the appropriate cross-sectional area of the cable according to the distance between the encoder and the drive. For specific requirements, see "Table 3-46 " on page 124.

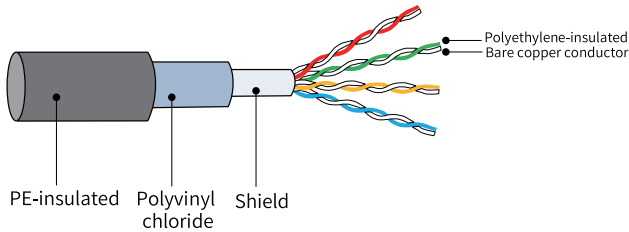


Figure 3-51 Shielded twisted pair

Table 3-46 Relationship between the length and the cross-sectional area of the encoder cable

Cable Length (m)	Cross-Sectional Area (AWG)
10	≤ 26
20	
30	
40	≤ 24
50	≤ 22
60	
70	≤ 21
80	
90	≤ 20
100	

### 3.9.1.3 Collector Input Wiring

#### Collector input wiring 1

Due to the collector electrical characteristics, the rising edge of the signal is slow, and the signal transmission distance is limited. The collector input wiring method is suitable only for applications with the cable length shorter than 20 m and the frequency lower than 50 kHz. For applications with the cable length equal to or longer than 20 m or frequencies equal to or greater than 50 kHz, it is recommended to use the push-pull output encoders or differential output encoders.

Collector encoder input wiring 1 procedure:

1. Connect the A, B, and Z output signal cables of the encoder to A-, B-, and Z- of the ABZ encoder terminal, respectively. Connect the power supply cable of the encoder to 15V and PGND of the ABZ encoder terminal.
2. Change the power supply mode of the ABZ encoder terminal to 15V by setting sub-switch 4 of DIP switch S2 to OFF.
3. Connect the shield of the encoder cable to the PE terminal next to the ABZ encoder terminal.
4. Select the filtering function according to the application by setting F1-29 or F1-42 (for 530/531 single-axis drive units).

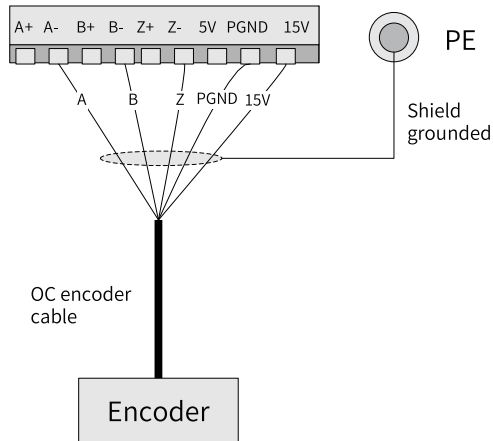


Figure 3-52 Collector encoder input wiring 1

#### Collector input wiring 2

When one of the following situations is encountered, and only the collector output encoder can be selected, collector input wiring 2 can be applied.

- The encoder cable length is longer than 20 m.
- The encoder signal frequency is greater than 50 kHz.

- In the closed-loop vector control mode, when the running frequency is greater than a certain value, the motor encounters abnormality.

Collector encoder input wiring 2 procedure:

1. Connect the A, B, and Z output signal cables of the encoder to A+, B+, and Z+ of the ABZ encoder terminal, respectively. At the same time, short A-, B-, and Z- to PGND, and connect the power supply cable of the encoder to 15V and PGND.
2. Change the power supply mode of the ABZ encoder terminal to 15V by setting sub-switch 4 of DIP switch S2 to OFF.
3. Connect the shield of the encoder cable to the PE terminal next to the ABZ encoder terminal.
4. Select the filtering function according to the application by setting F1-29 or F1-42 (for 530/531 single-axis drive units).

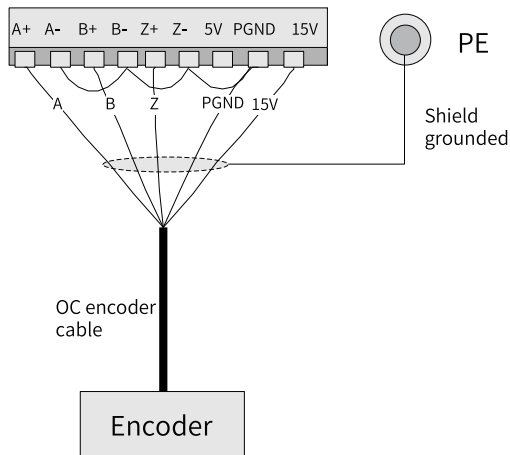


Figure 3-53 Collector encoder input wiring 2

### 3.9.1.4 Push-Pull Input Wiring

The procedure is as follows:

1. For push-pull complementary output encoders (with positive and negative signals, such as A+/A-), connect the A-, B-, and Z- output signal cables of the encoder to A-, B-, and Z- of the ABZ encoder terminal, respectively. Do not connect the A+, B+, and Z+ output signal cables of the encoder. For push-pull single-ended signal output encoders (no positive or negative signals, such as A), connect the A, B, and Z signal cables of the encoder to A-, B-, and Z- of the ABZ encoder terminal, respectively. Then connect the power cable of the encoder to 5V or 15V (as shown in the figure below) and PGND.

2. Select the encoder power supply mode (5 V or 15 V) of the ABZ encoder terminal according to the encoder power supply voltage. Set sub-switch 4 of the DIP switch S2 to ON to select 5 V power supply output, and to OFF to select 15 V power supply output.
3. Connect the shield of the encoder cable to the PE terminal next to the ABZ encoder terminal.
4. Select the filtering function according to the application by setting F1-29 or F1-42 (for 530/531 single-axis drive units).

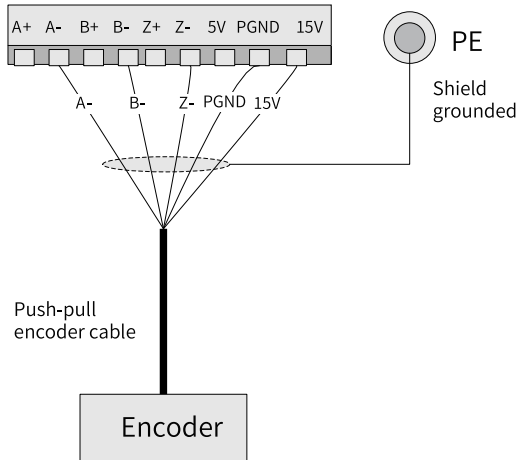


Figure 3-54 Push-pull encoder input wiring

## Note

For push-pull complementary output encoders (with positive and negative signals, such as A+/A-), connect the A+/B+/Z+ signal cables or A-/B-/Z- signal cables of the encoder to the A-/B-/Z- terminals of the ABZ encoder. Do not connect the A+/B+/Z+ terminals of the ABZ encoder. Otherwise, the internal circuit of the encoder may be damaged.

### 3.9.1.5 Distinguishing Collector Output Encoders from Push-Pull Output Encoders

During field debugging, do the following to distinguish the collector output encoder from the push-pull output encoder:

1. Connect the power cable of the encoder to the power supply terminal of the ABZ encoder. Do not connect the A, B, and Z signal cable of the encoder to the ABZ encoder terminal of the drive.
2. Switch the multimeter to the DC voltage level, connect the black test lead to PGND of the ABZ encoder terminal, and the red test lead to the encoder A or B output signal cable.



- Slowly turn the motor shaft. If the multimeter shows that the voltage changes, the encoder is a push-pull output type; if the multimeter shows that the voltage keeps at 0 V, the encoder is a collector output type.

### 3.9.2 Wiring Resolver Encoders

#### Product models and encoder terminals

The following table describes the drive unit models that support resolver encoders and the encoder terminals.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXG400)	Terminal Definition	Terminal Description
None (DB15 terminal)	Resolver encoder terminal	Provides one encoder terminal.	<a href="#">"Table 3-23 " on page 83</a>	Supports the resolver encoder.

#### Note

"One" indicates that the model has one encoder terminal of this type.

#### Encoder specifications

Resolution	12-bit
Excitation frequency	10 kHz
Excitation output voltage	7 Vrms
Sin/Cos voltage	3.5 Vpp
Transformation Ratio	0.5
Maximum Motor Speed	60000 rpm
Frequency Division Coefficient	1:N
Frequency Division Number	1024/N
Frequency Division Interface	Differential/OC/push-pull

#### Wiring description

Connect the signal cable of the resolver encoder to the resolver encoder terminal (DB15) of the drive. The wiring diagram is shown in the figure below.



## Caution

Shielded twisted pair (STP) cables are recommended. Connect one twisted pair cable to one pair of differential signal cables.

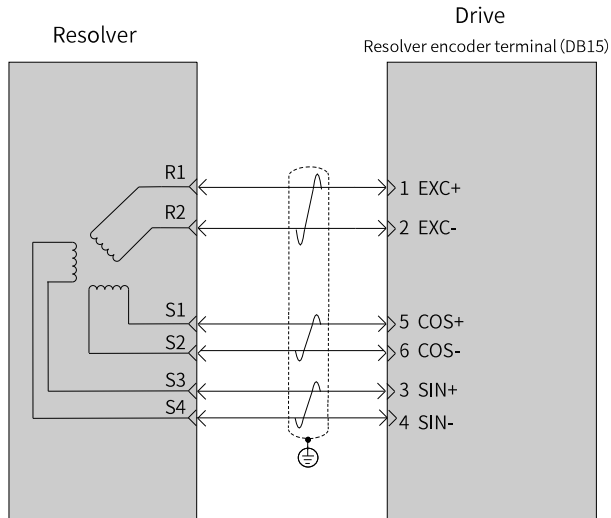


Figure 3-55 Wiring the resolver encoder

When you need to use the incremental differential frequency division output function, connect the PLC or PG card to the resolver encoder terminal (DB15) of the drive, as shown in the following figure. In addition, provide power supply for frequency division output according to the user's level requirements.

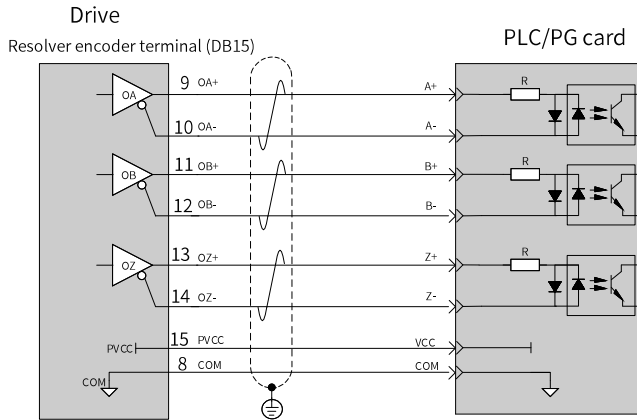


Figure 3-56 Wiring for incremental differential frequency division output

**Parameter settings**

Set F1-28 (encoder type) to 3 (resolver encoder).

Set F1-29 to select the related filter mode.

**3.9.3 Wiring Sin-Cos Encoders**

**Product models and encoder terminals**

The following table describes the drive unit models that support sin-cos encoders and the encoder terminals.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)		Terminal Definition
		G530	G531	
None (DB15 terminal)	Multi-encoder terminal	One	One	<i>"Table 3-24 " on page 84</i>

**Note**

"One" indicates that the model has one encoder terminal of this type.

**Encoder specifications**

Power supply	5 V/300 mA
Differential Voltage	06-1.2 Vpp; typical value: 1.0 Vpp
Maximum common mode voltage	3 V
Width	300 kHz

## Wiring Description

Connect the signal cable of the sin-cos encoder to the multi-encoder terminal (DB15) of the drive, as shown below.



**Caution**

Connect one twisted pair cables to one pair of differential signal cables. It is recommended that the twisted cable not exceed 10 m.

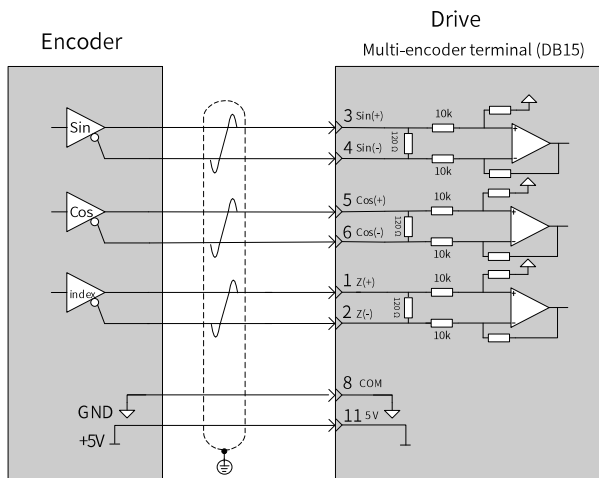


Figure 3-57 Wiring the sin-cos encoder

## Parameter settings

Set F1-23 (PG2 encoder type) to 2 to select the sin-cos encoder.

Set F1-21 (sinusoid per revolution of sin-cos encoder) according to the actual value of the encoder.

## 3.9.4 Wiring Inovance 23-Bit Communication Encoders

### Product models and encoder terminals

The following table describes the drive unit models that support Inovance 23-bit communication encoders and the encoder terminals.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)			Terminal Definition
		G300	G530	G531	
None (DB9 terminal)	23-bit encoder terminal	Provides one encoder terminal.	-	-	"Table 3-22 " on page 83
None (DB15 terminal)	Multi-encoder terminal	-	Provides one encoder terminal.	Provides one encoder terminal.	"Table 3-24 " on page 84
Terminal Mark	Terminal Name	Drive Unit (Dual-axis) Model (MD810-50M4TDXGXXX)			Terminal Definition
		G300			
None (DB9 terminal)	23-bit encoder terminal	Provides two encoder terminals.			"Table 3-35 " on page 95

**Note**

- "One" indicates that the model has one encoder terminal of this type.
- "Two" indicates that the model has two encoder terminals of this type.
- "-" indicates that the model does not have the encoder terminal of this type.

**Encoder specifications**

Power supply	5 V/300 mA
Resolution	23-bit
Data refresh frequency	16 kHz
Maximum RS485 communication speed	4 Mbit/s

**Wiring description**

Connect the signal cable of the Inovance 23-bit communication encoder to the 23-bit encoder terminal (DB9) or multi-encoder terminal (DB15) of the drive, as shown below.

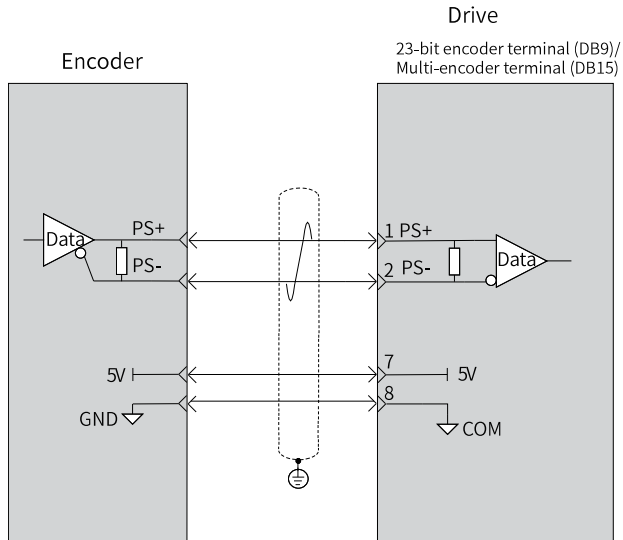


Figure 3-58 Wiring of Inovance 23-bit communication encoders

### Parameter settings

Encoder type settings:

- For drive unit (single-axis) 530/531 models, set F1-23 (PG2 encoder type) to 1 to select the 23-bit encoder.
- For other drive units that support 23-bit encoders, set F1-28 (encoder type) to 1 to select the 23-bit encoder.

The 23-bit absolute value encoder adopts high-speed RS485 bus, and the communication distance is related to the selected cables. The cables must meet the following requirements:

- The cross-sectional area is not smaller than 22AWG.
- The resistance is not higher than 2.5  $\Omega$ .
- The distributed capacitance is not higher than 4.8 nF.
- The shielded twisted pair is recommended.

Leoni L45467-J17-B15 is recommended.

### 3.9.5 Wiring SSI Encoders

#### Product models and encoder terminals

The following table describes the drive unit models that support SSI encoders and the encoder terminals.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)		Terminal Definition
		G530	G531	
None (DB15 terminal)	Multi-encoder terminal	One	One	<a href="#">"Table 3-24 " on page 84</a>

## Note

"One" indicates that the model has one encoder terminal of this type.

## Encoder specifications

Power Supply	5 V/300 mA, 12 V/200 mA
Resolution	32-bit
Maximum SSI Communication Speed	1 Mbit/s

## Wiring description

Connect the signal cable of the SSI encoder to the multi-encoder terminal (DB15) of the drive, as shown below.

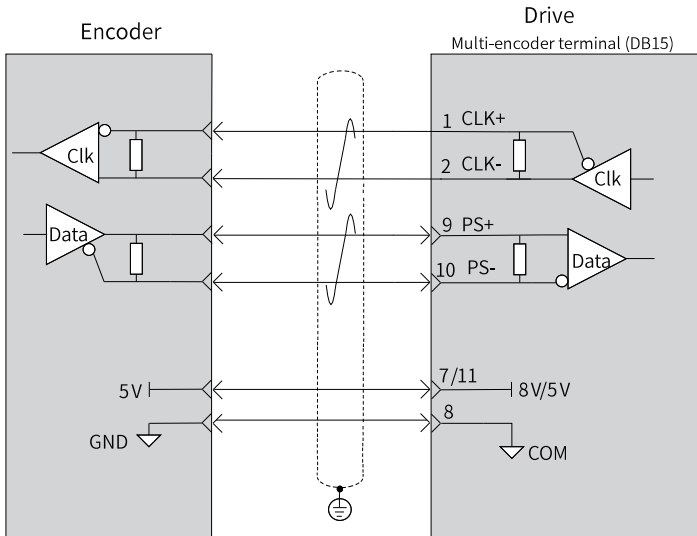


Figure 3-59 Wiring the SSI encoder

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## Note

Select the power supply voltage according to the encoder power supply.

"Table 3-47" on page 135 describes the relationship between the SSI baud rate and the cable length.

---

Table 3-47 Relationship between the SSI baud rate and the cable length

Baud Rate (kbps)	Cable Length (m)
1000	10
500	25
400	50
250	150
125	300

## Parameter settings

- Set F1-23 (PG2 encoder type) to 3 to select the SSI encoder.
  - Set F1-47 (encoder type) to 0 to select the SSI resolver encoder or to 1 to select the SSI laser encoder.
  - Set F1-38 (SSI encoder baud rate) according to the encoder specification and the cable length. In general, the higher the baud rate, the shorter the data transmission time, and the shorter the allowable cable length. The lower the baud rate, the longer the data transmission time, and the longer the allowable cable length. "Table 3-47" on page 135 describes the relationship between the SSI baud rate and the cable length.
  - Set F1-39 (single-turn bit of SSI encoder) according to the encoder specifications. The maximum value is 24 bits.
  - Set F1-40 (multi-turn bit of SSI encoder) according to the encoder specifications. The maximum value is 24 bits.
  - Set F1-44 (error bit of SSI encoder).
- 

## Note

In the SSI data, the sum of the multi-turn bits, the single-turn bits, and the error bits must be less than 36 bits, and the upper limit resolution of the multi-turn bits and single-turn bits must be less than 24 bits.

---



### 3.9.6 Incremental Frequency Division Output

#### Product models and encoder terminals

The following table describes the drive unit models that support incremental frequency division output the encoder terminals.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)		Terminal Definition
		G530	G531	
None (DB15 terminal)	Multi-encoder terminal	Yes	Yes	<a href="#">"Table 3-24 " on page 84</a>

The following table describes the drive unit models that support resolver encoders and the encoder terminals.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXG400)	Terminal Definition
None (DB15 terminal)	Resolver encoder terminal	Yes	<a href="#">"Table 3-23 " on page 83</a>

#### Specifications for frequency division output

Power Supply	5 V to 30 V
Type	ABZ incremental
Interface	Push-pull output
Frequency-division output	50 mA
Maximum frequency	500 kHz

#### Wiring description

Connect the frequency division PLC or PG card signal cable to the resolver encoder terminal (DB15) or multi-encoder terminal (DB15) of the drive, as shown below, and provide the power supply for frequency division output according to the level requirements.

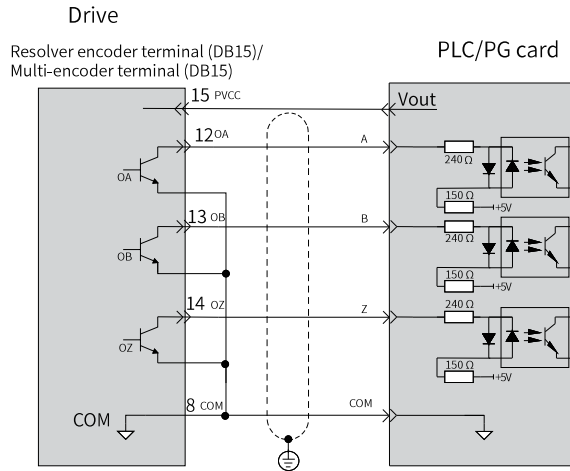


Figure 3-60 Wiring for incremental frequency division output

## Parameter settings

Set F1-20 (frequency division signal source).

If the frequency division signal is given by ABZ incremental encoder, set the ABZ incremental frequency division coefficient through F1-35. Otherwise, set the frequency coefficient of the absolute encoders through F1-46.

### 3.9.7 Selecting Filter Modes

Select the filter mode of the encoder terminal by setting F1-29, F1-42, and F1-43. F1-42 and F1-43 are dedicated for 530/531 single-axis drive unit. There are four filter modes, including non-adaptive filtering, adaptive filtering (default value), fixed interlocking, and automatic interlocking, as described below:

- Non-adaptive filtering: The filter coefficient of the encoder terminal is fixed and small, which is suitable for applications with no or small interference, high speed, and large frequency hopping.
- Adaptive filtering: The filter coefficient of the encoder terminal is automatically adjustable. Therefore, the terminal has strong anti-interference abilities, especially when the feedback speed of the encoder is lower than 100 kHz. This mode applies to scenarios with strong interference. It is the default mode.
- Fixed interlocking: When the terminal is set to this mode, the terminal has all functions when set to adaptive filtering. In addition, in this mode, the terminal also features edge jitter elimination of the encoder feedback signal. This mode applies to scenarios where edge jitter exists in the encoder feedback signal.
- Automatic interlock: When the terminal is set to the fixed interlocking mode at zero speed, the useful signal may be mistakenly eliminated as edge jitter. In this

case, automatic interlocking is recommended, which enables the terminal to switch between the adaptive filtering mode and the fixed interlocking mode. This can better cope with the working conditions with both zero speed and non-zero speed.

### 3.10 Wiring STO Terminals

#### Product models and encoder terminals

The following table describes the drive unit (single-axis) models that support the STO function and the STO terminal.

Terminal Mark	Terminal Name	Drive Unit (Single-axis) Model (MD810-50M4TXXGXXX)								Terminal Definition
		G200	G201	G210	G211	G300	G400	G530	G531	
CN4	STO terminal	-	-	-	-	-	-	Reserved	One	<i>"Table 3-19 " on page 82</i>
STO	STO terminal	-	One	Reserved	One	Reserved	Reserved	-	-	
Terminal Mark	Terminal Name	Drive Unit (Dual-axis) Model (MD810-50M4TDXXGXXX)					Terminal Definition			
		G200	G201	G210	G211	G300				
STO	Axis 1 STO terminal, axis 2 STO terminal	Reserved	One	Reserved	One	-	<i>"Table 3-37 " on page 96</i>			

#### Note

- "One" indicates that the model has one terminal of this type.
- "-" indicates that the model does not have the terminal of this type.
- "Reserved" indicates that the model has the terminal of this type without electrical connection.

## Electrical specifications and connection of the input circuit

The following table describes the relationship between the STO input status and the drive working status.

STO1 Input Status	STO2 Input Status	Drive Working Status
Low	Low	Not running
Low	High	
High	Low	
High	High	Running

The following table describes the electrical characteristics of the safety request input signal.

Item	Feature	Description
Voltage range	24 VDC ( $\pm 15\%$ )	-
Input current	4 mA (Typ.)	Value of each channel
Logic level standard	"0" < 3 V; "1" > 15 V	-
Digital input impedance	5.78 k $\Omega$	-

The following figure describes the STO terminal wiring.

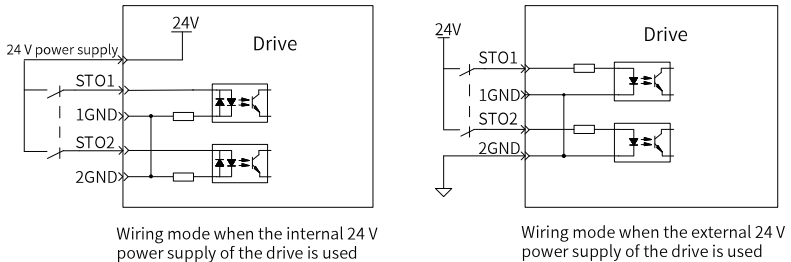
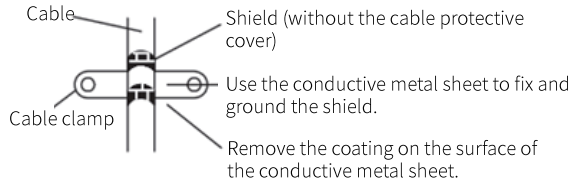


Figure 3-61 STO terminal wiring

## EMC requirements

- To avoid short circuits between two adjacent conductors, use shielded cables with the shield connected to the protection ground, or use flat cables with a ground cable inserted between each signal conductor.
- Double-layer shielded cables or single-layer shielded twisted pair cables are recommended.
- Use the conductive metal sheet to fix and ground the cable shield, as shown in the figure below.



- The maximum cable length allowed between the drive and the safety switch is 30 m.

### Other requirements

- All cables must be well protected, routed, and secured.
- Do not pull or pinch the cables during installation.
- When using the external 24 V power supply, to avoid common faults of the cable, route STO1 cables and STO2 cables through different routes or use double-layer shielded cables for protection.

Cable	Description
Category	Low voltage, double-layer shielded cables or single-layer shielded twisted pair cables
Maximum cross-sectional area	0.8 mm <sup>2</sup> (18AWG)
Minimum cross-sectional area	0.3 mm <sup>2</sup> (28AWG)
Maximum length	The maximum length between the STO input terminal and the operation contact is 30 m.

## 3.11 Grounding

### 3.11.1 Grounding the Control Board

By default, the control board is grounded. When EMC interference exists, remove the grounding screws of the control board.

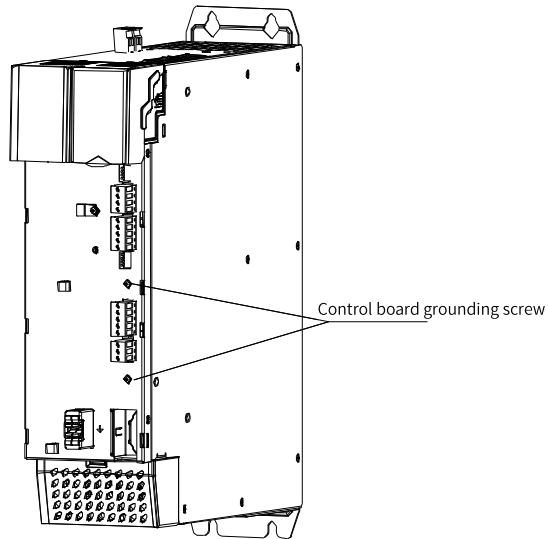


Figure 3-62 Grounding screw of the control board for the power supply unit

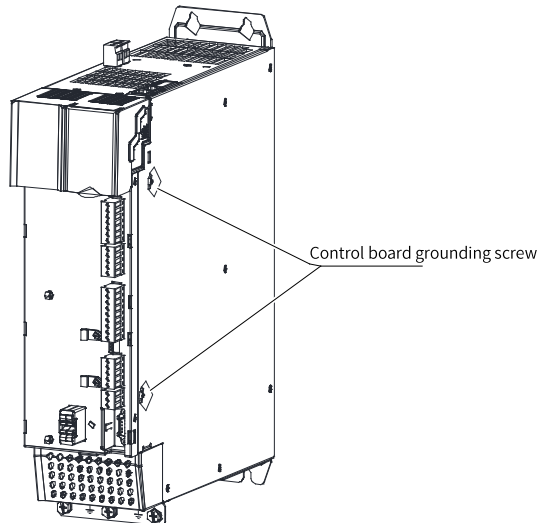


Figure 3-63 Grounding screw of the control board for the drive unit

### 3.11.2 Grounding a Single Device

Connect the power supply unit, drive unit, and components such as the input electric reactor and filter to the PE copper bar by star connection, as shown in the following figure.

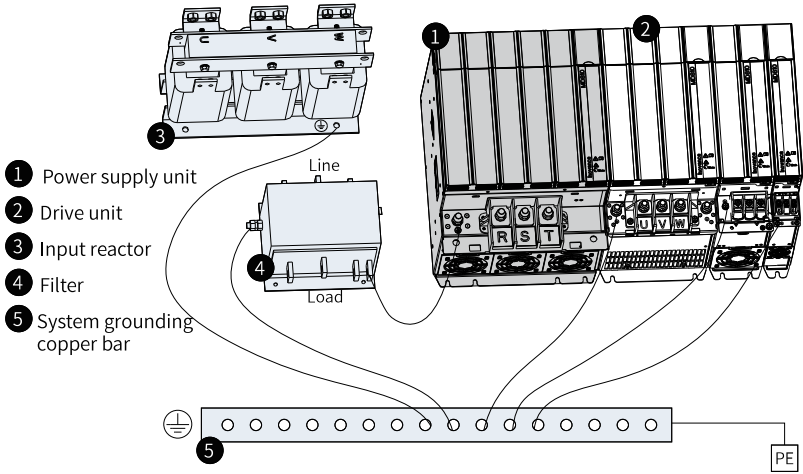


Figure 3-64 System grounding connection

### 3.11.3 Grounding of Multiple Devices

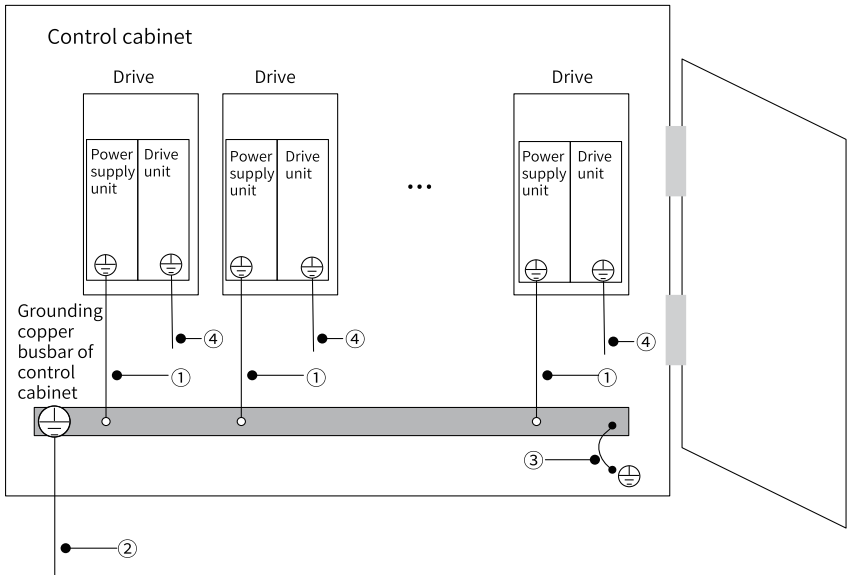


Figure 3-65 Grounding in parallel connection

Table 3-48 Grounding description for parallel connection

No.	Wiring Description
①	The main circuit input PE terminal of the product is connected to the grounding copper busbar of the control cabinet through the protective grounding conductor.
②	Connect the PE cable of the input power supply 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 cable ground to the output PE terminal of the product.

### 3.11.4 Grounding the Cabinet System

To suppress the interference of devices installed in the cabinet, isolate them that might interfere with each other. According to the strength of interference, devices must be installed in different EMC areas or cabinets. The following table describes the installation requirements.

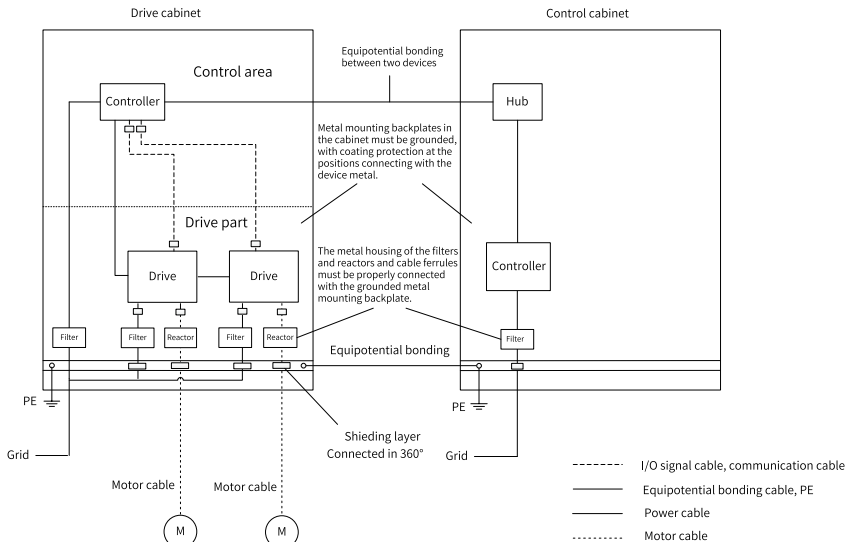


Figure 3-66 Recommended cabinet system grounding



Table 3-49 Requirements of cabinet system grounding

No.	Wiring Requirements
1	Place the devices for control and the devices for drive in two cabinets.
2	Use grounding cables with a cross-sectional area of at least 16 mm <sup>2</sup> to connect different cabinets, therefore realizing equipotential between cabinets.
3	Place the devices in different areas in the cabinet according to the device signal strength.
4	Carry out equipotential bonding for the devices in different areas of the cabinet.
5	Shield all communication (such as RS485) signal cables leading from the cabinet.
6	Install the power input filter close to the cabinet input interface.
7	Protect each grounding point in the cabinet by spraying.

## 4 Option Selection

### 4.1 Co-bus External Power Terminal

The bus can be used to connect non-adjacent units by co-bus external power terminal.

- The 100 A co-bus external power terminal is applicable to the booksize unit with the width of 50 mm, including:  
22 kW power supply unit  
1.5-7.5 kW drive unit (single-axis) and 1.5-5.5 kW drive unit (dual-axis)
- The 200 A co-bus external power terminal is applicable to the booksize unit with the width of 100 mm, 200 mm, and 300 mm, including:  
45 kW, 110 kW, and 160 kW power supply unit  
11-160 kW drive unit (single-axis) and 7.5-18.5 kW drive unit (dual-axis)

The following figure describes the co-bus external power terminal.

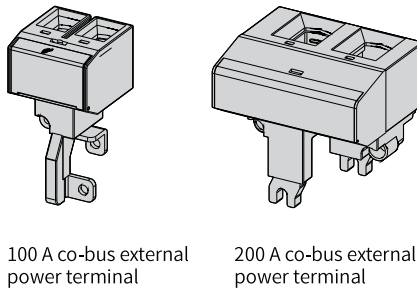


Figure 4-1 Co-bus external power terminal

Table 4-1 Recommended cross-sectional area of the cable for the co-bus external power terminal

Terminal Model	Cross-sectional Area of the Cable
100 A co-bus external power terminal	10AWG to 1AWG
200 A co-bus external power terminal	6AWG to 250 Kcmil

### 4.2 Through-hole Mounting Bracket

Through-hole mounting brackets are required only for single-row installation of booksize units. Select a through-hole mounting bracket based on the unit's width.

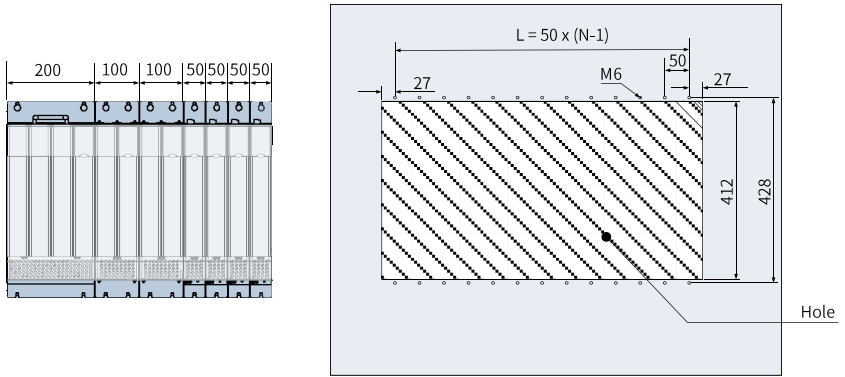


Figure 4-2 Dimensions of the through-hole mounting bracket and mounting hole dimensions on the backplane (unit: mm)

### 4.3 Air Guide Plate

Air guide plates are required only for dual-row installation of booksize units. Select an air guide plate based on the unit's width.

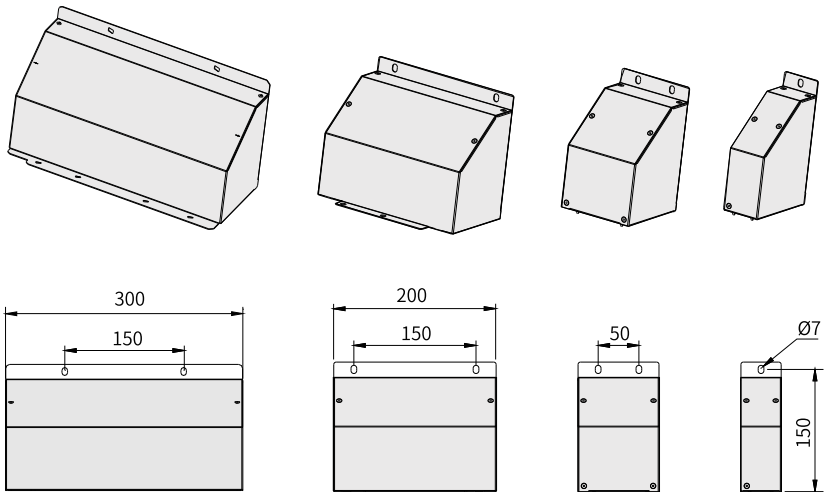


Figure 4-3 Dimensions of the air guide plate (unit: mm)

### 4.4 Shield Bracket

At the output side of the booksize power supply unit and the drive unit, it is recommended to use a motor cable with the shield. In this case, you can use the

shield bracket to ground the cable shield. Select a shield bracket based on the size of the power supply unit and the drive unit, as shown in the following figure and table.

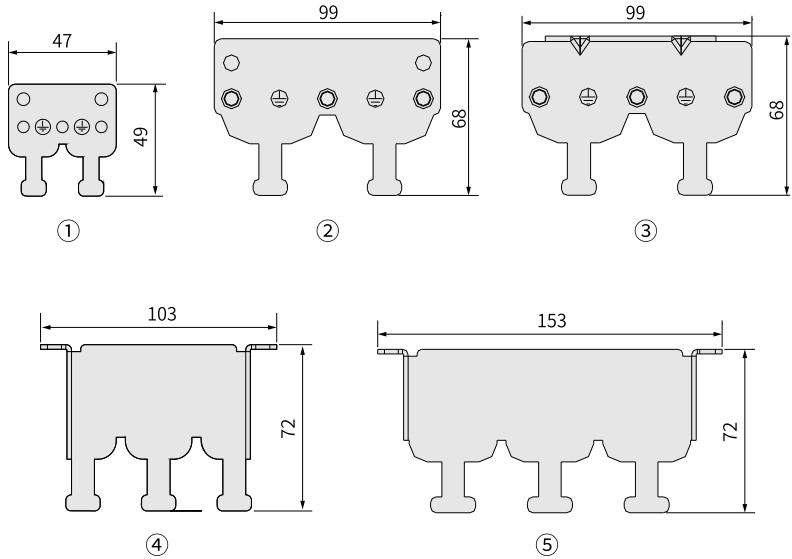


Figure 4-4 Dimensions of the shield bracket (unit: mm)

Table 4-2

Width of the Power Supply Unit/Drive Unit	Shield Bracket for the Power Supply Unit	Shield Bracket for the Drive Unit
50 mm	①	①
100 mm	③	②
200 mm	④	④
300 mm	⑤	⑤

## 4.5 External LCD Operating Panel

The external LCD operating panel SOP-20-MD810 enables you to copy and modify parameters, and burn programs. The following figure describes the appearance and dimensions of the panel.

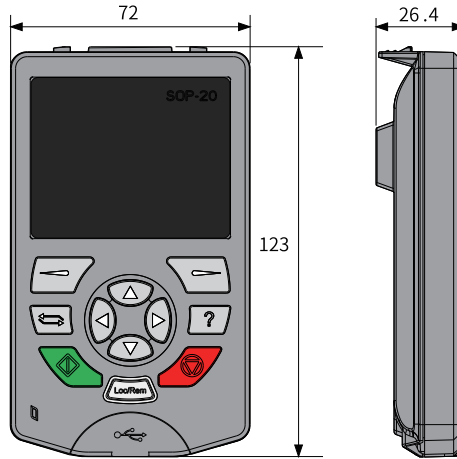


Figure 4-5 Appearance and dimensions of the SOP-20-MD810

## 4.6 DC Soft Charge Unit

If a drive unit fails, you need to power off the faulty drive unit and the power supply unit, replace with a new drive unit, and then power on the power supply unit and the new drive unit. To ensure that the power supply unit can operate without power-off during this case, you can install a DC soft charge unit for each drive unit.



Figure 4-6 Appearance of INOV-SU series DC soft charge units

### Model selection

Table 4-3 Model selection of INOV-SU series DC soft charge units

Drive Unit Model	DC Soft Charge Unit Model
MD810-50M4T1.5GXXX	INOV-SU-30 (width of 50 mm)
MD810-50M4TD1.5GXXX	

Drive Unit Model	DC Soft Charge Unit Model
MD810-50M4T2.2GXXX	
MD810-50M4TD2.2GXXX	
MD810-50M4T3.7GXXX	
MD810-50M4TD3.7GXXX	
MD810-50M4T5.5GXXX	
MD810-50M4TD5.5GXXX	
MD810-50M4T7.5GXXX	
MD810-50M4TD7.5GXXX	INOV-SU-60 (width of 100 mm)
MD810-50M4T11GXXX (W)	
MD810-50M4TD11GXXX	
MD810-50M4T15GXXX (W)	
MD810-50M4T18.5GXXX(W)	
MD810-50M4T22GXXX (W)	INOV-SU-100 (width of 100 mm)
MD810-50M4TD15GXXX	
MD810-50M4TD18.5GXXX	
MD810-50M4T30GXXX (W)	
MD810-50M4T37GXXX (W)	INOV-SU-170 (width of 200 mm)
MD810-50M4T45GXXX	
MD810-50M4T55GXXX	
MD810-50M4T75GXXX	-
MD810-50M4T90GXXX	
MD810-50M4T110GXXX	
MD810-50M4T132GXXX	
MD810-50M4T160GXXX	
MD810-50M4T200GXXXH	
MD810-50M4T250GXXXH	
MD810-50M4T315GXXXH	
MD810-50M4T355GXXXH	

### Dimensions

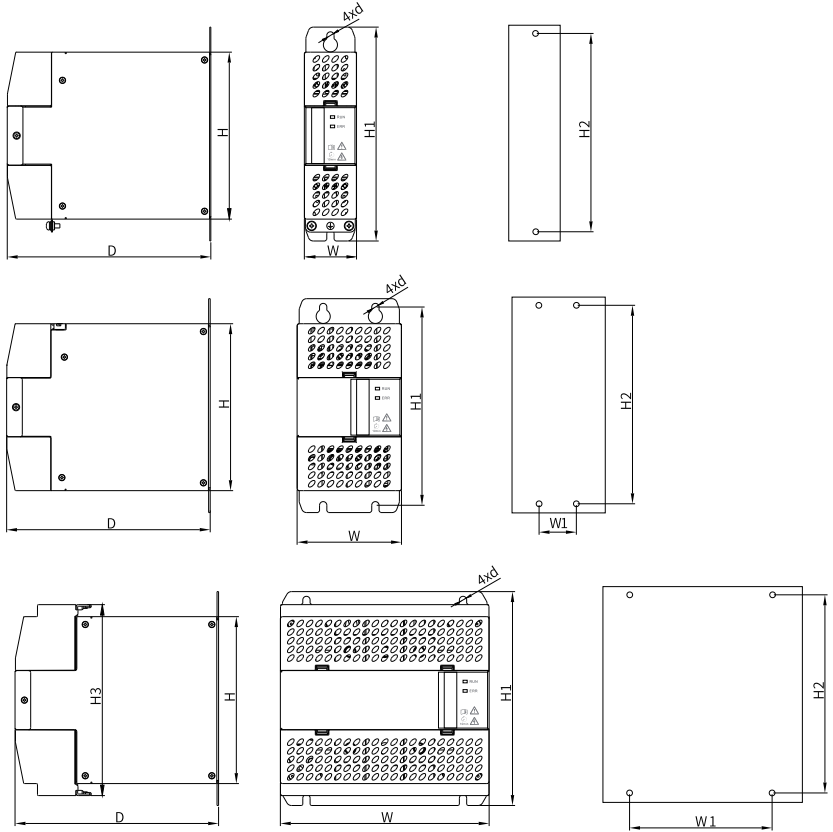


Figure 4-7 Dimensions of the INOV-SU series DC soft charge unit

DC Soft Charge Unit Model	Mounting Hole (mm)		Overall Dimension (mm)					Mounting Hole Diameter (mm)
	W1	H2	H	H1	H3	W	D	
INOV-SU-30	-	-	160	205	-	50	195	φ7
INOV-SU-60	50	190	160	205	-	100	195	φ7
INOV-SU-100	50	190	160	205	-	100	195	φ7
INOV-SU-170	150	190	160	205	183	200	195	φ7

## 4.7 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:

$$U^2 / R = P_b$$

Where:

- U indicates the braking voltage at system stable braking. U varies with systems. For three-phase 380–480 V, the default braking voltage of the drive is 760 V. For single-phase 200–240 V, the default braking voltage of the drive is 360 V. The braking voltage can be adjusted by F1-02.
- P<sub>b</sub> 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 derating K, the power of the braking resistor is calculated using the following formula:

$$K \times P_r = P_b \times D$$

Where:

- K is set to a value around 50%.
- P<sub>r</sub> indicates the power of the braking resistor.
- D indicates the braking frequency, that is, percentage of the regenerative process to the whole working process.

According to the preceding formulas, the following can be obtained:

$$K \times P_r = P_b \times D = U^2 / R \times D$$

$$P_r = (U^2 \times D) / (R \times K)$$

The braking resistor power P<sub>r</sub> can be calculated accordingly.

K is the derating coefficient of the braking resistor. A small value of K prevents the braking resistor from overheat. Increase K moderately if heat can be well dissipated, but in no case should K exceed 50%. Failure to comply may result in braking resistor overheat and fire.

Braking frequency (D) is determined by applications. Typical values of braking frequency in different applications are listed in ["Table 4-4" on page 152](#).



Table 4-4 Typical values of braking frequency in different applications

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

### Selection of braking components

Power Supply Unit Model	Applicable Motor (kW)	Braking Unit		125% Braking Torque (10% ED, Max. 10s)		Remarks	Minimum Braking Resistance (Ω)
		Model	Quantity	Braking Resistor Specification	Braking Resistor Qty.		
MD810-20M4T22GXXX	22	Built-in	-	4 kW, 32 Ω	1	-	24
MD810-20M4T45GXXX	45	Built-in	-	9 kW, 13 Ω	1	-	12.8
MD810-20M4T110GXXX	110	MDBUN-90-T	2	11 kW, 8.0 Ω	2	Input voltage ≤ 440 VAC	6.8 x 2
	110	MDBUN-90-5T	2	11 kW, 10.5 Ω	2	Input voltage > 440 VAC	7.7 x 2
MD810-20M4T160GXXX (W)	160	MDBUN-200-T	2	16 kW, 2.8 Ω	2	Input voltage ≤ 440 VAC	2.5 x 2
	160	MDBUN-200-5T	2	16 kW, 3.6 Ω	2	Input voltage > 440 VAC	2.8 x 2
MD810-20M4T355GXXX	355	MDBUN-200-T	3	23 kW, 3.8 Ω	3	Input voltage ≤ 440 VAC	2.5 x 3
	355	MDBUN-200-5T	3	23 kW, 4.9 Ω	3	Input voltage > 440 VAC	2.8 x 3

### Dimensions of the braking unit

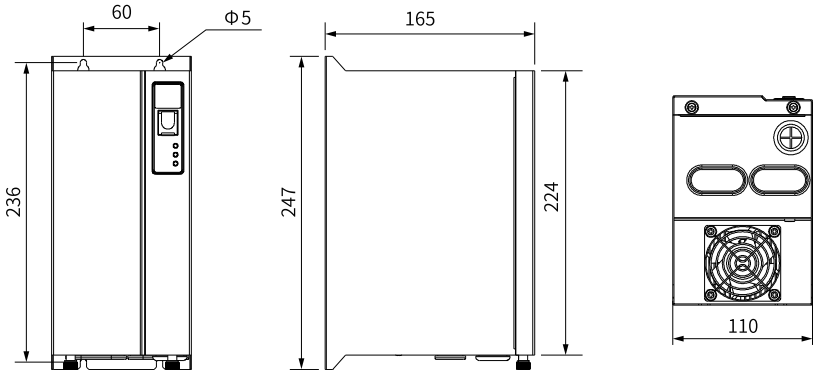


Figure 4-8 Structure dimensions of the MDBUN series braking unit (unit: mm)

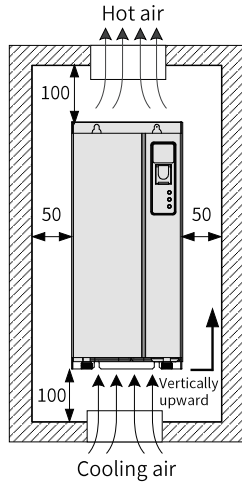


Figure 4-9 Mounting dimensions of the MDBUN series braking unit (unit: mm)

## 4.8 PROFIBUS DP Bus Adapter

The output cable of the PROFIBUS-DP bus adapter must be 90° to the ground. SIEMENS 6ES7972-0BB12-0XA0 is recommended, as shown below.



Figure 4-10 Appearance of SIEMENS 6ES7972-0BB12-0XA0

## 4.9 Peripheral Components

### 4.9.1 List of Peripheral Components

Table 4-5 Peripheral components at the power supply unit side

Drive Model	Fuse Model (Bussmann, with UL Certification)	EMC Filter Model (Schaffner and Jianli)	AC Input Reactor Model (Inovance)	Circuit Breaker Rated Current (A)	Contactor Rated Current (A)
MD810-20M4T22GXXX	FWH-100Ba	FN 3258-75-34	MD-ACL-60-0.24-4T-2%	65	80
MD810-20M4T45GXXX	FWH-150B	FN 3258-100-35	MD-ACL-120-0.12-4T-2%	150	160
MD810-20M4T110GXXX	FWH-325A	FN 3359-250-28	MD-ACL-250-0.056-4T-2%	205	400
MD810-20M4T160GXXX (W)	FWH-500A	FN 3359-320-99	MD-ACL-330-0.042-4T-2%	300	400
MD810-20M4T355GXXX	170M5016	FN 3359-800-99	MD-ACL-800-0.017-4T-2%	620	800

Table 4-6 Peripheral components at the drive unit side

Drive Model	Bus Fuse (Bussmann, with UL Certification)		DC Soft Charge Unit	DC Circuit Breaker (ABB, with UL Certification)	AC Output Reactor (Inovance)	AC Output Reactor (Schaffner)
	Model	Quantity				
MD810-50M4T1.5GXXX	FWC-16A10F	1	INOV-SU-30	S804S-UCK40	MD-OCL-5-1.4-4T-1%	RWK 305-4-KL
MD810-50M4T2.2GXXX	FWC-20A10F	1	INOV-SU-30	S804S-UCK40	MD-OCL-7-1.0-4T-1%	RWK 305-7.8-KL
MD810-50M4T3.7GXXX	FWC-16A10F	2			MD-OCL-10-0.7-4T-1%	RWK 305-10-KL
MD810-50M4T5.5GXXX	FWC-20A10F	2			MD-OCL-15-0.47-4T-1%	RWK 305-14-KL
MD810-50M4T7.5GXXX	FWC-25A10F	2			MD-OCL-20-0.35-4T-1%	RWK 305-17-KL
MD810-50M4T11GXXX	FWP-32A14Fa	2			MD-OCL-30-0.23-4T-1%	RWK 305-24-KL
MD810-50M4T15GXXX	FWP-40A14Fa	2	INOV-SU-60	S804S-UCK80	MD-OCL-40-0.18-4T-1%	RWK 305-32-KL
MD810-50M4T18.5GXXX	FWP-50A14Fa	2			MD-OCL-50-0.14-4T-1%	RWK 305-45-KL
MD810-50M4T22GXXX	170M1368	1			MD-OCL-60-0.12-4T-1%	RWK 305-45-KL
MD810-50M4T30GXXX	170M1369	1	INOV-SU-100	S804S-UCK125	MD-OCL-80-0.087-4T-1%	RWK 305-60-KL

Drive Model	Bus Fuse (Bussmann, with UL Certification)		DC Soft Charge Unit	DC Circuit Breaker (ABB, with UL Certification)	AC Output Reactor (Inovance)	AC Output Reactor (Schaffner)
	Model	Quantity				
MD810-50M4T37GXXX	170M1370	1			MD-OCL-90-0.078-4T-1%	RWK 305-72-KL
MD810-50M4T45GXXX	170M1371	1	INOV-SU-170	T4DCN250TMA 250FF3P	MD-OCL-120-0.058-4T-1%	RWK 305-90-KL
MD810-50M4T55GXXX	170M1372	1			MD-OCL-150-0.047-4T-1%	RWK 305-110-KL
MD810-50M4T75GXXX	170M1370	2			MD-OCL-200-0.035-4T-1%	RWK 305-156-KS
MD810-50M4T90GXXX	FWH-500A	1	-	-	MD-OCL-250-0.028-4T-1%	RWK 305-182-KS
MD810-50M4T110GXXX	FWH-600A	1	-	-	MD-OCL-250-0.028-4T-1%	RWK 305-230-KS
MD810-50M4T132GXXX	FWH-700A	1	-	-	MD-OCL-330-0.021-4T-1%	RWK 305-280-KS
MD810-50M4T160GXXX	FWH-800A	1	-	-	MD-OCL-330-0.021-4T-1%	RWK 305-330-KS
MD810-50M4T200GXXXH	170M6413	2	-	-	MD-OCL-490-0.014-4T-1%	RWK 305-400-S
MD810-50M4T250GXXXH	170M6415	2	-	-	MD-OCL-490-0.014-4T-1%	RWK 305-500-S
MD810-50M4T315GXXXH	170M6416	2	-	-	MD-OCL-660-0.011-4T-1%	RWK 305-600-S
MD810-50M4T355GXXXH	170M6418	2	-	-	MD-OCL-800-0.0087-4T-1%	RWK 305-680-S
MD810-50M4TD1.5GXXX	FWC-16A10F	2	INOV-SU-30	S804S-UCK40	MD-OCL-5-1.4-4T-1%	RWK 305-4-KL
MD810-50M4TD2.2GXXX	FWC-20A10F	2			MD-OCL-7-1.0-4T-1%	RWK 305-7.8-KL
MD810-50M4TD3.7GXXX	FWC-25A10F	2			MD-OCL-10-0.7-4T-1%	RWK 305-10-KL
MD810-50M4TD5.5GXXX	FWC-25A10F	2			MD-OCL-15-0.47-4T-1%	RWK 305-14-KL
MD810-50M4TD7.5GXXX	FWC-32A10F	2	INOV-SU-60	S804S-UCK80	MD-OCL-20-0.35-4T-1%	RWK 305-17-KL
MD810-50M4TD11GXXX	170M1368	1			MD-OCL-30-0.23-4T-1%	RWK 305-24-KL
MD810-50M4TD15GXXX	170M1369	1	INOV-SU-100	S804S-UCK125	MD-OCL-40-0.18-4T-1%	RWK 305-32-KL
MD810-50M4TD18.5GXXX	170M1370	1			MD-OCL-50-0.14-4T-1%	RWK 305-45-KL

## 4.9.2 Fuse, Contactor, and Circuit Breaker

Model	Recommended Input IEC Cable (mm <sup>2</sup> ) <sup>Note 1</sup>	Recommended IEC Ground Cable (mm <sup>2</sup> )	Power Supply Unit Terminal Width (mm)	Screw	Recommended Fuse (Bussmann, with UL Certification)		Recommended Contactor	Recommended Circuit Breaker
					Rated Current (A)	Model		
Three-phase 380-480 V, 50 Hz/60 Hz (47-63 Hz)								
MD810-20M4T22GX XX	3 x 10	10	14	M6	100	FWH-100Ba	65	80
MD810-20M4T45GX XX	3 x 25	16	18	M6	150	FWH-150B	150	160
MD810-20M4T110G XXX	3 x 95	70	28	M10	325	FWH-325A	205	400
MD810-20M4T160G XXX (W)	3 x 185	95	38	M12	500	FWH-500A	300	400
MD810-20M4T355G XXX	2 x (3 x 185)	185	-	M16	1000	170M5016	620	800

### Note

The preceding table applies to standards in China.

3 x 10 indicates one three-conductor cable, and 2 x (3 x 95) indicates two three-conductor cables.

## 4.9.3 Cable Lug



Figure 4-11 Appearance of cable lugs manufactured by Suzhou Yuanli

### Dimensions of TNR series cable lugs

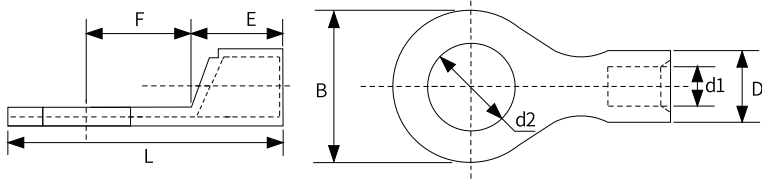


Figure 4-12 Dimensions of TNR series cable lugs

Table 4-7 Models and dimension of TNR series cable lugs (unit: mm)

Model	Specification		D	d1	E	F	B	d2	L	Current (A)	Crimping Tool
	AWG/MCM	mm <sup>2</sup>									
TNR0.75-4	22-16	0.25-1.0	2.8	1.3	4.5	6.6	8.0	4.3	15	10	RYO-8
TNR1.25-4	22-16	0.25-1.65	3.4	1.7	4.5	7.3	8.0	5.3	15.8	19	AK-1M

### GTNR series cable lugs

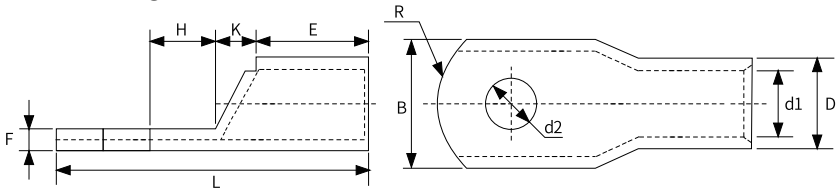


Figure 4-13 Dimensions of GTNR series cable lugs

Table 4-8 Models and dimensions of GTNR series cable lugs (unit: mm)

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR1.5-5	4.0	2.2	5.0	5.0	2.0	8.0	5.3	1.0	16.0	5.0	RYO-8 YIT-8 RYO-14
GTNR2.5-4				5.0			4.3		18.0		
GTNR2.5-5				6.0	5.3		20.0				
GTNR2.5-6					10.2	6.4	0.8				
GTNR4-5	5.2	3.6	7.0	6.0	2.0	10.0	5.3	1.0	20.0	7.0	
GTNR4-6				6.0			6.4		20.0		
GTNR6-5	6.0	4.2	9.0	6.0	3.0	10.0	5.3	1.2	23.0	7.0	
GTNR6-6				7.5			6.4		26.0		
GTNR6-8									12.0		
GTNR10-6	7.0	5.0	9.0	8.0	3.5	12.4	6.4	1.3	26.5	7.0	
GTNR10-8				8.0			8.4		27.5		
GTNR16-6	7.8	5.8	12.0	8.0	4.0	12.4	6.4	1.3	31.0	7.0	
GTNR16-8				8.0			8.4				
GTNR25-6	9.5	7.5	12.0	8.0	4.5	14.0	6.4	2.0	32.0	10.0	
GTNR25-8				9.0			8.4		1.6		34.0

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR25-10				10.5		17.5	10.5	1.4	37.0	14.0	CT-100
GTNR35-6	11.4	8.6	15.0	9.0	5.0	15.5	6.4	2.8	38.0		
GTNR35-8				10.5		8.4					
GTNR35-10				17.5		10.5	2.5	40.5			
GTNR50-8	12.6	9.6	16.0	11.0	6.0	18.0	8.4	2.8	43.5		
GTNR50-10							10.5				
GTNR70-8	15.0	12.0	18.0	13.0	7.0	21.0	8.4	2.8	50.0		
GTNR70-10							10.5				
GTNR70-12							13.0				
GTNR95-10	17.4	13.5	20.0	13.0	9.0	25.0	10.5	3.9	55.0		
GTNR95-12							13				
GTNR120-12	19.8	15.0	22.0	14.0	10.0	28.0	13.0	4.7	60.0	16.0	RYC-150
GTNR120-16				16.0			17.0		64.0		
GTNR150-12	21.2	16.5	26.0	16.0	11.0	30.0	13.0	4.7	69.0		
GTNR150-16							17.0				
GTNR185-16	23.5	18.5	32.0	17.0	12.0	34.0	17.0	5.0	78.0		
GTNR240-16	26.5	21.5	38.0	20.0	14.0	38.0	17.0	5.5	92.0		
GTNR240-20							21.0				

**TNS series cable lugs**

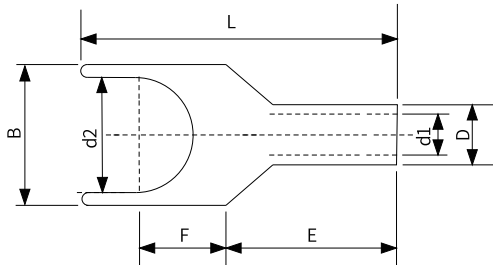


Figure 4-14 Dimensions of TNS series cable lugs

Table 4-9 Model and dimensions of TNS series cable lug (unit: mm)

Model	D	d1	E	F	B	d2	L	Crimping Tool
TNS1.25-3	3.4	1.9	4.7	6.5	5.7	3.2	16.0	RYO-8 YYT-8 RYO-14
TNS1.25-3S				6.5	5.7	3.7	16.0	
TNS1.25-3W				6.5	6.2	3.7	16.0	
TNS1.25-4S				6.5	6.4	4.3	16.0	

Model	D	d1	E	F	B	d2	L	Crimping Tool			
TNS1.25-4W	4.0	2.4	4.7	6.5	7.2	4.3	16.0	CT-38 CT-100			
TNS1.25-5				6.5	8.0	5.3	16.0				
TNS2-3				6.5	5.7	3.2	16.0				
TNS2-3S				6.5	5.7	3.7	16.0				
TNS2-3W				6.5	6.2	3.7	16.0				
TNS2-4S				6.5	6.4	4.3	16.0				
TNS2-4W				6.5	7.2	4.3	16.0				
TNS2-5				6.5	8.0	5.3	16.0				
TNS2-6	5.0	3.4	6.4	9.0	10.7	6.4	20.1	CT-38 CT-100			
TNS3.5-4				6.9	8.0	4.3	18.0				
TNS3.5-5				8.0	8.0	5.3	18.0				
TNS5.5-3				5.6	3.6	6.5	7.1		7.3	3.2	19.5
TNS5.5-3S							7.5		8.2	3.7	19.5
TNS5.5-4							7.5		8.2	4.3	19.5
TNS5.5-5							8.0		9.0	5.3	19.5
TNS5.5-6							12.0		12.0	6.4	26.2
TNS8-6	7.0	4.6	8.6	8.5	12.2	6.7	24.0	CT-100			
TNS14-5	9.3	5.6	10.0	11.0	12.0	5.3	27.5				
TNS14-6				11.0	12.0	6.7	27.5				
TNS22-8	11.3	7.5	12.0	13.0	14.0	8.4	34				

#### 4.9.4 Bus Fuse

To prevent faults caused by short circuits, prevent further damage to the system, and protect the semiconductor devices of the power supply unit, install a bus fuse between the power supply unit and the drive unit.

Because the 1.5-75 kW drive unit has a built-in bus fuse, an external bus fuse is not required. For the 90-355 kW drive unit, install a bus fuse. The following table describes the recommended bus fuse models.

Table 4–10 Recommended bus fuse models

Drive Unit Model	Recommended Fuse (Bussmann, with UL Certification)		
	Rated Current (A)	Model	Quantity
MD810-50M4T1.5GXXX	16	FWC-16A10F	1
MD810-50M4T2.2GXXX	20	FWC-20A10F	1
MD810-50M4T3.7GXXX	16	FWC-16A10F	2
MD810-50M4T5.5GXXX	20	FWC-20A10F	2
MD810-50M4T7.5GXXX	25	FWC-25A10F	2
MD810-50M4T11GXXX	32	FWP-32A14Fa	2
MD810-50M4T15GXXX	40	FWP-40A14Fa	2
MD810-50M4T18.5GXXX	50	FWP-50A14Fa	2
MD810-50M4T22GXXX	125	170M1368	1
MD810-50M4T30GXXX	160	170M1369	1



Drive Unit Model	Recommended Fuse (Bussmann, with UL Certification)		
	Rated Current (A)	Model	Quantity
MD810-50M4T37GXXX	200	170M1370	1
MD810-50M4T45GXXX	250	170M1371	1
MD810-50M4T55GXXX	315	170M1372	1
MD810-50M4T75GXXX	200	170M1370	2
MD810-50M4T90GXXX	500	FWH-500A	1
MD810-50M4T110GXXX	600	FWH-600A	1
MD810-50M4T132GXXX	700	FWH-700A	1
MD810-50M4T160GXXX	800	FWH-800A	1
MD810-50M4T200GXXXH	900	170M6413	2
MD810-50M4T250GXXXH	1100	170M6415	2
MD810-50M4T315GXXXH	1250	170M6416	2
MD810-50M4T355GXXXH	1500	170M6418	2
MD810-50M4TD1.5GXXX	16	FWC-16A10F	2
MD810-50M4TD2.2GXXX	20	FWC-20A10F	2
MD810-50M4TD3.7GXXX	25	FWC-25A10F	2
MD810-50M4TD5.5GXXX	25	FWC-25A10F	2
MD810-50M4TD7.5GXXX	32	FWC-32A10F	2
MD810-50M4TD11GXXX	125	170M1368	1
MD810-50M4TD15GXXX	160	170M1369	1
MD810-50M4TD18.5GXXX	200	170M1370	1

#### 4.9.5 DC Circuit Breaker

To install a DC soft charge unit, install a DC circuit breaker between the DC soft charge unit and the power supply unit.

Table 4-11 Selection of DC circuit breakers

DC Soft Charge Unit Model	Recommended DC Circuit Breaker (ABB, with UL Certification)	
	Rated Current (A)	Model
INOV-SU-30	40	S804S-UCK40
INOV-SU-60	80	S804S-UCK80
INOV-SU-100	125	S804S-UCK125
INOV-SU-170	250	T4DCN250TMA250FF3P

#### 4.9.6 AC Input Reactor

An AC input reactor is an option used to reduce harmonics in the input current. Therefore, when the application has high requirements on harmonic suppression, install an AC reactor. For drive models above 200 kW, ensure that the cabinet has

sufficient space for installing the reactor. The following table describes recommended AC input reactor manufacturers and models.

Table 4–12 Recommended AC input reactor models

Power Supply Unit Model	AC Input Reactor Model (Inovance)
MD810-20M4T22GXXX	MD-ACL-60-0.24-4T-2%
MD810-20M4T45GXXX	MD-ACL-120-0.12-4T-2%
MD810-20M4T110GXXX	MD-ACL-250-0.056-4T-2%
MD810-20M4T160GXXX (W)	MD-ACL-330-0.042-4T-2%
MD810-20M4T355GXXX	MD-ACL-800-0.017-4T-2%

## Model

The following figure describes the AC Input reactor model.

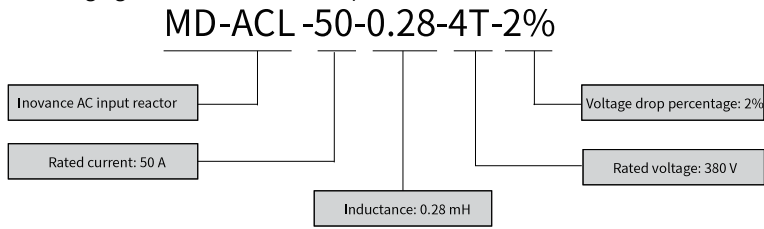


Figure 4-15 Descriptions of the AC Input reactor model

## Dimensions

- Dimensions of the AC input reactor (60 A)

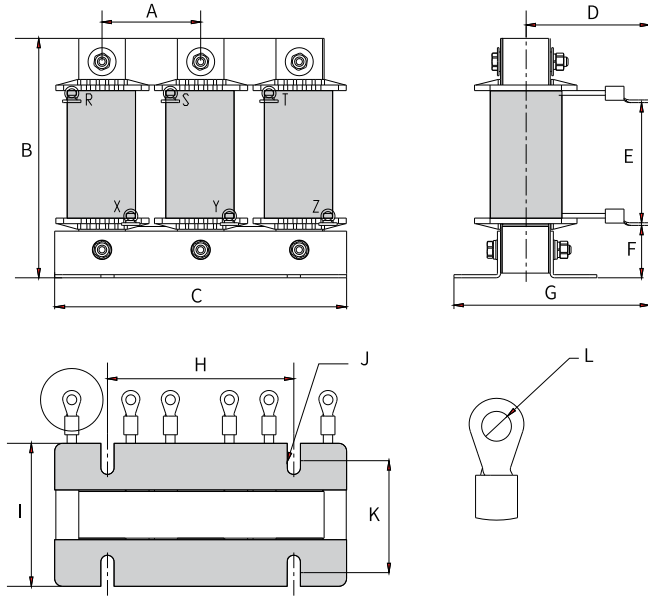


Figure 4-16 Dimensions of the AC input reactor (60 A)

Table 4-13 Dimensions (unit: mm) of the AC input reactor (60 A)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L
60	64	160	195	80±10	75±5	35±5	135	120±1	92±2	Φ8.5 x 20	72±2	Φ6.4

- Dimensions of the AC input reactor (120 A)

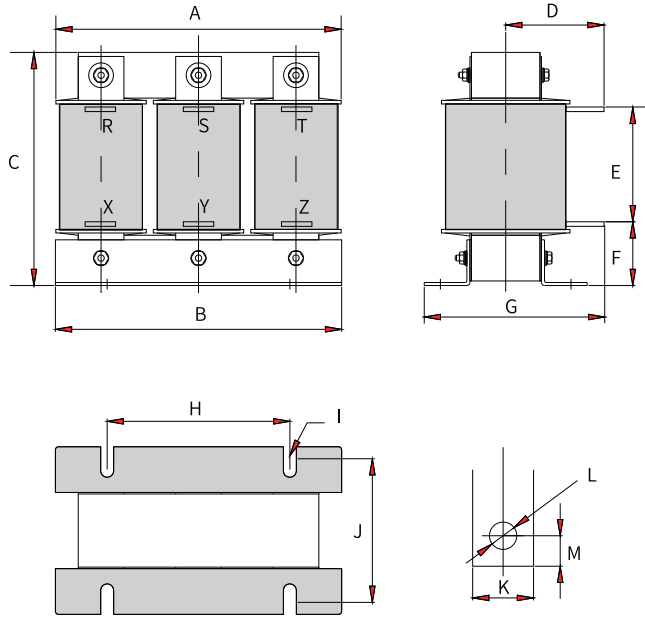


Figure 4-17 Dimensions of the AC input reactor (120 A)

Table 4-14 Dimensions (unit: mm) of the AC input reactor (120 A)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L	M
120	195	188±1	160	78±1 0	79±5	40±5	135	120±1	Φ8.5 x 20	92±2	20	Φ9	10

- Dimensions of the AC input reactor (250 A and 330 A)

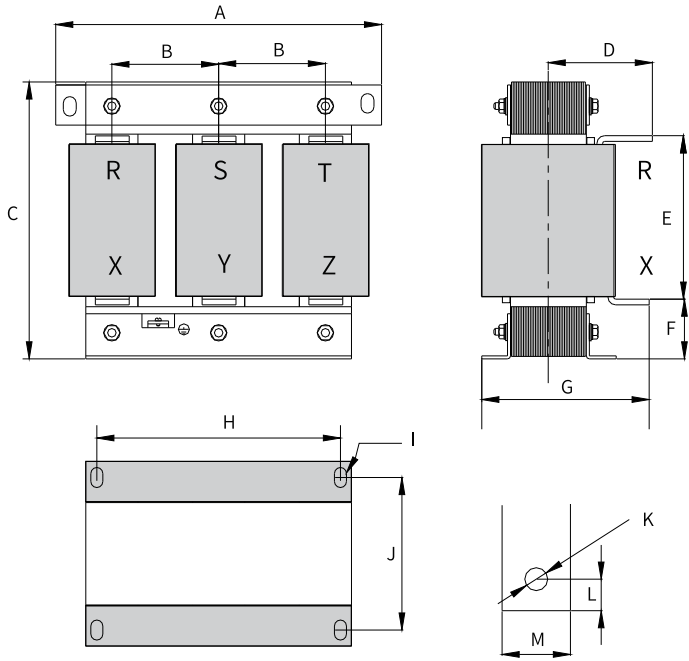


Figure 4-18 Dimensions of the AC input reactor (250 A and 330 A)

Table 4-15 Dimensions (unit: mm) of the AC input reactor (250 A and 330 A)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L	M
250	250	81±5	260	102±10	160±5	50±5	175	182±1	Φ11 x 18	96±2	Φ11	13	25
330	290	95±5	275	107±10	160±5	60±5	180	214±1	Φ11 x 18	100±2	Φ12	15	30

- Dimensions of the AC input reactor (800 A)

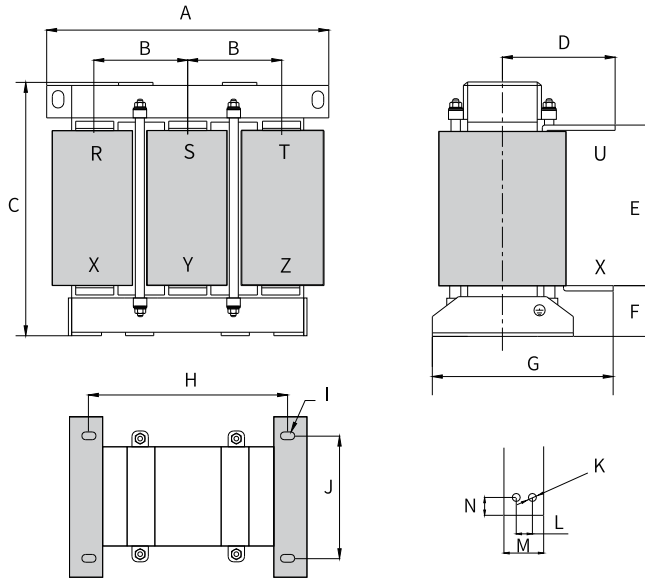


Figure 4-19 Dimensions of the AC input reactor (800 A)

Table 4-16 Dimensions (unit: mm) of the AC input reactor (800 A)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L	M	N
800	385	123±5	390	142±10	238±5	70±5	250	260±2	Φ12 x 20	175±1	Φ12	22	50	23

### 4.9.7 AC Output Reactor

The cables between the drive and the motor cannot be too long. This is because an over-long cable will cause large distributed capacitance and high harmonic current. When the cable length is equal to or longer than the value listed in the following table, install an AC output reactor close to the drive. Determine whether to install an AC output reactor at the output side of the drive according to on-site conditions.

Table 4-17 Cable length limit with the output reactor configured

Drive Model	Rated Voltage (V)	Min. Cable Length (m)
MD810-50M4T1.5GXXX	200 to 500	50
MD810-50M4T2.2GXXX	200 to 500	50
MD810-50M4T3.7GXXX	200 to 500	50
MD810-50M4T5.5GXXX	200 to 500	70
MD810-50M4T7.5GXXX	200 to 500	100
MD810-50M4T11GXXX	200 to 500	110
MD810-50M4T15GXXX	200 to 500	125

Drive Model	Rated Voltage (V)	Min. Cable Length (m)
MD810-50M4T18.5GXXX	200 to 500	135
MD810-50M4T22GXXX	200 to 500	150
MD810-50M4T30GXXX	280 to 690	150
MD810-50M4T37GXXX	280 to 690	150
MD810-50M4T45GXXX	280 to 690	150
MD810-50M4T55GXXX	280 to 690	150
MD810-50M4T75GXXX	280 to 690	150
MD810-50M4T90GXXX	280 to 690	150
MD810-50M4T110GXXX	280 to 690	150
MD810-50M4T132GXXX	280 to 690	150
MD810-50M4T160GXXX	280 to 690	150
MD810-50M4T200GXXXH	280 to 690	150
MD810-50M4T250GXXXH	280 to 690	150
MD810-50M4T315GXXXH	280 to 690	150
MD810-50M4T355GXXXH	280 to 690	150
MD810-50M4TD1.5GXXX	200 to 500	50
MD810-50M4TD2.2GXXX	200 to 500	50
MD810-50M4TD3.7GXXX	200 to 500	50
MD810-50M4TD5.5GXXX	200 to 500	70
MD810-50M4TD7.5GXXX	200 to 500	100
MD810-50M4TD11GXXX	200 to 500	110
MD810-50M4TD15GXXX	200 to 500	125
MD810-50M4TD18.5GXXX	200 to 500	135

**Model selection (Inovance)**

The following figure describes Inovance AC output reactor model.

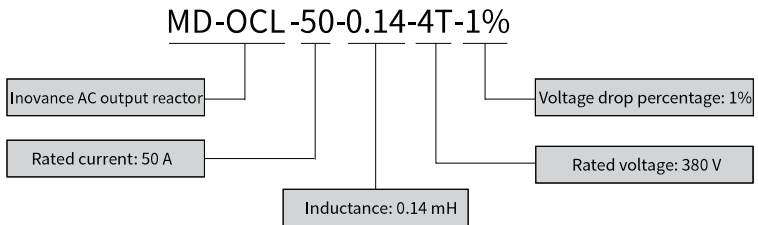


Figure 4-20 Inovance AC output reactor model

The following table describes the recommended models of Inovance AC output reactors.

Table 4-18 Recommended models of Inovance AC output reactors

Drive Model	AC Output Reactor Model (Inovance)
MD810-50M4T1.5GXXX	MD-OCL-5-1.4-4T-1%
MD810-50M4T2.2GXXX	MD-OCL-7-1.0-4T-1%
MD810-50M4T3.7GXXX	MD-OCL-10-0.7-4T-1%
MD810-50M4T5.5GXXX	MD-OCL-15-0.47-4T-1%
MD810-50M4T7.5GXXX	MD-OCL-20-0.35-4T-1%
MD810-50M4T11GXXX	MD-OCL-30-0.23-4T-1%
MD810-50M4T15GXXX	MD-OCL-40-0.18-4T-1%
MD810-50M4T18.5GXXX	MD-OCL-50-0.14-4T-1%
MD810-50M4T22GXXX	MD-OCL-60-0.12-4T-1%
MD810-50M4T30GXXX	MD-OCL-80-0.087-4T-1%
MD810-50M4T37GXXX	MD-OCL-90-0.078-4T-1%
MD810-50M4T45GXXX	MD-OCL-120-0.058-4T-1%
MD810-50M4T55GXXX	MD-OCL-150-0.047-4T-1%
MD810-50M4T75GXXX	MD-OCL-200-0.035-4T-1%
MD810-50M4T90GXXX	MD-OCL-250-0.028-4T-1%
MD810-50M4T110GXXX	MD-OCL-250-0.028-4T-1%
MD810-50M4T132GXXX	MD-OCL-330-0.021-4T-1%
MD810-50M4T160GXXX	MD-OCL-330-0.021-4T-1%
MD810-50M4T200GXXXH	MD-OCL-490-0.014-4T-1%
MD810-50M4T250GXXXH	MD-OCL-490-0.014-4T-1%
MD810-50M4T315GXXXH	MD-OCL-660-0.011-4T-1%
MD810-50M4T355GXXXH	MD-OCL-800-0.0087-4T-1%
MD810-50M4TD1.5GXXX	MD-OCL-5-1.4-4T-1%
MD810-50M4TD2.2GXXX	MD-OCL-7-1.0-4T-1%
MD810-50M4TD3.7GXXX	MD-OCL-10-0.7-4T-1%
MD810-50M4TD5.5GXXX	MD-OCL-15-0.47-4T-1%
MD810-50M4TD7.5GXXX	MD-OCL-20-0.35-4T-1%
MD810-50M4TD11GXXX	MD-OCL-30-0.23-4T-1%
MD810-50M4TD15GXXX	MD-OCL-40-0.18-4T-1%
MD810-50M4TD18.5GXXX	MD-OCL-50-0.14-4T-1%

### AC output reactor dimensions (Inovance)

- Dimensions of the AC output reactor (50-90 A)



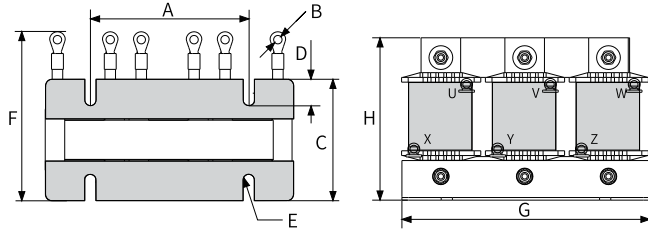


Figure 4-21 Dimensions of the AC output reactor (50-90 A)

Rated Current (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)
50	120±1	6*Φ6.4	92±2	20	4*Φ8.5	131±10	200	130
60	120±1	6*Φ6.4	92±2	20	4*Φ8.5	131±10	200	130
80	120±2	6*Φ6.4	92±2	20	4*Φ8.5	125±10	200	165
90	120±2	6*Φ6.4	92±2	20	4*Φ8.5	125±10	200	165

● Dimensions of the AC output reactor (120 A)

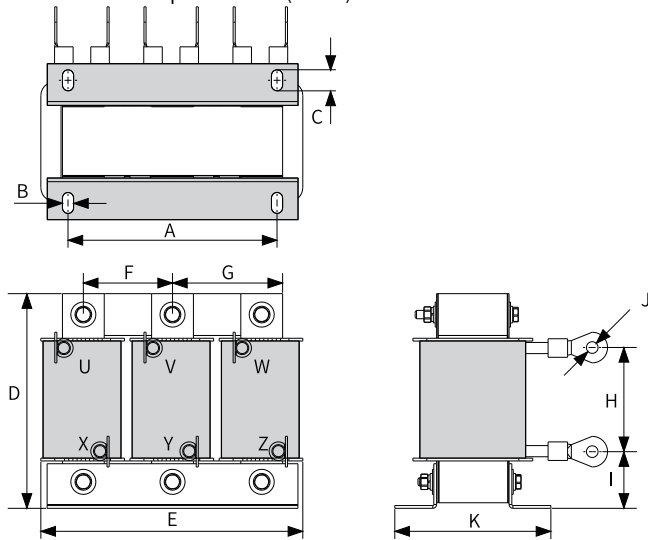


Figure 4-22 Dimensions of the AC output reactor (120 A)

Rated Current (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	I (mm)	J (mm)	K (mm)
120	150±1	8	15	165	195	64	79	75±5	40±5	6*Φ8.4	165

● Dimensions of the AC output reactor (150-250 A)

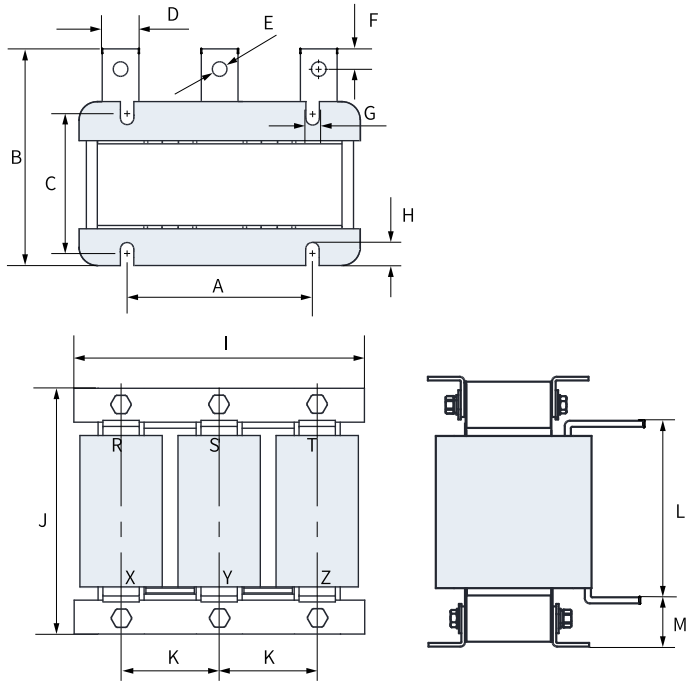


Figure 4-23 Dimensions of the AC output reactor (150-250 A)

Rated Current (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	I (mm)	J (mm)	K (mm)	L (mm)	M (mm)
150	120±1	155	92±2	20	Φ11	10	8.5	20	195	210	64±5	135±5	36±5
200	120±1	165	102±2	20	Φ11	10	8.5	20	195	210	64±5	145±5	30±5
250	120±1	165	102±2	20	Φ11	10	8.5	20	195	210	64±5	143±5	30±5

- Dimensions of the AC output reactor (330 A)

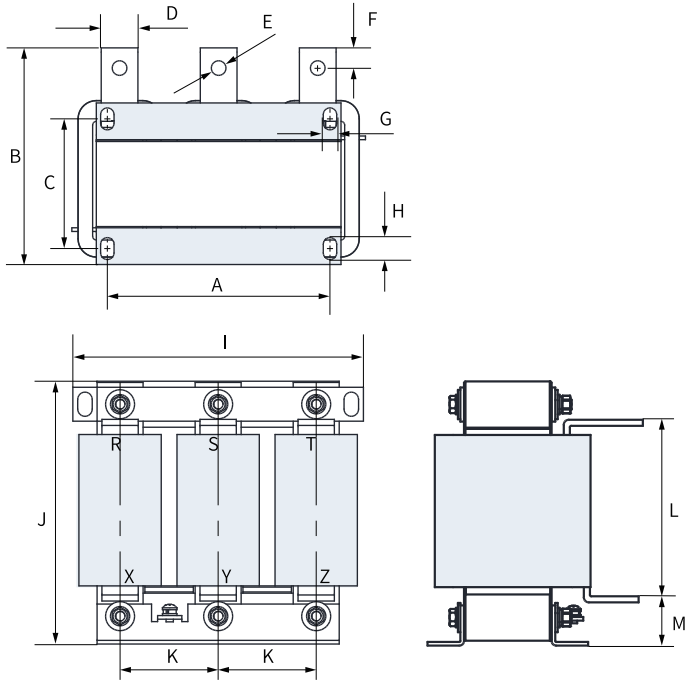





Figure 4-24 Dimensions of the AC output reactor (330 A)




Rated Current (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	I (mm)	J (mm)	K (mm)	L (mm)	M (mm)
330	182±1	175	91±2	30	φ12	15	11	18	255	240	81±5	155±5	43±5

**Model selection (Schaffner)**

The following table describes the recommended models of Schaffner AC output reactors.

Table 4-19 Recommended models of Schaffner AC output reactors

Drive Model	AC Output Reactor	Rated Current (A) at 40°C	Rated Power of Standard Motor (kW)	Rated Inductance (mH)	Power Consumption (W)	I/O Terminal			Weight (kg)
									
MD810-50M4T1.5GXXX	RWK 305-4-KL	4	1.5	1.47	22	KL	-	-	1.2
MD810-50M4T2.2GXXX	RWK 305-7.8-KL	7.8	3	0.754	25	KL	-	-	1.2
MD810-50M4T3.7GXXX	RWK 305-10-KL	10	4	0.588	30	KL	-	-	1.8
MD810-50M4T5.5GXXX	RWK 305-14-KL	14	5.5	0.42	34	KL	-	-	2.2
MD810-50M4T7.5GXXX	RWK 305-17-KL	17	7.5	0.346	38	KL	-	-	2.5
MD810-50M4T11GXXX	RWK 305-24-KL	24	11	0.245	45	KL	-	-	2.5
MD810-50M4T15GXXX	RWK 305-32-KL	32	15	0.184	55	KL	-	-	3.9
MD810-50M4T18.5GXXX	RWK 305-45-KL	45	18.5	0.131	60	KL	-	-	6.1
MD810-50M4T22GXXX	RWK 305-45-KL	45	22	0.131	60	KL	-	-	6.1
MD810-50M4T30GXXX	RWK 305-60-KL	60	30	0.098	65	KL	-	-	6.1
MD810-50M4T37GXXX	RWK 305-72-KL	72	37	0.082	70	KL	-	-	6.1
MD810-50M4T45GXXX	RWK 305-90-KL	90	45	0.065	75	KL	-	-	7.4
MD810-50M4T55GXXX	RWK 305-110-KL	110	55	0.053	90	KL	-	-	8.2
MD810-50M4T75GXXX	RWK 305-156-KS	156	75	0.038	120	-	KS	-	10.7
MD810-50M4T90GXXX	RWK 305-182-KS	182	90	0.032	140	-	KS	-	16
MD810-50M4T110GXXX	RWK 305-230-KS	230	110	0.026	180	-	KS	-	22
MD810-50M4T132GXXX	RWK 305-280-KS	280	132	0.021	220	-	KS	-	29
MD810-50M4T160GXXX	RWK 305-330-KS	330	160	0.018	240	-	KS	-	32
MD810-50M4T200GXXXH	RWK 305-400-S	400	200	0.015	330	-	-	S	34
MD810-50M4T250GXXXH	RWK 305-500-S	500	250	0.012	340	-	-	S	35

Drive Model	AC Output Reactor	Rated Current (A) at 40°C	Rated Power of Standard Motor (kW)	Rated Inductance (mH)	Power Consumption (W)	I/O Terminal			Weight (kg)
									
MD810-50M4T315GXXXH	RWK 305-600-S	600	315	0.01	380	-	-	S	37
MD810-50M4T355GXXXH	RWK 305-680-S	680	355	0.009	410	-	-	S	38
MD810-50M4TD1.5GXXX	RWK 305-4-KL	4	1.5	1.47	22	KL	-	-	1.2
MD810-50M4TD2.2GXXX	RWK 305-7.8-KL	7.8	3	0.754	25	KL	-	-	1.2
MD810-50M4TD3.7GXXX	RWK 305-10-KL	10	4	0.588	30	KL	-	-	1.8
MD810-50M4TD5.5GXXX	RWK 305-14-KL	14	5.5	0.42	34	KL	-	-	2.2
MD810-50M4TD7.5GXXX	RWK 305-17-KL	17	7.5	0.346	38	KL	-	-	2.5
MD810-50M4TD11GXXX	RWK 305-24-KL	24	11	0.245	45	KL	-	-	2.5
MD810-50M4TD15GXXX	RWK 305-32-KL	32	15	0.184	55	KL	-	-	3.9
MD810-50M4TD18.5GXXX	RWK 305-45-KL	45	18.5	0.131	60	KL	-	-	6.1

**Dimensions of the AC output reactor (Schaffner)**  
4 A to 45 A model

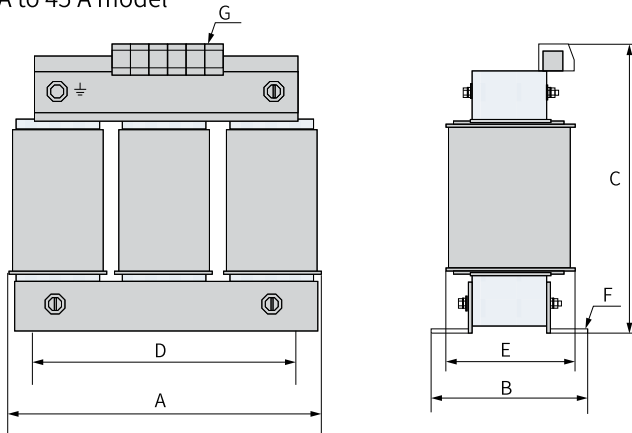


Figure 4-25 Dimensions of the AC output reactor (4-45 A)

## 60 A to 110 A model

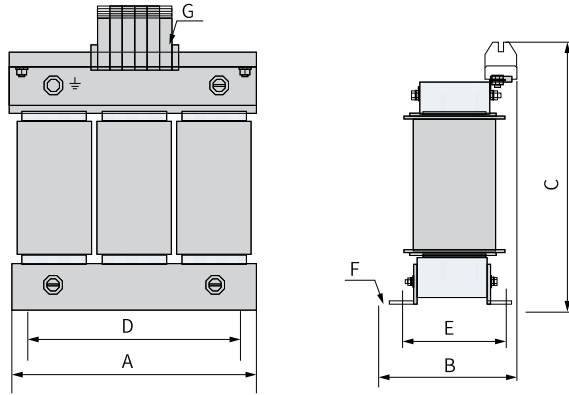


Figure 4-26 Dimensions of the AC output reactor (60-110 A)

## 124 A to 330 A model

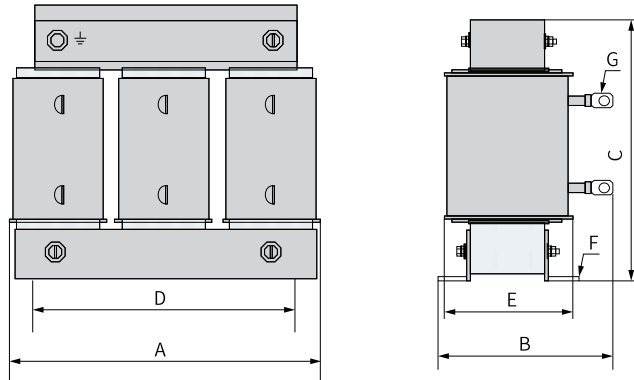


Figure 4-27 Dimensions of the output reactor (124-330 A)

Table 4-20 Dimensions of the AC output reactor (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 <sup>2</sup>
10 A	100	Max. 70	Max. 115	56	43	4.8 x 9	2.5 mm <sup>2</sup>
14 A	125	Max. 70	Max. 135	100	45	5 x 8	2.5 mm <sup>2</sup>
17 A	125	Max. 75	Max. 135	100	55	5 x 8	2.5 mm <sup>2</sup>
24 A	125	Max. 75	Max. 135	100	55	5 x 8	4 mm <sup>2</sup>
32 A	155	Max. 95	Max. 170	130	56	8 x 12	10 mm <sup>2</sup>
45 A	155	Max. 110	Max. 190	130	72	8 x 12	10 mm <sup>2</sup>
60 A and 72 A	155	Max. 125	Max. 190	130	70	8 x 12	16 mm <sup>2</sup>

Series	A	B	C	D	E	F	G
90 A	190	Max. 115	Max. 225	170	57	8 x 12	35 mm <sup>2</sup>
110 A	190	Max. 130	Max. 220	170	67	8 x 12	35 mm <sup>2</sup>
124 A	190	Max. 180	Max. 160	170	67	8 x 12	8
143 A	190	Max. 180	Max. 160	170	77	8 x 12	8
156 A and 170 A	190	Max. 180	Max. 160	170	77	8 x 12	10
182 A	210	Max. 180	Max. 185	175	97	8 x 12	10
230 A	240	220	-	190	119	11 x 15	12
280 A	240	235	-	190	133	11 x 15	12
330 A	240	240	-	190	135	11 x 15	12
400 A and 500 A	240	220	-	190	119	11 x 15	11
600 A and 680 A	240	230	-	190	128	11 x 15	11
790 A	300	218	-	240	136	11 x 15	11
910 A	300	228	-	240	148	11 x 15	11
1100 A	360	250	-	310	144	11 x 15	11

#### 4.9.8 EMC Filter

The external EMC filter meets the EN 61800-3 C2 emission requirement of CE certification. Connect the filter to ground reliably and ensure that the length of the cable connecting the power supply unit and filter is shorter than 30 cm.




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#### **Note**

- The length of the cable connecting the power supply unit and the filter must be shorter than 30 cm and as short as short possible. The filter and the power supply unit must be connected to the same ground reference plane, and the filter must be reliably connected to ground. Otherwise, the performance of the filter will be affected.
  - The power supply unit with the built-in filter capacitor conforms to European EMC directive 2014/30/ EU and the standard EN 61800-3 C3, and applies to the second environment.
-

## Appearance

Table 4-21 EMC filter models and appearances

Filter Model		Appearance
Schaffner	FN3258 Series	
	FN3359 Series	
Jianli	-	

## Model selection

Schaffner and Jianli filters are recommended, as listed in the following table.

Table 4-22 Recommended manufacturers and models of EMC filters

Power Supply Unit Model	EMC Filter Model (Schaffner)	EMC Filter Model (Jianli)
MD810-20M4T22GXXX	FN 3258-75-34	DL-65EBK5
MD810-20M4T45GXXX	FN 3258-100-35	DL-100EBK5
MD810-20M4T110GXXX	FN 3359-250-28	DL-250EBK5
MD810-20M4T160GXXX (W)	FN 3359-320-99	DL-400EBK3
MD810-20M4T355GXXX	FN 3359-800-99	DL-700EBK3

## Dimensions (Schaffner)

- Dimensions of FN 3258 series filters (50-180 A)



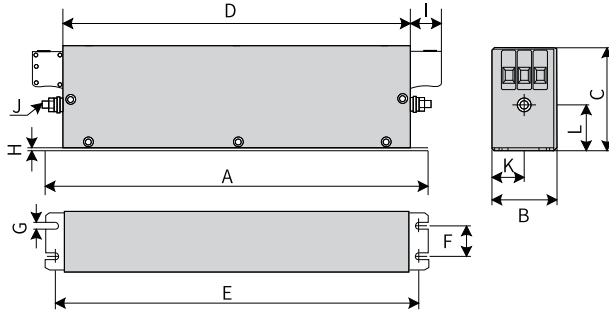


Figure 4-28 Dimensions (unit:mm) of FN 3258 series filters (50-180 A)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L
7	190	40	70	160	180	20	4.5	1	22	M5	20	29.5
16	250	45	70	220	235	25	5.4	1	22	M5	22.5	29.5
30	270	50	85	240	255	30	5.4	1	25	M5	25	39.5
42	310	50	85	280	295	30	5.4	1	25	M6	25	37.5
55	250	85	90	220	235	60	5.4	1	39	M6	42.5	26.5
75	270	80	135	240	255	60	6.5	1.5	39	M6	40	70.5
100	270	90	150	240	255	65	6.5	1.5	45	M10	45	64
130	270	90	150	240	255	65	6.5	1.5	45	M10	45	64
180	380	120	170	350	365	102	6.5	1.5	51	M10	60	47

● Dimensions of FN 3359 series filters (150-2500 A)

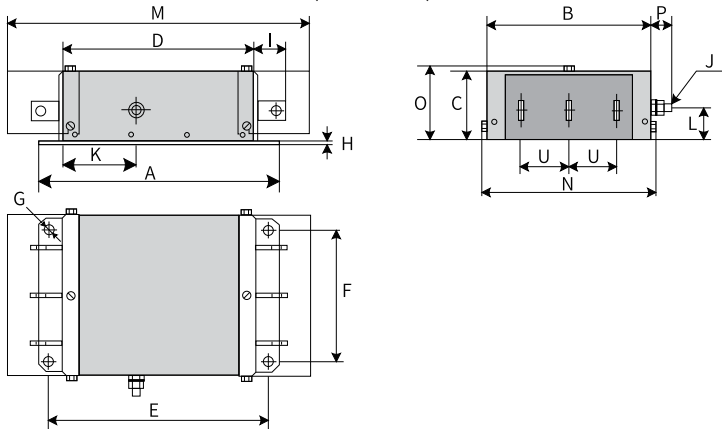


Figure 4-29 Dimensions (unit:mm) of FN 3359 series filters (150-2500 A)

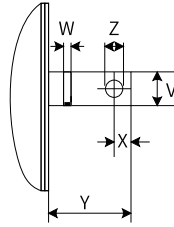


Figure 4-30 Dimensions of grounding copper busbar (unit: mm)

Table 4-23 Dimensions (unit mm) of FN 3359 series filters (150-2500 A)

Current	150 A	180 A	250 A	320 A	400 A	600 A	800 A	1000 A	1600 A	2500 A
A	300	300	300	300	300	300	350	350	400	600
B	210	210	230	260	260	260	280	280	300	370
C	120	120	125	115	115	135	170	170	160	200
D	160	160	180	210	210	210	230	230	250	300
E	120	120	120	120	120	120	145	145	170	250
F	185	185	205	235	235	235	255	255	275	330
G	φ12	φ12	φ12	φ12	φ12	φ12	φ12	φ12	φ12	φ14
H	2	2	2	2	2	2	3	3	3	3
I	33	33	33	43	43	43	53	53	93	98
J	M10	M10	M10	M12	M12	M12	M12	M12	M12	M16
K	55	55	62.5	20	20	20	25	25	25	25
L	30	30	35	20	20	20	25	25	25	25
M	420	420	420	440	440	440	510	510	-	-
N	171	171	191	221	221	221	241	241	-	-
O	127	127	132	122	122	142	177	177	-	-
S	-	-	-	-	-	-	-	-	26	35
T	-	-	-	-	-	-	-	-	26	35
U	50	50	55	60	60	60	60	60	60	100
V	-	-	-	25	25	25	40	40	60	70
W	-	-	-	6	6	8	8	8	10	15
X	-	-	-	15	15	15	20	20	17	20
Y	-	-	-	40	40	40	50	50	90	95
Z	-	-	-	φ10.5	φ10.5	φ10.5	φ14	φ14	φ14	φ14

## Dimensions (Jianli)

- Dimensions of Jianli series filter (50-200 A)

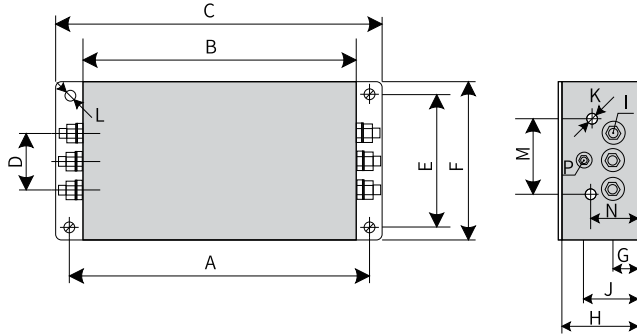


Figure 4-31 Dimensions (unit: mm) of Jianli filters (50-200 A)

Table 4-24 Dimensions (unit: mm) of Jianli filters (50-200 A)

Model	A	B	C	D	E	F	G	H	I	J	K	M	N	P	L
DL-25EBK5	243	224	265	58	70	102	25	92	M6	58	M4	74	49	M6	6.4 x 9.4
DL-35EBK5															
DL-50EBK5															
DL-65EBK5															
DL-80EBK5	354	323	388	66	155	188	30	92	M8	62	M4	86	56	M8	6.4 x 9.4
DL-100EBK5															
DL-130EBK5															
DL-160EBK5															
DL-200EBK5															

● Dimensions of Jianli series filter (250-800 A)

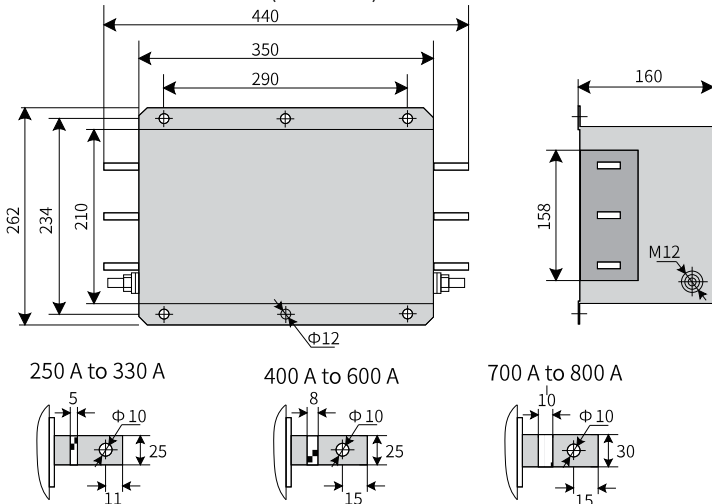


Figure 4-32 Dimensions (unit: mm) of Jianli filters (250-800 A)

- Dimensions of Jianli series filter (1000 A)

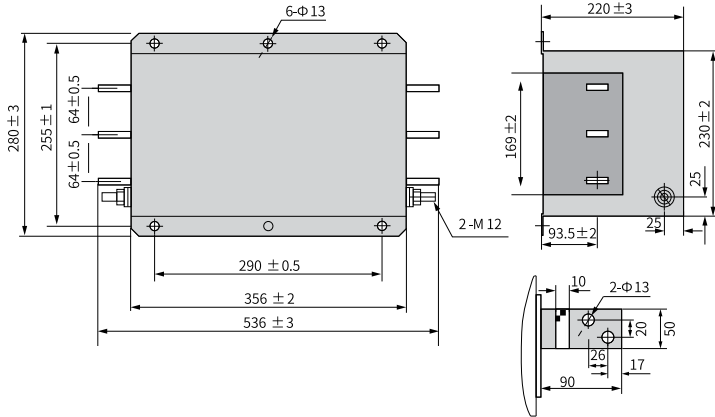


Figure 4-33 Dimensions (unit: mm) of Jianli series filter (1000 A)

## 4.9.9 Simple Filter

A simple filter can be used to suppress the RF electromagnetic noise generated from the power grid and the AC drive during operation. For equipment using residual current devices (RCDs), a simple filter can be installed at the input end of the drive to avoid RCD malfunctions during operation, as shown in "Figure 4-35" on page 180.

The simple filter must be grounded securely and the cable between the filter and AC drive must be shorter than 30 cm. The grounding terminal of the simple filter must be connected to the grounding terminal of the drive. The grounding cable must be as short as possible and cannot exceed 30 cm.

### Dimensions

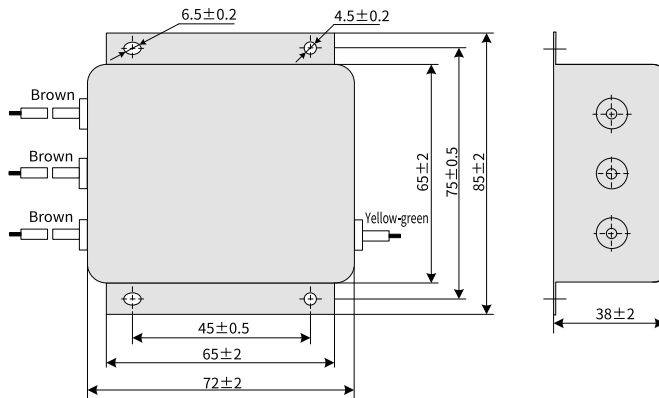


Figure 4-34 Outline dimensions of the simple filter

Table 4-25 Outline dimensions of the simple filter

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

## Installation Method

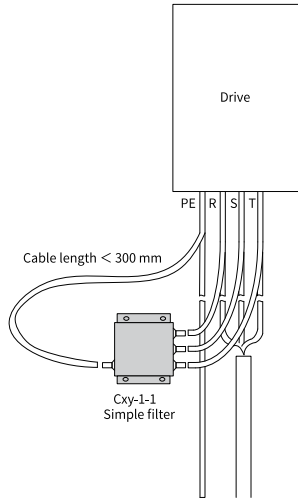


Figure 4-35 Installation of the simple filter

## 4.9.10 Magnetic Ring and Buckle


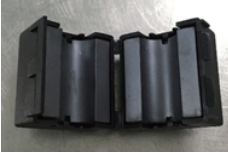
### Model

The magnetic ring is mainly used on the input or output side of the drive. Install it as close to the drive as possible. When installed on the input side, it 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 the bearing current.

The magnetic ring or buckle 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 interference suppression generated by the drive. However, its cost is relatively high.
- Ferrite magnetic buckle: 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 4-26 Appearance and models of the magnetic ring and buckle

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

## Dimensions

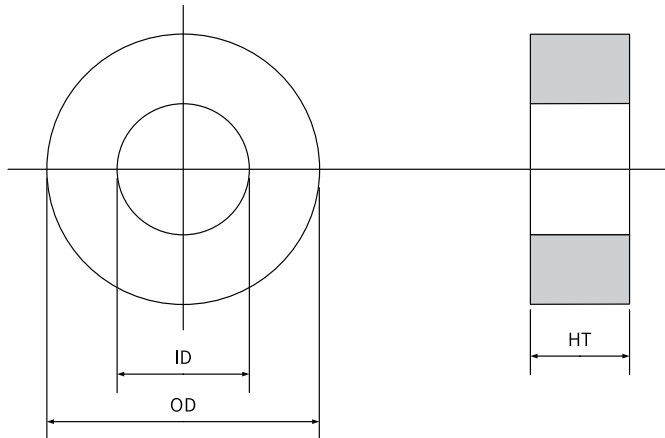


Figure 4-36 Magnetic ring dimensions

Table 4-27 Magnetic ring dimensions

Magnetic Ring Model	Dimensions (OD × ID × HT) (mm)
DY644020H	64 × 40 × 20
DY805020H	80 × 50 × 20
DY1207030H	120 × 70 × 30

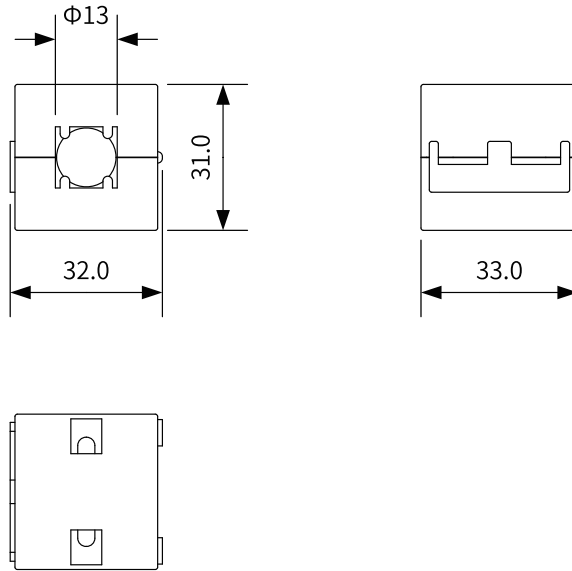


Figure 4-37 Magnetic buckle dimensions

Table 4-28 Magnetic buckle dimensions

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

## Installation of the magnetic ring or magnetic buckle

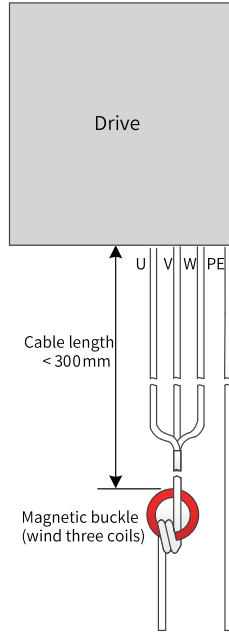


Figure 4-38 Installation of the magnetic ring

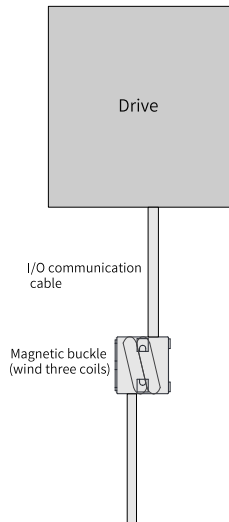


Figure 4-39 Installation of the magnetic buckle



## 5 Troubleshooting of Common EMC Problems

### 5.1 RCD Selection and Measurement Against Leakage

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

- The drive will generate a certain high-frequency leakage current during operation. To avoid malfunction of the RCD, select an RCD with the operating current of not lower than 100 mA for each drive.
- When multiple drives connected in parallel share one RCD, the operating current of the RCD must be equal to or higher than 300 mA.
- Recommended RCD manufacturers are Chint and Schneider.

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

Table 5-1 Troubleshooting for leakage current

RCD Trip	Possible Cause	Solution
Instantaneous RCD trip upon power-on	The anti-interference performance of the RCD is poor.	<ol style="list-style-type: none"> <li>1. Use an RCD of the recommended manufacturers.</li> <li>2. Use an RCD with a larger operating current.</li> <li>3. Move the unbalanced load to the front end of the RCD.</li> <li>4. If an EMC filter unit is installed, disconnect the EMC screws.</li> <li>5. If an EMC filter is installed, disconnect the EMC filter.</li> </ol>
	The operating current of the RCD is too small.	
	The back end of RCD is connected with an unbalanced load.	
	The front end of the drive has a large capacitance to ground.	
RCD trip during operation	The anti-interference performance of the RCD is poor.	<ol style="list-style-type: none"> <li>1. Use an RCD of the recommended manufacturers.</li> <li>2. Install an EMC filter unit or EMC filter.</li> <li>3. Install a simple filter on the input side of the drive, and wind magnetic rings on LN and RST cables near the RCD.</li> <li>4. Use an RCD with a larger rated operating current.</li> <li>5. Reduce the carrier frequency properly without affecting the performance.</li> <li>6. Use shorter motor cables.</li> </ol>
	The operating current of the RCD is too small.	
	The back end of RCD is connected with an unbalanced load.	
	The distributed capacitance to the ground of the motor cable and motor is too large.	

## 5.2 Harmonic Suppression

To suppress the harmonic current 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.

## 5.3 Common I/O Signal Interference

Due to improper cabling or grounding, the drive might generate strong interference during use. When the drive interferes with other devices, do as follows.

No.	Solution
1	Use the shielded cables as the I/O signal cables, with the shield connected to the PE terminal.
2	Connect the PE terminal of the motor to that of the drive, and connect the PE terminal of the drive to that of the power grid.
3	Add an equipotential grounding cable between the host controller and the drive.
4	Wind the output U/V/W cables of the drive on a magnetic ring for two to four turns.
5	Increase the capacitor filter at the DI. The recommended maximum value is 0.1 $\mu\text{F}$ . 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 $\mu\text{F}$ . The required capacitor voltage withstanding level is 50 V or above.
7	Add a magnetic buckle to the signal cable, or wind the signal cable on the magnetic ring for one to two turns.
8	Use a shielded power cable and ground the shield securely.
9	Remove the grounding screw on the control board. For details, see <a href="#">"3.11.1 Grounding the Control Board" on page 140</a> .

## 5.4 Communication Interference

### 5.4.1 RS485 and CAN Communication Interference

Follow the following table for troubleshooting.

Step	Action
1	Add a 120 $\Omega$ termination resistor at each end of the bus.
2	Use a multi-core shielded twisted pair cable instead, and ground the shield at both ends.
3	Separate the communication cable from the power cable by a distance of at least 30 cm.
4	For multi-node communication, adopt the daisy chain topology for routing.

Step	Action
5	For multi-node communication, add an equipotential bonding grounding wire between nodes.
6	Add a ferrite clamp at each end of the communication cable, or wind the communication cable on a magnetic ring for one to two turns.
7	Wind the output U/V/W cables of the AC drive on a magnetic ring for two to four turns.
8	Use a shielded power cable and ensure that the shield is well-grounded.

### 5.4.2 EtherCAT and PROFINET Communication Interference

Make rectification according to the following table.

No.	No.
1	Check whether the communication network cables meet the specification requirements of shielded Cat 5e cables.
2	Check whether the communication port is loose or in poor contact.
3	Separate the communication cable and power cable at a distance of at least 30 cm.
4	For multi-node communication, add an equipotential bonding wire between the nodes.
5	Check that any cable between two nodes is not longer than 100 m in length.
6	Add a magnetic buckle at both ends of the communication cable and wind the communication cable for one to two turns.
7	Add a magnetic ring to the output U, V, and W cables at the drive side and wind the cables for two to four turns.
8	Use a shielded power cable and ground the shield securely.
9	Installation the EtherCAT/PROFINET communication expansion card to optional expansion card slot 2.

## 6 Certification and Standard Compliance

### 6.1 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	EMC directive	2014/30/EU	EN IEC 61800-3
	LVD directive	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
Function safety certification (STO)	Machinery directive	2006/42/EC	EN 61800-5-2 EN 62061:2005/A2 EN ISO 13849-1 EN 61508 ed.2
KC certification	Korea radio law		KN 11

### Note

The CE, UL, and cUL certifications of the product conform to the latest directives and standards.

### 6.2 CE Certification

#### 6.2.1 Precautions for Compliance with European Norms



Figure 6-1 CE mark

- The "CE Mark" indicates compliance with the directives for safety (LVD), electromagnetic compatibility (EMC), and environmental protection (RoHS).
- It is required when engaging in business and commerce (manufacturing, importing, and selling) in Europe.

- The drive complies with LVD, EMC, and RoHS directives and carries 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 product with other devices has the responsibility of ensuring compliance with CE standards when the CE mark is labeled on the final device.

## 6.2.2 Requirement for Compliance with EMC Directive

- The drive is applicable to the first and second environment and complies with EMC directive 2014/30/EU and standard EN IEC 618003.



When used in the first environment, the product may generate radio interference. Besides the CE compliance described in this chapter, take measures to avoid interference if required.

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- To enable the drive to comply with the EMC directive and standard, install an EMC filter on the input side and use shielded cables on the output side. Ground the filter properly and ground the shield of the output cable 360 degrees.



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.

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## EMC specifications

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

Table 6-1 Maximum motor cable length allowed by conduction and radiation disturbance

Model	Maximum Cable Length Allowed by Conducted Emission				Maximum Cable Length Allowed by Radiated Emission			
	C2		C3		C2		C3	
	Built-in Filter	External EMC Filter	Built-in Filter	External EMC Filter	Built-in Filter	External EMC Filter	Built-in Filter	External EMC Filter
MD810-20M4T22GXXX MD810-20M4T45GXXX MD810-20M4T110GXXX MD810-20M4T160GXXX MD810-20M4T355GXXX	-	3 m	3 m	-	-	3 m	3 m	-

### Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. Therefore, 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.

Based on the expected environment, the products are divided into the following four categories:

- Category C1: a PDS with rated voltage less than 1000 V and intended for use in the first environment
- Category C2: a PDS with rated voltage less than 1000 V, which is neither a plug in device nor a movable device and is intended to be installed and commissioned only by a professional.
- Category C3: a PDS with rated voltage less than 1000 V and intended for use in the second environment.
- Category C4: a PDS with rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

### 6.2.3 Requirements for Compliance with the LVD

The drive has been tested in accordance with EN61800-5-1 and has complied with the low voltage directive (LVD). To enable devices with the drive integrated to comply with the LVD, ensure the following requirements are met.

#### Installation location

Install the drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by IEC 606641-1.

#### Installation Environment

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

#### Installation protection

- 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.
- To install a cabinet-mounted drive (IP20), ensure that no foreign objects can access the cabinet from the top and the front.

#### Main circuit wiring

For details, see ["3.3 Wiring Descriptions of Main Circuit Terminals" on page 60](#).

#### Protective devices

To comply with EN 61800-5-1 standards, install a fuse/circuit breaker on the input side of the drive to prevent accidents caused by short circuit in the internal circuit. For details about the selection of the fuse/circuit breaker, see ["4.9.2 Fuse, Contactor, and Circuit Breaker" on page 156](#).

### 6.3 UL or cUL Certification



Figure 6-2 UL/cUL mark

- The UL/cUL mark commonly applies to products sold in the United States and Canada. It indicates that UL has performed product tests and evaluation, and determined that their stringent standards have been met. To obtain the UL/cUL

certification, an electrical product and its main built-in components must all be UL certified.

- The drive has been tested in accordance with UL 61800–5–1 and CSA C22.2 No. 100-14 standards and has complied with UL/cUL standards. To make devices with the drive integrated comply with UL/cUL standards, customers must ensure the following requirements are met.

### Installation location

Install the drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by UL61800–5–1.

### Ambient temperature

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

–20°C to +60°C for open type products

### Installation requirements

As an open type product, the drive is installed in a cabinet. Its installation requirements are as follows:

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 NEC standards.

### Main circuit wiring



Output terminals BR, (-), or (+) is not allowed to be installed on site.

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



- When using an electric screwdriver to tighten terminal screws, set a low speed to prevent damage to the terminal screws.
- Tighten the terminal screws at an angle within 5 degrees. Failure to comply may result in screw damage.

### **Control circuit wiring**

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

### **Specifications of main circuit cables**

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

- Use cables with copper conductors.
- The recommended cables for the main circuit are 600 V Class 2 heat-resistant indoor PVC cables that can work under temperature of 75°C continuously. 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 Inovance.

### **Cable Selection**

For details, see ["3.4 Cable Selection for Main Circuits" on page 63](#).

### **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 sufficient protective devices against short circuit in branch circuits according to applicable regulations and this 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 ["4.9.2 Fuse, Contactor, and Circuit Breaker" on page 156](#).

## 6.4 KC certification



Applicant Suzhou Inovance Technology Co., Ltd.  
AC Drive  
Model MD800 series  
Made In China  
Manufacturer  
Suzhou Inovance Technology Co.,Ltd.

A급기기 (업무용 방송통신기자재)

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지역에서 사용하는 것을 목적으로 합니다.

## Appendix Requirements for Coolant and Circulation

### System of Water-Cooled Models

#### Requirements on the radiator and pipes

- The SS304 stainless steel or PE plastic radiator is recommended. Iron radiators are prone to rust, lowering the water quality; therefore, iron radiators are not allowed.
- Carbon steel and cast iron pipes are not allowed. SS304 stainless steel, PVC, PPR pipes are recommended as the hard pipes. EPDM rubber, PU, and PE pipes are recommended as the soft pipes.
- Note that the pipes must be connected properly to prevent leakage. Generally, soldering, thread+sealing ring connection, splicing, and gluing are used for connecting hard pipes. For soft pipes, hose clamp connection and thread+sealing ring connection are used. After the pipes are connected for the first time, a pressure test must be performed to ensure that leakage does not occur.

#### Usage requirements on the coolant

- Deionized water (purified water or vehicle antifreeze) must be used as the coolant, and the coolant must be circulated and isolated.
- A pressure relief device (such as a relief valve) is required for the cooling circuit to lower the water pressure. The operating water pressure must be lower than or equal to 0.6 MPa.
- If the purified water is used as the coolant, the preservative must be added to the purified water. If the minimum ambient temperature in winter is lower than the freezing point, use the antifreeze.
- If the drive is stopped for more than two days, exhaust all water in the heatsink by applying 0.3 to 0.5 MPa air to the water inlet for 5 to 10 minutes with the water outlet opened.
- Check that the water cooled heatsink is watertight and meets protection requirements.
- Generally, the coolant flow at the inlet of the water cooled heatsink is 16 L/min.

#### Requirements on the purified water and selection of the preservative and antifreeze

- Requirements on the purified water

Table -2 Requirements on the purified water

Item	Unit	Value
PH	-	6 to 8
Hardness	°dH	< 10
Conductivity	μS/cm	< 10
Chlorine element	mg/l	< 10

Item	Unit	Value
Iron element	mg/l	< 0.1
Maximum particle size	µm	< 300

- Preservative: Add 0.03% to 0.05% sodium metasilicate to prevent corrosion of the aluminum parts.
- Antifreeze: It is recommended to use antifreeze containing anti-corrosion and corrosion inhibitors. Generally, the freezing point of the antifreeze must be 10°C to 15°C lower than the lowest ambient temperature where the drive is used. For example, if the lowest ambient temperature is -30°C, the freezing point of the antifreeze must be lower than -45°C.

Table -3 Relationship between the ethylene glycol concentrations and freezing points

Freezing Point (°C)	Ethylene Glycol Concentration	Density (20°C) mg/cm <sup>3</sup>
-10	28.4	1.0340
-15	32.8	1.0426
-20	38.5	1.0506
-25	45.3	1.0586
-30	47.8	1.0627
-35	50.0	1.0671
-40	54.0	1.0713
-45	57.0	1.0746
-50	59.0	1.0786
-45	80.0	1.0958
-30	85.0	1.1001
-13	100.0	1.1130

### Maintenance requirements

The water-cooled drive has high requirements on water quality. Therefore, it is recommended to test the PH value and conductivity of the circulating water once a month to ensure that the water quality meets the requirements mentioned before. If the water quality does not meet the requirements, the water-cooled heatsink might be severely corroded, resulting in water leakage.



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