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MD880-30 Series Regenerative Rectifier

Hardware Guide

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

Data code 19011080B01

Preface

Introduction

The MD880-30 series is a general low-voltage regenerative rectifier developed by Inovance. It features high power density, compact structure, and high reliability. The product is available in the voltage class of 400 V and 690 V. The rated power of a single module ranges from 423 kW to 1026 kW. Higher rated output power (up to 5726 kW) can be provided to one or more inverter modules or other loads by parallel connection. The highly integrated regenerative rectifier module features simple structure, convenient assembly and maintenance, better utilization of the cabinet space, fewer cabinets, and less space occupation. It can be used in large hoisting equipment (for example, metallurgical equipment, papermaking equipment, and port machinery), ships, cables, wind power converters, unit test benches, low pressure controllers, oil and gas transmission pipelines, and mining conveyors.

This guide covers the safety instructions, product information, mechanical and electrical installation, routine maintenance and inspection, and ordering instructions.

Note

- The drawings in this guide are shown for illustration only and may be different from the product you purchased. Actual structure and configuration depend on the product.
- The guide may be updated with product upgrade or specification change or for better accuracy and convenience.

More information

Document	Code	Description
MD880-30 Series Regenerative Rectifier Hardware Guide (the present guide)	19010688	Covers the safety instructions, product information, mechanical and electrical installation, and routine maintenance and inspection.
MD880-30 Series Regenerative Rectifier Software Guide	19010689	Covers the debugging tools, quick commissioning instructions, function modules, parameter description, connector resources, and troubleshooting.
HCU Control Module User Guide	19010528	Covers the product information, installation instructions, wiring circuits of HCU terminals, and maintenance.
HPCU Parallel Control Module User Guide	19010690	Covers the product information, installation instructions, bus connection, and parameter setting.

Revision History

Revision time	Version	Description of change(s)
2024-12	B01	Corrected minor errors.
2023-12	B00	**Modified the following contents:** • Updated *"1.3 Specifications and Model Selection" on page 17* to add two columns of air volume data. • Updated *"1.6.1 Operation Principle of Regenerative Rectifier" on page 20* to add notes. • Updated *"1.8.4 Dimensions of Regenerative Rectifier Frame Module (L+2H8)" on page 30* to add the diagram for dimensions of the top copper busbar. • Updated *"6.1 Order Number" on page 133* to remove the table of the options (spare parts) ordering instructions. • Updated the front cover, back cover, preface, and fundamental safety instructions. • Corrected minor errors.
2020-11	A02	Corrected minor errors.
2019-12	A01	Changed the logo. Changed the layout style. Corrected the P_{Hd} data of the 690 V system in Table 1-2 Specifications and models of the MD880-30 series regenerative rectifier. Corrected minor errors in Figures 3-14, 3-16, 3-18, and 3-19. Others: Corrected textual errors.
2019-4	A00	Initial release.

Access to the guide

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

- Log in to the Inovance website (http://www.inovance.com), go to **Service** > **Documentation Download**, enter the keyword, and then download the guide.
- Scan the QR code on the product with your mobile phone.
- Scan the QR code below to install My Inovance app, where you can search for and download the guide.



Warranty

Inovance provides gratis warranty service within the gratis warranty term (as specified in your order) for any fault or damage under normal use conditions. Maintenance will be charged after the gratis warranty term.

Even within the gratis warranty term, maintenance will be charged for any damage caused by:

- Operations not following the instructions in the guide
- Fire, flood, and unusual voltage
- Using the product for unintended functions
- Using the product outside the specified scope
- 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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Fundamental Safety Instructions

Safety statements

- This chapter provides essential safety instructions for proper use of the product. Before using this product, read through the guide to fully understand these safety instructions. Failure to observe the safety instructions may result in personal injury or death or product 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 in the environment specified in this guide. Using this product in the environment not satisfying all the specifications can cause malfunction or damage to parts not covered by the gratis warranty range.
- Inovance shall not be held responsible for any personal injury or loss of property caused by improper use.

Levels of precautions



indicates that death or severe personal injury will result if proper precautions are not taken.



indicates that death or severe personal injury may result if proper precautions are not taken.



indicates that minor personal injury or product damage can result if proper precautions are not taken.

Safety precautions

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified, and then operate the product as specified in the guide.
- The drawings in this 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 and checking the delivery



- 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.
- Check the delivery against the packing list carefully. 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 for secondary packaging integrity, damage, water seepage, dampness, and deformation before unpacking.
- Unpack the product in order. Never hit the package with force.
- Check for damage, rust, or signs of bumping on the surfaces of the product and accessories upon unpacking.
- Check the number of the product, accessories, and paper materials against the packing list carefully upon unpacking.

Storage and transportation
 • Large or heavy equipment must be handled by skilled personnel using specialized hoisting equipment; otherwise, it may result in personal injury or product damage. • Before hoisting the product, 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 product damage. • Never stand or stay below the product which is being hoisted. • Hoist the product at a constant speed with a steel rope to prevent any vibration or shock to the product. Never turn the product over or keep the product suspended for a long time. Dosing so may result in personal injury or product damage.
 • Handle the product with care and mind your steps during transportation to prevent personal injury or product damage. • When handling the product by hand, hold the product enclosure to prevent parts from falling, or there is a risk of personal injury. • Store and transport the product based on the storage and transportation requirements, or there is a risk of product damage. • Do not store or transport the product in locations where the product may be exposed to splashing water or rain, direct sunlight, strong electric field, strong magnetic field, or strong vibration. • Store the product for up to 3 months. Take stricter protective measures and carry out the necessary inspections for a longer storage time. • Ensure the product is securely and properly packaged before transportation. Use a fully enclosed container for long-distance transportation. • Never transport the product with other devices or items that could impact or cause harm to the product.

Installation

DANGER

- Installation must be performed by skilled personnel who have received the trainings on electrical devices and have sufficient electrical knowledge. Installation by unskilled personnel is prohibited.

WARNING

- Read the guide and safety instructions carefully before installation.
- Never install the product in locations where there is strong electric or magnetic field.
- Before installation, check that the mechanical strength of the installation site can bear the product weight, or it may result in a mechanical hazard.
- Do not wear loose clothes or accessories during installation, or it may result in an electric shock.
- Before installing the product in an enclosed environment (for example, a cabinet or case), use a cooling device (for example, a fan or air conditioner) to cool the environment to the required temperature. Failure to do so may result in product over-temperature or a fire.
- Never retrofit the product.
- Do not fiddle with the bolts for fixing product components or the bolts marked in red.
- When the product 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.
- When a device with strong electromagnetic interference (for example, a transformer) is required, install a shielding device for the product to prevent malfunction.
- Install the product on metal or other non-flammable objects, and prevent flammable materials from contacting or attaching to the product. Failure to do so may result in a fire.

CAUTION

- During installation, cover the top of the product with a piece of cloth or paper, to prevent foreign matters such as metal chips, oil, and water from falling into the product and causing the product failure. After installation, remove the covering to prevent it from blocking the vent, which may affect the heat dissipation and cause the product to overheat.
- Resonance may occur when a constant-speed machine executes variable speed operations. In this case, install the anti-vibration rubber under the motor frame or activate the vibration suppression function to reduce resonance.

Wiring
 • Installation, wiring, maintenance, inspection, or part replacement must be performed by skilled personnel. • Before wiring, disconnect all the power supplies of the product. Before wiring or other operations, wait for at least the time specified on the warning label because residual voltage still exists after power-off. Measure the DC voltage of the main circuit to ensure that the voltage is below the safety voltage, or it may result in an electric shock. • Never perform wiring, remove the product cover, or touch the circuit board with power-on. Dosing so may result in an electric shock. • Be sure that the product is grounded properly, or it may result in an electric shock.
 • Never connect the input power supply to an output terminal of the product. Dosing so may result in product damage or even a fire. • When a drive is connected to the motor, be sure that the phase sequences of the product and motor terminals are consistent to prevent reverse motor rotation. • Cables must meet cross-sectional area and shield requirements. The shield must be reliably grounded at one end. • Fix the terminal screws with the tightening torque specified in the guide. Improper tightening torque may cause the connecting part over-temperature or damage, resulting in a 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 product damage.
 • During wiring or other operations, follow the proper electrostatic discharge (ESD) procedures, and wear an anti-static wrist strap. Failure to do so may result in damage to internal circuits of the product. • Use the shielded twisted pair cable to wire the control circuit, and connect the shield to the grounding terminal of the product. Failure to do so may result in product malfunction.

Power-on



- Before power-on, check that the product is installed properly with secure wiring and the motor can be restarted.
- Before power-on, be sure that the power supply meets the product requirements, or it may result in product damage or a fire.
- Never open the cabinet door or protective cover of the product, touch any terminal of the product, or remove any part of the product with power-on. Doing so may result in an electric shock.



- Perform a trial run after wiring and parameter setting to ensure safe operation of the product. Failure to do so may result in personal injury or product damage.
- Before power-on, be sure that the rated voltage of the product is consistent with the supply voltage, or it may result in a fire.
- Before power-on, be sure that no one is near the product, the motor, and other devices, or it may result in personal injury or death.

Operation



- The product must be operated by skilled personnel, or it may result in personal injury or death.
- During the product operation, never touch any terminals or remove any parts of the product. Doing so may result in an electric shock.



- Never touch the product enclosure, fan, or resistor with a bare hand. Doing so may cause burns.
- Prevent metal or other objects from falling into the product during operation, or it may result in a fire or product damage.

Maintenance
 • Installation, wiring, maintenance, inspection, or part replacement must be performed by skilled personnel. • Never maintain the product with power-on, or it may result in an electric shock. • Before maintenance, disconnect all the power supplies of the product and wait for at least the time specified on the warning label. • When a permanent magnet motor is used, do not touch the motor terminals immediately after the product is powered off because the terminals will generate induced voltage during the motor rotation. Failure to do so may result in an electric shock.
 • Perform routine and periodic product inspection and maintenance based on the maintenance requirements, with the maintenance records kept properly.

Maintenance
 • Installation, wiring, maintenance, inspection, or part replacement must be performed by skilled personnel. • Never maintain the product with power-on, or it may result in an electric shock. • Before inspection or maintenance, disconnect all the power supplies of the product and wait for at least the time specified on the warning label.
 • Submit a request for maintenance 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 do so may result in personal injury or death and product damage. • Troubleshooting and maintenance of a faulty or damaged product must be performed by skilled personnel based on the maintenance instructions, with the maintenance records kept properly. • Replace quick-wear parts of the product in according with the replacement instructions. • Never operate the damaged product. Doing so may cause personal injury or death or greater damage. • Recheck the wiring and reset the parameters after product replacement.

Disposal
WARNING • Dispose of the retired product in accordance with applicable national regulations and standards. Failure to do so may result in loss of property or personal injury or death. • Recycle the retired product in accordance with industrial waste disposal standards to prevent environmental pollution.

Safety labels

Be sure to observe the safety labels on the product for safe operations. Never deface or remove the safety labels. The description of the safety labels is as follows.

Be sure to observe the product-specific safety labels for safe operations. The description of the safety labels is as follows.

Safety label	Description
	• Read the this guide and safety instructions carefully before using the product. Failure to do so may result in personal injury or death or product damage. • Never directly touch any terminals or remove the cover with power-on or within 10 min after power-off. Dosing so may cause an electric shock.

1 Product Information

1.1 Nameplate and Model

MD880-30M-0900-4
① ② ③ ④

① **Product series** MD880: MD880 series AC drive	③ **Rated current** 0900: 900 A
② **Product type** 30M: Regenerative rectifier module 30F: Regenerative rectifier filter module 30K: Regenerative rectifier frame module	④ **Voltage class** 4: Three-phase 400 VAC 7: Three-phase 690 VAC

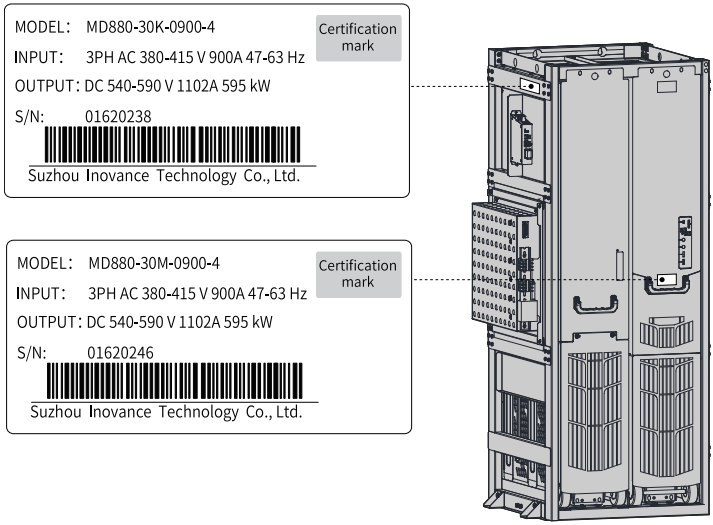


Figure 1-1 Nameplate

1.2 Voltage and Power Rating

Table 1–1 Voltage and power rating of the regenerative rectifier frame module

Product type	Rated voltage	Rated power
Regenerative rectifier frame module	380 VAC to 415 VAC	423 kW to 595 kW
	525 VAC to 690 VAC	684 kW to 1026 kW

Note

If you need larger power, use the parallel mode. A maximum of six regenerative rectifier modules in parallel are supported.

1.3 Specifications and Model Selection

Model selection

The MD880 regenerative rectifier is available as a standard cabinet, a frame module, or a module. *"Table 1-2 " on page 17* provides the rated parameters and losses of the regenerative rectifier under different working conditions. For details on the models and ordering information, see "Model" in column 1 of *" Ordering Instructions" on page 133*.

Table 1–2 Specifications and models of the MD880-30 series regenerative rectifier

Model MD880-30-...	Nominal use					Low-overload use		High-overload use		Loss	Loss	Cooling air volume <1>	Cooling air volume (L)
	I_N	I_N	I_{max}	S_N	P_N	I_{LD}	P_{LD}	I_{HD}	P_{HD}	P_{loss} <1>	P_{loss} (L)		
	A_{AC}	Adc	Adc	kVA	kW	Adc	kW	Adc	kW	kW	kW	m^3/h	m^3/h
U_N = 400 V (380-415 V), ± 10% (-15%, < 1 min) (power rated at 400 V)													
0640-4	640	783	1018	443	423	752	406	587	317	4.9	3.0	663	1632
0900-4	900	1102	1432	624	595	1057	571	826	446	8.0	4.0	1632	1632
1190-4	1190	1457	1894	825	787	1399	755	1093	590	9.1	5.0	1326	1632
1674-4	1674	2049	2664	1160	1106	1967	1062	1537	830	14.9	7.5	3264	1632
2380-4	2380	2913	3787	1649	1573	2796	1510	2185	1180	18.2	10.0	2652	3264
3348-4	3348	4098	5327	2319	2213	3934	2124	3073	1660	29.8	15.0	6528	3264
5022-4	5022	6147	7991	3479	3319	5901	3186	4610	2489	44.7	22.5	9792	5022
U_N = 690 V (525-690 V), ± 10% (-15%, < 1 min) (power rated at 690 V)													
0600-7	600	734	955	717	684	705	657	551	513	6.2	3.0	964	1632
0900-7	900	1102	1432	1076	1026	1057	985	826	770	9.1	4.0	2024	1632
1116-7	1116	1366	1776	1334	1272	1311	1221	1024	954	11.5	5.0	1928	1632
1674-7	1674	2049	2664	2001	1909	1967	1832	1537	1431	16.9	7.5	4048	1632
2232-7	2232	2732	3551	2667	2545	2623	2443	2049	1909	23.0	10.0	3856	3264
3348-7	3348	4098	5327	4001	3817	3934	3664	3073	2863	33.8	15.0	8096	3264
5022-7	5022	6147	7991	6002	5726	5901	5497	4610	4294	50.7	22.5	12144	5022

Note

<1>: Layout of H8 regenerative rectifier module

Definitions

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

I_{max} : Maximum output current available for at least 10s every 300s at startup

$P_{loss\ (L)}$: Loss of the regenerative rectifier input reactor

$P_{loss\ (H8)}$: Loss of the regenerative rectifier module

S_N : Rated apparent power

P_N : Rated output power

I_{LD} : Continuous output current in low-overload use

P_{LD} : Output power in low-overload use

I_{HD} : Continuous output current in high-overload use

P_{HD} : Output power in high-overload use

L: Layout of the regenerative rectifier filter module

1.4 Product Dimensions and Weight

Table 1–3 Dimensions and weight of the MD880-30 series regenerative rectifier

Model MD880-30K-…	Layout	Dimensions (W x D x H) (mm)	Weight (kg)	Module model MD880-…	Quantity	Layout	Dimensions (W x D x H) (mm)	Weight (kg)
0640-4	L+H8	631 x 624 x 1450	350	30M-0640-4	1	H8	230 x 582 x 1394	130
				30F-0640-4	1	L	230 x 564 x 1394	150
0900-4	L+H8	631 x 624 x 1450	350	30M-0900-4	1	H8	230 x 582 x 1394	130
				30F-0900-4	1	L	230 x 564 x 1394	150
1190-4	L+2H8	874 x 624 x 1450	565	30M-0640-4	2	H8	230 x 582 x 1394	130
				30F-1190-4	1	L	230 x 564 x 1394	185
1674-4	L+2H8	874 x 624 x 1450	565	30M-0900-4	2	H8	230 x 582 x 1394	130
				30F-1674-4	1	L	230 x 564 x 1394	185
0600-7	L+H8	631 x 624 x 1450	365	30M-0600-7	1	H8	230 x 582 x 1394	130
				30F-0600-7	1	L	230 x 564 x 1394	165
0900-7	L+H8	631 x 624 x 1450	365	30M-0900-7	1	H8	230 x 582 x 1394	130
				30F-0900-7	1	L	230 x 564 x 1394	165
1116-7	L+2H8	874 x 624 x 1450	612	30M-0600-7	2	H8	230 x 582 x 1394	130
				30F-1116-7	1	L	230 x 564 x 1394	232
1674-7	L+2H8	874 x 624 x 1450	612	30M-0900-7	2	H8	230 x 582 x 1394	130
				30F-1674-7	1	L	230 x 564 x 1394	232

1.5 Technical Data

Table 1–4 Technical data of the MD880-30 series regenerative rectifier

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
	Unbalance degree	Maximum value: ± 3% of the rated line voltage
	Output voltage	400 V system: 540 VDC to 590 VDC 690 V model: 740 VDC to 975 VDC
	Overload capacity	Low overload: 110% of the rated current for 1 min per every 5 min High overload: 150% of the rated current for 1 min per every 5 min
	Operating efficiency	> 98%
	Fundamental wave power factor	> 0.95 (rated full load)
Ambient environment	Ambient temperature	–10℃ to +40℃, +40℃ to +50℃ (for derating)
	Ambient humidity	5%RH to 95%RH (non-condensing)
	Installation altitude	Maximum altitude: 4000 m ≤ 1000 m: derating not required > 1000 m: derating required
Storage environment	Storage temperature	–40℃ to +70℃
	Storage humidity	5% to 95% (non-condensing)
Mechanical data	Vibration resistance	Class 3M4 according to GB/T4798.3; steady-state sinusoidal vibration: 2–9 Hz, 3 mm, 9–200 Hz, 10 m/s^2; shock: 100 m/s^2, 11 ms
	IP rating	Frame: IP00; cabinet: IP21
	Safety performance	Compliant with EN 61800-5-1
	Cooling method	Forced air cooling (AF), compliant with EN 60146
Protection functions	Protection against	Short circuit, overcurrent, overload, overvoltage, undervoltage, phase loss, three-phase unbalance, and overheat

1.6 Hardware Principle

1.6.1 Operation Principle of Regenerative Rectifier

- The regenerative rectifier is a four-quadrant rectifier system, mainly consisting of a combination of the regenerative rectifier module and the regenerative rectifier filter module, as well as the pre-charge circuit, the HCU control module, and the expansion module.
- The regenerative rectifier rectifies the three-phase AC to DC, which is used by the inverter to drive a motor or other loads, and transfers the energy fed back by the motor or other loads to the power grid. The regenerative rectifier filter module is a L filter for suppressing input current harmonics.
- The regenerative rectifier is suitable for TN, TT, and IT systems.

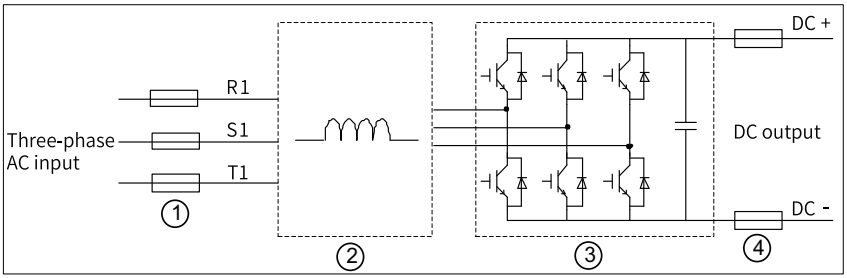


Figure 1-2 Stand-alone regenerative rectifier system

No.	Description
①	Fuse on the AC side
②	Regenerative rectifier filter module
③	Regenerative rectifier module
④	Fuse on the DC side

Note

For details on the application of the regenerative rectifier system, see *"3.7 Typical Wiring for Cabinet Assembly" on page 82*.

1.6.2 Parallel Connection Principle of Regenerative Rectifier

The regenerative rectifier can be paralleled for capacity expansion. The two parallel units adopt the L+2H8 frame structure, that is, two regenerative rectifier modules share one regenerative rectifier filter module. If larger capacity is required, use the (L+2H8) x N

structure instead. The maximum value of N for both 400 V and 690 V systems is 3. However, parallel connection is supported only when the software and hardware of the regenerative rectifier modules are identical and the specifications of the regenerative rectifier filter modules are also identical.

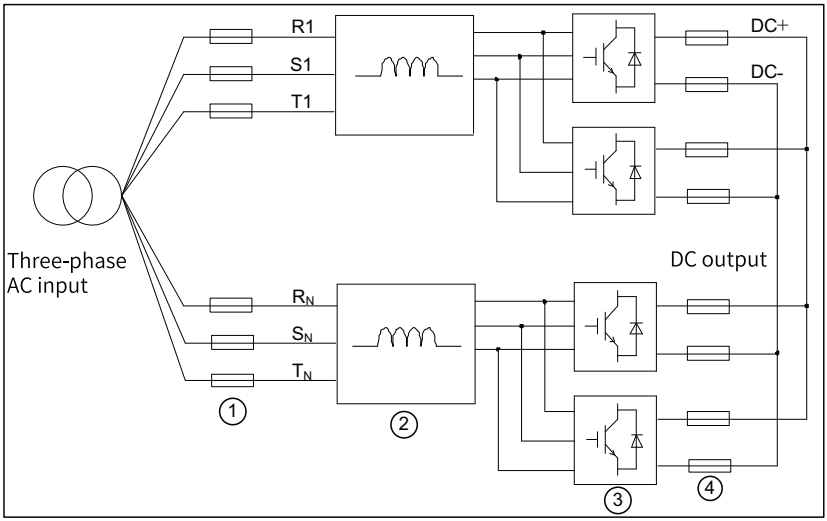


Figure 1-3 Diagram of the parallel regenerative rectifier system

No.	Description
①	Fuse on the AC side
②	Regenerative rectifier filter module
③	Regenerative rectifier module
④	Fuse on the DC side

1.6.3 Electrical Diagram of Typical Drive System

The following diagram shows the electrical connection of the regenerative rectifier and drive system.

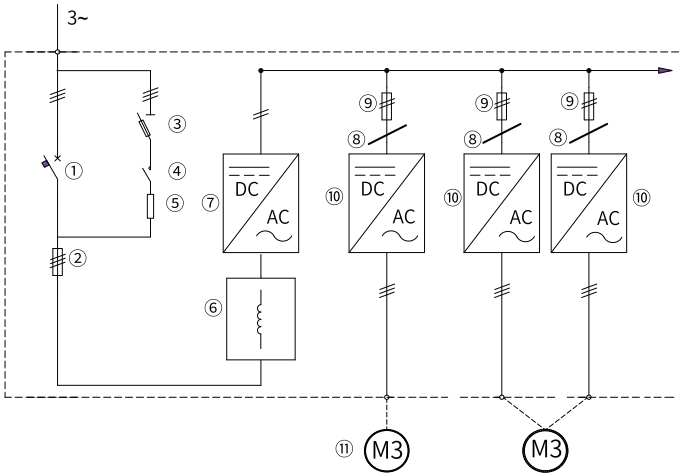


Figure 1-4 Electrical connection of the regenerative rectifier and drive system

No.	Description
1	Main circuit breaker
2	Fuse on the AC side
3	Pre-charge fuse switch
4	Pre-charge contactor
5	Pre-charge resistor
6	Regenerative rectifier filter module
7	Regenerative rectifier module
8	Common mode filter (option)
9	Fuse on the DC side
10	Inverter module
11	Motor

1.7 Layout and Dimensions of Module

1.7.1 Layout of MD880-30M Regenerative Rectifier Module

- The regenerative rectifier module can be used either as a stand-alone unit or in parallel with other modules. The regenerative rectifier module has a maximum output current of 900 A as a stand-alone unit.
- The regenerative rectifier module must be used with the regenerative rectifier filter module.

- The AC input side of the regenerative rectifier module is equipped with a quick connector plug, which is plugged into the quick connector socket inside the cabinet when the rectifier module is inserted into the cabinet. Each module in parallel can be connected to the busbar separately.

Install the power-on pre-charge circuit in either of the following cases:

- The regenerative rectifier module is connected to the DC bus through an isolator.
- The regenerative rectifier module is directly connected to the DC bus, which has no charging capability. The layout of the regenerative rectifier module is as follows.

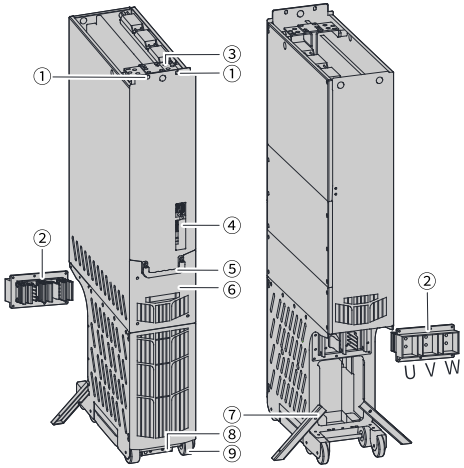


Figure 1-5 Components of the regenerative rectifier module

No.	Description
①	Top fastening hole with protective coating
②	Quick connector plug (matching the quick connector socket on the module)
③	DC output terminal
④	24 V power supply terminal/optical fiber connection terminal (see *"3.4.1 Connecting the Regenerative Rectifier Module" on page 75* for details)
⑤	Handle
⑥	Cooling fan
⑦	Anti-tip bracket
⑧	Bottom fastening hole with protective coating, or grounding point (PE) between the regenerative rectifier frame and the cabinet frame
⑨	Pulley

1.7.2 Dimensions of MD880-30M Regenerative Rectifier Module

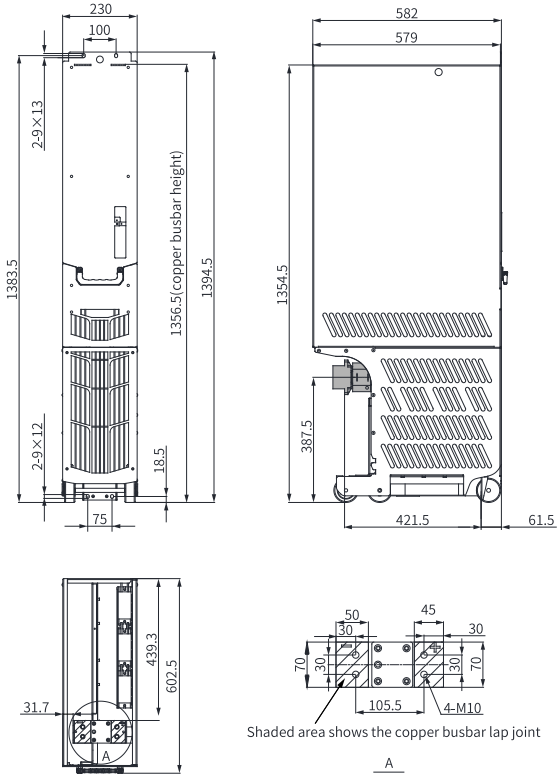


Figure 1-6 Dimensions of the regenerative rectifier module (mm)

Note

The component highlighted in gray is the quick connector socket.

1.7.3 Layout of MD880-30F Regenerative Rectifier Filter Module

The regenerative rectifier filter module is designed to suppress current harmonics and is an important part of the regenerative rectifier. Its layout is as follows.

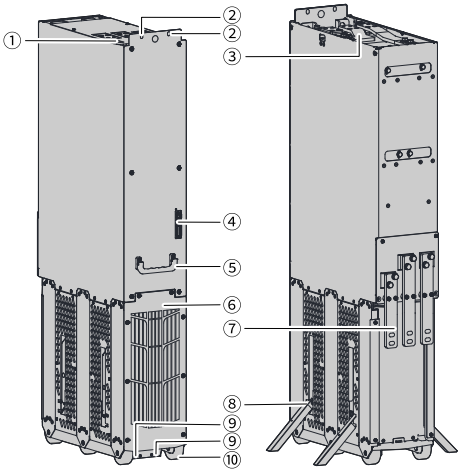


Figure 1-7 Components of the regenerative rectifier filter module

No.	Description
①	AC voltage sampling terminal
②	Fastening hole
③	Input copper busbar
④	Fan power input terminal, or L temperature switch terminal (see *"3.4.2 Connecting the Regenerative Rectifier Filter Module" on page 75* for details)
⑤	Handle
⑥	Cooling fan
⑦	Output copper busbar
⑧	Anti-tip bracket
⑨	Fastening hole with protective coating, or grounding point (PE) between the module frame and the cabinet frame
⑩	Pulley

1.7.4 Dimensions of MD880-30F Regenerative Rectifier Filter Module

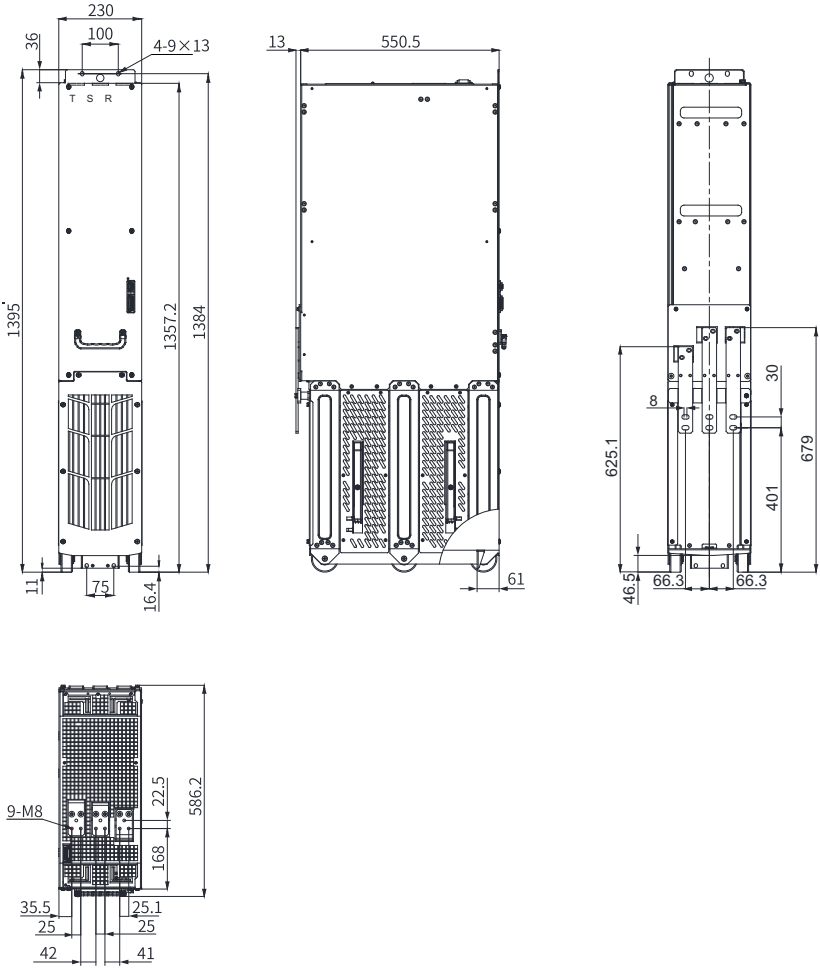


Figure 1-8 Dimensions of the regenerative rectifier filter module (mm)

1.8 Layout and Dimensions of Frame Modules

1.8.1 Layout of Regenerative Rectifier Frame Module (L+H8)

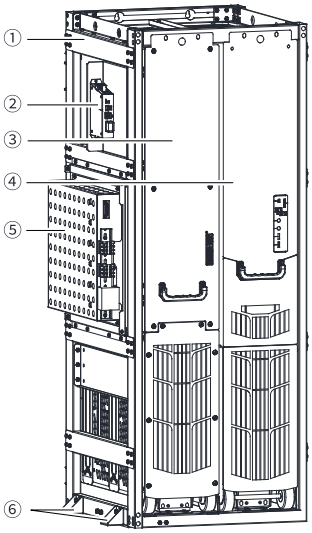


Figure 1-9 Regenerative rectifier L+H8 frame

No.	Description
①	Frame
②	HSVM-10 synchronous voltage detection module (option)
③	Regenerative rectifier filter module
④	Regenerative rectifier module
⑤	Regenerative rectifier frame module accessory kit (For details on the terminal, see *"3.5.1 Connecting the L+H8 Frame Module" on page 77*.)
⑥	Fastening parts for transportation

1.8.2 Dimensions of Regenerative Rectifier Frame Module (L+H8)

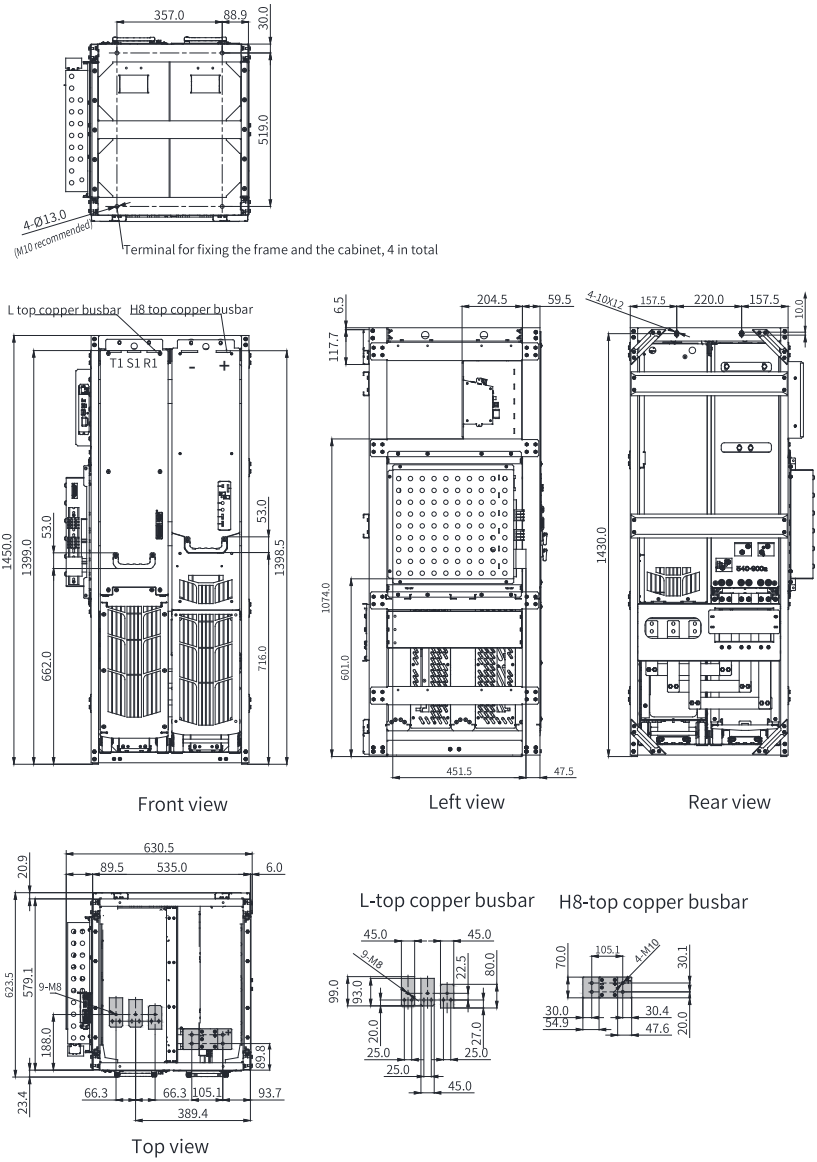


Figure 1-10 Dimensions of regenerative rectifier L+H8 frame (mm)

1.8.3 Layout of Regenerative Rectifier Frame Module (L+2H8)

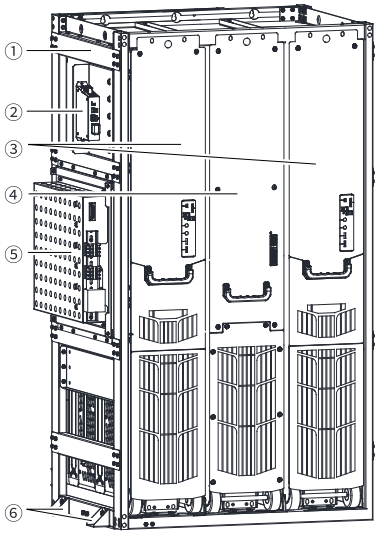


Figure 1-11 Regenerative rectifier L+2H8 frame

No.	Description
①	Frame
②	HSVM-10 synchronous voltage detection module (option)
③	Regenerative rectifier module
④	Regenerative rectifier filter module
⑤	Regenerative rectifier frame module accessory kit (For details on the terminal, see *"3.5.2 Terminals of L+2H8 Frame Module" on page 78*.)
⑥	Fastening parts for transportation

1.8.4 Dimensions of Regenerative Rectifier Frame Module (L+2H8)

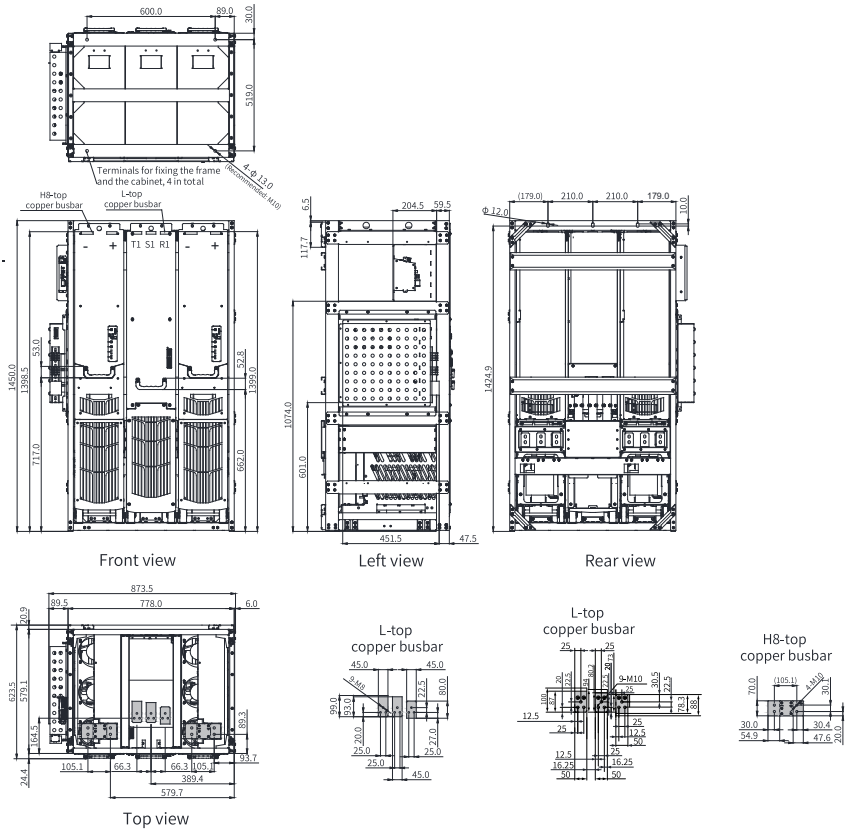


Figure 1-12 Dimensions of the regenerative rectifier L+2H8 frame (mm)

1.9 Cabinet Layout

1.9.1 Layout of Regenerative Rectifier and Drive System

The following figure shows the layout of the regenerative rectifier and drive system. The actual model depends on the load current.

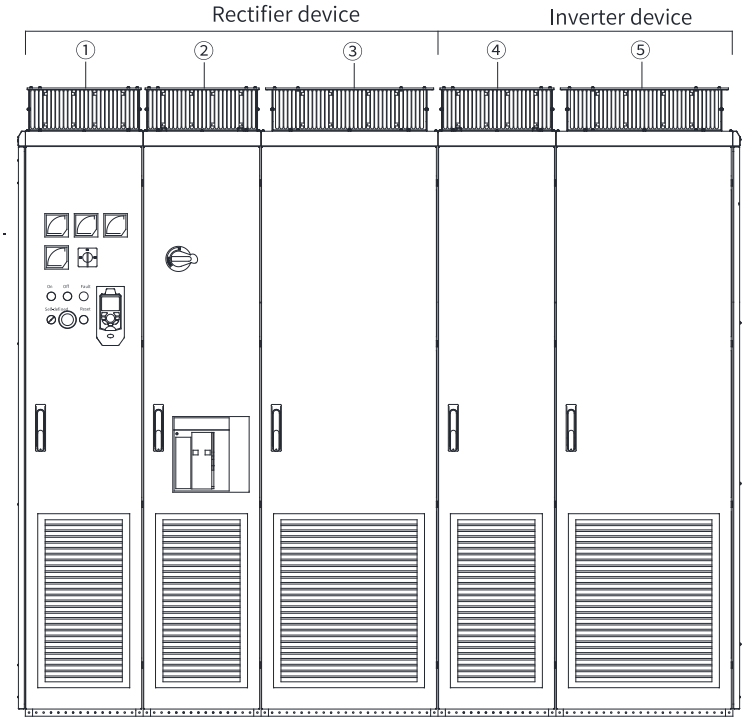


Figure 1-13 Layout of the regenerative rectifier and drive system cabinet

No.	Name	Description
①	Auxiliary control cabinet	Includes the control power supply, control module, instruments, and control panel
②	Cable incoming cabinet for regenerative rectifier	Includes the main circuit breaker and pre-charge circuit
③	Regenerative rectifier cabinet	Includes the regenerative rectifier filter module, regenerative rectifier module, synchronous voltage detection module (HSVM), and fan power supply module
④	Inverter cabinet	Includes different models of inverter power modules
⑤	Inverter cabinet	Includes different models of inverter power modules

1.9.2 Layout of Auxiliary Cabinet

The auxiliary cabinet is designed to accommodate the control devices and auxiliary devices of the rectifier and drive system, mainly including the control circuit power supply transformer, power supply module, HCU control module, HPCU parallel expansion

module, and SOP-20-880 operating panel and display. The layout and dimensions of the cabinet vary with different options.

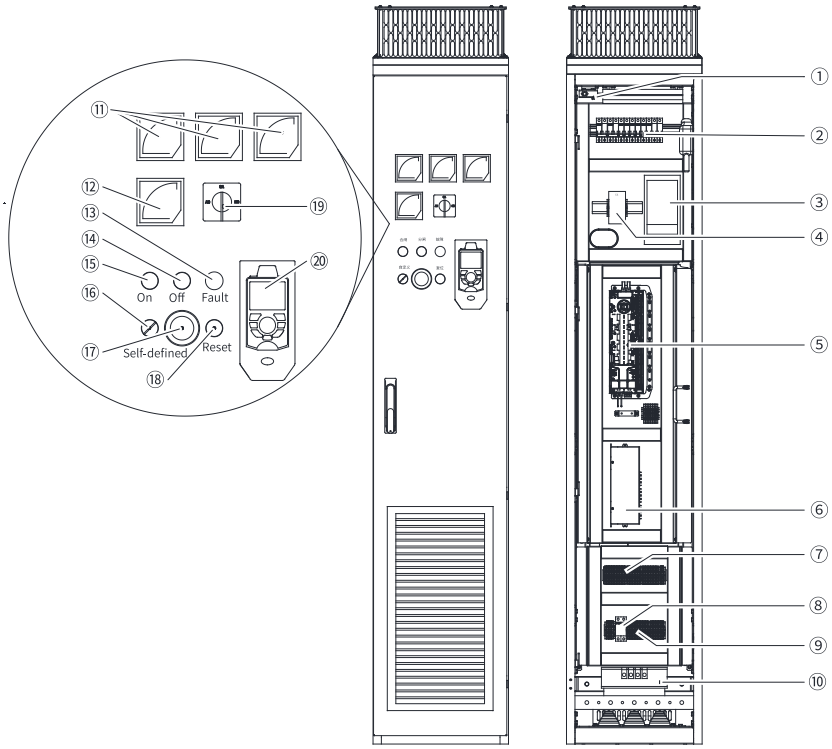


Figure 1-14 Layout of the auxiliary cabinet

No.	Name	Description
1	Door limit switch	Controls the auxiliary cabinet lighting, with the light ON when opening the door and OFF when closing the door
2	Circuit breaker for auxiliary power supply	Switches on/off the auxiliary power supply and provides overload and short-circuit protection
3	Fuse isolator of auxiliary power supply	Switches on/off the auxiliary power circuit and provides overload protection
4	Power supply module	Provides 24 VDC power supply for relays, HCUs, and indicators
5	HCU control module	Controls the regenerative rectifier
6	HPCU parallel expansion module	Controls parallel expansion
7	Terminal block	Provides 24 VDC power supply

No.	Name	Description
8	Maintenance socket	Provides 220 VAC power supply
9	Terminal block	Input terminal for external I/O signals
10	Transformer	Transformer for auxiliary power supply
11	AC ammeter	Displays input current of main power supply
12	AC voltmeter	Displays the phase-to-phase voltage of main power supply
13	Fault indicator	Displays the fault state
14	Off switch	Power off
15	On switch	Power on
16	User-defined	User-defined function
17	Emergency stop switch	Cuts off the main circuit breaker in case of an emergency
18	Reset button	Resets the device when a fault occurs
19	Voltage selector	Switches the display of different phase-to-phase voltage
20	SOP-20-880	Controls the rectifier/drive and displays the parameters

1.9.3 Layout of Cable Incoming Cabinet

The regenerative rectifier cable incoming cabinet is used for the connection between the power grid and the regenerative rectifier. The cabinet includes components such as a main breaker and pre-charge resistor. The structure and dimensions of the cabinet vary with different optional components.

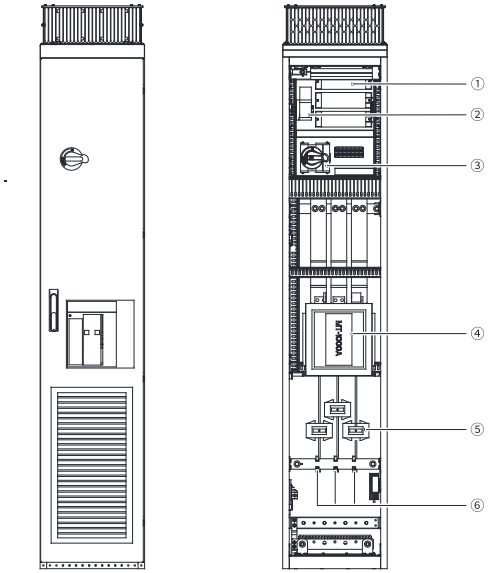


Figure 1-15 Layout of regenerative rectifier cable incoming cabinet

No.	Name	Function
①	Pre-charge resistor	Restricts the charging current of the bus capacitor.
②	Pre-charge contactor	Switches on/off the pre-charge circuit.
③	Pre-charge circuit fuse switch	Switches on/off the pre-charge circuit and provides overload and short circuit protection.
④	Frame circuit breaker	Switches on/off the main circuit and provides overload and short circuit protection.
⑤	Current transformer	Measures the current on the input side.
⑥	AC power input	R, S, and T input terminals

1.9.4 Layout of Regenerative Rectifier Cabinet

Layout of the regenerative rectifier cabinet (L+H8)

The regenerative rectifier cabinet mainly includes the regenerative rectifier filter module and the regenerative rectifier module. The following figure shows the L+H8 layout.

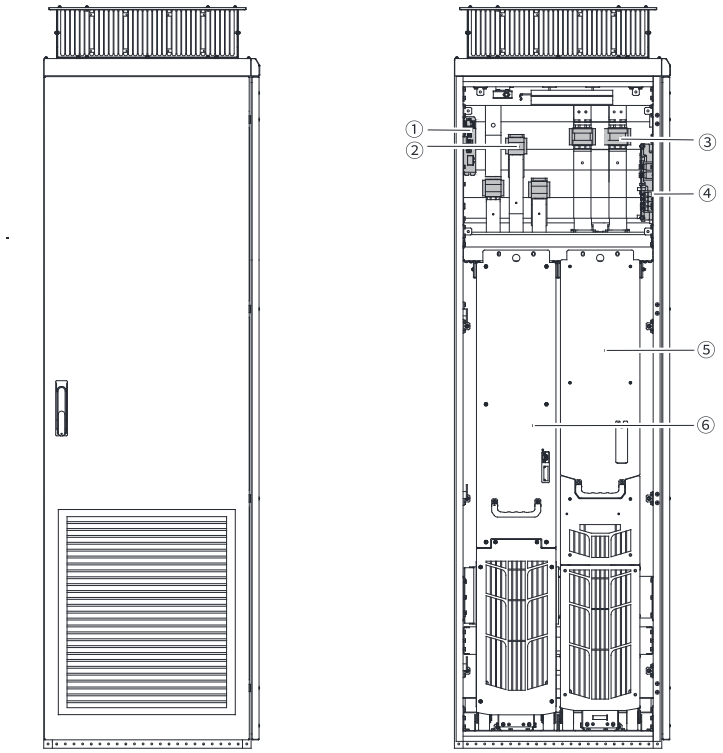


Figure 1-16 Layout of the regenerative rectifier cabinet (L+H8)

No.	Name	Description
①	HSVM synchronous voltage detection module	For three-phase AC voltage sampling
②	Fuse on the AC side	Provides overload and short-circuit protection on the regenerative rectifier side
③	Fuse on the DC side	Provides short-circuit protection on the DC side or inverter side
④	Fan power supply	Power supply for the fan of the regenerative rectifier filter module
⑤	Regenerative rectifier module	Regenerative rectifier IGBT power module, which must be used with a regenerative rectifier filter module
⑥	Regenerative rectifier filter module	Regenerative rectifier input reactor

Layout of the regenerative rectifier cabinet (L+2H8)

The regenerative rectifier cabinet mainly includes the regenerative rectifier filter module and the regenerative rectifier module. The following figure shows the L+2H8 layout.

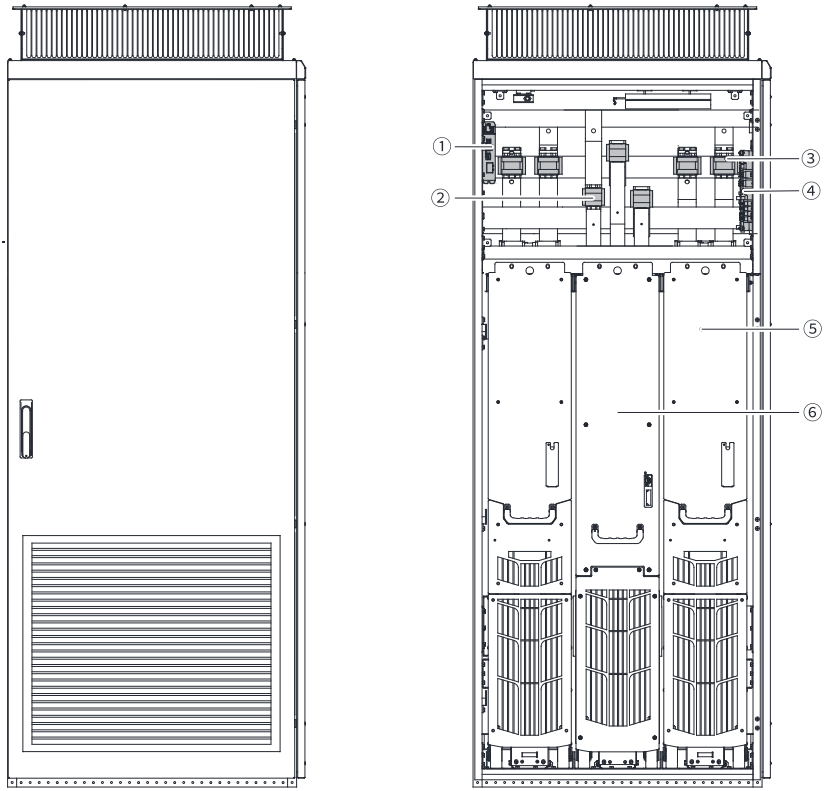


Figure 1-17 Layout of the regenerative rectifier cabinet (L+H8)

No.	Name	Description
①	HSVM synchronous voltage detection module	For three-phase AC voltage sampling
②	Fuse on the AC side	Provides overload and short-circuit protection on the regenerative rectifier side
③	Fuse on the AC side	Provides short-circuit protection on the DC side or inverter side
④	Fan power supply	Power supply for the fan of the regenerative rectifier filter module

No.	Name	Description
⑤	Regenerative rectifier module	Regenerative rectifier IGBT power module, which must be used with a regenerative rectifier filter module
⑥	Regenerative rectifier filter module	Regenerative rectifier input reactor

1.10 Derating Characteristics

Ambient temperature-based derating

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

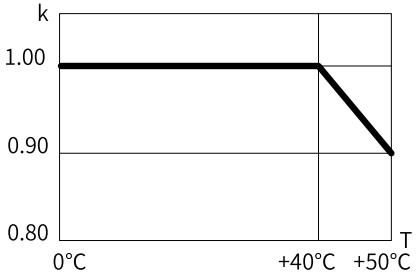


Figure 1-18 Ambient temperature-based derating

Altitude-based derating

When the altitude is 1000 m to 4000 m, the output current of the regenerative rectifier module must be derated by 1% per 100 m increase.

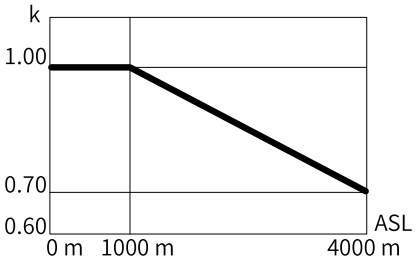


Figure 1-19 Altitude-based derating

1.11 Overload Characteristics

For some drive systems where overload may occur, proper base load current is necessary for the MD880-30 series regenerative rectifier. The criterion for overload is that the drive is operated with its base load current before and after the overload occurs in a cycle of 300s.

Curve in the low overload mode

In the low overload mode, the drive can run at 110% of the low overload base current (I_{LD}) for 60s every five minutes.

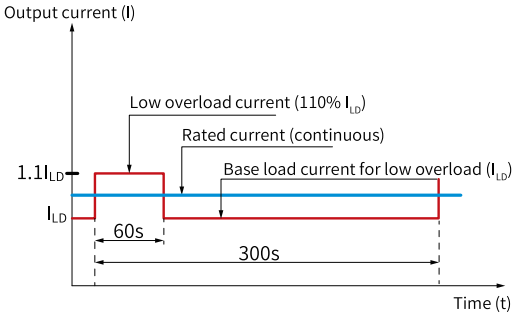


Figure 1-20 Curve in the low overload mode

Curve in the high overload mode

In the high overload mode, the drive can run at 150% of the high overload base current (I_{HD}) for 60s every five minutes.

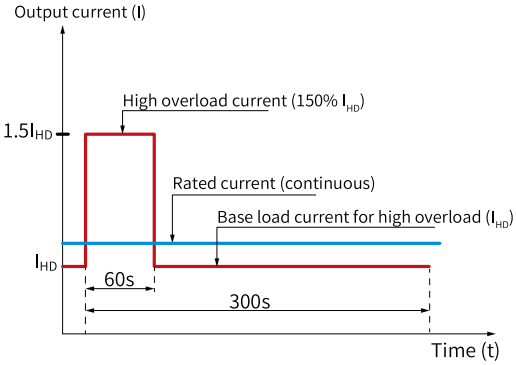


Figure 1-21 Curve in the high overload mode

1.12 Common Tightening Torques of Screws and Bolts

Table 1–5 Electrical connection

Screw/Bolt	Strength grade	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	8.8	13
M10	8.8	20
M12	8.8	35
M16	8.8	85

Table 1–6 Mechanical connection

Screw/Bolt	Strength grade	Max. torque (N·m)
M5	4.8	2.8
M6	4.8	4.8
M8	8.8	13

Table 1–7 Post insulator connection

Screw/Bolt	Strength grade	Max. torque (N·m)
M6	4.8	4.8
M8	8.8	13
M10	8.8	20
M12	8.8	35

Table 1–8 Cable connector

Screw/Bolt	Strength grade	Max. torque (N·m)
M8	8.8	13
M10	8.8	20
M12	8.8	35

1.13 Selecting the Fuse

Fuse on the AC side

Table 1–9 Selection of the fuse on the AC side

Model MD880-30K-...	Layout	Fuse on the AC side		Quantity	Specifications
		Bussmann	Medium voltage		
0640-4	L+H8	170M6415	RS306-3-S1P-1100A690V	3	1100 A, 690 V, size 3, single indicator, flush end
0900-4	L+H8	170M6418	RS306-3-S1P-1500A690V	3	1500 A, 690 V, size 3, single indicator, flush end
1190-4	L+2H8	170M6413	RS306-3-S1P-900A690V	6	900 A, 690 V, size 3, single indicator, flush end
1674-4	L+2H8	170M6416	RS306-3-S1P-1250A690V	6	1250 A, 690 V, size 3, single indicator, flush end
0600-7	L+H8	170M6413	RS306-3-S1P-900A690V	3	900 A, 690 V, size 3, single indicator, flush end
0900-7	L+H8	170M6418	RS306-3-S1P-1500A690V	3	1500 A, 690 V, size 3, single indicator, flush end
1116-7	L+2H8	170M6413	RS306-3-S1P-900A690V	6	900 A, 690 V, size 3, single indicator, flush end
1674-7	L+2H8	170M6418	RS306-3-S1P-1500A690V	6	1250 A, 690 V, size 3, single indicator, flush end

Table 1–10 Selection of the fuse on AC side (UL certified)

Model MD880-30K-...	Layout	Fuse on the AC side	Quantity	Specifications
		Bussmann		
0900-7	L+H8	170M6418	3	1500 A, 690 V, size 3, single indicator, flush end
1674-7	L+2H8	170M6418	6	1250 A, 690 V, size 3, single indicator, flush end

Fuse on the DC side

Table 1–11 Selection of the fuse on the DC side

Model MD880-30M-...	Layout	Fuse on the DC side		Quantity	Specifications
		Bussmann	Medium voltage		
0640-4	H8	170M6416	RS306-3-S1P-1250A690V	2	1250 A, 690 V, size 3, single indicator, flush end
0900-4	H8	170M6413	RS306-3-S1P-900A690V	4	900 A, 690 V, size 3, single indicator, flush end
0600-7	H8	170M6649	RS306-3-S5P-1100A1250V-D	2	1100 A, 1250 V, size 3, single indicator, flush end
0900-7	H8	170M6547	RS306-3-S5P-900A1250V-D	4	900 A, 250 V, size 3, single indicator, flush end

1.14 Selecting the Pre-charge Circuit

Table 1–12 Selection of the pre-charge resistor

Voltage class	Rated current	Pre-charge resistor resistance	Pulse load power
400V	640 A to 1674 A	2 Ω	36000 Ws
690V	600 A to 1674 A	5 Ω	36000 Ws

Table 1–13 Selection of the pre-charge circuit fuse and contactor

Type	Manufacturer	Model	Quantity	Specifications
Fuse	Vicfuse	NT00C-40A690V-gG	3	40 A/690 V, square body, blade end, plug-in connection
Pre-charge contactor	Schneider	LC1D32M7C	1	32 A/690 V, 3P, 1NO1NC

Note

- To prevent overheating of the pre-charge resistor, the interval between two times of switch-on must not be shorter than three minutes.
- The regenerative rectifier can support inverters with up to four times the rectifier power.

1.15 Selecting the Reactor

Select the regenerative rectifier reactor based on 4% of the relative short-circuit impedance. Considering the equalizing reactor inductance of the regenerative rectifier module, the relative short-circuit impedance of the actually selected input reactor is slightly smaller.

The regenerative rectifier filter (L) and the regenerative rectifier power module (H8) are already included in the regenerative rectifier frame module, with no need for additional reactors. If users select the regenerative rectifier module only, they must design and prepare the input reactor themselves according to the requirements of *"Table 1-14 Selection of the regenerative rectifier reactor" on page 42*. For better thermal design and filter performance, it is recommended to purchase a standard regenerative rectifier filter.

Table 1–14 Selection of the regenerative rectifier reactor

Model of regenerative rectifier frame module	Model of regenerative rectifier module (H8)	Rated voltage (V)	Rated current (A)	Inductance (μH)
MD880-30K-0640-4	MD880-30M-0640-4 x 1	400	640	40
MD880-30K-0900-4	MD880-30M-0900-4 x 1	400	900	25
MD880-30K-1190-4	MD880-30M-0640-4 x 2	400	1190	22
MD880-30K-1674-4	MD880-30M-0900-4 x 2	400	1674	14
MD880-30K-0600-7	MD880-30M-0600-7 x 1	690	600	79
MD880-30K-0900-7	MD880-30M-0900-7 x 1	690	900	42
MD880-30K-1116-7	MD880-30M-0600-7 x 2	690	1116	42
MD880-30K-1674-7	MD880-30M-0900-7 x 2	690	1674	26

2 Mechanical Installation

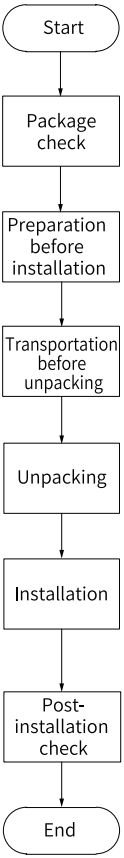


Figure 2-1 Installation flowchart

2.1 Installation Precautions

2.1.1 Transportation and Storage

Precautions during transportation

The product is heavy with a high center of gravity, which has been marked on the product.

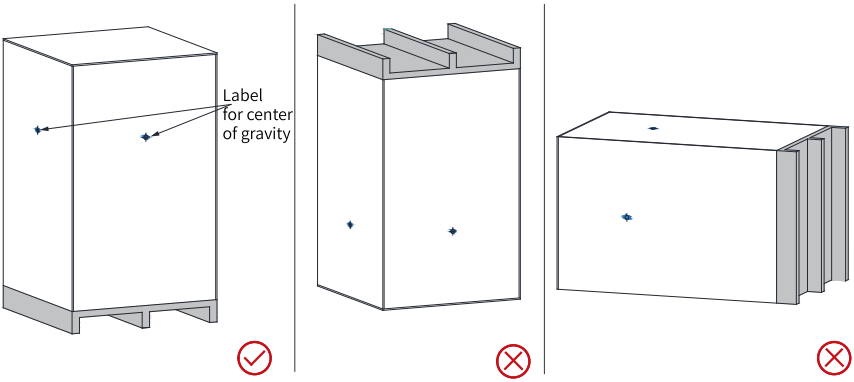


Figure 2-2 Placement method

- Place the product on a flat and solid ground that can bear its weight.
- Transportation must be performed by well-trained personnel with suitable hoisting tools.
- Transport the product only in the upright position as indicated on the package. Never transport the cabinet in an inverted or flat position. Due to the weight and length, the product must be transported by using the auxiliary angle steel on the top of the cabinet and the wooden pallet under the cabinet.
- The cabinet must be immobilized on a wooden pallet before the product is transported with a forklift. If the cabinet needs to be transported to another place, do not remove the product from the pallet.
- The auxiliary angle steel must be installed on the product before the product is transported with a crane.

Transportation

Handle the packaged product through the pallet and transport it with a forklift or crane.

- The load capacity of the transportation equipment must be larger than the weight of a single cabinet. The distance between forklift feet must be adjusted properly (larger than one half of the cabinet length).
- The hoisting rope of the crane must pass through the pallet under the cabinet, with the hoisting height not higher than 0.3 m.
- Do not use a hydraulic vehicle for long-distance transportation or on slopes.
- Designate staff to hold the product on both sides during handling.

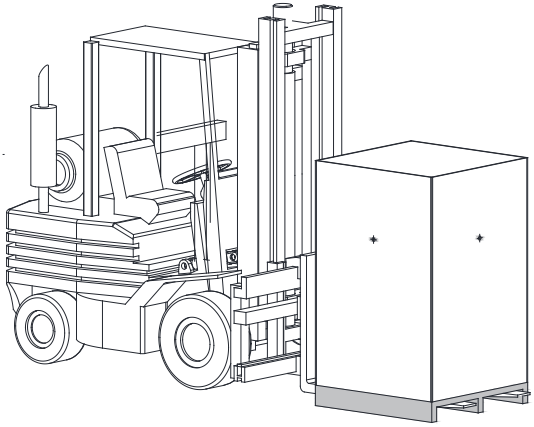


Figure 2-3 Transportation with a forklift

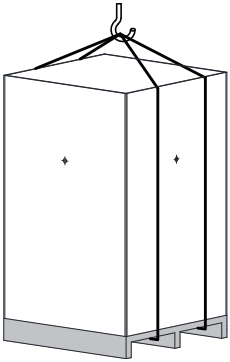


Figure 2-4 Transportation with a crane

Package check

Be sure to inspect the MD880-30 series regenerative rectifier carefully upon receipt from the shipping company. Check each received item against the delivery note. Notify the shipping company immediately of any missing components or damage. Contact Inovance for technical support when necessary.

WARNING

- If the product is damaged during transportation, its electrical safety performance may no longer be ensured. Do not connect the product before a professional high-voltage test is performed.
- Failure to observe the warning notice may result in personal injury or death or severe loss of property.

Storage

Store the cabinet in a clean and dry room maintained between -40°C and +70°C with a variation less than 1°C/min. In case of long-term storage, cover the cabinet or take other appropriate measures to ensure that it is protected from contamination and environmental influences.

Keep the following requirements in mind to properly store the product.

- Try to store the product with the original package.
- Prevent the product from being exposed to moisture, high temperature, or direct sunlight for a long time.

2.1.2 Mechanical Installation Checklist

WARNING

- For safe and reliable operation, the product must be properly installed and put into use by qualified personnel in accordance with all warnings and precautions.
- Pay special attention to compliance with general and national requirements on installation of high-voltage equipment as well as the requirements relating to the proper use of tools and personal protective equipment.
- Failure to observe the warning notice may result in personal injury or death or severe loss of property.

After installation, tick the corresponding column of each item to confirm completion.

Table 2–1 Mechanical installation checklist

No.	Item	Con firmed
1	The center of gravity is labeled.	☐
2	The package is intact and free of damage and dampness.	☐

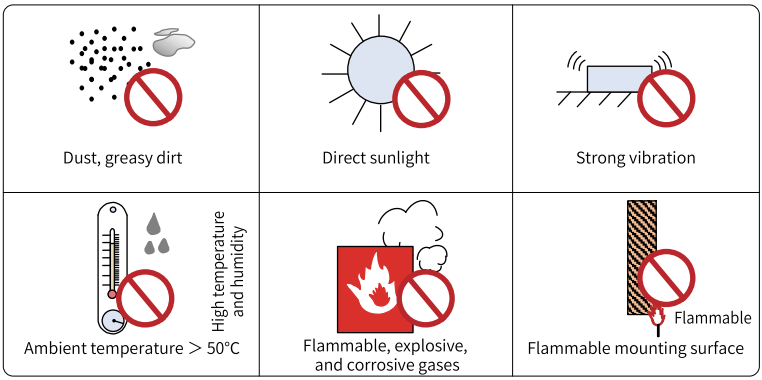
No.	Item	Confirmed
3	The load-bearing capacity of the ground and the environment fulfill the regenerative rectifier installation requirements. For details, see "2.2.1 Requirements on Installation Environment" on page 47.	☐
4	The ceiling height meets the minimum requirements for unhindered ventilation. There is sufficient space for air inlet and outlet without obstruction. There is sufficient space for a safe passage when the cabinet door is opened. For details, see "2.4.1 Cabinet Installation Requirements" on page 57.	☐
5	The cabinet enclosure is free of deformation, paint peeling, cracks, and other defects. The inside of the cabinet is free of water stains and other defects.	☐
6	The accessories (options) in the cabinet are complete.	☐
7	The wooden pallet is removed when the cabinet is transported to the final installation site.	☐
8	The cabinet is installed at the pre-designed anchor point as required. The cabinet devices are connected as specified. For details, see "2.4.1 Cabinet Installation Requirements" on page 57.	☐
9	All contact protection devices (protective plates) inside and outside the cabinet have been installed before commissioning.	☐

2.2 Installation Preparations

2.2.1 Requirements on Installation Environment

Item	Requirement
Heat dissipation and ventilation	Install the regenerative rectifier module on the surface of a non-flammable object and mount the module vertically to a mounting bracket with screws. Reserve enough space around the cabinet for heat dissipation because the regenerative rectifier module generates a lot of heat under operation.
Installation site	The installation site must meet the following requirements: • The installation base is flat and solid enough to bear the cabinet weight. • Free from direct sunlight. • Humidity ≤ 95% RH with no condensation. • Free from corrosive, flammable, and explosive gases. • Free from greasy dirt and dust.
Vibration	The installation site cannot be subject to vibration. For the vibration resistance performance, see "1.5 Technical Data" on page 19.

Item	Requirement
Ambient temperature	Derating is required when the ambient temperature is greater than 40°C or the installation altitude is above 1000 m. For the derating coefficient, see *"1.10 Derating Characteristics" on page 37*.
Protective enclosure	The product is designed for installation in a cabinet and must be used within a final system, which must be equipped with an enclosure providing fire, electrical, and mechanical protection and meeting local laws and regulations and applicable IEC standards.



2.2.2 Installation tools

- Nut wrench or socket wrench, 13#
- Nut wrench or socket wrench, 16#
- Nut wrench or socket wrench, 18#
- Phillips and slotted (2.5–6 mm) screwdrivers for tightening the screws on components
- Torque wrench
- Crowbar

2.3 Frame Module Installation

2.3.1 Requirements on L+H8 Frame Module Installation Space

- Minimum requirements on cabinet dimensions:

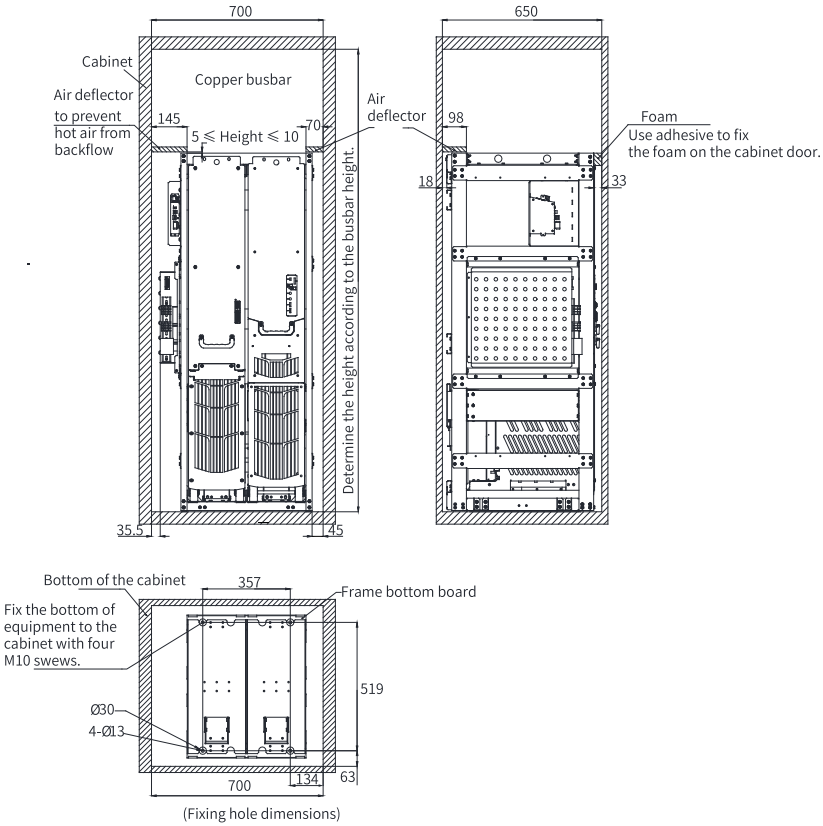


Figure 2-5 Minimum requirements on cabinet dimensions (mm)

Note

It is recommended to use a standard cabinet with the depth of 800 mm. For a special cabinet, the internal depth must be at least 650 mm.

- Two beams must be designed at the bottom of the cabinet so that the frame can be pushed in easily.

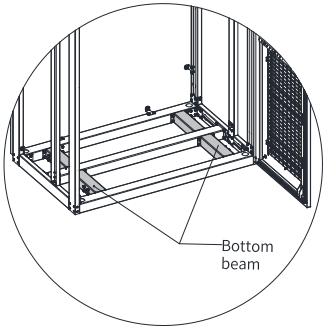


Figure 2-6 Bottom beams

The dimensions of the beams are as follows.

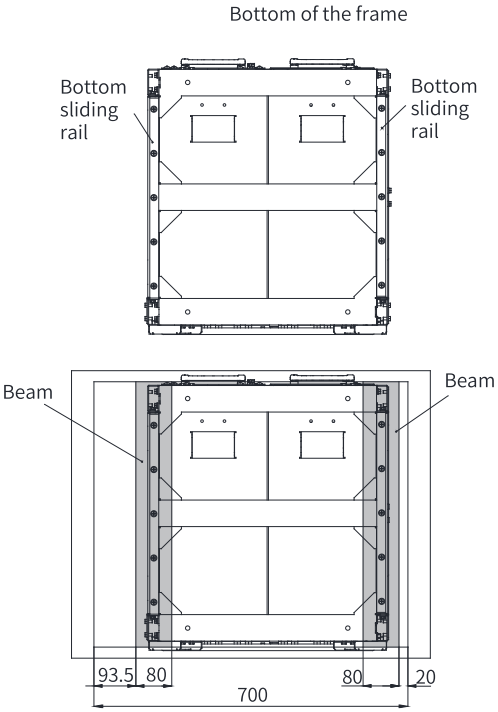
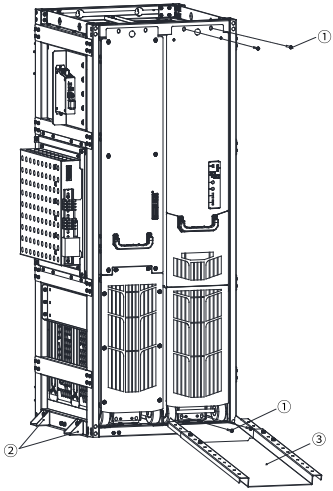


Figure 2-7 Beam dimensions (mm)

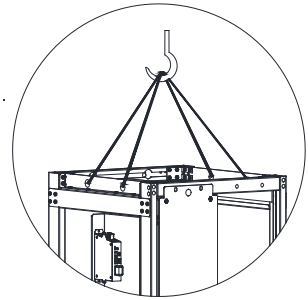
2.3.2 L+H8 Frame Module Installation Procedures

Procedures:

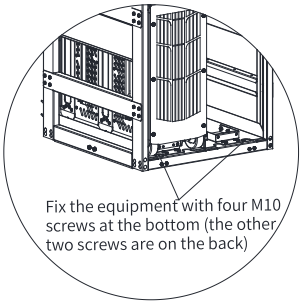
1. Pull the H8 regenerative rectifier module out of the frame to reduce the weight of the frame module.
   - Remove four components (②) for fixing the frame during transportation.
   - Hoist the frame onto a flat surface.
   - Remove four M8 bolts (①) of the H8 module.
   - Place the guide rail (③) and take out the H8 module.



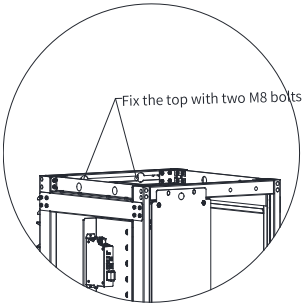
2. Hoist the frame into the cabinet.



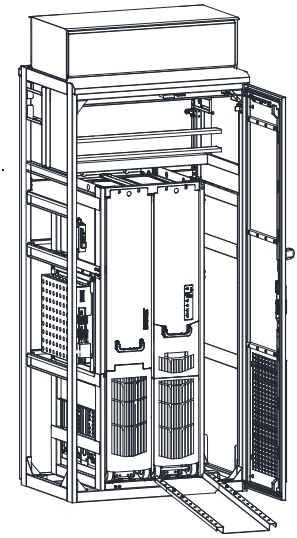
3. When the bottom of the frame comes into contact with the bottom of the cabinet, manually push the frame to the specified position. Fasten the screws at the bottom of the frame.



4. Fasten the screws at the top of the frame.



5. Place the guide rail to push the H8 module in, and then fasten four M8 bolts at the top and the bottom.



2.3.3 Requirements on L+2H8 Frame Module Installation Space

- Minimum requirements on cabinet dimensions:

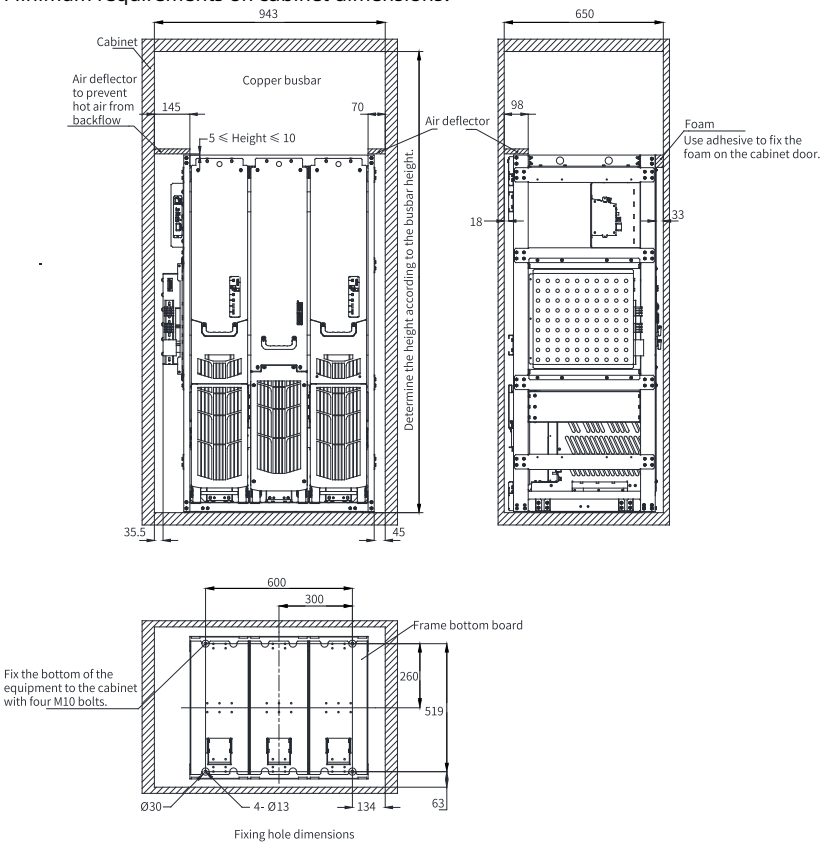
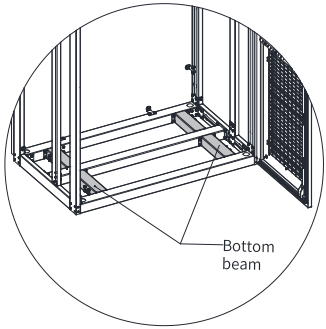


Figure 2-8 Minimum requirements on cabinet dimensions (mm)

Note

It is recommended to use a standard cabinet with the depth of 800 mm. For a special cabinet, the internal depth must be at least 650 mm.

- Two beams must be designed at the bottom of the cabinet so that the frame can be pushed in easily.



The dimensions are as follows.

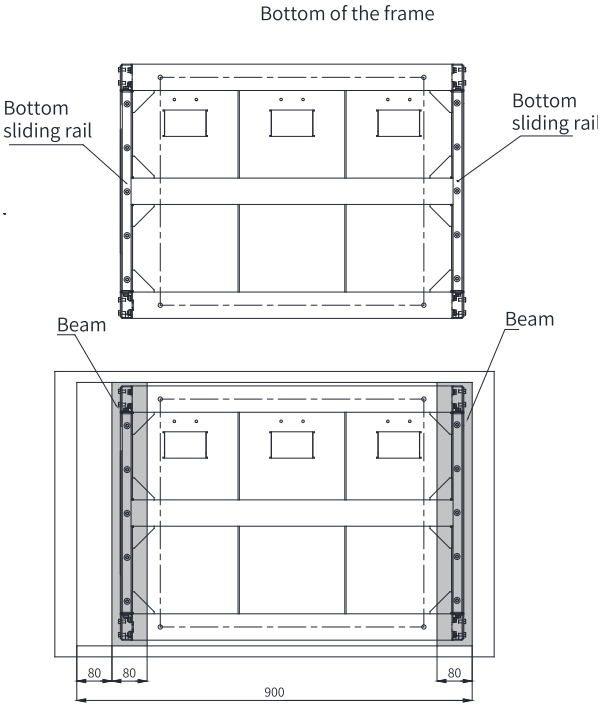


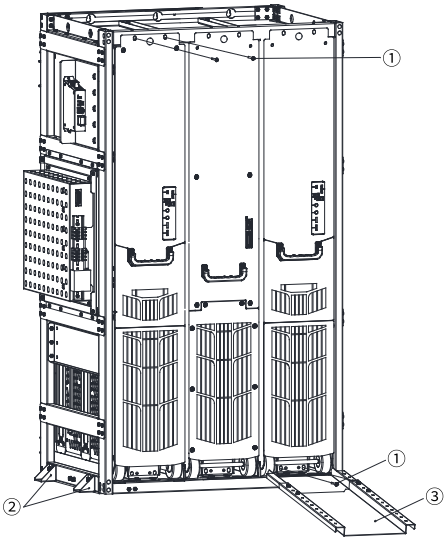
Figure 2-9 Dimensions of bottom beams (mm)

2.3.4 L+2H8 Frame Module Installation Procedures

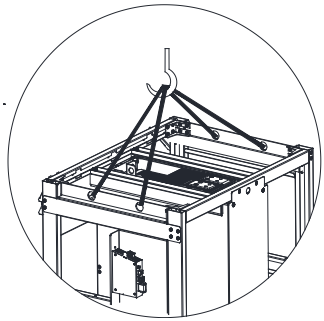
Procedures:

1. Take two H8 regenerative rectifier modules out of the frame to reduce the weight of the frame module.

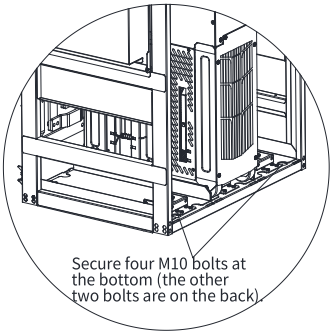
- Remove four components (②) for fixing the frame during transportation.
- Hoist the frame onto a flat surface.
- Remove four M8 bolts (①) of the H8 module.
- Place the guide rail (③) and take out the H8 module.



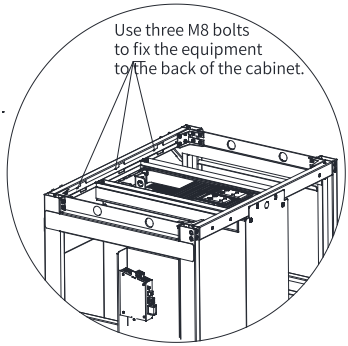
2. Hoist the frame into the cabinet.



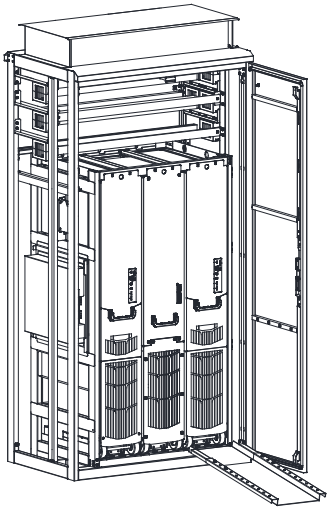
3. When the bottom of the frame comes into contact with the bottom of the cabinet, manually push the frame to the specified position. Fasten the bottom screws.



4. Fasten the rear screws.



5. Place the guide rail to push the H8 module in, and then fasten four M8 bolts (for each module) at the top and the bottom.



2.4 Cabinet Installation

2.4.1 Cabinet Installation Requirements

- Space on the top of the cabinet
  Do not install the regenerative rectifier cabinet in a completely unprotected environment. Install all cabinets according to the drawings, with sufficient space around the cabinets for air flow, full range of door opening/closing, and maintenance. Reserve a passage for entering the installation foundation and the space for the auxiliary devices for transporting back the regenerative rectifier cabinet.
  - The installation site must be dry and clean. The air supplied must not contain any conductive gas, vapor, or dust, which is harmful to the product. If necessary, deploy filters to clean the air of the installation site.
  - If there is dust present in the air, install filter mats in front of the vent of the cabinet door and the ventilation hood on the top of the cabinet. The IP rating of the cabinet is IP21.

Note

To complies with IP21, the MD880-30 series regenerative rectifier cabinet must be enclosed by installing a side panel on the left and right sides.

Install the product with reference to the attached dimension drawing. The distance between the cabinet top and the ceiling is associated with the options matching the IP rating of the cabinet, as shown in the following figure.

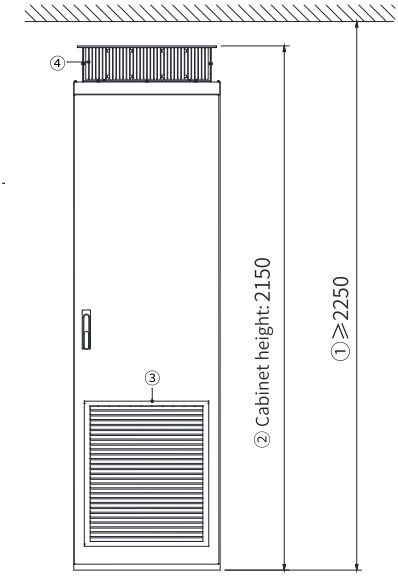


Figure 2-10 Distance between the cabinet top and the ceiling (IP21)

No.	Description	No.	Description
①	Minimum ceiling height (mm)	③	Air inlet area
②	Total cabinet height (mm)	④	Air outlet area

- Space in front of the cabinet
  The cooling air is drawn in the power unit from the front through the vent or window blind at the bottom of the cabinet door. The heated air is discharged through the perforated canopy or the window blind of the ventilation hood.

  The cabinet is allowed to install against the wall; however, the distance between the front of the cabinet and the wall must be ≥ 1500 mm, and sufficient space must be reserved for two sides of the cabinet.

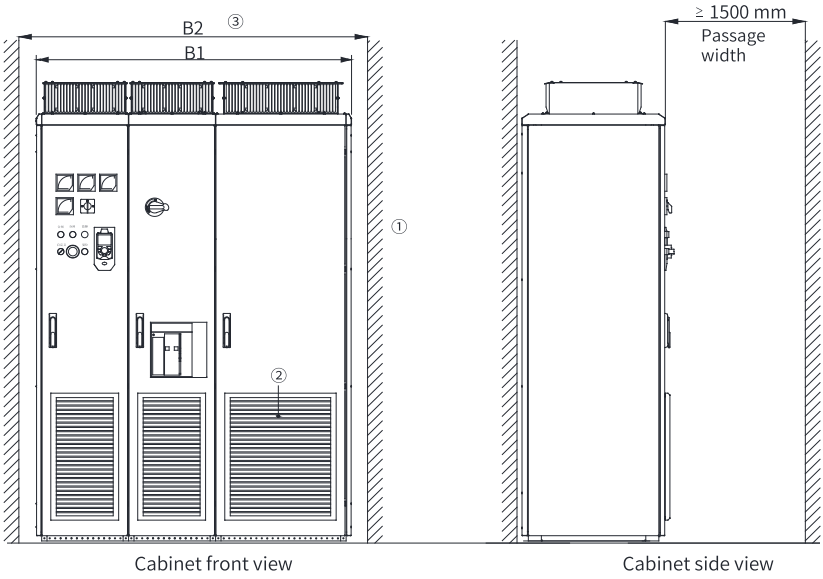


Figure 2-11 Space in front of the cabinet

No.	Description	No.	Description
①	Wall of the building	③	The space width B2 in the building must be larger than the total width B1 of parallel cabinets.
②	Air inlet area	-	-

Note

Take the front door handle into consideration. Reserve sufficient space for maintenance and overhaul to ensure that the front door can open to an angle of > 90° (with a maximum door opening angle of about 100° if unobstructed).

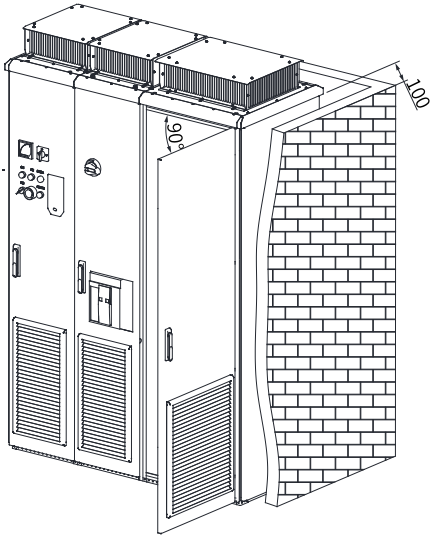


Figure 2-12 Space reserved for door opening/closing (mm)

- Ground flatness
  The installation foundation must be flat and solid enough to bear the cabinet weight, so that the following function of the cabinet can be performed properly. Ensure that the door lock works properly during door opening and closing.

  When cabinets are connected in parallel, ensure that there is no gap between the cabinet and the ground. If the gap is unavoidable (as shown in ① of *"Figure 2-15 Foundation layout" on page 63*), use a pad (as shown in ② of *"Figure 2-15 Foundation layout" on page 63*) to keep the cabinet horizontal, and use proper fillings (for example, fireproofing mud) to fill the gap.

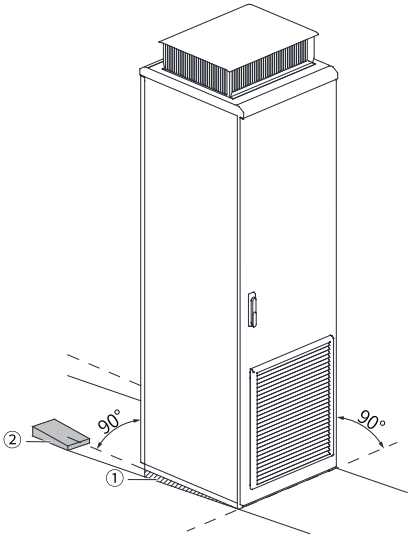


Figure 2-13 Requirements on the ground

- Installing the expansion screws
  Before installing the cabinet on concrete ground, install the expansion screws in the ground at the positions corresponding to the holes for fixing the cabinet.

  The expansion screw installation procedures are as follows.

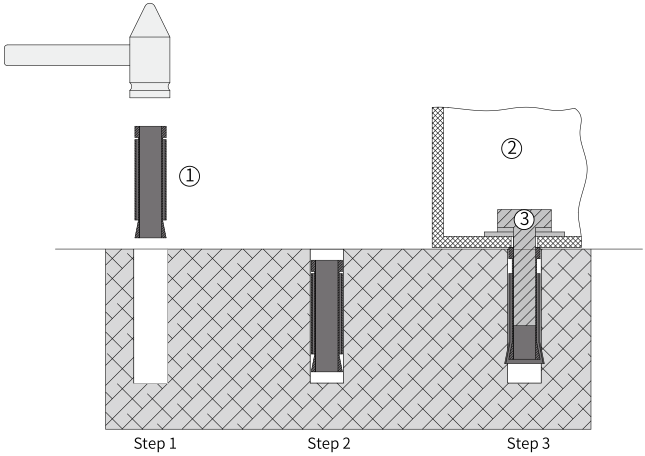


Figure 2-14 Expansion screw installation procedures

No.	Description	No.	Description
①	Expansion screw	③	M12 bolt
②	Cabinet	-	-

Steps:

1. Drilling a hole: Hole diameter < Maximum outer diameter of the expansion screw ①; Hole depth > Length of the expansion screw;
   Perpendicular to the ground
2. Knocking the expansion screw into the hole (below the surface) with a hammer, as shown in Step 2. The expansion screw consists of two movable parts: spring-type expansion tube and screw.
3. After placing the cabinet in the required position, fasten it with M12 bolts. The screw will be pulled up, making the spring-type expansion tube deform to fasten the cabinet, as shown in Step 3.

- Foundation

Note

- Separate high-voltage cables from low-voltage cables by using different brackets. If they cannot be separated, lay low-voltage cables in fully-enclosed metal ducts.
- The cable trench must be non-flammable, smooth, damp-proof, dust-proof, and rat-proof.
- Failure to observe the warning notice may result in personal injury or death or severe loss of property.

During foundation design, take the following factors into consideration: inspection space in front of the regenerative rectifier cabinet, and routing of power supply cables, actuating motor cables, and system control cables. Design a cable trench or cable guide below the cabinet. The power cables and signal cables must be separated, or the product functions may be influenced. The following figure shows the routing requirements.

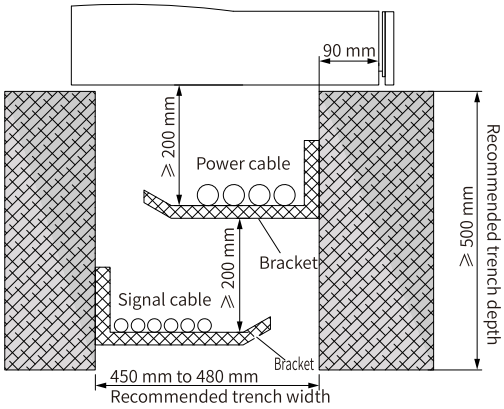


Figure 2-15 Foundation layout

2.4.2 Cabinet Installation Procedures

1. Unpacking the cabinet

   Place the packaged product on the empty and flat ground of a factory building. Use appropriate tools, such as a crowbar, to pry off the wooden crate along the gap at the plate edge. Then, remove the cover plate, side plate, and end plate.

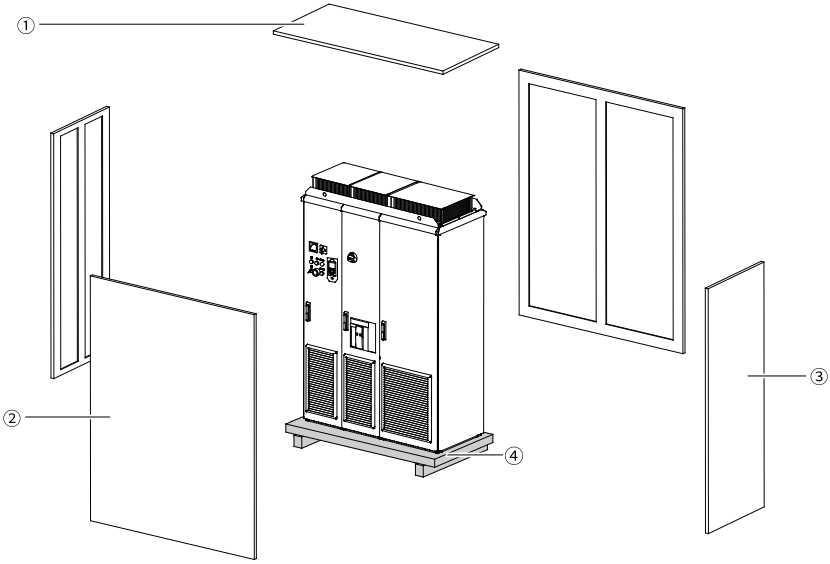


Figure 2-16 Unpacking the cabinet

No.	Code	No.	Code
①	Cover plate	③	End plate
②	Side plate	④	Pallet

Note

- During unpacking, insert the crowbar into the wooden crate as short as possible to prevent equipment damage. Pry off the crate with care and watch out for nails.
- When removing the packing materials such as plastic film, do not use sharp tool to prevent equipment damage.
- Dispose of the packing materials according to local laws and regulations.

2. Removing the pallet

Before installing the cabinet, remove the screws for fastening the pallet and the cabinet from four corners of the cabinet, and then remove the pallet.

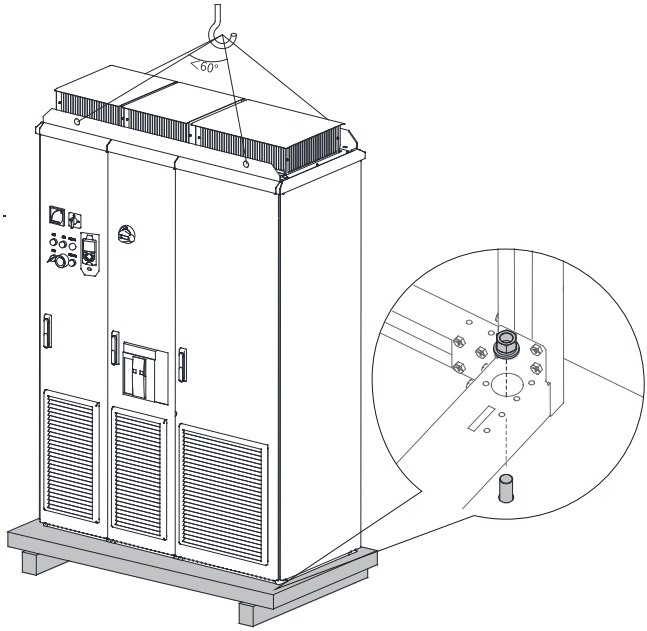


Figure 2-17 Unloading the cabinet from the pallet

3. Handling the cabinet after unpacking

- Use a crane or similar devices for installation. Handle the cabinet with a crane with the load capacity larger than the weight of one set of the cabinet.

- When the cabinet is hoisted, ensure that the maximum angle of the hoisting rope is 60°.
- Use the angle steel on the top of the cabinet for hoisting and handling, with the hoisting height not higher than 0.3 m.
- Be sure that the cabinet door is locked before transportation. Designate staff to hold the cabinet on both sides during transportation.

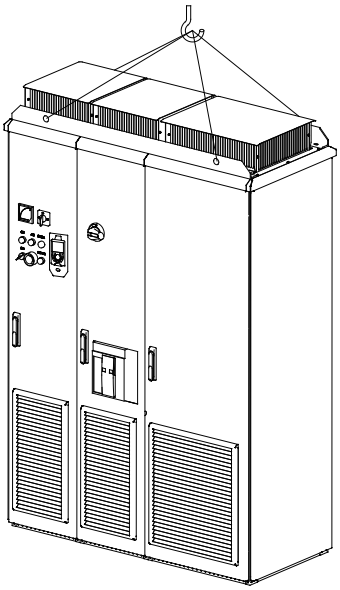


Figure 2-18 Handling the cabinet after unpacking

Open the cabinet door, align the foundation bolt mounting holes at the bottom of the cabinet with the expansion screws on the ground, tighten twelve M12 bolts to fix the cabinet, and close the cabinet door.

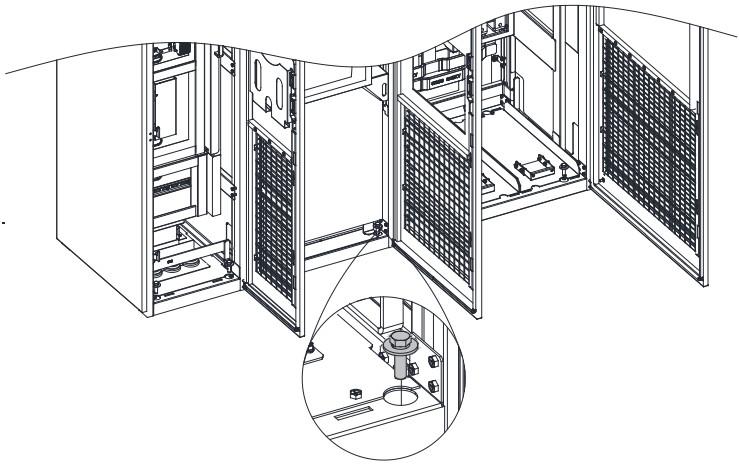


Figure 2-19 Fixing the cabinet

3 Electrical Installation

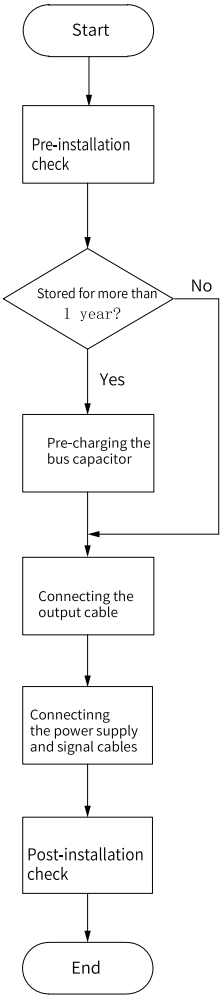


Figure 3-1 Electrical installation flowchart

3.1 Safety Notice

3.1.1 Safety Precautions



- The equipment is typically used in industrial applications with high voltage. The equipment contains live and rotating components. Therefore, there is a risk of severe injury or significant material damage if the required covers are removed without authorization during operation, if it is used or operated incorrectly, or if it has not been properly maintained.
- Only professionals are allowed to operate the electrical devices according to the following "five safety rules" and safety precautions specified in the guide.
  - Power off the equipment
  - Ensure that the equipment cannot be energized again.
  - Make sure that the equipment is de-energized without residual voltage left.
  - Make sure that the equipment is grounded properly.
  - Cover or isolate the adjacent live components.

3.1.2 Pre-wiring Inspection

Take necessary protective measures during electrical installation to ensure personal safety. Comply with the following rules when perform electrical installation.

- The equipment runs with high voltage. The wiring work must be carried out only after the cabinet is powered off without any residual voltage.
- Only qualified professionals are allowed to operate the equipment.
- Take caution when operating the equipment that disconnected from the power supply as external supply voltage may still be present. The power terminals and control terminals may still be live even when the equipment is stopped.
- The equipment may still be live even 15 minutes after power-off due to the DC bus capacitor inside. Therefore, ensure that the voltage is about 0 V before opening the equipment.
- Ensure that the motors, cabinets, and other components are installed and connected in accordance with the national technical rules and other applicable regional regulations. Special attention must be paid to regulations concerning cable dimensions, fuses, grounding, open circuit, isolation, and overcurrent protection.
- If the fuse in a branch circuit trips, the fault current may have been disconnected. To reduce the risk of fire or an electric shock, check the conductive parts and other

components and replace the damaged parts. Find the cause of the tripped fuse and make sure the problem is solved.

3.1.3 General Statements

Static electricity

Note

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

Optical components



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

3.1.4 Component Insulation Check

The MD880-30 series regenerative rectifier has been tested for insulation between the main circuit and the housing at the factory. Therefore, do not perform any withstand voltage and insulation resistance tests on the rectifier again.

3.2 EMC-Compliant Installation and Routing

3.2.1 Routing Requirements

Routing signal cables separately from power cables

When analog signals are used to remotely control the regenerative rectifier, the signal cables and high-voltage circuit cables (power input, rectifier output, and braking resistor connecting cables) must be routed separately with a distance longer than 30 cm to reduce interference from the regenerative rectifier or other devices on the analog signals. This routing requirement must be met even in the control cabinet.

Analog control signal cables

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

Power cables

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

Control cables and power supply cables

If the power supply cables and control cables must be intersected, make the intersection angle 90 degrees.

3.2.2 Routing Recommendations

- During routing, route cables that used to transmit different types of signals through different routes. Separate disturbing cables from sensitive cables with a minimum clearance of 30 cm wherever possible. When two types of cables must be cross-connected, they must be cross-connected at 90 degrees to avoid interference.

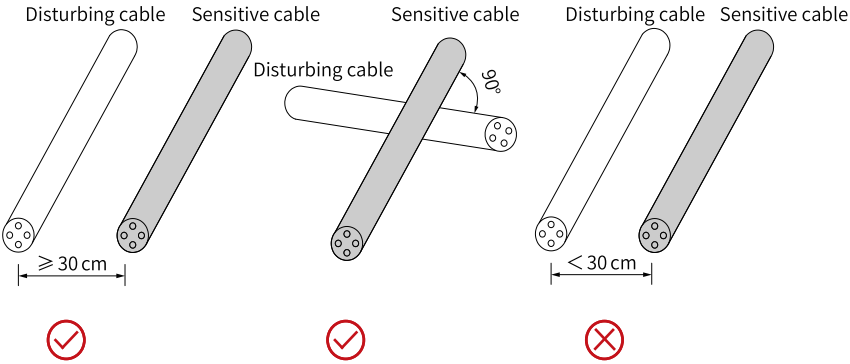


Figure 3-2 Routing of disturbing cables and sensitive cables

- It is recommended to route different types of signal cables through different routes and separate different types of signals with equipotential signals. When routing signal cables of the same type, the equipotential signal cable stays in the outer layer and equipotential signals should stay in the middle if possible, as shown below.

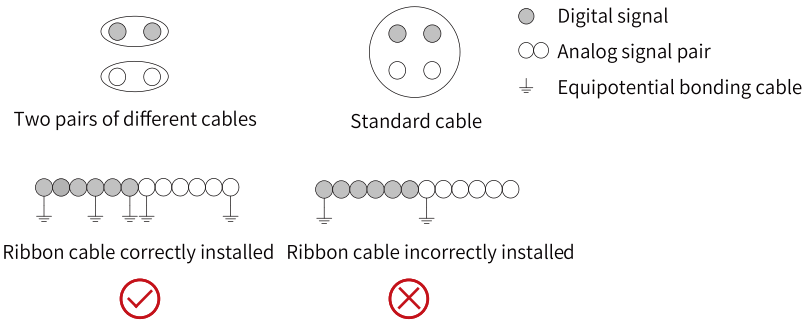


Figure 3-3 Routing of cables that transmit different types of signals

- For multi-conductor 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 conductors shielded, as shown in the following figure.

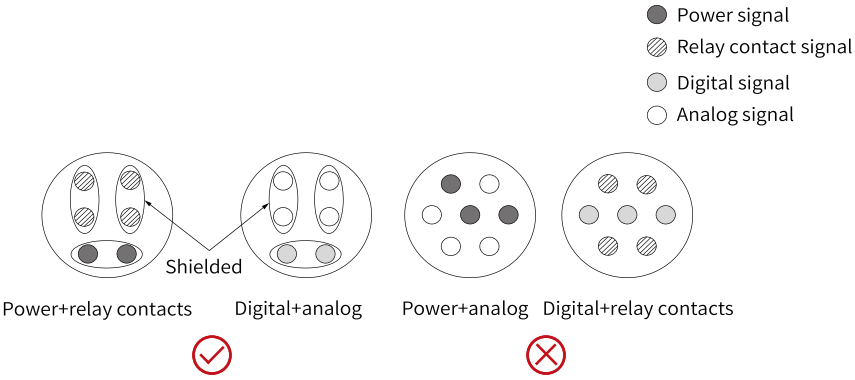


Figure 3-4 Routing of multi-conductor cables

- If certain conductors in a multi-conductor cable are reserved or unused, connect these conductors to the equipotential bonding points.

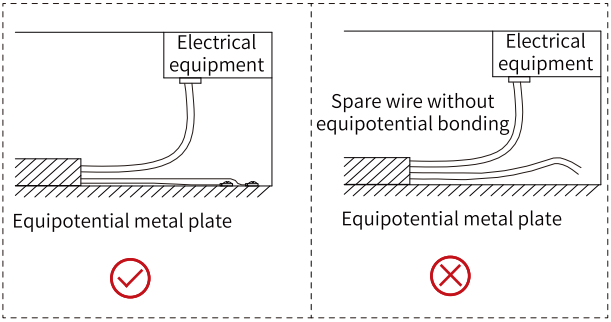


Figure 3-5 Handling reserved or unused conductors

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

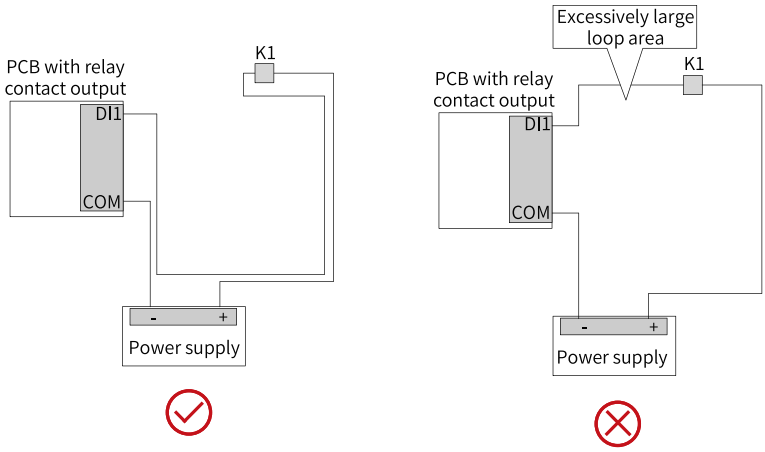


Figure 3-6 Routing for a small loop area

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

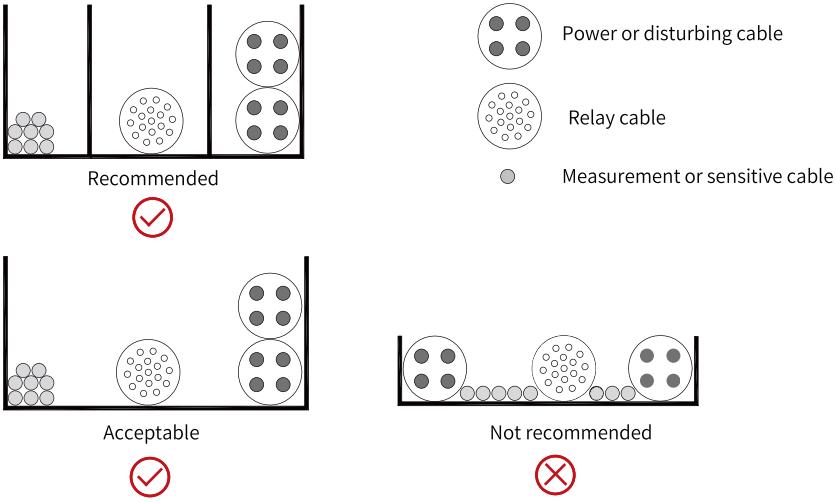


Figure 3-7 Laying multiple types of cables

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

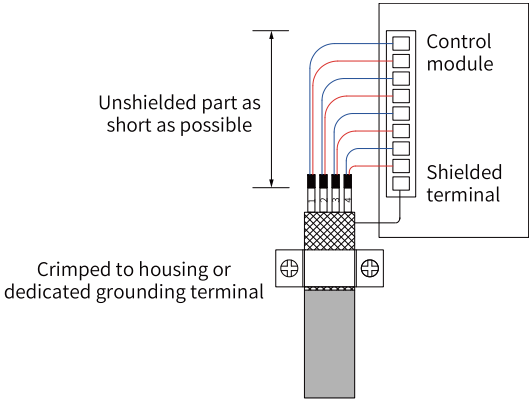


Figure 3-8 Handling shielded cables

3.2.3 Connecting the Shielded Power Cables

The input power cable and shield of the regenerative rectifier module must be in large-area contact with the shield plate in the cabinet to achieve good EMC performance. See the figure below for the connection method.

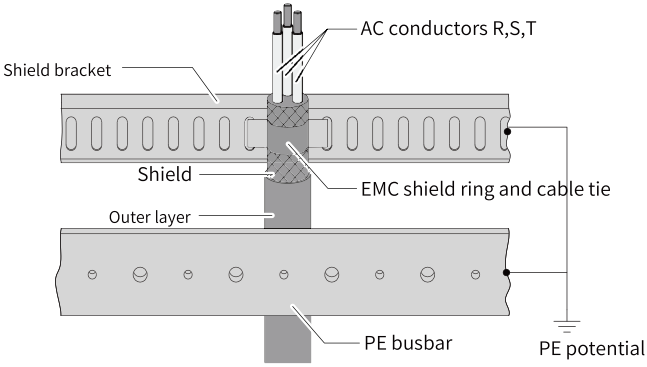


Figure 3-9 Connection of shielded power cables

3.3 Pre-charging the DC-Link Capacitor

The DC side of the regenerative rectifier module contains several electrolytic capacitors, the service lives of which depend on the operating time, load, and ambient temperature. Therefore, their service lives can be extended by lowering the ambient temperature.

Capacitor failure is often associated with product damage, input fuse failure, or fault trip. Contact Inovance if you suspect a capacitor failure. Spare parts can be obtained from Inovance. Do not use non-Inovance specified spare parts.

Note

The equipment cannot be stored for more than one year. If the equipment is stored for more than one year, the DC bus capacitors in the equipment must be charged again before commissioning. The storage period is calculated from the date of manufacturing rather than the date of delivery.

For the charging method, see the following procedures:

Charging requirements:

Apply the rated voltage to the DC-link capacitor without load for at least 30 min; during this period, no charging module is allowed to be enabled.

Recommended components for the charging circuit:

- One three-phase fuse switch 10 A/400 V or 10 A/690 V
- Three 100 W/230 V incandescent lamps for the regenerative rectifier module of a 400 V system, or three 1 K/100 W resistors in the incandescent lamp position
- Six 100 W/230 V incandescent lamps for the regenerative rectifier module of a 690 V system. Two incandescent lamps must be connected in series in every power phase.
- Small components, such as lamp holder and 1.5 mm^2 cables.

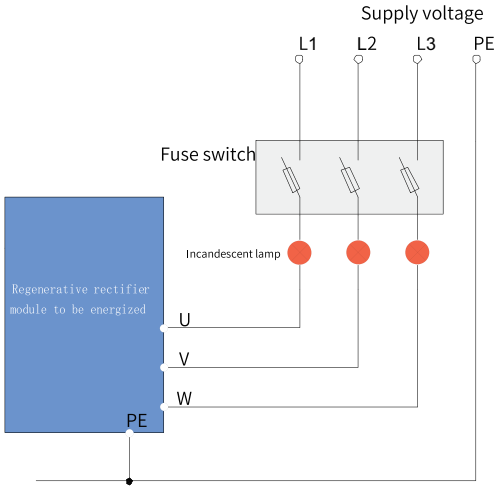


Figure 3-10 Charging connection

3.4 Module Connection

3.4.1 Connecting the Regenerative Rectifier Module

The following figure shows the terminals of the regenerative rectifier module.

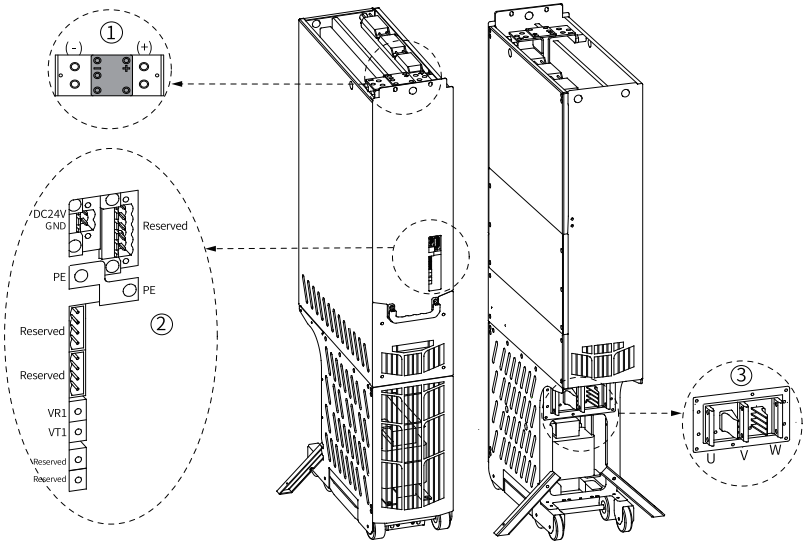


Figure 3-11 Terminals of the regenerative rectifier module (H8)

Table 3–1 Description of the terminals of regenerative rectifier module (H8)

No.	Terminal designation	Description
①	(+), (-) DC output	400 V system: 540 VDC to 590 VDC 690 V model: 740 VDC to 975 VDC Connected to the M10/20N·m copper busbar.
②	Power supply terminal (DC24V, GND), optical fiber terminal (VR1/VT1)	Power supply terminal: two-conductor twisted pair cable, single-conductor cable, cross-sectional area: 0.5 mm^2 to 2.5 mm^2; optical fiber terminal: optical fiber connection
③	U, V, and W AC input	Connected to the cabinet by a quick connector

3.4.2 Connecting the Regenerative Rectifier Filter Module

The following figure describes the layout of terminals of the regenerative rectifier module.

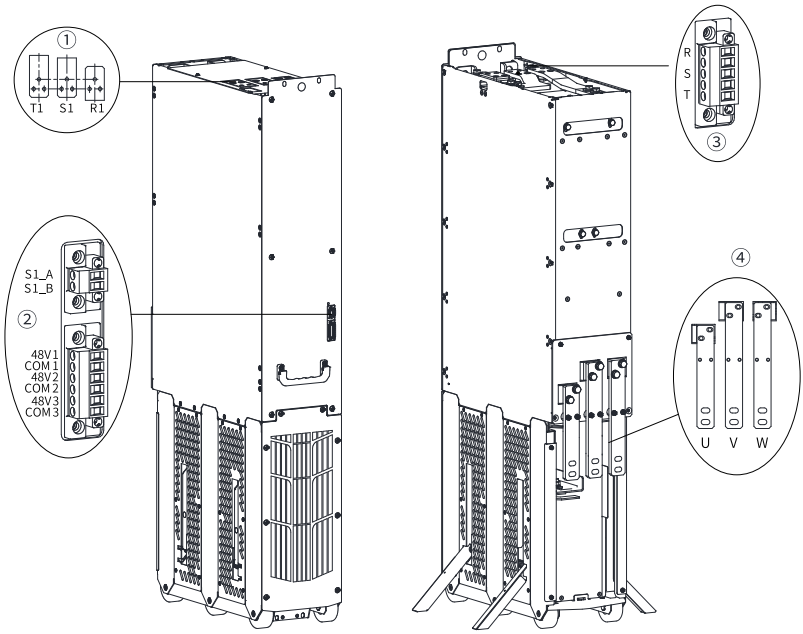


Figure 3-12 Layout of terminals of the regenerative rectifier module (L)

Table 3–2 Descriptions of terminals of the regenerative rectifier module (L)

No.	Terminal Name	Description
①	R1, S1 and T1 AC input	-
②	Reactor overtemperature switch (S1_A, S1_B)	-
	48 VDC fan power input (48V1) 48 VDC fan power input (COM1) 48 VDC fan power input (48V2) 48 VDC fan power input (COM2) 48 VDC fan power input (48V3) 48 VDC fan power input (COM3)	Ensure that the polarity is correct.
③	AC voltage detection (R) AC voltage detection (S) AC voltage detection (T)	Connect to the HSVM-10 synchronous voltage detection module in the correct phase sequence.
④	U, V, and W AC output	-

3.5 Connection of Frame Module

3.5.1 Connecting the L+H8 Frame Module

The following figure shows the terminals of the L+H8 frame module.

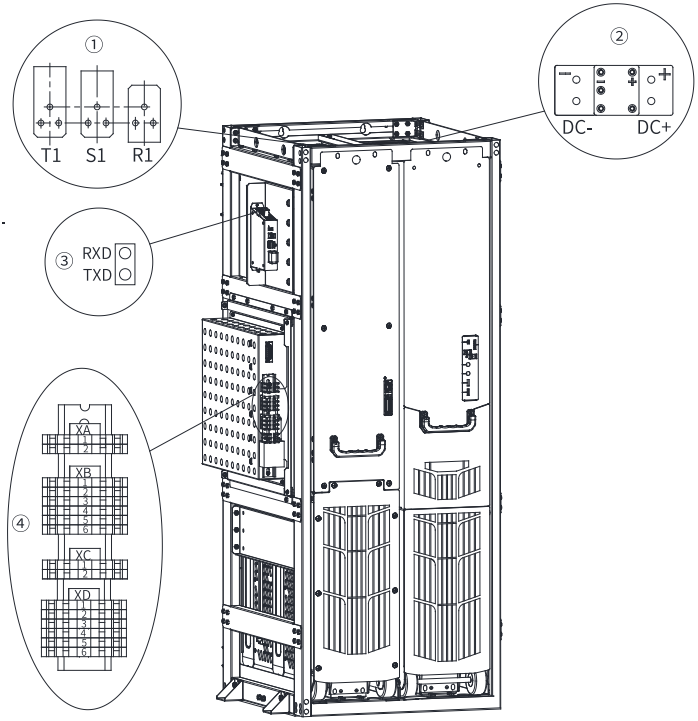


Figure 3-13 Terminals of the L+H8 frame module

Table 3–3 Description of the L+H8 terminals

No.	Mark	Description
①	R1	Three-phase AC input
	S1	
	T1	
②	DC-	DC output
	DC+	
③	RXD	Receiving terminal, Inobus communication protocol, communicating with HCU via the HOFM optical fiber expansion module
	TXD	Transmitting terminal, Inobus communication protocol, communicating with HCU via the HOFM optical fiber expansion module

No.	Mark	Description
④	XA:1	L reactor overtemperature switch (S1_A)
	XA:2	L reactor overtemperature switch (S1_B)
	XB:1	External 24 VDC input (24V)
	XB:4	External 24 VDC input (COM)
	XC:1	Fan power board input (1DC+)
	XC:2	Fan power board input (1DC-)
	XD:1	Buffer circuit input (R2, S2, T2)
	XD:2	
	XD:3	
	XD:4	Buffer circuit input (R2, S2, T2)
	XD:5	
	XD:6	

The following figure shows the terminals for electrical connection.

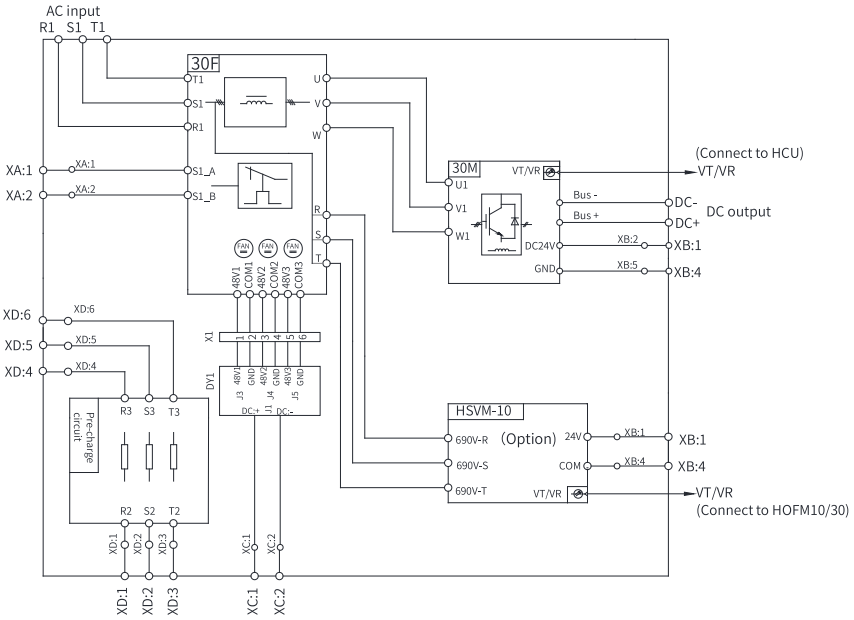


Figure 3-14 Connection of the terminals of L+H8 frame module

3.5.2 Terminals of L+2H8 Frame Module

The following figure shows the terminals of the L+2H8 frame module.

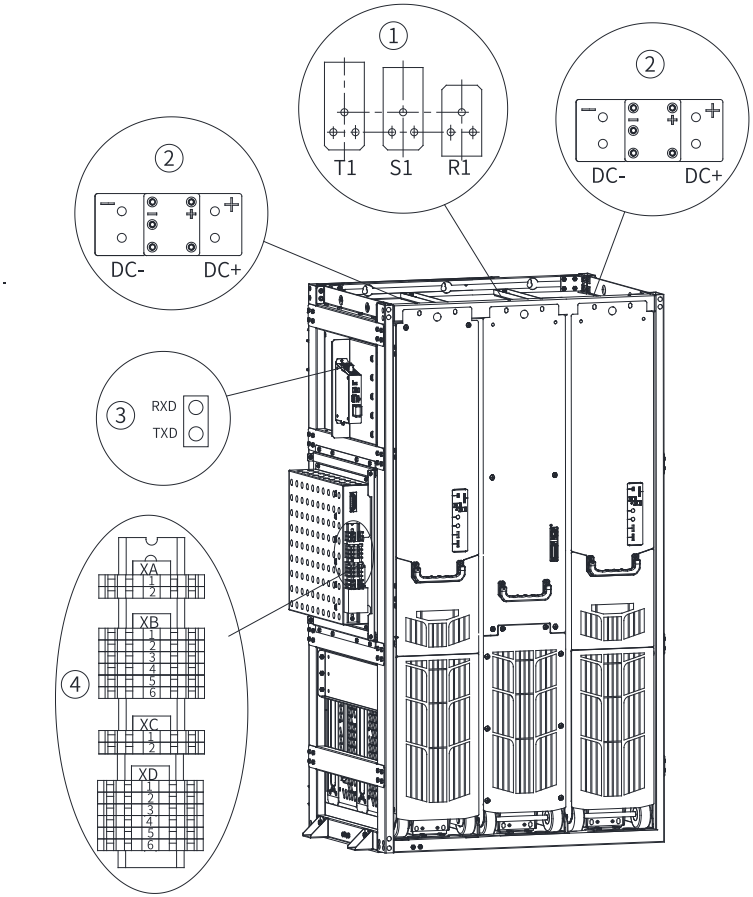


Figure 3-15 Terminals of the L+2H8 frame module

Table 3–4 Description of the L+2H8 terminals

No.	Mark	Description
①	R1	Three-phase AC input
	S1	
	T1	
②	DC-	DC output
	DC+	

No.	Mark	Description
③	RXD	Receiving terminal, Inobus communication protocol, communicating with HCU via the HOFM optical fiber expansion module
	TXD	Transmitting terminal, Inobus communication protocol, communicating with HCU via the HOFM optical fiber expansion module
④	XA:1	L reactor overtemperature switch (S1_A)
	XA:2	L reactor overtemperature switch (S1_B)
	XB:1	External 24 VDC input (24V)
	XB:4	External 24 VDC input (COM)
	XC:1	Fan power board input (1DC+)
	XC:2	Fan power board input (1DC-)
	XD:1	Buffer circuit input (R2, S2, T2)
	XD:2	
	XD:3	
	XD:4	Buffer circuit output (R3, S3, T3)
	XD:5	
	XD:6	

The following figure shows the terminals for electrical connection.

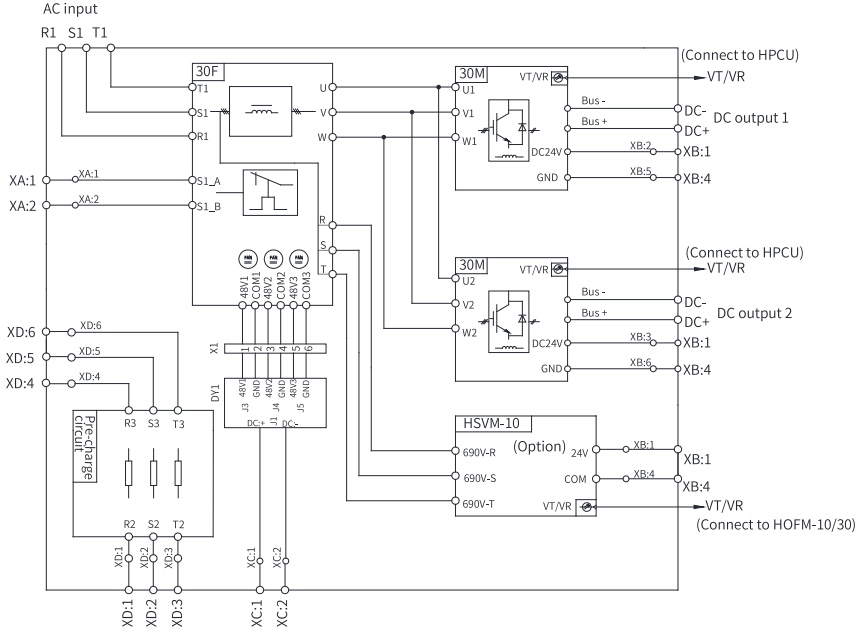


Figure 3-16 Connection of the terminals of L+2H8 frame module

3.6 Cabinet Connection

3.6.1 Connecting the Incoming Cable

Preparations

- Install and secure the cabinet properly.
- Take full safety measures at the installation site.
- Observe the "five safety rules" .

The input cable is connected to the R/S/T terminals of the input copper busbar of the regenerative rectifier cabinet. The following figure shows the position of the input copper busbar.

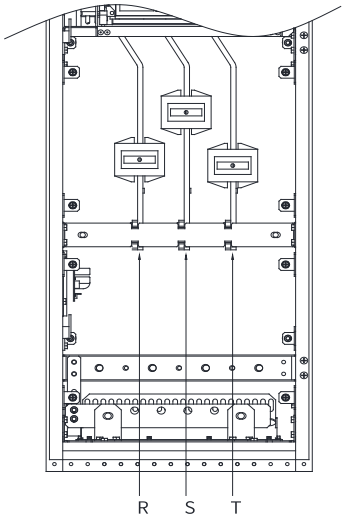


Figure 3-17 Position of the input copper busbar

Connection procedures:

1. Open the cabinet and remove the cover protecting the power cable terminal area.
2. Route the incoming cables into the cabinet from the bottom.
3. Connect the PE cable to the PE bus.
4. Route the cables upward to the R, S, T terminals of the copper busbar.
5. Connect the cables to the copper busbar and secure them in an appropriate position.
6. When the shielded power cable is used, fix the shield to the shield plate as required by EMC.

3.7 Typical Wiring for Cabinet Assembly

When the regenerative rectifier frame module is assembled into a cabinet, the pre-charge circuit and typical wiring method is as follows:

The pre-charge resistor and pre-charge contactor must be used to charge the DC-link capacitor, as shown in the following figure. During pre-charge, the resistor converts electrical energy into heat; therefore, frequent switch-on and switch-off are prohibited. The interval between switch-ons must be longer than three minutes to prevent overheat which may damage the pre-charge resistor.

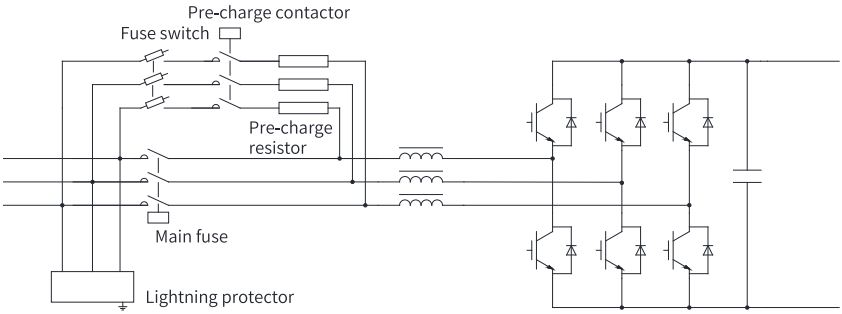


Figure 3-18 Pre-charging the DC-link capacitor

The following figure shows the typical wiring diagram of the regenerative rectifier frame module and related modules for cabinet assembly.

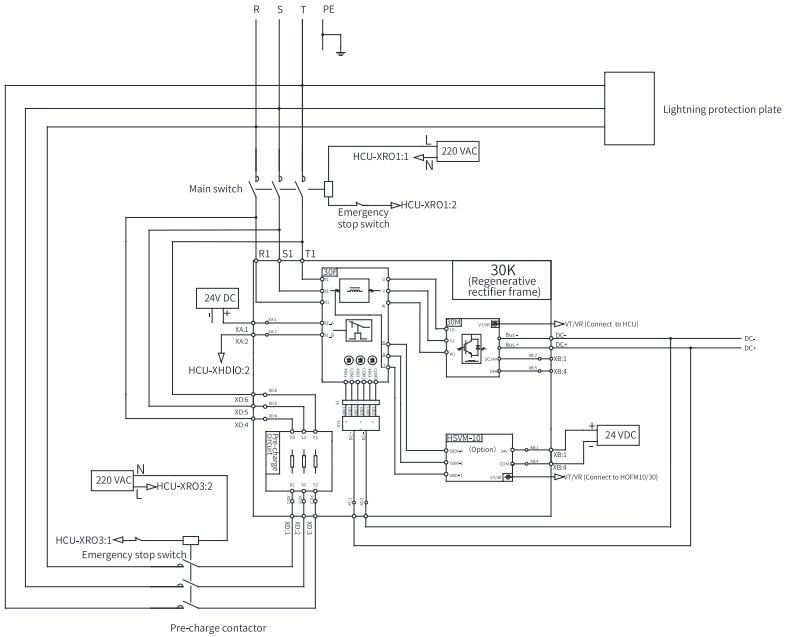


Figure 3-19 Typical wiring diagram for cabinet assembly

Note

- For detailed instructions for use of the DI and DO of the HCU, see *HCU Control Module Hardware Guide*.
- The three-phase voltage detection cable of the optional HSVM module must be connected to R, S, T terminals above the regenerative rectifier filter module in the regenerative rectifier frame (the HSVM module can be installed in a reserved position on the left side of the frame. For specific wiring, see *"Figure 3-14 Connection of the terminals of L+H8 frame module" on page 78* and *"Figure 3-16 Connection of the terminals of L+2H8 frame module" on page 80*).
- When connecting to 1, 2, 3 of the XD terminal block, be sure that the phase sequence is correct. When connecting to 1 and 2 of the XC terminal block, be sure that the polarity of the bus is correct.
- Pre-charge contactor coil voltage: 220 VAC; rated current of the main contact: 32 A; recommended brand: Schneider LC1D32M7C

3.8 Recommendation on Cable Specifications and Models

Table 3–5 Recommended main circuit cables

Module model	Rated input current (A)	Recommended quantity and cross-sectional area (mm^2)	Terminal
U_N : three-phase 400 VAC (380 VAC to 415 VAC)			
MD880-30M-0640-4	640	3 x 120	OT120-12
MD880-30M-0900-4	900	4 x 120	OT120-12
MD880-30M-1190-4	1190	5 x 120	OT120-12
MD880-30M-1674-4	1674	4 x 240	OT240-12
U_N : three-phase 690 VAC (525 VAC to 690 VAC)			
MD880-30M-0600-7	600	3 x 120	OT120-12
MD880-30M-0900-7	900	4 x 120	OT120-12
MD880-30M-1116-7	1116	5 x 120	OT120-12
MD880-30M-1674-7	1674	4 x 240	OT240-12

Table 3–6 Recommended main circuit cables (UL certified)

Model	Rated input current (A)	Recommended quantity and cross-sectional area (AWG)	Terminal
MD880-30K-0900-7	900	4 x 400 kcmil	TLK240-12
MD880-30K-1674-7	1674	4 x 500 kcmil	TLK400-12

Note

- Cables recommended in the table are symmetric three-conductor shielded cables, with each conductor connected to each phase of the AC input copper busbar. The PE cable must be connected separately. The cross-sectional area of the PE cable must meet the following requirements:
  - When the cross-sectional area of the phase conductor (S) ≤ 16 mm^2, the cross-sectional area of the PE cable equals S.
  - When the cross-sectional area of the phase conductor (S) is greater than 16 mm^2 but lower than or equal to 35 mm^2, the cross-sectional area of the PE cable equals 16 mm^2.
  - When the cross-sectional area of the phase conductor (S) is greater than 35 mm^2, the cross sectional area of the PE cable equals S/2.
- For the recommended cables, 3 x 120 mm^2 indicates that each phase requires three cables with a cross-sectional area of 120 mm^2.
- For the recommended terminals, OT/120-12 indicates that the cable is crimped to a OT-type terminal; the cross-sectional area is 120 mm^2m; and the size of the wiring screw hole is M12.
- Observe the maximum size of the terminal listed in the following table. The size of the terminals cannot exceed the maximum size. Otherwise, the mechanical stability and specified electrical clearance cannot be ensured.
- Derating is required when multiple cables of the same specification are connected in parallel.

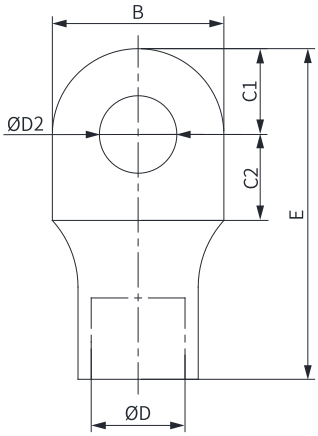


Figure 3-20 Terminal appearance

Table 3–7 Maximum dimensions of the terminal

Screw/Bolt	Cross-sectional area (mm^2)	D2 (mm)	B (mm)	E (mm)	C1 (mm)	C2 (mm)
M5	6	5.3	10	23.8	5.5	6.0
M6	10	6.4	12.4	27.5	7.0	8.0
M6	16	6.4	12.4	31.0	7.0	8.0
M6	25	6.4	14.0	32.0	7.0	8.0
M10	35	10.5	17.5	40.5	10.0	10.5
M10	50	10.5	18.0	43.5	10.5	11.0
M10	70	10.5	21.8	50.0	13.0	13.0
M10	95	10.5	25.0	55.0	13.0	13.0
M12	70	13.0	21.8	50.0	13.0	13.0
M12	95	13.0	25	55	13.0	13.0
M12	120	13.0	28.4	60	14.0	14.0

3.9 Connecting the HCU Control Module

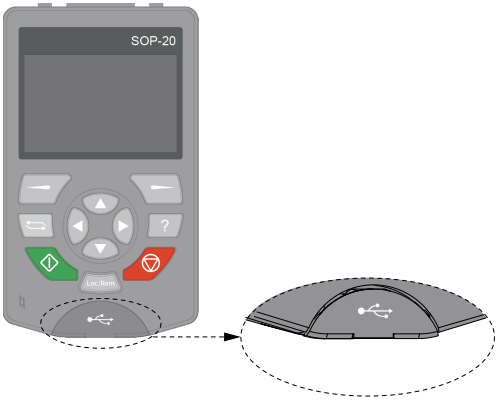
For details on how to install the HCU control module and connect the control cable, see *" HCU Control Module" on page 89*.

3.10 Connecting SOP-20-880 to the PC

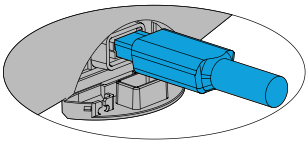
The USB mini-B terminal on SOP-20-880 is used to connect to the PC. The USB cable length cannot exceed 3 m.

The USB2.0 communication protocol is used between the SOP-20-880 and the PC.

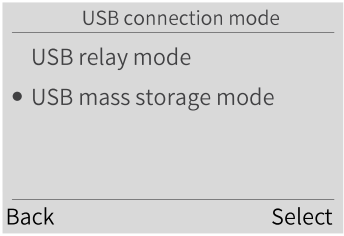
1. Open the cover of the USB port.



2. Plug in the USB shielded cable. It is recommended to use a cable with a ferrite core, as shown below.



3. Connect the cable to the PC.
   USB relay mode and USB mass storage mode are available when the USB cable is connected to the PC.



- In the USB relay mode, the SOP-20-880 is used for interaction between the PC tool and the drive.
- In the USB mass storage mode, the SOP-20-880 can be used as a memory.

3.11 Connecting SOP-20-880 To the Control Module

The RJ45 terminal is on the back of the SOP-20-880, which is connected to the HCU control board through a network cable that complies with EIA/TIA/568A or 568B standards. For details, see *HCU Control Unit Hardware Guide*. On the control board at the end of a communication network, set the jumper to connect the termination resistor. It is recommended to use the shielded twisted pair cable as the SOP-20-880 bus. The total maximum length is 100 m.

Table 3–8 SOP-20-880 bus transmission distance, number of nodes, and baud rate

Distance (m)	Baud rate (kbps)	Number of nodes	Cable specification	Remarks
100	1000	32	≥ 0.5 mm^2	The maximum number of nodes is 128 when the repeater is used. The maximum number of nodes is 32 when no repeater is used. The maximum number of nodes is reduced by 4 when there is polarity offset.
50	2000	32	≥ 0.5 mm^2	
25	4000	32	≥ 0.5 mm^2	

3.12 Post-Wiring Inspection

Check the following key items after completing necessary electrical installation for the cabinet. Read *"3.1.1 Safety Precautions" on page 68* and *"3.1.2 Pre-wiring Inspection" on page 68* before operating the product.

Table 3–9 Post-wiring checklist

No.	Item	Confirmed
1	Check the connection between the input power supply and the DC bus to verify that the correct voltage is supplied.	☐
2	Check the auxiliary power supply to verify that the correct voltage is supplied.	☐
3	The input and output power cables must be fixed on the cable fixing rack to reduce tension.	☐
4	The cables must be connected to the terminals with specified torques.	☐
5	When EMC shielded cables are used, the cable shields of the regenerative rectifier must be secured to the shield plate to meet the EMC requirements.	☐
6	The parallel output of the regenerative rectifiers is properly connected to the DC bus.	☐
7	The manufacturing date of the regenerative rectifier can be found on its nameplate. If the time from the manufacturing date to the initial commissioning or the downtime of the power components is less than one year, the DC link capacitor do not need to be pre-charged. If the downtime is more than one year, the capacitor must be pre-charged according to *"3.3 Pre-charging the DC-Link Capacitor" on page 73*.	☐
8	The control cables must be connected based on the terminal layout and routed by the shield. The control cables must be routed separately from the power supply cables to prevent interference. Applicable EMC directives must be followed in principle.	☐
9	The control cables (if any) have been connected to appropriate terminals and the terminals are tightened. Check the cables by pulling them.	☐
10	The power supply cable has been connected to the appropriate terminal; the phase sequence is correct; and the terminal is tightened. Check the cable by pulling it.	☐

4 Control Module

4.1 HCU Control Module

The HCU-30 control module is designed to control the regenerative rectifier module by communication through high-speed optical fiber. It is normally installed in the auxiliary control cabinet.

The module is energized by an external 24 VDC power supply and has multiple built-in isolated power supplies, including digital 24 VDC isolated power supply, isolated power supply for InoLink RS485 communication, and power supply for SOP-20-880 device. It can also provide power for function modules inserted in the HCU-30 expansion slots. The module can be upgraded through a backend PC or SOP-20-880 device.

4.1.1 HCU Control Module Composition

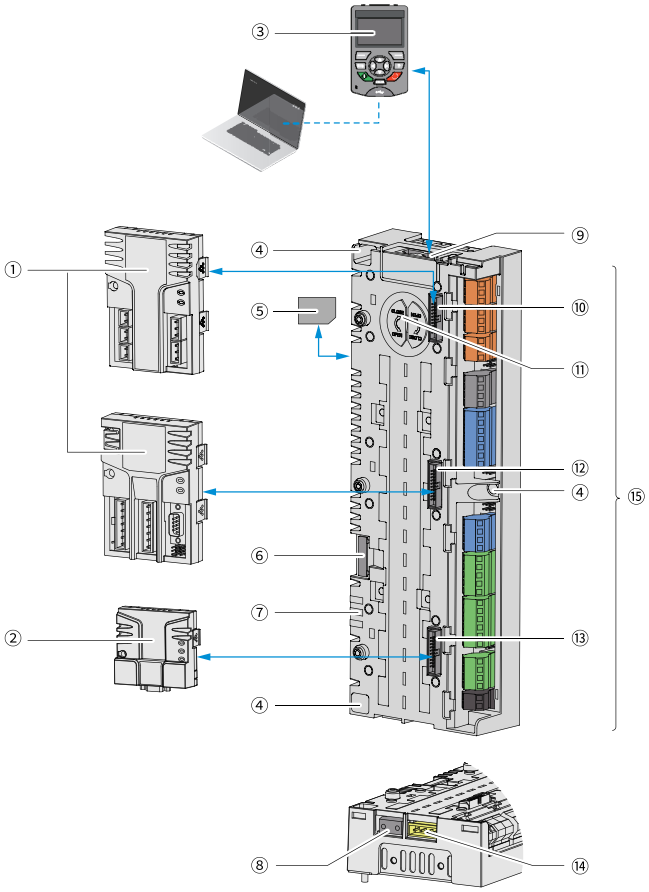


Figure 4-1 HCU control module composition

Table 4–1 HCU control module composition

No.	Name	Function
1	Function module SIZE1	105 mm x 73 mm x 24 mm function module
2	Function module SIZE2	75 mm x 73 mm x 24 mm function module
3	Smart operating panel	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

No.	Name	Function
6	Functional safety slot	Terminal for connection to functional safety modules
7	Indicator	Power, operation, and fault indicators
8	Optical fiber communication port	Optical fiber communication interface 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 the SOP-20-880 panel 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.

4.1.2 LED Indicators

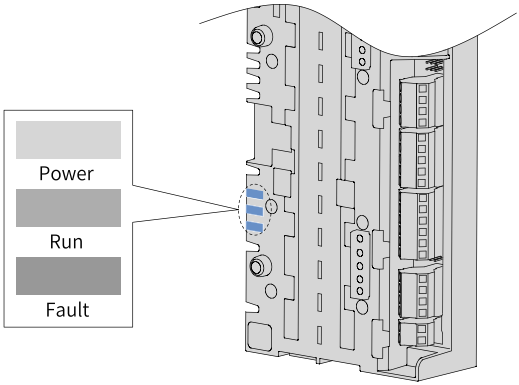


Figure 4-2 Positions and description of LED indicators

Table 4–2 Description of LED indicators

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	Red light steady ON	The system is faulty.
		Yellow light steady ON	A system alarm is reported.
		OFF	The system is normal.
		Red light flashing	The HCU auxiliary source is faulty. Check whether 24 V power supply is short-circuited or overloaded.
4	Fault and Run	Fault (yellow) and Run (green) flashing simultaneously	The HCU is selected on the PC or SOP-20-880. The flashing will end after 10 seconds.
		Fault (red) and Run (green) flashing alternately	The FPGA of the HCU is abnormal or the external expansion RAM is abnormal.

4.1.3 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.

4.1.4 HCU Dimensions and Installation

4.1.4.1 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

The following tools may be required during installation.

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

Tightening torques of screws and fasteners

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

4.1.4.2 Overall Dimensions

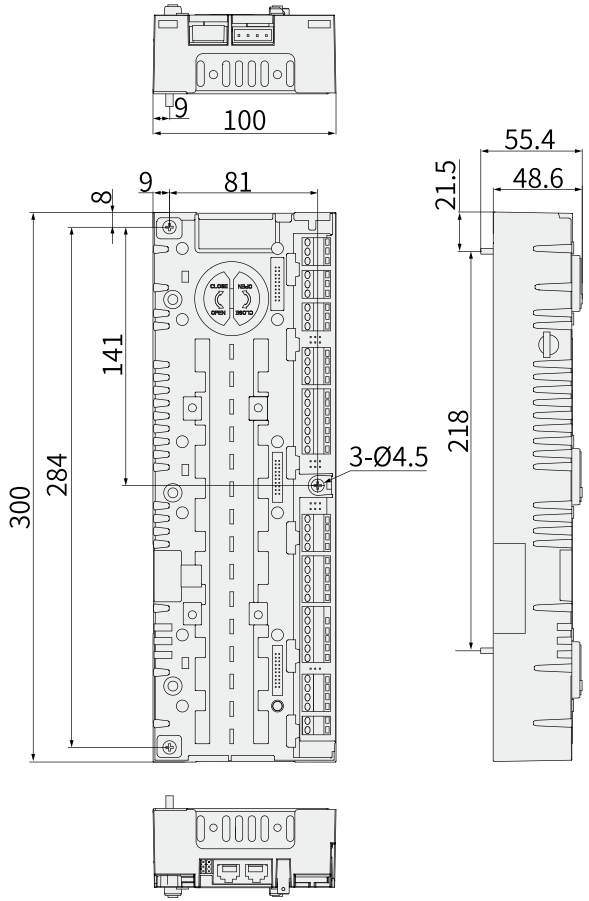


Figure 4-3 Overall dimensions of the HCU control module (mm)

4.1.4.3 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.

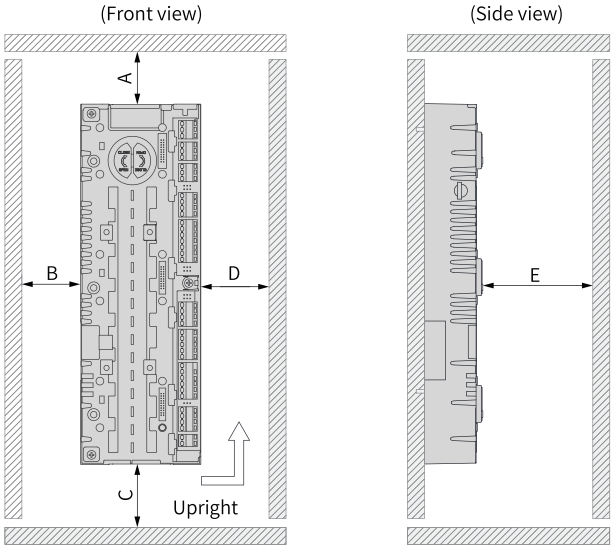


Figure 4-4 HCU installation space

Table 4–3 HCU installation space (mm)

A	B	C	D	E
≥ 100	≥ 30	≥ 100	≥ 50	≥ 100

4.1.4.4 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.

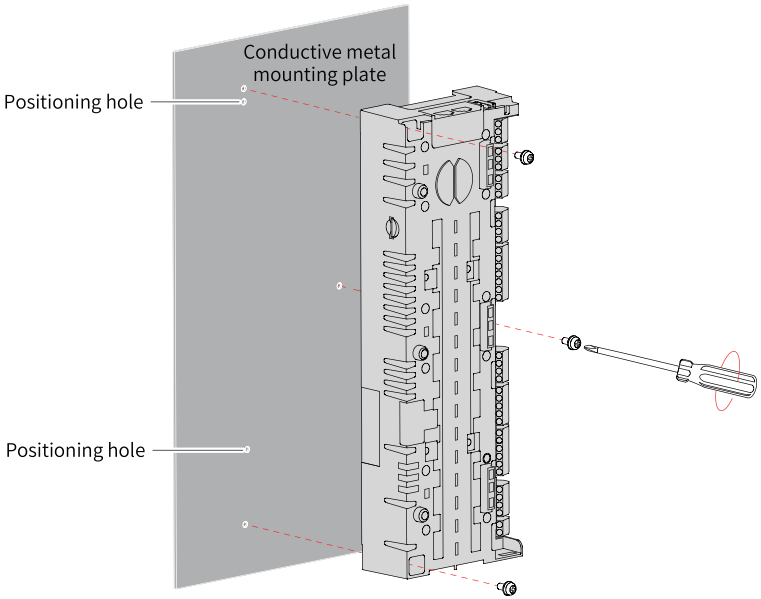


Figure 4-5 Installing the HCU

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.

4.1.5 Overview of HCU Control Module Terminals

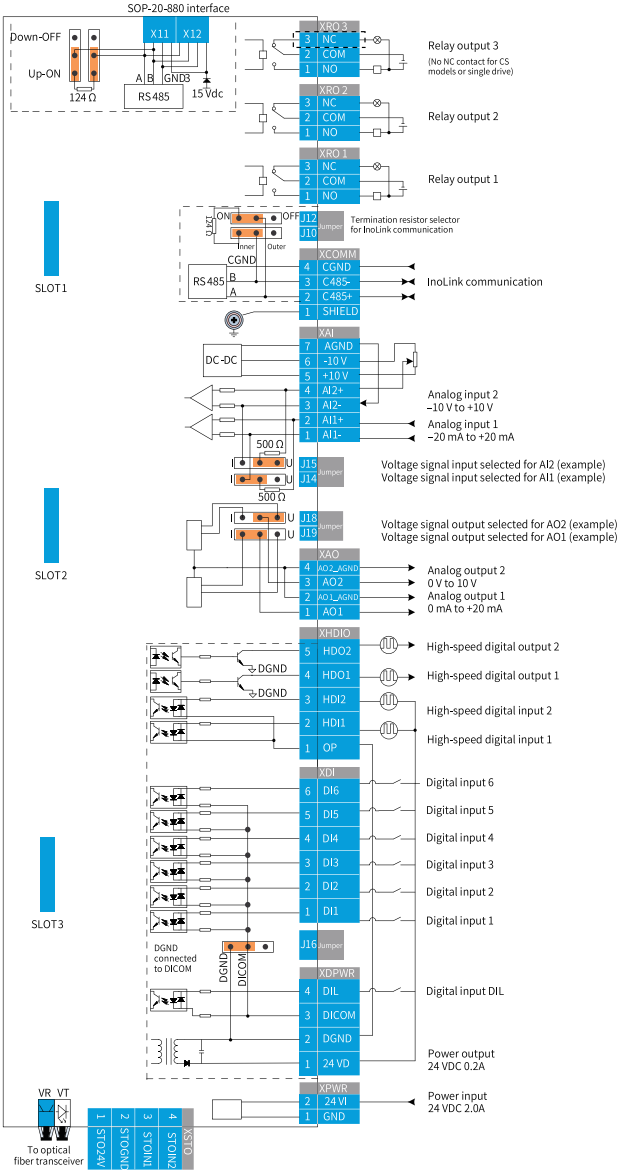


Figure 4-6 Wiring circuits of HCU terminals

4.1.5.1 Standard Terminals

Table 4–4 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

4.1.5.2 Description of HCU-30 Terminals

Table 4–5 Configuration for default I/O terminals of HCU-30

No.	Terminal	Description	Remarks
1	XRO1	Control signal of main circuit breaker	Not modifiable
2	XRO2	Fault output signal	Default function, configurable
3	XRO3	Control signal of auxiliary contactor	Not modifiable
4	DI1	Reserved	Configurable
5	DI2	Power-on signal	Default function, configurable
6	DI3	Closing feedback signal of main circuit breaker	Not modifiable
7	DI4	Reserved	Configurable
8	DI5	Power-off signal	Default function, configurable
9	DI6	Fault reset signal	Default function, configurable
10	HDI1	L temperature switch signal	Not modifiable
11	DIL	Emergency stop	Default function, configurable

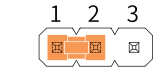
Note

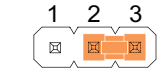
To modify the terminal configuration, see *MD880-30 Series Regenerative Rectifier Software Guide*.

4.1.5.3 Details of HCU Control Module Terminals

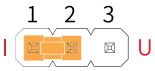
Table 4–6 Details of HCU control module terminals

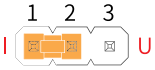
Terminal	Code	Description	Cable specification
XPWR: Power input terminal			
1	GND	24.0 VDC±10%, 2.0 A	Recommended to use dual-conductor twisted pair cables with a cross-sectional area of 0.5 mm^2 to 2.5 mm^2
2	24VI		
XDPWR: DIL terminal			

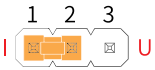
<table>
<tr><th>Terminal</th><th>Code</th><th>Description</th><th>Cable specification</th></tr>
<tr><td>1</td><td>24VD</td><td>Provides power supply for DI, HDI, and HDO
24.0 VDC±10%, 0.2 A</td><td rowspan="4">Twisted pair cable or single-conductor cable
Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
Note: The load of the 24VD terminal must not exceed 0.2 A.</td></tr>
<tr><td>2</td><td>DGND</td><td>24VD ground</td></tr>
<tr><td>3</td><td>DICOM</td><td>DI common output, which can be connected to DGND through jumper J16</td></tr>
<tr><td>4</td><td>DIL</td><td>Digital interlock or common DI with identical technical parameters as common DIs</td></tr>
<tr><td colspan="4">Jumper J16: Power supply selection</td></tr>
<tr><td colspan="4">

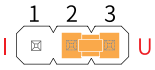
Shorting DGND and DICOM allows DIs to be powered by the 24 VDC internal power supply.</td></tr>
<tr><td colspan="4">

Disconnecting DGND from DICOM allows DIs to be powered by an external power supply.</td></tr>
<tr><td colspan="4">XDI: DI terminal</td></tr>
<tr><td>1</td><td>DI1</td><td rowspan="6">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</td><td rowspan="6">Single-conductor cable
Cross-sectional area: 0.5 mm^2 to 2.5 mm^2</td></tr>
<tr><td>2</td><td>DI2</td></tr>
<tr><td>3</td><td>DI3</td></tr>
<tr><td>4</td><td>DI4</td></tr>
<tr><td>5</td><td>DI5</td></tr>
<tr><td>6</td><td>DI6</td></tr>
<tr><td colspan="4">XHDIO: HDIO input terminal</td></tr>
</table>

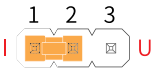
<table>
<tr><th>Terminal</th><th>Code</th><th>Description</th><th>Cable specification</th></tr>
<tr><td>1</td><td>OP</td><td>HDI common terminal</td><td rowspan="5">Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
Recommended to use shielded twisted pair cables
HDO and DGND twisted pair
HDI and OP twisted pair</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">Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
Recommended to use shielded twisted pair cables
AO1 and AO1_AGND twisted pair
AO2 and AO2_AGND twisted pair</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">

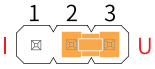
Shorting 1 and 2 selects current signal output for AO1.</td></tr>
<tr><td colspan="4">

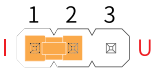
Shorting 2 and 3 selects voltage signal output for AO1.</td></tr>
<tr><td colspan="4">Jumper J18: Current or voltage signal selection for AO2</td></tr>
<tr><td colspan="4">

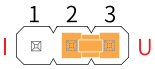
Shorting 1 and 2 selects current signal output for AO2.</td></tr>
<tr><td colspan="4">

Shorting 2 and 3 selects voltage signal output for AO2.</td></tr>
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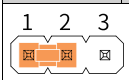
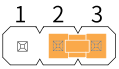
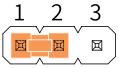
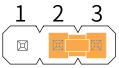
<table>
<tr><th>Terminal</th><th>Code</th><th>Description</th><th>Cable specification</th></tr>
<tr><td colspan="4">XAI: AI terminal</td></tr>
<tr><td>1</td><td>AI1-</td><td rowspan="4">Current input: -20 mA to +20 mA; Rin: 500 Ω
Voltage input: -10 V to +10 V; Rin: 200 kΩ
Differential input; input range: ±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="7">Cross-sectional area: 0.5 mm² to 2.5 mm²
Use two dual-conductor shielded twisted pair cables when using two AIs.
Use one four-conductor shielded twisted pair cable for one AI under 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">

Shorting 1 and 2 selects current signal input for AI1.</td></tr>
<tr><td colspan="4">

Shorting 2 and 3 selects voltage signal input for AI1.</td></tr>
<tr><td colspan="4">Jumper J15: Current or voltage signal selection for AI2</td></tr>
<tr><td colspan="4">

Shorting 1 and 2 selects current signal input for AI2.</td></tr>
<tr><td colspan="4">

Shorting 2 and 3 selects voltage signal input for AI2.</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 mm² to 2.5 mm²</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	Cable specification
 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-conductor 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-conductor 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-conductor 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 take effect 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	Cable specification
1	VR	Receive optical fiber communication	Optical fiber type: Plastic optical fiber (POF)
2	VT	Transmit optical fiber communication	

4.1.6 HCU Function Application

4.1.6.1 Function Modules

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

Table 4–7 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.

4.1.6.2 Combined Application of HSVM-10 and HCU

The HSVM-10 synchronous voltage detection module is designed to detect the AC line voltage of the regenerative rectifier/active rectifier. It transmits the detected signal to the HCU through the optical fiber to control and protect the rectifier system.

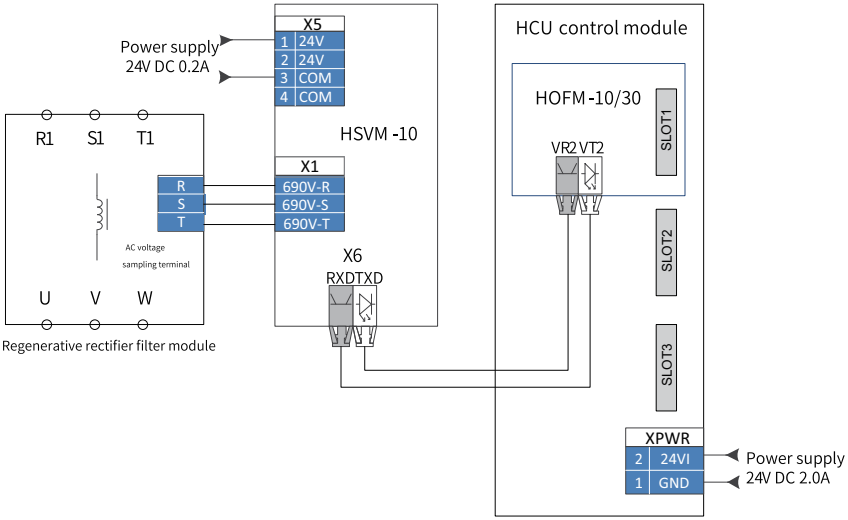


Figure 4-7 Example of cable connection

Note

- The HSVM-10 is insert into SLOT1 by default. After power-on, the HCU-30 can automatically recognize the HSVM-10 module.
- For details on how to use the HSVM-10 module, see *HSVM-10 Synchronous Voltage Detection Module User Guide*.

4.1.6.3 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.

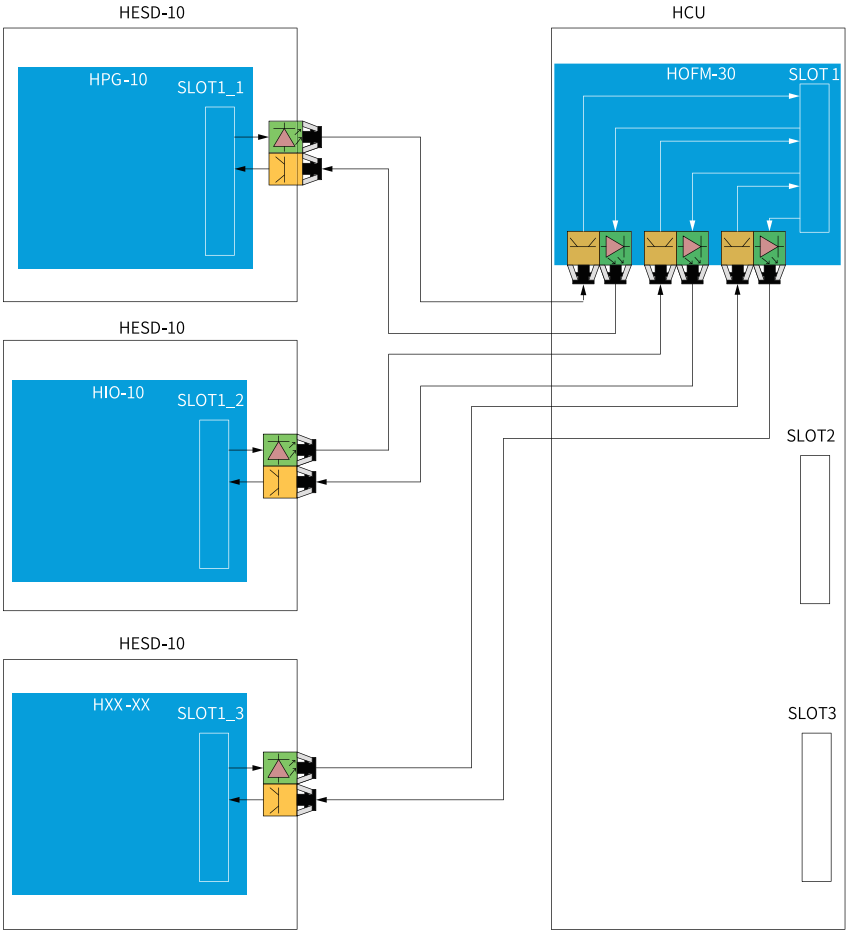


Figure 4-8 HESD wiring example

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.

4.1.6.4 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.

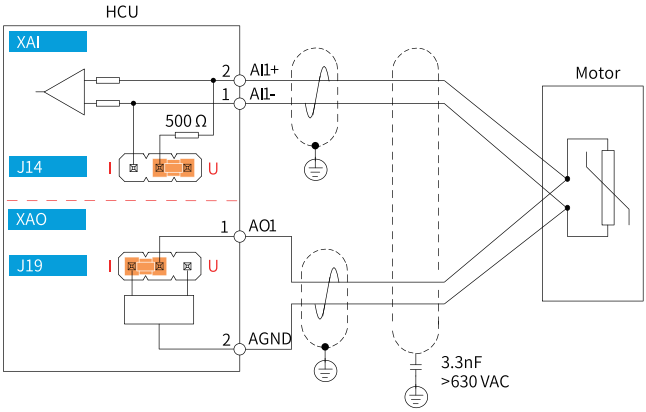


Figure 4-9 Wiring for temperature detection with AI and AO

4.1.6.5 InoLink Communication Bus Application

Use the InoLink bus when information exchange is required between several regenerative rectifier modules in the system.

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 cables should be as short as possible, with the link length not longer than 40 m. Keep the cables from entangling and away from power cables.

If the 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.

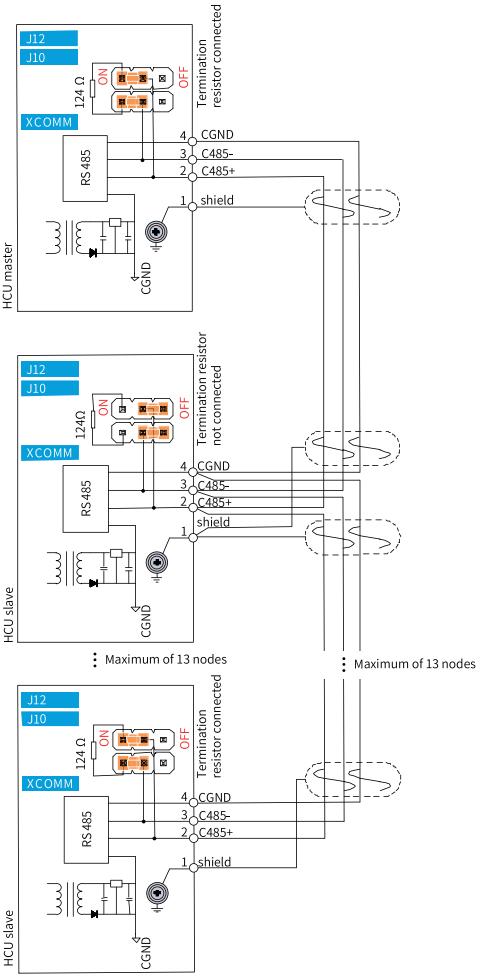


Figure 4-10 Example of connection application

4.1.6.6 Communication Application

X11 and X12 terminals are designed for connecting the HCU control module and the smart operating panel SOP-20-880. RS485 communication is used with an SOP-20-880 or PC as the master and several HCUs as the slaves. X11 and X12 are RJ45 terminals with identical pin assignment for cascading.

Connecting to SOP-20-880

With SOP-20-880 as the master and the HCU as the slave, the PC can communicate with SOP-20-880 through a USB cable. The far-end HCU on this link must be equipped with a termination resistor.

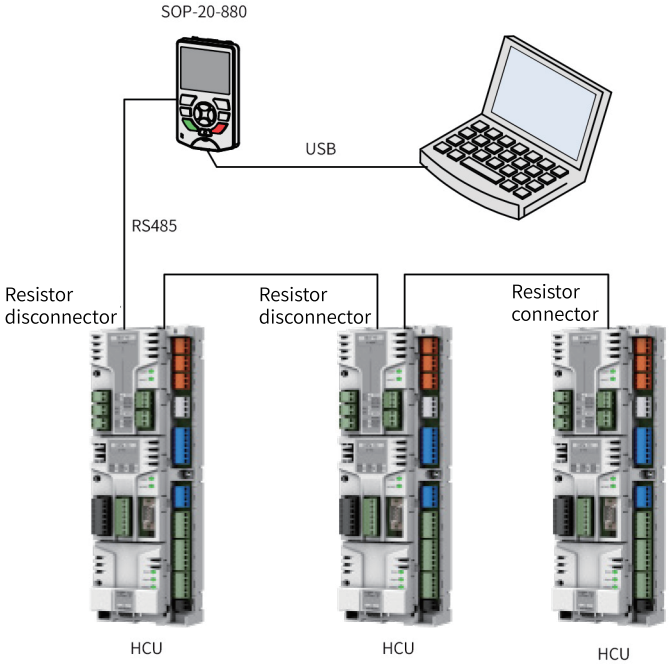


Figure 4-11 Wiring for connection with SOP-20-880

Note

- Never connect the RJ45 terminals X11 and X12 on the HCU directly to the network port of the PC with a network cable. Dosing so may result in PC or HCU damage.

4.2 HPCU Parallel Control Module

The HPCU parallel control module serves as an intermediate device. It receives the driving signals and control signals from the HCU and rapidly transmits them to each regenerative rectifier module. Additionally, it collects the current, voltage, status, and other information from each regenerative rectifier module and transmits them to the HCU. It also controls the synchronization, current sharing, reset, start and stop of all parallel regenerative rectifier modules.

HPCU-40 (up to 4 parallel modules), HPCU-60 (up to 6 parallel modules), or HPCU-A0 (up to 10 parallel modules) are available to meet the system requirements.

4.2.1 HPCU Standard Terminals

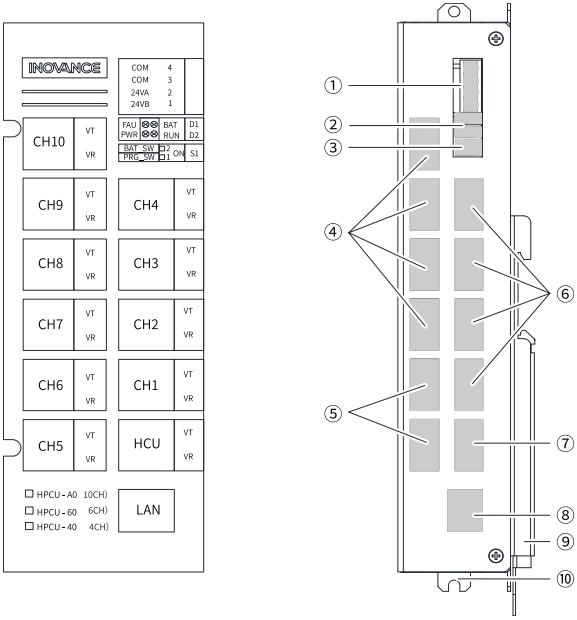


Figure 4-12 Diagram of HPCU

Table 4–8 HPCU terminal functions

No.	Name	Terminal	Description	Remarks
①	Power supply X1	COM 4	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	Green light steady ON	The HPCU is powered normally.
			OFF	The HPCU is not powered or the power supply has failed.
		RUN	Green light steady ON	The power module is running.
			OFF	The power module is not running.
		FAU	Red light steady ON	The system is faulty.
			OFF	The system is normal.
		BAT	Reserved	-
			Reserved	-
③	DIP switch S1	BAT_SW	Reserved	-
		PRG_SW	Reserved	-
④	Optical fiber transceiver	CH7 to CH10	Parallel module channels 7 to 10	VT: 50 M transmit optical fiber communication VR: 50 M receive 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	-	For guide rail mounting	-
⑩	Mounting hole	-	Four holes for securing installation	-

4.2.2 LED Indicators

Table 4–9 Description of the LED indicators

No.	Code	Status	Description
1	PWR	Green indicator steady ON	The HPCU power supply is in normal condition.
		OFF	The HPCU is not energized or the power supply is faulty.
2	RUN	Green indicator steady ON	The power module is running.
		OFF	The power module is not running.
3	FAU	Red indicator flashing	The system malfunctions.
		OFF	The system is functioning normally.
4	BAT	Reserved	-
		Reserved	-

4.2.3 Electrical Connection of HPCU

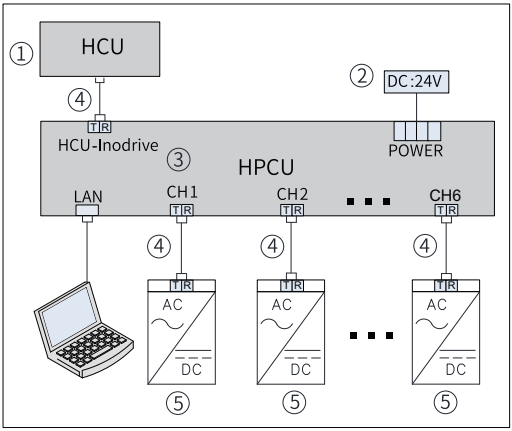


Figure 4-13 Electrical connection of HPCU

Table 4–10 Description of the electrical connection of HPCU

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

5 Maintenance and Inspection

5.1 Safety Instructions

This chapter mainly covers the following:

- Precautions on maintenance and inspection of the regenerative rectifier
- Periodic maintenance and inspection of components
- Replacement of components during maintenance



Take necessary safety measures before maintenance and inspection:

- Note that the regenerative rectifier module is energized with high voltage, and any connections must be completed with the module de-energized.
- Before maintenance, turn the module power supply off for 15 min and verify that the voltage of the module is lower than 36 VDC; otherwise, the residual charge on the capacitor may cause personal injury.
- When the external power supply is connected, hazardous voltage is still present in the module and the cabinet even if the main breaker is disconnected. Do not perform any operations before checking and verifying that no voltage is present.
- Installation, wiring, maintenance, inspection, or parts replacement must be performed by skilled personnel.
- Install and wire the product according to national standards, industry standards, and local safety codes.
- Handle heavy equipment or equipment with a high center of gravity with care. Improper hoisting or handling may result in death, severe personal injury, or major loss of property.
- Be aware of the possible rotation of the fan by inertia.

5.2 Precautions for Cleaning

To keep stable operation of the equipment, remove the dust and contamination periodically.

Pay attention to the following:

- Dust accumulation
  The dusts inside the cabinet and modules can only be removed by professionals regularly (at least once a year) according to 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 of the cabinet and modules unobstructed and ensure that the cooling fan is functioning properly.

5.3 Inspection Precautions

Inspection means taking proper measures to keep normal operation of the product and eliminate the product faults.

Required tools

The following tools may be required for inspection and components replacement:

- Wrench or socket wrench, 6 mm
- Wrench or socket wrench, 8 mm
- Wrench or socket wrench, 10 mm
- Wrench or socket wrench, 12 mm
- Torque wrench
- Phillips screwdriver, PH1 and PH2
- It is recommended to used a socket wrench set including two extension rods.

Service lives of components

To ensure long-term normal operation of the regenerative rectifier, Regularly maintain the electronic components based on their service lives, which are influenced by the operating environment and conditions. The following table lists the service lives of the components for your reference.

Table 5–1 Service lives of the components

Name	Standard service life
DC fan	5 years
Electrolytic capacitor	8 years
Printed circuit board	10 years

Tightening torques for screws

Observe the following tightening torques when tightening the connectors of conductive parts (for connecting the DC bus terminals and the motor terminals to the copper busbar), non-conductive parts (for connecting the grounding terminals and protective grounding terminals), and common steel connectors.

Table 5–2 Tightening torques for current-carrying components

Screw/Bolt	Grounding terminals, protective grounding terminals, and steel connectors (N·m) (Conducting the fault current)	Plastic-encased busbar (N·m) (Conducting the operating current)
M2.5	0.3	0.3
M3	0.55	0.55

Screw/Bolt	Grounding terminals, protective grounding terminals, and steel connectors (N·m) (Conducting the fault current)	Plastic-encased busbar (N·m) (Conducting the operating current)
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

Regularly check whether the cable terminals and screw terminals are secured properly. If not, retighten the loose ones. Check the routing for faults and replace damaged components promptly.

Note

The actual maintenance cycle depends on the mounting environment and operating conditions of the equipment.

5.4 Component Replacement

5.4.1 Replacing the Filter Screen

Note

- Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.
- Before replacement, power off the product to prevent the fan from sucking in contaminated air. When using an externally powered fan, be aware of the rotation of the fan by inertia or cut off the external power supply.
- If the dirty filter screen is not replaced promptly, the devices in the cabinet may break down due to high temperature.

Removing the filter screen

If IP42 air inlet kit is used for the cabinet, clean the air inlet in the following procedures.

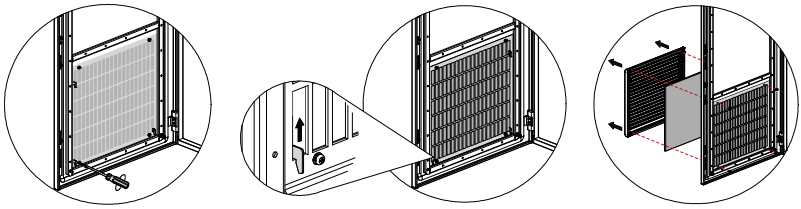


Figure 5-1 Removing the filter screen

Procedures:

1. Power off the cabinet and disconnect the fan power supply.
2. Open the front door of the cabinet and remove four M4 screws from the window blind.
3. Raise the window blind and take it out.
4. Remove the filter screen from the window blind and clean (or replace) it.

Installing the filter screen

Reverse the procedures for removing the filter screen:

1. Install the cleaned (or a new) filter screen into the window blind.
2. Insert the window blind into the reserved holes.
3. Retighten screws on the inner side of the front door to secure the window blind.

Repeat the preceding procedures for all filter screens to be replaced.

5.4.2 Replacing the DC Fan of the Regenerative Rectifier Module

WARNING

Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.

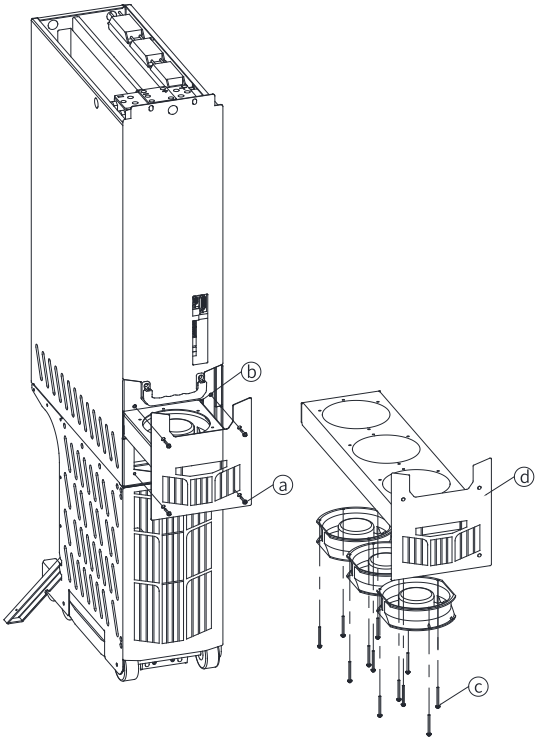


Figure 5-2 Replacing the fan of the regenerative rectifier module

Procedures:

1. Disconnect the DC power supply of the drive cabinet. Measure the voltage to verify no residual voltage on the product.
2. Open the cabinet door and remove four M5 screws (a) from the fan assembly (d) with a screwdriver.
3. Pull out the fan power supply cable (b) while pulling out the fan assembly from the front of the module.
4. Remove the twelve M4 screws from the fan assembly (four M4 screws for a fan).
5. Replace with new fans of the same specifications in the reverse order of the above procedures.

Note

- The air flows from bottom to top. When installing the fan, make the UP arrow face upwards.
- Do not pinch the power cable of the fan during installation.

5.4.3 Replacing the DC Fan of the Regenerative Rectifier Filter Module

WARNING

Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.

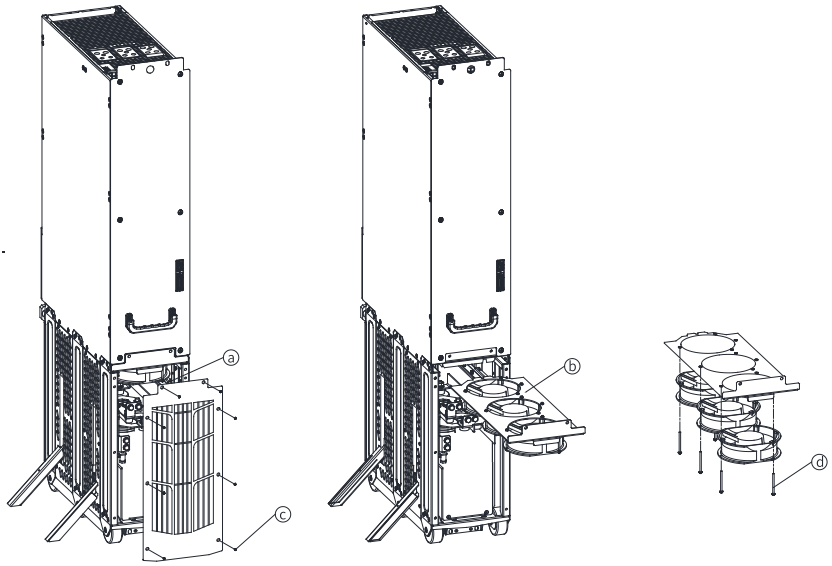


Figure 5-3 Replacing the fan of the regenerative rectifier filter module

Procedures:

1. Disconnect the DC power supply of the drive cabinet. Measure the voltage to verify that the product is de-energized.
2. Open the cabinet door, and remove the eight M5 screws (c) for fixing the panel with a screwdriver to remove the panel.
3. Disconnect the fan from the module (a).
4. Pull out the fan assembly (b).
5. Remove the twelve M4 screws (d) for fixing the fans (four M4 screws for a fan) and then remove the old fans.
6. Install new fans and the fan assembly by reversing the order of the above procedures.

7. Wire the fan to the power supply module and then install the panel.

Note

- The air flows from bottom to top. When installing the fan, make the UP arrow face upwards.
- Do not pinch the power cable of the fan during installation.

5.4.4 Replacing the Frame Accessory Kit

WARNING

Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.

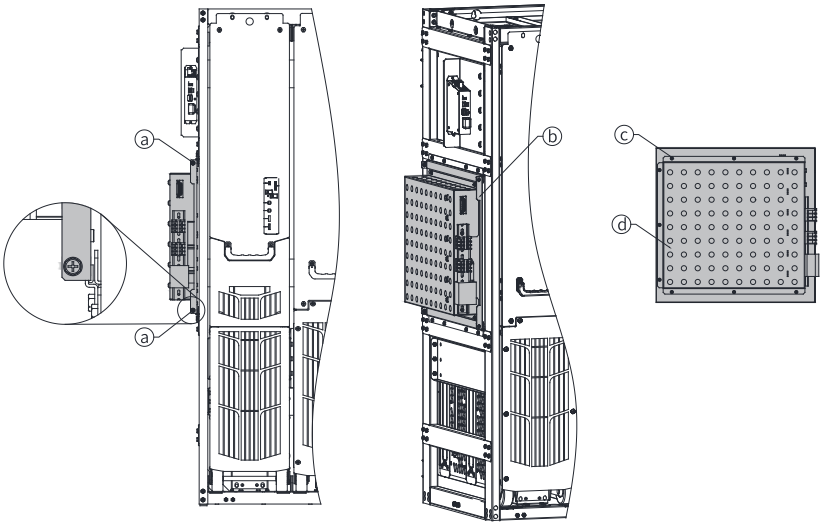


Figure 5-4 Replacing the frame accessory kit

Procedures:

1. Disconnect the DC power supply of the drive cabinet. Measure the voltage to verify that the product is de-energized.

2. Disconnect all terminals connected to the accessory kit.
3. Remove two M6 screws (a) in the front with a screwdriver.
4. Pull the sheet metal bending edge (b) to take out the accessory kit.
5. Remove nine M4 screws (c) for fixing the accessory kit cover with a screwdriver, remove the accessory kit cover (d), service internal components, and connect proper cables.
6. Install the accessory kit by reversing the order of the above procedures.
7. Wire cables properly.

5.4.5 Replacing the Fan Power Supply

WARNING

Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.

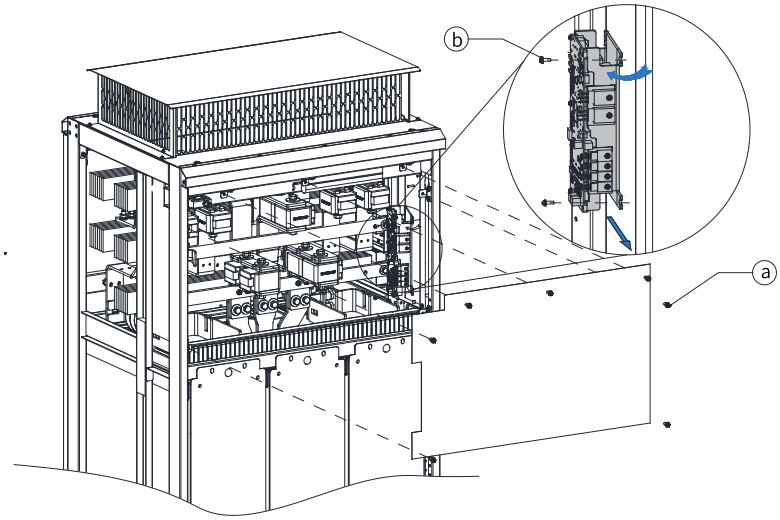


Figure 5-5 Replacing the fan power supply

Procedures:

1. Disconnect the DC power supply of the drive cabinet. Measure the voltage to verify that the product is de-energized.
2. Open the cabinet door.

3. Loosen the screws (a) on the upper cover of the cabinet to remove the cover.
4. Disconnect the terminals for connecting the fan power supply.
5. Remove two screws (b) for fixing the power supply to remove the power supply. Be careful not to drop the screws inside the module.
6. Replace with a new power supply by reversing the order of the above procedures.
7. Reconnect the power supply terminals.
8. Tighten the cover and close the cabinet door.

Note

Do not damage the fixing screws. Tighten the fixing screws of the power supply with a tightening torque of 1.2 N•m.

5.4.6 Replacing the HSVM-10 Module

WARNING

Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.

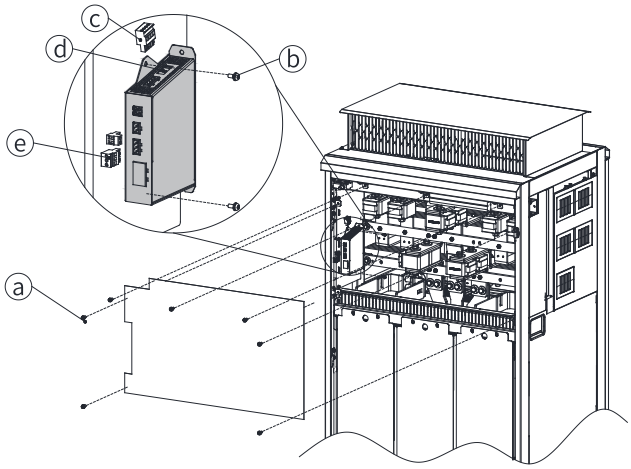


Figure 5-6 Replacing the HSVM-10 module

Procedures:

1. Disconnect the DC power supply of the drive cabinet. Measure the voltage to verify that the product is de-energized.
2. Open the cabinet door.
3. Loosen the screws (a) on the upper cover of the cabinet to remove the cover.
4. Pull out the optical fiber (b) on the top of the HSVM-10 module.
5. Pull out the 24 V power supply terminal (c) on the top of the HSVM-10 module.
6. Pull out the three-phase AC voltage detection terminal (e) in the front of HSVM-10 module.
7. Remove two M4 screws (b) for fixing the HSVM-10 module to take out the HSVM-10 module. Be careful not to drop the screws inside the module.
8. Replace with a new HSVM-10 module by reversing the order of the abve procedures.
9. Tighten the cover and close the cabinet door.

Note

Do not damage the fixing screws. Tighten the screws that used to fix the HSVM-10 module with a tightening torque of 1.2 N•m.

5.4.7 Replacing the Lightning Protection Board



Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.

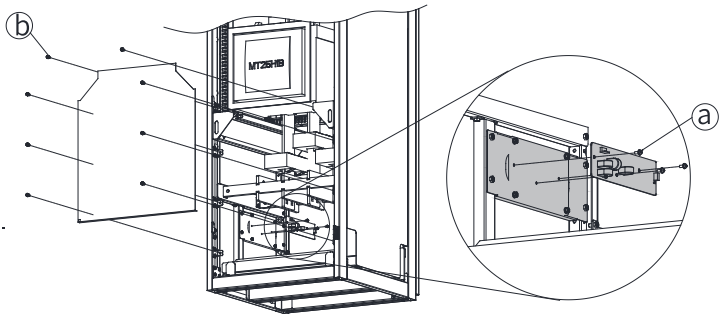


Figure 5-7 Replacing the lightning protection board

Procedures:

1. Disconnect the AC power supply of the drive cabinet and the isolator of the charging circuit. Measure the voltage to verify that the product is de-energized.
2. Open the cabinet door.
3. Loosen the screws (b) on the lower cover of the cabinet to remove the cover.
4. Remove the screws (a) for fixing the lightning protection board and the lightning protection board terminals.
5. Replace with a new lightening protection board by reversing the order of the above procedures.
6. Reconnect the terminals.
7. Tighten the cover and close the cabinet door.

Note

- Do not damage the fixing screws. Tighten the screws that are used to fix the lightening protection board with the tightening torque of 1.2 N·m.
- The lightning protection board is provided as standard only for the cabinet. The module does not contain the lightning protection board. When the customer or integrator forms the cabinet, they need to consider the lightning protection measures according to the actual application. They can also purchase the Inovance lightning protection board (MOV-1004 for 400 V systems and MOV-1007 for 690 V systems).

5.4.8 Replacing the Fuse

WARNING

Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.

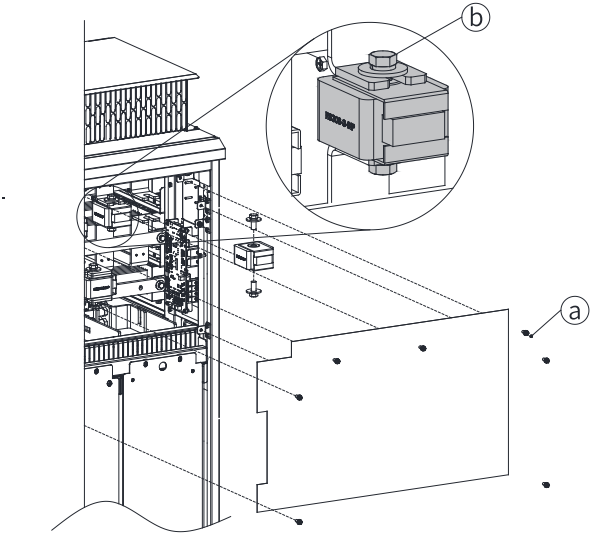


Figure 5-8 Replacing the fuse

Procedures:

1. Disconnect the AC power supply of the drive cabinet and the fuse switch of the pre-charge circuit. Measure the voltage to verify that the product is de-energized.
2. Open the cabinet door.
3. Loosen the screws (a) on the upper cover of the cabinet to remove the cover.
4. Loosen the fuse nut (b) and pull out the fuses together with the nut. Note: do not loosen the nut completely to prevent the nut from falling into the module.
5. Remove the nut and check the status of the fuses. In case of a blown fuse, replace all the fuses and then tighten the nut with a tightening torque of up to 35 N·m.
6. Install the cover by reversing the order of the above procedures and close the cabinet door.

5.4.9 Replacing the Regenerative Rectifier Module



- Component replacement must be performed by skilled personnel. Before maintenance and inspection, read the safety instructions in *" Fundamental Safety Instructions" on page 8* and *"5.1 Safety Instructions" on page 114*. Failure to do so may result in personal injury or death or product damage.
- The module is heavy with a high center of gravity. Take enough care during operation. Improper operation may easily cause the module to overturn.
- When removing the module, carefully pull the module out of the cabinet along the ramp plate. When holding the handle, step on the module base with one foot to prevent the module from falling backwards.
- When installing the module, push the module back into the cabinet along the ramp plate. Keep your fingers away from the edge of the front panel to prevent them from getting stuck between the module and the cabinet. In addition, step on the module base with one foot to prevent the module from falling backwards.
- Never tilt the module or place it on a sloping floor.

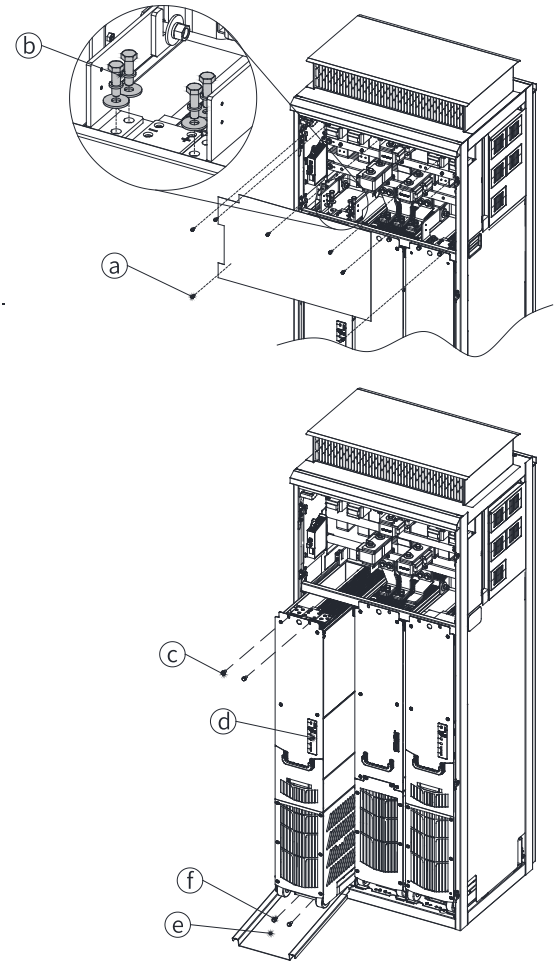


Figure 5-9 Replacing the regenerative rectifier module

Procedures:

1. Disconnect the DC power supply of the drive cabinet. Measure the voltage to verify that the product is de-energized.
2. Open the cabinet door.
3. Loosen the screws (a) on the upper cover of the cabinet to remove the cover.
4. Disconnect two DC buses (b) on the top of the module. Be careful not to drop the screws into the module.
5. Remove the cover (d) on the optical fiber terminal in the front of the module to pull out the fiber cable.

6. Remove two M8 screws (f) for securing the bottom of the module to the cabinet base.
7. Fixing the guide rail (e): Pull the guide rail from the cabinet base so that the base hook engages with the guide rail hole.
8. Remove two M8 screws (c) for securing the top of the module to the cabinet frame.
9. Carefully pull the module out from the cabinet along the guide rail. When holding the handle, step on the module base with one foot to prevent the module from falling backwards.
10. Replacing the module: Reverse the order of the above procedures. Mind your fingers. Step on the module base with one foot to prevent the module from falling backwards.
11. Reconnect the optical fiber cable and tighten the cover.
12. Remove the guide rail and close the cabinet door.

Note

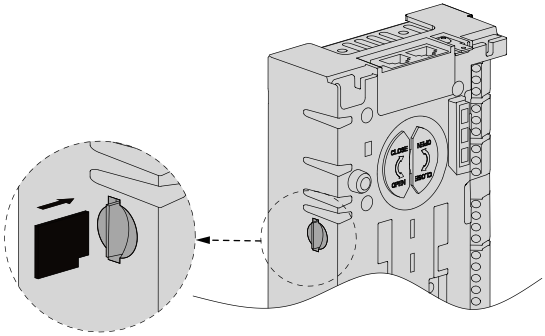
Do not damage the fastening screws: Tighten the fastening screws of the module with the torque of 20 N•m and those of the DC busbars with the torque of 40 N•m.

5.4.10Replacing the SD Card and Battery of the HCU Control Module

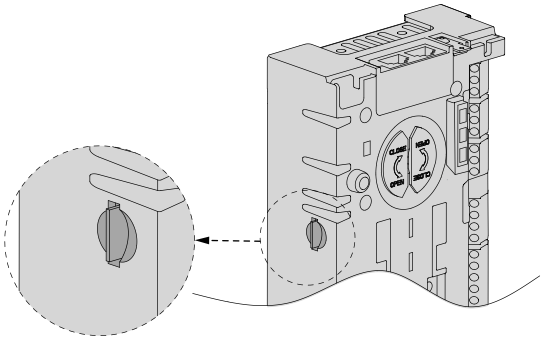
Replacing the memory card

After replacing the HCU control module, you can keep present parameter setting by inserting the original SD card from the faulty module to the new module. To install and remove the SD card, do as follows.

1. Press the SD card to take it out straightly from the faulty module.
2. Push the SD card into the SD card base of the HCU control module, as shown below.



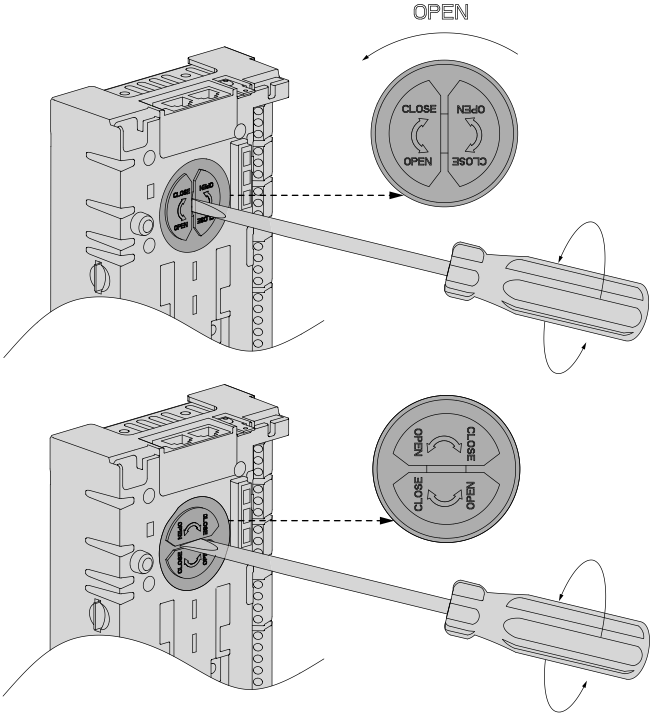
3. Ensure the SD card is inserted in place, and then check whether the SD card floats. Otherwise, an exception can occur due to poor contact.



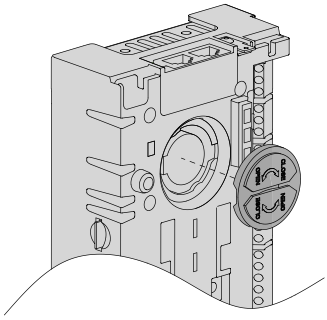
Replacing the battery

Steps:

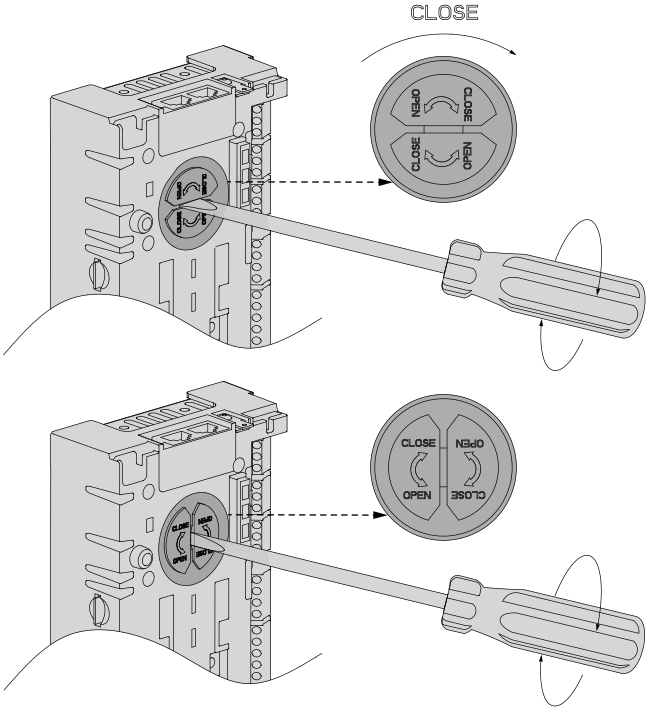
1. Turn the battery cover 90° counterclockwise with a #2 straight screwdriver until the cover is released.

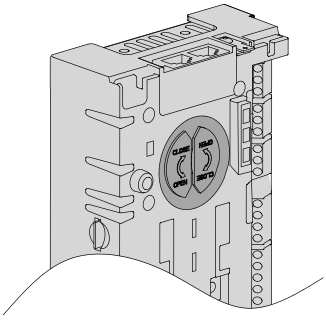


2. Remove the cover, press one side of the battery with the screwdriver, take the battery out and replace it with a new one.



3. Close the cover and rotate the cover 90° clockwise to fasten the cover.

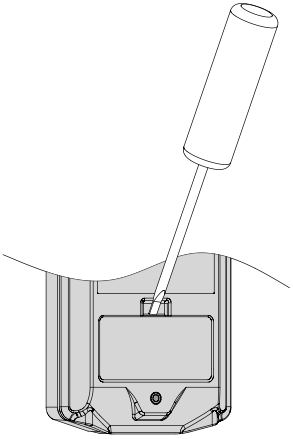




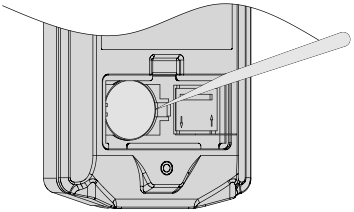
4. Dispose of the retired battery in accordance with local rules or applicable laws.

5.4.11Replacing the SOP-20-880 Battery

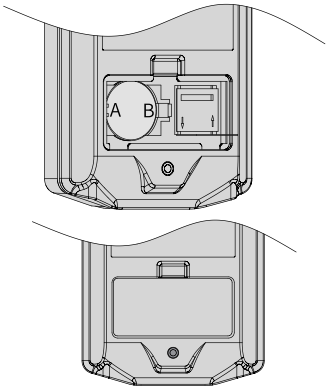
1. Remove the battery cover with a straight screwdriver or finger.



2. Pry the battery out with tweezers or a straight screwdriver, as shown below.



3. Insert the battery into the snap-fit joint on end A first, and then press down the battery on end B to install the battery in place.



4. Install the battery cover with a tool or your finger.

6 Ordering Instructions

6.1 Order Number

This chapter lists the models and order numbers of the regenerative rectifier.

The MD880 regenerative rectifier is available as a standard cabinet, a frame module, or a module. The nominal parameters and losses of the regenerative rectifier under different applications are provided in *"Table 1-2 Specifications and models of the MD880-30 series regenerative rectifier" on page 17*. The ordering instructions for the MD880-30 series frame module and options are provided in *"Table 6-1 Ordering instructions of the MD880-30K series regenerative rectifier" on page 135* and *"Table 6-2 Ordering instructions of the MD880-30M series regenerative rectifier options (spare parts)" on page 137*.

For selection, see *"Table 1-2 Specifications and models of the MD880-30 series regenerative rectifier" on page 17* and then confirm the regenerative rectifier power and voltage class based on the actual application mode and derating. After the power is confirmed, select the frame module (MD880-30K) or the power module (MD880-30M) based on the cabinet assembly mode, determine the quantity, and then place an order in accordance with the order number and the whole unit code provided in *"Table 6-1 Ordering instructions of the MD880-30K series regenerative rectifier" on page 135* and *"Table 6-2 Ordering instructions of the MD880-30M series regenerative rectifier options (spare parts)" on page 137*.

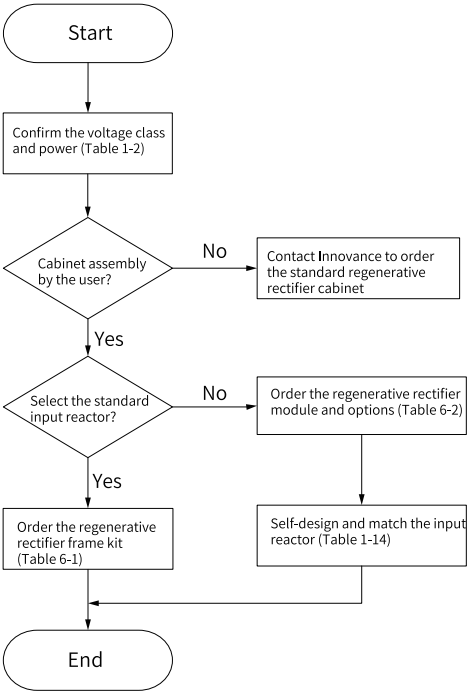


Figure 6-1 Ordering flowchart

Note

If you need a standard regenerative rectifier cabinet, contact Inovance.

If you plan to configure the reactor yourself, you need to purchase a regenerative rectifier module as well as optional parts such as HCU-30, HSVM-10 and HOFM-10. If you need the parallel mode, purchase an HPCU parallel control module.

Table 6–1 Ordering instructions of the MD880-30K series regenerative rectifier

Model MD880-30-...	Frame	Order number	Quantity	Note
0640-4	L+H8	1. MD880-30K-0640-4	1	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HOFM-10	1	Optical fiber expansion module
		4. HSVM-10	1	Synchronous voltage detection module
0900-4	L+H8	1. MD880-30K-0900-4	1	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HOFM-10	1	Optical fiber expansion module
		4. HSVM-10	1	Synchronous voltage detection module
1190-4	L+2H8	1. MD880-30K-1190-4	1	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module
1674-4	L+2H8	1. MD880-30K-1674-4	1	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module
2380-4	2 x (L+2H8)	1. MD880-30K-1190-4	2	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module

Model MD880-30-...	Frame	Order number	Quantity	Note
3348-4	2 x (L+2H8)	1. MD880-30K-1674-4	2	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module
5022-4	3 x (L+2H8)	1. MD880-30K-1674-4	3	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-60	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module
0600-7	L+H8	1. MD880-30K-0600-7	1	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HOFM-10	1	Optical fiber expansion module
		4. HSVM-10	1	Synchronous voltage detection module
0900-7	L+H8	1. MD880-30K-0900-7	1	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HOFM-10	1	Optical fiber expansion module
		4. HSVM-10	1	Synchronous voltage detection module
1116-7	L+2H8	1. MD880-30K-1116-7	1	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module

Model MD880-30-...	Frame	Order number	Quantity	Note
1674-7	L+2H8	1. MD880-30K-1674-7	1	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module
2232-7	2 x (L+2H8)	1. MD880-30K-1116-7	2	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module
3348-7	2 x (L+2H8)	1. MD880-30K-1674-7	2	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module
5022-7	3 x (L+2H8)	1. MD880-30K-1674-7	3	Regenerative rectifier frame module
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-60	1	Parallel expansion module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous voltage detection module

Table 6–2 Ordering instructions of the MD880-30M series regenerative rectifier options (spare parts)

Order number	Quantity	Note
MD880-30M-0640-4	1	Regenerative rectifier module
MD880-30M-0900-4	1	Regenerative rectifier module
MD880-30M-0600-7	1	Regenerative rectifier module
MD880-30M-0900-7	1	Regenerative rectifier module
HCU-30	1	Regenerative rectifier control module
HOFM-10	1	Optical fiber expansion module
HSVM-10	1	Synchronous voltage detection module

Order number	Quantity	Note
HPCU-40	1	Parallel expansion module
HPCU-60	1	Parallel expansion module
H8-quick-kit	1	Quick-fit mounting base

6.2 Selection Instance

1. Selecting the frame module:
   Place an order according to *"Table 6-1 Ordering instructions of the MD880-30K series regenerative rectifier" on page 135* after confirming the regenerative rectifier specifications (for example, 400 V/1674 A) based on the inverter power.

2. When you plan to assemble the cabinet and configure the input reactor by yourself:

   - In case of a single product, specify the order number and quantity. An example is as follows:

Model MD880-30-...	Order Number	Quantity
0900-4	MD880-30M-0900-4	1
	HCU-30	1
	HOFM-10	1
	HSVM-10	1
	H8-quick-kit	1

   - In case of parallel products, specify the order number and quantity. An example is as follows:

Model MD880-30-...	Order Number	Quantity
1674-4	MD880-30M-0900-4	2
	HCU-30	1
	HOFM-10	1
	HSVM-10	1
	HPCU-40	1
	H8-quick-kit	2

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