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# MD800 Series AC Drive (Multidrive System)

## Design and Selection Guide

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

Data code 19011492 A05

# Preface

## Introduction

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

This guide describes specifications, and dimensions of the AC drive, specific specifications and selection of options (including installation accessories, cables, and peripheral electrical components), common EMC problems and solutions, and certifications and standards.

## More Documents

| Document Name | Description |
|---|---|
| MD800 Series AC Drive (Multidrive System) Quick Installation and Commissioning Guide | Describes the installation, wiring, quick commissioning, commissioning parameters, and troubleshooting of this product. |
| MD800 Series AC Drive (Multidrive System) Maintenance Guide | Describes the daily maintenance, parts replacement, and troubleshooting of the product. |
| MD800 Series AC Drive (Multidrive System) Function Guide | Describes the commissioning tools, system commissioning steps, definition of parameters and fault codes, and functions and applications of the product. |
| MD800 Series AC Drive (Multidrive System) Communication Guide | Describes the communication mode, networking, and configuration of the product. |

## Revision History

| Date | Version | Description |
|---|---|---|
| November 2021 | A05 | Updated the description of communication connection and networking diagrams in section 3.3 "Communication Connection". |
| August 2021 | A04 | Updated the IP rating in section 1.3.1 "Electrical Specifications".<br>Updated the relative humidity for operating in section 1.3.2 "Technical Specifications".<br>Updated the description of CN3 and CN4 terminal pins in section 3.2.1 "Control Circuit Terminals".<br>Added section 4.3 "EMC Shielding Bracket". |

| Date | Version | Description |
| --- | --- | --- |
| June 2021 | A03 | Modified for consistency with the encoded version. |
| June 2021 | A01 | Supplemented the description of EMC shield bracket models in section 1.6 "List of Options".<br>Updated the description of EMC shield bracket models in section 4.1.3.1 "EMC Filter".<br>Updated the air flow requirements for the single-phase 220 V models in section 1.3.1 "Electrical Specifications".<br>Updated the vibration description in technical specifications. |
| March 2021 | A00 | First release |

## Document Acquisition

This guide is not delivered with the AC drive. You can obtain the PDF version of this document using the following method:

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

# Table of Contents

Preface ..... 1
Fundamental Safety Instructions ..... 5
1 Product Information ..... 11
1.1 Nameplate ..... 11
1.2 Product Model ..... 13
1.3 Technical Indicators ..... 14
1.3.1 Electrical Specifications ..... 14
1.3.2 Technical Specifications ..... 22
1.4 Components ..... 25
1.5 System Composition ..... 30
1.6 Options ..... 32
2 Mechanical Design ..... 33
2.1 Mounting Dimensions ..... 33
2.2 Mounting Hole Dimensions ..... 35
2.3 Clearance Requirements ..... 36
2.4 Heat Dissipation Requirements ..... 38
3 Electrical Design ..... 46
3.1 Wiring of the Main Circuit ..... 46
3.1.1 Main Circuit Terminals ..... 46
3.1.2 Requirements on Wiring the Main Circuit ..... 49
3.1.3 Lug Selection ..... 52
3.1.4 Cable Selection for Main Circuit ..... 54
3.2 Wiring of the Control Circuit ..... 63
3.2.1 Control Circuit Terminals ..... 63
3.2.2 Expansion Card Functions ..... 70
3.2.3 Wiring Description of Control Circuit Terminals ..... 81
3.2.4 Control Circuit Wiring Requirements ..... 84
3.3 Communication Connection ..... 86
3.3.1 RS485 Communication Wiring ..... 86
3.3.2 CAN Communication Wiring ..... 87
3.3.3 Ethernet Wiring ..... 89
3.4 Grounding ..... 93
3.4.1 Main Circuit Grounding Requirements ..... 93
3.4.2 Grounding of the Control Board ..... 93
3.4.3 Grounding of a Single Device ..... 94
3.4.4 Grounding of Multiple Devices ..... 96
3.4.5 Grounding of the Cabinet System ..... 96

4 Selection of Options . . . . . 98
4.1 Peripheral Electrical Devices . . . . . 98
4.1.1 Fuse, Circuit Breaker, and Contactor . . . . . 98
4.1.2 AC Input Reactor . . . . . 98
4.1.3 Input Filter . . . . . 101
4.1.3.1 EMC Filter . . . . . 101
4.1.3.2 Simple Filter . . . . . 106
4.1.4 Braking Components . . . . . 108
4.1.5 Output Reactor . . . . . 110
4.1.6 Magnetic Ring and Buckle . . . . . 115
4.1.7 Motor . . . . . 117
4.2 External LCD Operating Panel . . . . . 119
4.3 EMC Shielding Bracket . . . . . 120
5 Requirements on Installation of Options . . . . . 122
5.1 AC Input Reactor . . . . . 122
5.2 Output Reactor . . . . . 122
5.3 Fuses, Contactors, and Circuit Breakers . . . . . 122
5.4 EMC Filter . . . . . 122
5.5 Simple Filter . . . . . 123
5.6 Magnetic Ring and Ferrite Clamp . . . . . 123
6 Troubleshooting for Common EMC Interference Problems . . . . . 126
6.1 RCD Malfunction . . . . . 126
6.2 Harmonic Suppression . . . . . 127
6.3 Control Circuit Interference . . . . . 127
6.3.1 High-Speed Pulse Interference . . . . . 127
6.3.2 Common I/O Signal Interference . . . . . 127
6.4 Communication Interference . . . . . 128
6.4.1 RS485 and CAN Communication Interference . . . . . 128
6.4.2 EtherCAT and PROFINET Communication Interference . . . . . 128
7 Compliance . . . . . 130
7.1 Compliance with Certifications, Directives and Standards . . . . . 130
7.2 CE Certification . . . . . 130
7.2.1 Introduction to CE Certification . . . . . 130
7.2.2 Conditions for Compliance with the EMC Directive . . . . . 131
7.2.3 Conditions for Compliance with the LVD . . . . . 133
7.3 UL or cUL Certification . . . . . 133
7.4 KC Certification . . . . . 136

# 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 use.

## Safety Levels and Definitions

| | |
|---|---|
|   | Indicates that failure to comply with the notice will result in death or severe personal injuries. |
|   | Indicates that failure to comply with the notice may result in death or severe personal injuries. |
|   | Indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage. |

## General Safety Instructions

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

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




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

**Storage and Transportation**




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




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

**Installation**




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




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




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

**Wiring**




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




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




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

**Power-on**




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




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

**Operation**




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




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

**Maintenance**




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




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

**Repair**




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




- 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<br>• Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death.<br>• 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.

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

# 1 Product Information

## 1.1 Nameplate

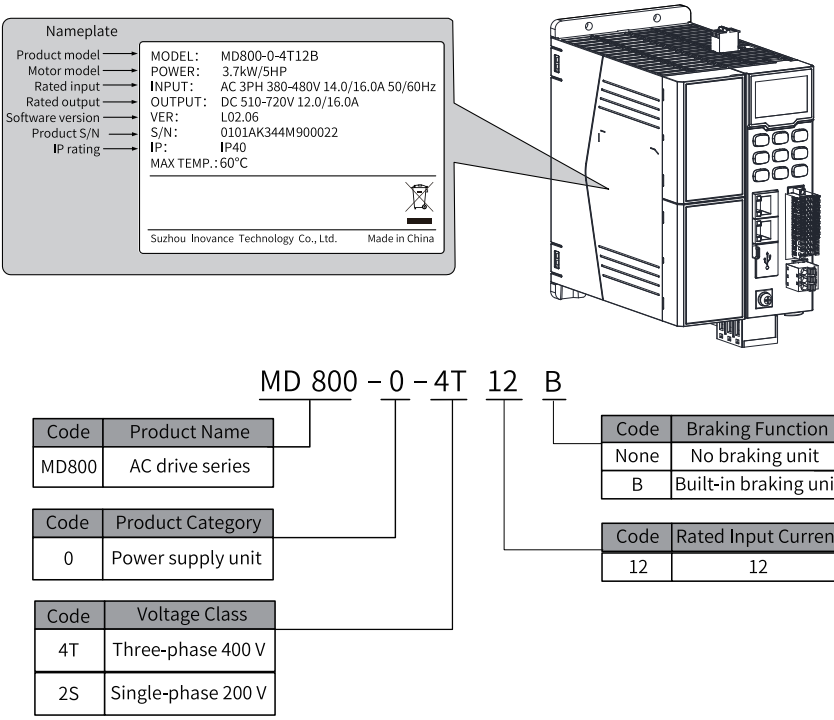
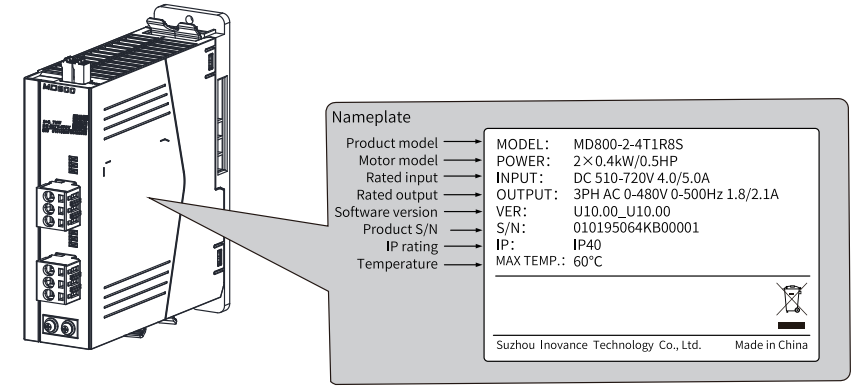



Figure 1-1 Nameplate and model number of the power supply unit




MD800 – 2 – 4T 1R8 S

| Code | Product Name |
|---|---|
| MD800 | AC drive series |

| Code | Product Category |
|---|---|
| 1 | Single-axis drive unit |
| 2 | Dual-axis drive unit |

| Code | Voltage Class |
|---|---|
| 4T | Three-phase 400 V |
| 2T | Three-phase 200 V |

| Code | Functional Safety |
|---|---|
| None | No STO |
| S | With STO |

| Code | Rated Output Current |
|---|---|
| 1R8 | 1.8 A (R: decimal point) |
| 17 | 17 A |

Figure 1-2 Nameplate and model number of the drive unit

## 1.2 Product Model

Table 1–1 Product models (three-phase 380–480 V)

| Category | Power (kW) | Product Model |
|---|---|---|
| Power supply unit | 3.7 | MD800-0-4T12 |
| | | MD800-0-4T12B |
| | 7.5 | MD800-0-4T22 |
| | | MD800-0-4T22B |
| | 15 | MD800-0-4T41 |
| | | MD800-0-4T41B |
| Drive unit (dual-axis) | 0.4 | MD800-2-4T1R8 |
| | | MD800-2-4T1R8S |
| | 0.75 | MD800-2-4T3R4 |
| | | MD800-2-4T3R4S |
| | 1.5 | MD800-2-4T4R8 |
| | | MD800-2-4T4R8S |
| | 2.2 | MD800-2-4T5R5 |
| | | MD800-2-4T5R5S |
| | 3.7 | MD800-2-4T9R5 |
| | | MD800-2-4T9R5S |
| Drive unit (single-axis) | 0.4 | MD800-1-4T1R8 |
| | | MD800-1-4T1R8S |
| | 0.75 | MD800-1-4T3R4 |
| | | MD800-1-4T3R4S |
| | 1.5 | MD800-1-4T4R8 |
| | | MD800-1-4T4R8S |
| | 2.2 | MD800-1-4T5R5 |
| | | MD800-1-4T5R5S |
| | 3.7 | MD800-1-4T9R5 |
| | | MD800-1-4T9R5S |
| | 5.5 | MD800-1-4T13 |
| | | MD800-1-4T13S |
| | 7.5 | MD800-1-4T17 |
| | | MD800-1-4T17S |

Table 1–2 Product models (single-phase 200–240 V)

| Category | Power (kW) | Product Model |
|---|---|---|
| Power supply unit | 2.2 | MD800-0-2S24 |
| | | MD800-0-2S24B |
| | 3.7 | MD800-0-2S40 |
| | | MD800-0-2S40B |
| Drive unit (dual-axis) | 0.2 | MD800-2-2T1R7 |
| | | MD800-2-2T1R7S |
| | 0.4 | MD800-2-2T3 |
| | | MD800-2-2T3S |
| | 0.75 | MD800-2-2T5 |
| | | MD800-2-2T5S |
| | 1.5 | MD800-2-2T8 |
| | | MD800-2-2T8S |
| | 2.2 | MD800-2-2T11 |
| | | MD800-2-2T11S |
| Drive unit (single-axis) | 0.2 | MD800-1-2T1R7 |
| | | MD800-1-2T1R7S |
| | 0.4 | MD800-1-2T3 |
| | | MD800-1-2T3S |
| | 0.75 | MD800-1-2T5 |
| | | MD800-1-2T5S |
| | 1.5 | MD800-1-2T8 |
| | | MD800-1-2T8S |
| | 2.2 | MD800-1-2T11 |
| | | MD800-1-2T11S |

## 1.3 Technical Indicators

### 1.3.1 Electrical Specifications

#### Three-phase 380 V to 480 V

Table 1–3 Electrical specifications of power supply unit (three-phase 380 V to 480 V)

| Item | Unit | Specifications | | |
|---|---|---|---|---|
| Model: MD800-0-4T_ _ (B) | - | 12 | 22 | 41 |
| Power (heavy load) | kW | 3.7 | 7.5 | 15 |
| Power (light load) | kW | 5.5 | 11 | 18.5 |
| Structure | - | S2 | | |
| Weight (gross/net) | kg | 1.7/1.5 | 1.7/1.5 | 1.9/1.7 |

| Item | | Unit | Specifications | | |
|---|---|---|---|---|---|
| Input | Rated input current (heavy load) | A | 12 | 22 | 41 |
| | Rated input current (light load) | A | 16 | 33 | 44 |
| | Power capacity (heavy load) | kVA | 10 | 18.3 | 34.1 |
| | Power capacity (light load) | kVA | 13.3 | 27.4 | 36.6 |
| | Grid type | - | TN, TT, or IT | | |
| | Rated voltage and frequency | - | Three-phase 380 VAC to 480 VAC, 50/60 Hz | | |
| | Voltage range | - | Allowed fluctuation: –15% to +10%; actual allowed range: 323 VAC to 528 VAC | | |
| | Frequency range | - | Allowed fluctuation: ±5%; actual allowed range: 47 Hz to 63 Hz | | |
| Output | Output voltage | V | 510 VDC to 720 VDC | | |
| | Rated output current (heavy load) | A | 12.2 | 22.4 | 41.8 |
| | Rated output current (light load) | A | 16 | 33 | 44.6 |
| | Efficiency (heavy load) | - | 99.2% | 99.2% | 99.3% |
| | Efficiency (light load) | - | 99.2% | 99.1% | 99.3% |
| | Overload capacity | - | Heavy load: 150% for 60s with rated current<br>Light load: 110% for 60s with rated current | | |
| Heat dissipation design | Thermal design power (heavy load) | W | 42 | 75 | 131 |
| | Thermal design power (light load) | W | 58 | 120 | 157 |
| | Air flow | CFM | 16 | 30 | 30 |
| | Cooling mode | - | Forced air cooling | | |
| Overvoltage category | | - | Overvoltage Category III (OVC III) | | |
| Pollution degree | | - | No conductive dust<br>Meet the following requirements of the IEC 60721-3-3 standard:<br>Chemical gas: Class 3C3<br>Solid particle: Class 3S2 | | |
| IP rating | | - | IP40 (except for terminals and fans) | | |
| Noise | | dB(A) | 33 | 60 | 60 |

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

| Item | | Unit | Specifications | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model: MD800-1-4T_ _ (S) | | - | 1R8 | 3R4 | 4R8 | 5R5 | 9R5 | 13 | 17 |
| Power (heavy load) | | kW | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 |
| Power (light load) | | kW | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 |
| Structure | | - | S1 | | | | | | |
| Weight (gross/net) | | kg | 1.1/0.9 | 1.1/0.9 | 1.1/0.9 | 1.1/0.9 | 1.1/0.9 | 1.1/0.9 | 1.1/0.9 |
| Input | Rated input current (heavy load) | A | 2.3 | 4.2 | 6 | 6.9 | 11.8 | 16.2 | 21.2 |
| | Rated input current (light load) | A | 2.6 | 5.7 | 6.7 | 11.2 | 16.1 | 21.1 | 26 |
| | Input voltage | - | 510 VDC to 720 VDC | | | | | | |
| Applicable motor | Heavy load | kW | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 |
| | Light load | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 |
| | Heavy load | HP | 0.5 | 1 | 2 | 3 | 5 | 7.5 | 10 |
| | Light load | | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 |
| Output | Output voltage | V | 0 to AC input voltage | | | | | | |
| | Output frequency | Hz | 0 to 590 | | | | | | |
| | Rated output current (heavy load) | A | 1.8 | 3.4 | 4.8 | 5.5 | 9.5 | 13 | 17 |
| | Rated output current (light load) | A | 2.1 | 4.6 | 5.4 | 9 | 13 | 17 | 21 |
| | Efficiency (heavy load) | - | 96.2% | 97.0% | 98.0% | 98.4% | 98.6% | 98.7% | 98.7% |
| | Efficiency (light load) | - | 97.7% | 98.0% | 98.4% | 98.4% | 98.6% | 98.6% | 98.5% |
| Carrier frequency | | kHz | VF: Carrier frequency range: 0.8 to 15; default: 6<br>SVC: Carrier frequency range: 2 to 7; default: 6 | | | | | | |
| Overload capacity | | - | Heavy load: 150% for 60s with rated current<br>Light load: 110% for 60s with rated current | | | | | | |
| Heat dissipation design | Thermal design power (heavy load) | W | 22 | 32 | 42 | 47 | 70 | 98 | 122 |
| | Thermal design power (light load) | W | 24 | 41 | 47 | 80 | 99 | 136 | 197 |
| | Air flow | CFM | 0 | 4 | 4 | 4 | 9.5 | 10 | 13 |
| | Cooling mode | - | Natural air cooling | Forced air cooling | | | | | |

| Item | Unit | Specifications | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Overvoltage category | - | Overvoltage Category III (OVC III) | | | | | | |
| Pollution degree | - | No conductive dust<br>Meet the following requirements of the IEC 60721-3-3 standard:<br>Chemical gas: Class 3C3<br>Solid particle: Class 3S2 | | | | | | |
| IP rating | - | IP40 (except for terminals and fans) | | | | | | |
| Noise | dB(A) | 0 | 33 | 33 | 33 | 47 | 51 | 59 |

Table 1–5 Electrical specifications of dual-axis drive unit (three-phase 380 V to 480 V)

| Item | | Unit | Specifications | | | | |
|---|---|---|---|---|---|---|---|
| Model: MD800-2-4T_ _ (S) | | - | 1R8 | 3R4 | 4R8 | 5R5 | 9R5 |
| Power (heavy load) | | kW | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 |
| Power (light load) | | kW | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 |
| Structure | | - | S1 | | | | |
| Weight (gross/net) | | kg | 1.3/1.1 | 1.3/1.1 | 1.3/1.1 | 1.3/1.1 | 1.3/1.1 |
| Input | Rated input current (heavy load) | A | 4.5 | 8.5 | 12 | 13.7 | 23.7 |
| | Rated input current (light load) | A | 5.3 | 11.5 | 13.5 | 22.4 | 29.8 |
| | Input voltage | - | 510 VDC to 720 VDC | | | | |
| Applicable motor | Heavy load | kW | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 |
| | Light load | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 |
| | Heavy load | HP | 0.5 | 1 | 2 | 3 | 5 |
| | Light load | | 1 | 2 | 3 | 5 | 7.5 |
| Output | Output voltage | V | 0 to AC input voltage | | | | |
| | Output frequency | Hz | 0 to 590 | | | | |
| | Rated output current (heavy load) | A | 1.8 | 3.4 | 4.8 | 5.5 | 9.5 |
| | Rated output current (light load) | A | 2.1 | 4.6 | 5.4 | 9 | 12 |
| | Efficiency (heavy load) | - | 96.1% | 97.0% | 97.9% | 98.4% | 98.6% |
| | Efficiency (light load) | - | 97.7% | 98.0% | 98.4% | 98.4% | 98.6% |
| Carrier frequency | | kHz | VF: Carrier frequency range: 0.8 to 15; default: 6<br>SVC: Carrier frequency range: 2 to 7; default: 6 | | | | |
| Overload capacity | | - | Heavy load: 150% for 60s with rated current<br>Light load: 110% for 60s with rated current | | | | |

| Item | | Unit | Specifications | | | | |
|---|---|---|---|---|---|---|---|
| Heat dissipation design | Thermal design power (heavy load) | W | 45 | 64 | 85 | 98 | 141 |
| | Thermal design power (light load) | W | 49 | 82 | 95 | 163 | 198 |
| | Air flow | CFM | 4 | 4 | 6 | 9.5 | 13 |
| | Cooling mode | - | Forced air cooling | | | | |
| Overvoltage category | | - | Overvoltage Category III (OVC III) | | | | |
| Pollution degree | | - | No conductive dust<br>Meet the following requirements of the IEC 60721-3-3 standard:<br>Chemical gas: Class 3C3<br>Solid particle: Class 3S2 | | | | |
| IP rating | | - | IP40 (except for terminals and fans) | | | | |
| Noise | | dB(A) | 33 | 33 | 44 | 47 | 59 |

## Single-phase 200 V to 240 V

Table 1–6 Electrical specifications of power supply unit (single-phase 200 V to 240 V)

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

| Item | | Unit | Specifications | |
|---|---|---|---|---|
| Output | Output voltage | V | 270 VDC to 360 VDC | |
| | Rated output current (heavy load) | A | 13.5 | 22.6 |
| | Rated output current (light load) | A | 15.1 | 24.8 |
| | Efficiency (heavy load) | - | 98.1% | 98.1% |
| | Efficiency (light load) | - | 98.7% | 98.1% |
| | Overload capacity | - | Heavy load: 150% for 60s with rated current<br>Light load: 110% for 60s with rated current | |
| Heat dissipation design | Thermal design power (heavy load) | W | 59 | 94 |
| | Thermal design power (light load) | W | 65 | 110 |
| | Air flow | CFM | 25 | 30 |
| | Cooling mode | - | Air cooling | |
| Overvoltage category | | - | Overvoltage Category III (OVC III) | |
| Pollution degree | | - | No conductive dust<br>Meet the following requirements of the IEC 60721-3-3 standard:<br>Chemical gas: Class 3C3<br>Solid particle: Class 3S2 | |
| IP rating | | - | IP40 (except for terminals and fans) | |
| Noise | | dB(A) | 53 | 60 |

Table 1–7 Electrical specifications of single-axis drive unit (single-phase 200 V to 240 V)

| Item | | Unit | Specifications | | | | |
|---|---|---|---|---|---|---|---|
| Model: MD800-1-2T_ _ (S) | | - | 1R7 | 3 | 5 | 8 | 11 |
| Power (heavy load) | | kW | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
| Power (light load) | | kW | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 |
| Structure | | - | S1 | | | | |
| Weight (gross/net) | | kg | 1.1/0.9 | 1.1/0.9 | 1.1/0.9 | 1.1/0.9 | 1.1/0.9 |
| Input | Rated input current (heavy load) | A | 2.1 | 3.7 | 6.2 | 10 | 13.7 |
| | Rated input current (light load) | A | 2.4 | 4.4 | 10 | 12 | 22 |
| | Input voltage | - | 270 VDC to 360 VDC | | | | |

| Item | | Unit | Specifications | | | | |
|---|---|---|---|---|---|---|---|
| Applicable motor | Heavy load | kW | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
| | Light load | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 |
| | Heavy load | HP | 0.3 | 0.5 | 1 | 2 | 3 |
| | Light load | | 0.5 | 1 | 2 | 3 | 5 |
| Output | Output voltage | V | 0 to AC input voltage | | | | |
| | Output frequency | Hz | 0 to 590 | | | | |
| | Rated output current (heavy load) | A | 1.7 | 3 | 5 | 8 | 11 |
| | Rated output current (light load) | A | 1.9 | 3.5 | 8 | 9.6 | 17.6 |
| | Efficiency (heavy load) | - | 97.1% | 97.4% | 97.6% | 98.3% | 98.2% |
| | Efficiency (light load) | - | 98.3% | 98.3% | 98.3% | 98.5% | 98.5% |
| Carrier frequency | | kHz | VF: Carrier frequency range: 0.8 to 15; default: 6<br>SVC: Carrier frequency range: 2 to 7; default: 6 | | | | |
| Overload capacity | | - | Heavy load: 150% for 60s; light load: 110% for 60s | | | | |
| Heat dissipation design | Thermal design power (heavy load) | W | 9 | 15 | 26 | 34 | 53 |
| | Thermal design power (light load) | W | 10 | 18 | 35 | 43 | 61 |
| | Air flow | CFM | 0 | 4 | 4 | 4 | 10 |
| | Cooling mode | - | Natural air cooling | Forced air cooling | | | |
| Overvoltage category | | - | Overvoltage Category III (OVC III) | | | | |
| Pollution degree | | - | No conductive dust<br>Meet the following requirements of the IEC 60721-3-3 standard:<br>Chemical gas: Class 3C3<br>Solid particle: Class 3S2 | | | | |
| IP rating | | - | IP40 (except for terminals and fans) | | | | |
| Noise | | dB(A) | 0 | 33 | 33 | 33 | 33 |

Table 1–8 Electrical specifications of dual-axis drive unit (single-phase 200 V to 240 V)

| Item | Unit | Specifications | | | | |
|---|---|---|---|---|---|---|
| Model: MD800-2-2T_ _ (S) | - | 1R7 | 3 | 5 | 8 | 11 |
| Power (heavy load) | kW | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |

| Item | | Unit | Specifications | | | | |
|---|---|---|---|---|---|---|---|
| Power (light load) | | kW | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 |
| Structure | | - | S1 | | | | |
| Weight (gross/net) | | kg | 1.3/1.1 | 1.3/1.1 | 1.3/1.1 | 1.3/1.1 | 1.3/1.1 |
| Input | Rated input current (heavy load) | A | 4.3 | 7.5 | 12.5 | 20 | 27.5 |
| | Rated input current (light load) | A | 4.8 | 8.8 | 20 | 24 | 44 |
| | Input voltage | - | 270 VDC to 360 VDC | | | | |
| Applicable motor | Heavy load | kW | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
| | Light load | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 |
| | Heavy load | HP | 0.3 | 0.5 | 1 | 2 | 3 |
| | Light load | | 0.5 | 1 | 2 | 3 | 5 |
| Output | Output voltage | V | 0 to AC input voltage | | | | |
| | Output frequency | Hz | 0 to 590 | | | | |
| | Rated output current (heavy load) | A | 1.7 | 3 | 5 | 8 | 11 |
| | Rated output current (light load) | A | 1.9 | 3.5 | 8 | 9.6 | 17.6 |
| | Efficiency (heavy load) | - | 97.0% | 97.4% | 97.6% | 98.3% | 98.2% |
| | Efficiency (light load) | - | 98.3% | 98.3% | 98.3% | 98.5% | 98.50% |
| Carrier frequency | | kHz | VF: Range: 0.8 to 15; default: 6<br>SVC: Range: 2 to 7; default: 6 | | | | |
| Overload capacity | | - | Heavy load: 150% for 60s with rated current<br>Light load: 110% for 60s with rated current | | | | |
| Heat dissipation design | Thermal design power (heavy load) | W | 18 | 29 | 51 | 69 | 109 |
| | Thermal design power (light load) | W | 20 | 35 | 69 | 87 | 122 |
| | Air flow | CFM | 4 | 4 | 7 | 7 | 13 |
| | Cooling mode | - | Forced air cooling | | | | |
| Overvoltage category | | - | Overvoltage Category III (OVC III) | | | | |
| Pollution degree | | - | No conductive dust<br>Meet the following requirements of the IEC 60721-3-3 standard:<br>Chemical gas: Class 3C3<br>Solid particle: Class 3S2 | | | | |
| IP rating | | - | IP40 (except for terminals and fans) | | | | |
| Noise | | dB(A) | 33 | 33 | 33 | 45 | 59 |

## 1.3.2 Technical Specifications

Table 1–9 General Specifications

| Item | | Specifications |
|---|---|---|
| Environment | Installation environment | Indoor |
| | Operating temperature | –20°C to +60°C; ambient temperature variation: < 0.5 °C/min.<br>Without overload, derating is required above 50°C. Derate the rated current by 2.5% for every additional 1°C. Max. temperature: 60°C.<br>With overload, derating is required above 40°C. Derate the rated current by 2.5% for every additional 1°C. Max. temperature: 60°C. |
| | Storage temperature | –40°C to +70°C |
| | Transportation temperature | –40°C to +70°C |
| | Relative humidity for operating | Relative humidity range: 5% to 95% |
| | Relative humidity for storage | 5% to 95% |
| | Relative humidity for transportation | Less than 95% at +40°C |
| | Altitude | Max.: 4000 m (13123 ft) for star grids; 2000 m (6562 ft) for triangular grids.<br>Above 1000 m, derate 1% for every additional 100 m. |
| | Vibration | For transportation with packaging: compliant with Class 2M3 requirements in IEC 60721-3-2.<br>For operation in intended scenarios: compliant with Class 3M4 requirements in IEC 60721-3-3.<br>For installation with packaging removed: compliant with ISTA 1H. |

Table 1–10 Technical specifications of power supply unit

| Item | | Specifications |
|---|---|---|
| Protection | | Overtemperature protection, power phase loss protection, overvoltage protection, and braking transistor short circuit detection |
| HMI | Communication/ bus | Support for the Modbus-RTU protocol: max. baud rate 115200 bps, 128 nodes, max. distance 1000 m.<br>Support for the CANopen protocol: max. baud rate 1 Mbps, 127 nodes, max. distance 1000 m.<br>Support for the CANlink protocol: max. baud rate 1 Mbps, 63 nodes, max. distance 1000 m.<br>Support for PROFINET RT: max. baud rate 100 Mbps, full duplex, 65535 nodes, max. distance 100 m.<br>Support for EtherCAT: max. baud rate 100 Mbps, full duplex, 65535 nodes, max. distance 100 m. |
| | AI | AI1 to AI2: programmable –10 V to +10 V/0 mA to 20 mA; 12-bit resolution; correction accuracy: 0.3%; input impedance: 22 kΩ for voltage input and 500 Ω for current input.<br>Support for PT100, PT1000, KTY-84-130, and PTC-130 temperature detection. |
| | DI and DO | DI1 to DI4: General DIs. Response time: 10 ms. Not supporting high-speed pulse input. Input frequency: < 100 Hz. Photocoupler isolation. Compatible with bipolar input. Input impedance: 3.3 kΩ. Input voltage range at active level: 15 V to 30 V<br>DIO1 to DIO4: General multifunctional input or output terminals. The input or output function is determined by corresponding parameters. When they are used for digital input, their specifications are the same as those of DI1-DI4. When they are used for digital output, they have the common collector open-drain output function, and cannot be connected to the power supply without adding a pull-up resistor in between. The resistance of the resistor is determined based on the load. The maximum output capacity is 24 VDC/50 mA. |
| | RO | TA-TB: NC contacts TA-TC: NO contacts Capacity: 30 VDC/3 A; 250 VAC/3 A (COSϕ = 0.4) |
| | Operating panel display | Standard: 7-bit LCD digital presentation, multiple notations, and 9 keys. Two bits are green and indicate the axis number, and five bits are white and indicate the content. The notations indicate units and status. |

Table 1–11 Technical specifications of drive unit

| Item | | Specifications |
|---|---|---|
| Basic parameters | Load type | Motor type: synchronous/asynchronous |
| | Output frequency resolution | Digital setting: 0.01 Hz<br>Analog setting: max. frequency x 0.025% |
| | Carrier frequency | V/f control: 0.8 kHz to 15 kHz; default: 6 kHz<br>SVC control: 2 kHz to 7 kHz; default: 6 kHz<br>Support for automatic adjustment of carrier frequency based on the heatsink temperature |
| | Motor type and control mode | Three-phase asynchronous motor: V/f control and sensorless vector control (SVC)<br>Permanent magnet synchronous motor: SVC |
| | Speed range | 1:50 (asynchronous motor, V/f)<br>1:100 (asynchronous motor, SVC) |
| | Speed control accuracy | ±1.0% (V/f control)<br>±0.5% (SVC) |
| | Speed fluctuation | ±0.5% (SVC) |
| | Torque response | < 20 ms (SVC) |
| | Torque control accuracy | ±5% (SVC) (above 10 Hz) |
| | Torque control mode | SVC |
| | Overload capacity | 115% for 1 hour with the rated current 150% for 1 minute with the rated current 178% for 2 seconds with the rated current |
| | Torque boost | Automatic torque boost Customized torque boost: 0.1% to 30.0% |
| | V/f curve | Five modes: Linear V/f Multi-point V/f Square V/f Complete V/f separation Half V/f separation |
| Protection | | Protection against the following faults: Short circuit to ground at power-on, inter-phase short circuit, motor overtemperature (PTC), drive overcurrent, drive overload (output power limit), motor overload, drive overvoltage, drive undervoltage, drive stall in SVC mode, drive overtemperature, output phase loss, communication fault, current measurement fault, motor auto-tuning fault, EEPROM read-write fault, locked-rotor, excessive speed deviation, and stall |

| Item | | Specifications |
|---|---|---|
| Customized functions | Acceleration/ deceleration curves | Linear, S curve mode 1, and S curve mode 2 |
| | Built-in PID | Two sets of PID parameters, support for process control closed-loop systems. |
| | Command source for operation command | Three sources:<br>LED operating panel or external LCD operating panel, control terminal, and communication. Support for switchover between command sources by multiple methods |
| | Frequency source | Seven frequency sources are available:<br>Digital setting, voltage AI, current AI, communication, PID, multi-speed, and built-in simple PLC<br>Support for switchover and superposition by multiple methods |
| | Wobble function | Multiple triangular-wave frequency control modes |

## 1.4 Components

### Components of the Power Supply Unit

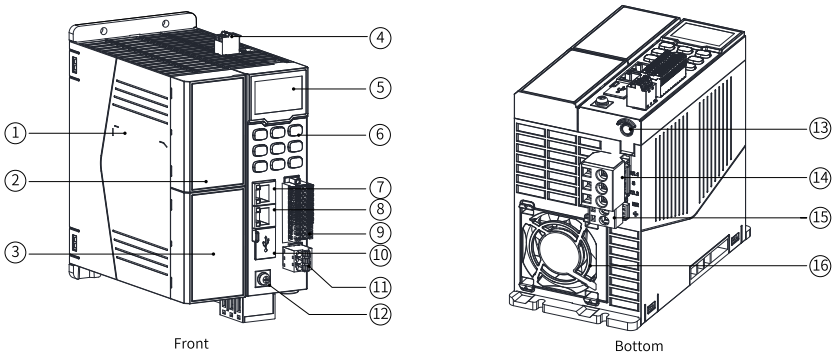



Figure 1-3 Components of the power supply unit

Table 1–12 Description of the components of power supply unit

| No. | Component Name | Description |
|---|---|---|
| 1 | Nameplate | Used to display the product information. |
| 2 | Position of optional expansion card 1 | Used to install optional expansion card 1. |
| 3 | Position of expansion card 2 | Used to install optional expansion card 2. It is recommended that the Ethernet card be installed at this position. |

| No. | Component Name | Description |
|---|---|---|
| 4 | 24 V input terminal | External 24 V control power input<br>With the external 24V power supply input, even after the main circuit is powered off, the control part can still work normally, without affecting the communication, parameter setting, fault information query, and other operations. |
| 5 | LED display on the operating panel | Includes the axis number, status, unit and data display. |
| 6 | Keys on the operating panel | Used for operations through the operating panel. |
| 7 | Communication terminal (CN3) | CAN communication terminal, which can also be used to connect GP-inolink for software upgrade and commissioning |
| 8 | Communication terminal (CN4) | Used for CAN communication. It can also be used to connect GP-inolink or SOP-20 for software upgrade and commissioning. |
| 9 | Control terminal (CN1) | Integrates MODBUS communication, analog input, digital input, digital output, + 24V power output, and +10V power output signals. |
| 10 | Type-C USB commissioning interface, termination resistor DIP switch (CN5) | Used as the Type-C USB commissioning interface to connect the computer for software upgrade and commissioning, MODBUS communication termination resistor DIP switch in built-in CN1, or CAN communication termination resistor DIP switch in built-in CN3 and CN4. |
| 11 | Relay terminal (CN2) | Used for relay output. |
| 12 | Grounding terminal | Used for protective grounding. |
| 13 | Optional grounding screw | Used for grounding (optional) of the control board. |
| 14 | R(L1)/S/T(L2) input terminals | Used to connect the three-phase/single-phase AC input power supply. (R/S/T for three-phase power supply, and L1/L2 for single-phase power supply). |
| 15 | BR/+ braking terminal (optional) | Used to connect the braking resistor. |
| 16 | Cooling fan | Used for heat dissipation. |

## Components of the Drive Unit

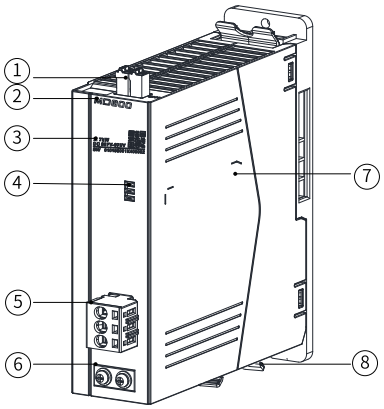



Figure 1-4 Components of the drive unit (single-axis)

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

| No. | Component Name | Description |
|---|---|---|
| 1 | STO terminal (optional) | Used as the optional STO terminal. |
| 2 | Product model | Used to display the product series. |
| 3 | Power, voltage class, QR code, serial number | Used to display the power, voltage class, QR code, and serial number of the product. |
| 4 | Indicators | Used as indicators of output terminals. |
| 5 | U/V/W output terminals | Used to connect the three-phase motor. |
| 6 | 2-M4 screw grounding terminal | Two grounding (PE) terminals used for protective grounding. |
| 7 | Nameplate | Used to display the product information. |
| 8 | Cooling fan | Cooling fan |

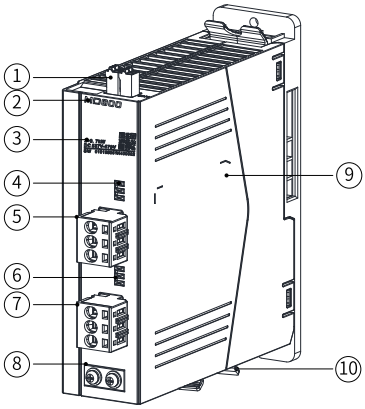



Figure 1-5 Components of the drive unit (dual-axis)

Table 1–14 Description of the components of drive unit (dual-axis)

| No. | Component Name | Description |
|---|---|---|
| 1 | STO terminal (optional) | Used as the optional STO terminal. |
| 2 | Product series | Used to display the product series. |
| 3 | Power, voltage class, QR code, serial number | Used to display the power, voltage class, QR code, and serial number of the product. |
| 4 | Indicator of output axis 1 | Used as the indicator of output terminal 1. |
| 5 | Output terminal of U1/V1/W1 axis 1 | Used as output terminal 1 of the AC drive to connect the three-phase motor. |
| 6 | Indicator of output axis 2 | Used as the indicator of output terminal 2. |
| 7 | Output terminal of U2/V2/W2 axis 2 | Used as output terminal 2 of the AC drive to connect the three-phase motor. |
| 8 | 2-M4 screw grounding terminal | Two grounding (PE) terminals used for protective grounding. |
| 9 | Nameplate | Used to display the product information. |
| 10 | Cooling fan | Used for heat dissipation. |

## Components of the Filter Unit

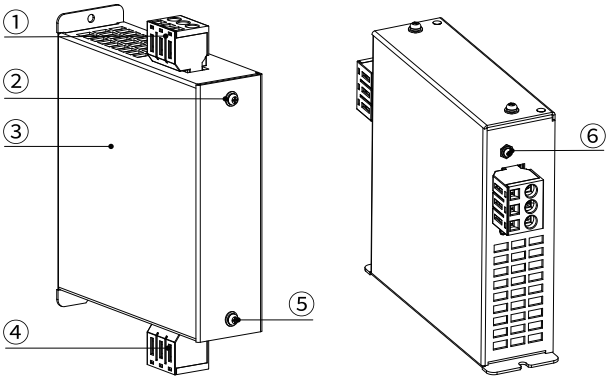



Figure 1-6 Components of the filter unit

Table 1–15 Description of the components of filter unit

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

## 1.5 System Composition

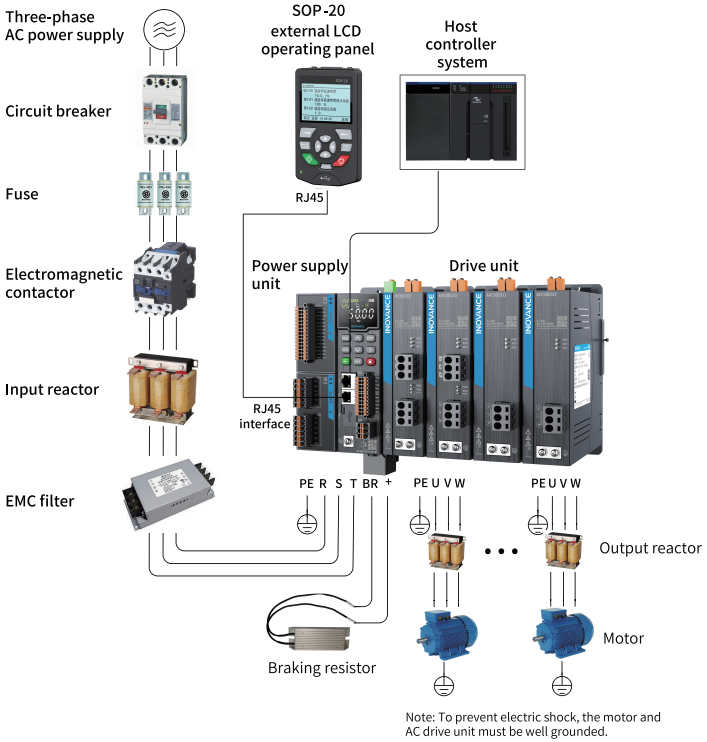



Figure 1-7 MD800 series system connection

Table 1–16 Function description of MD800 system peripherals

| Component Name | Installation Position | Function Description |
|---|---|---|
| Circuit breaker | Between the power supply and input side of the power supply unit | MCCB: Cuts off power supply when overcurrent occurs on downstream devices.<br>Earth leakage circuit breaker: Provides protection against potential leakage current during drive running to prevent electric shock and even a fire. |
| Fuse | Between the power supply and input side of the power supply unit | Protects downstream semiconductors of the power supply unit in case of short circuits. |
| Electromagnetic contactor | Between the circuit breaker and input side of the power supply unit | Switches ON/OFF the drive. Do not start/stop the drive frequently using the contactor (keep an interval of at least 1 hour between ON and OFF operations) or use it to directly start the drive. |

| Component Name | Installation Position | Function Description |
|---|---|---|
| Input reactor | Input side of the power supply unit | Improves the power factor of the power input side. Eliminates higher harmonics of the input side effectively and prevents damage to other devices caused by the distortion of voltage waveform. Eliminate input current unbalance due to inter-phase unbalance. 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 | Reduces external conduction and radiation interference of the drive. Decreases conduction interference flowing from the power supply to the drive and improves the anti-interference capacity of the drive. |
| Braking resistor | Input side of the power supply unit | Dissipates regenerated 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 drive generally has much higher 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, which will: a) Degrade motor insulation performance and damage motor in long run. b) Generate large leakage current and cause frequent Drive drive protection trips. If the distance between the AC drive and the motor is longer than 100 m, it is recommended that an AC output reactor be installed. |
| dv/dt reactor | At the output side of the drive unit and close to the drive | Optional. Protects motor insulation and reduces bearing current. |
| Output magnetic ring | At the output side inside the drive unit | Reduces bearing current. |
| Motor | At the output side of the drive | Select an appropriate motor. |
| SOP-20 external LCD operating panel | Connected to the CN4 terminal through a network cable | Optional for commissioning and parameter setting. |

## 1.6 Options

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

Table 1–17 Options

| Category | | Unit Model | Option Model |
|---|---|---|---|
| Expansion card | Multi-functional card | All power supply units | IO-M1 |
| | Single-contact relay expansion card | All power supply units | IO-R1 |
| | Double-contact relay expansion card | All power supply units | IO-R2 |
| | PROFINET communication extension card | All power supply units | SI-PN |
| | EtherCAT communication expansion card | All power supply units | SI-ECAT |
| Operating panel | LCD operating panel | All power supply units | SOP-20 |
| | External operating panel network cable | All power supply units | C45590-GNCN-25003 |
| EMC shielded bracket | Shielded bracket for the power supply unit | All power supply units | MD800-PBJ100M-W1 |
| | Shielded bracket for the drive unit | All drive units | MD800-PBJ50M-W1 |
| Input reactor | Input reactor | For details about the applicable power supply unit models and option models, see *"4.1.2 AC Input Reactor" on page 98*. | |
| EMC filter | Schaffner C2 filter | For details about the applicable power supply unit models and option models, see *"4.1.3.1 EMC Filter" on page 101*. | |
| | Inovance C2 filter | For details about the applicable power supply unit models and option models, see *"4.1.3.1 EMC Filter" on page 101*. | |
| Output reactor | Output reactor (Schaffner) | For details about the applicable drive unit models and option models, see *"4.1.5 Output Reactor" on page 110*. | |
| | Output reactor (Inovance) | For details about the applicable drive unit models and option models, see *"4.1.5 Output Reactor" on page 110*. | |
| Magnetic ring | Magnetic ring | All drive units | DY644020H |
| | | All drive units | DY805020H |
| | | All drive units | DY1207030H |

# 2 Mechanical Design

## 2.1 Mounting Dimensions

### Power Supply Unit

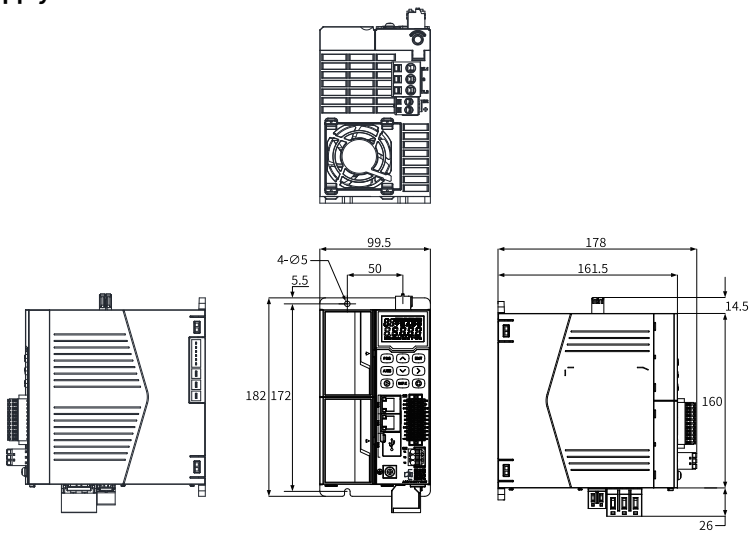



Figure 2-1 Overall and mounting dimensions of the power supply unit (unit: mm)

## Drive Unit (Single-axis)

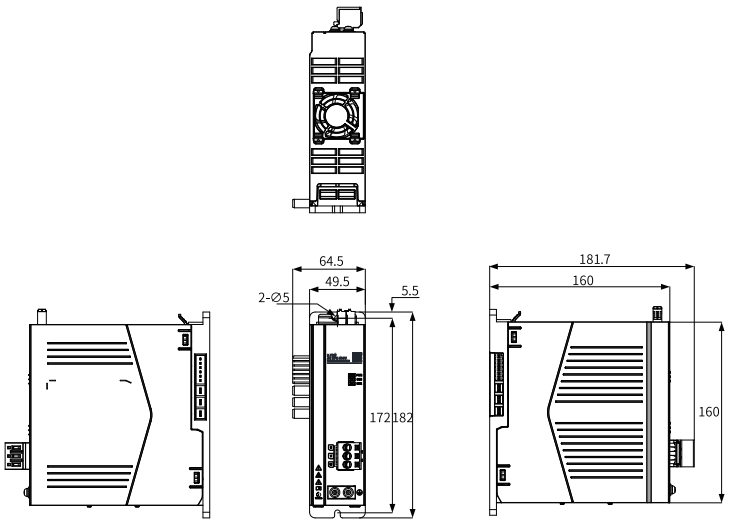



Figure 2-2 Overall and mounting dimensions of the single-axis drive unit (unit: mm)

## Drive Unit (Dual-axis)

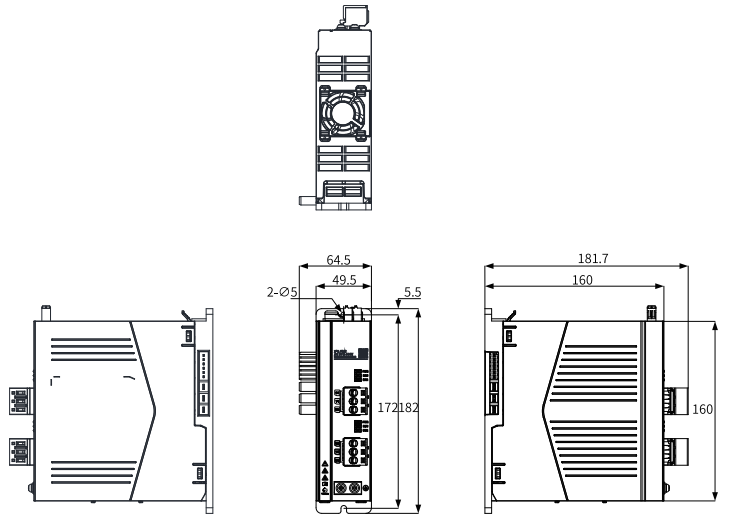



Figure 2-3 Overall and mounting dimensions of the dual-axis drive unit (unit: mm)

**Filter Unit**

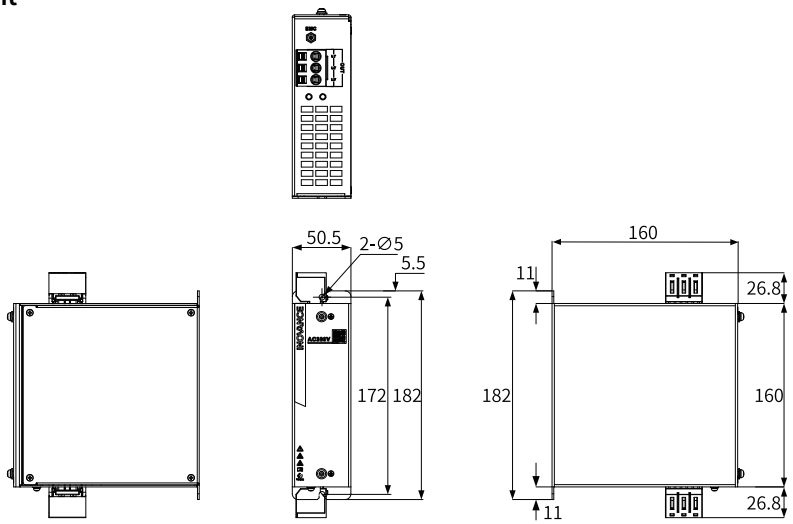



Figure 2-4 Overall and mounting dimensions of the filter unit (unit: mm)

## 2.2 Mounting Hole Dimensions

The AC drive is book-shaped, with all its units being the same in height and width. This requires equally-spaced mounting holes. The longitudinal spacing of mounting holes is 172 mm and the transverse spacing is 50 mm. For good heat dissipation, ensure a clearance of at least 55 mm on the right and left sides each, and a clearance of at least 200 mm on the top and bottom sides each.

The following figure shows the mounting hole dimensions for an AC drive consisting of one power supply unit and five drive units.

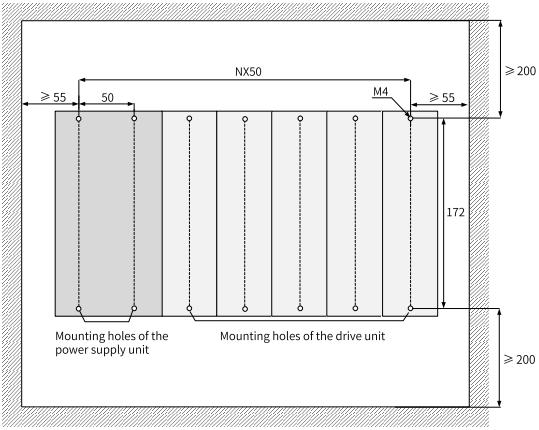
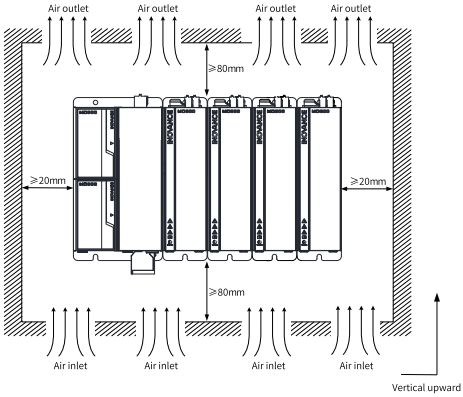



Figure 2-5 Mounting hole dimensions (unit: mm)

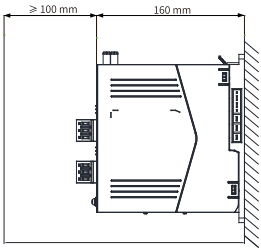
## 2.3 Clearance Requirements

The recommended installation methods of MD800 include single rack installation and multiple rack installation.

- When only a single unit is installed, the required reserved clearance around the unit is shown in the following figure.




Front view




Side view

Figure 2-6 Installation clearance (single unit)

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

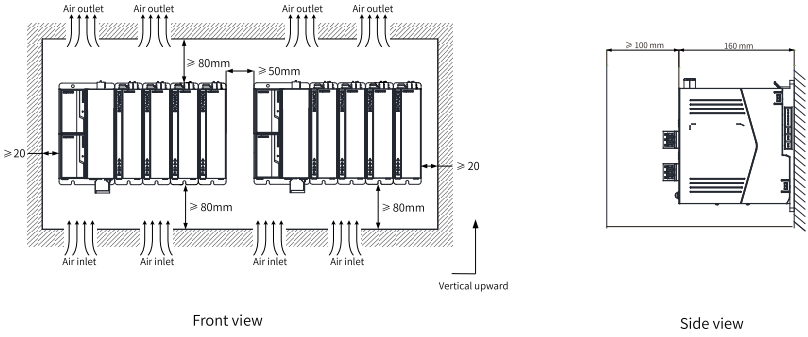



Figure 2-7 Installation clearance (side-by-side installation)

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

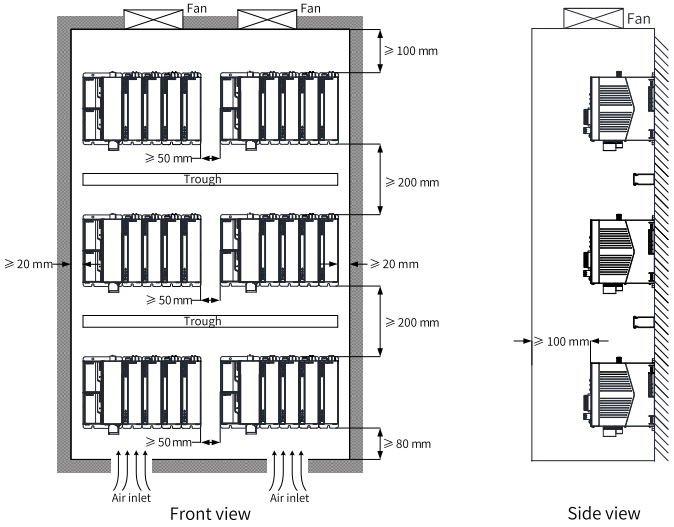



Figure 2-8 Installation clearance (multiple rack installation)

## *Note*

Install the fan in the correct air exhaust direction to ensure that air flows from inside to outside of the cabinet. Otherwise, hot air cannot be exhausted and the drive may be overheated or damaged.

## 2.4 Heat Dissipation Requirements

### Heat Dissipation Design for the Cabinet Door

Forced-air cooling is implemented by the built-in fan for the AC drive. Provide an air inlet with an appropriate size on the cabinet door to ensure enough cooling air entering the cabinet. The air flows upward due to thermal expansion. Therefore, ensure that the cabinet air inlet is at least 50 mm lower than the air inlet of the drive unit, as shown in the following figure.

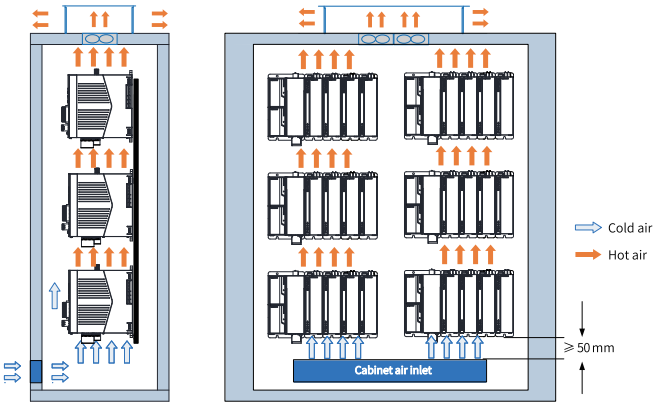



Figure 2-9 Position of the cabinet air inlet

Ensure enough effective area of the cabinet air inlet with the AC drive mounted. For minimum requirements, see the following tables.

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

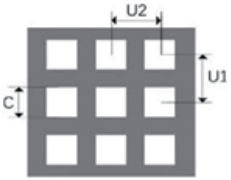
| Module Type | Power (kW) | Quantity | Minimum Effective Area of Air Inlet of Electric Control Cabinet with Passive Ventilation ($cm^2$)[Note 1] |
|---|---|---|---|
| Drive unit (single-axis) | 0.4 | 1 | 11.5 |
| | 0.75 | 1 | 11.5 |
| | 1.5 | 1 | 11.5 |
| | 2.2 | 1 | 11.5 |
| | 3.7 | 1 | 11.5 |
| | 5.5 | 1 | 11.5 |
| | 7.5 | 1 | 11.5 |
| Drive unit (dual-axis) | 0.4 | 1 | 11.5 |
| | 0.75 | 1 | 11.5 |
| | 1.5 | 1 | 11.5 |
| | 2.2 | 1 | 11.5 |
| | 3.7 | 1 | 11.5 |
| Power supply unit | 3.7 | 1 | 34.5 |
| | 7.5 | 1 | 34.5 |
| | 15 | 1 | 34.5 |

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

| Module Type | Power (kW) | Quantity | Minimum Effective Area of Air Inlet of Electric Control Cabinet with Passive Ventilation ($cm^2$)[Note 1] |
|---|---|---|---|
| Drive unit (single-axis) | 0.2 | 1 | 11.5 |
| | 0.4 | 1 | 11.5 |
| | 0.75 | 1 | 11.5 |
| | 1.5 | 1 | 11.5 |
| | 2.2 | 1 | 11.5 |
| Drive unit (dual-axis) | 0.2 | 1 | 11.5 |
| | 0.4 | 1 | 11.5 |
| | 0.75 | 1 | 11.5 |
| | 1.5 | 1 | 11.5 |
| | 2.2 | 1 | 11.5 |
| Power supply unit | 2.2 | 1 | 34.5 |
| | 3.7 | 1 | 34.5 |

Note 1: The effective area of an air inlet/outlet is the actual ventilation area, instead of the gross opening area.

For example, on the grating shown in the following figure, the size of each hole is C x C, and there are 9 holes, so the effective area of the air inlet is 9 x C x C.




Figures in the preceding tables are for single unit only. For a cabinet containing multiple units, calculate the total effective inlet area by summing each single effective area according to the table.

For example, a cabinet contains:

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

Based on this, the minimum effective area of the air inlet is 34.5+11.5+11.5 x 2+11.5 = 80.5 cm2. If an air filter is installed at the air inlet, the air inlet resistance will rise significantly and the effective area of the air inlet must be increased to 1.2 to 1.5 times the value indicated in the table. The effective area in the preceding tables refers to the actual through-hole area of an opening. The effective area is calculated by multiplying the opening area by the cut-out rate.

### Design of Top Ventilation

Ensure smooth discharge of hot air from the cabinet to the outside to keep sufficient heat dissipation for the drive unit. Use active ventilation design for the cabinet.

Table 2–3 Minimum effective area of the cabinet air outlet for the power supply unit or drive unit (three-phase 380 V to 480 V)

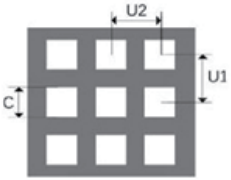
| Module Type | Power (kW) | Quantity | Minimum Effective Area of Air Outlet of Electric Control Cabinet with Passive Ventilation ($cm^2$)[Note 1] |
|---|---|---|---|
| Drive unit (single-axis) | 0.4 | 1 | 18.4 |
| | 0.75 | 1 | 18.4 |
| | 1.5 | 1 | 18.4 |
| | 2.2 | 1 | 18.4 |
| | 3.7 | 1 | 18.4 |
| | 5.5 | 1 | 18.4 |
| | 7.5 | 1 | 18.4 |
| Drive unit (dual-axis) | 0.4 | 1 | 18.4 |
| | 0.75 | 1 | 18.4 |
| | 1.5 | 1 | 18.4 |
| | 2.2 | 1 | 18.4 |
| | 3.7 | 1 | 18.4 |
| Power supply unit | 3.7 | 1 | 55.2 |
| | 7.5 | 1 | 55.2 |
| | 15 | 1 | 55.2 |

Table 2–4 Minimum effective area of the cabinet air outlet for the power supply unit or drive unit (single-phase 200 V to 240 V)

| Module Type | Power (kW) | Quantity | Minimum Effective Area of Air Outlet of Electric Control Cabinet with Passive Ventilation ($cm^2$)[Note 1] |
|---|---|---|---|
| Drive unit (single-axis) | 0.2 | 1 | 18.4 |
| | 0.4 | 1 | 18.4 |
| | 0.75 | 1 | 18.4 |
| | 1.5 | 1 | 18.4 |
| | 2.2 | 1 | 18.4 |
| Drive unit (dual-axis) | 0.2 | 1 | 18.4 |
| | 0.4 | 1 | 18.4 |
| | 0.75 | 1 | 18.4 |
| | 1.5 | 1 | 18.4 |
| | 2.2 | 1 | 18.4 |
| Power supply unit | 2.2 | 1 | 55.2 |
| | 3.7 | 1 | 55.2 |

Note 1: The effective outlet areas are the actual ventilation area, instead of the gross opening areas.

For example, on the grating shown in the following figure, the size of each hole is C x C, and there are 9 holes, so the effective area of the air inlet is 9 x C x C.




Figures in the preceding tables are for single unit only. For a cabinet containing multiple units, calculate the total effective outlet area by summing each single effective area according to the table. If an air filter is installed at the outlet, the air outlet resistance will rise significantly and the ventilation opening area must be increased to 1.2 out 1.5 times the value indicated in the table. The effective area in the preceding tables refers to the actual through-hole area of an opening. The effective area is calculated by multiplying the opening area by the cut-out rate.

For example, a cabinet contains:

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

Based on this, the minimum effective area of the air inlet is 55.2+18.4+18.4 x 2+18.4 =128.8 $cm^2$. In active ventilation, a fan is installed on the top of the cabinet to draw hot air out of the cabinet. Active ventilation is commonly used. For smooth discharge of hot air, ensure that the overall exhaust air flow of the cabinet is greater than the sum of exhaust air flow of all the drives in the cabinet. The cooling air flow required by MD800 is listed in the following tables.

Table 2–5 Cooling air flow for the power supply unit and drive unit (three-phase 380 V to 480 V)

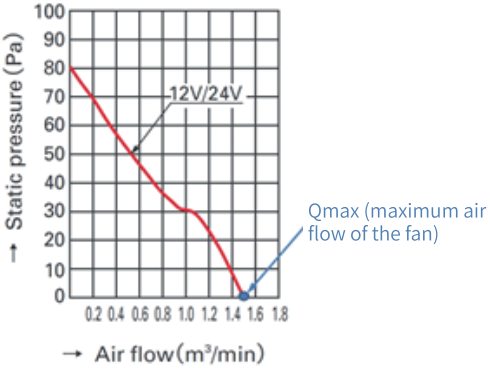
| Module Type | Power (kW) | Quantity | Required Air Flow Qmax (CFM) of the Fan for Electric Control Cabinet with Active Top Ventilation[Note 1] |
|---|---|---|---|
| Drive unit (single-axis) | 0.4 | 1 | 0 |
| | 0.75 | 1 | 8 |
| | 1.5 | 1 | 8 |
| | 2.2 | 1 | 8 |
| | 3.7 | 1 | 18 |
| | 5.5 | 1 | 19.1 |
| | 7.5 | 1 | 26 |
| Drive unit (dual-axis) | 0.4 | 1 | 8 |
| | 0.75 | 1 | 8 |
| | 1.5 | 1 | 12 |
| | 2.2 | 1 | 18 |
| | 3.7 | 1 | 26 |
| Power supply unit | 3.7 | 1 | 32 |
| | 7.5 | 1 | 60 |
| | 15 | 1 | 60 |

Table 2–6 Cooling air flow for the power supply unit and drive unit (single-phase 200 V to 240 V)

| Module Type | Power (kW) | Quantity | Required Air Flow Qmax (CFM) of the Fan for Electric Control Cabinet with Active Top Ventilation[Note 1] |
|---|---|---|---|
| Drive unit (single-axis) | 0.2 | 1 | 0.0 |
| | 0.4 | 1 | 8.0 |
| | 0.75 | 1 | 8.0 |
| | 1.5 | 1 | 8.0 |
| | 2.2 | 1 | 20.0 |
| Drive unit (dual-axis) | 0.2 | 1 | 8.0 |
| | 0.4 | 1 | 8.0 |
| | 0.75 | 1 | 14 |
| | 1.5 | 1 | 14 |
| | 2.2 | 1 | 26 |

| Module Type | Power (kW) | Quantity | Required Air Flow Qmax (CFM) of the Fan for Electric Control Cabinet with Active Top Ventilation[Note 1] |
|---|---|---|---|
| Power supply unit | 2.2 | 1 | 50 |
| | 3.7 | 1 | 60 |

Note 1: Qmax corresponds to the maximum value point at which the P-Q curve of the fan meets the abscissa, as shown in the following figure.




Figures in the preceding tables are for single unit only. For a cabinet containing multiple units, calculate the total air flow by summing each single air flow according to the table.

For example, a cabinet contains:

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

Based on this, the minimum ventilation air flow required is 60+26+18+8 = 112 CFM.

## Cabinet Fan Design

Cabinet fan selection procedure:

1. Calculate the sum of cooling air flow required by all the modules based on *"Table 2–5 " on page 43* and *"Table 2–6 " on page 43*.
2. Determine the maximum air flow (Qmax) of the cabinet.
3. Determine the specifications and quantity of fans according to the maximum air flow (Qmax).
   Note that:

   Maximum air flow of the cabinet = (1.3 to 1.5 times) Sum of cooling air flow

Maximum air flow of the cabinet = (1.6 to 2.2 times) Sum of cooling air flow (if a mesh filter or other components are installed at the cabinet air outlet)

## *Note*

- The air volume of the selected fan cannot be smaller than the maximum air volume Qmax. If a single fan cannot meet this requirement, multiple fans can be used.
- Install the fan in the correct air exhaust direction to ensure that air flows from inside to outside of the cabinet. Otherwise, hot air cannot be exhausted and the drive may be overheated or damaged.

# 3 Electrical Design

## 3.1 Wiring of the Main Circuit

### 3.1.1 Main Circuit Terminals

#### Terminal Arrangement of the Power Supply Unit

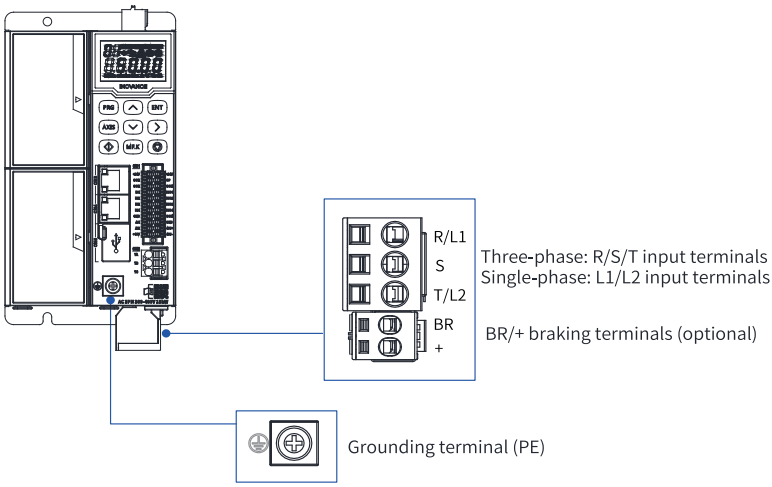



Table 3–1 Main circuit terminal description of the power supply unit

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

## Terminal Arrangement of the Drive Unit (Single-axis)

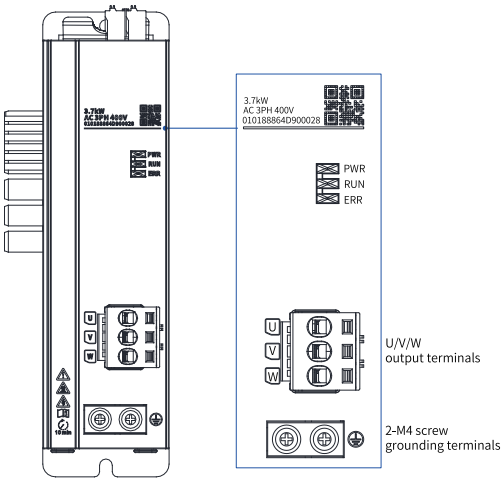



Table 3–2 Main circuit terminal description of the drive unit (single-axis)

| Terminal Code | Terminal Name | Function Description |
|---|---|---|
| U, V, W (single-axis drive unit) | Device output terminals | Used to connect a three-phase motor. |
|  | Grounding (PE) terminal | Used for protective grounding. |

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

| Indicator Code | Indicator Name | Status Description |
|---|---|---|
| PWR<br>(yellow) | Power indicator | Steady ON: powered on<br>OFF: powered off |
| RUN<br>(green) | Running indicator | Steady ON: running<br>OFF: stopped<br>Blinking: operated by the operating panel of the power supply unit |
| ERR<br>(red) | Alarm indicator | Steady ON: faulty<br>OFF: normal<br>Blinking: alarm |

## Terminal Arrangement of the Drive Unit (Dual-axis)

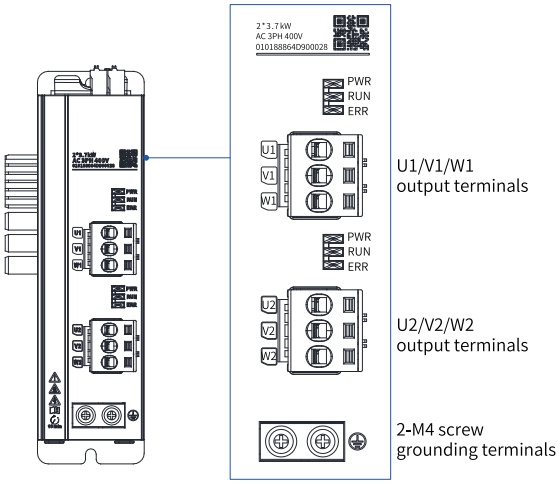



Table 3–4 Main circuit terminal description of the drive unit (dual-axis)

| Terminal Code | Terminal Name | Function Description |
|---|---|---|
| U1, V1, W1/U2, V2, W2 | Device output terminals | Used to connect a three-phase motor. |
|  | Grounding (PE) terminal | Used for protective grounding. |

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

| Indicator Code | Indicator Name | Status Description |
|---|---|---|
| PWR<br>(yellow) | Power indicator | Steady ON: powered on<br>OFF: powered off |
| RUN<br>(green) | Running indicator | Steady ON: running<br>OFF: stopped<br>Blinking: operated by the operating panel of the power supply unit |
| ERR<br>(red) | Alarm indicator | Steady ON: faulty<br>OFF: normal<br>Blinking: alarm |

**Terminal Arrangement of the Filter Unit**

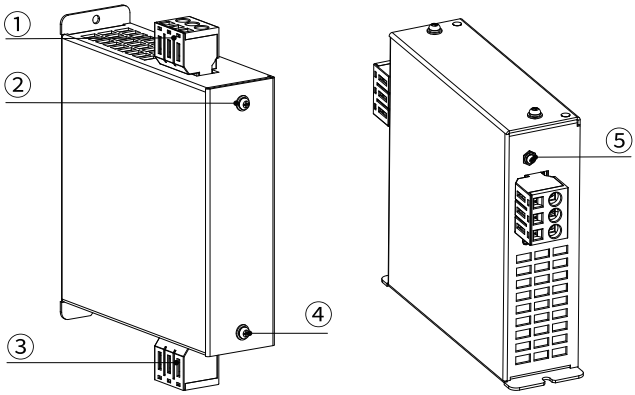



Table 3–6 Terminal description of the filter unit

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

## 3.1.2 Requirements on Wiring the Main Circuit

**Requirements on Wiring the Main Circuit**

- Terminals BR and (+) are optional. Avoid connecting them to the AC power supply.
- Ensure that the wiring length for the braking unit does not exceed 10 m. Use the twisted pair wire or tight pair wires for parallel wiring.
- Avoid connecting the braking resistor directly to the DC bus. Failure to comply may result in damage to the AC drive or even fire.
- Wiring and installation of external main circuits must comply with local regulations and related IEC requirements. Use copper lead wires of appropriate dimensions according to the recommendations on main circuit cable selection.
- To protect the main circuit, separate it from the possible contact surface and provide covers as required.

- Avoid connecting the output side to a capacitor or surge protection device. Failure to comply may result in frequent triggering of the protection mechanism or even damage to the AC drive.
- An excessively long motor cable may result in electrical resonance due to the distributed capacitance. The electrical resonance may in return lead to damage to motor insulation or high leakage current, triggering the overcurrent protection mechanism of the AC drive. When using a motor cable longer than 150 m, install an AC output reactor close to the AC drive.
- The control circuit is a safety extra-low voltage (SELV) circuit, which must be insulated and isolated from other circuits. Make sure that the control circuit is connected to the SELV circuit.
- Prevent foreign objects from entering the wiring part of the terminal block.
- Avoid welding when using stranded wires.
- Tightening torque required by terminals may vary. Tighten the screws in accordance with applicable requirements. Use screwdrivers, ratchets, or wrenches as appropriate. When using an electric tool to tighten the terminal screws, set the tool to a low speed to avoid damage to the terminal screws. Tighten the terminal screws at an angle within 5 degrees. Failure to comply may result in terminal screw damage.

### Requirements on Routing the Main Circuit

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

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

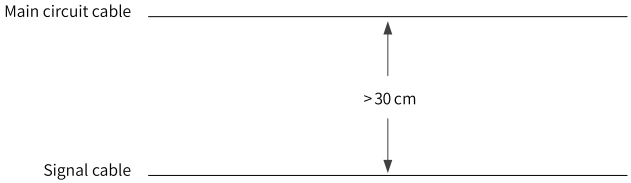



Figure 3-1 Routing of cables

## Motor Cable Length Requirements

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

When using a motor cable longer than the maximum length indicated in the following table, install an output reactor on the output side of the AC drive, or use a motor conforming to IEC60034-25 IVIC B. The output reactor can reduce the voltage stress on the motor winding.

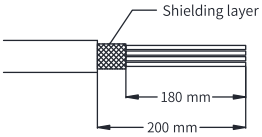
Table 3–7 Requirement for output reactor based on cable length and motor types

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

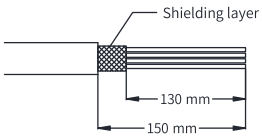
## Requirements on Preparing Motor Output Cables

Prepare the motor output cables as follows. (Taking the dual-axis drive unit of the AC drive as an example)

1. Peel off the insulation jacket and shield of the cable according to the following length requirements.

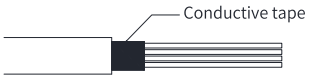



Cable connecting U1/V1/W1

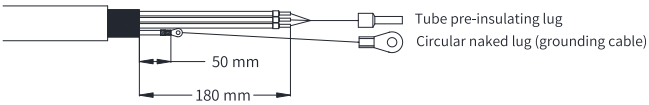



Cable connecting U2/V2/W2

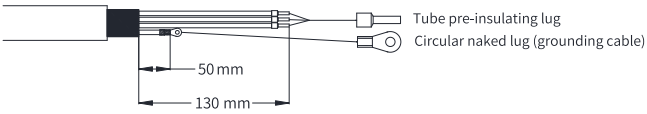
2. Leave the shield exposed, or wrap it with conductive adhesive tape for three turns.



3. Prepare lugs of U/V/W and ground cables according to the following length requirements.




Cable connecting U1/V1/W1




Cable connecting U2/V2/W

## 3.1.3 Lug Selection

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

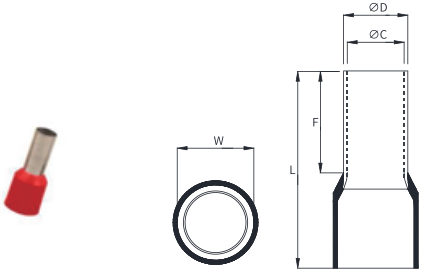



Figure 3-2 Appearance and dimensions of the tube pre-insulating lug (TG-JT type)

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

| Cable Section | Model | Dimensions (mm) | | | | | Insulating Casing Color (1) For Germany (2) For France | Crimp Tool |
|---|---|---|---|---|---|---|---|---|
| | | F | L | W | Dϕ | Cϕ | | |
| A.W.G.22<br>0.5 $mm^2$ | E0512 | 12 | 18 | 2.7 | 1.3 | 1 | (1) Orange<br>(2) White | OPT AN-04WF |
| A.W.G.20<br>0.75 $mm^2$ | E7512 | 12 | 18 | 2.8 | 1.5 | 1.2 | (1) White<br>(2) Blue | OPT AN-04WF |
| A.W.G.18<br>1.0 $mm^2$ | E1012 | 12 | 18.5 | 2.9 | 1.7 | 1.4 | (1) Yellow<br>(2) Red | OPT AN-04WF |

| Cable Section | Model | Dimensions (mm) | | | | | Insulating Casing Color (1) For Germany (2) For France | Crimp Tool |
|---|---|---|---|---|---|---|---|---|
| | | F | L | W | Dϕ | Cϕ | | |
| A.W.G.16<br>1.5 $mm^2$ | E1512 | 12 | 18.5 | 3.5 | 2 | 1.7 | (1) Red<br>(2) Black | OPT AN-04WF |
| A.W.G.14<br>2.5 $mm^2$ | E2512 | 12 | 19.5 | 4.1 | 2.6 | 2.3 | (1) Blue<br>(2) Gray | OPT AN-04WF |
| A.W.G.12<br>4.0 $mm^2$ | E4012 | 12 | 19.5 | 4.5 | 3.15 | 2.8 | (1) Gray<br>(2) Orange | OPT AN-10WF |
| A.W.G.10<br>6.0 $mm^2$ | E6012 | 12 | 20 | 6.4 | 3.85 | 3.5 | (1) Black<br>(2) Green | OPT AN-10WF |
| A.W.G.8<br>10 $mm^2$ | E10-12 | 12 | 22.5 | 7.7 | 5.05 | 4.7 | (1) Milk white<br>(2) Brown | OPT AN-16WF |

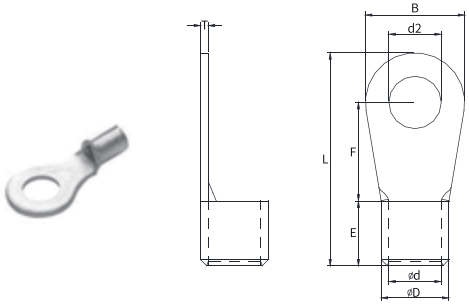



Figure 3-3 Appearance and dimensions of the circular naked lugs (TO Type)

Table 3–9 Specifications and dimensions of the circular naked lugs (TO Type)

| Cable Section | Model | Dimensions (mm) | | | | | | | | Crimp Tool |
|---|---|---|---|---|---|---|---|---|---|---|
| | | d2 | B | F | L | E | D | d | T | |
| A.W.G.22-16<br>0.5–1.5 $mm^2$ | RNBS 1.25-4 | 4.3 | 6.5 | 6 | 14.5 | 5 | 3.5 | 2 | 0.75 | IZUMI 5N18 |
| A.W.G.16-14<br>1.5-2.5 $mm^2$ | RNBS 2-4 | 4.3 | 6.5 | 6 | 14.5 | 5 | 4 | 2.5 | 0.8 | IZUMI 5N18 |
| A.W.G.14-12<br>2.5–4 $mm^2$ | RNB 3.5-4 | 4.3 | 8 | 8 | 18 | 6 | 5 | 3 | 1 | IZUMI 5N18 |
| A.W.G.12-10<br>4–6 $mm^2$ | RNBS 5.5-4 | 4.3 | 7 | 6 | 16.5 | 7 | 5.5 | 3.5 | 1 | IZUMI 5N18 |
| A.W.G.8<br>8 $mm^2$ | RNB 8-4 | 4.3 | 8.8 | 10.5 | 23.5 | 8.5 | 7 | 5 | 1.2 | IZUMI 5N18 |
| A.W.G.6<br>14 $mm^2$ | RNB 14-4 | 4.3 | 12 | 13.5 | 29.5 | 10.5 | 9 | 6 | 1.4 | OPT TP-150D |

### 3.1.4 Cable Selection for Main Circuit

#### Power Cable Selection Requirements

For the selection of power cables, follow the requirements specified by local countries or regions. The requirements for EC cable selection are as follows:

- Comply with EN 60204-1 and IEC 60364-5-52. To meet UL requirements, use 75°C copper wire that meets UL cable requirements.
- Use PVC copper wires.
- 40°C ambient temperature and 70°C cable surface temperature are required. (Note: Contact the manufacturer when the ambient temperature exceeds 40°C.)

## *Note*

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

The shielded cable must be used to satisfy the EMC requirements. Shielded cables are classified into the three-conductor cable and four-conductor cable, as shown in the following figure. If the conductivity of three-core cable shield is not sufficient, add an independent PE cable or use a four-conductor cable, of which one phase conductor is PE cable. To suppress radio frequency interference effectively, use coaxial copper braid as the shielding layer of cable. The braided density of cooper braid should be greater than 90% to enhance the shielding efficiency and conductivity.

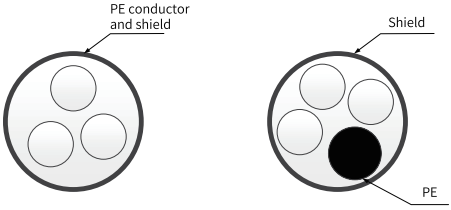



Figure 3-4 Recommended power cable types

## Recommended IEC Cable Specifications for the Main Circuit

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

| Category | Power (kW) | I/O terminals (RST, UVW) | | Braking terminals BR, + (Optional) | |
|---|---|---|---|---|---|
| | | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications |
| Power supply unit | 3.7 | 2.5 | E2512 | 2.5 | E2512 |
| | 7.5 | 6 | E6012 | 4 | E4012 |
| | 15 | 10 | E10-12 | 6 | E6012 |
| Drive unit | 0.4 | 0.75 | E7512 | - | - |
| | 0.75 | 0.75 | E7512 | - | - |
| | 1.5 | 0.75 | E7512 | - | - |
| | 2.2 | 0.75 | E7512 | - | - |
| | 3.7 | 1.5 | E1512 | - | - |
| | 5.5 | 2.5 | E2512 | - | - |
| | 7.5 | 4 | E4012 | - | - |

| Category | Power (kW) | Motor Grounding | | Protective Grounding | |
|---|---|---|---|---|---|
| | | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications |
| Power supply unit | 3.7 | N/A | N/A | 2.5 | RNBS2-4 |
| | 7.5 | N/A | N/A | 6 | RNBS5.5-4 |
| | 15 | N/A | N/A | 10 | RNB14-4 |
| Drive unit | 0.4 | 0.75 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 0.75 | 0.75 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 1.5 | 0.75 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 2.2 | 0.75 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 3.7 | 1.5 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 5.5 | 2.5 | RNBS2-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 7.5 | 4 | RNB3.5-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |

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

| Category | Power (kW) | I/O terminals (RST, UVW) | | Braking terminals BR, + (Optional) | |
|---|---|---|---|---|---|
| | | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications |
| Power supply unit | 2.2 | 6 | E6012 | 2.5 | E2512 |
| | 3.7 | 10 | E10-12 | 4 | E4012 |
| Drive unit | 0.2 | 0.75 | E7512 | - | - |
| | 0.4 | 0.75 | E7512 | - | - |
| | 0.75 | 0.75 | E7512 | - | - |
| | 1.5 | 1 | E1012 | - | - |
| | 2.2 | 1.5 | E1512 | - | - |

| Category | Power (kW) | Motor Grounding | | Protective Grounding | |
|---|---|---|---|---|---|
| | | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications |
| Power supply unit | 2.2 | N/A | N/A | 6 | RNBS5.5-4 |
| | 3.7 | N/A | N/A | 10 | RNB14-4 |
| Drive unit | 0.2 | 0.75 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 0.4 | 0.75 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 0.75 | 0.75 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 1.5 | 1 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 2.2 | 1.5 | RNBS1.25-4 | Same as the protective grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |

## Recommended NEC Cable Specifications for the Main Circuit

Table 3–12 Recommended NEC cable specifications for the main circuit (three-phase 380–480 V)

| Category | Power (kW) | I/O terminals | | Braking terminals BR, + (Optional) | |
|---|---|---|---|---|---|
| | | Recommended Cable Specifications (AWG) | Recommended Lug Specifications | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications |
| Power supply unit | 3.7 | 12 | E4012 | 14 | E2512 |
| | 7.5 | 8 | E10-12 | 10 | E6012 |
| | 15 | 6 | - | 10 | E6012 |
| Drive unit | 0.4 | 14 | E2512 | - | - |
| | 0.75 | 14 | E2512 | - | - |
| | 1.5 | 14 | E2512 | - | - |
| | 2.2 | 14 | E2512 | - | - |
| | 3.7 | 12 | E4012 | - | - |
| | 5.5 | 10 | E6012 | - | - |
| | 7.5 | 10 | E6012 | - | - |

| Category | Power (kW) | Motor Grounding | | Protective Grounding | |
|---|---|---|---|---|---|
| | | Recommended Cable Specifications (AWG) | Recommended Lug Specifications | Recommended Cable Specifications (AWG) | Recommended Lug Specifications |
| Power supply unit | 3.7 | N/A | N/A | 12 | RNB3.5-4 |
| | 7.5 | N/A | N/A | 8 | RNB8-4 |
| | 15 | N/A | N/A | 6 | RNB14-4 |
| Drive unit | 0.4 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 0.75 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 1.5 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 2.2 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 3.7 | 12 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 5.5 | 10 | RNBS5.5-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 7.5 | 10 | RNBS5.5-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |

## *Note*

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

Table 3–13 Recommended NEC cable specifications for the main circuit (single-phase 220–240 V)

| Category | Power (kW) | I/O terminals | | Braking terminals BR, + (Optional) | |
|---|---|---|---|---|---|
| | | Recommended Cable Specifications (AWG) | Recommended Lug Specifications | Recommended Cable Specifications ($mm^2$) | Recommended Lug Specifications |
| Power supply unit | 2.2 | 8 | E10-12 | 14 | E2512 |
| | 3.7 | 6 | - | 12 | E4012 |
| Drive unit | 0.2 | 14 | E2512 | - | - |
| | 0.4 | 14 | E2512 | - | - |
| | 0.75 | 14 | E2512 | - | - |
| | 1.5 | 14 | E2512 | - | - |
| | 2.2 | 14 | E2512 | - | - |

| Category | Power (kW) | Motor Grounding | | Protective Grounding | |
|---|---|---|---|---|---|
| | | Recommended Cable Specifications (AWG) | Recommended Lug Specifications | Recommended Cable Specifications (AWG) | Recommended Lug Specifications |
| Power supply unit | 2.2 | N/A | N/A | 8 | RNB8-4 |
| | 3.7 | N/A | N/A | 6 | RNB14-4 |
| Drive unit | 0.2 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 0.4 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 0.75 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 1.5 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |
| | 2.2 | 14 | RNBS2-4 | Same as the grounding cable specifications of the power supply unit in actual applications | Same as the protective grounding lug specifications of the power supply unit in actual applications |

## *Note*

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

## 3.2 Wiring of the Control Circuit

### 3.2.1 Control Circuit Terminals

#### Control Circuit Terminals of Power Supply Unit

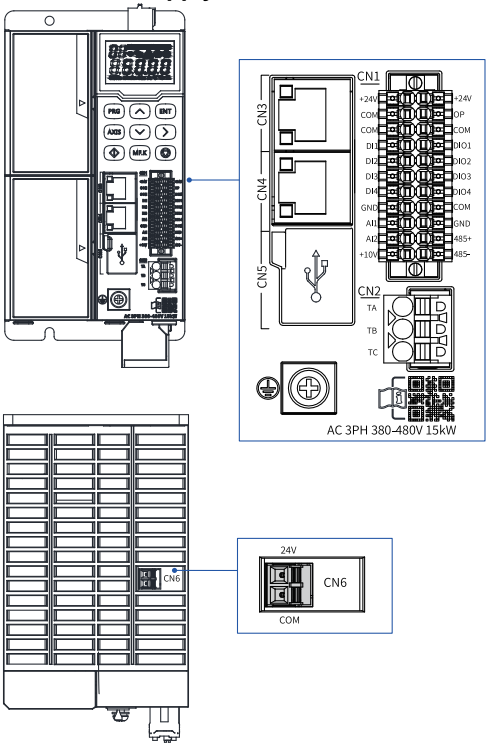
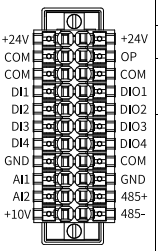



Figure 3-5 Arrangement of control circuit terminals of power supply unit

Table 3–14 Control terminals (CN1)

| Appearance | Interface Type | Code | Function | Performance Indicators |
|---|---|---|---|---|
|  | +24 V power output | +24 V | +24 V power output | Max. output current: 100 mA |
| | Digital common terminal | COM | +24 V output voltage reference terminal and digital common terminal | - |
| | Common terminal for multifunctional input terminal | OP | Common terminal for multifunctional input terminal | Internally isolated from COM and 24 V |
| | +10 V power output | +10 V | +10 V voltage for analog | Max. output current: 10 mA |
| | Analog common terminal | GND | Analog common terminal | - |
| | Analog input | AI1 | Analog input | The terminal may be assigned with a voltage input, current input, or temperature input function through parameter configuration.<br>A terminal assigned with the voltage or current input function supports –10 V to +10 V/0 mA to 20 mA, 12-bit resolution, correction accuracy 0.3%, and input impedance, 22 kΩ for voltage input and 500 Ω for current input.<br>Support for PT100, PT1000, KTY-84-130, and PTC-130 temperature detection. |
| | | AI2 | Analog input | |

| Appearance | Interface Type | Code | Function | Performance Indicators |
|---|---|---|---|---|
| (Continued) | Digital input | DI1 | Digital input terminal 1 | General DIs. Not supporting high-speed pulse input. Input frequency: < 100 Hz. Photocoupler isolation. Compatible with bipolar input. Input impedance: 3.3 kΩ. Input voltage range at active level: 15 V to 30 V |
| | | DI2 | Digital input terminal 2 | |
| | | DI3 | Digital input terminal 3 | |
| | | DI4 | Digital input terminal 4 | |
| | DIO | DIO1 | Digital input and output terminal 1 | General multifunctional input or output terminals. The input or output function is determined by corresponding parameters. When they are used for digital input, their specifications are the same as those of DI1-DI4. When they are used for digital output, they have the common collector open-drain output function, and cannot be directly connected to the power supply without adding a pull-up resistor in between. The resistance of the resistor is determined based on the load. The maximum output capacity is 24 VDC/50 mA. |
| | | DIO2 | Digital input and output terminal 2 | |
| | | DIO3 | Digital input and output terminal 3 | |
| | | DIO4 | Digital input and output terminal 4 | |
| | RS485 communication interface | RS485+ | Positive terminal for RS485 communication | Max. baud rate 115200 bps, 128 nodes, support for Modbus communication protocol. Wired in daisy chain topology. |
| | | RS485– | Negative terminal for RS485 communication | |
| | | GND | Grounding terminal for communication | |

Table 3–15 Relay terminals (CN2)

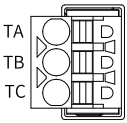
| Appearance | Interface Type | Code | Function | Performance Indicators |
|---|---|---|---|---|
|  | RO | TA | Common terminal | TA-TB: NC<br>TA-TC: NO<br>Contact capacity:<br>30 VDC/3 A<br>250 VAC/3 A (COSϕ = 0.4) |
| | | TB | NC terminal | |
| | | TC | NO terminal | |

Table 3–16 Communication and commissioning terminals (CN3, CN4, and CN5)

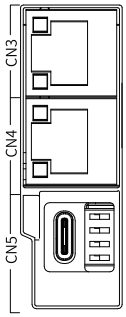
| Appearance | Interface Type | Code | Function | Performance Indicators |
|---|---|---|---|---|
|  | RJ45 network port | CN3 | 1. CAN communication interface.<br>2. Support for software upgrade and commissioning over GP-inolink. | Support for the CANopen/ CANlink protocol: max. baud rate 1 Mbps, 64 nodes, max. distance 1000 m. Wired in daisy chain topology. |
| | RJ45 network port | CN4 | 1. CAN communication interface.<br>2. Support for software upgrade and commissioning over GP-inolink.<br>3. Support for commissioning through connection to the SOP-20 operating panel. | |
| | USB type C | CN5 | Support for software upgrade and commissioning through connection to a computer. | USB 2.0 standard. |

Table 3–17 External 24 V input terminals (CN6)

| Appearance | Interface Type | Code | Function | Performance Indicators |
|---|---|---|---|---|
| 24V<br>  <br>COM | Positive terminal for +24 V power input | 24 V | Negative terminal for external 24 V power input. | Max. input current: 1 A. |
| | Negative terminal for +24 V power input | COM | | |

Table 3–18 DIP switch terminals

| Appearance | Terminal Name | Description | DIP Switch Position |
|---|---|---|---|
| CN5<br>  <br>ON-OFF | Selection of RS485 termination resistor | The termination resistor is connected when pins 1 and 2 are switched to ON. |  |
| | | The termination resistor is disconnected when pins 1 and 2 are switched to OFF. |  |
| | Selection of CAN termination resistor | The termination resistor is connected when pins 3 and 4 are switched to ON. |  |
| | | The termination resistor is disconnected when pins 3 and 4 are switched to OFF. |  |

Table 3–19 CN3 terminal pins

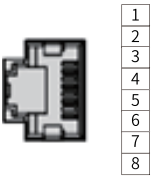
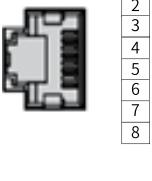
| No. | Code | Name | Arrangement |
|---|---|---|---|
| 1 | CANH | H terminal for CAN communication |  |
| 2 | CANL | L terminal for CAN communication | |
| 3 | CGND | Grounding terminal for CAN communication | |
| 4 | Reserved | Reserved | |
| 5 | Reserved | Reserved | |
| 6 | Reserved | Reserved | |
| 7 | Reserved | Reserved | |
| 8 | Reserved | Reserved | |



Table 3–20 CN4 terminal pins

| No. | Code | Name | Arrangement |
|---|---|---|---|
| 1 | CANH | H terminal for CAN communication |  |
| 2 | CANL | L terminal for CAN communication | |
| 3 | CGND | Grounding terminal for CAN communication | |
| 4 | Reserved | Reserved | |
| 5 | Reserved | Reserved | |
| 6 | Reserved | Reserved | |
| 7 | Reserved | Reserved | |
| 8 | Reserved | Reserved | |

## Control Circuit Terminals of Drive Unit (Single-Axis)

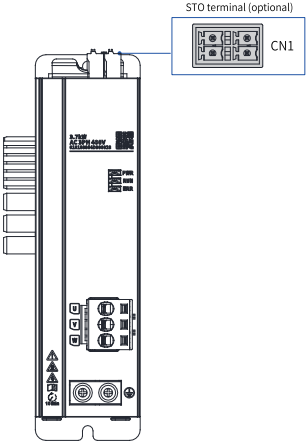
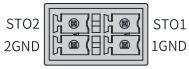



Figure 3-6 Arrangement of STO terminals of drive unit (single-axis)

Table 3–21 STO terminals of drive unit (single-axis) (optional)

| Appearance | Code | Terminal Name | Performance Indicators |
|---|---|---|---|
|   | STO1 | STO channel 1 power positive | 24 V input |
| | 1GND | STO channel 1 power negative | |
| | STO2 | STO channel 2 power positive | |
| | 2GND | STO channel 2 power negative | |

## Control Circuit Terminals of Drive Unit (Dual-Axis)

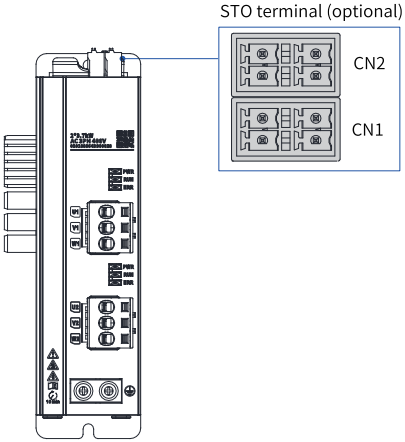



Figure 3-7 Arrangement of STO terminals of drive unit (dual-axis)

Table 3–22 STO terminals of drive unit (dual-axis) (optional)

| Appearance | Code | Terminal Name | Performance Indicators |
|---|---|---|---|
| STO2 2GND STO1 1GND | STO1 | STO channel 1 power positive | 24 V voltage input, fluctuation ±10%. |
| | 1GND | STO channel 1 power negative | |
| | STO2 | STO channel 2 power positive | |
| | 2GND | STO channel 2 power negative | |

## 3.2.2 Expansion Card Functions

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

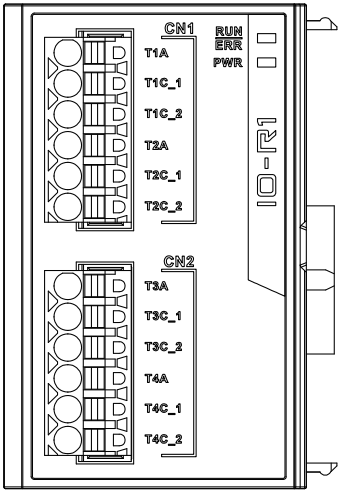



Figure 3-8 Terminal arrangement of the single-contact relay output card (IO-R1)

Table 3–23 Terminal functions of the single-contact relay output card (IO-R1)

| Terminal Type | Terminal Code | Terminal Function | Specifications |
|---|---|---|---|
| CN1 | T1A | Common terminal 1 | TA-TC: NO<br>Contact capacity:<br>30 VDC/3 A<br>250 VAC/3 A (Cosϕ = 0.4) |
| | T1C_1 | NO terminal 1_1 | |
| | T1C_2 | NO terminal 1_2 | |
| | T2A | Common terminal 2 | |
| | T2C_1 | NO terminal 2_1 | |
| | T2C_2 | NO terminal 2_2 | |
| CN2 | T3A | Common terminal 3 | |
| | T3C_1 | NO terminal 3_1 | |
| | T3C_2 | NO terminal 3_2 | |
| | T4A | Common terminal 4 | |
| | T4C_1 | NO terminal 4_1 | |
| | T4C_2 | NO terminal 4_2 | |

Table 3–24 Indicators of the single-contact relay output card (IO-R1)

| Indicator | | State Description | Solution |
|---|---|---|---|
| RUN/ERR | Green indicator steady ON | Normal running state | N/A |
| | Green indicator blinking | The expansion card is in initialization state. | N/A |
| | Green indicator OFF | Waiting for initialization of the power supply unit | N/A |
| | Red indicator steady ON | Hardware fault | Replace the expansion card. |
| | Red indicator blinking | Data frame loss or communication disconnection with the power supply unit or drive unit | 1. Check the hardware connection.<br>2. Check whether the power supply unit or drive unit is normal.<br>3. If the hardware connection, power supply unit, and drive unit are normal, replace the expansion card. |
| | Red and green indicators blinking alternatively | Internal communication bus in the BUSOFF state, and communication restart in progress | Replace the expansion card if the state is not recovered. |
| PWR | Yellow indicator steady ON | Power normal | N/A |
| | Yellow indicator OFF | Power supply abnormal | Replace the expansion card. |

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

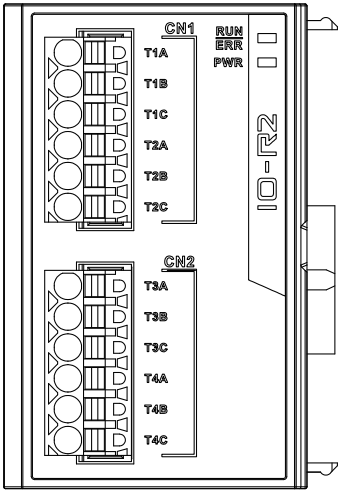



Figure 3-9 Terminal arrangement of the dual-contact relay output card (IO-R2)

Table 3–25 Terminal functions of the dual-contact relay output card (IO-R2)

| Terminal Type | Terminal Code | Terminal Function | Specifications |
|---|---|---|---|
| CN1 | T1A | Common terminal 1 | TA-TB: NC<br>TA-TC: NO<br>Contact capacity:<br>30 VDC/3 A<br>250 VAC/3 A (Cosϕ = 0. 4) |
| | T1B | NC terminal 1 | |
| | T1C | NO terminal 1 | |
| | T2A | Common terminal 2 | |
| | T2B | NC terminal 2 | |
| | T2C | NO terminal 2 | |
| CN2 | T3A | Common terminal 3 | |
| | T3B | NC terminal 3 | |
| | T3C | NO terminal 3 | |
| | T4A | Common terminal 4 | |
| | T4B | NC terminal 4 | |
| | T4C | NO terminal 4 | |

Table 3–26 Indicators of the dual-contact relay output card (IO-R2)

| Indicator | | State Description | Solution |
|---|---|---|---|
| RUN/ERR | Green indicator steady ON | Normal running state | N/A |
| | Green indicator blinking | The expansion card is in initialization state. | N/A |
| | Green indicator OFF | Waiting for initialization of the power supply unit | N/A |
| | Red indicator steady ON | Hardware fault | Replace the expansion card. |
| | Red indicator blinking | Data frame loss or communication disconnection with the power supply unit or drive unit | 1. Check the hardware connection.<br>2. Check whether the power supply unit or drive unit is normal.<br>3. If the hardware connection, power supply unit, and drive unit are normal, replace the expansion card. |
| | Red and green indicators blinking alternatively | Internal communication bus in the BUSOFF state, and communication restart in progress | Replace the expansion card if the state is not recovered. |
| PWR | Yellow indicator steady ON | Power normal | N/A |
| | Yellow indicator OFF | Power supply abnormal | Replace the expansion card. |

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

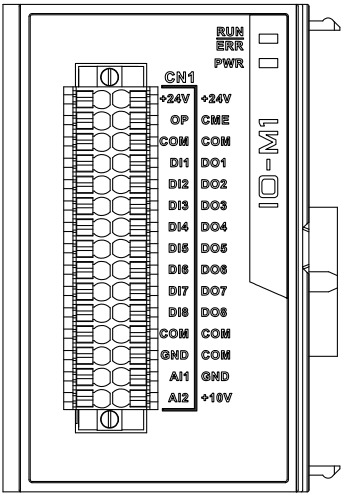



Figure 3-10 Terminal arrangement of the multi-functional card (IO-M1)

Table 3–27 Terminal functions of the multi-functional card (IO-M1)

| Terminal Code | Terminal Function | Terminal Type | Specifications |
|---|---|---|---|
| +24V | 24 V power supply | - | 24V±10%, maximum: 100 mA |
| OP | Common terminal for multi-functional input terminal | - | - |
| CME | Multi-functional output common terminal | - | - |
| COM | - | - | - |
| DI1 | DI terminal 1 | Digital input | DI1 to DI8 are ordinary DIs whose response time is 10 ms. They do no support for high-speed pulse input. Their input frequency is lower than 100 Hz. Photocoupler isolation is supported and they are compatible with bipolar input. Input impedance: 3.3 kΩ Effective level input voltage range: 15–30 V |
| DI2 | DI terminal 2 | | |
| DI3 | DI terminal 3 | | |
| DI4 | DI terminal 4 | | |
| DI5 | DI terminal 5 | | |
| DI6 | DI terminal 6 | | |
| DI7 | DI terminal 7 | | |
| DI8 | DI terminal 8 | | |

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

Table 3–28 Indicators of the multi-functional card (IO-M1)

| Indicator | | State Description | Solution |
|---|---|---|---|
| RUN/ERR | Green indicator steady ON | Normal running state | N/A |
| | Green indicator blinking | The expansion card is in initialization state. | N/A |
| | Green indicator OFF | Waiting for initialization of the power supply unit | N/A |
| | Red indicator steady ON | Hardware fault | Replace the expansion card. |
| | Red indicator blinking | Data frame loss or communication disconnection with the power supply unit or drive unit | 1. Check the hardware connection.<br>2. Check whether the power supply unit or drive unit is normal.<br>3. If the hardware connection, power supply unit, and drive unit are normal, replace the expansion card. |
| | Red and green indicators blinking alternatively | Internal communication bus in the BUSOFF state, and communication restart in progress | Replace the expansion card if the state is not recovered. |
| PWR | Yellow indicator steady ON | Power normal | N/A |
| | Yellow indicator OFF | Power supply abnormal | Replace the expansion card. |

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

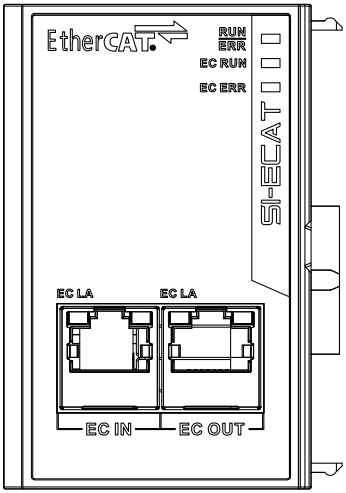



Figure 3-11 Terminal arrangement of the EtherCAT communication card (SI-ECAT)

The EtherCAT communication expansion card (SI-ECAT) is connected to the EtherCAT master station using the standard Ethernet RJ45 socket. Its pin signal definitions are the same as those of the standard Ethernet pins. They can be connected using crossover cables or straight-through cables.

Table 3–29 Terminal functions of the EtherCAT communication expansion card (SI-ECAT)

| Terminal Code | Terminal Name | Description |
|---|---|---|
| EC IN | Input terminal | After installation, EC IN is on the left and ECAT OUT is on the right when facing to the RJ45 interface. The two interfaces must be connected correctly.<br>The Cat5e shielded twisted pair (STP) network cable must be used for ensuring stability.<br>To improve the anti-interference capability of communication, it is recommended to install it in the expansion card slot 2. |
| EC OUT | Output terminal | |

Table 3–30 Indicators of the EtherCAT communication expansion card (SI-ECAT)

| Indicator | | State Description | Solution |
|---|---|---|---|
| RUN/ERR | Green indicator steady ON | Communication normal | N/A |
| | Red indicator steady ON | ECAT card and node communication timeout | Check the connector for interference. |
| | Red indicator blinking slowly | ECAT card and power supply unit communication timeout | 1. Check that the communication card is installed correctly.<br>2. Check whether the power supply unit is normal. |
| | Red indicator blinking quickly | ECAT card faulty | Troubleshoot the fault according to the fault code displayed on the operating panel of the power supply unit. |
| EC RUN | Green indicator blinking slowly | EtherCAT state machine status: disconnection | N/A |
| | Green indicator OFF | EtherCAT state machine status: INIT = initializing | N/A |
| | Green indicator blinking quickly | EtherCAT state machine status: PREOP = pre-operational | N/A |
| | Green indicator blinking once | EtherCAT state machine status: SAFEOP = safe operation | N/A |
| | Green indicator steady ON | EtherCAT state machine status: OP = operating | N/A |
| EC ERR | Red indicator OFF | EtherCAT communication normal | N/A |
| | Red indicator steady ON | EtherCAT communicate faulty | Check the fault code on the operating panel of the power supply unit. |

| Indicator | | State Description | Solution |
|---|---|---|---|
| EC LA | Yellow indicator OFF | No connection with the previous EtherCAT device | N/A |
| | Yellow indicator steady ON | Connected with the previous EtherCAT device | N/A |
| | Green indicator OFF | No data exchange with the network interface | N/A |
| | Green indicator blinking | Data exchange with the network interface | N/A |

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

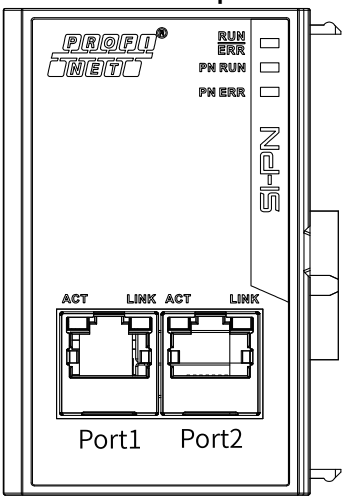



Figure 3-12 Terminal arrangement of the PROFINET communication expansion card (SI-PN)

The PROFINET communication expansion card (SI-PN) is connected to the PROFINET master station using the standard Ethernet RJ45 socket. Its pin signal definitions are the same as those of the standard Ethernet pins. They can be connected using crossover cables or straight-through cables.

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

| Terminal Code | Terminal Name | Description |
|---|---|---|
| Port1 | Network port Port1 | Connection terminals (Port1 for input and Port2 for output)<br>After installation, Port1 is on the left and Port2 is on the right when facing to the RJ45 interface.<br>The Cat5e shielded twisted pair (STP) network cable is recommended for ensuring stability.<br>To improve the anti-interference capability of communication, it is recommended to install it in the expansion card slot 2. |
| Port2 | Network port Port2 | |

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

| Indicator | | State Description | Solution |
|---|---|---|---|
| RUN/ERR | Green indicator steady ON | Communication normal | N/A |
| | Red indicator steady ON | PROFINET expansion card and node communication timeout | 1. Restart the PROFINET card.<br>2. Eliminate field interference. |
| | Red indicator blinking quickly (500 ms) | PROFINET expansion card internal communication timeout | |
| | Red indicator blinking slowly (1s) | PROFINET expansion card and power supply unit timeout | |
| PN RUN | Steady ON | PROFINET expansion card communication normal | N/A |
| PN ERR | Steady ON | Communication with the master station interrupted | Check the wiring. |
| | Blinking | Blinking request sent by master station | N/A |

## 3.2.3 Wiring Description of Control Circuit Terminals

### Wiring of Analog Input Terminals (AI1–AI2)

Weak analog voltage signals are prone to suffer external interference. Therefore, the shielded cable shorter than 20 m is required. In applications where the analog signal suffers severe interference, install a filter capacitor or ferrite core at the analog signal source.

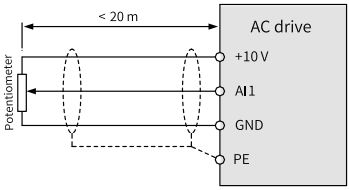



Figure 3-13 Wiring of AI terminals

### Wiring of Digital Input Terminals (DI1–DI4)

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

- Sink wiring mode
  - Using the internal 24 V power supply of the AC drive is the most commonly used wiring mode. In this mode, the OP terminal and 24 V terminal of the AC drive are shorted, and the COM terminal is connected to the 0V terminal of the external controller, as shown in the following figure.

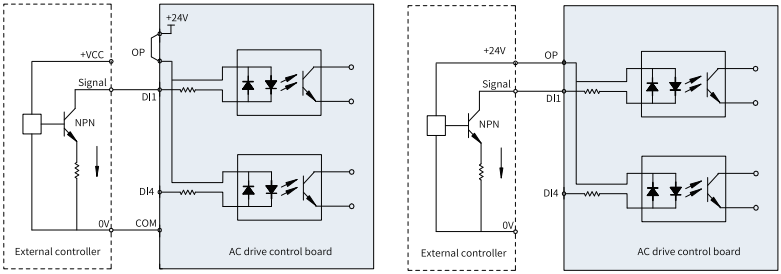



Figure 3-14 Sink wiring mode

  - If an external 24 V power supply is used, the jumper between the +24 V and the OP terminals must be removed, the 24 V positive electrode of the external power supply must be connected to the OP terminal, and the 0 V terminal of the external power supply must be connected to a corresponding DI terminal through the controller contact. See the following figure.

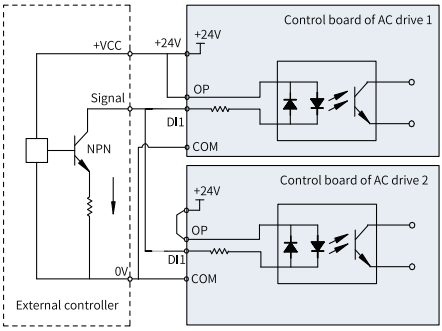



Figure 3-15 Parallel connection of DI terminals (multiple AC drives) in sink mode

- Source wiring mode
  - If the 24 V internal power supply of the AC drive is used, the jumper between the + 24V and the OP terminals must be removed, the OP and the COM terminals must be connected, and the + 24V terminal and the common terminal of the external controller must be connected, as shown in the following figure.
  - If an external power supply is used, the jumper between the +24 V and the OP terminals must be removed, the 0V terminal of the external power supply must be connected to the OP terminal, and the 24V positive electrode of the external power supply must be connected to a corresponding DI terminal through the external controller contact.

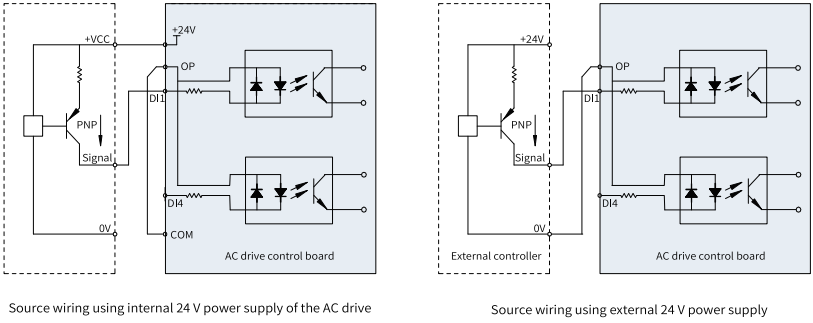



Figure 3-16 Source wiring mode

### Wiring of Digital Input/Output Terminals (DIO1–DIO4)

DIO1 to DIO4 can be used as DI or DO terminals, which can be set by F4-41. They are used as DI terminals by default and cannot be used as both DI terminals and DO terminals at the same time.

When they are used as DI terminals, their wiring mode is consistent with that of DI1 to DI4. When they are used as DO terminals, the DO common terminal is COM and only the sink wiring mode is supported, as shown in the following figure. In this case, it is recommended that the DI common terminal OP be connected to the 24V terminal. If the OP terminal is connected to the COM terminal, the customer's device may receive input signals before signals are output through the DIO terminal.

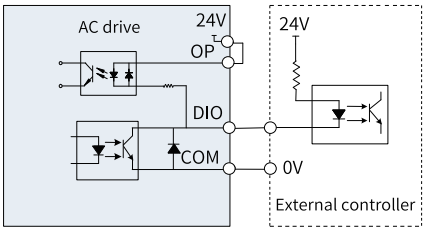



Figure 3-17 Wiring of DIO terminals used as DO terminals

## Wiring of Relay Output Terminals

The inductive load (relay, contactor, and motor) causes voltage spike after the current is removed. A voltage dependent resistor (VDR) must be used for protection at the relay contact and absorption circuits such as VDRs, RC absorption circuits and diodes must be installed on inductive loads to ensure minimum interference during cutoff.

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

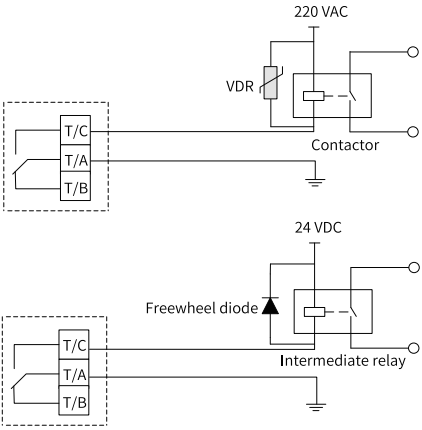



Figure 3-18 Anti-interference processing of relay output terminals

## *Note*

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

### 3.2.4 Control Circuit Wiring Requirements

## *Note*

Connect the control circuit cables according to EN 60204-1.

#### Cable Selection Requirements for the Control Circuit

To avoid the influence of strong external interference noise on the control circuit, it is recommended that the shielded cable with shielding layer be used as the signal cable. The shielding layer must be connected to the equipment in 360° with signal shielding brackets at both ends of the shielding layer. Separate shielded cables should be used for different analog signals, and shielded twisted pair (STP) cables are recommended for digital signal cables.

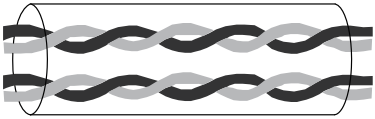


Figure 3-19 STP

Table 3–33 Recommended cable specifications for the control circuit

| Category | Terminal Type | Recommended IEC Cable Specifications ($mm^2$) | Recommended NEC Cable Specifications (AWG) | Recommended Lug Specifications |
|---|---|---|---|---|
| Power supply unit and optional expansion card | Control signal terminal | 0.5 | 22-20 | IEC:<br>0.5 $mm^2$ (E0512)<br>0.75 $mm^2$ (E7512)<br>1 $mm^2$ (E1012)<br>1.5 $mm^2$ (E1512)<br>NEC:<br>22 AWG (E0512)<br>20 AWG (E0512)<br>18 AWG (E1012)<br>16 AWG (E1512)<br>For details about the lug specifications, see *"3.1.3 Lug Selection" on page 52*. |
| | 24 V input terminal | 0.5-1.5 | 22-16 | |
| | Relay terminal | 0.5-1.5 | 22-16 | |
| Drive unit | STO terminal (optional) | 0.5 | 22-20 | |

## Wiring Requirements for the I/O Signal Cables

- I/O signals include analog input (AI), analog output (AO), digital input (DI), digital output (DO) and relay output signals. Before wiring the I/O terminals, disconnect the main power supply and ensure that the danger indicator of the AC drive is off.
- To avoid interference on the I/O signals, separate the I/O signal cables at least 30 cm from the main circuit cables (three-phase R/S/T and U/V/W, or single-phase L1/L2) and other power cables (or power lines).
- To avoid malfunction of the AC drive and equipment, separate the cable connecting the relay output terminal from other I/O signal cables by more than 30 cm.

# 3.3 Communication Connection

## 3.3.1 RS485 Communication Wiring

### RS485 Communication Connection with PLC

Use a three-conductor shielded cable as the RS485 bus. The AC drive comes with three cables for connection to the RS485+, RS485-, and GND terminals. The cables for RS485+ and RS485- connection are twisted-pair shielded cables. The shield is used to connect GND.

Table 3–34 Cable pin connections for communication between PLC and the AC drive

| AC Drive | | PLC | |
|---|---|---|---|
| Communication Type | Signal | Communication Type | Signal |
| RS485 | RS485+ | RS485 | RS485+ |
| | RS485– | | RS485– |
| | GND | | GND |

### RS485 Communication Connection for Multiple AC Drives in Parallel

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

Table 3–35 Cable pin connections for communication between multiple AC drives in parallel

| AC Drive (Side A) | | AC Drive (Side B) | |
|---|---|---|---|
| Communication Type | Signal | Communication Type | Signal |
| RS485 | RS485+ | RS485 | RS485+ |
| | RS485– | | RS485– |
| | GND | | GND |

Use the daisy chain topology for the RS485 bus in the case of a large number of nodes, as shown in the following figure. Ensure that the RS485 signal reference ground of all nodes are connected together. A maximum of 128 nodes can be connected.

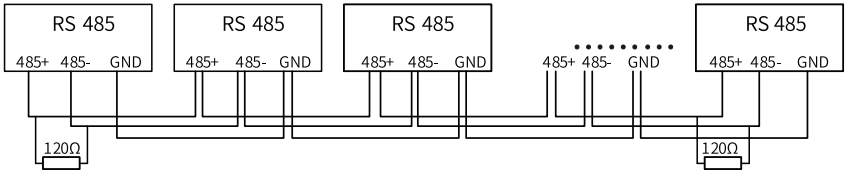



Figure 3-20 RS485 bus topology

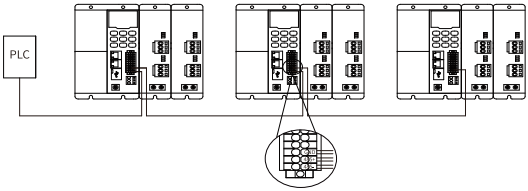



Figure 3-21 Daisy chain topology

### Transmission Distance

The maximum allowable number of nodes and transmission distance of a standard RS485 circuit vary with transmission rates, as listed in the following table.

Table 3–36 Maximum number of nodes and transmission distance

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

### Settings of Termination Resistor

Table 3–37 Settings of Termination Resistor

| Port | | Pin Description |
|---|---|---|
| Pin | Network Name | |
| 1 | DIP switch for enabling/ disabling RS485 termination resistor | When pins 1 and 2 are switched to ON, the RS485 termination resistor is enabled. This RS485 termination resistor is disabled by default. |
| 2 | | |

## 3.3.2 CAN Communication Wiring

### CAN Communication Connection with PLC

The power supply unit is provided with two RJ45 network ports for the CAN bus. Use a Cat 5e shielded network cable for connection. Connect the head and tail of the bus each to a 120 Ω termination resistor to prevent CAN signal reflection.

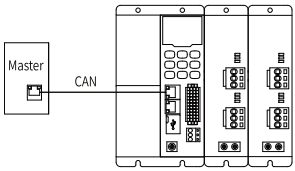



Figure 3-22 Topology of CAN communication with PLC

### CAN Communication Connection for Multiple AC Drives in Parallel

Use Cat 5e shielded network cables to connect the AC drives in series, as shown in the topology below. Up to 64 nodes can be connected. Connect the head and tail of the bus each to a 120 Ω termination resistor to prevent CAN signal reflection.

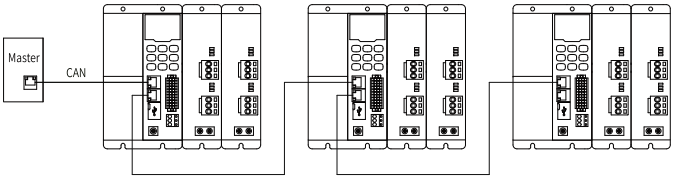



Figure 3-23 CAN bus topology

### Transmission Distance

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

Table 3–38 Transmission distance and rate

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

### Settings of Termination Resistor

Table 3–39 Settings of termination resistor

| Port Definition | | Pin Description |
|---|---|---|
| Pin | Network Name | |
| 3 | DIP switch for CAN termination resistor | When pins 3 and 4 are switched to ON, the CAN termination resistor is enabled. This CAN termination resistor is disabled by default. |
| 4 | | |

### 3.3.3 Ethernet Wiring

#### Communication Networking

The AC drive supports two types of Ethernet buses: PROFINET and EtherCAT. Use standard RJ45 network ports and registered jacks. Use Cat 5e shielded twisted pair cables and injection-molded wires with iron shells to connect to the Ethernet master station. You can configure communication parameters to enable the AC drive to communicate with the Ethernet master station, thereby implementing networking of the AC drive.

Ethernet supports a variety of topologies, including bus, star, and tree topologies. Different networking modes can be implemented by using switches.

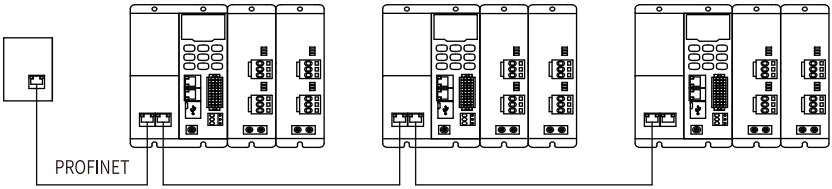



Figure 3-24 PROFINET bus topology

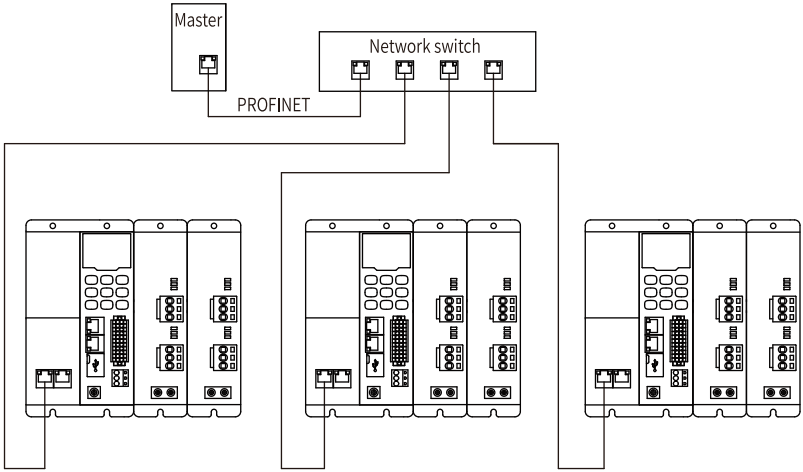



Figure 3-25 PROFINET star topology

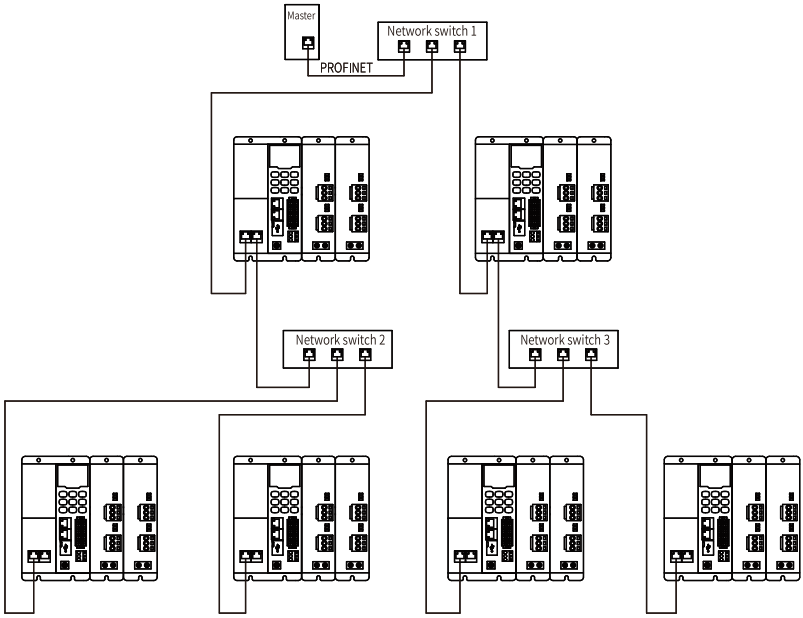



Figure 3-26 PROFINET tree topology

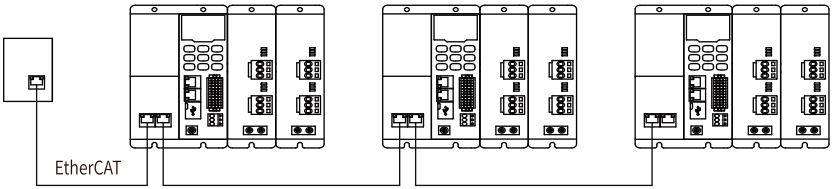



Figure 3-27 EtherCAT bus topology

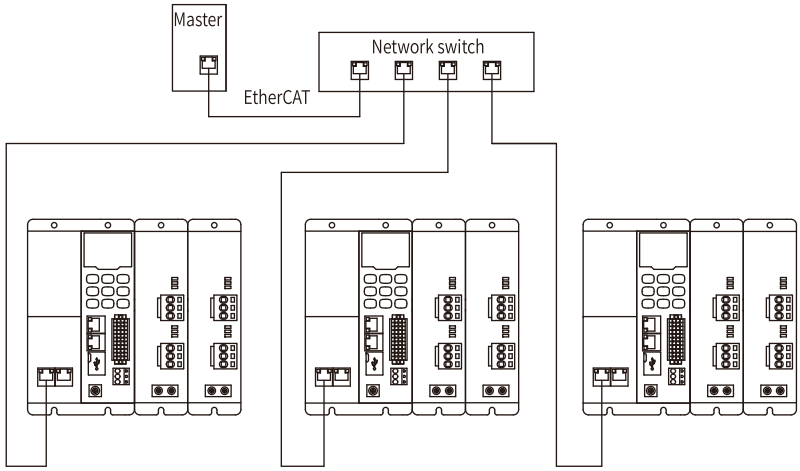



Figure 3-28 EtherCAT star topology

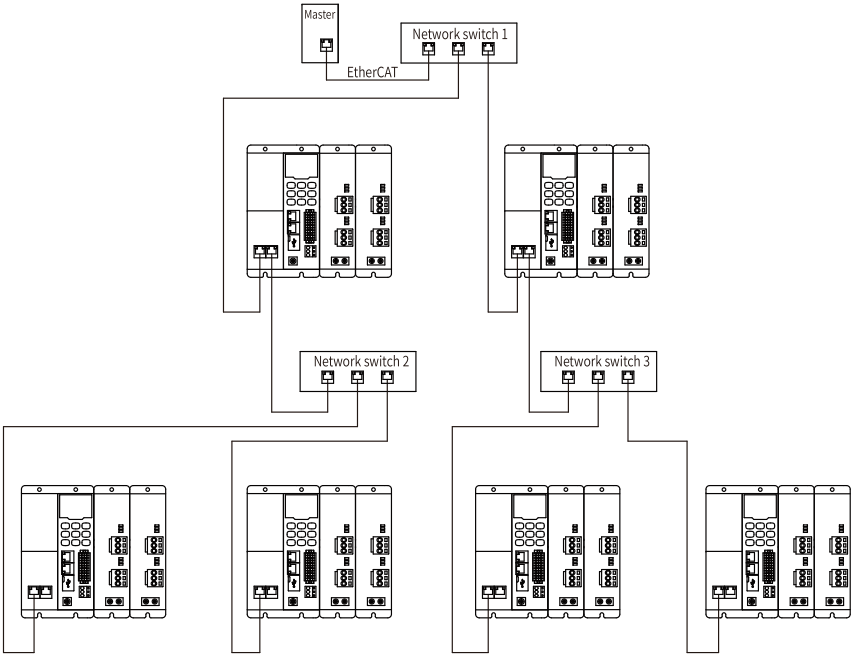



Figure 3-29 EtherCAT tree topology

## Cable Specifications

Use a shielded cable as the Ethernet bus for network data transmission. Network cables of the specifications specified in the following table are recommended.

Table 3–40 Ethernet cable specifications

| Item | Specifications |
|---|---|
| Cable type | Elastic crossover cable (8P8C straight-through cable), S-FTP, Cat 5e |
| Standard compliance | EIA/TIA568A, EN50173, ISO/IEC11801<br>EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36 |
| Lead wire cross section | AWG 26 |
| Lead wire type | Twisted pair cable |
| Pair | 4 |

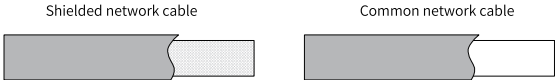



Figure 3-30 Shielded network cables

During wiring, hold the registered jack of the RJ45 network cable and insert it in the RJ45 port of the communication module until you hear a click sound. To remove the RJ45 network cable, press and hold the tail of the registered jack, and pull it out along the direction parallel with the module.

To avoid the influence of other stress on the communication cable and ensure the stability of communication, fasten the cable near the equipment before starting Ethernet communication.

A ring or linear topology can be implemented by using two ports on the AC drive. In this case, connect the head or tail of the cable to only one of the two ports. Check that any cable between two nodes is within 100 m in length.

## *Note*

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

## 3.4 Grounding

### 3.4.1 Main Circuit Grounding Requirements




- Ground the grounding terminal to avoid electric shocks. Comply with the relevant local electrical regulations for grounding.
- To prevent electric shocks, ensure that the protective grounding conductor meets the technical specifications and local safety standards, and shorten the grounding cable length as much as possible. The leakage current of the product will exceed 3.5 mA, so copper cables with a cross-sectional area of at least 10 $mm^2$ must be used as protective grounding conductors according to EN 61800-5-1, or two protective grounding conductors of the same specification shall be used for connection.
- When using multiple devices, follow the instructions for grounding all devices. Incorrect equipment grounding will lead to misoperation of equipment.

Main circuit grounding requirements:

- Use a proper yellow-green copper wire for protective grounding conductor, and do not connect it to switches such as circuit breakers.
- The grounding terminal must be reliably grounded to ensure normal running of the equipment and avoid equipment damage.
- Do not connect the grounding terminal to the N terminal of the power supply.
- It is recommended that the equipment be installed on a conductive metal surface to ensure that the entire conductive bottom of the equipment is properly overlapped with the installation surface.
- The grounding screws must be fixed with the recommended tightening torque to avoid loose or too tight fixing of the protective grounding conductor.

### 3.4.2 Grounding of the Control Board

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

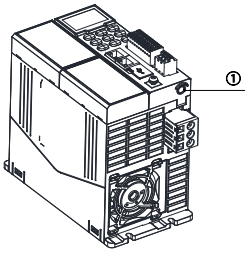



Figure 3-31 Position of the EMC grounding screw of the control board

### 3.4.3 Grounding of a Single Device

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

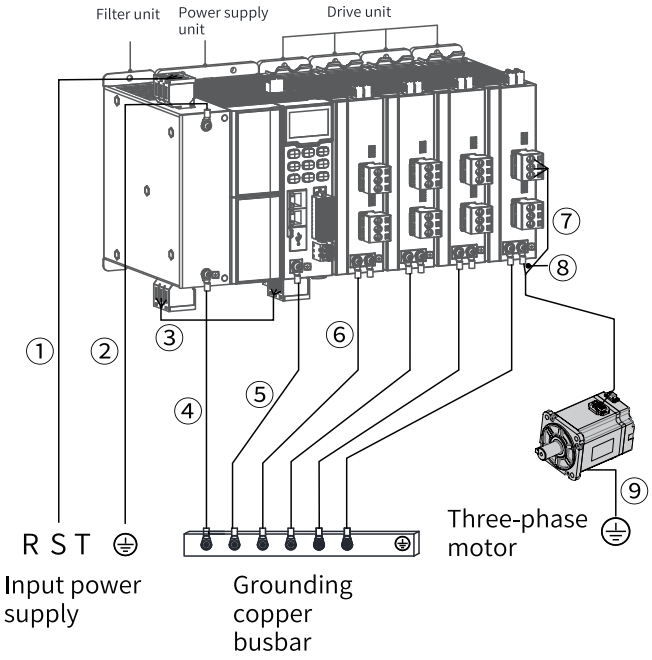



Figure 3-32 Equipment grounding

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

## *Note*

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

### 3.4.4 Grounding of Multiple Devices

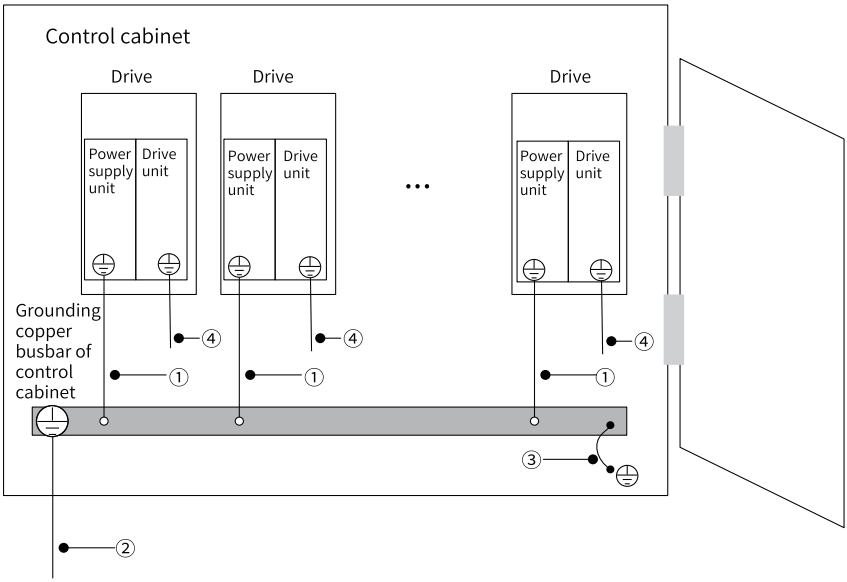



Figure 3-33 Grounding in parallel connection

Table 3–41 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. |

### 3.4.5 Grounding of the Cabinet System

The most economical and effective measure to suppress interference in the cabinet is to isolate the interference source from the equipment that may be interfered during installation. According to the strength of interference sources, the electric cabinet must be divided into multiple EMC areas or multiple cabinets, and the equipment

must be installed in the corresponding areas according to the wiring requirements in the following table.

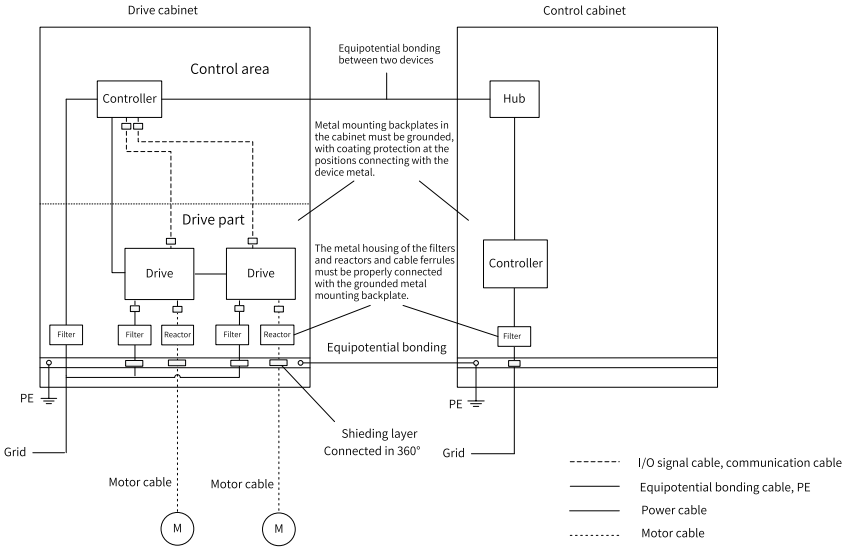



Figure 3-34 Recommended cabinet system grounding

Table 3–42 Cabinet system grounding requirements

| No. | Wiring Requirements |
|---|---|
| 1 | Place the control equipment and the drive equipment in two separate cabinets. |
| 2 | When multiple cabinets are used, grounding cables with a cross-sectional area of at least 16 $mm^2$ shall be used for connection between cabinets to realize equipotential between cabinets. |
| 3 | Place the equipment in different areas according to the signal strength inside the cabinet. |
| 4 | Equipotential bonding must be carried out for equipment in different areas of the cabinet. |
| 5 | All communication (for example, RS485) and signal cables leading from the electrical cabinet must be shielded. |
| 6 | The power input filter in the cabinet must be placed close to the cabinet input interface. |
| 7 | Each grounding point in the cabinet must be protected by spraying. |

# 4 Selection of Options

## 4.1 Peripheral Electrical Devices

### 4.1.1 Fuse, Circuit Breaker, and Contactor

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

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

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

| Model of Power Supply Unit | Rated Input Current (Heavy Load) (A) | Recommended Fuse | | | Recommended contactor | Recommended Circuit Breaker |
|---|---|---|---|---|---|---|
| | | Semiconductor Fuse (Bussmann) | | Semiconductor Fuse (Class J) | | |
| | | Rated Current (A) | Model | Rated Current (A) | Rated Current (A) | Rated Current (A) |
| Single-phase 200–240 V | | | | | | |
| MD800-0-2S24<br>MD800-0-2S24B | 24 | 40 | FWP-40B | 35 | 26 | 35 |
| MD800-0-2S40<br>MD800-0-2S40B | 40 | 60 | FWP-60B | 60 | 50 | 60 |
| Three-phase 380–480 V | | | | | | |
| MD800-0-4T12<br>MD800-0-4T12B | 12 | 25 | FWP-25B | 25 | 16 | 25 |
| MD800-0-4T22<br>MD800-0-4T22B | 22 | 50 | FWP-50B | 50 | 26 | 50 |
| MD800-0-4T41<br>MD800-0-4T41B | 41 | 60 | FWP-60B | 60 | 50 | 60 |

### 4.1.2 AC Input Reactor

The AC input reactor is an option used to suppress the harmonics in the input current. In applications where strong suppression of harmonics is required, install an external AC input reactor.

**Model and Dimensions (Inovance)**

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

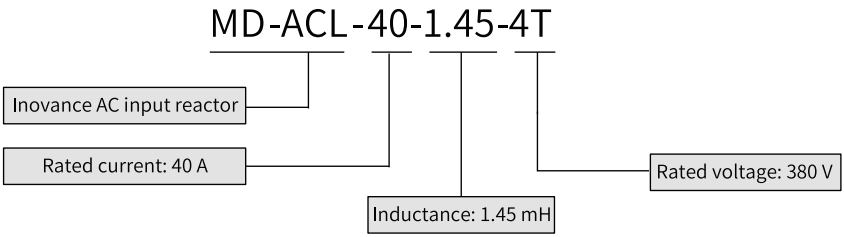



Figure 4-1 AC input reactor model

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

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

Dimensions of the AC input reactor

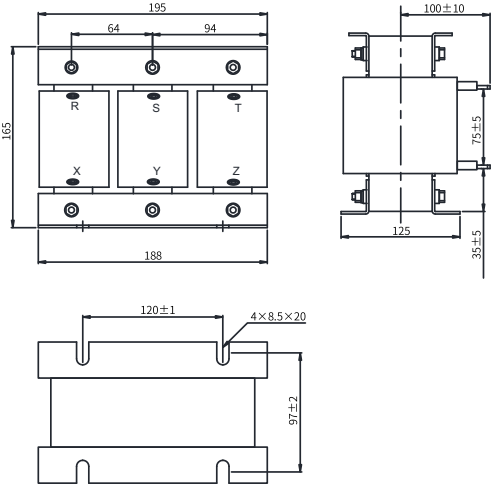



Figure 4-2 Dimensions of 15 A AC input reactor

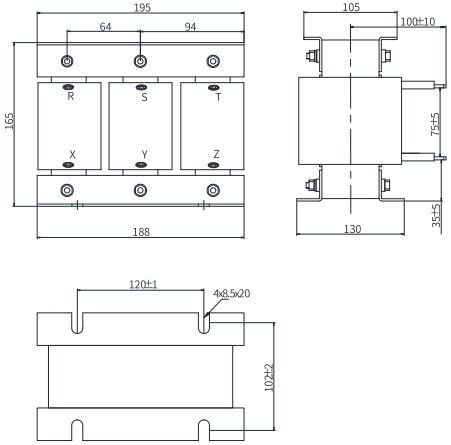



Figure 4-3 Dimensions of 30 A AC input reactor

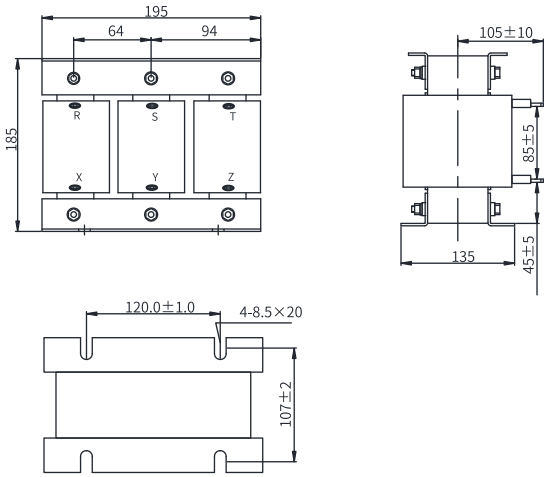



Figure 4-4 Dimensions of 50 A AC input reactor

**Model and Dimensions (Schaffner)**

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

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

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

## 4.1.3 Input Filter

### 4.1.3.1 EMC Filter

To enable the AC drive to meet the EN IEC 61800-3 emission requirements, the AC drive must be connected to the external EMC filter listed in the following table. Inovance and Schaffner EMC filters can be used.

## Appearance

Table 4–4 Standard EMC filter models and appearance

| Filter Model | | Appearance |
|---|---|---|
| Schaffner | FN2010N series |  |
| | FN3288 series |  |
| Inovance | FIL800 series |  |

## Model

Select the filter based on the rated input current of the AC drive according to the following table.

Table 4–5 Schaffner filter model selection

| Model of Power Supply Unit | Rated Input Current (Heavy Load) (A) | Filter Model | Power Consumption (W) |
|---|---|---|---|
| Single-phase 200–240 V | | | |
| MD800-0-2S24<br>MD800-0-2S24B | 24 | FN 2010N-30-08 | / |

| Model of Power Supply Unit | Rated Input Current (Heavy Load) (A) | Filter Model | Power Consumption (W) |
|---|---|---|---|
| MD800-0-2S40<br>MD800-0-2S40B | 40 | FN 2010N-60-24 | / |
| Three-phase 380–480 V | | | |
| MD800-0-4T12<br>MD800-0-4T12B | 12 | FN3288-16-44-C..-R65 | / |
| MD800-0-4T22<br>MD800-0-4T22B | 22 | FN3288-20-33-C..-R65 | / |
| MD800-0-4T41<br>MD800-0-4T41B | 41 | FN3288-40-33-C..-R65 | / |

Table 4–6 Inovance filter model selection

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

**Dimensions**

The filter dimensions are as follows.

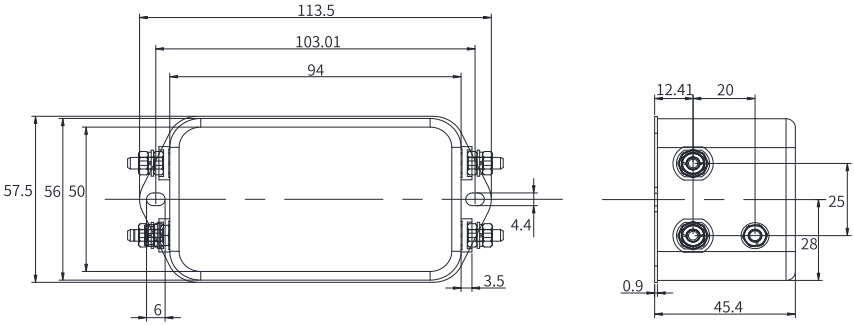



Figure 4-5 Filter dimensions (FN2010N-30-08) (unit: mm)

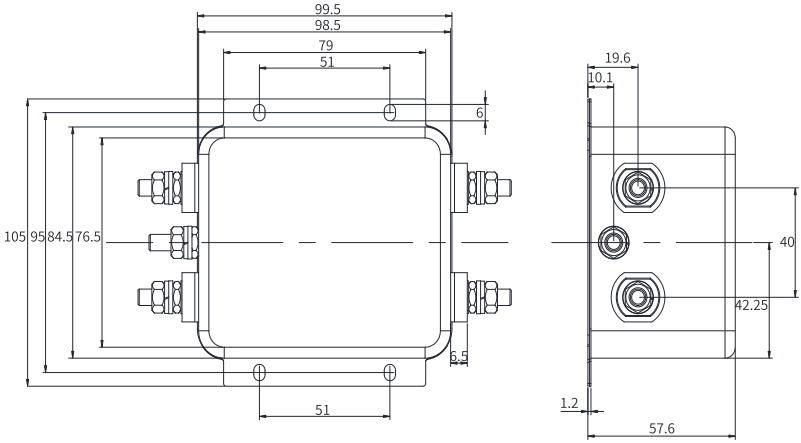



Figure 4-6 Filter dimensions (FN2010N-60-24) (unit: mm)

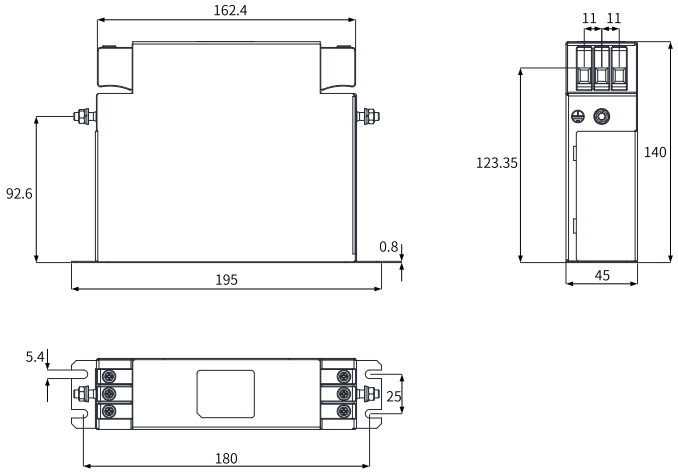



Figure 4-7 Filter dimensions (FN3288-16-44) (unit: mm)

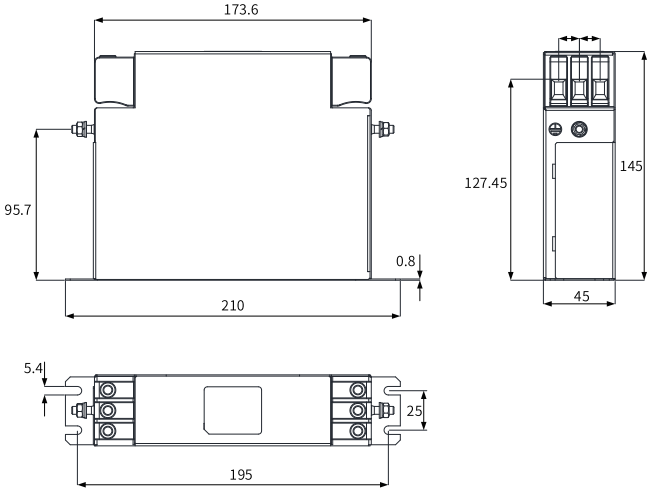



Figure 4-8 Filter dimensions (FN3288-20-25-33) (unit: mm)

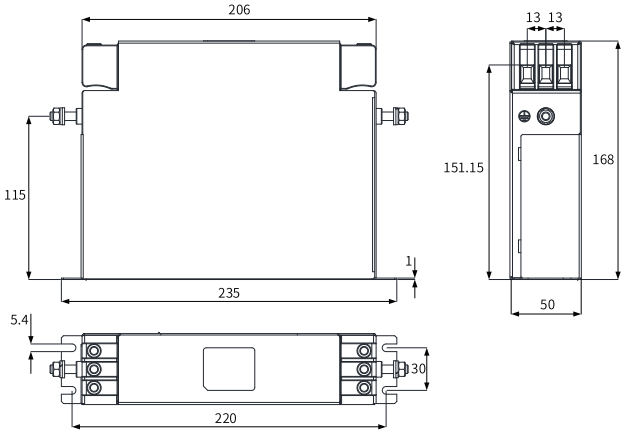



Figure 4-9 Filter dimensions (FN3288-40-33) (unit: mm)

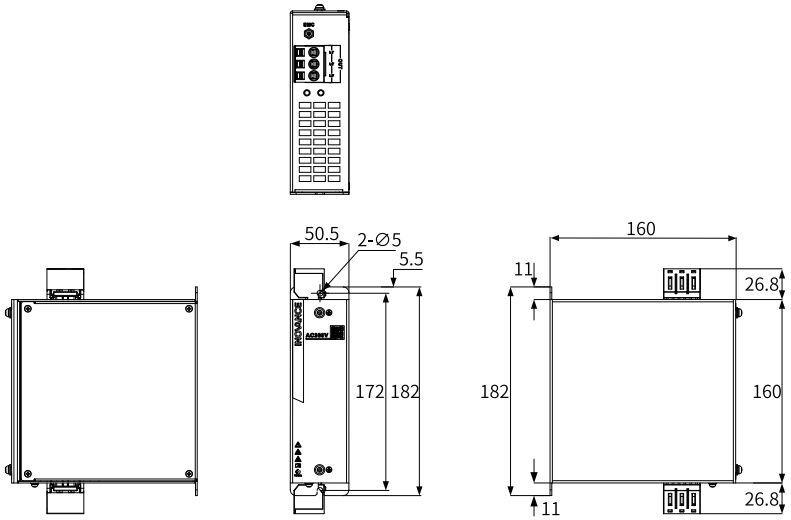



Figure 4-10 Inovance Filter dimensions (FIL800) (unit: mm)

### 4.1.3.2 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 4–12 " on page 108* .

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**

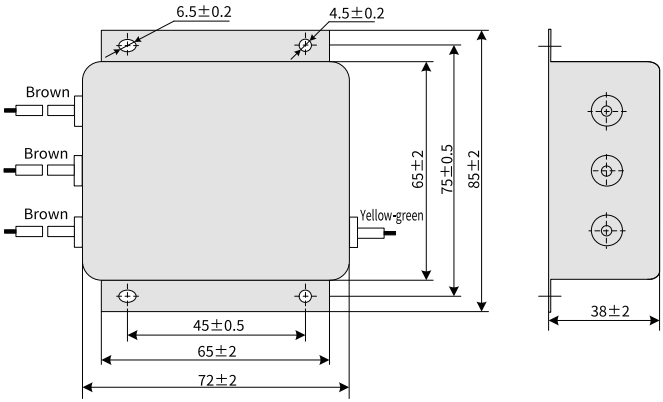



Figure 4-11 Outline dimensions of the simple filter

Table 4–7 Outline dimensions of the simple filter

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

**Installation Method**

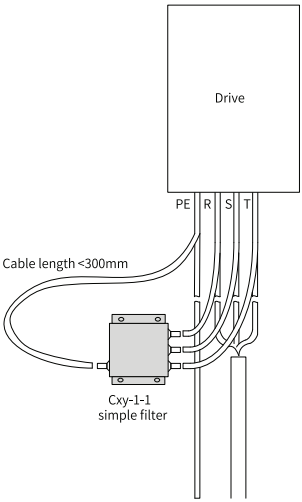



Figure 4-12 Installation of the simple filter

## 4.1.4 Braking Components

### Resistance Selection of the Braking Resistor

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

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

Pb indicates the braking power.

### Power Selection of the Braking Resistor

In theory, the power of braking resistor is the same as the braking power. However, in consideration of derating K, the power of braking resistor is calculated using the following formula: K × Pr = Pb × D.

K is set to 50% or an approximate value.

Pr indicates the power of the braking resistor.

D indicates the braking frequency (percentage of regenerative process to whole deceleration).

The following two formulas can be obtained:

K × Pr = Pb × D = U × U/R × D

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

The braking resistor power is calculated accordingly.

K is the derating coefficient of the braking resistor. A small value of K prevents the braking resistor from overheating. K can be increased properly if the heat dissipation condition is good, but cannot exceed 50%. Otherwise, the braking resistor may be overheated, which may cause a fire.

Braking frequency (D) is determined by applications. Typical values of braking frequency in different applications are listed in *"Table 4–8 " on page 109*.

Table 4–8 Typical values of braking frequency in different applications

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

## Braking Unit Models

Table 4–9 Model selection of braking component

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

## *Note*

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

### 4.1.5 Output Reactor

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

#### Model and Dimensions (Inovance)

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

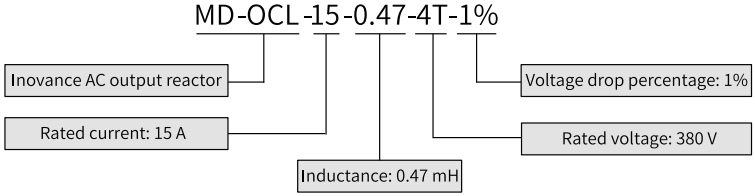



Figure 4-13 AC output reactor model

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

| Drive Unit Model | Rated Output Current (Heavy Load) (A) | Motor Capacity (kW) | Reactor Model | Inductance (mH) | Power Consumption (W) |
|---|---|---|---|---|---|
| Single-phase 200–240 V | | | | | |
| MD800-1-2T1R7<br>MD800-1-2T1R7S<br>MD800-2-2T1R7<br>MD800-2-2T1R7S | 1.7 | 0.2 | MD-OCL-5-1.4-4T-1% | 1.4 | 15 |
| MD800-1-2T3<br>MD800-1-2T3S<br>MD800-2-2T3<br>MD800-2-2T3S | 3.0 | 0.4 | MD-OCL-5-1.4-4T-1% | 1.4 | 15 |
| MD800-1-2T5<br>MD800-1-2T5S<br>MD800-2-2T5<br>MD800-2-2T5S | 5.0 | 0.75 | MD-OCL-5-1.4-4T-1% | 1.4 | 15 |
| MD800-1-2T8<br>MD800-1-2T8S<br>MD800-2-2T8<br>MD800-2-2T8S | 8.0 | 1.5 | MD-OCL-5-1.4-4T-1% | 1.4 | 15 |
| MD800-1-2T11<br>MD800-1-2T11S<br>MD800-2-2T11<br>MD800-2-2T11S | 11.0 | 2.2 | MD-OCL-7-1.0-4T-1% | 1.0 | 20 |
| Three-phase 380–480 V | | | | | |
| MD800-1-4T1R8<br>MD800-1-4T1R8S<br>MD800-2-4T1R8<br>MD800-2-4T1R8S | 1.8 | 0.4 | MD-OCL-5-1.4-4T-1% | 1.4 | 15 |
| MD800-1-4T3R4<br>MD800-1-4T3R4S<br>MD800-2-4T3R4<br>MD800-2-4T3R4S | 3.4 | 0.75 | MD-OCL-5-1.4-4T-1% | 1.4 | 15 |
| MD800-1-4T4R8<br>MD800-1-4T4R8S<br>MD800-2-4T4R8<br>MD800-2-4T4R8S | 4.8 | 1.5 | MD-OCL-5-1.4-4T-1% | 1.4 | 15 |
| MD800-1-4T5R5<br>MD800-1-4T5R5S<br>MD800-2-4T5R5<br>MD800-2-4T5R5S | 5.5 | 2.2 | MD-OCL-7-1.0-4T-1% | 1.0 | 20 |
| MD800-1-4T9R5<br>MD800-1-4T9R5S<br>MD800-2-4T9R5<br>MD800-2-4T9R5S | 9.5 | 3.7 | MD-OCL-10-0.7-4T-1% | 0.7 | 25 |

| Drive Unit Model | Rated Output Current (Heavy Load) (A) | Motor Capacity (kW) | Reactor Model | Inductance (mH) | Power Consumption (W) |
|---|---|---|---|---|---|
| MD800-1-4T13<br>MD800-1-4T13S | 13.0 | 5.5 | MD-OCL-15-0.47-4T-1% | 0.47 | 28 |
| MD800-1-4T17<br>MD800-1-4T17S | 17.0 | 7.5 | MD-OCL-20-0.35-4T-1% | 0.35 | 32 |

Dimensions of the AC output reactor

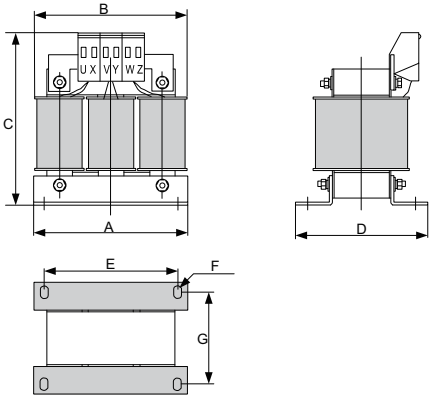



Figure 4-14 Dimensions of 5–10 A AC output reactor

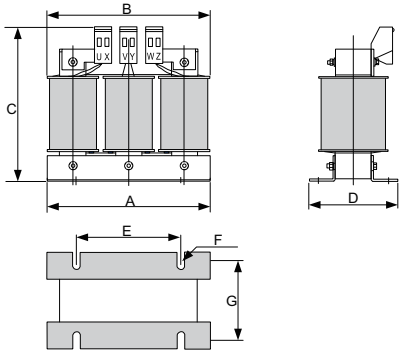



Figure 4-15 Dimensions of 15 A AC output reactor

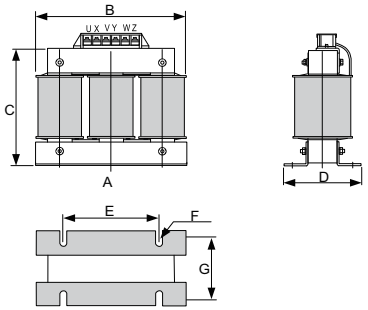



Figure 4-16 Dimensions of 20 A AC output reactor

Table 4–11 Dimensions of 5–20 A AC output reactors (unit: mm)

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

## Model and Dimensions (Schaffner)

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

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

| Drive Unit Model | Rated Output Current (Heavy Load) (A) | Motor Capacity (kW) | Applicable Reactor | Inductance (mH) | Power Consumption (W) |
|---|---|---|---|---|---|
| Single-phase 200–240 V | | | | | |
| MD800-1-2T1R7<br>MD800-1-2T1R7S<br>MD800-2-2T1R7<br>MD800-2-2T1R7S | 1.7 | 0.2 | RWK 305-4-KL | 1.47 | 22 |
| MD800-1-2T3<br>MD800-1-2T3S<br>MD800-2-2T3<br>MD800-2-2T3S | 3.0 | 0.4 | RWK 305-4-KL | 1.47 | 22 |
| MD800-1-2T5<br>MD800-1-2T5S<br>MD800-2-2T5<br>MD800-2-2T5S | 5.0 | 0.75 | RWK 305-7.8-KL | 0.754 | 25 |

| Drive Unit Model | Rated Output Current (Heavy Load) (A) | Motor Capacity (kW) | Applicable Reactor | Inductance (mH) | Power Consumption (W) |
|---|---|---|---|---|---|
| MD800-1-2T8<br>MD800-1-2T8S<br>MD800-2-2T8<br>MD800-2-2T8S | 8.0 | 1.5 | RWK 305-10-KL | 0.588 | 30 |
| MD800-1-2T11<br>MD800-1-2T11S<br>MD800-2-2T11<br>MD800-2-2T11S | 11.0 | 2.2 | RWK 305-14-KL | 0.42 | 34 |
| Three-phase 380–480 V | | | | | |
| MD800-1-4T1R8<br>MD800-1-4T1R8S<br>MD800-2-4T1R8<br>MD800-2-4T1R8S | 1.8 | 0.4 | RWK 305-4-KL | 1.47 | 22 |
| MD800-1-4T3R4<br>MD800-1-4T3R4S<br>MD800-2-4T3R4<br>MD800-2-4T3R4S | 3.4 | 0.75 | RWK 305-4-KL | 1.47 | 22 |
| MD800-1-4T4R8<br>MD800-1-4T4R8S<br>MD800-2-4T4R8<br>MD800-2-4T4R8S | 4.8 | 1.5 | RWK 305-7.8-KL | 0.754 | 25 |
| MD800-1-4T5R5<br>MD800-1-4T5R5S<br>MD800-2-4T5R5<br>MD800-2-4T5R5S | 5.5 | 2.2 | RWK 305-7.8-KL | 0.754 | 25 |
| MD800-1-4T9R5<br>MD800-1-4T9R5S<br>MD800-2-4T9R5<br>MD800-2-4T9R5S | 9.5 | 3.7 | RWK 305-14-KL | 0.42 | 34 |
| MD800-1-4T13<br>MD800-1-4T13S | 13.0 | 5.5 | RWK 305-17-KL | 0.346 | 38 |
| MD800-1-4T17<br>MD800-1-4T17S | 17.0 | 7.5 | RWK 305-32-KL | 0.184 | 55 |

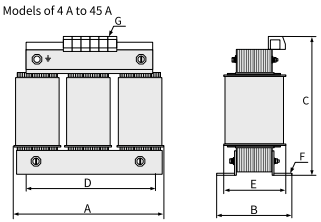



Figure 4-17 Dimensions of 4–32 A output reactor

Table 4–13 Mounting dimensions of 4–17 A AC output reactors (unit: mm)

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

## 4.1.6 Magnetic Ring and Buckle

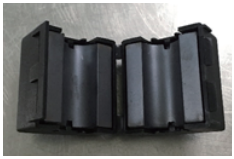
### Model

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

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: high permeability when within 1 MHz, good suppression of drive interference, but high cost
- Ferrite magnetic buckle: good performance when in the frequency band above 1 MHz, suppression of interference noise of various signal cables, low cost, and convenient and neat for installation

Table 4–14 Appearance and models of the magnetic rings and buckle

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

## Dimensions

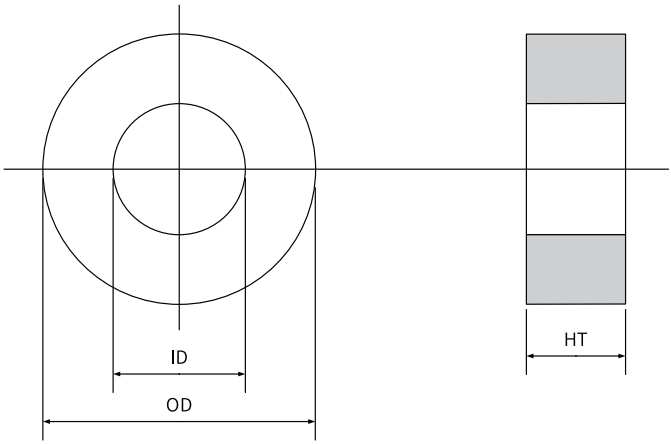



Figure 4-18 Magnetic ring dimensions

Table 4–15 Magnetic ring dimensions

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

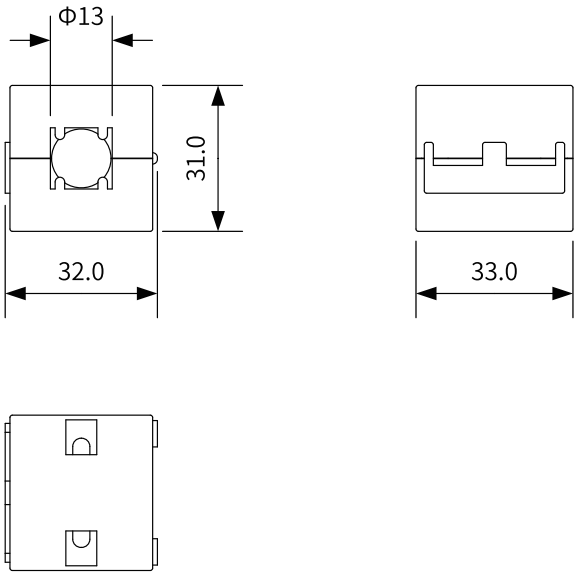



Figure 4-19 Magnetic buckle dimensions

Table 4–16 Magnetic buckle dimensions

| Magnetic Buckle Model | Overall Dimensions (Length x Outer Diameter x Inner Diameter) (mm) |
|---|---|
| 74271225 | 32.8 × 28 × 13 |

### 4.1.7 Motor

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

- The motor works in an environment of high temperature.
- The motor keeps cyclic running with short single cycle and frequent acceleration/deceleration.

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

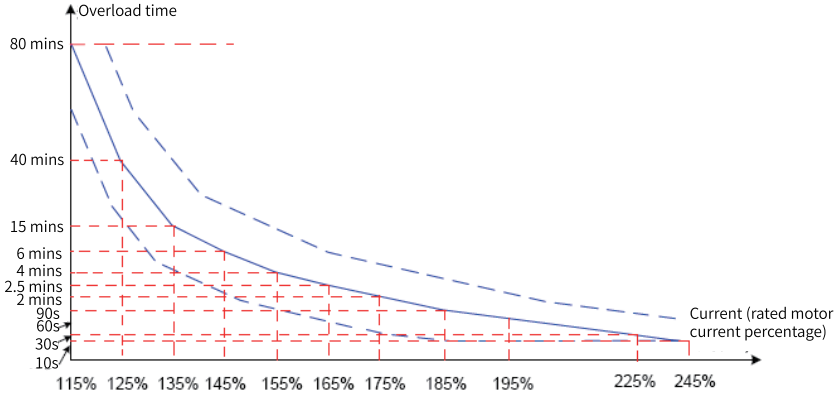



Figure 4-20 Motor overload protection curve

When the motor running current reaches 175% of the rated motor current and the motor runs at this level for 2 minutes, E11.00 (motor overload) is detected. When the motor running current reaches 115% of the rated motor current and the motor runs at this level for 80 minutes, E11.00 (motor overload) is detected.

Example 1: The rated motor current is 100 A.

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

## *Note*

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

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

According to the motor overload curve, 150% (I) is in the range of 145% (I1) and 155% (I2). 145% corresponds to overload protection time 6 minutes (T1) and 155% corresponds to overload protection time 4 minutes (T2). It can be concluded that in default settings, the overload protection time for 150% rated current of the motor is 5 minutes. It can be calculated as follows:

T = T1 + (T2 - T1) x (I - I1) / (I2-I1) = 6 + (4 - 6) x (150% - 145%) / (155%-145%) = 5 minutes

Then, calculate the motor overload protection gain from the following formula: F9-01 = Desired overload protection time / Corresponding overload protection time = 2 / 5 = 0.4.




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

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

On the condition that F9-01 (Motor overload protection gain) is set to 1.00 and F9-02 (Motor overload pre-warning coefficient) is set to 80%, when the motor running current reaches 145% of the rated motor current and the motor runs at this level for 4.8 minutes (80% x 6), the DO terminal or fault relay outputs the motor overload pre-warning signal.

The motor overload pre-warning function enables the AC drive to send a warning signal to the control system through the DO before motor overload protection. It is used to determine how early to send the pre-warning signal before the motor overload protection. The higher the value is, the later the pre-warning signal is sent. When the accumulative output current of the AC drive is higher than the value of the overload time (value Y of motor overload protection inverse time-lag curve) multiplied by F9-02 (Motor overload pre-warning coefficient), the multi-functional DO terminal of the AC drive outputs a motor overload pre-warning signal.

When F9-02 is set to 100%, the motor overload pre-warning and the motor overload protection are performed simultaneously.

## 4.2 External LCD Operating Panel

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

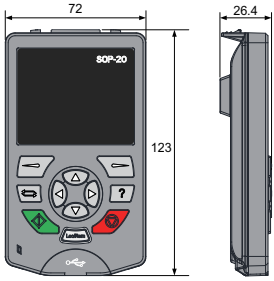



Figure 4-21 Overall dimensions of the external LCD operating panel (unit: mm)

## 4.3 EMC Shielding Bracket

EMC shielding brackets are optional. They can be used for both the power supply unit and the drive unit and are installed at the input side of the power supply unit and the output side of the drive unit. EMC shielding brackets can connect the cable shield of main circuit and ensure that the installed drives meet the EMC requirements. The optional EMC shielding brackets are used for secondary fixing of power cables and stable grounding of the shield.

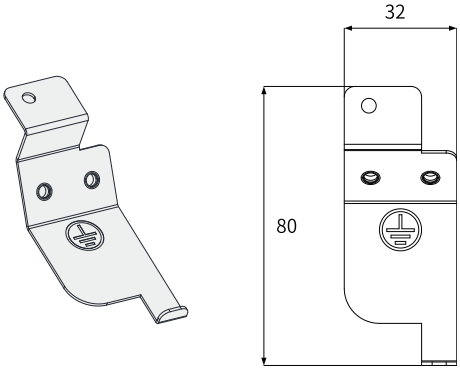



Figure 4-22 Dimensions of EMC shielding bracket for the power supply unit

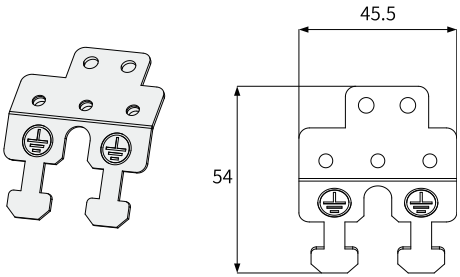



Figure 4-23 Dimensions of EMC shielding bracket for the drive unit

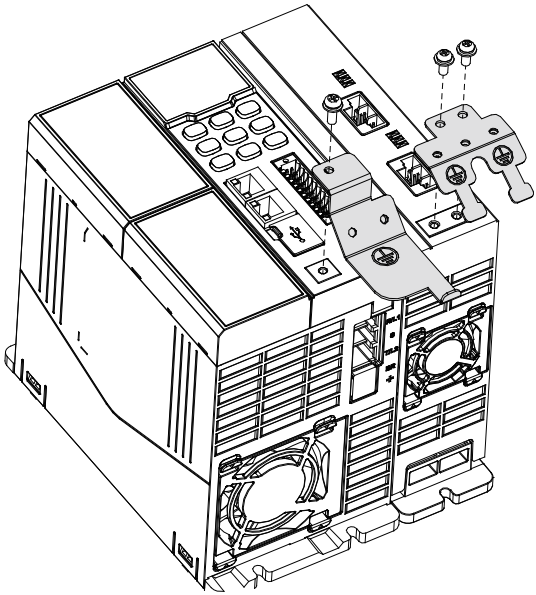


Figure 4-24 Mounting position of the shielding bracket

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

# 5 Requirements on Installation of Options

## 5.1 AC Input Reactor

The AC input reactor is an option used to suppress the harmonics in the input current. In applications where strong suppression of harmonics is required, install an external AC input reactor.

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

## 5.2 Output Reactor

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

## 5.3 Fuses, Contactors, and Circuit Breakers




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

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

## 5.4 EMC Filter

The optional EMC filter is able to meet the EN61800-3 category C2 emission limits. EMC filters are recommended to be installed according to the following requirements:

- The filter must be reliably grounded.
- The EMC filter must be installed close to the input terminals of the equipment, and the cables connecting them must be shorter than 30 cm.
- The grounding terminal of EMC filter and the grounding terminal of equipment must be connected together, and the filter and the equipment must be installed on the same conductive installation surface, which is connected to the main ground of the cabinet.

- The LINE terminal of the EMC filter must be connected to the power grid, and the LOAD terminal must be connected to the AC drive.

## 5.5 Simple Filter

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

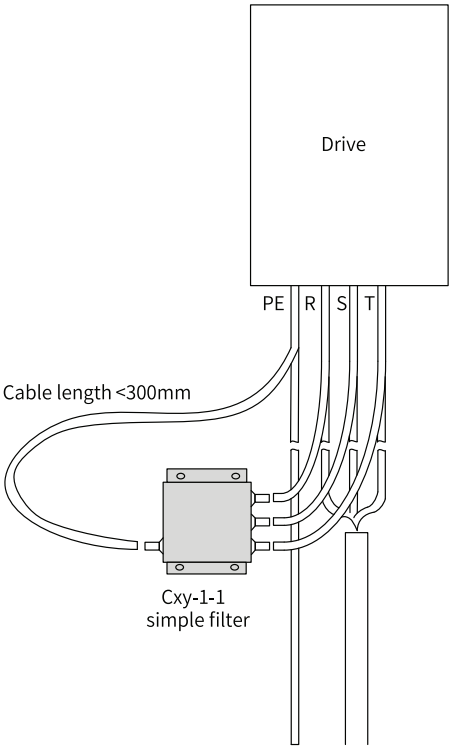



Figure 5-1 Installing a simple filter

## 5.6 Magnetic Ring and Ferrite Clamp

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

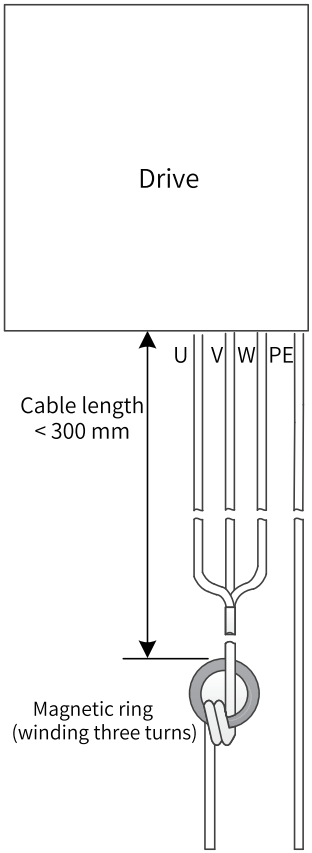



Figure 5-2 Installing a magnetic ring

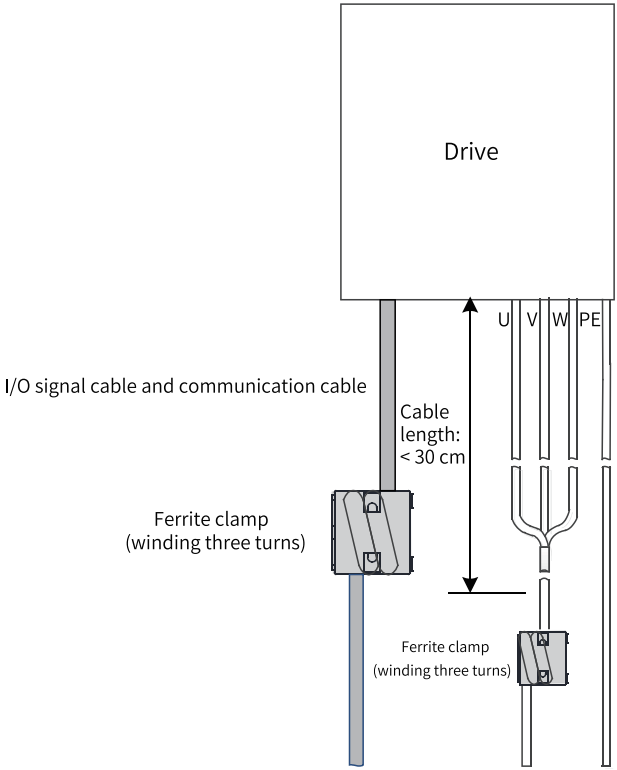



Figure 5-3 Installing a ferrite clamp

## *Note*

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

# 6 Troubleshooting for Common EMC Interference Problems

## 6.1 RCD Malfunction

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

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

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

Table 6–1 Troubleshooting for leakage current

| RCD Tripped | Possible Cause | Solution |
|---|---|---|
| RCD tripped upon power-on immediately | The anti-interference performance of the RCD is poor. | 1. Use an RCD of recommended manufacturers.<br>2. Use an RCD with higher operating current.<br>3. Move the unbalanced load to the front end of the RCD.<br>4. If an EMC filter unit is installed, disconnect the EMC screws.<br>5. If an EMC filter is installed, disconnect the EMC filter. |
| | The operating current of the RCD is too low. | |
| | The back end of RCD is connected with an unbalanced load. | |
| | The to-ground capacitance at the front end of the AC drive is high. | |
| RCD tripped during operation | The anti-interference performance of the RCD is poor. | 1. Use an RCD of recommended manufacturers.<br>2. Install an EMC filter unit or EMC filter.<br>3. Install a simple filter on the input side of this product, and wind magnetic rings on LN and RST cables near the RCD.<br>4. Use an RCD with higher rated operating current.<br>5. Reduce the carrier frequency properly without affecting the performance.<br>6. Use shorter motor cables. |
| | The operating current of the RCD is too low. | |
| | The back end of RCD is connected with an unbalanced load. | |
| | The to-ground distributed capacitance of the motor cables and motors is too high. | |

## 6.2 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.

## 6.3 Control Circuit Interference

### 6.3.1 High-Speed Pulse Interference

Follow the following table for troubleshooting.

| Step | Action |
|---|---|
| 1 | Use a shielded twisted-pair cable and ground it at both ends. |
| 2 | Connect the motor enclosure to the PE terminal of the AC drive. |
| 3 | Connect the PE terminal of the AC drive to the PE terminal of the grid. |
| 4 | Add an equipotential bonding grounding wire between the host controller and the AC drive. |
| 5 | Separate the signal cable from the power cable by a distance of at least 30 cm. |
| 6 | Add a ferrite clamp to the signal cable, or wind the signal 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. |

### 6.3.2 Common I/O Signal Interference

This product generates very strong interference. Although EMC measures are taken, the interference may still exist due to improper cabling or grounding during use. When the product interferes with other devices, the following solutions can be adopted.

| Step | Solution |
|---|---|
| 1 | Use the shielded cables as the I/O signal cables, with the shielding layer connected to the PE terminal. |
| 2 | Reliably connect the PE terminal of the motor to the PE terminal of the AC drive, and connect the PE terminal of the AC drive to the PE of the power grid. |
| 3 | Add an equipotential bonding wire between the host controller and the AC drive. |

| Step | Solution |
|---|---|
| 4 | Wind the output U/V/W cables of the AC drive on a magnetic ring for two to four turns. |
| 5 | Increase the capacitor filter at the low-speed DI. The recommended maximum value is 0.1 uF. The required capacitor voltage withstanding level is 50 V and above. |
| 6 | Increase the capacitor filter at the AI. The recommended maximum value is 0.22 uF. The required capacitor voltage withstanding level is 50 V and 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 shielding layer securely. |
| 9 | Try to remove the grounding screw on the control board. For details, see *"3.4.2 Grounding of the Control Board" on page 93*. |

## 6.4 Communication Interference

### 6.4.1 RS485 and CAN Communication Interference

Follow the following table for troubleshooting.

| Step | Action |
|---|---|
| 1 | Add a 120 Ω 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. |
| 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. |

### 6.4.2 EtherCAT and PROFINET Communication Interference

Make rectification according to the following table.

| No. | Step |
| --- | --- |
| 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 | The maximum cable length allowed between two nodes is 100 m. |
| 6 | Add a magnetic buckle at both ends of the communication cable and wind the communication cable 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 ground the shielding layer securely. |
| 9 | Installation the EtherCAT communication expansion card to optional expansion card slot 2. |

# 7 Compliance

## 7.1 Compliance with Certifications, Directives and Standards

The following table lists the certifications 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 | | Standards Compliance |
|---|---|---|---|
| CE certification | EMC directive | 2014/30/EU | EN IEC 61800-3 |
| | LVD | 2014/35/EU | EN 61800-5-1 |
| | RoHS directive | 2011/65/EU | EN 50581 |
| UL certification | - | | UL61800-5-1<br>C22.2 No.274-17 |
| Functional safety certification (STO) | Machinery directive | 2006/42/EC | EN 61800-5-2<br>EN 62061 :2005/A2<br>EN ISO 13849-1<br>EN 61508 ed.2 |

### *Note*

The CE/UL/cUL certification of the product comply with the latest versions of the directives and standards.

## 7.2 CE Certification

### 7.2.1 Introduction to CE Certification



Figure 7-1 CE mark

- The CE mark is required for commercial trades (including manufacture, import, and sale) in Europe to indicate compliance with the directives for safety (LVD), electromagnetic compatibility (EMC), and environmental protection (RoHS).
- The CE mark is required for engaging in commercial business (production, importation, and distribution) in Europe.

- This product conforms to the Low Voltage Directive (LVD), Electromagnetic Compatibility (EMC) Directive, and Restriction of Hazardous Substances (RoHS) Directive, and is therefore marked with CE.
- Machines and devices integrated with this product must also be CE certified for distribution in Europe.
- The integrator who integrates this product into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE certification.

### 7.2.2 Conditions for Compliance with the EMC Directive

- This product satisfies the European EMC directive 2014/30/EU and the EN 61800-3 standard, and is applicable to both the first environment and the second environment.




When applied in the first environment, this product may generate radio interference. In addition to the CE compliance requirements described in this chapter, take measures to avoid radio interference if otherwise required.

- To satisfy the EMC directive and standard, install an EMC filter on the input side of the product, select a recommended shielded cable for the output side, ground the filter reliably, and ensure all-round connection of the shield of the output cable.




Manufacturers of systems integrating with this product are responsible for system compliance with the European EMC directive and EN IEC 61800-3 requirements in different system application environments.

#### EMC Specifications

Observe the product requirements during installation. This product meets the requirements of the EN IEC 61800-3 standard. Limit the motor cable length in accordance with the following table to avoid impact of conduction and radiation interference.

Table 7–1 Maximum allowable length of motor cable considering conduction and radiation interference

| Product Model | Max. Cable Length for Conducted Emission | | | | Max. Cable Length for Radiated Emission | | | |
|---|---|---|---|---|---|---|---|---|
| | Category C1 | | Category C2 | | Category C1 | | Category C2 | |
| | Built-in filter | External EMC filter | Built-in filter | External EMC filter | Built-in filter | External EMC filter | Built-in filter | External EMC filter |
| Single-phase | - | 10 m | - | 25 m | - | - | - | 25 m |
| Three-phase | - | - | - | 50 m | - | - | - | 50 m |

## Introduction of EMC Standard

Electromagnetic compatibility (EMC) describes the ability of electronic and electrical devices to work properly in the electromagnetic environment and not to generate electromagnetic interference that influences nearby 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.
- A device or system must have sufficient immunity to the electromagnetic interference in the environment. This involves electromagnetic susceptibility.

EN IEC 61800-3 defines the following two environments:

- First environment: This includes domestic premises, and establishments directly connected to a low-voltage power supply network which supplies power to buildings used for domestic purposes.
- Second environment: This includes all establishments other than those directly connected to a low-voltage power supply network which supplies power to buildings used for domestic purposes.

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

- Category C1: power drive system (PDS) of rated voltage below 1000 V, intended for use in the first environment
- Category C2: PDS of rated voltage below 1000 V, which is neither a plug-in device nor a removable device and, when used in the first environment, is intended to be installed and commissioned only by a professional person
- Category C3: PDS of rated voltage below 1000 V, intended for use in the second environment and not intended for use in the first environment
- Category C4: PDS of 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

### 7.2.3 Conditions for Compliance with the LVD

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

**Installation Location**

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

**Installation Environment**

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

**Requirements on Installation and Protection**

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

**Main Circuit Wiring Requirements**

For details, see *"3.1.2 Requirements on Wiring the Main Circuit" on page 49*.

**Requirements on Protective Devices**

To meet the requirements of EN 61800-5-1, a fuse/circuit breaker must be connected on the input side to prevent accidents caused by internal short circuits. For details about the selection of the fuse/circuit breaker, see *"4.1.1 Fuse, Circuit Breaker, and Contactor" on page 98*.

## 7.3 UL or cUL Certification




Figure 7-2 UL/cUL Mark

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

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

**Installation Location**

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

**Ambient Temperature**

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

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

**Requirements on Installation**

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

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

**Main Circuit Wiring Requirements**




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

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

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

### Control Circuit Wiring Requirements

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

### Cable Selection Requirements for the Main Circuit

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

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

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

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

### Cable Selection

For details, see *"3.1.4 Cable Selection for Main Circuit" on page 54*.

### Requirements on Protective Devices

- To meet the requirements of UL standards, a fuse/circuit breaker must be connected on the input side to prevent accidents caused by internal short circuits.
- Install adequate branch circuits for short circuit protection in accordance with applicable regulations and the requirements in this user guide. This product is suitable for circuits with a short circuit current lower than 100 kA, and the maximum voltage of 480 VAC (400 V). For details about the selection of the fuse/circuit breaker, see *"4.1.1 Fuse, Circuit Breaker, and Contactor" on page 98*.

## 7.4 KC Certification



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

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