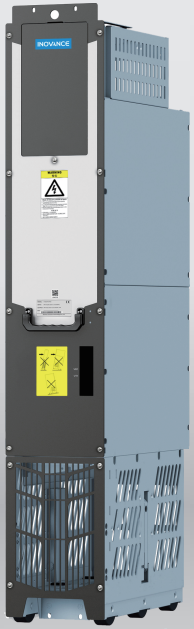
INOVANCE

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MD880-20 Series Basic Rectifier

Hardware Guide

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

Data code 19011491A07

Legal Information

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The contents are subject to change without notice due to product upgrade.

Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

Introduction

The MD880-20 is a general low-voltage rectifier product developed by Inovance. It features high power density, compact structure, and high reliability. This series of rectifiers are available in voltage levels of 400 V and 690 V. The rated power of a single module ranges from 475 kW to 929 kW. A higher rated output power can be achieved through parallel connection of multiple modules, with a maximum rated output power of 5183 kW. It can supply the required power to one or more inverter modules. The product can be applied to a wide range of industries, including metallurgy, papermaking, cranes, vessels, and cables.

More documents

Name	Data code	Description
MD880-20 Series Basic Rectifier Module Hardware Guide	19011491	Presents technical specifications, components, dimensions, mechanical installation, electrical installation, routine maintenance, and component replacement.
MD880 (LC)-20 Series Basic Rectifier Function Guide	19012538	Presents the function application and troubleshooting methods of the product.
MD880LC-20 Series Basic Rectifier Commissioning Guide	19012539	Presents the commissioning tool, commissioning flowchart, specific commissioning procedure, and parameters of the product.
MD880LC-20 Series Basic Rectifier Parameter Guide	19012537	Presents parameters and fault codes of the drive.

Revision history

Date	Version	Revision
May 2026	A07	Updated *"2.11 Fuse Selection" on page 30* Added legal information, industrial information security, service and support.
October 2024	A06	Made minor corrections.

Date	Version	Revision
December 2023	A05	• Updated *" Preface" on page 2* • Updated *"1.1 General Safety Instructions" on page 8* • Updated *"2.1 Model and Nameplate" on page 17* • Updated *"2.3 Specifications and Model Selection" on page 18* • Updated *"6.3 Inspection Precautions" on page 88*
November 2022	A04	• Updated structural diagrams. • Removed the heat dissipation and power consumption data from Table 1-1. • Added loss data for the basic rectifier module to Table 1-2.
February 2021	A03	• Added silk-screen markings to the terminal distribution diagram of the basic rectifier module in section 4.4.1. • Fixed the bookmark jumps for sections 2.5 and 2.6. • Added external 24V power supply to the layout diagram in section 2.7.1.
November 2020	A02	Made minor corrections.
December 2019	A01	• Updated the logo. • Corrected the pin descriptions for J18 and J19 in Figure 5-3.
March 2017	A00	First release.

Access to the guide

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

- Visit *https://www.inovance.com/global*, and choose **Service&Support > Support > Documentation Download**.
- Scan the **QR code** on the product with your smartphone.
- Scan the QR code below to install **My Inovance app**, where you can search for and download the guide.

Warranty

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

Even within the warranty period, maintenance can be charged for the following product damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by using the product for unintended functions
- Damage caused by using the product outside the specified scope
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

When applicable, relevant maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the agreed terms and conditions shall prevail.

For details, see the Warranty Card.

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1 Fundamental Safety Instructions

1.1 General Safety Instructions

Safety disclaimer

- This chapter provides essential safety instructions for proper use of the product. Before using this product, read through the guide and comprehend all the safety instructions. Failure to comply with the safety instructions may result in death, severe injury, or equipment damage.
- "DANGER", "WARNING", and "CAUTION" signs in this guide are only supplements to the safety instructions, and do not reflect all safety instructions to be followed.
- Use this product according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injury or property damage caused by improper use.

Safety levels and definitions



Indicates that failure to comply with the notice can result in death or severe personal injury.



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



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

Safety precautions

- Drawings in the guide are sometimes shown without covers or protective guards. Install the covers or protective guards as specified, 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.
- Operators must take mechanical protection measures to protect their safety. For example, they must wear safety shoes, safety clothing, safety glasses, protective gloves and sleeves, or other protective equipment.

Unpacking
 • Do not install the product in the case of any damage, rust, or signs of use on the product or accessories upon unpacking. • Do not install the product in the case of water seepage into the product or missing or damaged components upon unpacking. • Do not install the product in the case of any discrepancy between the product you received and the product name on the packing list.
 • 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 for damage, rust, or dents on the surfaces of the product and accessories upon unpacking. • After unpacking, check the contents against the packing list to ensure that the equipment and accessories are in the correct quantities, and that all documentation is complete.

Storage and transportation



- Large or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply could result in personal injury or equipment damage.
- Before hoisting the equipment, ensure that components such as the front cover and terminal blocks are secured firmly with screws. Loosely connected components may fall off and result in personal injury or equipment damage.
- Do not stand or stay below the product which is being hoisted.
- 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 could result in personal injury or equipment damage.



- Handle the equipment with care and mind your steps during transportation to prevent personal injury 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 could result in personal injury.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply could result in equipment damage.
- Do not store or transport the equipment in locations where the equipment may be exposed to splashing water or rain, direct sunlight, strong electric field, strong magnetic field, or strong vibration.
- Store the equipment for up to three months. Take stricter protective measures and carry out the necessary inspections for a longer storage time.
- Pack the equipment securely and properly before transportation. Use a fully enclosed container for long-distance transportation.
- Do not transport the equipment with other devices or items that may impact or cause harm to the equipment.

Installation

DANGER

- This equipment must be operated only by trained and qualified electrical personnel.

WARNING

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic field.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply may 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 an enclosed environment (such as a cabinet or case), use cooling devices (such as fans or air conditioners) to cool the space and meet the installation environment requirements. Failure to do so can result in equipment overtemperature or fire accidents.
- 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 terminal device, appropriate guard devices (guards for fire, electrical, and mechanical protection) meeting applicable IEC standards and local laws and regulations must be provided.
- 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 may result in a fire.

CAUTION

- Cover the top of the product 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 product and causing faults. After installation, remove the cloth or paper on top of the product to prevent overtemperature 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, switch off all the power supplies of the equipment. Wait for at least the time designated on the 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 can result in electric shock. • Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply can result in electric shock. • Make sure that the equipment and product are grounded properly. Failure to comply can result in the risk of electric shock.
 • Never connect the power cable to output terminals of the equipment or product. Failure to comply may damage the equipment or even cause a fire. • When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation. • Cables used must comply with corresponding cross-sectional area and shielding requirements. The shield of the shielded cable must be grounded at one end properly. • Tighten the terminal screws with the torque specified in the user guide. Insufficient or excessive torque may cause overtemperature and damage to the joint, which could result in fire. • After wiring, be sure that all cables are connected properly with no screws, gaskets, or exposed cables inside the product, or it may result in an electric shock or equipment damage.
 • During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply may result in damage to the equipment or internal circuits. • Use the shielded twisted pair cable to wire the control circuit, and connect the shield to the grounding terminal of the equipment. Failure to comply may result in equipment malfunction.

Power-on

DANGER

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

WARNING

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

Operation

DANGER

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

WARNING

- Do not touch the enclosure, fan, or resistor with bare hands. Failure to comply may result in burns.
- 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 may result in an electric shock.
- Before maintenance, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.
- When using a permanent magnet (PM) motor, do not touch the motor terminals while the motor is rotating, because induced voltage may be present at the terminals even after the product is powered off. Failure to comply may result in electric shock.



- Perform routine and regular 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 may result in electric shock.
- Before inspection or repair, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.



- Submit a request for repair based on the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time specified on the warning label before power-on or other operations. Failure to comply may result in personal injury or death and equipment damage.
- Troubleshooting and repair of a faulty or damaged equipment must be performed by professionals based on the repair instructions, with the repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply could result in death, personal injury, or severe equipment damage.
- Recheck the wiring and reset the parameters after equipment replacement.

Disposal
WARNING • Dispose of the retired equipment in accordance with applicable national regulations and standards. Failure to comply can result in property damage, personal injury, or death. • Recycle retired equipment in accordance with industry waste disposal standards to avoid environmental pollution.

Safety label

To ensure safe operation, comply with safety labels on the equipment and do not damage or remove the labels. The following table describes the meanings of the safety labels.

Safety Label	Description
	• Before using the equipment, read the guide and safety precautions carefully. Failure to comply may result in personal injury, death, or equipment damage. • Do not touch the terminals or remove the cover with power-on or within 10 min after power-off. Failure to comply may result in electric shock.

1.2 Industrial Information Security

The product provides interfaces for network connection and data transmission. To protect factories, systems, machines, and networks from cyberattacks, it is essential to implement proper protection mechanism for industrial security.

Customers are responsible for providing and maintaining a secure connection between the product and their network or any other network to protect their factories, systems, machines, and networks from unauthorized access. Such systems or machines can be connected to an enterprise network or the Internet only when a secure connection is established and appropriate security measures (such as using antivirus software or installing firewalls) are in place.

Inovance continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update the product promptly and always use the latest version.



Tampering with software (such as viruses, Trojans, and Worms) can lead to unsafe drive state, which can put the device in an unsafe operation state. This may result in death, serious injury, and property damage. Observe the following strictly.

- Always use the latest software version. If the product version is no longer supported or the latest version of the program is not applied, customers are at increased risk of cyber-attacks.
- Take proper protection measures (including but not limited to deploying antivirus software, firewall, WAF, IPS/IDS, situational awareness system, ID verification, and data encryption) to prevent files in the mobile storage device from being damaged by malware and protect products, networks, systems, and interfaces from unauthorized access, disturbance, intrusion, data disclosure, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Product Information

2.1 Model and Nameplate

MD880 - 20M - 0982 - 4
① ② ③ ④

①	**Product series** MD880: MD880 AC drive series	③	**Rated current** 0982: 982 A
②	**Product type** 20M: Basic rectifier module	④	**Voltage class** 4: Three-phase 400 VAC 7: Three-phase 690 VAC

Note

③: The "rated current" code indicates only one current rating.

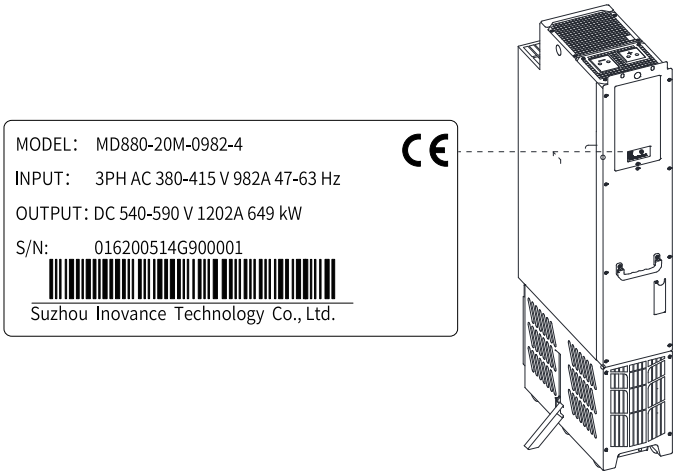


Figure 2-1 Nameplate

2.2 Voltage Level and Power Rating

Table 2–1 Voltage level and power rating of the MD880 series basic rectifier modules

Rated voltage	Rated current	Output voltage	Rated output power	Max. mass	Dimensions (W x D x H)
VAC	A (AC)	VDC	kW	kg	mm
400 V system: 380 to 415	718	540 to 590	475	180	230 x 602.5 x 1393.5
	982		649	182	230 x 602.5 x 1393.5
690 V system: 525 to 690	570	740 to 975	650	184	230 x 602.5 x 1393.5
	815		929	195	230 x 602.5 x 1393.5

2.3 Specifications and Model Selection

The MD880-20 series basic rectifier module is available in two voltage levels. The following table lists the specific models and specifications.

Table 2–2 MD880-20 series basic rectifier module models

Model MD880-20M-...	No overload					Low overload		High overload		Loss	Cooling air flow (m^3/h)	Structure
	I_N	I_N	I_{max}	S_N	P_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}	P_{loss}		
	Aac	Adc	Adc	kVA	kW	Adc	kW	Adc	kW	kW		
UN = 400 V (380 V to 415 V), ±10% (-15%, < 1 min); rated power based on 400 V												
6-pulse												
0718-4	718	879	1142	497	475	844	456	659	356	3.52	1088	T2
0982-4	982	1202	1562	680	649	1154	623	901	487	5.12	2024	T2
1336-4	1336	1635	2126	926	883	1570	848	1226	662	7.04	2176	2 x T2
1826-4	1826	2235	2905	1265	1207	2146	1159	1676	905	10.24	4048	2 x T2
2739-4	2739	3352	4358	1898	1810	3218	1738	2514	1358	15.36	6072	3 x T2
3651-4	3651	4469	5809	2529	2413	4290	2317	3351	1810	20.48	8096	4 x T2
4564-4	4564	5586	7262	3162	3016	5363	2896	4190	2262	25.6	10120	5 x T2
5477-4	5477	6704	8715	3794	3620	6435	3475	5028	2715	30.72	12144	6 x T2
12-pulse												
1336-4	1336	1635	2126	926	883	1570	848	1226	662	7.04	2176	2 x T2
1826-4	1826	2235	2905	1265	1207	2146	1159	1676	905	10.24	4048	2 x T2
2674-4	2674	3273	4255	1853	1767	3142	1697	2455	1325	14.08	4352	4 x T2
3651-4	3651	4469	5809	2529	2413	4290	2317	3351	1810	20.48	8096	4 x T2
4008-4	4008	4906	6377	2777	2649	4709	2543	3679	1987	21.12	6528	6 x T2
5477-4	5477	6704	8715	3794	3620	6435	3475	5028	2715	30.72	12144	6 x T2
UN = 690 V (525 V to 690 V), ±10% (-15%, < 1 min); rated power based on 690 V												
6-pulse												
0570-7	570	698	907	681	650	670	624	523	487	2.96	964	T2
0815-7	815	998	1297	974	929	958	892	748	697	4.32	1632	T2
1061-7	1061	1299	1688	1268	1210	1247	1161	974	907	5.92	1928	2 x T2
1515-7	1515	1854	2411	1811	1727	1780	1658	1391	1295	8.64	3264	2 x T2

Model MD880-20M-...	No overload					Low overload		High overload		Loss	Cooling air flow (m^3/h)	Structure
	I_N	I_N	I_{max}	S_N	P_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}	P_{loss}		
	Aac	Adc	Adc	kVA	kW	Adc	kW	Adc	kW	kW		
2273-7	2273	2782	3617	2716	2591	2671	2488	2087	1944	12.96	4896	3 x T2
3031-7	3031	3710	4823	3622	3456	3561	3317	2782	2592	17.28	6528	4 x T2
3788-7	3788	4636	6027	4527	4319	4451	4146	3477	3239	21.6	8160	5 x T2
4546-7	4546	5564	7233	5433	5183	5341	4976	4173	3887	25.92	9792	6 x T2
12-pulse												
1061-7	1061	1299	1688	1268	1210	1247	1161	974	907	5.92	1928	2 x T2
1515-7	1515	1854	2411	1811	1727	1780	1658	1391	1295	8.64	3264	2 x T2
2122-7	2122	2597	3376	2536	2419	2493	2323	1948	1814	11.84	3856	4 x T2
3031-7	3031	3710	4823	3622	3456	3561	3317	2782	2592	17.28	6528	4 x T2
4546-7	4546	5564	7233	5433	5183	5341	4976	4173	3887	25.92	9792	6 x T2

Definitions:

I_N : Rated input (AC) or output (DC) current

I_{max} : Maximum output current

S_N : Rated apparent power

P_N : Rated output power

I_{Ld} : Continuous output current in low overload applications

P_{Ld} : Output power in low overload applications

I_{Hd} : Continuous output current in high overload applications

P_{Hd} : Output power in high overload applications

2.4 Technical Data

Table 2–3 Technical data of the MD880-20 series basic rectifier module

Item		Specification
Basic performance	AC input voltage	400 V system: 380 VAC to 415 VAC, ±10% (–15%, < 1 min) 690 V system: 525 VAC to 690 VAC, ±10% (–15%, < 1 min)
	Input frequency	47 Hz to 63 Hz (±5 Hz)
	Unbalance factor	Maximum: ≤ ±3% of rated line voltage
	Output voltage	400 V system: 540 VDC to 590 VDC 690 V system: 740 VDC to 975 VDC
	Overload capacity	Low overload: 110%, 1 minute of continuous overload allowed every 5 minutes High overload: 150%, 1 minute of continuous overload allowed every 5 minutes
	Operating efficiency	> 98%
Operating environment	Ambient temperature	–10°C to +50°C; derating required for temperatures between 40°C and 50°C
	Ambient humidity	5% to 95% RH, without condensation
	Altitude	≤ 1000 m; derating required for altitudes above 1000 m; maximum altitude: 4000 m
Storage environment	Storage temperature	-40°C to +70°C
	Storage humidity	5% to 95% RH, without condensation
Mechanical data	Vibration	Usage/Transportation scenario: Tested according to IEC 60068-2-6; amplitude of 3.5 mm at 5 Hz to 8.4 Hz; acceleration rate of 1·g at 8.4 Hz to 200 Hz; 10 cycles/axis direction
	Shock	Usage/Transportation scenario: Tested according to IEC 60068-2-27; acceleration rate of 10·g, pulse width of 11 ms, 18 shocks in total in three axes
	IP rating	IP00 (module)
	Safety performance	EN 61800-5-1
	Cooling method	Forced air cooling (AF) compliant with EN 60146
Protective functions	Protective functions	Providing protections against short circuit, overcurrent, overload, overvoltage, undervoltage, phase loss, and overtemperature

2.5 Hardware Principles

2.5.1 Principle Overview

The MD880-20 series basic rectifier module employs thyristors to convert three-phase AC power into DC power to supply the DC bus in a drive system. The DC bus can power one or multiple inverter modules at the downstream stage.

The basic rectifier module includes an AC reactor to filter grid currents, reducing voltage ripple on the DC bus. Thyristor rectifiers differ from general diode rectifiers in that the thyristor is controllable. You can enable DC bus pre-charge upon power-on by controlling the conduction angle of the thyristor. With the MD880-20 series rectifier product, you do not need to install extra pre-charge circuits in the basic rectifier module or inverter module.

The basic rectifier module supports two control modes: charging mode and normal running mode.

- Charging mode: After the main power supply is switched on, the control program gradually increases the thyristor conduction angle to pre-charge capacitors in devices connected to the DC bus. When the DC capacitor voltage reaches the preset value, the basic rectifier module automatically switches to the normal running mode.
- Normal running mode: The thyristors operate in a similar way to diodes.

The following figure shows the simplified main circuit of the basic rectifier module.

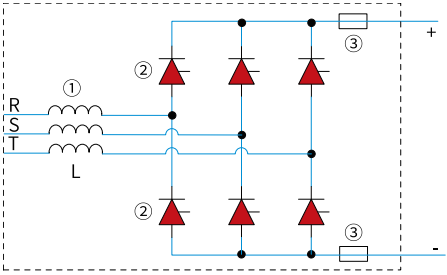


Figure 2-2 Main circuit of the basic rectifier module

No.	Name	Description
①	AC input reactor	Reduces harmonic waves from the grid.
②	Thyristor	Converts AC power into DC power.
③	DC fuse	Prevents device damage due to short circuits at the downstream stage.

2.5.2 6-Pulse/12-Pulse Basic Rectifier

The 6-pulse basic rectifier is suitable for general-purpose rectification needs. The 12-pulse basic rectifier is typically used in applications requiring low harmonic distortion.

6-pulse basic rectifier

A 6-pulse basic rectifier system supports a maximum of six basic rectifier modules operating in parallel mode. The following figure shows the parallel connection.

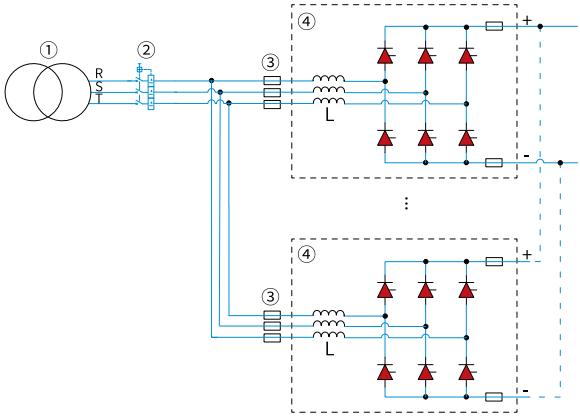


Figure 2-3 Wiring diagram of the 6-pulse basic rectifier in parallel mode

No.	Description
①	Grid transformer
②	Air circuit breaker
③	AC fuse
④	Basic rectifier module

12-pulse basic rectifier

The 12-pulse rectifier can eliminate the fifth and seventh harmonics on the grid side, significantly reducing the harmonic distortion in the line current and the conducted emissions. The 12-pulse rectifier requires a phase-shifting transformer or two separate transformers. The primary and secondary sides of the transformer must have the same transformation ratio, and there is a phase difference of 30° between the windings on the secondary side.

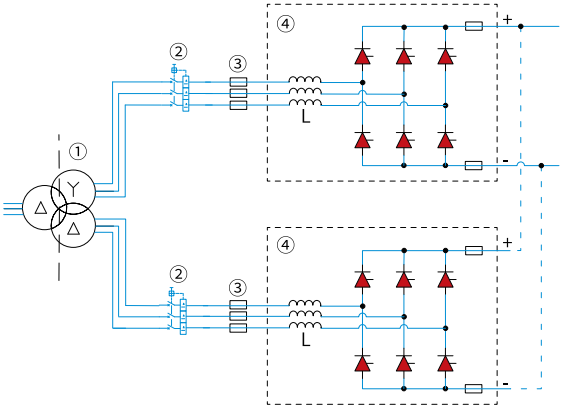


Figure 2-4 Wiring diagram of the 12-pulse basic rectifier

No.	Description
①	Phase-shifting transformer (See *"2.10 Phase-Shifting Transformer Selection Requirements" on page 29*.)
②	Air circuit breaker
③	AC fuse
④	Basic rectifier module

2.5.3 Electrical Diagram of Typical Drive System

The following figure shows a typical drive system with one basic rectifier module and three inverter modules.

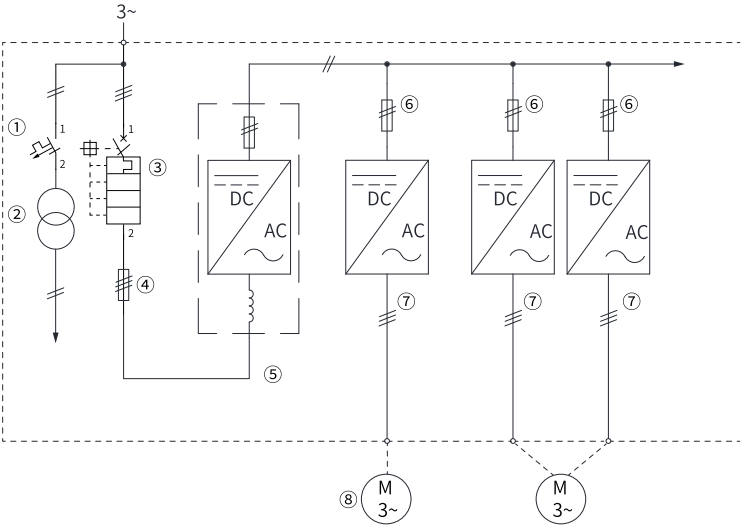


Figure 2-5 Electrical connection of the basic rectifier and drive system

No.	Description
①	Control power switch
②	Auxiliary power transformer
③	Air circuit breaker
④	AC fuse
⑤	Basic rectifier module
⑥	Inverter DC fuse
⑦	Inverter module
⑧	Motor

2.6 Module Layout

2.6.1 Structural Layout of the Basic Rectifier Module

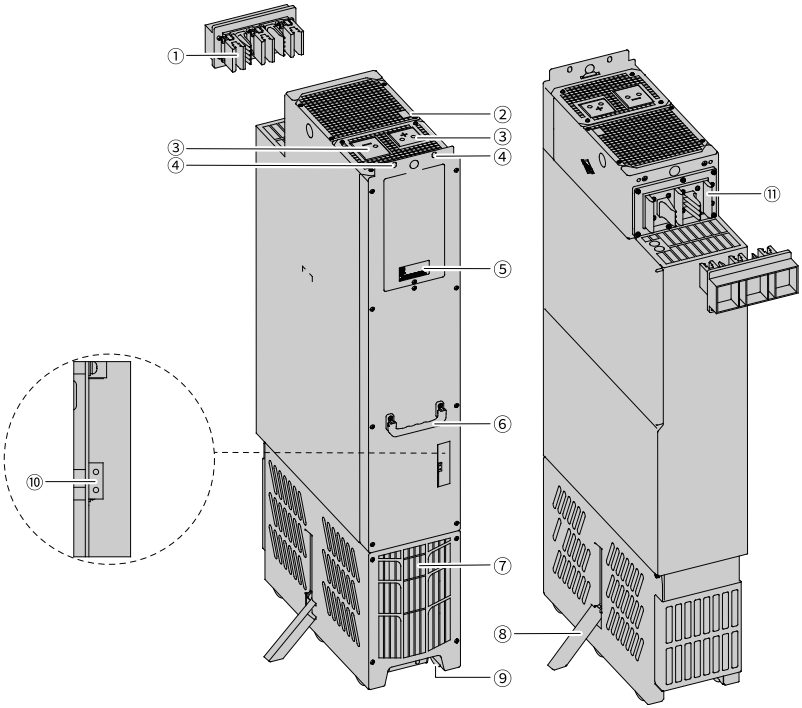


Figure 2-6 Structural layout of the basic rectifier module

No.	Description
①	Quick connector plug (included in the T2 installation kit option or cabinet)
②	External 24 V power supply
③	DC output terminal
④	Module fixing hole with grounding protection
⑤	Nameplate label
⑥	Handle
⑦	Cooling fan
⑧	Anti-toppling bracket
⑨	Caster
⑩	Optical fiber port
11	Quick connector socket

2.6.2 Outline Dimensions of the Basic Rectifier Module

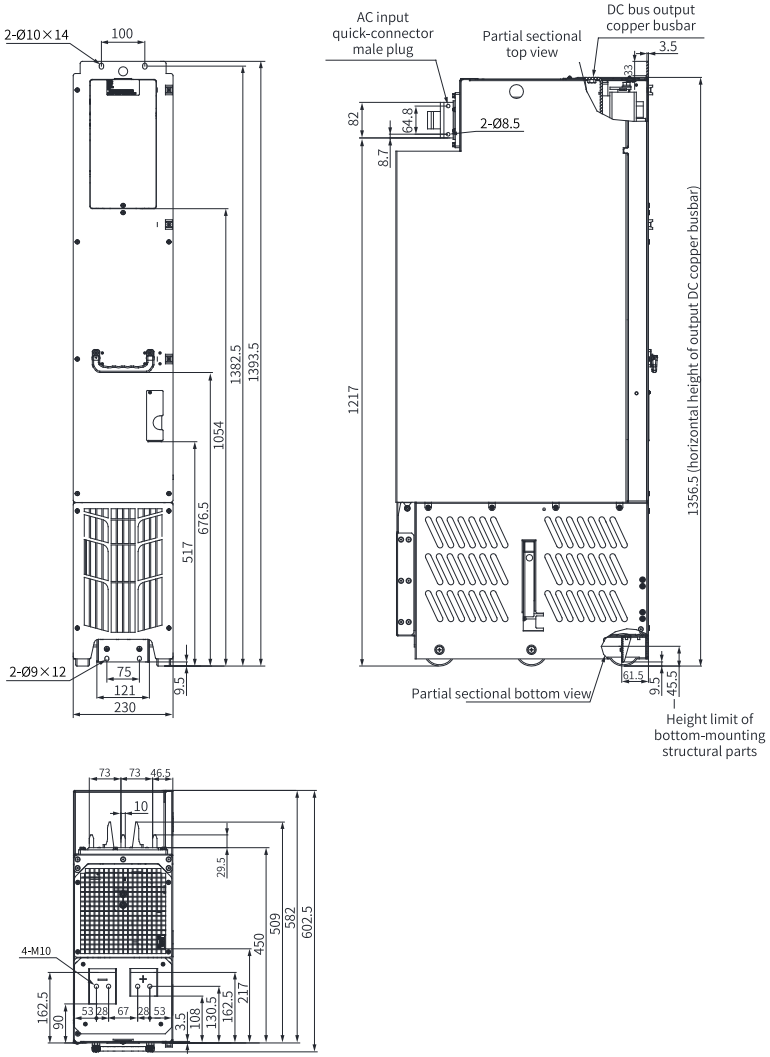


Figure 2-7 Outline dimensions of the basic rectifier module (unit: mm)

2.7 Derating

Ambient temperature-based derating

When the temperature is 40°C to 50°C, the output current of the basic rectifier module must be derated by 1% per every additional 1°C. Output current = Rated current x Derating coefficient (K).

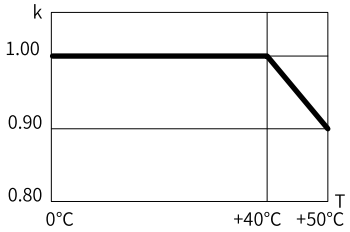


Figure 2-8 Ambient temperature-based derating

Altitude-based derating

When the altitude is 1000 m to 4000 m, the output current of the basic rectifier module must be derated by 1% for every additional 100 m. For applications above 4000 m, contact Inovance technical support.

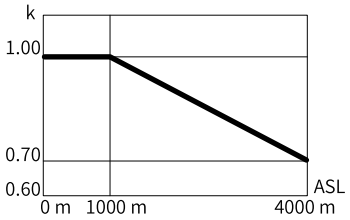


Figure 2-9 Altitude-based derating

2.8 Overload Capacity

When the MD880-20 series basic rectifier module is used in a drive system where overload may occur, an appropriate reference load current must be set. The criterion for overload judgment is that the drive system operates at the reference load current before and after an overload occurs, with a load duration of 300 s as the reference.

Curve of low overload mode

The reference load current (I_{LD}) for low overload mode is based on a 110% load cycle lasting 60 seconds.

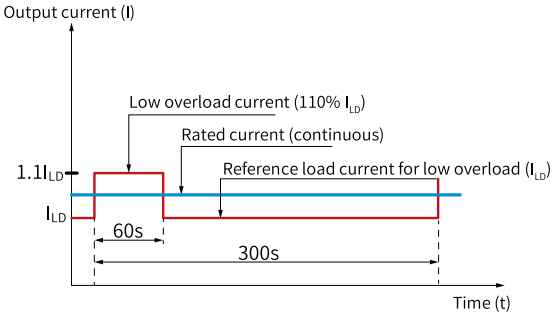


Figure 2-10 Curve of low overload mode

Curve of high overload mode

The reference load current (I_{HD}) for low overload mode is based on a 150% load cycle lasting 60 seconds.

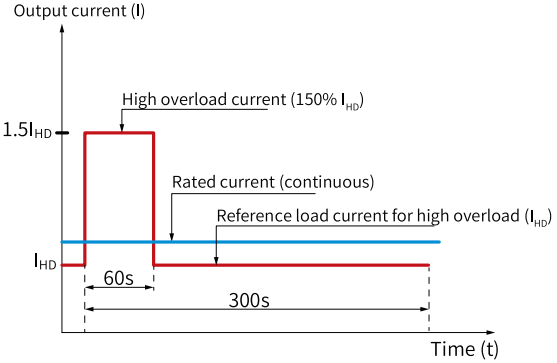


Figure 2-11 Curve of high overload mode

2.9 Tightening Torque of Common Screws and Bolts

Table 2–4 Electrical connection

Screw/Bolt	Property class	Max. torque (N·m)
M3	4.8	0.55
M4	4.8	1.2
M5	4.8	2.8
M6	4.8	4.8
M8	4.8	13
M10	4.8	20
M12	4.8	35
M16	4.8	85

Table 2–5 Mechanical connection

Screw/Bolt	Property class	Max. torque (N·m)
M5	4.8	2.8
M6	4.8	4.8
M8	4.8	13

Table 2–6 Insulator connection

Screw/Bolt	Property class	Max. torque (N·m)
M6	4.8	4.8
M8	4.8	13
M10	4.8	20
M12	4.8	35

Table 2–7 Cable connectors

Screw/Bolt	Property class	Max. torque (N·m)
M8	4.8	13
M10	4.8	20
M12	4.8	35

2.10 Phase-Shifting Transformer Selection Requirements

Table 2–8 Phase-shifting transformer selection requirements

No.	Type	Description	Remarks
1	Connection group	Dy11d0 or Dy5d0	Grounding on the secondary side is prohibited. Shielded power cables are recommended. If the preceding requirements are not met, derating is required.
2	Phase shift between secondary sides	30° electrical angle	
3	Voltage difference between secondary sides	< 0.5%	
4	Short circuit impedance at secondary sides	> 5%	
5	Short circuit impedance difference between secondary sides	≤ 5%	

2.11 Fuse Selection

Fuse selection on the DC side

Table 2–9 Fuse on the DC side

Model	Recommended fuse model on the DC side	
	Model (Bussmann)	Qty
MD880-20M-0718-4	170M5499	Two per pole
MD880-20M-0982-4	170M5499	Two per pole
MD880-20M-0570-7	170M5499	One per pole
MD880-20M-0815-7	170M5499	Two per pole

Fuse on the AC side

Table 2–10 Fuse on the AC side

Model	Recommended fuse model on the AC side		
	Model (Bussmann)	Model (SINOFUSE)	Qty
MD880-20M-0718-4	170M6415	RS306-3-S1P-1100A690V	3
MD880-20M-0982-4	170M6418	RS306-3-S1P-1500A690V	3
MD880-20M-0570-7	170M6413	RS306-3-S1P-900A690V	3
MD880-20M-0815-7	170M6416	RS306-3-S1P-1250A690V	3

3 Mechanical Installation

3.1 Mechanical Installation Flowchart

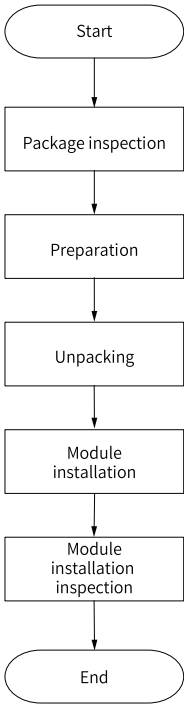


Figure 3-1 Mechanical installation flowchart

3.2 Installation Precautions

3.2.1 Transportation

Transportation precautions

- The basic rectifier module is heavy, so it can be handled only by trained operators with proper hoisting tools.
- Place the equipment on a flat surface that is firm enough to bear the weight of the equipment.
- During transportation, keep the equipment upright as indicated on the packaging. Never place it upside down or on its side.
- The basic rectifier module has a high center of gravity. Do not place the module on surfaces with an angle of slope larger than 5°.

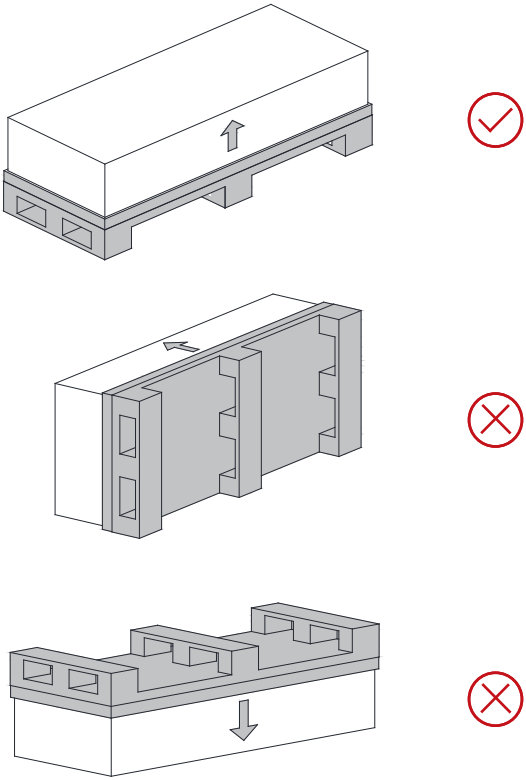


Figure 3-2 Placement during transportation

- When using a forklift, secure the equipment onto the wooden pallet. Do not disassemble the equipment from the pallet while it is still awaiting transportation.
- For handling with a crane, lift the equipment together with the wooden pallet.

Package inspection

Perform inspection on the MD880-20 series basic rectifier module carefully when receiving the module. Check every item received against the delivery list. In case of any missing components or damage, notify the carrier immediately. When necessary, contact Inovance or the local agent for support.

Note

- If the equipment is damaged during transportation, the electrical safety of the equipment can no longer be guaranteed. Do not connect the equipment before a professional high-voltage test is performed.
- Failure to comply may result in major property loss, physical injury, or even death.

Storage

Keep the equipment in a clean and dry room, with temperatures between -40°C and +70° C and temperature variation lower than 1°C/min. For long-term storage, cover the module or take other appropriate measures to protect it against contamination and environmental pollutants.

For temporary and long-term storage, observe the following requirements:

- Pack the equipment into the original packing box provided by Inovance whenever possible.
- Do not expose the equipment to environments with moisture, high temperatures, or direct sunlight for a long time.

3.2.2 Installation Checklist

- The basic rectifier module must be properly installed and commissioned by qualified personnel, taking into account all the warning notices provided.
- In particular, the general and national guidelines for installation and safety of high-voltage equipment as well as guidelines relating to the proper use of tools and personal protective equipment must be observed.
- Failure to comply may result in great property loss, physical injury, or even death.

Check the box in the "Compliance" column for each item that is applicable. After installation is done, check each item step by step and fill in the "Done" column.

Table 3–1 Basic rectifier module installation checklist

No.	Check Item	Compliance	Done
1	The packing box is intact and dry.	□	□
2	The clearance around the basic rectifier module (for unblocked air exhaust) meets requirements, and sufficient space is reserved for the air inlet and outlet.	□	□
3	The basic rectifier module enclosure is free of deformation, peeling, cracking, or water stain.	□	□
4	All accessories (documents and options) are delivered.	□	□
5	The surrounding of the basic rectifier module has been protected properly before commissioning.	□	□

3.3 Installation Preparation

3.3.1 Preparation

Note

- Install the basic rectifier modules according to the drawings, with sufficient space around for air flow, door open/close, and maintenance.
- Ensure that the installation site is dry and clean, and the air supplied does not contain any electrically conductive gas, water vapor, or dust that can impair the equipment. If necessary, use a filter to purify the air at the installation site.
- For ambient temperatures higher than 40°C, derate the power. When the basic rectifier module is installed in a location with altitude higher than 1000 m, derate the power.

Installation space requirements

The following figure shows the minimum requirements of installation space.

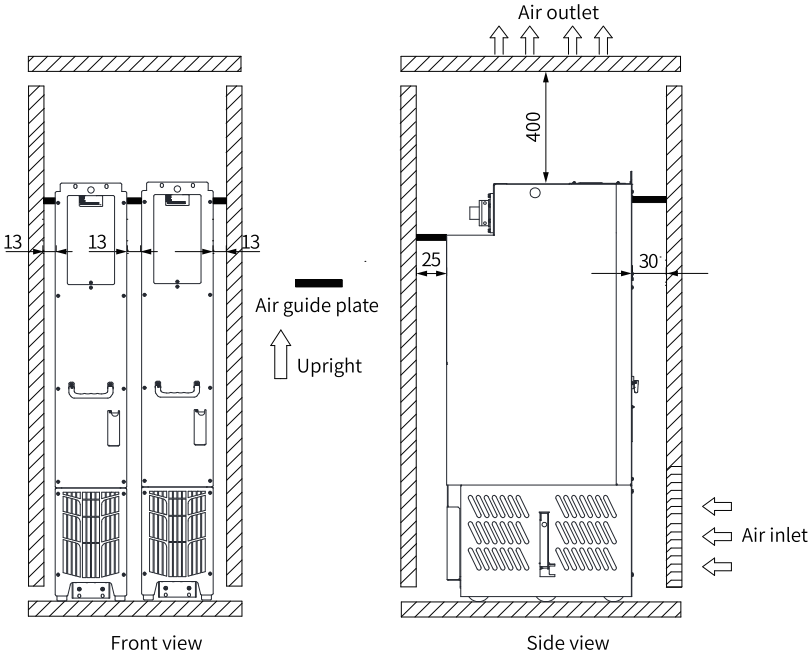


Figure 3-3 Clearance requirements (mm)

Air inlet/outlet area

Reserve sufficient ventilation clearance above and below the basic rectifier module to ensure heat dissipation. Do not route any cables or install any components in the ventilation clearance, especially when cable ducts are used.

Calculate the air inlet/outlet area as follows:

Air inlet area: S_{Inlet} = (1.5 to 2.0) x ($S_{Module1}$ + $S_{Module2}$ + $S_{Module3}$ +...+ $S_{ModuleN}$)

where

S_{Inlet} : Air inlet area of the system (unit: cm^2)

S_{Module} : Air inlet area of each module (unit: cm^2)

Air outlet area: S_{Outlet} = (1.2 to 1.5) x S_{Inlet} (unit: cm^2)

The air inlet area of the T2 basic rectifier module is as follows:

Table 3–2 Air inlet area

Structure	Air Inlet Area S_{Inlet} (cm^2)
T2	1400

Note

Failure to comply with the installation requirements of the basic rectifier module will significantly shorten its service life and may result in faults or premature failure of the module.

3.3.2 Handling Before Unpacking

- Handle the packed basic rectifier module with the pallet beneath the package.
- Use a forklift and a crane with a load capacity greater than the weight of the basic rectifier module for transportation.
- Adjust the spacing between forklift feet to a distance greater than half the length of the basic rectifier module.
- Ensure that the lifting strap of the crane passes through the pallet under the basic rectifier module, with the relief height not larger than 0.3 m.
- Do not use a hydraulic vehicle for transportation over long distances or on slopes.

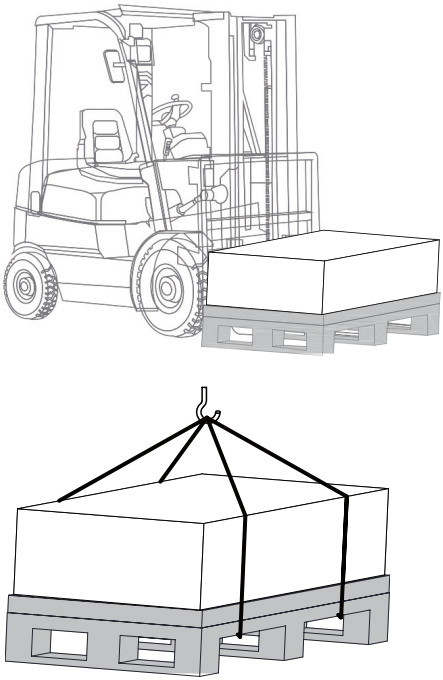


Figure 3-4 Handling before unpacking

3.3.3 Unpacking

The basic rectifier module is packed in a corrugated carton box, which is tied to a wooden pallet with PET straps.

Unpack the module in the following steps:

1. Remove all the straps and ties and open the cover of the carton.
2. Remove all filling materials.
3. Take out the basic rectifier module.
4. Cut the stretch wrap film on the module.
5. Check the module for any damage.

Dispose of or recycle the packing materials according to local regulations.

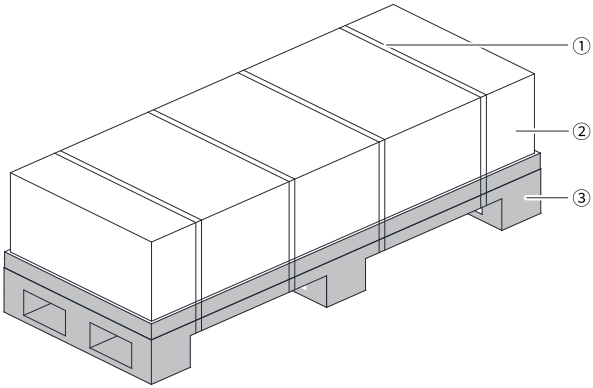


Figure 3-5 Package of the basic rectifier module

Item	Description
①	Tie
②	Carton cover
③	Pallet

3.4 Cabinet Layout

1 x T2 basic rectifier module in a 400 mm-wide cabinet

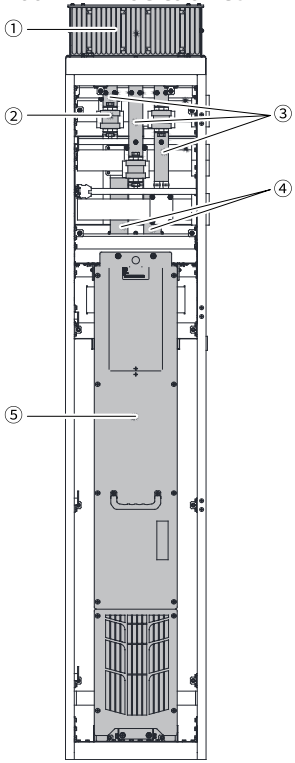


Figure 3-6 T2—400 mm-wide cabinet

No.	Description
①	Top protective cover
②	AC fuse
③	R/S/T AC input copper busbar
④	(+)/(-) DC output copper busbar
⑤	Basic rectifier module

2 x T2 basic rectifier modules in a 600 mm-wide cabinet

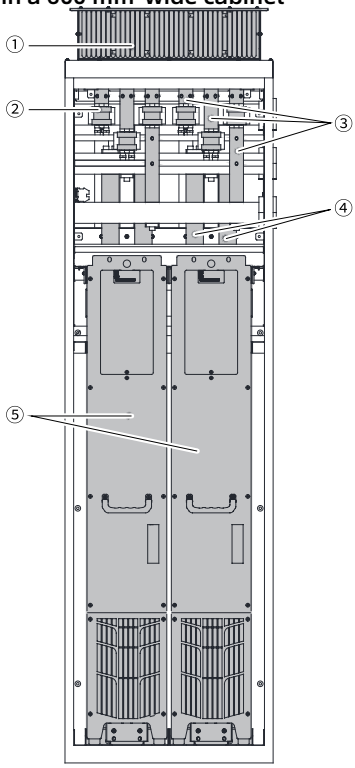


Figure 3-7 T2—600 mm-wide cabinet

No.	Description
①	Top protective cover
②	AC fuse
③	R/S/T AC input copper busbar
④	(+)/(–) DC output copper busbar
⑤	Basic rectifier module

3 x T2 basic rectifier modules in a 800 mm-wide cabinet

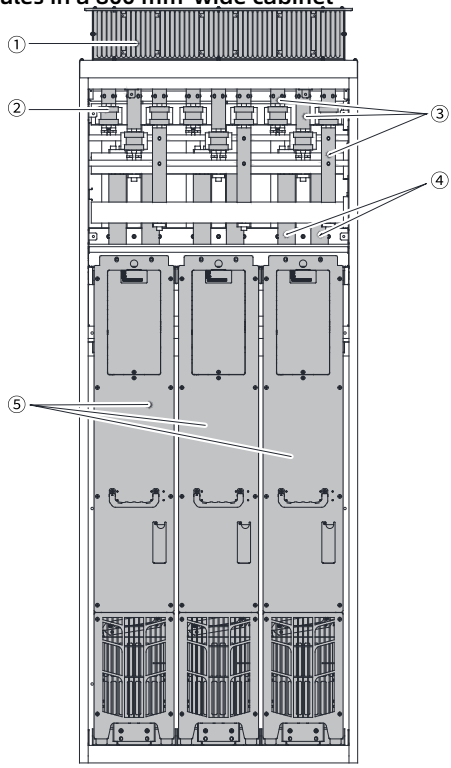


Figure 3-8 T2—800 mm-wide cabinet

No.	Description
①	Top protective cover
②	AC fuse
③	R/S/T AC input copper busbar
④	(+)/(-) DC output copper busbar
⑤	Basic rectifier module

Installing 1 x T2 basic rectifier in a 400 mm-wide cabinet

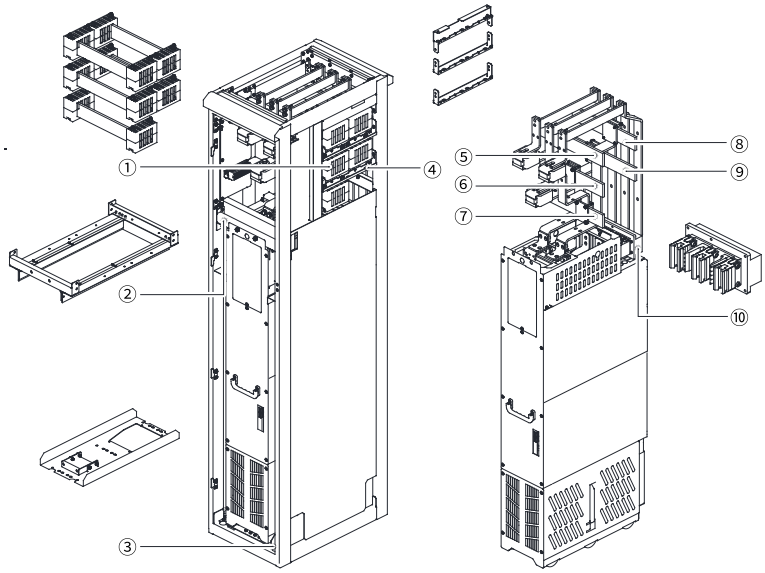


Figure 3-9 T2—400 mm-wide cabinet

No.	Description
①	Bus and bus clamp
②	Upper fixing bracket
③	Lower mounting plate
④	Bus clamp fixing bracket
⑤	R copper busbar
⑥	S copper busbar
⑦	T copper busbar
⑧	(+) copper busbar
⑨	(-) copper busbar
⑩	Quick connector socket

3.5 Dimensions and Installation of T2 Quick Installation Kit

The T2 quick installation kit is an option installed inside the cabinet. It is used to secure the quick connector socket (which is fixed in the cabinet as a part of the cabinet) to facilitate independent cabinet assembly.

3.5.1 Design of Dimensions

Note

The T2 quick installation kit includes an upper part and a lower part. The upper part is installed in the upper half of the cabinet, whereas the lower part is installed in the lower half of the cabinet.

Dimensions of the lower part

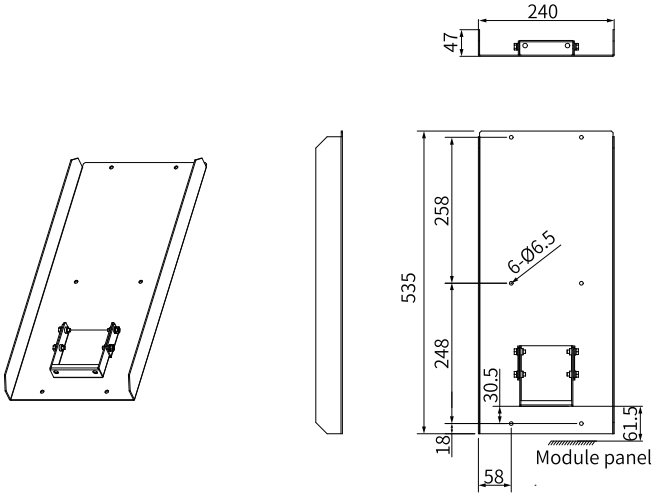


Figure 3-10 Dimensions of the lower part (unit: mm)

Dimensions of the upper part

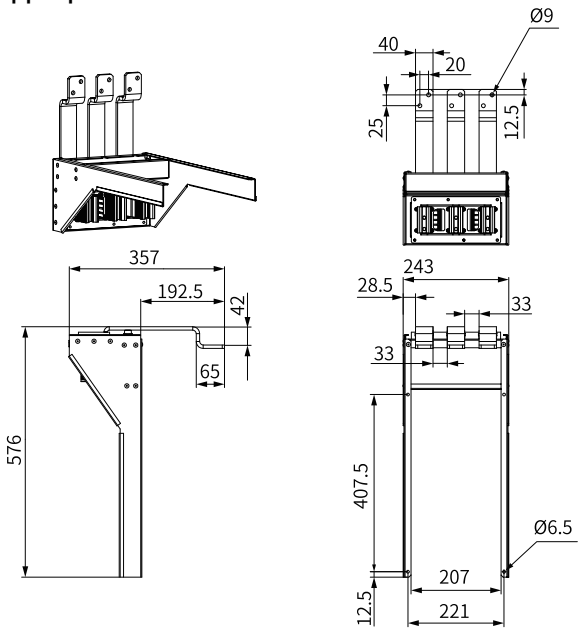


Figure 3-11 Dimensions of the upper part (unit: mm)

Recommended method of fixing the upper part

It is recommended to prepare two beams (A and B) to secure the upper part of the T2 quick installation kit. Place beams A and B front and back and fix them to the left and right sides of the cabinet. Beam B is used for fixing both the frame kit and the module. You can design the two beams in the same way according to the following dimensions and hole specifications.

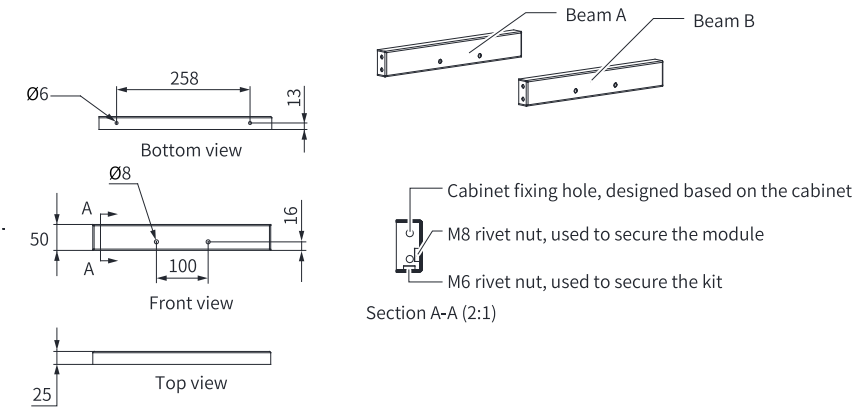


Figure 3-12 Beam dimensions (unit: mm)

Relative positions of the upper and lower parts

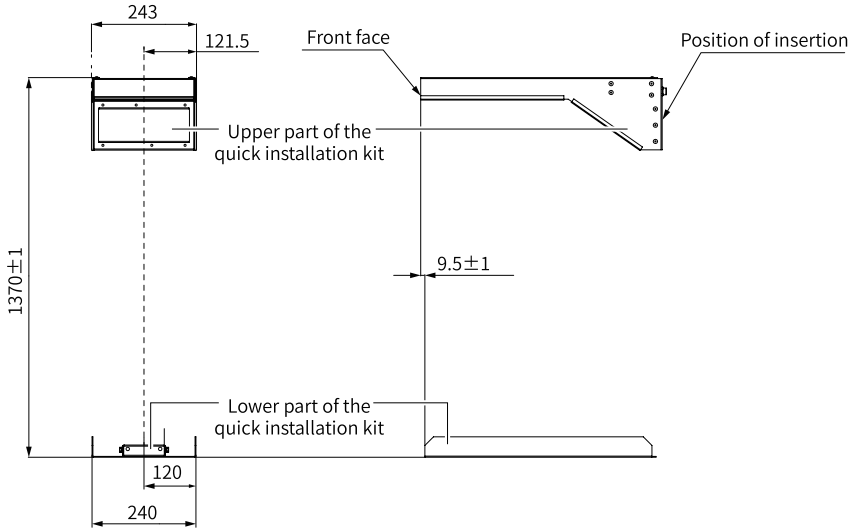


Figure 3-13 Requirements of relative positions (unit: mm)

3.5.2 Dimensional Requirements of Cabinet for T2 Quick Installation Kit

Requirements of cabinet dimensions

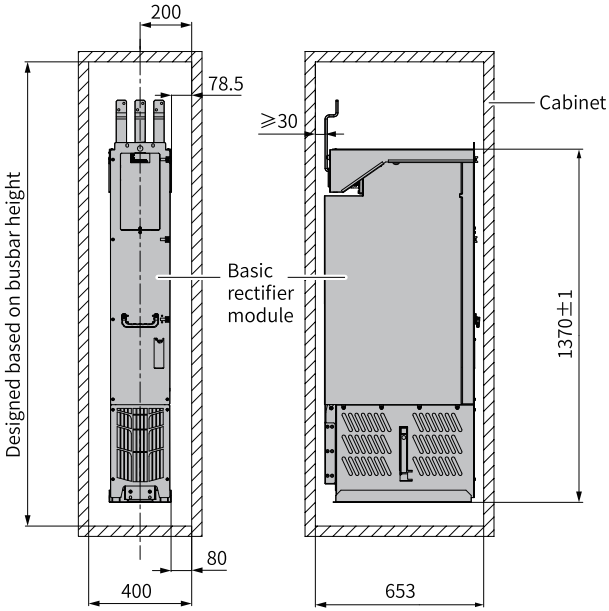


Figure 3-14 Requirements of cabinet dimensions (unit: mm)

Dimensions of holes on the front bottom beam of the cabinet

Two grooves are required on the front bottom beam of the cabinet for placing the module guide rail. The following figure shows the dimensions of the holes.

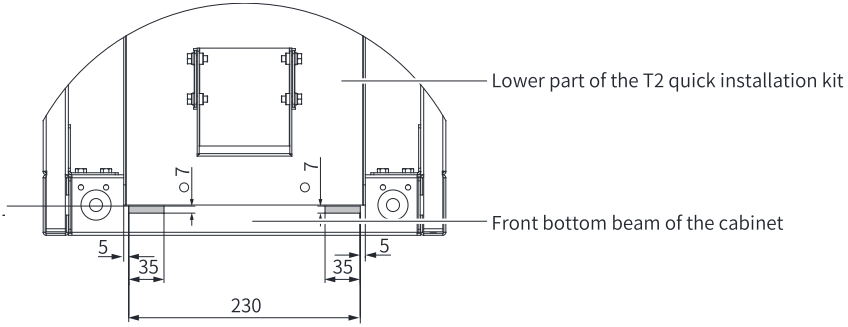


Figure 3-15 Dimensions of holes on the front bottom beam of the cabinet (unit: mm)

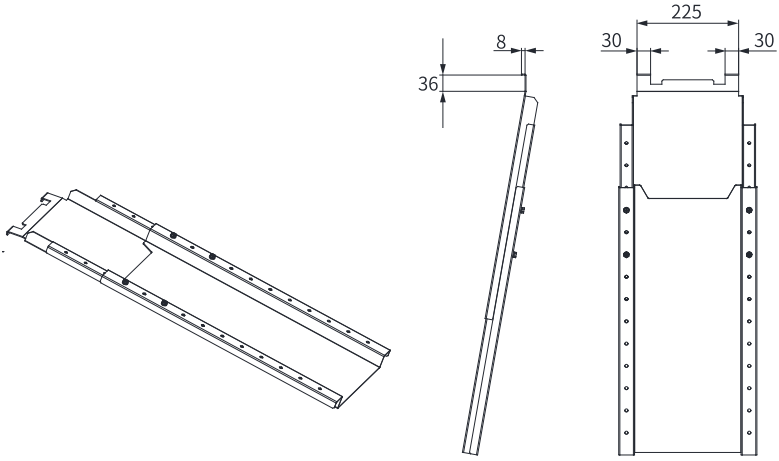


Figure 3-16 Dimensions of the guide rail (unit: mm)

3.5.3 Installing T2 Quick Installation Kit

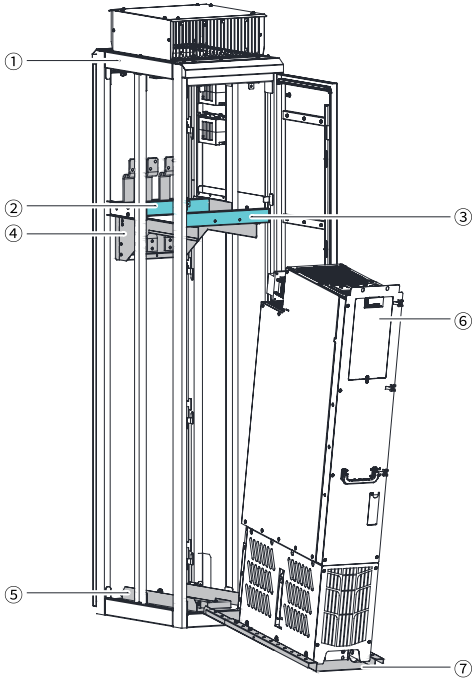
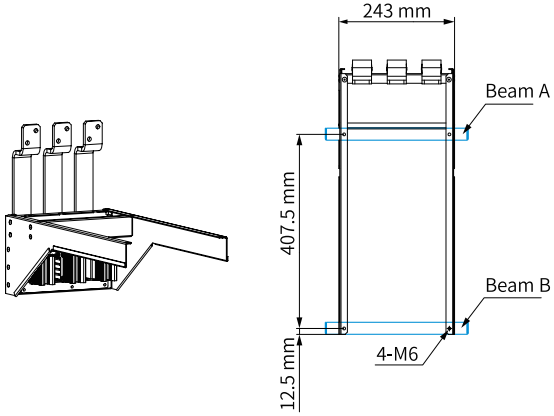


Figure 3-17 Installing T2 quick installation kit

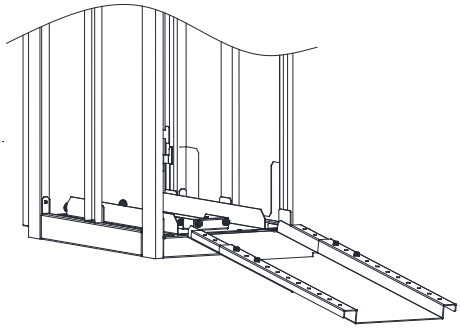
No.	Description
①	Cabinet
②	Beam A
③	Beam B
④	Upper part of the T2 quick installation kit
⑤	Lower part of the T2 quick installation kit
⑥	Basic rectifier module
⑦	Guide rail

Installation procedure

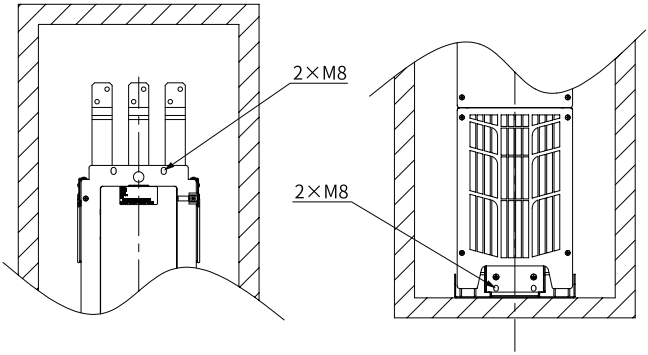
1. Secure the upper part of the T2 quick installation kit to the cabinet with four M6 bolts, fastened from bottom to top through beams A and B.



2. Secure the lower part to the bottom of the cabinet with six M6 bolts.
3. Insert the guide rail into the two grooves on the front bottom beam of the cabinet.



4. Push the basic rectifier module into the cabinet and secure it to the upper and lower parts of the quick installation kit with four M8 bolts.


2×M8
2×M8

4 Electrical Installation

4.1 Electrical Installation Flowchart

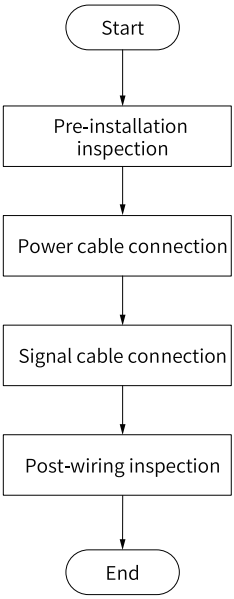


Figure 4-1 Electrical installation flowchart

4.2 Safety Alerts

4.2.1 Protective Measures Before Installation

Note

- The drive contains live parts and rotary components and is typically used in industrial applications involving high voltage. Therefore major personal injury or property loss may occur when necessary covers are removed illegally or the drive is being operated/maintained improperly.
- The drive can only be operated by professional technicians who have read and comply with the safety instructions in this guide.
- The following five safety rules must always be observed during any kind of work on electrical equipment:
  - Power off the equipment.
  - Make sure that the equipment cannot be energized again.
  - Make sure that the equipment is free of residual voltage.
  - Make sure that the equipment is grounded properly.
  - Cover or isolate adjacent live parts.

4.2.2 Electrical Installation Check

Note

- The equipment runs with high voltage. The wiring work must be carried out only after the cabinet is powered off without any residual voltage left.
- Only qualified professionals are allowed to work on the equipment.
- Take caution when working on the equipment even after it is disconnected from power supply, as there may still be external supply voltage. The power and control terminals may be live even when the equipment is in the stop state.
- The equipment may still be live even 15 minutes after power-off due to the capacitors in the inverter module connected to the basic rectifier module. Therefore, ensure that the voltage is below 36 VDC before opening the equipment.
- The user is responsible for ensuring that the motor, cabinet units, and other components are installed and connected in accordance with the recognized technical rules in the country of installation and with other applicable regional regulations. Pay special attention to provisions on cable dimensions, safety devices, grounding, disconnection, isolation, and over-current protection.
- Tripping of a safety device on a branch circuit may cut off the fault current. To reduce the risk of fire or electric shock, check the conductive parts and other components and replace the damaged parts. After a safety device trips, identify and rectify the cause of the tripping.

4.2.3 General Statements

Static electricity

Note

The circuit board contains components that are sensitive to static electricity. Wear a grounded wrist strap when working on the circuit board. Do not touch the circuit board unless necessary.

Optical components

Handle the optical fiber carefully. When removing the optical fiber, hold and pull the connector rather than the fiber itself. As the optical fiber is extremely susceptible to dirt, do not touch the ends of the fiber with bare hands.

4.2.4 Component Insulation Check

The MD880 series AC drive has been tested for insulation between the main circuit and the housing at the factory. Therefore, do not perform any withstand voltage or insulation resistance tests on the AC drive again.

4.3 Overview

Note

The following are operations carried out inside the cabinet. The cabinet is used in industrial applications involving high voltage. Its parts become live or rotate during operation. Therefore, unauthorized removal of required covers, improper use or operation, or poor maintenance can lead to substantial property loss, severe physical injuries, or even death.

Note

Read and comply with the safety precautions and use instructions provided in this guide.

Basic rules for routing

Follow the basic rules below when wiring the basic rectifier module in the cabinet.

- Observe EMC guidelines.
- Use pre-formed cables for routing.
- Always use existing shielding plates.
- Always follow the existing cable routing paths.
- Protect cables at cabinet corners or areas with sharp objects.
- Re-install all protective covers removed during routing before closing the circuit and commissioning.

Preparation

Before any routing or connection work on the basic rectifier module, ensure that the following measures are taken.

- Disconnect the cabinet from the power supply.
- Observe the "five safety rules".
- Remove all covers that may obstruct routing or connection.

Safety and EMC

- Re-install all protective covers removed during routing before putting the basic rectifier module into operation.
- Secure the power cable shield to the shielding plate and the PE cable to the PE bus.

4.4 EMC-Compliant Installation and Routing

4.4.1 Routing Requirements

Routing signal cables and power cables separately

When analog signals are used to remotely control the basic rectifier module, route the signal cables and high-voltage circuit cables (power supply input, rectifier output, and braking resistor connection cables) through different routes with a distance of at least 30 cm. This is to reduce interference generated by the basic rectifier and other devices. This rule also applies to wiring inside the control cabinet.

Requirements on analog control signal cables

Use shielded twisted pair cables as the analog control signal cables. When stripping the sheath of the cable, keep the stripped part as short as possible (5 mm to 7 mm), and wrap the stripped shield with the insulating tape to prevent the shielded cable from contacting other devices which causes interference.

Requirements on power cables

Use shielded cables as power cables, or shield all the cables with cable conduits.

Requirements on control cables and power supply cables

If the power supply cables and control cables must be cross-connected, ensure that the cross-connection angle is as close to 90 degrees as possible.

4.4.2 Routing Suggestions

Disturbing cables

Route cables that transmit different types of signals through different routes. Separate disturbing cables from sensitive cables with a minimum clearance of 30 cm wherever possible. When the two types of cables must be cross-connected, ensure that the cross-connection angle is as close to 90 degrees as possible to prevent interference.

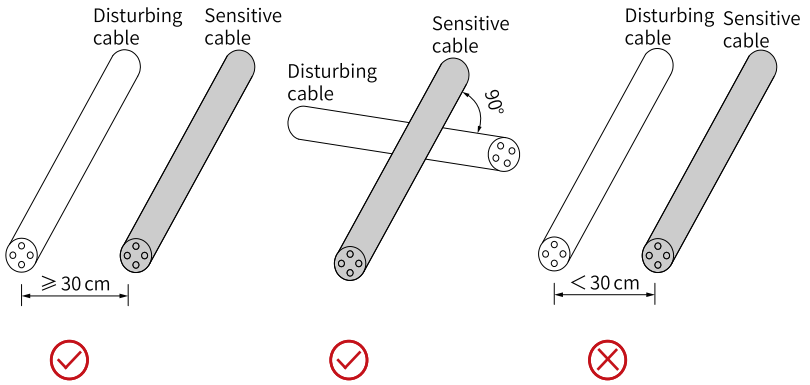


Figure 4-2 Routing disturbing cables and sensitive cables

Signal cables

It is recommended that different types of signal cables be routed through different routes and separated by equipotential cables. For cables carrying the same type of signal, equipotential cables must be arranged on the outer layers, with equipotential wiring arranged as much as possible in the middle section, as shown below.

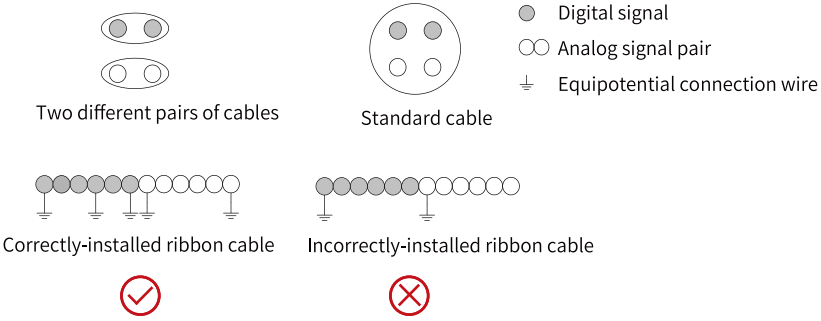


Figure 4-3 Routing cables that transmit different types of signals

Multi-core cables

For multi-core cables, it is recommended that one cable transmits one type of signals. If one cable is used to transmit different types of signals, use the cable with cores shielded, as shown in the following figure.

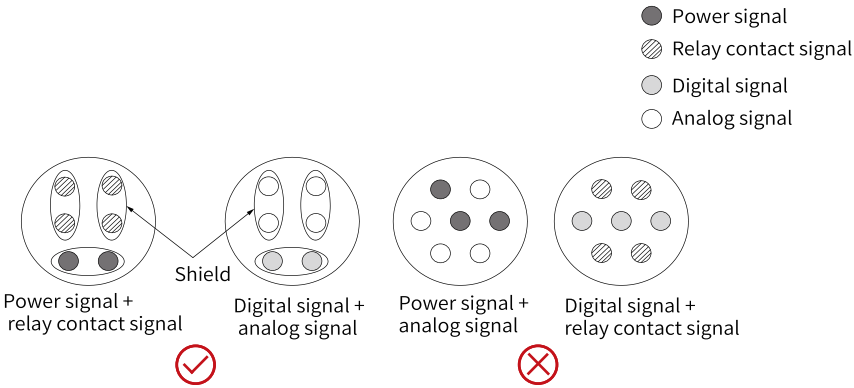


Figure 4-4 Routing multi-core cables

For unused (or reserved) cores in a multi-core cable, connect them to the equipotential bonding point.

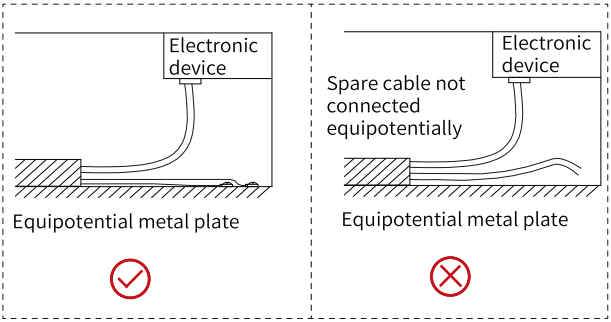


Figure 4-5 Handling reserved or unused cores in a multi-core cable

Routing loop

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

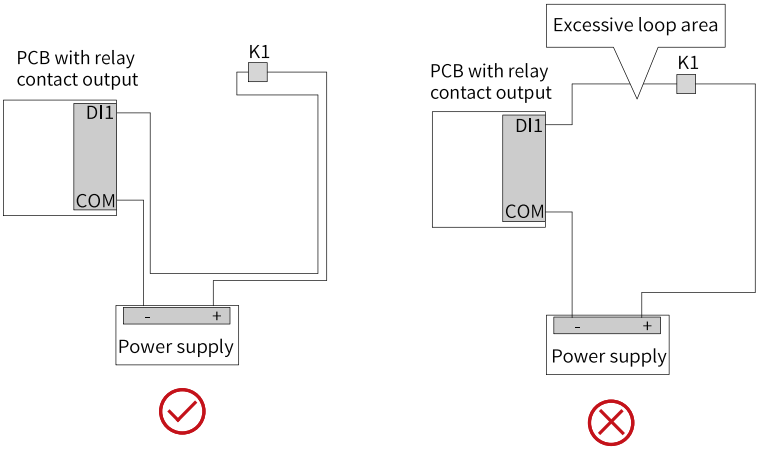


Figure 4-6 Recommended loop area

Multiple types of cables

For cables of different types, route them along the equipotential bonding metal plate. To enhance the internal EMC performance, separate different types of cables with metal separators (recommended) in the same metal (zinc-iron or stainless steel) duct.

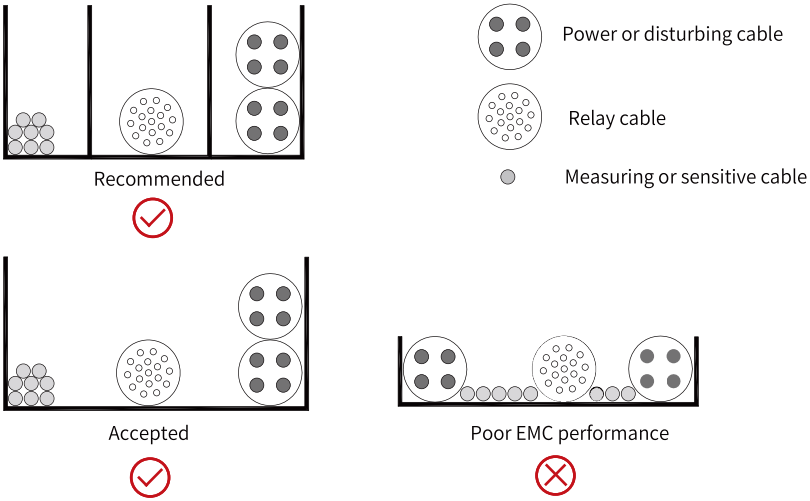


Figure 4-7 Routing multiple types of cables

Handing shielded cables

Minimize the unshielded part of the shielded cable, and connect the shield to the nearest PE terminal. If the unshielded part is excessively long, the conductor may be prone to signal interference, especially the encoder signals.

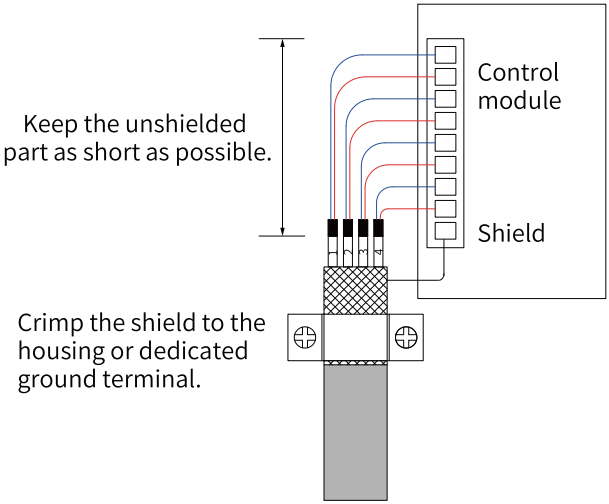


Figure 4-8 Requirements on handing shielded cables

Connecting shielded power cables

The shield of the shielded power input/output cables inside the cabinet modules must be in large-area contact with the shielding plate in the cabinet modules to achieve good EMC effect. See the figure below for the connection method.

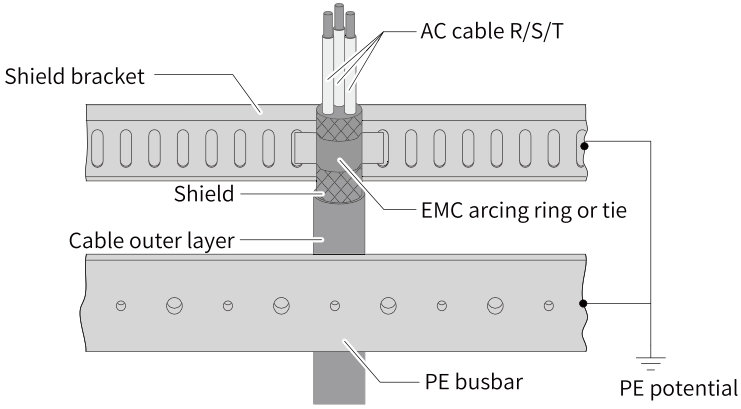


Figure 4-9 Requirements on connecting shielded power cables

4.5 Connection

Preparation:

- Disconnect the cabinet from power supply.
- Take full safety measures at the installation site.

- Observe the "five safety rules".

4.5.1 Connecting the Basic Rectifier Module

Terminal layout

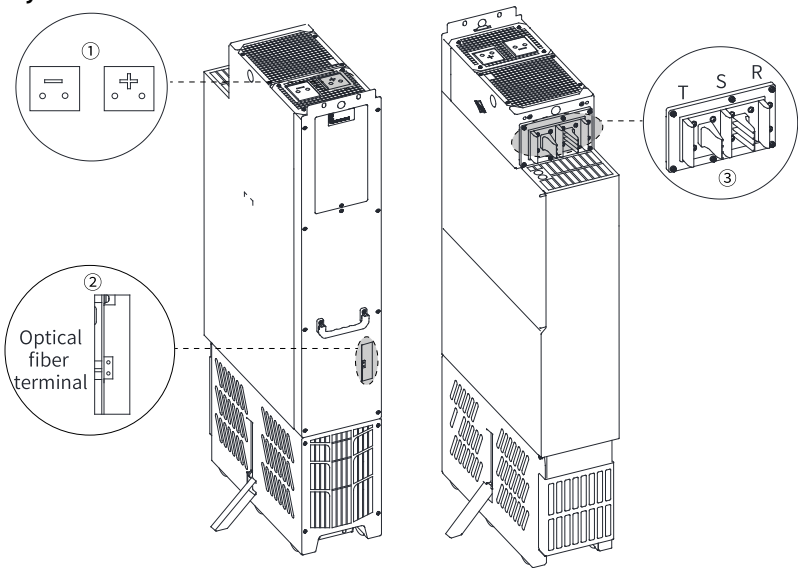


Figure 4-10 Terminal layout of the basic rectifier module

No.	Terminal	Description
①	(+), (-) DC output	400 V system: 540 VDC to 590 VDC 690 V system: 740 VDC to 975 VDC Connects to the copper busbar terminal of M10/42 N·m
②	Optical fiber terminal	Connects to the optical fiber cable
③	R/S/T AC input	Quick connector

Connection procedure

1. Check that the cabinet is properly equipped with the quick connector or T2 quick installation kit. Check that the AC input copper busbar and the DC bus copper bar are connected securely.
2. Install the basic rectifier module in the cabinet according to *" Mechanical Installation" on page 31*.
3. In the cable incoming cabinet, connect the power supply cable to the input terminal. Ensure that conductors are connected in the correct sequence: R, S, T.

Note

Fasten screws with the specified tightening torque. If the tightening torque is excessively low, the connector may be overheated during operation. If the tightening torque is excessively high, the equipment can be damaged.

4.5.2 Operating the Basic Rectifier Module in Grounded System (TT/TN)

It is strongly recommended to install the two grounding screws on the varistor board as shown below when operating the basic rectifier module in TT/TN system. After the grounding screws are installed, re-install the removed panel onto the basic rectifier module.

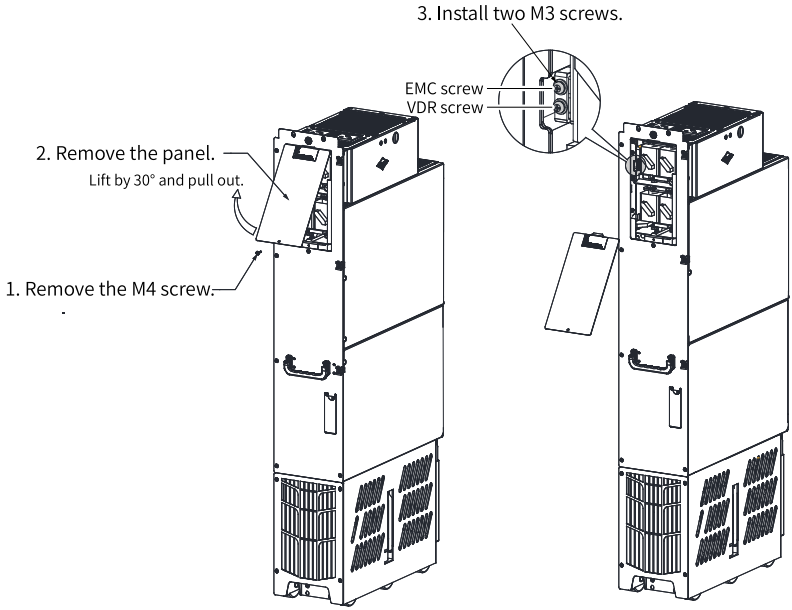


Figure 4-11 Installing the two M3 screws on the varistor board plate

Note

When the basic rectifier module is used in an isolated grid system (IT system), do not install the two grounding screws that have been removed before delivery by default.

4.5.3 Connecting the HCU-20 Control Module

For details about how to install the HCU-20 control module and connect the control cable, see *"5.1.4.4 Installation Procedures" on page 69*.

4.6 Connecting Power Cables and Busbar

4.6.1 Overview

This section provides simplified diagrams for connecting the power cable and busbar. These diagrams do not specify terminal marks and other details, so they are not applicable to electrical installation. The final electrical installation diagram shall prevail.

4.6.2 Wiring Diagram of the 6-Pulse Basic Rectifier (Single Mode)

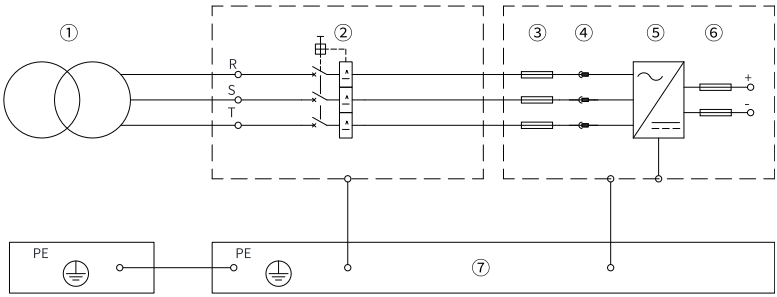


Figure 4-12 Wiring diagram of the 6-pulse basic rectifier (single mode)

No.	Name
①	Grid transformer
②	Air circuit breaker
③	AC fuse
④	Quick connector
⑤	Basic rectifier module
⑥	DC fuse
⑦	Grounding copper busbar

4.6.3 Wiring Diagram of the 6-Pulse Basic Rectifier (Parallel Mode)

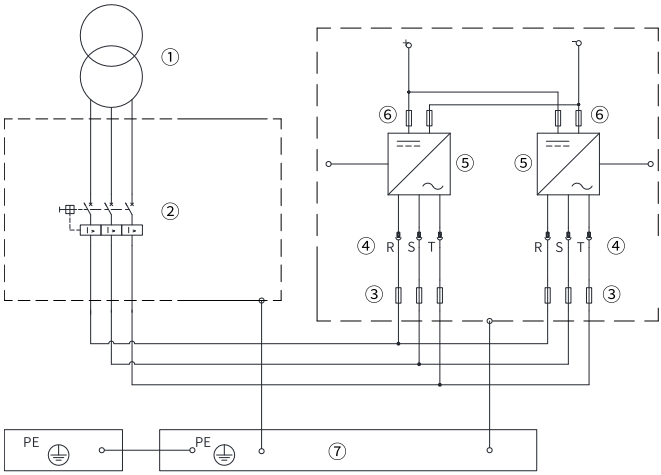


Figure 4-13 Wiring diagram of the 6-pulse basic rectifier (parallel mode)

No.	Name
①	Grid transformer
②	Air circuit breaker
③	AC fuse
④	Quick connector
⑤	Basic rectifier module
⑥	DC fuse
⑦	Grounding copper busbar

4.6.4 Wiring Diagram of the 12-Pulse Basic Rectifier

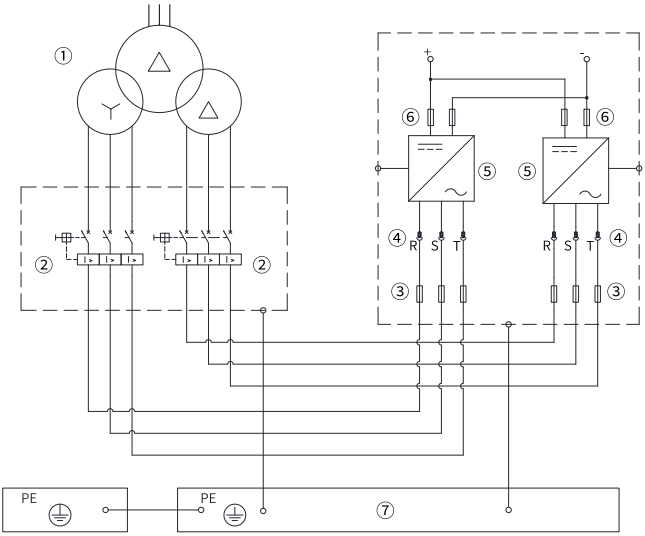


Figure 4-14 Wiring diagram of the 12-pulse basic rectifier

No.	Name
①	Phase-shifting transformer (See *"2.10 Phase-Shifting Transformer Selection Requirements" on page 29*.)
②	Air circuit breaker
③	AC fuse
④	Quick connector
⑤	Basic rectifier module
⑥	DC fuse
⑦	Grounding copper busbar

4.7 Installation Checklist

After electrical installation of the basic rectifier module is done, check the following items. Read *"1.1 General Safety Instructions" on page 8* before operating the equipment.

No.	Check Item	Applicable	OK
1	The input power supply and DC output bus are connected properly with the correct voltage level.	☐	☐
2	The auxiliary power supply provides the correct voltage.	☐	☐
3	Input/Output power cables are secured to the cable bracket for strain relief.	☐	☐

No.	Check Item	Applicable	OK
4	Cables are properly connected with the required tightening torque to the terminals provided.	☐	☐
5	The cable shield is fixed to the shielding plate to ensure EMC compliance.	☐	☐
6	Parallel outputs of the basic rectifier module are correctly connected to the DC bus.	☐	☐
7	The control cables are connected in accordance with the terminal layout and by shield. The control cables are routed separately from the power supply cables to prevent interference. Cable routing and connections comply with the relevant EMC specifications.	☐	☐

5 Control Module

5.1 HCU Control Module

5.1.1 HCU Control Module Composition

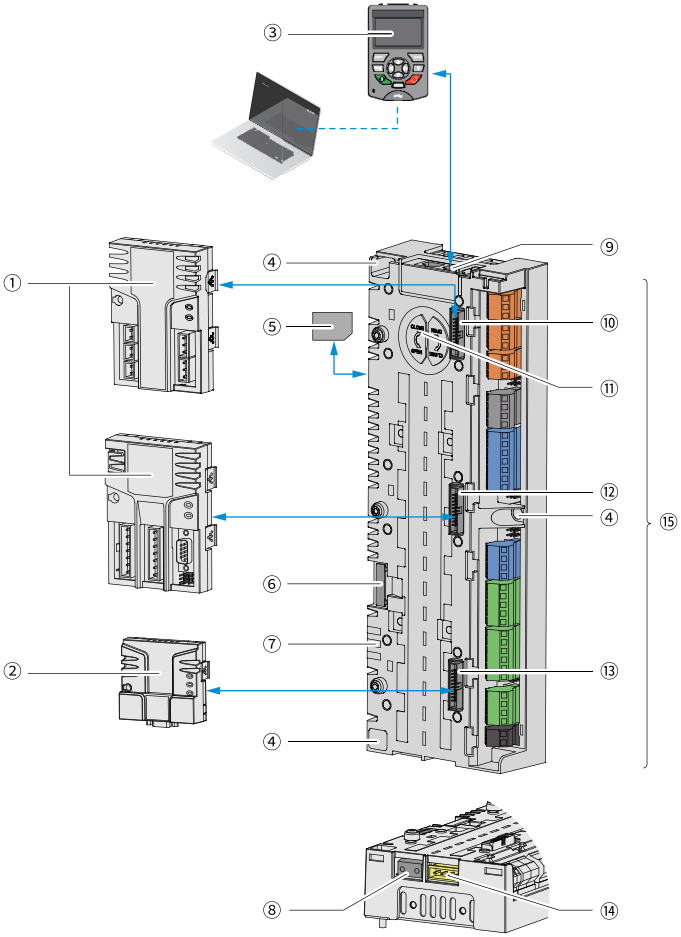


Figure 5-1 HCU control module composition

Table 5–1 HCU control module composition

No.	Name	Function
①	Function module in size 1	105 mm x 73 mm x 24 mm
②	Function module in size 2	75 mm x 73 mm x 24 mm
③	Smart operating panel	SOP-20-880
④	Fixing hole	Three holes for fixing the HCU
⑤	SD card	Pluggable 8 GB microSD memory card in standard HCU configuration
⑥	Functional safety slot	Terminal for connection functional safety modules
⑦	Indicator	Power, operation, and fault indicators
⑧	Optical fiber communication port	Optical fiber communication port between the HCU and the power unit
⑨	Smart operating panel terminal	Two RJ45 terminals with identical assignment, used to connect the HCU module to SOP-20-880 to facilitate cascading
⑩	SLOT1	Function module ports: SLOT1_1, SLOT1_2, and SLOT1_3
11	Battery cover	Cover of the spare RTC battery, which is a non-rechargeable lithium battery that must be replaced regularly
12	SLOT2	Function module ports: SLOT2_1, SLOT2_2, and SLOT2_3
13	SLOT3	Function module port: SLOT3_1
14	STO terminal	Reserved
15	User terminal	HCU standard user I/O terminals

Note

The RJ45 terminal of the HCU controller cannot be connected directly to the computer; otherwise, the computer may be damaged.

5.1.2 LED Indicator

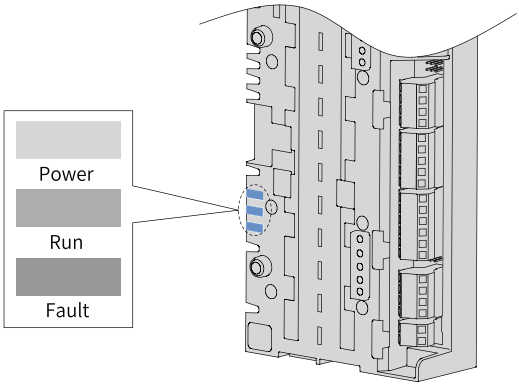


Figure 5-2 LED indicator positions and meanings

Table 5–2 Meaning of the LED indicator

No.	Name	State	Description
1	Power	Steady ON	The HCU is powered normally.
		OFF	The HCU is not powered or the power supply has failed.
2	Run	Steady ON	The power module is running.
		OFF	The power module is not running.
3	Fault	Steady red	The system is faulty.
		Steady yellow	A system alarm is reported.
		OFF	The system is normal.
		Flashing red	The HCU auxiliary power supply is faulty. Check whether 24 V power supply is short-circuited or overloaded.
4	Fault and Run	Flashing yellow and green alternatively	The HCU is selected by the PC or SOP-20-880. The flashing ends after 10 seconds.
		Flashing red and green alternatively	The FPGA of the HCU is abnormal or the external expansion RAM is abnormal.

5.1.3 SD Memory Card

The HCU is internally equipped with an SD card for storing the black box data and parameters to facilitate monitoring and analysis on the power module. The data is saved on the microSD memory card for analysis by qualified service technicians.

5.1.4 HCU Dimensions and Installation Instructions

5.1.4.1 Preparation Before Installation

Note

- Before installing or removing the HCU, make sure that the cabinet has been powered off for more than 15 min and the HCU input power supply is disconnected. Failure to comply can damage the HCU control module.
- When installing or removing a function module on the HCU, make sure that the HCU input power supply is disconnected. Failure to comply can damage the HCU or function module.
- Protect the HCU module from falling or shock.
- Do not disassemble the HCU module. Failure to comply may damage the module.
- Do not tighten terminals with excessive tightening torque.

Installation tools

You may need the following tools during installation:

- Phillips screwdrivers, sizes 1# and 2#
- Straight screwdrivers, sizes 1# and 2#

Screw and fastener tightening torque

The following tightening torque should be applied to the screws during HCU installation.

Screw	Tightening Torque
M3	0.55 N·m
M4	1.2 N·m

5.1.4.2 Overall Dimensions

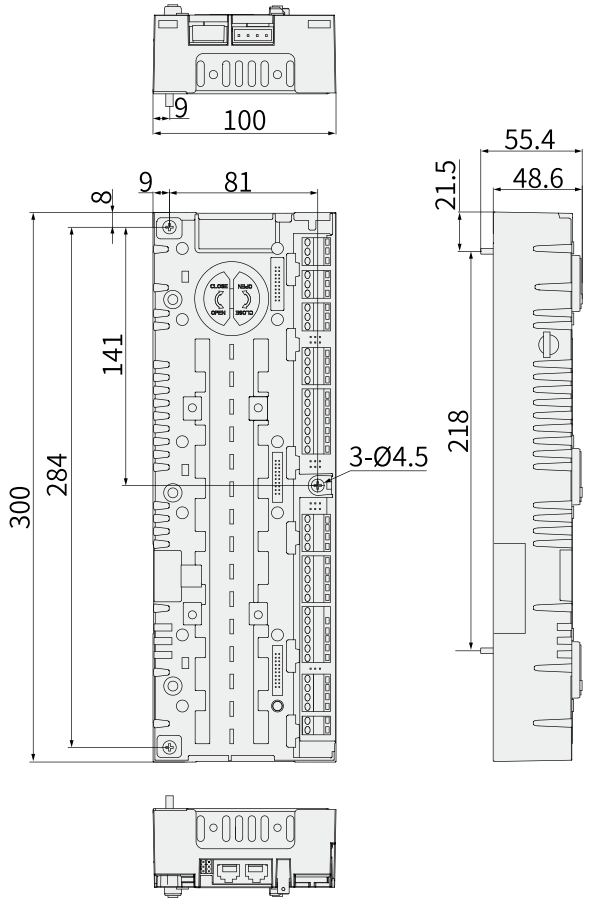


Figure 5-3 Overall dimensions of the HCU control module (mm)

5.1.4.3 Requirements on Installation Space

To facilitate installation, reserve certain clearance between the HCU and its surrounding structures and devices, as shown in the following figure. The HCU must be mounted on a conductive metal surface with its entire conductive back in good contact with the mounting surface.

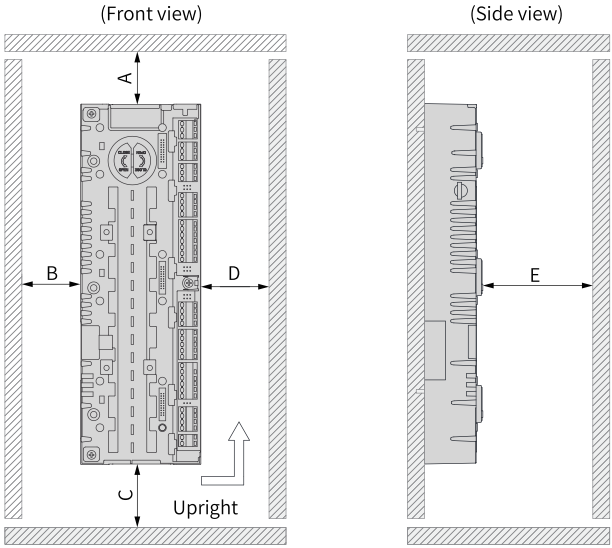


Figure 5-4 HCU installation space

Table 5–3 HCU installation space (mm)

A	B	C	D	E
≥ 100	≥ 30	≥ 100	≥ 50	≥ 100

5.1.4.4 Installation Procedures

1. Align the HCU vertically with the two positioning holes on the metal mounting plate.
2. Tighten the HCU mounting screws (three M4 screws) with a #2 Phillips screwdriver as shown below.

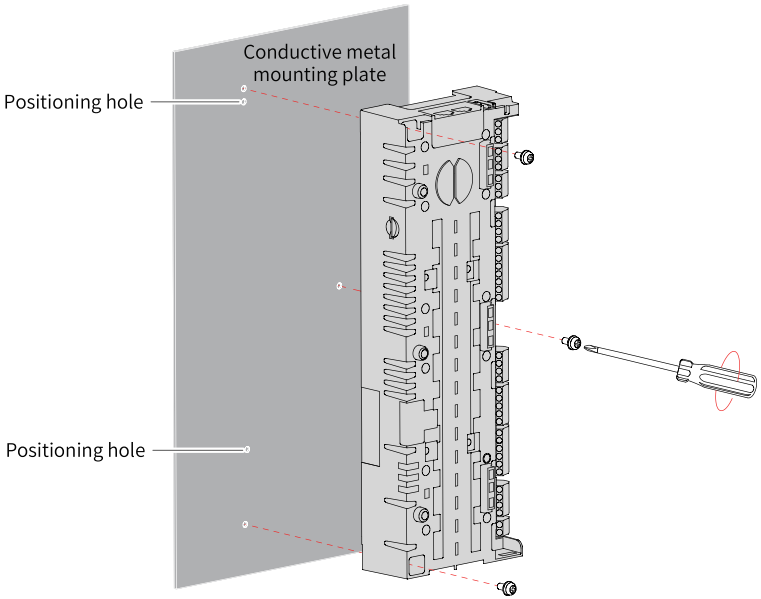


Figure 5-5 Installing the HCU

Grounding inside the cabinet

The mounting plate of the HCU must be a bare metal plate and reliably grounded.

The HCU enclosure must be grounded by connecting to the cabinet enclosure through the screws on the mounting surface.

5.1.4.5 Removing the HCU Cover

The AC drive is provided with an HCU cover as standard. To configure the HCU interfaces externally, you need to knock off the cover, as shown in the following figure.

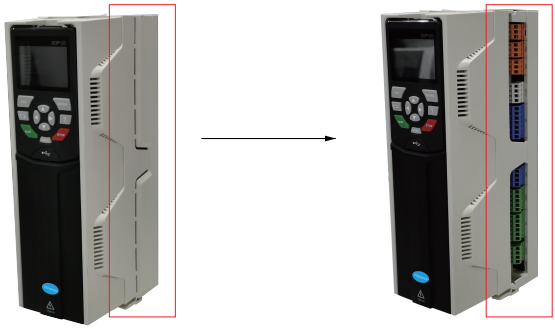


Figure 5-6 Removing the HCU cover

5.1.5 Overview of HCU Control Module Interfaces

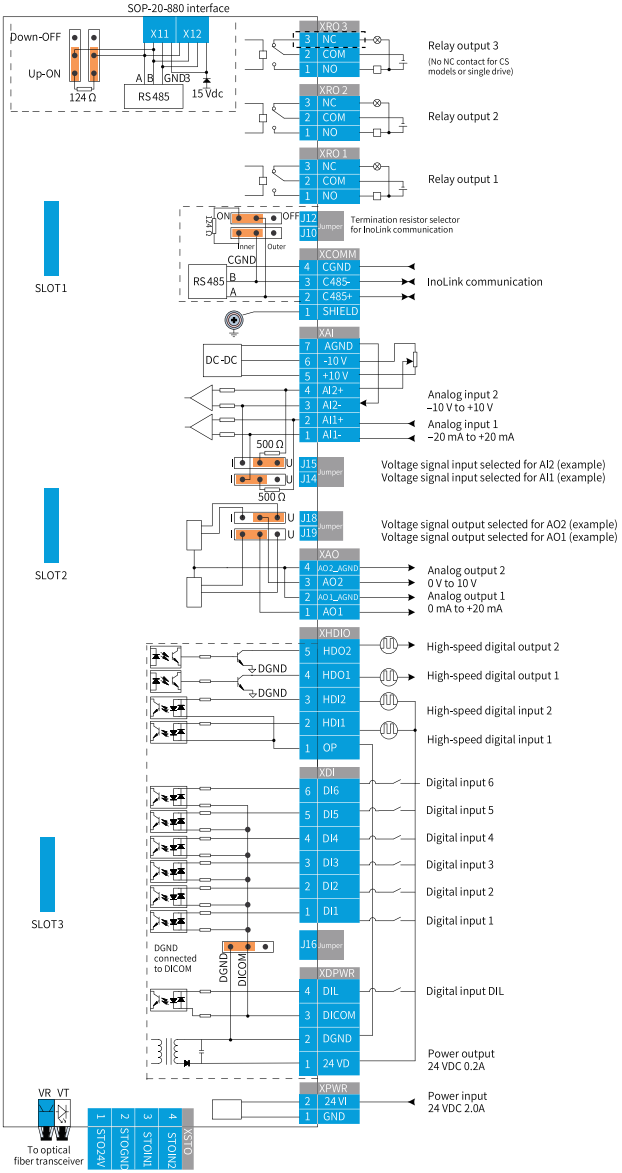


Figure 5-7 Wiring circuits of HCU terminals

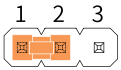
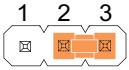
5.1.5.1 Standard Terminals

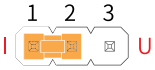
Table 5–4 Standard terminals of the HCU

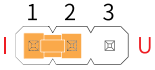
Name	Terminal	Description
Input power supply	XPWR: 24VI	HCU power supply
Digital power output	XDPWR: 24VD	Digital output power supply that is isolated from XPWR
Digital input	XDI: DI1 to DI6 and DIL	Input type: Relay contact, NPN, or PNP
High-speed digital input	XHDIO: HDI1 and HDI2	Input type: NPN or PNP
High-speed digital output	XHDIO: HDO1 and HDO2	Output type: Open collector
Analog output	XAO: AO1 and AO2	Output type: Current or voltage, selected by jumper
Analog input	XAI: AI1 and AI2	Input type: Current or voltage, selected by jumper
Relay output	XRO1, XRO2, and XRO3	Relay output: NO, NC, and COM No NC contact for the CS model or single-drive XRO3
InoLink communication	XCOMM	High-speed RS485, with termination resistor selected by jumper
RJ45 terminal	X11 and X12	For communication with SOP-20-880; two terminals with identical assignment to cascade multiple HCUs; length of connection cable < 3 m)
Safe Torque Off (STO)	XSTO	Provides 24 V power supply for the functional safety contact, with two functional safety contact inputs Products that support STO: CS model (multi-drive), 690 V air-cooled (single-drive), and water-cooled inverter products
Inodrive communication	Optical fiber or DB15	Optical interface: Optical fiber; electrical interface: DB15
SD CARD	SD	Push-push type card holder; SD card capacity: 8 GB
RTC battery	BAT	Non-rechargeable lithium battery that must be replaced regularly

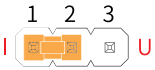
5.1.5.2 Details of HCU Control Module Terminals

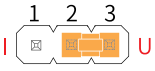
Table 5–5 Details of HCU control module terminals

Terminal	Code	Description	Recommended cable
XPWR: Power input terminal			
1	GND	24.0 VDC±10%, 2.0 A	Dual-core twisted pair cables with a cross-sectional area of 0.5 mm^2 to 2.5 mm^2
2	24VI		
XDPWR: DIL terminal			
1	24VD	Provides power supply for DI, HDI, and HDO 24.0 VDC±10%, 0.2 A	Twisted pair cable or single-core cable with a cross-sectional area of 0.5 mm^2 to 2.5 mm^2; Note: The load of the 24VD terminal cannot exceed 0.2 A.
2	DGND	24VD ground	
3	DICOM	DI common output, which can be connected to DGND through jumper J16	
4	DIL	Digital interlock or common DI with identical technical parameters as common DIs	
Jumper J16: Power supply selection for DI			
 24 VDC internal power supply applies when DGND and DICOM are shorted.			
 The external power supply applies when DGND is disconnected from DICOM.			
XDI: DI terminal			
1	DI1	24 V logic level: "0": < 5 V; "1": > 15 V Rin: 2.0 kΩ Input type: NPN/PNP, relay contact Hardware filter: 0.04 ms Imax: 15 mA	Single-core cable with a cross-sectional area of 0.5 mm^2 to 2.5 mm^2
2	DI2		
3	DI3		
4	DI4		
5	DI5		
6	DI6		
XHDIO: HDIO input terminal			

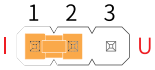
<table>
<tr><th>Terminal</th><th>Code</th><th>Description</th><th>Recommended cable</th></tr>
<tr><td>1</td><td>OP</td><td>HDI common terminal</td><td rowspan="6">Shielded twisted pair cable with a cross-sectional area of 0.5 mm^2 to 2.5 mm^2;
HDO twisted with DGND;
HDI twisted with OP</td></tr>
<tr><td>2</td><td>HDI1</td><td rowspan="2">Input type: NPN, PNP
24 V logic level: "0": < 5 V; "1": > 15 V
Rin: 2.0 kΩ
Input voltage range: 0 VDC to 30 VDC
Input frequency range: 0 kHz to 100 kHz
HDI maximum load (Imax): 15 mA</td></tr>
<tr><td>3</td><td>HDI2</td></tr>
<tr><td>4</td><td>HDO1</td><td rowspan="2">Output type: OC
Output frequency: 0 kHz to 100 kHz
HDO maximum load (Imax): 20 mA
Output voltage range: 0 VDC to 26.4 VDC</td></tr>
<tr><td>5</td><td>HDO2</td></tr>
<tr><td colspan="4">XAO: AO terminal</td></tr>
<tr><td>1</td><td>AO1</td><td rowspan="4">AO1 output range:
0 mA to 20 mA; Rload: ≤ 500 Ω
0 V to 10 V; Rload: ≥ 10 kΩ
AO2 output range:
0 mA to 20 mA; Rload: ≤ 500 Ω
0 V to 10 V; Rload: ≥ 10 kΩ
Resolution: 11 bits + sign bit
Accuracy: 2% of the full range</td><td rowspan="4">Shielded twisted pair cable with a cross-sectional area of 0.5 mm^2 to 2.5 mm^2
AO1 twisted with AO1_AGND;
AO2 twisted with AO2_AGND</td></tr>
<tr><td>2</td><td>AO1_AGND</td></tr>
<tr><td>3</td><td>AO2</td></tr>
<tr><td>4</td><td>AO2_AGND</td></tr>
<tr><td colspan="4">Jumper J19: Current or voltage signal selection for AO1</td></tr>
<tr><td colspan="4">

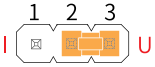
Current output applies when pins 1 and 2 are shorted.</td></tr>
<tr><td colspan="4">

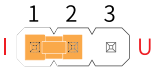
Voltage output applies when pins 2 and 3 are shorted.</td></tr>
<tr><td colspan="4">Jumper J18: Current or voltage signal selection for AO2</td></tr>
<tr><td colspan="4">

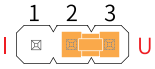
Current output applies when pins 1 and 2 are shorted.</td></tr>
<tr><td colspan="4">

Voltage output applies when pins 2 and 3 are shorted.</td></tr>
</table>

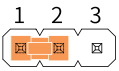
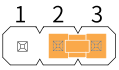
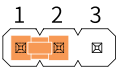
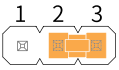
<table>
<tr><th>Terminal</th><th>Code</th><th>Description</th><th>Recommended cable</th></tr>
<tr><td colspan="4">XAI: AI terminal</td></tr>
<tr><td>1</td><td>AI1-</td><td rowspan="4">Current input: -20 mA to +20 mA; Rin: 500 Ω
Voltage input: -10 V to +10 V; Rin: 200 kΩ
Differential input; input range: ±30 V
Sampling interval per channel: 0.25 ms
Hardware filter: 0.25 ms
Resolution: 11 bits + sign bit
Error: 1% of full range</td><td rowspan="4">Use two dual-core shielded twisted pair cables with a cross-sectional area of 0.5 mm^2 to 2.5 mm^{2}when using two AIs.
Use one four-core shielded twisted pair cable for one AI at the reference voltage.</td></tr>
<tr><td>2</td><td>AI1+</td></tr>
<tr><td>3</td><td>AI2-</td></tr>
<tr><td>4</td><td>AI2+</td></tr>
<tr><td>5</td><td>+10V</td><td rowspan="3">+10V: +10 V±1%
-10V: -10 V±1%
Rload: 1 kΩ to 10 kΩ</td></tr>
<tr><td>6</td><td>-10V</td></tr>
<tr><td>7</td><td>AGND</td></tr>
<tr><td colspan="4">Jumper J14: Current or voltage signal selection for AI1</td></tr>
<tr><td colspan="4">

Current input applies when pins 1 and 2 are shorted.</td></tr>
<tr><td colspan="4">

Voltage input applies when pins 2 and 3 are shorted.</td></tr>
<tr><td colspan="4">Jumper J15: Current or voltage signal selection for AI2</td></tr>
<tr><td colspan="4">

Current input applies when pins 1 and 2 are shorted.</td></tr>
<tr><td colspan="4">

Voltage input applies when pins 2 and 3 are shorted.</td></tr>
<tr><td colspan="4">XCOMM: InoLink RS485 terminal</td></tr>
<tr><td>1</td><td>SHIELD</td><td rowspan="4">RS485 bus, 5 V standard level
Bus termination resistor: 124 Ω
Max. communication rate: 5 Mbps
Max. number of nodes: 16 (without repeater)
Max. transmission distance: 40 m</td><td rowspan="4">Four-conductor shielded twisted pair cable
Cross-sectional area: 0.5 mm^2 to 2.5 mm^2</td></tr>
<tr><td>2</td><td>C485+</td></tr>
<tr><td>3</td><td>C485-</td></tr>
<tr><td>4</td><td>CGND</td></tr>
<tr><td colspan="4">Jumpers J10 and J12: RS485 bus termination resistor selector (To connect the termination resistor, J10 and J12 must be in the same state.)</td></tr>
</table>

Terminal	Code	Description	Recommended cable
 Shorting 1 and 2 connects the termination resistor.			
 Shorting 2 and 3 disconnects the termination resistor.			
XRO1: Output terminal of relay 1			
1	RO1_NO	Output type: Passive NO and NC contacts Contact specifications: 250 VAC/ 30 VDC, 2 A	Single-core cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	RO1_COM		
3	RO1_NC		
XRO2: Output terminal of relay 2			
1	RO2_NO	Output type: Passive NO and NC contacts Contact specifications: 250 VAC/ 30 VDC, 2 A	Single-core cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	RO2_COM		
3	RO2_NC		
XRO3: Output terminal of relay 3			
1	RO3_NO	Output type: Passive NO and NC contacts Contact specifications: 250 VAC/ 30 VDC, 2 A	Single-core cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	RO3_COM		
3	RO3_NC		
X11 and X12: SOP-20-880 RS485 terminals			
1, 2, and 7	NC	RS485 bus, 5 V standard level Bus termination resistor: 124 Ω Max. communication rate: 4 Mbps Max. number of nodes: 32 (without repeater) Max. transmission distance: 100 m	Standard network cable
3 and 8	GND3		
4	A		
5	B		
6	15V3	15V3: 15 V±15%	
Jumpers J12 and J15: Bus termination resistor selector (J12 and J15 are active only when they are in the same state.)			
 Shorting 1 and 2 connects the termination resistor.			
 Shorting 2 and 3 disconnects the termination resistor.			
VR and VT: Optical fiber transceiver			

Terminal	Code	Description	Recommended cable
1	VR	Receiving optical fiber communication signals	Optical fiber type: Plastic optical fiber (POF)
2	VT	Transmitting optical fiber communication signals	

5.1.6 HCU Function Application

5.1.6.1 Function Modules

The HCU can work with other function modules to expand its functions. See the following for details.

Table 5–6 Function modules used with the HCU

No.	Name	Module model	Description	Connection method	Dimensions (W x D x H) (mm)
1	I/O module	HIO-10	Two AIs Two AOs Two DIOs One relay output	Slot	105 x 73 x 24
2	PROFIBUS DP module	HDP-10	PROFIBUS DP bus adapter	Slot	75 x 73 x 24
3	CAN bus module	HCAN-10	CANopen bus adapter	Slot	75 x 73 x 24
		HCAN-30	CAN 2.0 bus adapter	Slot	75 x 73 x 24
4	Optical fiber expansion module	HOFM-10	One pair of 50 M optical fiber interfaces	Slot	75 x 73 x 24
		HOFM-30	Three pairs of 50 M optical fiber interfaces	Slot	75 x 73 x 24
5	Modbus RTU module	HMBA-10	Modbus RTU bus adapter	Slot	75 x 73 x 24
6	EtherCAT module	HETC-10	EtherCAT bus adapter	Slot	75 x 73 x 24
7	Ethernet module	HETN-10	Ethernet commissioning module	Slot	75 x 73 x 24
8	PROFINET IO module	HPFN-10	PROFINET IO industrial Ethernet adapter	Slot	75 x 73 x 24
		HPFN-20	PROFINET IRT industrial Ethernet adapter	Slot	75 x 73 x 24
9	Modbus TCP module	HMBT-10	Modbus TCP industrial Ethernet adapter	Slot	75 x 73 x 24

No.	Name	Module model	Description	Connection method	Dimensions (W x D x H) (mm)
10	Parallel control module	HPCU-40	Supports parallel connection of 2 to 4 modules	Optical fiber	232 x 86 x 40
		HPCU-60	Supports parallel connection of 2 to 6 modules	Optical fiber	232 x 86 x 40
		HPCU-A0	Supports parallel connection of 2 to 10 modules	Optical fiber	232 x 86 x 40
11	Function expansion module	HESD-10	Expands one slot	Optical fiber	105 x 75 x 70
12	Sync voltage detection module	HSVM-10	Three-phase AC input voltage detection	Optical fiber	150 x 100 x 30
		HSVM-20	DC voltage detection module (supports one voltage channel and two current channels)	Optical fiber	150 x 100 x 30
13	Digital gateway commissioning and monitoring module	HGW-10	Supports centralized commissioning and operation data collection	Network cable	180 x 100 x 50
14	Smart operating panel	SOP-20-880	Human-machine interaction panel	RS485	150 x 100 x 30
15	Optical fiber router module	HOFR-50	Data exchange between two to five HCUs (master-slave communication through optical fiber)	Optical fiber	232 x 86 x 40
16	Pulse-by-pulse current limit module	HCBC-A0	Pulse-by-pulse current limit control for parallel power modules	Optical fiber	232 x 86 x 40

Note

- The HOFM-30 can be installed only in SLOT1 or SLOT2.
- The HDP-10 is recommended to be installed in SLOT3.

5.1.6.2 Slot Expansion Application

- Different function modules are available in the HCU application. The function modules are installed directly in the slots of the HCU.
- The HCU only has three slots. When more modules are needed, install HOFM and HESD expansion modules. Each HESD can connect to one function module.

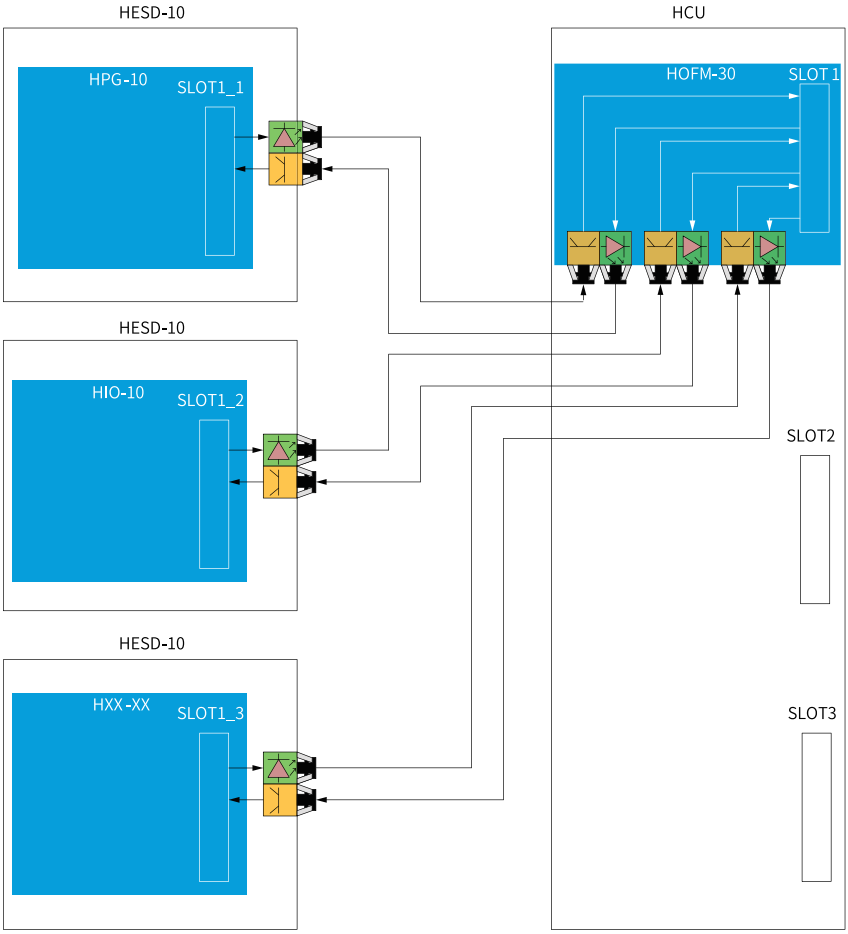


Figure 5-8 HESD wiring example

When installing function modules to the three slots, observe the following principles.

- Function modules can be directly installed in SLOT1, SLOT2, and SLOT3, with the addresses being SLOT1_1, SLOT2_1, and SLOT3_1.
- SLOT1 and SLOT2 each can be used with an HOFM-30 module to be expanded to three slots, with the addresses being SLOT1_1, SLOT1_2, SLOT1_3 and SLOT2_1, SLOT2_2, SLOT2_3, respectively.
- SLOT3 does not support slot expansion.
- In this case, the HESD module is not allowed to be further expanded by another HOFM optical fiber expansion module.

5.1.6.3 Temperature Detection with AI and AO

AI and AO can work together to detect temperature sensor signals. This method is generally used for motor temperature detection and supports a single sensor or one to three sensors connected in series.

In this case, select constant current output for the AO and voltage signal input for the AI. Temperature sensors PT100, PT1000, and KTY84 are supported.

Do not directly ground both ends of the cable shield. Ground one end and keep the other end unconnected, or ground one end directly and ground the other end through a capacitor in series.

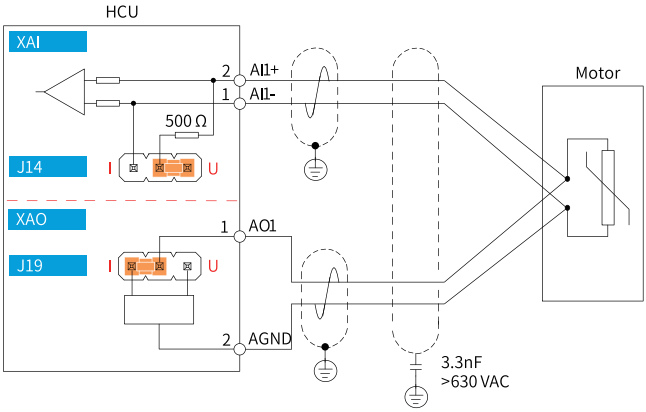


Figure 5-9 Wiring for temperature detection with AI and AO

5.1.6.4 InoLink Communication Bus Application

When information exchange is required between several AC drives in the system, use an InoLink bus.

The parameters of the InoLink bus are as follows:

- Communication baud rate: 5 Mbps
- Maximum number of nodes: 16

Shielded twisted pair cables must be used for wiring. To achieve the best communication quality and prevent electromagnetic interference, it is recommended to use high quality cables, such as PROFIBUS cables. The cable should be as short as possible, and the link length cannot exceed 40 m. Keep the cables from entangling and away from power cables.

If an HCU is at the end of the InoLink link, it must be equipped with a termination resistor, and the J10 and J12 jumpers must be set to the ON position.

The RS485 link topology of the InoLink bus is as follows:

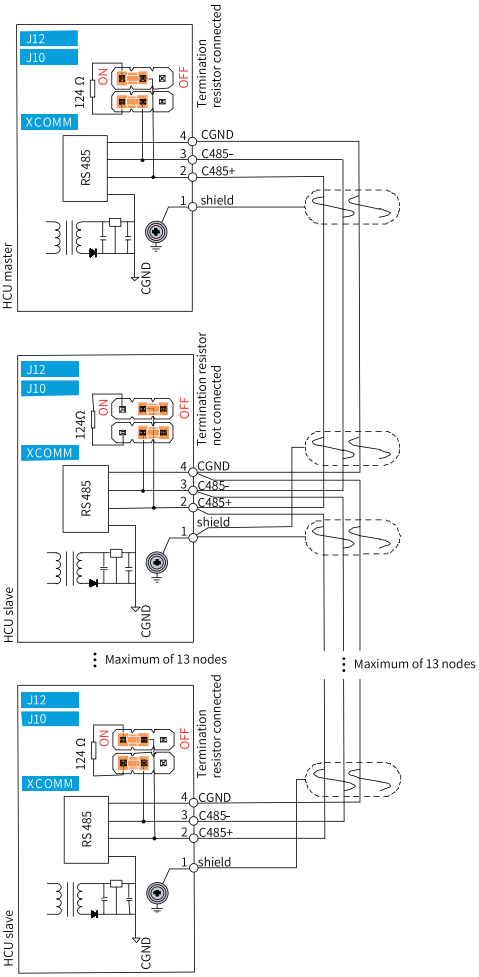


Figure 5-10 Example of connection application

5.2 HPCU Parallel Control Module

HPCU is a parallel control module. It receives drive signals and control signals from HCUs and synchronously transmits them to power modules. Meanwhile, it rapidly collects information, such as current, voltage, and module status, from the power modules and uploads the information to the HCUs. It also controls the synchronization, current equalization, reset, and start/stop of parallel power modules.

You can select HPCU-40 (four units in parallel), HPCU-60 (six units in parallel), or HPCU-A0 (10 units in parallel) as needed.

5.2.1 Components

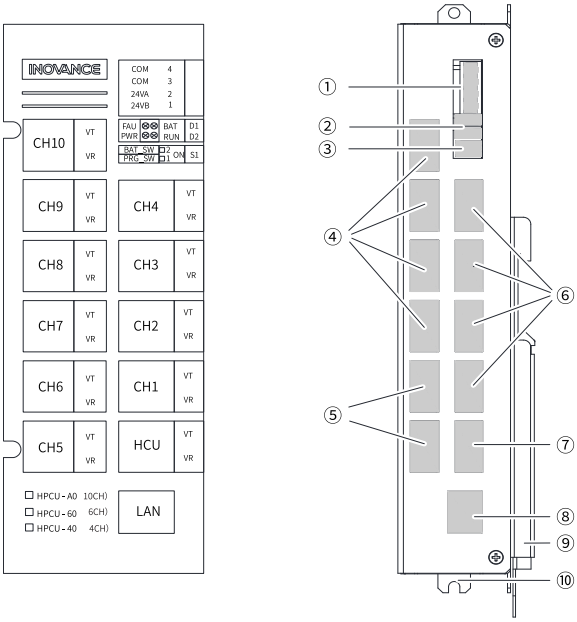


Figure 5-11 HPCU parallel control module

No.	Name	Port	Description	Remarks
①	Power supply X1	COM	GND	External power supply of the HPCU X1 terminal: 5.08 mm pitch, 4-pin black pluggable terminal Twisted pair Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
		COM 3	GND	
		24VA 2	24 VDC	
		24VB 1	24 VDC	
②	LED indicator	PWR	Steady green	The HPCU is powered normally.
			OFF	The HPCU is not powered or the power supply has failed.
②	LED indicator	RUN	Steady green	The power module is running.
			OFF	The power module is not running.
		FAU	Steady red	The system is faulty.
			OFF	The system is normal.
		BAT	Reserved	-
			Reserved	-
③	DIP switch S1	BAT_SW	Reserved	-
		PRG_SW	Reserved	-

No.	Name	Port	Description	Remarks
④	Optical fiber transceiver	CH7 to CH10	Parallel module channels 7 to 10	VT: 50 M TX optical fiber communication VR: 50 M RX optical fiber communication Optical fiber type: Plastic optical fiber (POF) HPCU-40 provides channels CH1 to CH4. HPCU-60 provides channels CH1 to CH6. HPCU-A0 provides channels CH1 to CH10.
⑤		CH5 and CH6	Parallel module channels 5 and 6	
⑥		CH1 to CH4	Parallel module channels 1 to 4	
⑦		HCU	Communication between HPCU and HCU	
⑧	-	LAN	Commissioning port	Connected to PC
⑨	Guide rail groove	-	Used for guide rail mounting	-
⑩	Mounting hole	-	Four holes for securing installation	-

5.2.2 LED Indicators

Table 5–7 Meaning of the LED indicator

No.	Name	State	Description
1	PWR	Steady green	The HPCU power supply is normal.
		OFF	The HPCU is not powered up or the power supply is faulty.
2	RUN	Steady green	The power module is running.
		OFF	The power module is not running.
3	FAU	Flashing red	The system is faulty.
		OFF	The system is normal.
4	BAT	Steady red	Battery undervoltage
		OFF	The battery is normal.

5.2.3 HPCU Electrical Connection

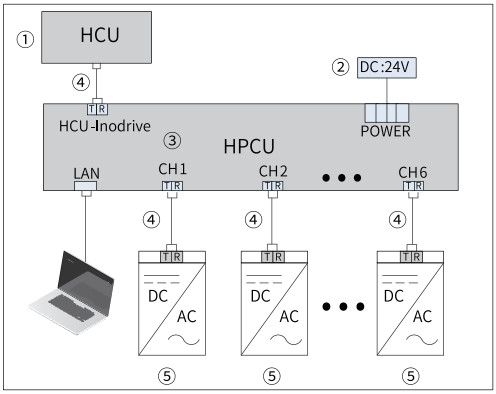


Figure 5-12 HPCU electrical connection

Table 5–8 HPCU electrical connection

No.	Name
①	HCU control module
②	External 24 VDC power supply
③	HPCU parallel control module
④	Optical fiber communication port
⑤	Basic rectifier module

6 Maintenance and Inspection

6.1 Safety Instructions for Maintenance and Repair

Precautions for maintenance and repair

Note

- Maintenance of the basic rectifier module can be performed only by professionals.
- Before maintenance, power off the module, wait for at least 15 minutes until the DC bus voltage is close to 0 V. Failure to comply can result in personal injury caused by the residual voltage in the capacitor.
- Be aware of the possible rotation of the cooling fan due to inertia.
- Perform maintenance on the basic rectifier module only after it has been powered off and cooled down.
- Install and wire the equipment according to national standards, industry standards, and local safety codes. Use only instruments that comply with the voltage withstanding requirements and keep the enclosure of the instruments well grounded.
- After you switch off the input circuit breaker switch, residual voltage can still exist. Check that no residual voltage is left before further operations.
- Be careful when measuring components in the cabinets. Prevent meter leads from coming into contact with each other or with other terminals.

Safety precautions

Take necessary electrical safety measures before maintenance and inspection.

1. Obtain operation authorization from the person responsible for electrical installation.
2. Clearly mark the work site and equipment.
3. Disconnect all possible voltage sources and ensure that they cannot be reconnected. Lock the workplace and tag it during maintenance and repair.
   a. Switch off the main disconnector or circuit breaker of the drive.
   b. Switch off the disconnector of the supply transformer.
   c. If the drive is connected to a permanent magnet motor, disconnect the motor from the drive by using a safety switch or other means.
   d. Disconnect the control circuit from external hazardous voltage.
   e. Before maintenance or repair, power off the module, wait for at least 15 minutes, and confirm that the DC bus voltage is approximately 0 V.
4. Avoid contact with any live parts in the workplace during maintenance and repair.
5. Take special measures when working near bare conductors.

6. Ensure that the equipment is powered off by measuring the voltage. If any shield or cabinet structure needs to be removed or dismantled during measurements, act in accordance with local laws and regulations concerning live working (including but not limited to protection against electric shock and arcing).
   - Make sure that the voltage between the drive input terminals (U, V, and W) and the ground (PE) busbar is close to 0 V.
   - Make sure that the voltage between the drive DC busbar (+ and –) and the ground (PE) busbar is close to 0 V.
7. Install temporary grounding as required by local codes.

Note

- Be aware that the basic rectifier module works with high voltage.
- Perform wiring only after the basic rectifier module is powered off.
- Allow only trained personnel to perform maintenance and inspection on the basic rectifier module. Failure to comply may result in substantial property loss, severe physical injury, or even death.
- Exercise extreme caution when working on the equipment that is opened. The power supply and terminals may be live even when the motor is not running due to possible presence of external power voltage.
- The basic rectifier module must be handled by trained personnel with care. Improper hoisting or handling of such equipment may lead to substantial property loss, severe physical injury, or even death.

6.2 Cleaning Precautions

The basic rectifier module is mainly comprised of electrical components, only the fan may be damaged due to wear and therefore requires maintenance and inspection. Clean the dust and pollutants regularly to ensure proper operation of the device.

Dust

Dust inside the basic rectifier module must be removed by authorized personnel at a regular interval according to the application environment (at least once a year). The cleaning must comply with relevant safety regulations. A brush and vacuum cleaner must be used to clean the dust. For positions that cannot be easily reached, use dry compressed air (max. 1 bar) for cleaning.

Ventilation

Always keep the ventilation openings and cooling air ducts of the cabinet unobstructed and ensure that the cooling fan functions properly.

6.3 Inspection Precautions

Precautions

- During inspection, take measures to keep normal operation of the equipment and rectify faults.
- Strictly obey correct operating instructions before starting any maintenance or inspection.
- Perform maintenance and inspection on the basic rectifier module only after it has been de-energized and cooled down.
- Install and wire the equipment according to national standards, industry standards, and local safety codes.
- Proceed with operations only after verifying that there is no voltage, because voltage still exists in the cabinets for a period of time after the input circuit breaker is switched off.
- Use only instruments that comply with the voltage withstanding requirements and keep the enclosure of the instruments well grounded.
- Be careful when measuring components in the cabinets. Prevent meter leads from contacting each other or coming into contact with other terminals.
- Only qualified personnel are allowed to perform installation, inspection, and maintenance on the basic rectifier module.

Required tools

You may need the following tools during inspection and component replacement:

- 6-mm wrench or socket wrench
- 8-mm wrench or socket wrench
- 10-mm wrench or socket wrench
- 12-mm wrench or socket wrench
- Torque wrench
- PH1 or PH2 Phillips screwdriver
- Recommended: Socket wrench set with two extension rods

Service life of components

To ensure long-term operation of the basic rectifier module, perform regular maintenance on the electronic components inside the module based on their service life. The service life of these components is affected by the operating environment and conditions. The following table lists the replacement interval of these components for your reference.

Table 6–1 Component replacement interval

Component	Standard replacement interval
DC fan	5 years
PCB	10 years

Tightening torques of screws

Observe the following tightening torque requirements when tightening common steel connectors or the connectors for conductive parts (power input terminals, DC bus terminals, and copper busbars) or non-conductive parts (grounding terminals and protective grounding terminals).

Table 6–2 Tightening torque for current-carrying components

Screw/Bolt	Grounding/Protective grounding/ Steel connector (N·m) (capable of conducting fault current)	Busbar with plastic housing (N·m) (capable of conducting operating current)
M2.5	0.3	0.3
M3	0.55	0.55
M4	1.2	1.2
M5	2.8	2.8
M6	4.8	4.8
M8	13	13
M10	20	20
M12	35	35

Cable terminals and fasteners

Check the cable terminals and screws regularly to ensure that they are secure. Check the routing for faults and replace damaged components promptly.

Note

The actual maintenance interval shall be determined based on the installation environment and operating conditions of the equipment.

6.4 Replacing Components

6.4.1 Overview

This section describes the components that need to be replaced at maintenance and inspection.

6.4.2 Safety Precautions

Take necessary safety measures before maintenance and inspection.

Note

- Be aware that the MD880-20 series basic rectifier module is operated with high voltages.
- Do not conduct any connection work unless the basic rectifier module is powered off.
- Due to capacitors in the circuits, hazardous voltage is present in the basic rectifier module even 15 minutes after the rectifier module is switched off. Therefore, ensure that the voltage is below 36 V before opening the basic rectifier module.
- Allow only trained personnel to perform maintenance and inspection on the basic rectifier module. Failure to comply may result in substantial property loss, severe physical injuries, or even death.
- Some equipment is very heavy or top-heavy and therefore must be handled by trained personnel with care. Improper hoisting or handling of such equipment may lead to substantial property loss, severe physical injuries, or even death.

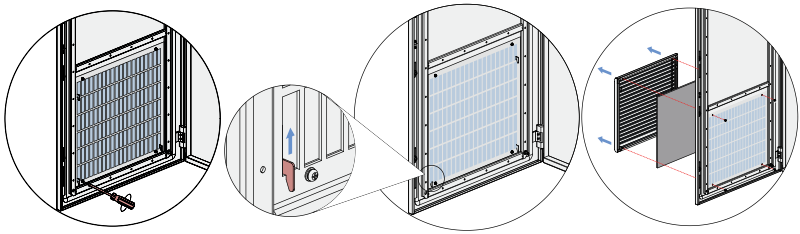
6.4.3 Replacing the Filter Screen

Preparation

- Observe *"4.2.1 Protective Measures Before Installation" on page 50*.
- Disconnect the cabinet from the power supply (including external power supply).
- Check the louvers on the cabinet door for any damage.
- Disconnect the power supply to prevent the fan from drawing in contaminated air from outside. When using an externally-powered fan, beware of the potential rotation of the fan due to inertia or switch off the external power supply.
- Replace the dirty filter screen regularly; otherwise, devices in the cabinet may stop due to high temperature.

Removing the filter screen

If the IP42 air inlet kit is used for the cabinet, clean the air inlet based on the following procedure.



Step 1 Step 2 Step 3

1. Open the front door of the cabinet and remove the four M4 screws from the louvers, as shown in Step 1.
2. Lift the louvers upward and remove it, as shown in Step 2.
3. Remove and clean (or replace) the filter screen, as shown in Step 3.

Installing the filter screen

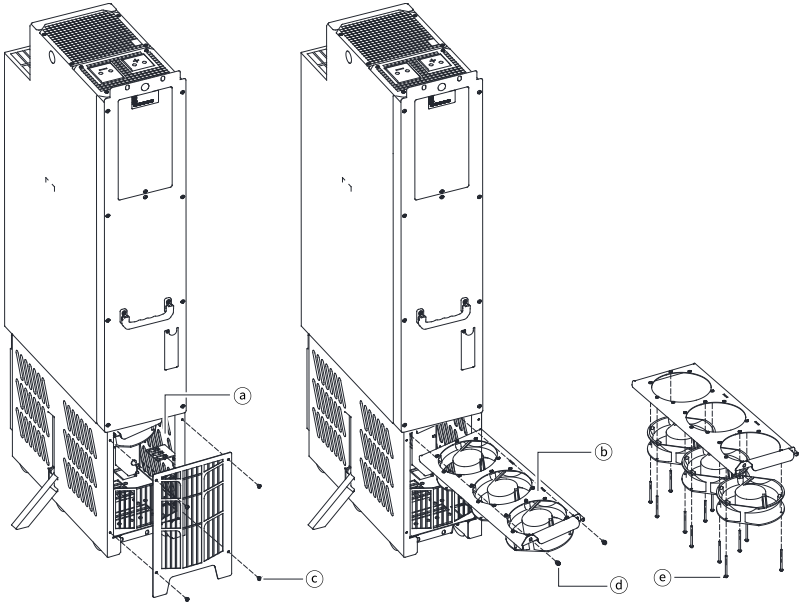
Perform the preceding procedure in reverse order:

1. Install the cleaned (or new) filter screen into the louvers.
2. Insert the louvers into the reserved hole.
3. Use screws to fix the louvers from the interior of the front door.

Repeat the preceding steps for all the filter screens that need to be replaced.

6.4.4 Replacing the DC Fan

Fans of the basic rectifier modules are divided into two types to match different power ratings. Replace the fans according to the following procedure.



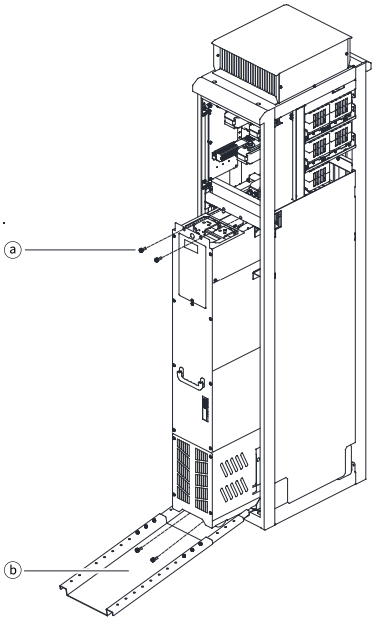
1. Disconnect the AC power supply of the drive system. Check that there is no residual voltage.
2. Open the cabinet door and use a screwdriver to remove the four M4 screws (c in the preceding figure) securing the front cover, and then remove the cover.
3. Disconnect the fan from the power supply module (a in the preceding figure).
4. Remove the two M5 screws (d in the preceding figure) securing the fan assembly and pull out the fan assembly (b in the preceding figure).

5. Remove the twelve M4 screws (e in the preceding figure) from the fan assembly (four M4 screws for each fan). Remove the fans.
6. Install a new fan and fan assembly based on the same procedure, but in the reverse order.
7. Connect the fan to the power supply module.

6.4.5 Replacing the Basic Rectifier Module

Replacing the basic rectifier module

Replace the basic rectifier module according to the following procedure.



1. Disconnect the AC power supply of the drive system. Measure and confirm there is no residual voltage.
2. Open the cabinet door.
3. Disconnect the optical fiber connections.
4. Disconnect the output DC bus.
5. Secure the guide rail (b in the preceding figure) of the basic rectifier module.
6. Remove the four M8 screws (a in the preceding figure) from the top and bottom of the basic rectifier module.
7. Pull out the basic rectifier module and unfold the anti-toppling bracket.
8. Install the basic rectifier module in reverse order.

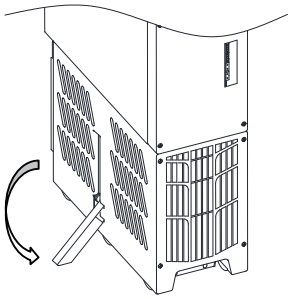
Note

It is recommended that the height of the cabinet base be lower than or equal to 10 mm to avoid an excessively large tilt angle of the guide rail.

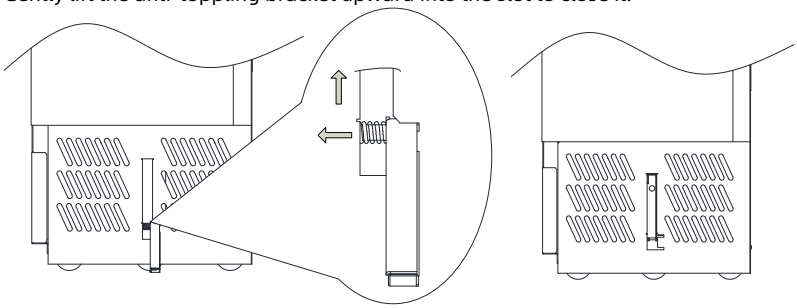
Folding and unfolding the anti-toppling bracket

Fold and unfold the anti-toppling bracket according to the following procedure.

1. Pull the anti-toppling bracket downward in the direction of the arrow, as shown in the figure.

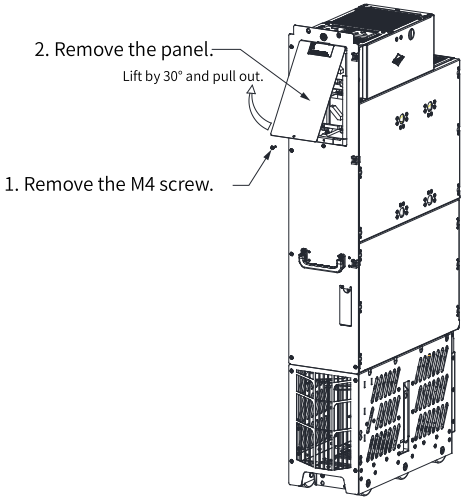


2. Press the anti-toppling bracket to the left against the spring until it aligns with the bracket slot.
3. Gently lift the anti-toppling bracket upward into the slot to close it.

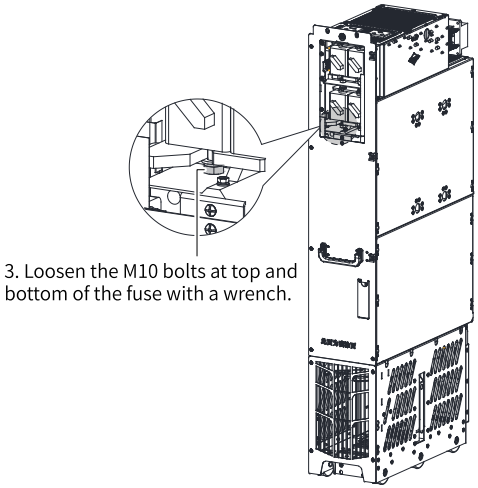


6.4.6 Replacing the DC Fuse

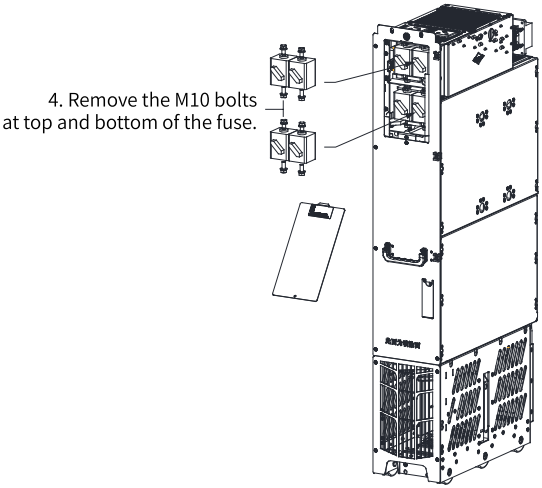
1. Remove one M4 screw from the panel, then remove the panel as shown in the figure below.



2. Use a wrench to loosen the M10 bolts at the top and bottom of the fuse, and then remove the fuse.



3. Remove the M10 bolts at the top and bottom of the fuse.



Note

It is recommended that the height of the cabinet base be lower than or equal to 10 mm to avoid an excessively large tilt angle of the guide rail.

7 Ordering Instructions

This chapter lists the models and part numbers of the basic rectifier modules.

Model MD880-20M-…	Frame	Part No.	Quantity	Remarks
0718-4	T2	1. MD880-20M-0718-4	1	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. T2-quick-kit	1	T2 quick installation kit (option)
0982-4	T2	1. MD880-20M-0982-4	1	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. T2-quick-kit	1	T2 quick installation kit (option)
1336-4	2 x T2	1. MD880-20M-0718-4	2	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-40	1	Parallel control module
		4. T2-quick-kit	2	T2 quick installation kit (option)
1826-4	2 x T2	1. MD880-20M-0982-4	2	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-40	1	Parallel control module
		4. T2-quick-kit	2	T2 quick installation kit (option)
2739-4	3 x T2	1. MD880-20M-0982-4	3	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-40	1	Parallel control module
		4. T2-quick-kit	3	T2 quick installation kit (option)
3651-4	4 x T2	1. MD880-20M-0982-4	4	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-40	1	Parallel control module
		4. T2-quick-kit	4	T2 quick installation kit (option)
4564-4	5 x T2	1. MD880-20M-0982-4	5	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-60	1	Parallel control module
		4. T2-quick-kit	5	T2 quick installation kit (option)
5477-4	6 x T2	1. MD880-20M-0982-4	6	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-60	1	Parallel control module
		4. T2-quick-kit	6	T2 quick installation kit (option)
0570-7	T2	1. MD880-20M-0570-7	1	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. T2-quick-kit	1	T2 quick installation kit (option)
0815-7	T2	1. MD880-20M-0815-7	1	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. T2-quick-kit	1	T2 quick installation kit (option)
1061-7	2 x T2	1. MD880-20M-0570-7	2	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-40	1	Parallel control module
		4. T2-quick-kit	2	T2 quick installation kit (option)

Model MD880-20M-…	Frame	Part No.	Quantity	Remarks
1515-7	2 x T2	1. MD880-20M-0815-7	2	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-40	1	Parallel control module
		4. T2-quick-kit	2	T2 quick installation kit (option)
2273-7	3 x T2	1. MD880-20M-0815-7	3	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-40	1	Parallel control module
		4. T2-quick-kit	3	T2 quick installation kit (option)
3031-7	4 x T2	1. MD880-20M-0815-7	4	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-40	1	Parallel control module
		4. T2-quick-kit	4	T2 quick installation kit (option)
3788-7	5 x T2	1. MD880-20M-0815-7	5	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-60	1	Parallel control module
		4. T2-quick-kit	5	T2 quick installation kit (option)
4546-7	6 x T2	1. MD880-20M-0815-7	6	Basic rectifier module
		2. HCU-20	1	Basic rectifier control module
		3. HPCU-60	1	Parallel control module
		4. T2-quick-kit	6	T2 quick installation kit (option)

Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

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