



User Guide

MD880-30 Series

Regenerative Rectifier Hardware



User Guide

A01

Data code 19011313

Preface

Thank you for purchasing the Unity Drive MD880 high-performance multidrive system.

The MD880 has set an new industrial benchmark in terms of structure, power density, response, control precision, and scope of application. Product Advantages:

- Voltage class: 400/690 V
- Rated power range: 3.7 to 5,600 kW
- Complete rectifier module types: basic rectifier, regenerative rectifier and active rectifier
- Compatible with asynchronous induction motors, permanent magnet synchronous motors and synchronous reluctance motors
- Excellent dynamic response and control accuracy

Wide application range:

- Metallurgy

High-speed wire rod and hot steel strip continuous rolling equipment, wide and thick plate equipment, cold rolling machine, pickling line, annealing line, galvanizing line, color coating line, non-ferrous metal alloy manufacturing equipment, and non-ferrous metal rolling equipment

- Papermaking

Papermaking combined equipment, including continuous production lines such as headbox, wire section, press section, drying section, sizing, hard calendering, coating, supercalender, and rewinding machine

- Harbor equipment and other large lifting equipment

Shore container bridge crane, rubber tired (rail type) container gantry crane, grab ship unloader, grab door seat crane, large shipbuilding gantry crane, and large metallurgical casting crane

- Ships

Marine electric main and auxiliary machine system equipment and installation ships

- Cables

Large frame stranding machine, coiling machine, copper aluminum multi-motor large drawing machine

- Others

Wind power converter, unit test bench, military equipment, power low voltage control, oil and gas transportation, mine transmission

The MD880-30 series products are regenerative rectifiers in the MD880 system, with stand-alone power up to 423–1026 kW, and maximum parallel power up to 5726 kW. The highly integrated regenerative rectifier module allows for convenient assembly and maintenance, better utilization of the cabinet space, fewer cabinets and less space occupation.

This guide describes the hardware of the MD880-30 series regenerative rectifier, covering safety instructions, product information, mechanical and electrical installation, control module, maintenance and inspection, and ordering instructions. Read and understand this manual before use. Contact our customer service center if you have any question during the use.

Precautions
◆ The drawings in the user guide sometimes show the product without covers or protective guards to display more details. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
◆ The drawings in the user guide are shown for reference only and may not match the product you purchased.
◆ The guide is the property of Unity Drive. The guide is subject to change without notice due to product upgrade.
◆ Contact our agents or customer service center if you have problems during the use.

Related Manuals

Rectifiers	Manual Code
◆ MD880-40 Series Active Rectifier Hardware User Guide	19010582
◆ MD880-40 Series Active Rectifier Software User Guide	19010583
◆ MD880-30 Series Regenerative Rectifier Hardware User Guide	19010688
◆ MD880-30 Series Regenerative Rectifier Software User Guide	19010689
◆ MD880-20 Series Basic Rectifier Hardware User Guide	19010517
◆ MD880-20 Series Basic Rectifier Software User Guide	19010567
Inverters	
◆ MD880-50 Series Inverter Hardware User Guide	19010447
◆ MD880-50 Series Inverter Software User Guide	19010602
Others	
◆ SOP-20-880 Smart Operation Panel User Guide	19010367
◆ SOP-20-880 Base Kit Installation Guide	19010401
◆ HCU Control Module User Guide	19010528
◆ HPCU Parallel Control Module User Guide	19010690

◆ HPG-10-HTL Incremental Encoder Signal Detection Module User Guide	19010500
◆ HPG-50-TTL Incremental Encoder Signal Detection Module User Guide	19010501
◆ HDP-10 PROFIBUS DP Fieldbus Adaptation Module User Guide	19010490
◆ HSVM-10 Synchronous Voltage Detection Module User Guide	19010588
◆ HCAN-10 Fieldbus Adaptation Module User Guide	19010727
◆ HOFM-10 Optical Fiber Expansion Module User Guide	19010443

Revision History

Date	Revised Version	Change Description
2020.4	A00	First issue.
2020.11	A01	Made minor corrections

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Safety Instructions

Safety Disclaimer

- 1) Before installing, using, and maintaining this product, read the safety information and precautions thoroughly, and comply with them during operations.
- 2) To ensure the safety of humans and products, follow the signs on the product and all the safety instructions in this user guide.
- 3) The "CAUTION", "WARNING" and "DANGER" signs are only supplements to the safety instructions.
- 4) Use this product according to the designated environment requirements. Damage caused by improper usage is not covered by warranty.
- 5) Unity Drive shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions



DANGER

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



WARNING

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



CAUTION

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

Safety Instructions

Unpacking	
DANGER	◆ Do not install the equipment if you find damage, rust, or indications of use on the product or accessories. ◆ Do not install the equipment if you find water seepage, component missing or damage upon unpacking. ◆ Do not install the equipment if you find the packing list does not conform to the equipment you received.



CAUTION

- ◆ Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation.
- ◆ Unpack the package by following the package sequence. Do not hit the package with force.
- ◆ Check whether there are damage, rust, or injuries on the surface of the product or product accessories.
- ◆ Check whether the number of packing materials is consistent with the packing list.

Storage and Transportation



WARNING

- ◆ Use professional loading and unloading equipment to carry large-scale or heavy equipment and products.
- ◆ When carrying this product with bare hands, hold the product casing firmly with care to prevent parts falling. Failure to comply may result in personal injuries.
- ◆ Handle the product with care during transportation and mind your step to prevent personal injuries or product damage.
- ◆ Never stand or stay below the equipment when the equipment is lifted by hoisting equipment.



CAUTION

- ◆ Store and transport this product based on the storage and transportation requirements for humidity and temperature.
- ◆ Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- ◆ Avoid storing this product for more than three months. Long-term storage requires stricter protection and necessary inspections.
- ◆ Pack the product strictly before transportation. Use a sealed box for long-distance transportation.
- ◆ Never transport this product with equipment or materials that may harm or have negative impacts on this product.

Installation



DANGER

- ◆ Product installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- ◆ Installation, wiring, maintenance, inspection, or parts replacement must be performed by only experienced personnel who have been trained with necessary electrical information.
- ◆ Installation personnel must be familiar with product installation requirements and relevant technical materials.
- ◆ Before installing equipment with strong electromagnetic interference, such as a transformer, install an electromagnetic shielding device for this product to prevent malfunctions.

 WARNING

- ◆ Thoroughly read the safety instructions and user guide before installation.
- ◆ Do not modify this product.
- ◆ Do not rotate the product components or loosen fixed bolts and bolts marked in red on product components.
- ◆ Do not install this product in places with strong electric or magnetic fields.
- ◆ When this product is installed in a cabinet or terminal equipment, protection measures such as a fireproof enclosure, electrical enclosure, or mechanical enclosure must be provided. The IP rating must meet IEC standards and local laws and regulations.
- ◆ Do not drop conductors such as wire ends and screws, or other foreign objects into the equipment. Failure to comply may cause damage to the device!
- ◆ Install the equipment in such a way as to ensure good heat dissipation.

Wiring
 DANGER

- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- ◆ Never perform wiring at power-on. Failure to comply will result in an electric shock.
- ◆ Before wiring, cut off all equipment power supplies. Wait at least 15 minutes before further operations because residual voltage exists after power-off.
- ◆ Make sure that the equipment and product are well grounded. Failure to comply will result in an electric shock.
- ◆ During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to the equipment or internal product circuits.

 WARNING

- ◆ Never connect the power cable to output terminals of the equipment or product. Failure to comply may cause equipment damage or even a fire.
- ◆ Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- ◆ After wiring, make sure that no screws are fallen and no cables are exposed in the equipment.

Power-on
 DANGER ◆ Before power-on, make sure that the equipment and product are installed properly with reliable wiring and the motor can be restarted. ◆ Before power-on, make sure that the power supply meets equipment requirements to prevent equipment damage or even a fire. ◆ At power-on, unexpected operations may be triggered on the equipment or product. Therefore, stay away from the equipment or product. ◆ After power-on, do not open the cabinet door of the equipment and protective cover of the product. Failure to comply will result in an electric shock. ◆ Do not touch any wiring terminals at power-on. Failure to comply will result in an electric shock. ◆ Do not remove any part of the equipment or product at power-on. Failure to comply will result in an electric shock.
Operation
 DANGER ◆ Do not touch any wiring terminals during operation. Failure to comply will result in an electric shock. ◆ Do not remove any part of the equipment during operation. Failure to comply will result in an electric shock. ◆ Do not touch the equipment shell, fan, or resistor for temperature detection. Failure to comply will result in heat injuries. ◆ Signal detection must be performed by only professionals during operation. Failure to comply will result in personal injuries or equipment damage.
 WARNING ◆ Prevent metal or other objects from falling into the device during operation. Failure to comply may result in equipment damage. ◆ Do not start or stop the equipment using the contactor. Failure to comply may result in equipment damage.
Maintenance
 DANGER ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Do not maintain the equipment at power-on. Failure to comply will result in an electric shock. ◆ Before maintenance, cut off all equipment power supplies and wait at least 15 minutes.
 DANGER ◆ Perform daily and periodic inspection and maintenance for the equipment and product according to maintenance requirements and keep a maintenance record.

Repair

 DANGER

- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- ◆ Do not repair the equipment at power-on. Failure to comply will result in an electric shock.
- ◆ Before inspection and repair, cut off all equipment power supplies and wait at least 15 minutes.

 WARNING

- ◆ Require for repair services according to the product warranty agreement.
- ◆ When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- ◆ Replace quick-wear parts of the product according to the replacement guide.
- ◆ Do not operate damaged equipment. Failure to comply may result in worse damage.
- ◆ After the equipment is replaced, perform wiring inspection and parameter settings again.

Disposal

 WARNING

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

Safety Signs

For safe equipment operation and maintenance, comply with safety signs on the equipment and products, and do not damage or remove the safety labels. The following table describes the safety signs.

For safe equipment operation and maintenance, comply with safety signs on the equipment and products, and do not damage or remove the safety labels. The following table describes the safety signs.

Safety Sign	Description
WARNING 警告  • This equipment should be serviced by qualified personnel only. • Locate and disconnect all energy sources.Wait 15 minutes then operate. • Observe the instructions described in the instruction manual. • 只有专业人士才能维护。 • 维护前确保切断所有电源，15分钟后方可操作。 • 维护前请阅读维护说明书。	◆ This equipment must only be serviced by qualified personnel. ◆ Disconnect all energy sources and wait 15 minutes before maintenance. ◆ Read the maintenance instructions before maintenance.
 注意 为防止预充电电阻过热，两次合闸的时间间隔不小于三分钟	◆ To prevent overheating of the pre-charging resistor, the interval between switch-ons must not be less than three minutes!

1 Product Information

The MD880-30 series product is a general low-voltage regenerative rectifier developed by Unity Drive. It features high power density, compact structure and high reliability. This series is available in 400 V and 690 V, with rate power ranging from 423 kW to 1026 kW. By paralleling multiple modules, higher rated output power up to 5726 kW can be achieved, which is provided to one or more subsequent inverter modules or other loads.

1.1 Nameplate and Model Number

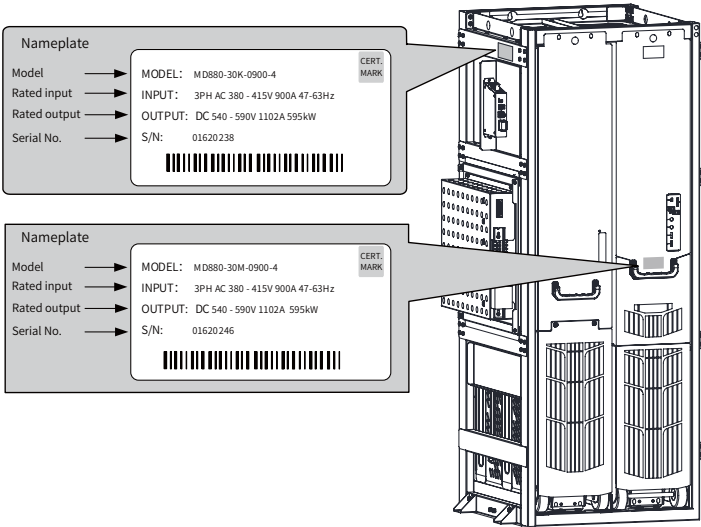


Figure 1-1 Nameplate

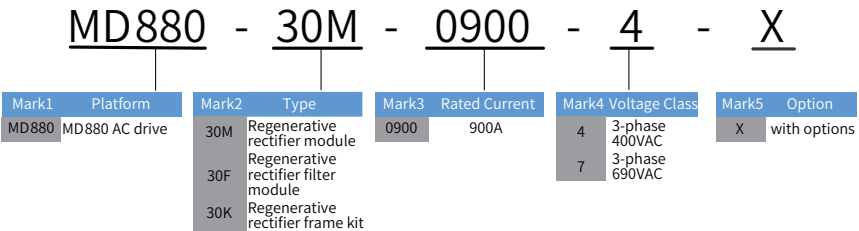


Figure 1-2 Model number

1.2 Voltage and Power Class

Table 1-1 Voltage and power class of regenerative rectifier frame kit

Product Type	Rated Voltage	Rated Power
Regenerative rectifier frame kit	380–415 VAC	423–595 kW
	525–690 VAC	684–1026 kW

Note: If you need larger power, use the parallel mode. A maximum of 6 regenerative rectifier modules in parallel is supported.

1.3 Specifications and Selection

1) Description

The MD880 regenerative rectifier is available as a standard cabinet, a frame kit or a module. Table 1-2 provides the rated parameters and losses of the rectifier under different working conditions. For details on selection and ordering, see the relevant part of Section 6 Ordering Instructions according to the "Regenerative Rectifier Model" column of the table.

Table 1-2 Specifications and Selection of MD880-30 Series Regenerative Rectifier

Regenerative Rectifier Model MD880-30-...	No Overload					Light Overload		Heavy Overload		Loss	Loss
	IN	IN	I _{max}	Ploss	PN	ILd	PLd	IHd	PHd	Ploss (L)	Ploss (H8)
	Aac	Adc	Adc	kW	kW	Adc	kW	Adc	kW	kW	kW
UN = 400 V (380–415 V), ±10%(-15%, < 1 min) (power: 400 V)											
0640-4	640	783	1018	443	423	752	406	587	317	4.9	3.0
0900-4	900	1102	1432	624	595	1057	571	826	446	8.0	4.0
1190-4	1190	1457	1894	825	787	1399	755	1093	590	9.1	5.0
1674-4	1674	2049	2664	1160	1106	1967	1062	1537	830	14.9	7.5
2380-4	2380	2913	3787	1649	1573	2796	1510	2185	1180	18.2	10.0
3348-4	3348	4098	5327	2319	2213	3934	2124	3073	1660	29.8	15.0
5022-4	5022	6147	7991	3479	3319	5901	3186	4610	2489	44.7	22.5
UN = 690 V (525–690 V), ±10%(-15%, < 1 min) (power: 690 V)											
0600-7	600	734	955	717	684	705	657	551	513	6.2	3.0
0900-7	900	1102	1432	1076	1026	1057	985	826	770	9.1	4.0
1116-7	1116	1366	1776	1334	1272	1311	1221	1024	954	11.5	5.0
1674-7	1674	2049	2664	2001	1909	1967	1832	1537	1431	16.9	7.5
2232-7	2232	2732	3551	2667	2545	2623	2443	2049	1909	23.0	10.0
3348-7	3348	4098	5327	4001	3817	3934	3664	3073	2863	33.8	15.0

5022-7	5022	6147	7991	6002	5726	5901	5497	4610	4294	50.7	22.5
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■ Definition:

I_N : rated input (AC), output (DC) current;

I_{Max} : maintains the maximum output current for at least 10s (every 300s) at startup;

$P_{loss(L)}$: regenerative rectifier input reactor loss;

$P_{loss(H8)}$: regenerative rectifier module loss;

S_N : rated apparent power;

P_N : rated output power;

I_{Ld} : continuous output current in light overload applications;

P_{Ld} : output power in light overload applications;

I_{Hd} : continuous output current in heavy overload applications;

P_{Hd} : output power in heavy overload applications;

H8: structure of regenerative rectifier module;

L: structure of regenerative rectifier filter module.

1.4 Product Dimensions and Weight

Table 1-3 Dimensions and Weight of MD880-30 Series Regenerative Rectifier

Regenerative Rectifier Model MD880-30K- ...	Structure	Dimensions W x D x H (mm)	Weight (kg)	Corresponding Module Model MD880-...	Quantity	Structure	Dimensions W x D x H (mm)	Weight (kg)
0640-4	L+H8	631x624x1450	350	30M-0640-4	1	H8	230x582x1394	130
				30F-0640-4	1	L	230x564x1394	150
0900-4	L+H8	631x624x1450	350	30M-0900-4	1	H8	230x582x1394	130
				30F-0900-4	1	L	230x564x1394	150
1190-4	L+2H8	874x624x1450	565	30M-0640-4	2	H8	230x582x1394	130
				30F-1190-4	1	L	230x564x1394	185
1674-4	L+2H8	874x624x1450	565	30M-0900-4	2	H8	230x582x1394	130
				30F-1674-4	1	L	230x564x1394	185
0600-7	L+H8	631x624x1450	365	30M-0600-7	1	H8	230x582x1394	130
				30F-0600-7	1	L	230x564x1394	165
0900-7	L+H8	631x624x1450	365	30M-0900-7	1	H8	230x582x1394	130
				30F-0900-7	1	L	230x564x1394	165
1116-7	L+2H8	874x624x1450	612	30M-0600-7	2	H8	230x582x1394	130
				30F-1160-7	1	L	230x564x1394	232
1674-7	L+2H8	874x624x1450	612	30M-0900-7	2	H8	230x582x1394	130
				30F-1674-7	1	L	230x564x1394	232

1.5 Technical Data

Table 1-4 Technical Data of MD880-30 Series Regenerative Rectifier

Item		Specifications
Basic	Input AC voltage	400 V system: 380–415 VAC, $\pm 10\%$ (-15%, < 1 min) 690 V system: 525–690 VAC, $\pm 10\%$ (-15%, < 1 min)
	Input frequency	47–63 Hz
	Unbalance	$\pm 3\%$ of rated voltage at most
	Output voltage	400 V system: 540–590 V DC 690 V system: 740–975 V DC
	Overload capacity	Light overload: 110% for 1 minute every 5 minutes Heavy overload: 150% for 1 minute every 5 minutes
	Working efficiency	More than 97%
	Power factor	> 0.98 (fundamental, at rated power)
Operating environment	Ambient temperature	-10°C to +40°C, derated at +40°C to +50°C
	Ambient humidity	5%–95%, no condensation
	Altitude	Max. 4000 m ≤ 1000 m: full performance > 1000 m: derated
Storage environment	Storage temperature	-40°C to +70°C
	Storage humidity	5%–95%, no condensation
Mechanical data	Antivibration performance	Comply with 3M4 vibration level in GB/T4798.3 Steady-state sinusoidal vibration: 2–9 Hz, 3 mm 9–200 Hz, 10 m/s ² Impact: 100 m/s ² , 11 ms
	IP rating	Frame: IP00 Cabinet: IP21
	Security performance	Complies with EN 61800-5-1
	Cooling	Forced air cooling (AF), compliant with EN 60146
Protection functions	Protection functions	Short circuit, overcurrent, overload, overvoltage, undervoltage, phase loss, phase unbalance, overtemperature

1.6 Hardware Description

1.6.1 Operating Principle

- The regenerative rectifier is a four-quadrant rectification system, consisting of a combination of a regenerative rectifier module and a regenerative rectifier filter module, a pre-charge circuit, an HCU control module and expansion modules.
- The regenerative rectifier rectifies 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 load to the power grid. The regenerative rectifier filter module is an L filter for suppressing input current harmonics.
- The regenerative rectifier is suitable for TN, TT and IT systems.

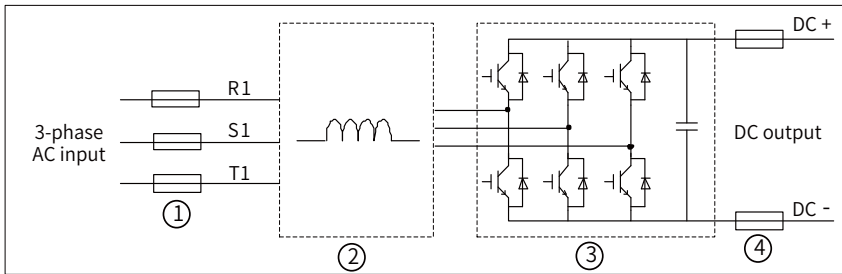


Figure 1-3 Diagram of the stand-alone regenerative rectifier system

No.	Description
1	AC side fuse
2	Regenerative rectifier filter module
3	Regenerative rectifier module
4	DC side fuse

1.6.2 Parallel Connection

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 $(L+2H8)*N$ structure instead. The maximum value of N for both 400 V and 690 V systems is 3. However, parallel is only possible when the software and hardware of the regenerative rectifier modules are identical and the specifications of the regenerative rectifier filter modules are also identical.

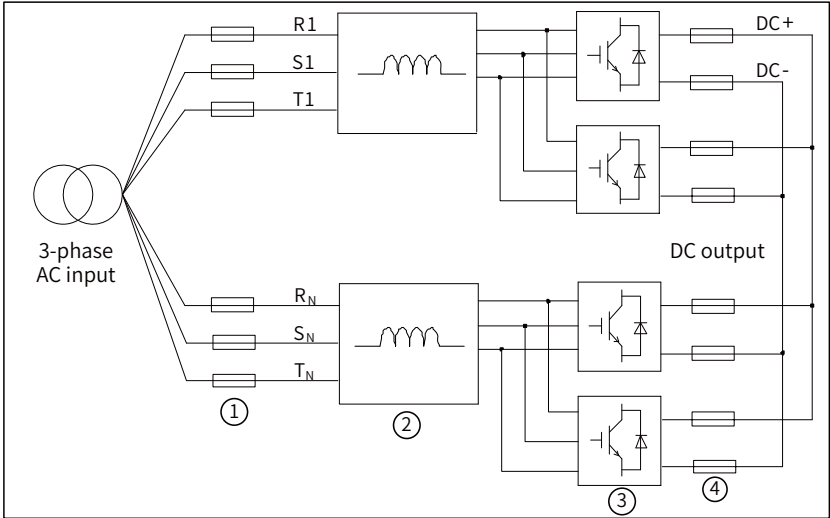


Figure 1-4 Diagram of the parallel regenerative rectifier system

No.	Description
1	AC side fuse
2	Regenerative rectifier filter module
3	Regenerative rectifier module
4	DC side fuse

1.6.3 Electrical Diagram of a Typical Drive System

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

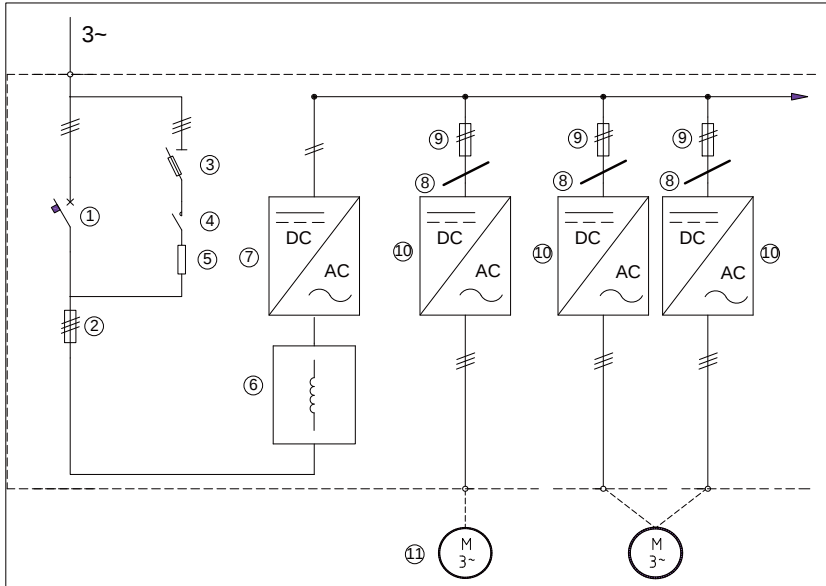


Figure 1-5 Electrical wiring of the regenerative rectifier and drive system

No.	Description
1	Main circuit breaker
2	AC side fuse
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
9	DC side fuse
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. In the case of the stand-alone mode, the maximum output current of the regenerative rectifier module is 900 A. The regenerative rectifier module must be used with a regenerative rectifier filter module.

The AC input side of the regenerative rectifier module is equipped with a quick connector, 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 individually wired to the bus.

A pre-charge circuit must be installed in the following cases:

- The regenerative rectifier module is connected to the DC bus through an isolating switch;
- The regenerative rectifier module is directly connected to the DC bus, and the bus is incapable of charging.

Layout of the regenerative rectifier module:

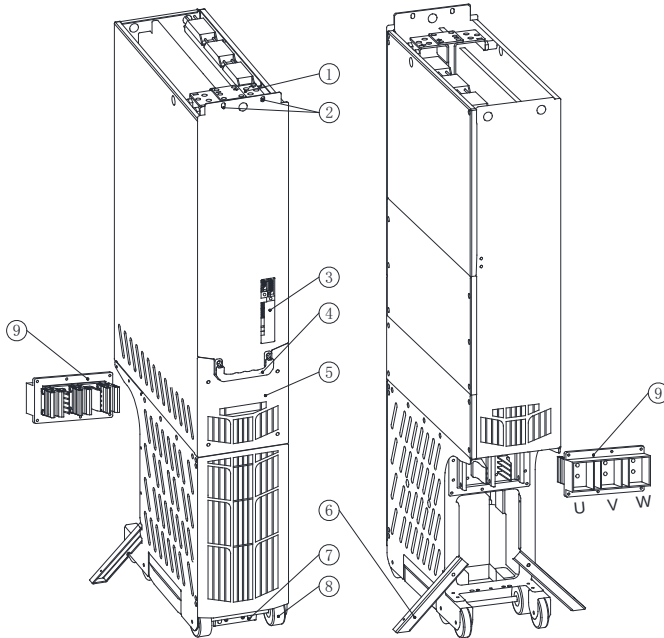


Figure 1-6 Layout of the regenerative rectifier module

No.	Description	No.	Description
1	DC output terminal	6	Anti-tipping support
2	Top spray protected fastening hole	7	Bottom sprayed protected fastening hole, the grounding point (PE) between the rectifier frame and the cabinet frame
3	24V power terminal/optical fiber connection terminal (see Section 3.4.1 Connecting Regenerative Rectifier Module for details)	8	Pulley
4	Handle	9	Quick connector plug (matching the quick connector socket inside the cabinet)
5	Cooling fan		

1.7.2 Dimensions of MD880-30M Regenerative Rectifier Module

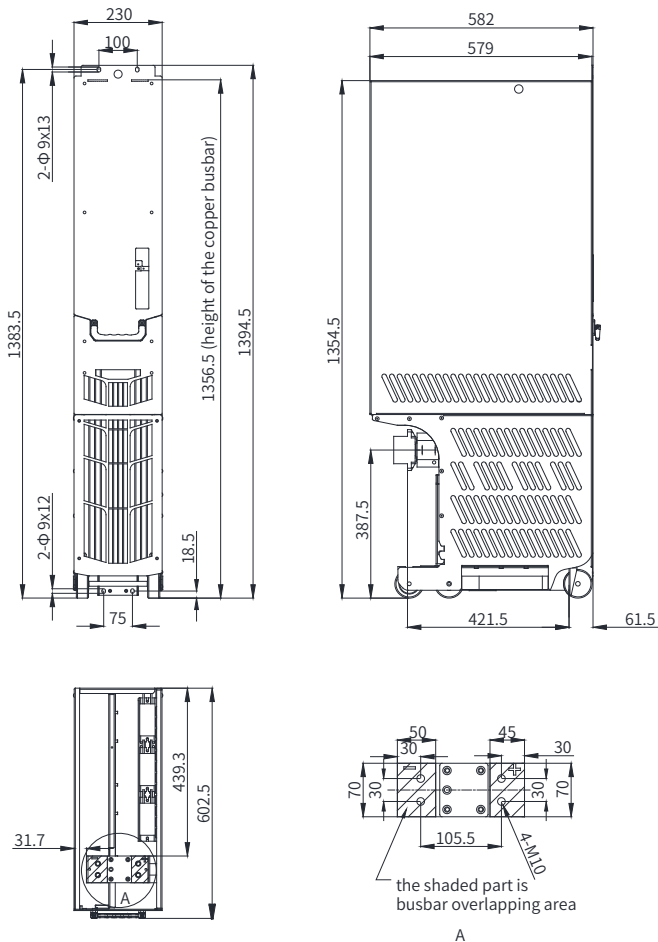


Figure 1-7 Dimensions of the regenerative rectifier module (unit: mm)

1.7.3 Layout of MD880-30F Regenerative Rectifier Filter Module

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

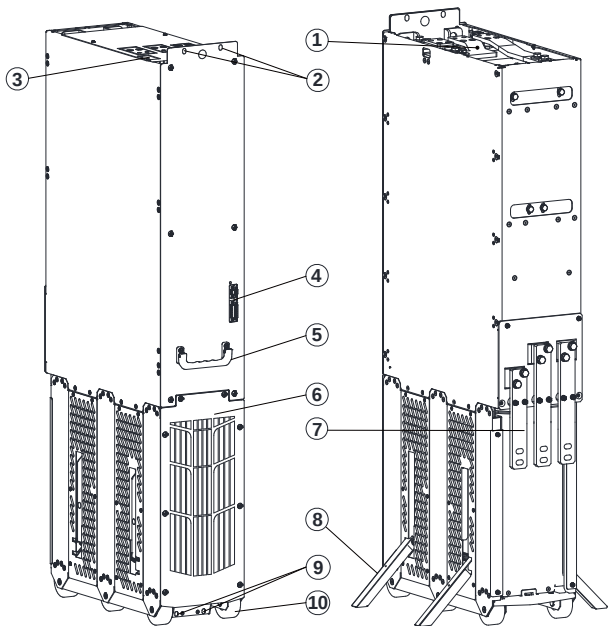


Figure 1-8 Layout of the regenerative rectifier filter module

No.	Description
1	Input copper busbar
2	Fastening hole
3	AC voltage sampling terminal
4	Fan power terminal, L temperature switch connection terminal (see Section 3.4.2 Connecting Regenerative Rectifier Filter Module for details)
5	Handle
6	Cooling fan
7	Output copper bar
8	Anti-tipping support
9	Spray protected fastening hole, the grounding point (PE) between the module frame and the cabinet frame
10	Pulley

1.7.4 Dimensions of MD880-30F Regenerative Rectifier Filter Module

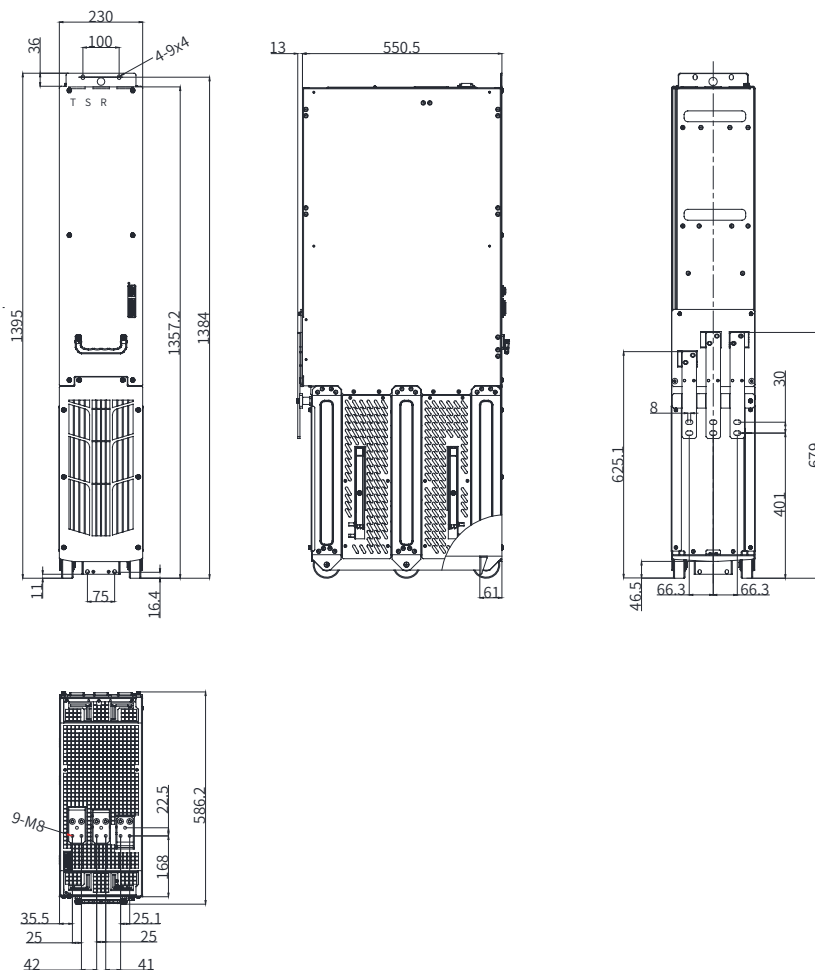


Figure 1-9 Dimensions of the regenerative rectifier filter module (unit: mm)

1.8 Layout and Dimensions of Frame Kit

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

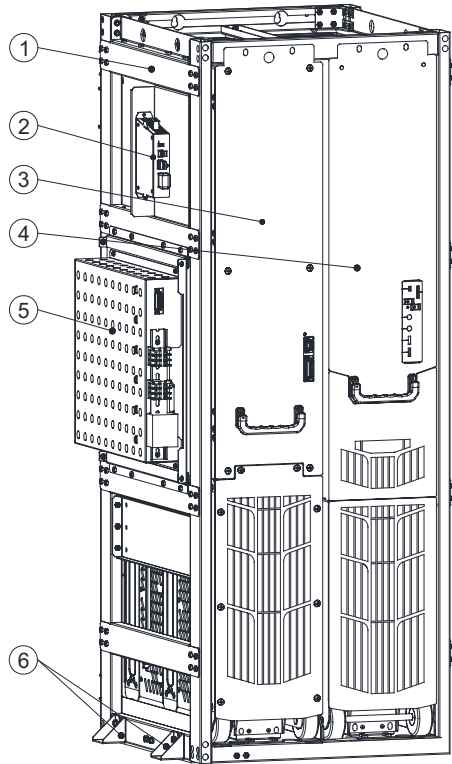


Figure 1-10 Regenerative rectifier L+H8 frame

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 kit accessory kit (see Section 3.5.1 Connecting L+H8 Frame Kit for details on the terminal)
6	Fastening parts for transportation

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

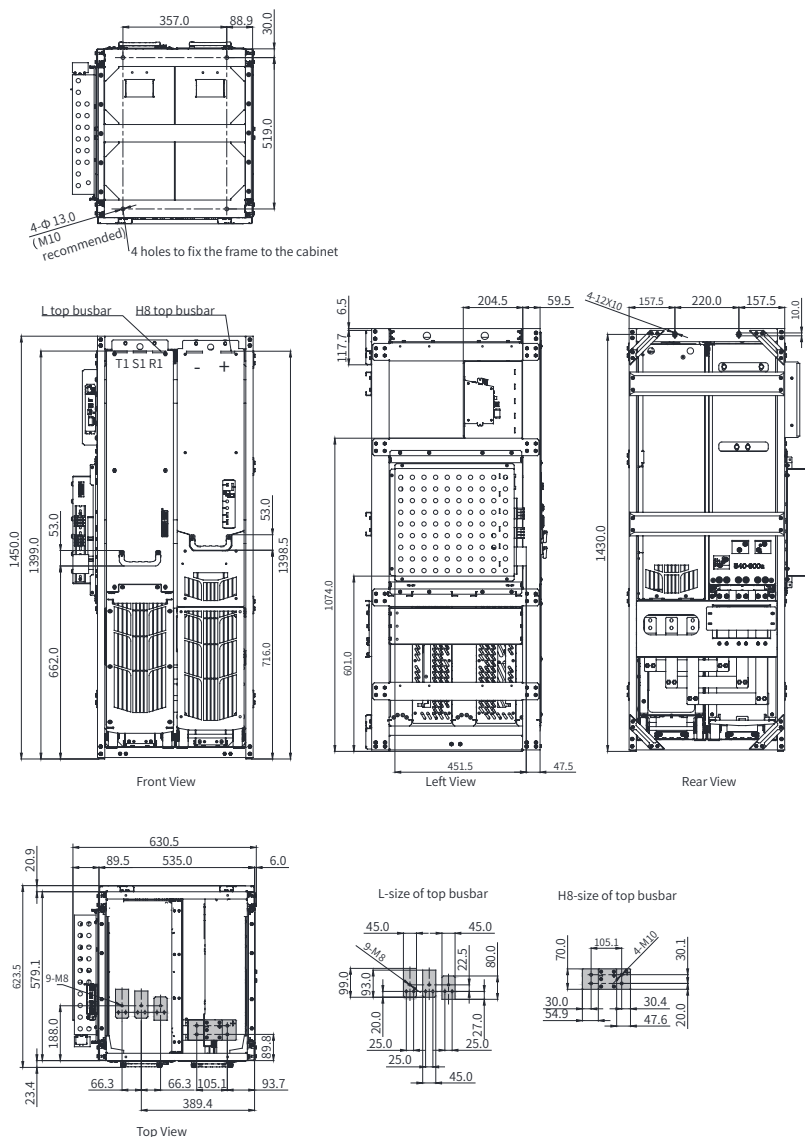


Figure 1-11 Dimensions of regenerative rectifier L+H8 frame (mm)

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

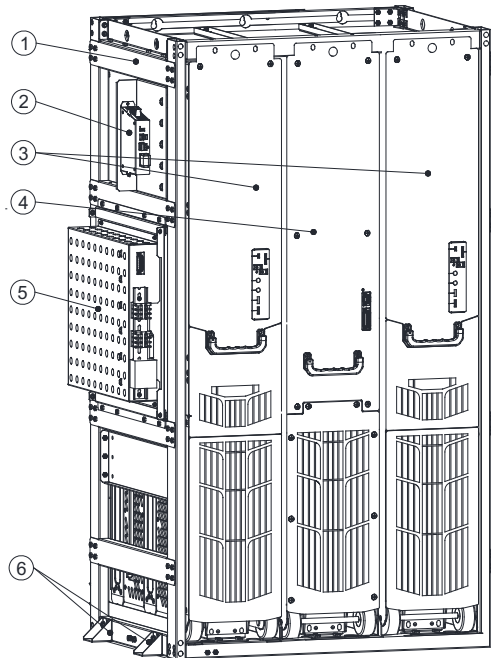


Figure 1-12 Regenerative rectifier L+2H8 frame

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 kit accessory kit (see Section 3.5.2 Connecting L+2H8 Frame Kit for details on the terminal)
6	Fastening parts for transportation



1.9 Cabinet Layout

1.9.1 Layout of Regenerative Rectifier And Drive System

The following diagram shows the layout of the regenerative rectifier and drive system. The actual model used is determined according to the load current.

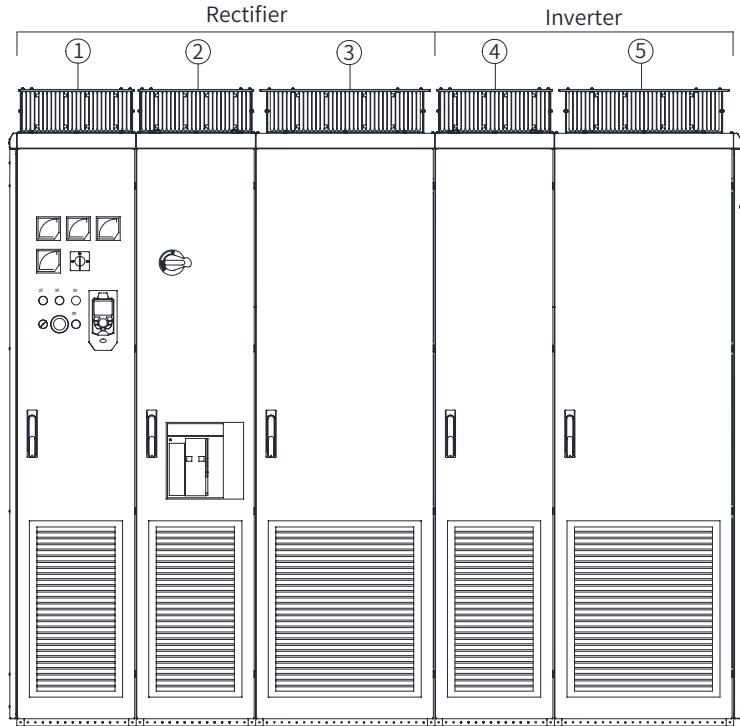


Figure 1-14 Layout of the regenerative rectifier and drive system

No.	Description	Function
1	Auxiliary control cabinet	Including control power, control module, instruments, and control panel
2	regenerative rectifier line connection cabinet	Including the main circuit breaker and pre-charge circuit
3	Regenerative rectifier cabinet	Including the regenerative rectifier filter module, regenerative rectifier module, synchronous voltage detection module (HSVM), and fan power module
4	Inverter cabinet	Including different types of inverter power modules
5	Inverter cabinet	Including different types of inverter power modules

1.9.2 Layout of Auxiliary Cabinet

The auxiliary cabinet is used to accommodate the control devices and auxiliary devices of the rectifier and drive system, including the control circuit power supply transformer, power supply module, HCU control module, HPCU parallel control module, and SOP-20-880 operation panel. The structure and dimensions of the cabinet vary with different optional components.

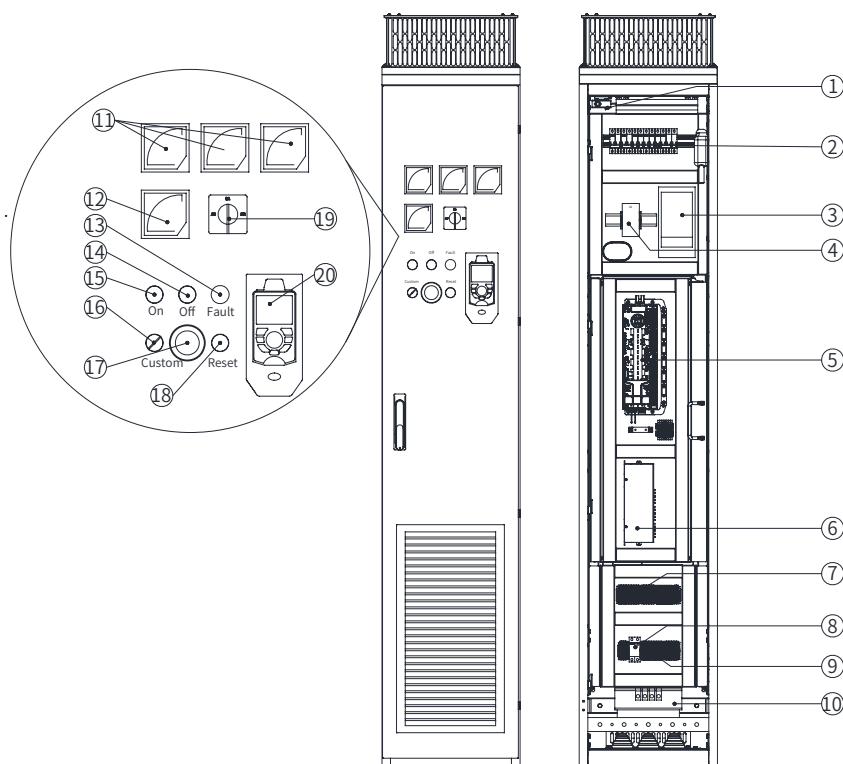


Figure 1-15 Layout of the auxiliary cabinet

No.	Description	Function
1	Door limit switch	Control the auxiliary cabinet lighting. The light is on when the cabinet door opens and off when closes.
2	Auxiliary power circuit breaker	Switch on/off the auxiliary power supply and provide overload short circuit protection
3	Isolation switch of the auxiliary power circuit breaker	Open/close the auxiliary power circuit and provide overload protection
4	Power module	Provide 24 VDC power supply for relays, HCU's, and indicator lights
5	HCU control module	For regenerative rectifier control
6	HPCU parallel control module	For parallel expansion control
7	Terminal block	For DC 24 V power output
8	Maintenance receptacle	Provide AC 220 V power
9	Terminal block	Input interface for external I/O signals
10	Transformer	Auxiliary power source transformer
11	AC ammeter	Display input current value of the main power supply
12	AC voltmeter	Display the interphase voltage of the main power supply
13	Fault indicator	For fault indication
14	Off switch	Power off
15	On switch	Power on
16	Custom	User-defined function
17	Emergency stop switch	Cut off the main circuit breaker upon emergency
18	Reset button	Reset after a fault occurs
19	Voltage selector	Switch the display of different interphase voltage values
20	SOP-20-880	For rectifier/drive control and parameter display

1.9.3 Layout of Line Connection Cabinet

The regenerative rectifier line connection 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 resistors. The structure and dimensions of the cabinet vary with different optional components.

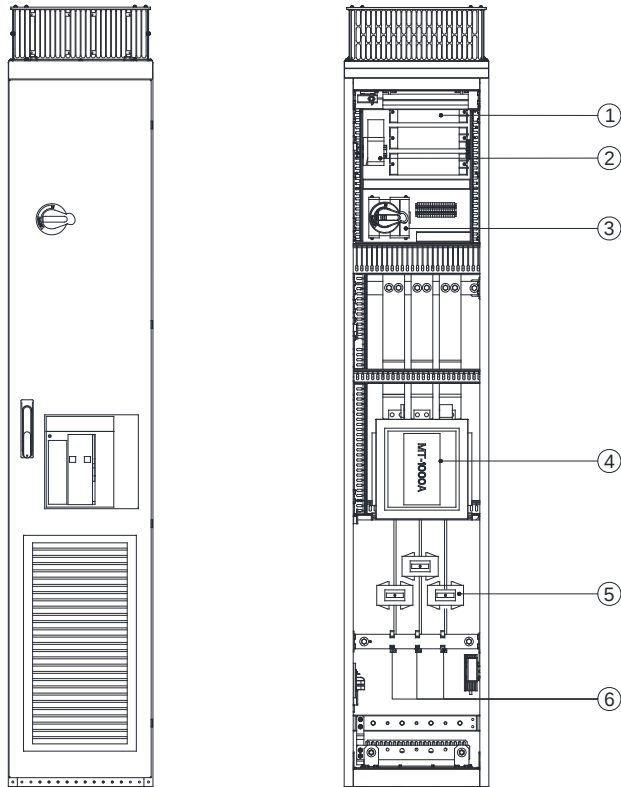


Figure 1-16 Layout of regenerative rectifier line connection cabinet

No.	Description	Function
1	Pre-charge resistor	Restrict the charging current of the bus capacitor
2	Pre-charge contactor	Open/close the pre-charge circuit
3	Pre-charge circuit fuse switch	Open/close the pre-charge circuit and provide overload and short circuit protection
4	Main circuit breaker	Open/close the main circuit and provide overload and short circuit protection
5	Current transformer	Measure current at the input side
6	AC power input	R, S, and T input terminals

1.9.4 Layout of Regenerative Rectifier Cabinet

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

The regenerative rectifier cabinet mainly includes a regenerative rectifier filter module and a regenerative rectifier module. The figure below shows an L+H8 structure layout.

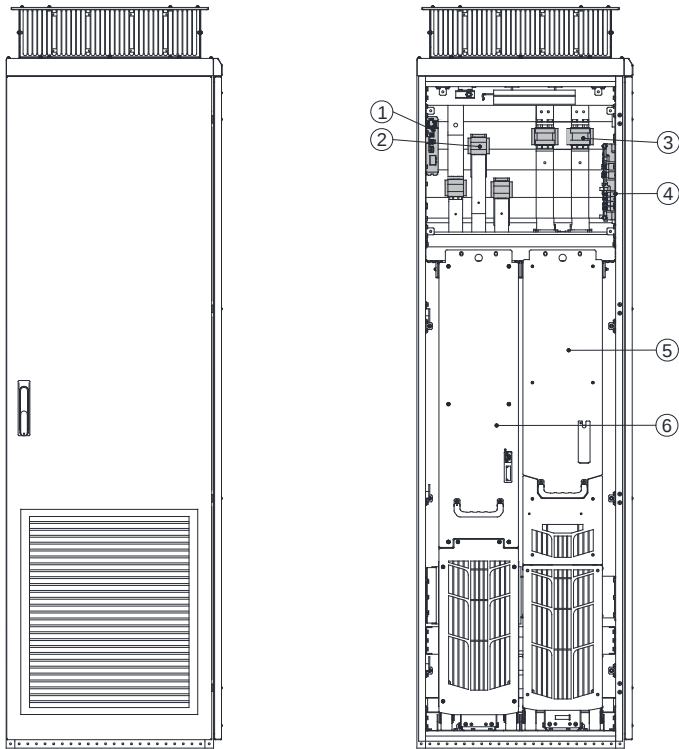


Figure 1-17 Layout of regenerative rectifier cabinet (L+H8)

No.	Description	Function
1	HSVM Synchronous voltage detection module	For three phase AC voltage sampling
2	AC side fuse	Provide overload and short circuit protection at the regenerative rectifier side
3	DC side fuse	Provide short circuit protection at the DC side or inverter side
4	Fan power	Power supply for the fan of the regenerative rectifier filter module
5	Regenerative rectifier module	The regenerative rectifier IGBT power module, which must be used with a regenerative rectifier filter module
6	Regenerative rectifier filter module	Regenerative rectifier Input reactor

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

The regenerative rectifier cabinet mainly includes a regenerative rectifier filter module and a regenerative rectifier module. The figure below shows an L+2H8 structure layout.

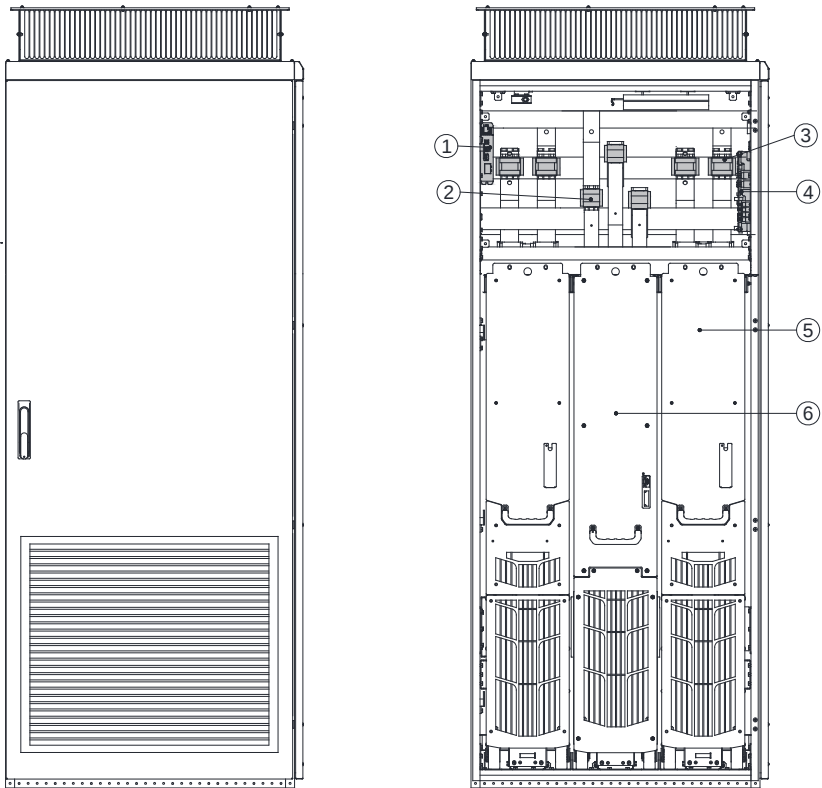


Figure 1-18 Layout of regenerative rectifier cabinet (L+2H8)

No.	Description	Function
1	HSVM Synchronous voltage detection module	For three phase AC voltage sampling
2	AC side fuse	Provide overload and short circuit protection at the regenerative rectifier side
3	AC side fuse	Provide short circuit protection at the DC side or inverter side
4	Fan power	Power supply for the fan of the regenerative rectifier filter module
5	Regenerative rectifier module	The 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

1) Ambient temperature

When the temperature is +40 to 50° C, the rated output current must be derated by 1% for every 1°C increase. The output current can be calculated by multiplying the current value given in the rating table by the derating factor (k):

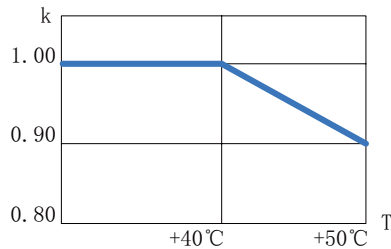


Figure 1-19 Ambient temperature

2) Altitude

When the altitude is 1000 m to 4000 m above sea level, for every 100 m increase in altitude, the output current of the regenerative rectifier must be derated by 1%.

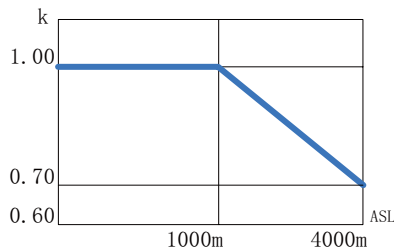


Figure 1-20 Altitude

1.11 Overload Capacity

For some drive systems where overload may occur, a proper reference load current is necessary for the MD880-30 series regenerative rectifier. When the drive system runs at the reference load current (load duration 300s), an overload occurs.

1) Curve in light overload mode

The reference load current in light overload mode (I_L) is based on a 60s 110% duty cycle.

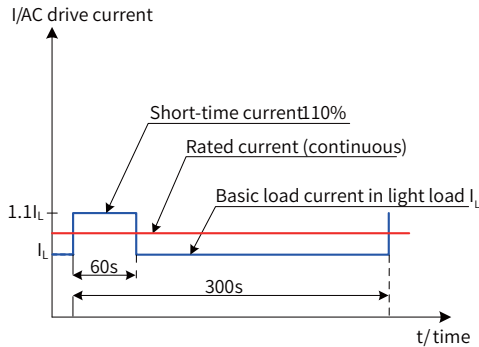


Figure 1-21 Curve in light overload mode

2) Curve in heavy overload mode

The reference load current in heavy overload mode (I_H) is based on a 60s 150% duty cycle.

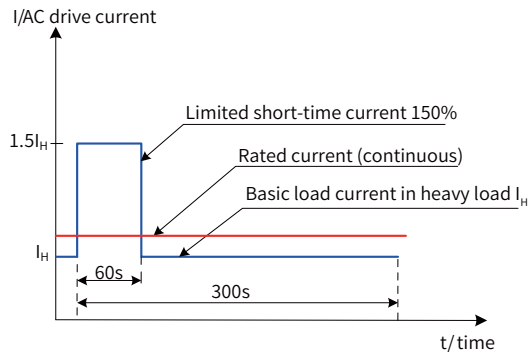


Figure 1-22 Curve in heavy overload mode

1.12 Tightening Torque of Fasteners

Table 1-5 Electrical Connection

Screw/Bolt	Strength Grade	Max. Torque (N·m)
M3	Strength grade: 4.8	0.5
M4	Strength grade: 4.8	1.2
M5	Strength grade: 4.8	2.8
M6	Strength grade: 4.8	4.8
M8	Strength grade: 8.8	20
M10	Strength grade: 8.8	40
M12	Strength grade: 8.8	70
M16	Strength grade: 8.8	200

Table 1-6 Mechanical connection

Screw/Bolt	Strength Grade	Max. Torque (N·m)
M5	Strength grade: 4.8	2.8
M6	Strength grade: 4.8	4.8
M8	Strength grade: 8.8	20

Table 1-7 Insulator connection

Screw/Bolt	Strength Grade	Max. Torque (N·m)
M6	Strength grade: 4.8	4.8
M8	Strength grade: 8.8	9
M10	Strength grade: 8.8	18
M12	Strength grade: 8.8	31

Table 1-8 Cable connector

Screw/Bolt	Strength Grade	Max. Torque (N·m)
M8	Strength grade: 8.8	15
M10	Strength grade: 8.8	32
M12	Strength grade: 8.8	50

1.13 Selection of Fuse

1) AC side fuse

Table 1-9 AC side fuse

Regenerative Rectifier Frame Kit Model MD880-30K-...	Structure	AC side fuse		Quantity	Specifications
		BUSSMANN	Sinofuse		
0640-4	L+H8	170M6415	RS306-3-S1P-1100A690V	3	1100 A, 690 V, SIZE: 3, single hole and flush end contact
0900-4	L+H8	170M6418	RS306-3-S1P-1500A690V	3	1500A, 690 V, SIZE: 3, single hole and flush end contact
1190-4	L+2H8	170M6413	RS306-3-S1P-900A690V	6	900A, 690 V, SIZE: 3, single hole and flush end contact
1674-4	L+2H8	170M6416	RS306-3-S1P-1250A690V	6	1250A, 690 V, SIZE: 3, single hole and flush end contact
0600-7	L+H8	170M6413	RS306-3-S1P-900A690V	3	900A, 690 V, SIZE: 3, single hole and flush end contact
0900-7	L+H8	170M6418	RS306-3-S1P-1500A690V	3	1500A, 690 V, SIZE: 3, single hole and flush end contact
1116-7	L+2H8	170M6413	RS306-3-S1P-900A690V	6	900A, 690 V, SIZE: 3, single hole and flush end contact
1674-7	L+2H8	170M6418	RS306-3-S1P-1500A690V	6	1250A, 690 V, SIZE: 3, single hole and flush end contact

2) DC side fuse

Table 1-10 DC side fuse

Regenerative Rectifier Module Model MD880-30M-...	Structure	DC side fuse		Quantity	Specifications
		BUSSMANN	Sinofuse		
0640-4	H8	170M6416	RS306-3-S1P-1250A690V	2	1250A, 690 V, SIZE: 3, single hole and flush end contact
0900-4	H8	170M6413	RS306-3-S1P-900A690V	4	900A, 690 V, SIZE: 3, single hole and flush end contact
0600-7	H8	170M6649	RS306-3-S5P-1100A1250V-D	2	1100 A, 1250V, SIZE: 3, single hole and flush end contact

Regenerative Rectifier Module Model MD880-30M-...	Structure	DC side fuse		Quantity	Specifications
		BUSSMANN	Sinofuse		
0900-7	H8	170M6547	RS306-3-S5P-900A1250V-D	4	900 A, 250 V, SIZE: 3, single hole and flush end contact

1.14 Selection of Pre-charge Circuit

Table 1-11 Selection of pre-charge resistor

Voltage Class	Rated Current	Pre-charge Resistor Resistance	Pulse Load Power
400 V	640~1674 A	2 ohm	36000 Ws
690 V	600~1674 A	5 ohm	36000 Ws

Table 1-12 Selection of pre-charge circuit fuse and contactor

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



NOTE

- ◆ To prevent overheating of the pre-charge resistor, the interval between switch-ons must not be less than three minutes!
- ◆ The regenerative rectifier can support inverters with power up to four times as large as the rectified power.

1.15 Selection of Reactor

The regenerative rectifier reactor is selected based on a 4% relative short-circuit impedance. Considering the inductance of the regenerative rectifier current-sense reactor, the actual relative short-circuit impedance will be slightly smaller.

The regenerative rectifier filter (L) and the regenerative rectifier power module (H8) are already included in the regenerative rectifier frame kit, and no additional reactor is required. If users only select the regenerative rectifier module, they need to design and prepare the input reactor themselves according to the requirements of Table 1-13. For better thermal design and filtering performance, it is recommended to purchase a standard regenerative rectifier filter.

Table 1-13 Selection of regenerative rectifier reactor

Regenerative Rectifier Frame Kit Model	Regenerative Rectifier Module Model (H8)	Rated Voltage (V)	Rated Current (A)	Inductance (uH)
MD880-30K-0640-4	MD880-30M-0640-4*1	400	640	40
MD880-30K-0900-4	MD880-30M-0900-4*1	400	900	25
MD880-30K-1190-4	MD880-30M-0640-4*2	400	1190	22
MD880-30K-1674-4	MD880-30M-0900-4*2	400	1674	14
MD880-30K-0600-7	MD880-30M-0600-7*1	690	600	79
MD880-30K-0900-7	MD880-30M-0900-7*1	690	900	42
MD880-30K-1116-7	MD880-30M-0600-7*2	690	1116	42
MD880-30K-1674-7	MD880-30M-0900-7*2	690	1674	26

2 Mechanical Installation

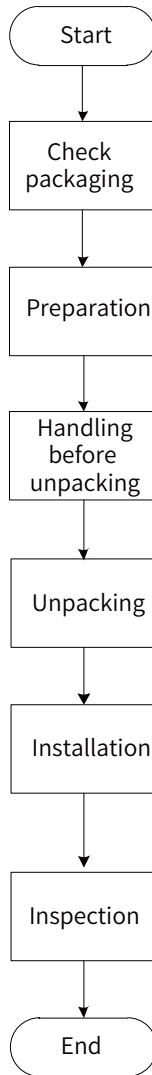


Figure 2-1 Installation flowchart

2.1 Installation Precautions

2.1.1 Transportation and Storage

1) Transportation

The cabinet units are heavy and have high center of gravity. Their center of gravity is labeled.

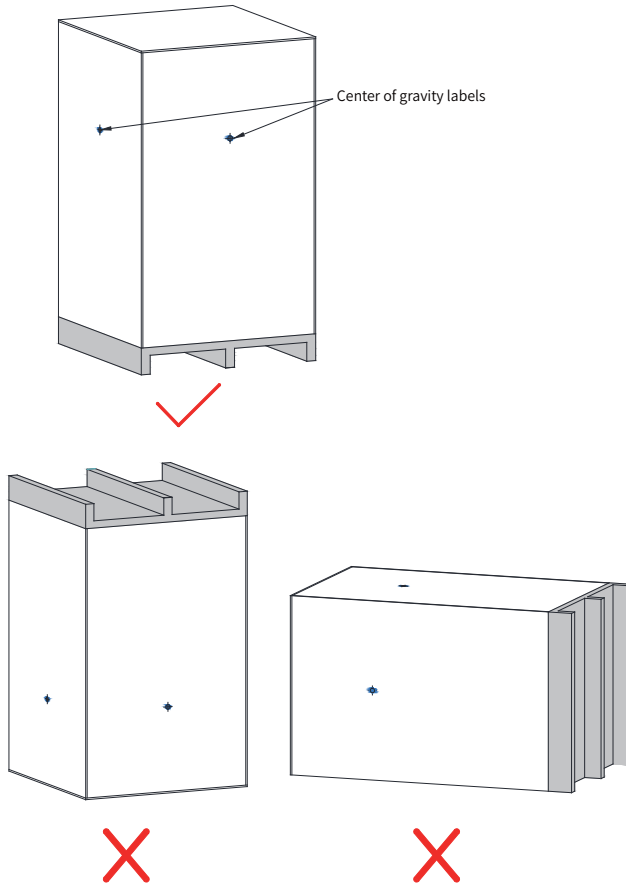


Figure 2-2 Handling

- Ensure that the ground at the installation location is flat and strong enough to bear the weight of the cabinet units.
- Suitable hoisting gear operated by trained personnel is also required due to the weight of the cabinet units.
- The cabinet units must always be transported in the upright position indicated. The cabinet modules must not be transported upside down or in a horizontal position.

Due to the weight and length of the cabinet modules, they can be transported only with the auxiliary hoisting angle iron on top of the cabinet units and the wooden pallet under the cabinet units.

- The cabinet units must be carried on a wooden pallet when transported with forklift trucks. The cabinet units must not be disassembled while still on wooden pallets and awaiting transport.
- When a hoist is used to move the cabinet units, the auxiliary hoisting angle iron must be installed on the cabinet units.

2) Transportation

Handle the equipment with a forklift or hoist. Handle the packed equipment with a pallet.

- The load capacity of the handling equipment must be larger than the weight of the load. Adjust the distance between forklift feet (larger than one half of the cabinet unit length).
- The lifting rope of the hoist must pass through the pallet under the cabinet units, with the relief height not larger than 0.3 m.
- The pallet jack must not move for a long distance or on the slop road.
- When being moved, the cabinet units need to be held by persons on left and right sides.

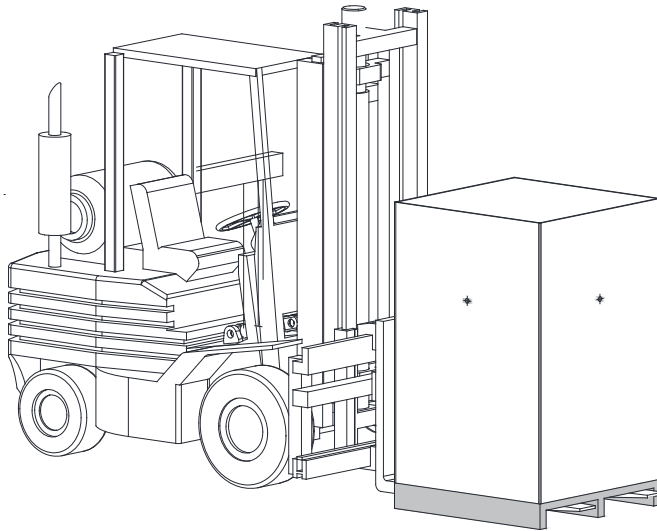


Figure 2-3 Forklift

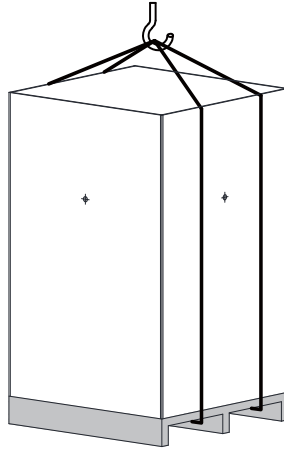


Figure 2-4 Hoist

3) Acceptance

After receiving the equipment, inspect it carefully. Check that you have received all the items specified on the delivery note. Notify the shipping company immediately of any missing components or damage. If necessary, contact Unity Drive.



- ◆ If the cabinet modules are damaged during transportation, the electrical safety of the cabinet can no longer be ensured. They must not be connected until a thorough high-voltage test has been carried out. Do not connect the equipment before high voltage testing.
- ◆ Personal injury or even death or material damage can result if these factors are not taken into account.

4) Storage

The cabinet units must be stored in a clean and dry room, with temperatures between -40°C and $+70^{\circ}\text{C}$ and temperature variation smaller than 1°C/min . If the cabinet is stored for a prolonged period once it has been unpacked, cover it or take other appropriate measures to ensure that it does not become dirty and that it is protected against environmental influences.

For storage of the equipment, pay attention to the following three aspects:

- Try to store the equipment with the original packing carton of the company.
- Do not expose the AC drive to moisture, high temperature, or outdoor direct sunlight for a long time.

2.1.2 Mechanical Installation Checklist



WARNING

- ◆ To ensure safe and reliable running, the equipment must be properly installed and commissioned by qualified personnel, taking into account all the warning notices provided.
- ◆ In particular, the general and national installation and safety guidelines for high-voltage installations as well as the guidelines relating to the proper use of tools and personal protective equipment must be observed.
- ◆ Personal injury or even death or material damage can result if these factors are not taken into account.

Check the boxes accordingly in the right-hand column if the activity applies to the cabinet unit in your scope of delivery. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities are complete.

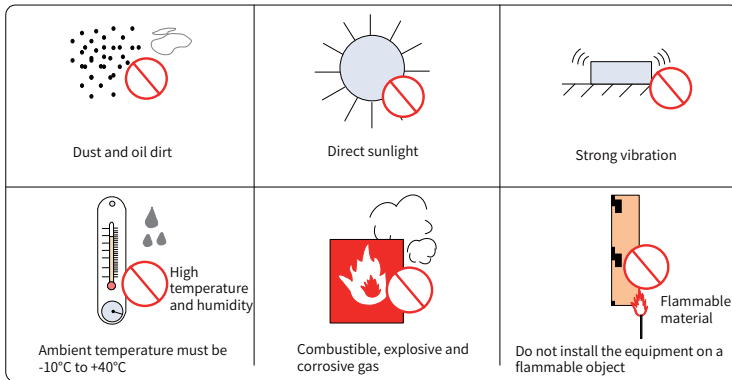
Table 2-1 Mechanical installation checklist

Item	Check That	Compliance
1	The center of gravity is labeled.	☐
2	The packing box is free of loss, damage, and dampness.	☐
3	The load-bearing capacity and properties of the ground must fulfill the requirements for installation of the equipment. For details, see " 2.2.1 Environment ".	☐
4	The minimum ceiling height required (for unhindered air discharge) must be observed. The cooling air supply and exhaust must not be obstructed and must have sufficient space. Sufficient space after cabinet doors are open must be reserved as safety passageway. For details, see " 2.4.1 Installation Requirements ".	☐
5	The cabinet unit housing is intact without distortion, peeling, or crack, and there is no water stain.	☐
6	The accessories (user manual, optional parts) inside the cabinet units are complete.	☐
7	Before the cabinet units are finally installed, the wooden pallets supplied with the transport unit must be removed properly.	☐
8	The cabinet must be firmly attached to the fixing points provided. Connect the equipment as specified. For details, see " 4) Installation of expansion screws ".	☐
9	All shock protection measures (guards) in and on the cabinet modules must be installed before commissioning.	☐

2.2 Installation Preparations

2.2.1 Environment

Item	Quantity
Heat dissipation and ventilation	Install the regenerative rectifier module on the surface of a flame-retardant object and mount it vertically to a mounting bracket with screws. The regenerative rectifier module generates a lot of heat when it is running. Reserve enough space for heat dissipation around the cabinet.
Installation location	Ensure the following requirements are satisfied: The installation base is flat and strong enough to bear the weight of the equipment Avoid direct sunlight Avoid places with humidity higher than 95% and where water drops exist. Avoid places with corrosive, inflammable, or explosive gas. Avoid places with oil dirt and dust
Vibration	Install the equipment in a place not prone to vibration. For the antivibration performance, see " " .
Ambient temperature	Derating is required for ambient temperatures greater than 40°C and altitudes above 1000 m. For the derating factor, see "1.10 Derating" .
Enclosure	This product is installed in a cabinet and must be installed in the final system. The final system must provide a fireproof enclosure, electrical enclosure and mechanical enclosure, and comply with local laws and regulations and relevant IEC standards.



2.2.2 Installation Tools

- 13 mm spanner or socket spanner;
- 16 mm spanner or socket spanner;
- 18 mm spanner or socket spanner;
- Cross screwdriver and straight screwdriver (2.5–6 mm);
- Torque wrench
- Crowbar

2.3 Installation of Frame Kit

2.3.1 Installation Space for L+H8 Frame Kit

1) Minimum requirement on cabinet dimensions:

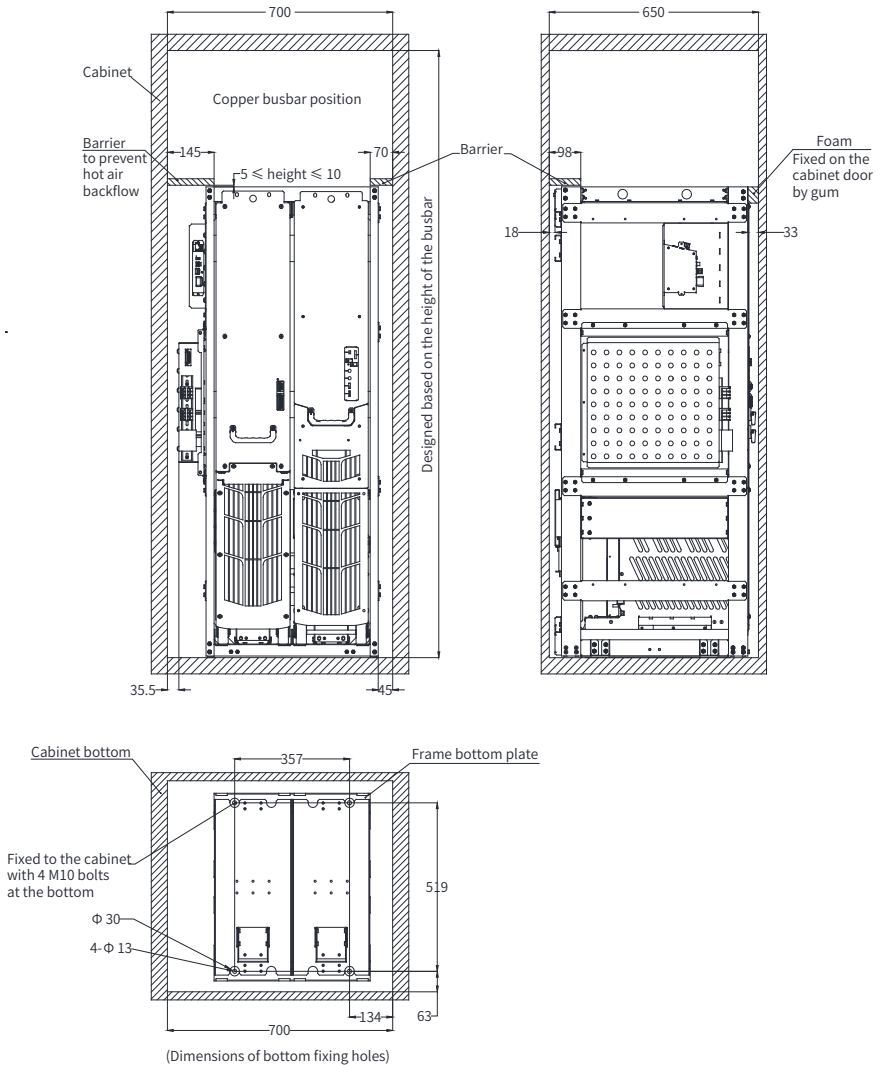


Figure 2-5 Minimum requirement on cabinet dimensions (unit: mm)



NOTE

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

- 2) Two beams are required at the bottom of the cabinet so that the frame can be pushed in easily.

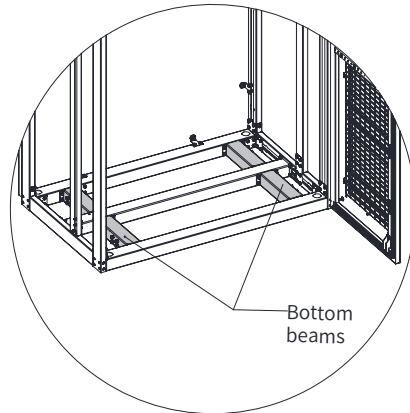


Figure 2-6 Bottom beams

The dimensions of the beam are as follows:

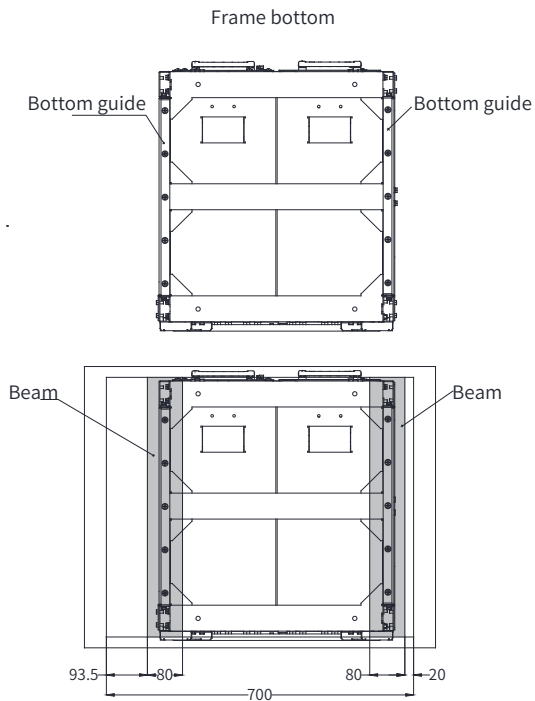
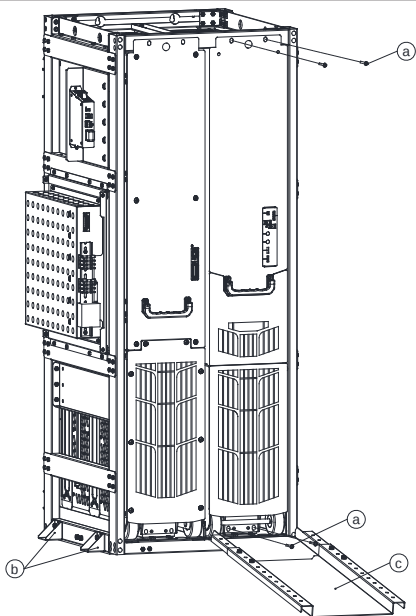


Figure 2-7 Beam dimensions (unit: mm)

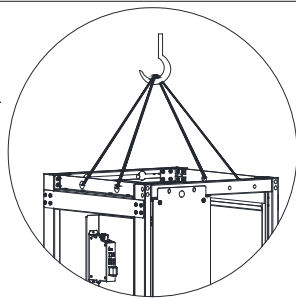
2.3.2 Installing L+H8 Frame Kit

Install the frame kit by the following steps:

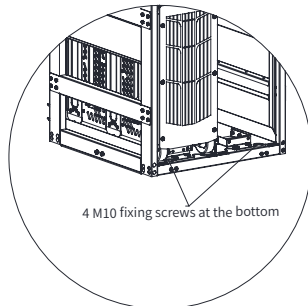
- 1) Pull the H8 regenerative rectifier module out of the frame (to reduce the weight of the frame kit).
- ◆ Remove the 4 transportation fixing parts (b).
- ◆ Lift the frame onto a flat surface.
- ◆ Remove the 4 M8 bolts (a) of the H8 module.
- ◆ Place the mounting rail (c) and take out the H8 module.



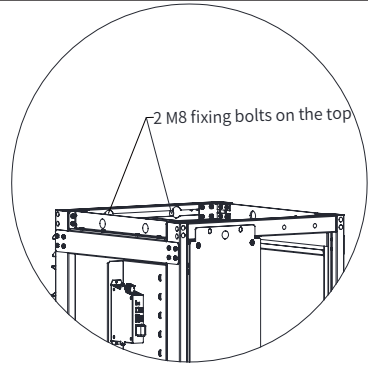
- 2) Lift the frame into the cabinet.



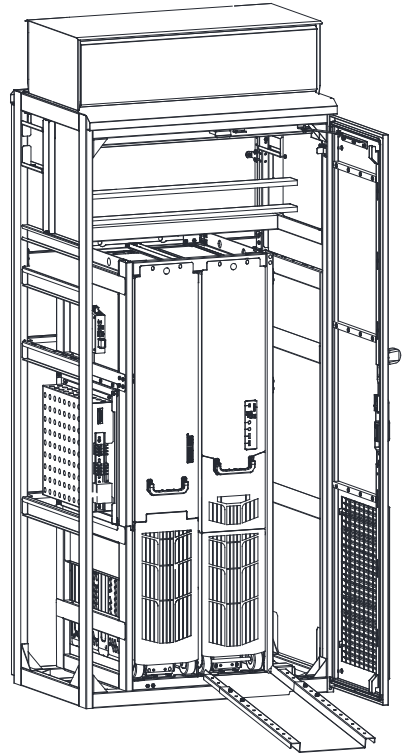
- 3) When the bottom of the frame comes into contact with the bottom of the cabinet, manually push the frame to the specified position. Lock the bottom of the frame.



- 4) Secure the screws on the top of the frame.



- 5) Place the mounting rail and push the H8 module into the frame to complete the installation.



2.3.3 Installation Space for L+2H8 Frame Kit

1) Minimum requirement on cabinet dimensions:

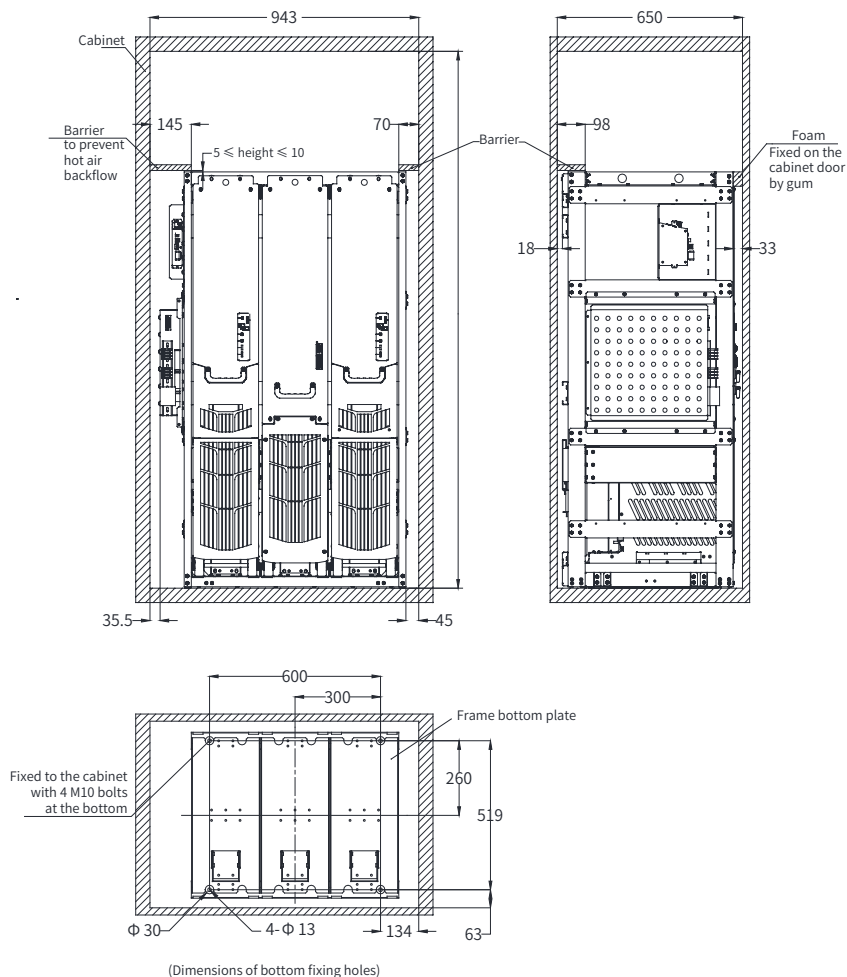


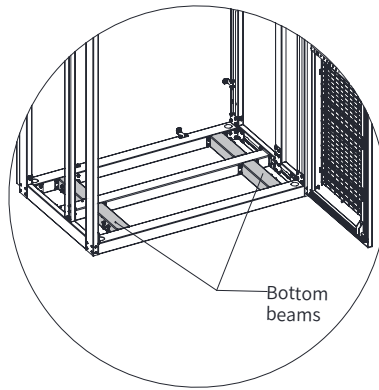
Figure 2-8 Minimum requirement on cabinet dimensions (unit: mm)



NOTE

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

- 2) Two beams are required at the bottom of the cabinet so that the frame can be pushed in easily.



The dimensions are as follows:

Frame bottom

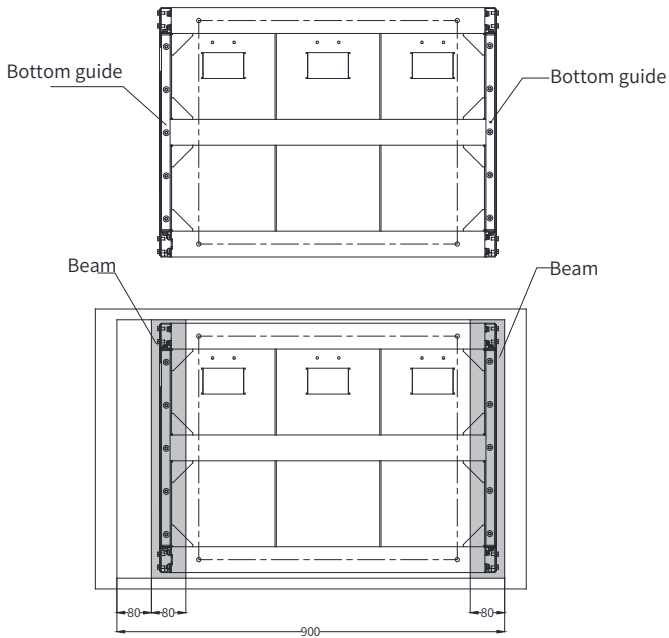
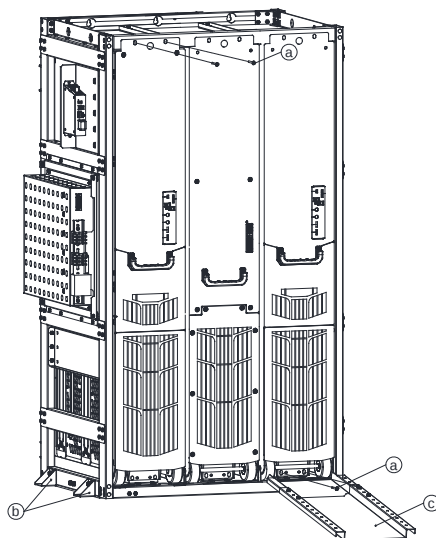


Figure 2-9 Dimensions of bottom beams (unit: mm)

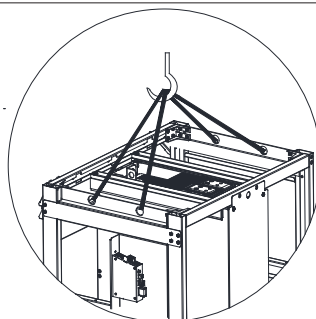
2.3.4 Installing L+2H8 Frame Kit

Install the frame kit by the following steps:

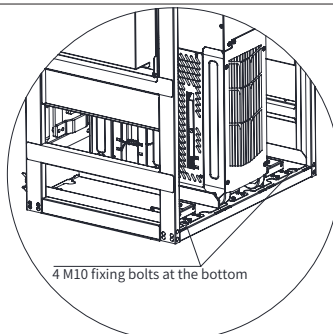
- 1) Pull the two H8 regenerative rectifier modules out of the frame (to reduce the weight of the frame kit).
- ◆ Remove the 4 transportation fixing parts (b).
- ◆ Lift the frame onto a flat surface.
- ◆ Remove the 4 M8 bolts (a) of the H8 module.
- ◆ Place the mounting rail (c) and take out the H8 module.



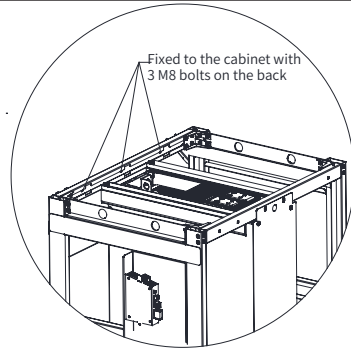
- 2) Lift the frame into the cabinet.



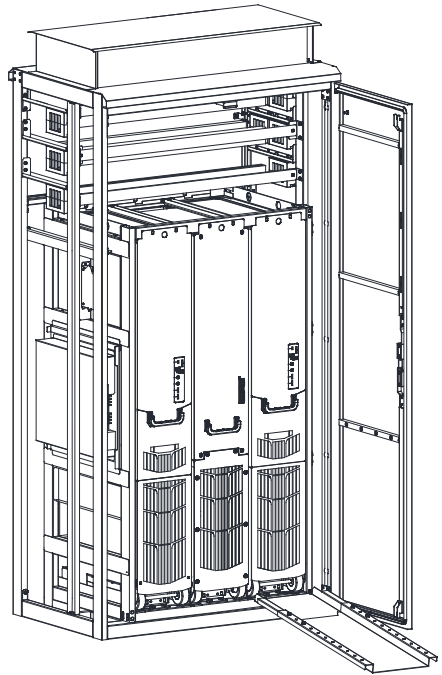
- 3) When the bottom of the frame comes into contact with the bottom of the cabinet, manually push the frame to the specified position. Lock the bottom screws.



- 4) Lock the bottom and rear screws.



- 5) Place the mounting rail and push the H8 module into the frame to complete the installation.



2.4 Installing the Cabinet

2.4.1 Installation Requirements

1) Space on the top of the cabinet

The cabinet must not be installed in an environment without any cover. All cabinets must be installed according to the drawings, with sufficient space around for air flow, door open/close and maintenance. The passageway for entering the installation foundation and the space for the auxiliary device need to be reserved.

- The operating areas must be dry and free of dust. The air supplied must not contain any electrically conductive gas, vapors, or dust, which could impair operation. It may be necessary to filter the air supplied to the installation room.
- If the air contains dust, filter mats can be installed in front of the ventilation grilles in the cabinet doors and also in front of the hoods. Cabinet modules complies with IP21.



NOTE

- ◆ To comply with IP21, The MD880-30 cabinet must be enclosed by installing a side panel on the left and right sides.

The cabinet units are installed in accordance with the dimension drawings supplied. The distance between the cabinet top and the ceiling is related to the IP options, as shown in the following figure:

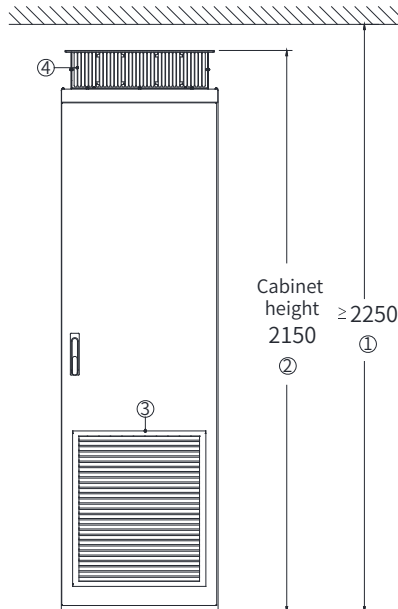


Figure 2-10 Distance between cabinet top and ceiling (IP21)

- ① min. height of the ceiling (mm); ② total height of the cabinet (mm); ③ air inlet area;
④ air outlet area

2) Space in front of the cabinet

The cooling air for the power unit is drawn in from the front through the ventilation holes or window blinds in the lower part of the cabinet doors. The warmed air is discharged through the perforated top cover or the ventilation holes in the hood.

- Cabinet units are allowed to lay against the wall, with the distance between the front of the cabinet and the wall ≥ 1500 mm. Sufficient space must be reserved for two sides of cabinet units.

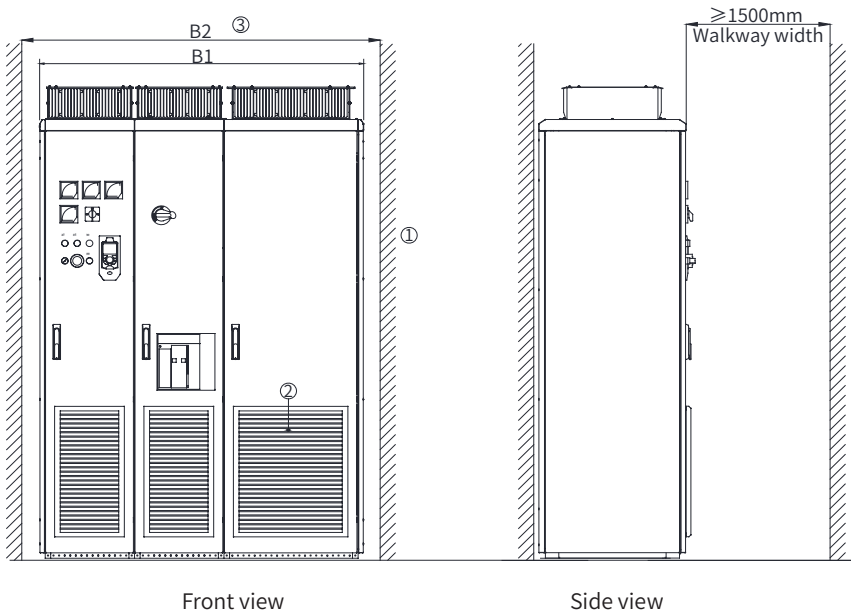


Figure 2-11 Space in front of the cabinet

- ① building wall; ② air inlet area; ③ the space width B2 of the building must be larger than the total cabinet width B1.



- ◆ Take the front door handle into consideration. Reserve sufficient space to ensure that the front door open/close angle is larger than 90° (maximum door open/close angle is about 100° without obstruction), so that there is sufficient operation space during maintenance and repair.

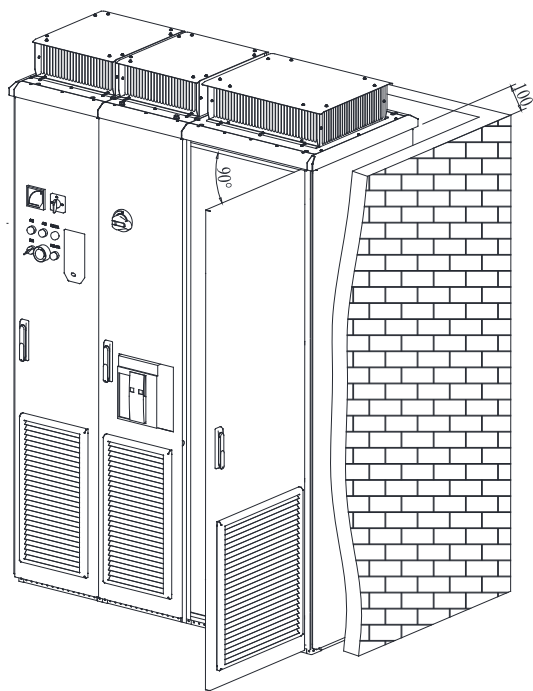


Figure 2-12 Space reserved for door open/close (unit: mm)

3) Requirements for ground flatness

The installation foundation is flat and strong enough to bear the weight of the cabinet units, so that the following function of the cabinet units can be performed properly. The door lock is used properly when the cabinet doors open and close.

When cabinet modules are connected side by side, there is no gap between the cabinet modules and the ground. If the gap is unavoidable (1 in Figure Figure 2-13), use a pad (2 in Figure Figure 2-13) to keep the cabinet horizontal, and use proper fillings (for example, fireproofing mud) to fill the space.

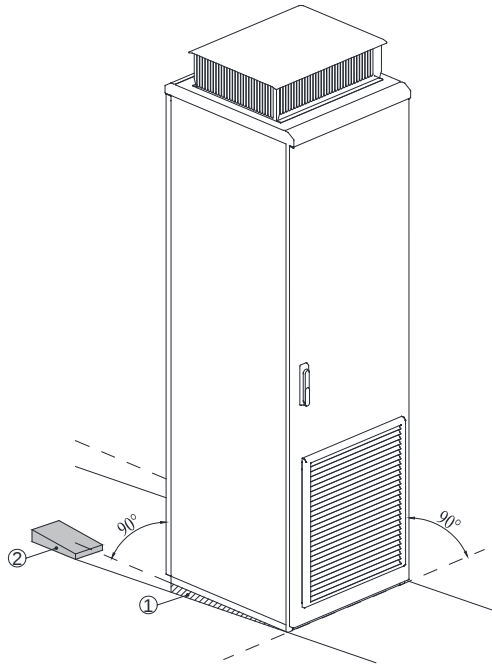


Figure 2-13 Requirements on ground

4) Installation of expansion screws

If the cabinet modules are installed on the concrete ground, install the expansion screws in the ground corresponding to the fixing holes of the cabinet modules.

The procedure of installing the expansion screw is described as follows:

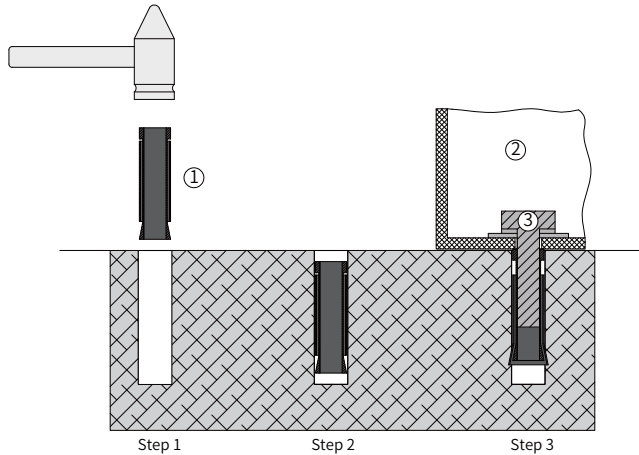


Figure 2-14 Installing the expansion screws

① expansion screw; ② cabinet equipment; ③ M12 bolt

The installation procedure is as follows:

- Drill holes.
Hole diameter < Maximum outer diameter of expansion screw
Hole depth > Length of expansion screw
Perpendicular to the ground
- Knock the expansion screw into the hole (below the surface) by using the hammer, as shown in Step 2. The expansion screw consists of two movable parts: bolt spring shell and stem.
- After placing the cabinet unit in the required position, fasten it with M12 bolts, and the expansion screw stem will be pulled up, making the spring shell deform to fasten the cabinet unit, as shown in Step 3.

5) Requirements on the foundation



- ◆ Lay medium voltage cables and low voltage cables in different brackets. If they cannot be separated due to restricted conditions, lay low voltage cables in full enclosed metal pipes.
- ◆ The cable trench must use non-flammable materials and be smooth. Damp-proof, dust-proof and rat-proof measures are required.
- ◆ Personal injury or even death or material damage can result if these factors are not taken into account.

During foundation design, take the following factors into consideration:

- Inspection space in front of the cabinet modules
- Routing of power cables, Rectifier cable, and system control cables

Design the cable trench or cable channel below the cabinet. The MV cables, power cables and signal cables must be separated.

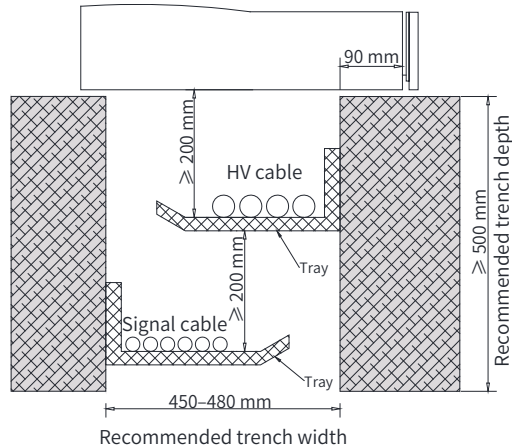


Figure 2-15 Foundation layout

2.4.2 Installation Procedure

1) Unpacking

Place the packed product on the empty and flat ground of the workshop, and prepare the tools such as crowbar.

Use the crowbar to pry off the crate along the gap from the plate edge. Then remove the cover plate, side plates, and ends plates.

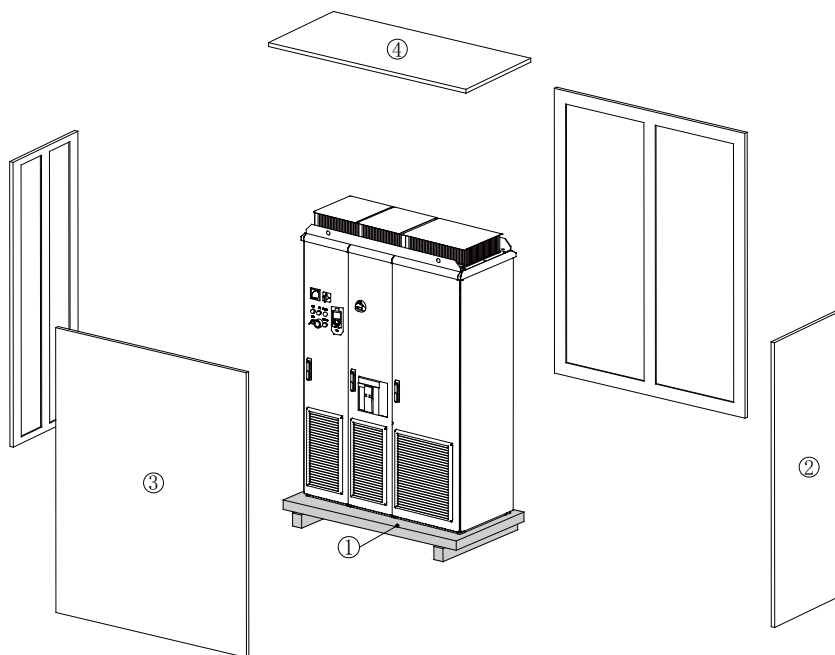


Figure 2-16 Unpacking the product

① pallet; ② end panels; ③ side panels; ④ cover



NOTE

- ◆ During unpacking, put the crowbar into the crate as short as possible so as to prevent damaging the equipment. Pry off the crate with care and protect yourself from being injured by nails. Exert extreme caution to avoid injury caused by nails.
- ◆ When removing the inner packing materials such as plastic film, do not use sharp tool to avoid scratching the equipment.
- ◆ The packaging material must be discarded in accordance with the applicable country-specific guidelines and rules.

2) Removing the pallet

Before installing cabinet units, loosen the screws for fastening the transportation pallet and cabinet units, and remove the pallet.

The fastening screws are in the four corners of the cabinet units.

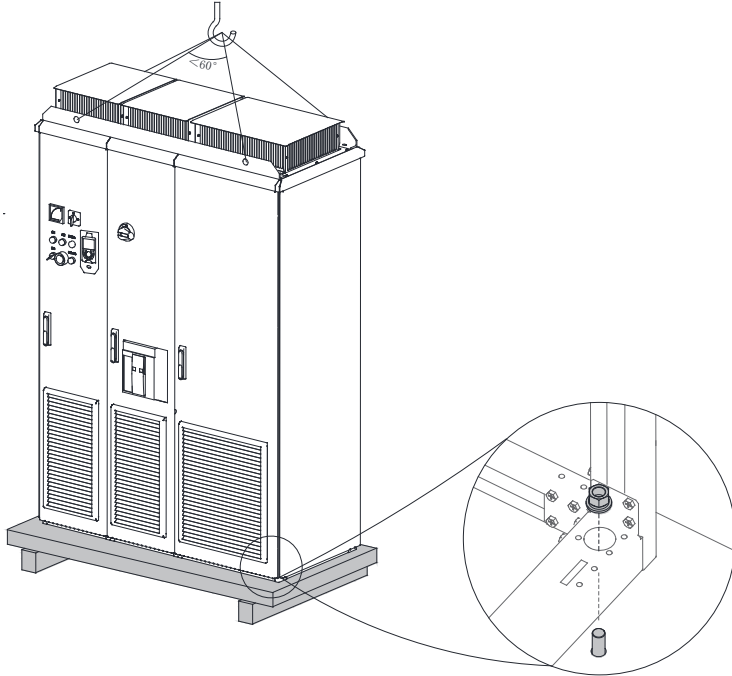


Figure 2-17 Lifting the cabinet units off the pallet

3) Handling after unpacking

- Handle the cabinet units with a hoist with a load capacity larger than the weight of one set of cabinet units.
- When the cabinet is hoisted, the maximum angle of the hoisting rope is 60° .
- Use the auxiliary hoisting angle iron on the top of the cabinet for lifting and handling, with the relief height not larger than 0.3 m.
- Ensure that the cabinet unit doors are locked before handling. The cabinet must be hold at both sides by hands during handling.

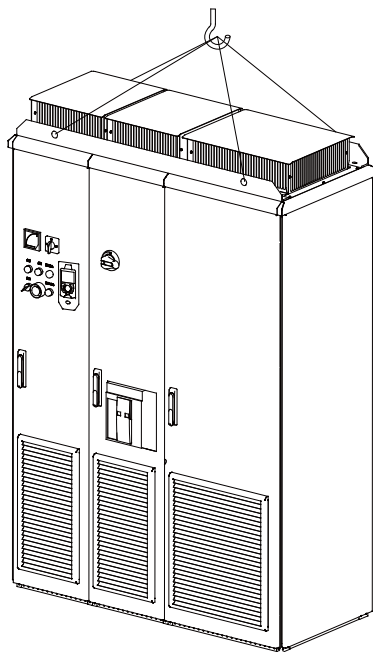


Figure 2-18 Handling the cabinet after unpacking

Open the cabinet door, align the anchor bolt mounting hole at the bottom of the cabinet with the expansion screw on the ground, fasten the twelve M12 bolts to fix the cabinet, close the cabinet door, and the installation is completed.

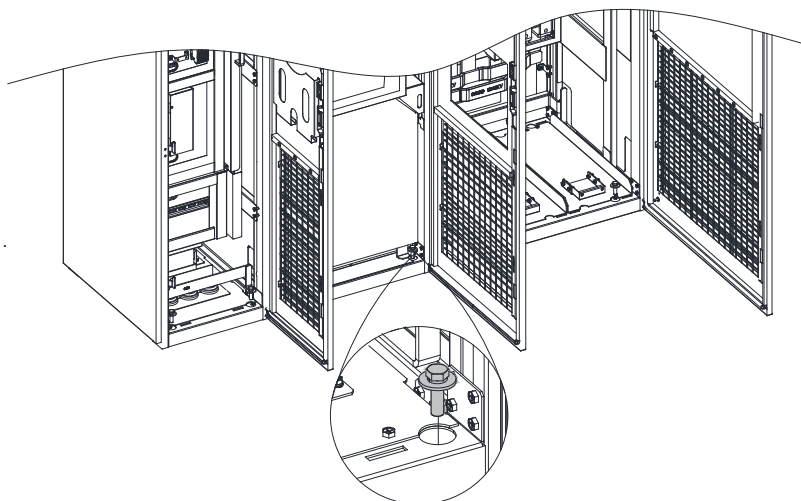


Figure 2-19 Fixing the cabinet

3 Electrical Installation

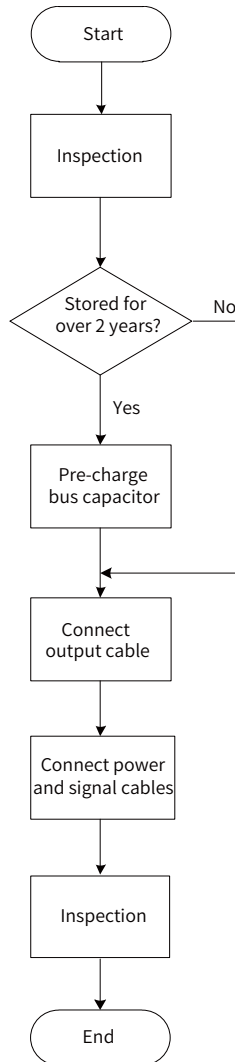


Figure 3-1 Electrical installation flowchart

3.1 Safety Instructions

3.1.1 Safety Precautions Before Installation

Safety precautions before installation
 DANGER ◆ This product is often used in industrial applications involving 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 professional technicians are allowed to perform operations and they must read and comply with safety information provided in this guide. ◆ When carrying out any kind of work on electrical devices, the following "five safety rules" must always be observed: ① Disconnect the equipment from power supply. ② Make sure that power supply will not be connected again. ③ Make sure that the equipment is de-energized. ④ Make sure that the equipment is reliably grounded. ⑤ Cover or enclose the adjacent components that are still live.

3.1.2 Inspection

Inspection
 DANGER ◆ The equipment runs with high voltage. All connection work must be carried out when the cabinet unit is de-energized. ◆ Only qualified technicians are allowed to operate the equipment. ◆ Take caution when operating the cabinet unit disconnected from power supply, as there may still be external supply voltage. The power and control terminals may be live even when the equipment is not running. ◆ Dangerously high voltage levels are still present in the cabinet even 15 minutes after power disconnection due to the DC bus capacitors. Therefore, open the cabinet unit after ensuring that the voltage is lower than 36 VDC. ◆ The user is responsible for ensuring that the motor, cabinet, and other components are installed and connected in accordance with the recognized technical rules in the country of installation and with other applicable regional regulations. Special attention should be paid to cable dimensions, fuses, grounding, shutdown, disconnection, and overcurrent protection. ◆ If an item of protective gear trips in a branch circuit, a leakage current may have been disconnected. To reduce the risk of fire or an electric shock, the current-carrying parts and other components in the cabinet should be inspected and damaged parts should be replaced. When an item of protective gear trips, the cause of the trip must be identified and rectified.

3.1.3 General

Electrostatic/optical components	
	DANGER
◆	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.
	CAUTION
◆	Carefully pick and place the optical fiber cables. When removing the optical fiber cable, pull the connector, not the cable itself. Since the optical fiber cable is extremely sensitive to dirt, do not touch the end of the cable with bare hands.

3.1.4 Insulation Test

The MD880-30 series of regenerative rectifier products have 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 them again.

3.2 EMC-Compliant Cable Routing

3.2.1 Requirements

- 1) The signal cables and power cables must be routed separately:

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

- 2) Requirements on the analog control signal cable:

Use the twisted pair shielded cables as the analog control signal cables.

When stripping the sheathing back of the cable, the stripped part must be as short as possible (5–7 mm), and wrap the stripped shield with the insulating tape to prevent the shielded cable from contacting other cables, eliminating interference.

- 3) Requirements on the power cables:

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

- 4) Requirements on the control cables and power supply cables:

If the control cable must run across the power cable, make sure they are arranged at an angle of close to 90°.

3.2.2 Routing Suggestions

- 1) Separate cables for transmitting different signals.
Reserve a distance between interfering cables and sensitive cables. If the routing space is large, the recommended distance is 30 cm.
If these two types of cables must cross, arrange them at an angle of 90° to prevent interference.

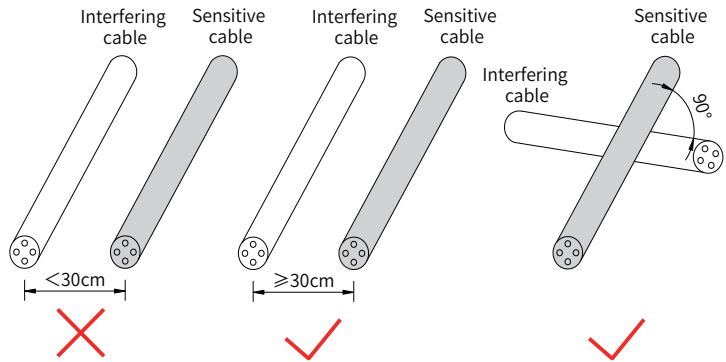


Figure 3-2 Routing of interfering cables and sensitive cables

- 2) Route different signal cables separately and isolate different types of signals with the equipotential signal. When routing cables of same signal type, lay the equipotential signal cables at the outer layer, and consider the equipotential signal arrangement in the middle. The following figure shows an example.

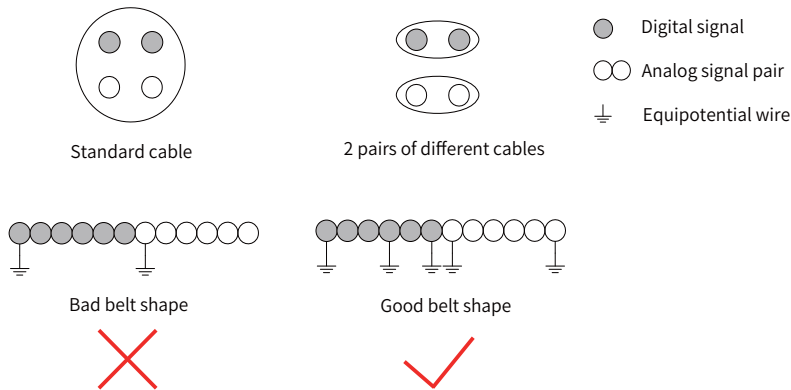


Figure 3-3 Routing of different types of signal cables

- 3) For the multi-conductor cable, it is recommended that a cable transmits the same type of signals. If a cable is used to transmit different types of signals, use the cable with conductor shielded, as shown in the following figure:

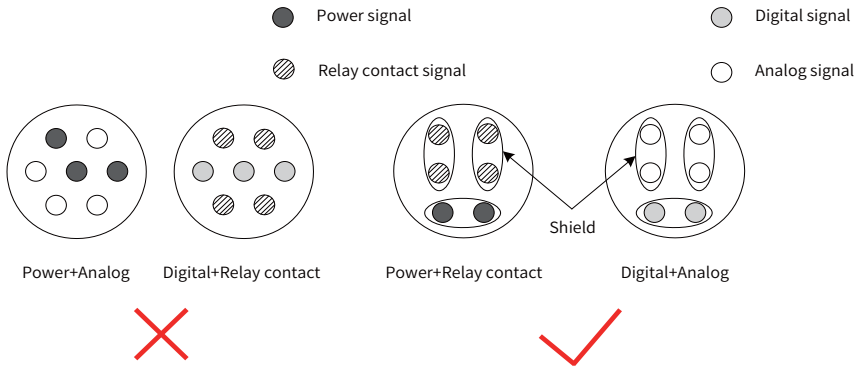


Figure 3-4 Routing of multi-core cables

- 4) When certain conductors in a multi-conductor cable are not used, connect all the unused (or reserved) conductors to the equipotential connection point.

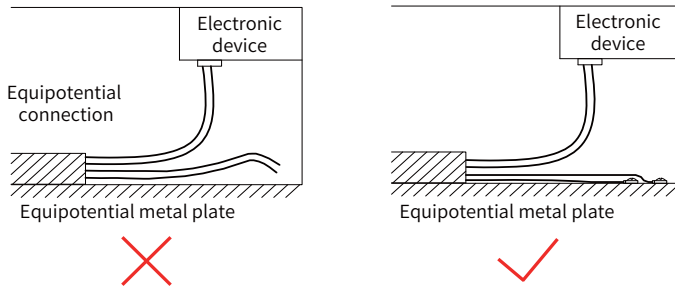


Figure 3-5 Handling of remaining cores in multi-core cable

- 5) For the low-level sensor signals and relay signals with a common, lay the two cables close to each other, preventing too large loop area. Make sure to use the twisted pair for the analog signal. Lay the digital signal cables close to each other.

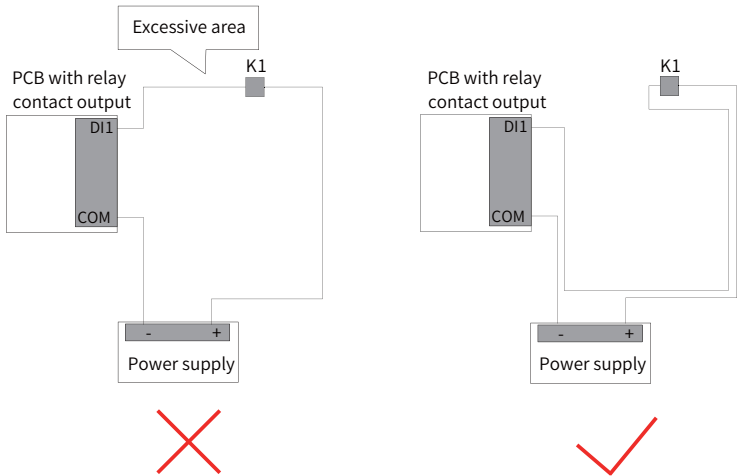


Figure 3-6 Routing for preventing too large loop area

- 6) Lay multiple types of cables along the metal block with equipotential connection and separate them to improve internal EMC. If cables in the same metal (zinc-iron or stainless steel) duct are separated with metal plate, the effect will be better.

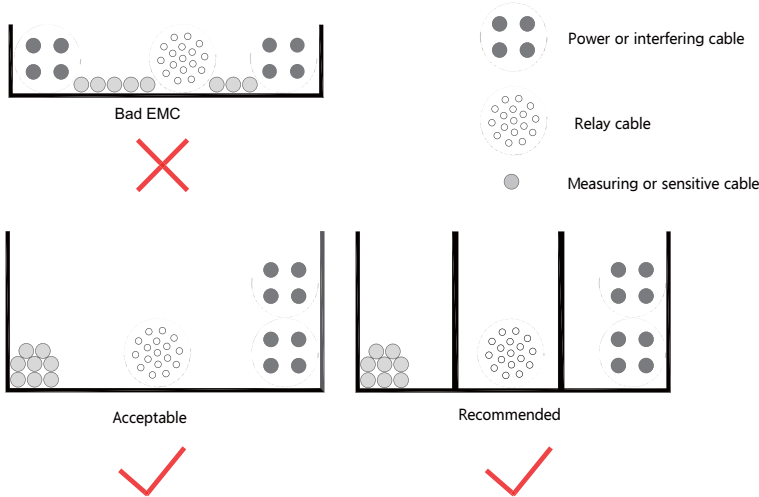


Figure 3-7 Routing of multiple types of cables

- 7) The unshielded part of the shielded cable must be as short as possible, and the shield braid is connected to the nearest PE end. If the stripped part is long, the cable is prone to interference, especially for encoder signals.

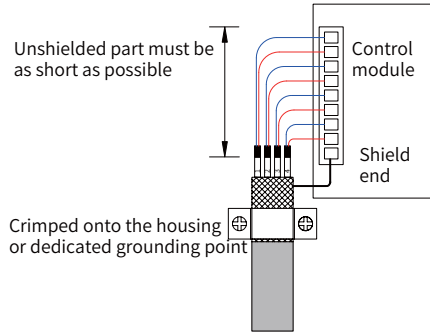


Figure 3-8 Requirements on shielded power cables

3.2.3 Connection of Shielded Power Cables

The input power cable and shield inside the regenerative rectifier module must be in large-area contact with the shield plate in the cabinet modules to achieve good EMC effect. The following figure shows the connection diagram.

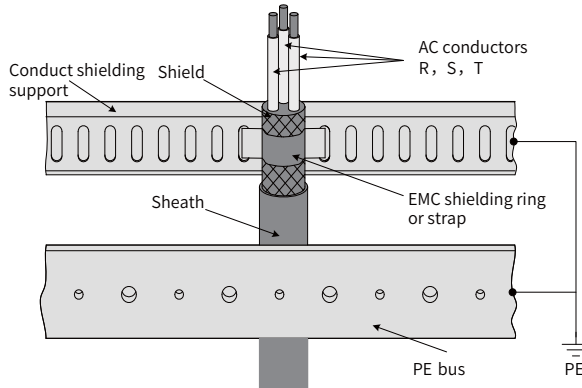


Figure 3-9 Connection of shielded power cables

3.3 Pre-charging the DC Link Capacitor

The DC side of the regenerative rectifier module contains several electrolytic capacitors. Their service life depends on working time, load and ambient temperature. The service life can be extended by lowering the ambient temperature.

Capacitor failures are often accompanied by device damage and input fuse failure or fault trip. If you suspect a capacitor failure, contact Unity Drive. You can acquire spare parts from Unity Drive. Do not use spare parts not specified by Unity Drive.



- ◆ The cabinet unit must not be stored for more than two years. If the cabinet unit is stored for more than two years, the DC link capacitors in the equipment must be charged before commissioning. The storage period is calculated from the date of manufacture rather than the date that the equipment was shipped.

For the charging procedure, see the following:

Charging requirements:

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

Recommended components for the charging circuit:

- ① 1 10 A/400 V, or 10 A/690 V three-phase fuse switch;
- ② 3 100 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;
- ③ 6 100 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;
- ④ Various small components, such as lamp holder and 1.5 mm² cable.

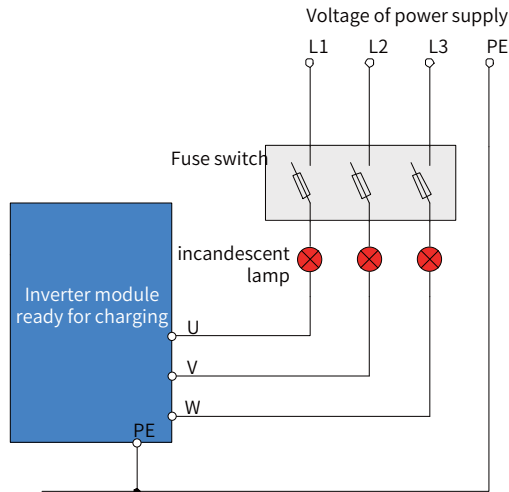


Figure 3-10 Charging connection diagram

3.4 Module Connection

3.4.1 Connection of Regenerative Rectifier Module

Terminals in the module are as follows:

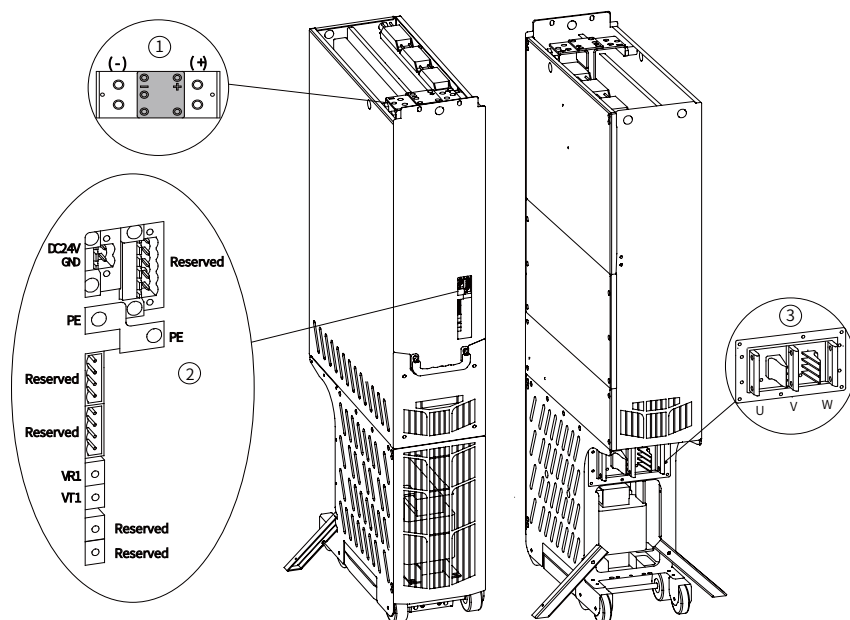


Figure 3-11 Terminals in the regenerative rectifier module (H8)

Table 3-1 Terminal connection parameters of the regenerative rectifier module (H8)

No.	Terminal	Description
1	(+), (-) DC output	400 V system: 540–590 VDC 690 V system: 740–975 VDC Connected to the M10/42N · m copper busbar
2	Power terminal (DC 24 V, GND) Optical fiber cable terminal (VR1/VT1)	Power terminal: 2-core twisted pair, single core, cross-sectional area: 0.5–2.5 mm ² Optical fiber cable terminal: for optical fiber cable connection
3	U, V, and W AC input terminals	Connected to the cabinet by quick connector

3.4.2 Connection of Regenerative Rectifier Filter Module

Terminals in the module are as follows:

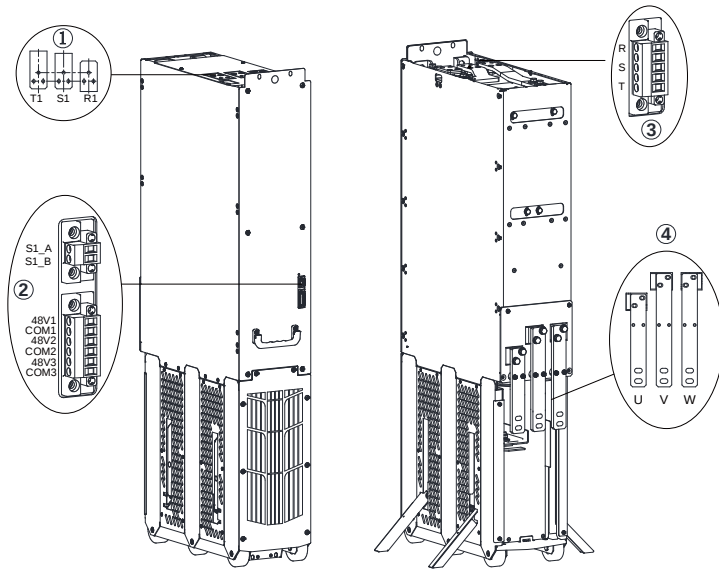


Figure 3-12 Terminals in the regenerative rectifier filter module (L)

Table 3-2 Terminal connection parameters of the regenerative rectifier filter module (L)

No.	Terminal	Description
1	R1, S1 and T1 AC input terminals	-
2	Reactor overtemperature switch (S1_A, S1_B)	-
	DC 48 V fan power input (48V1)	Do not connect to the wrong pole.
	DC 48 V fan power input (COM1)	
	DC 48 V fan power input (48V2)	
	DC 48 V fan power input (COM2)	
	DC 48 V fan power input (48V3)	
	DC 48 V fan power input (COM3)	
3	AC voltage detection (R) AC voltage detection (S) AC voltage detection (T)	Connect with HSVM -10 synchronous voltage detection module Connect according to the phase sequence
4	U, V and W AC output terminals	-

3.5 Connection of Frame Kit

3.5.1 Connection of L+H8 Frame Kit

Terminals in the L+H8 frame kit:

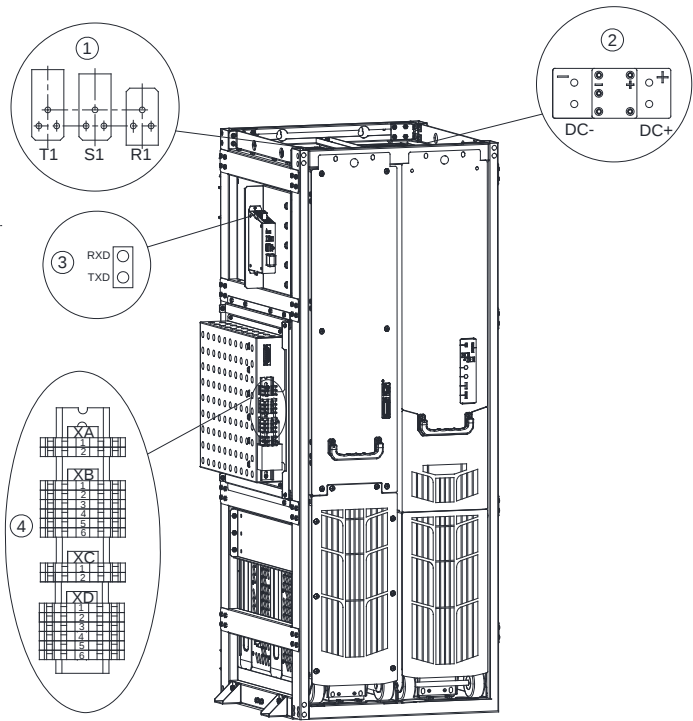


Figure 3-13 Terminals in the L+H8 frame kit

Table 3-3 L+H8 terminal connection parameters

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

No.	Terminal Mark	Description
3	RXD	Receive cable, , communicate with HCU through HOFM optical fiber expansion module with Inobus dedicated communication protocol
	TXD	Transmission cable, , communicate with HCU through HOFM optical fiber expansion module with Inobus dedicated communication protocol
4	XA:1	L reactor overtemperature switch S1_A
	XA:2	L reactor overtemperature switch S1_B
	XB:1	24 V terminal of external DC 24 V input
	XB:4	COM terminal of external DC 24 V input
	XC:1	fan power board input 1DC+
	XC:2	fan power board input 1DC-
	XD:1	Pre-charge circuit input R2, S2, T2
	XD:2	
	XD:3	
	XD:4	Pre-charge circuit output R3, S3, T3
	XD:5	
	XD:6	

Electrical connection of terminals:

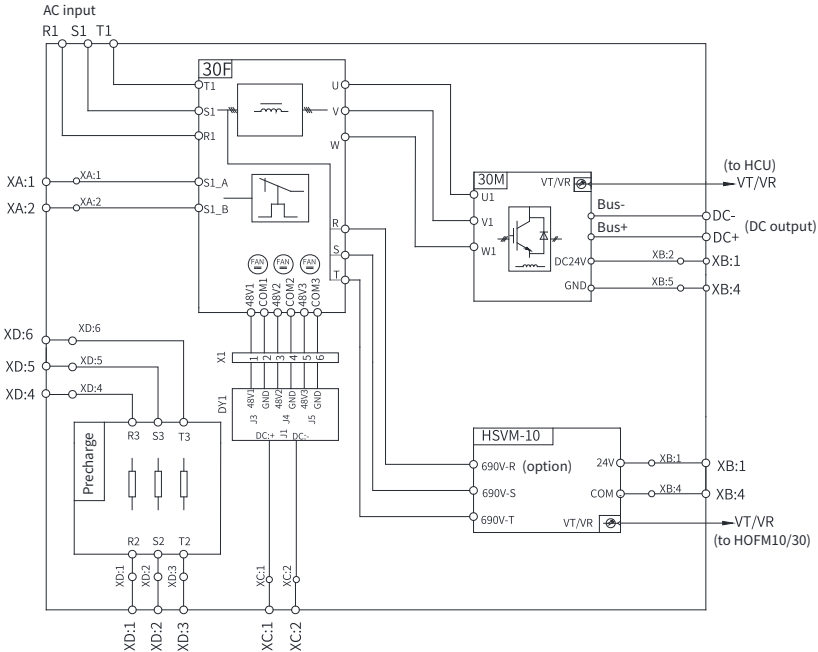


Figure 3-14 Terminals in the L+H8 frame kit

3.5.2 Connection of L+2H8 Frame Kit

Terminals in the L+2H8 frame kit:

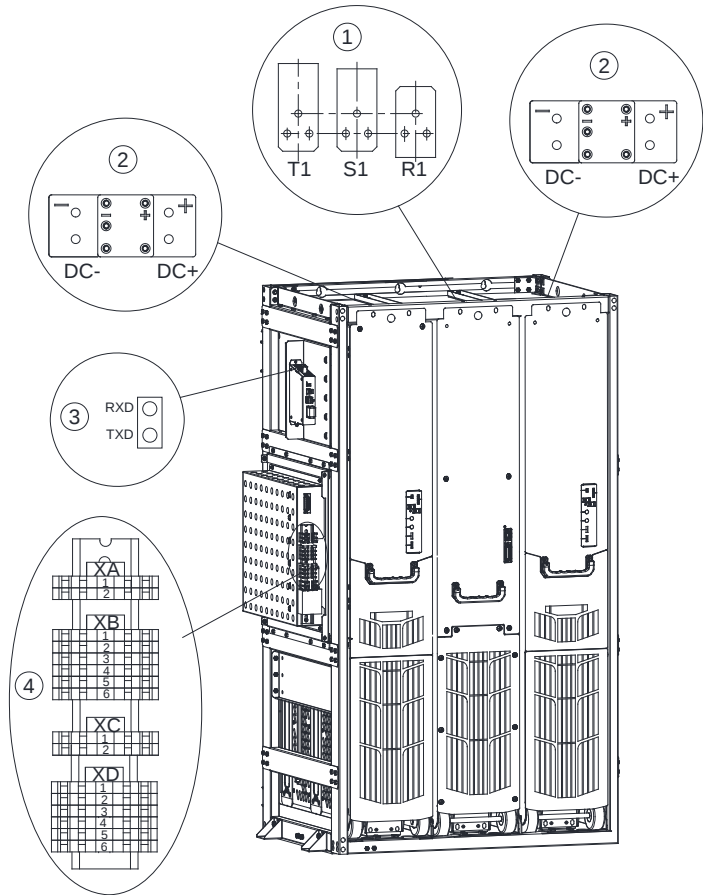


Figure 3-15 Terminals in the L +2H8 frame kit

Table 3-4 L+2H8 terminal connection parameters

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

No.	Terminal Mark	Description
3	RXD	Receive cable, , communicate with HCU through HOFM optical fiber expansion module with Inobus dedicated communication protocol
	TXD	Transmission cable, , communicate with HCU through HOFM optical fiber expansion module with Inobus dedicated communication protocol
4	XA:1	L reactor overtemperature switch S1_A
	XA:2	L reactor overtemperature switch S1_B
	XB:1	24 V terminal of external DC 24 V input
	XB:4	COM terminal of external DC 24 V input
	XC:1	Fan power board input 1DC+
	XC:2	Fan power board input 1DC-
	XD:1	Pre-charge circuit input R2, S2, T2
	XD:2	
	XD:3	
	XD:4	Pre-charge circuit output R3, S3, T3
	XD:5	
	XD:6	
	XD:6	

Electrical connection of terminals

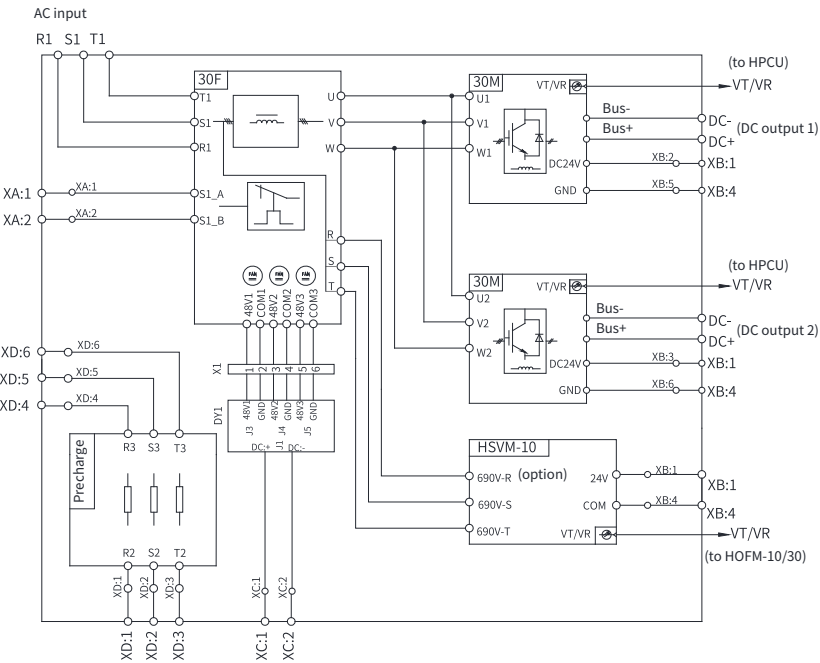


Figure 3-16 Terminals in the L+2H8 frame kit

3.6 Connection of the Cabinet

3.6.1 Connecting the incoming Cables

- 1) Preparation
 - Install and secure the cabinet units properly;
 - Take all the necessary safety measures at the installation location.
 - Obey the "Take 5 safety" rules.
- 2) 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:

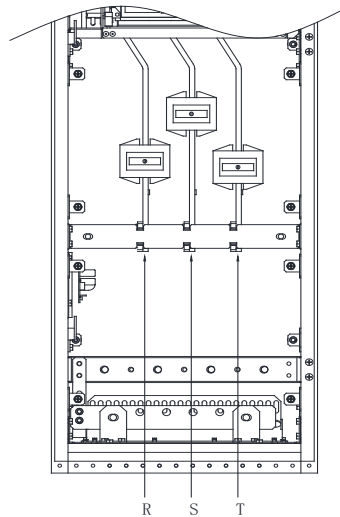


Figure 3-17 Position of the input copper busbar

Connection steps:

- ① Open the cabinet and remove the cover protecting the power cable terminal area;
- ② Feed the cables into the cabinet from the bottom;
- ③ Connect the PE cable to the PE busbar;
- ④ Lead the cables up to the terminals R, S, T on the copper bar.
- ⑤ Connect the cables to the copper busbar and secure them in appropriate position.
- ⑥ When shielded power cables are used, the shields must be secured to the shield plate in an EMC-compliant manner.

3.7 Cabinet Wiring

When the cabinet units are wired, the pre-charge circuit and the typical wiring method is as follows:

- 1) It is necessary to use the pre-charging resistor and the pre-charge contactor to charge the DC bus capacitor as shown in the following figure. During pre-charge, the resistor consumes energy as heat, therefore, frequent switch-on and switch-off are forbidden (interval between switch-ons must be larger than three minutes to prevent overheat which can damage the resistor).

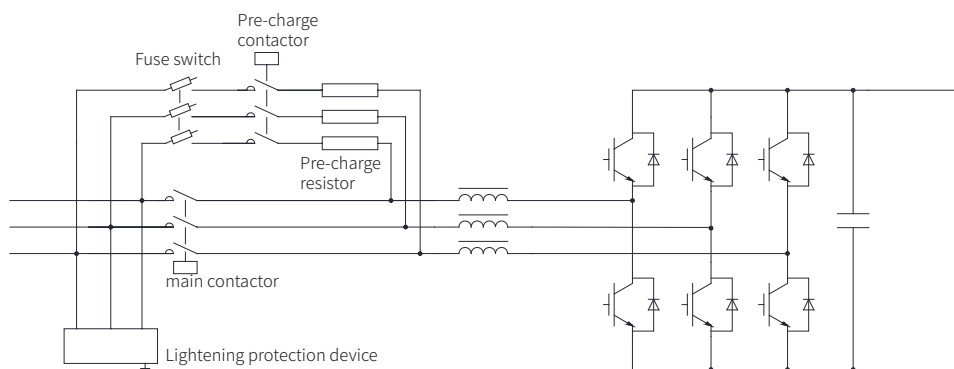


Figure 3-18 Pre-charging the DC bus capacitor

- 2) The following figure shows the typical wiring diagram of the rectifier frame kit and related modules :

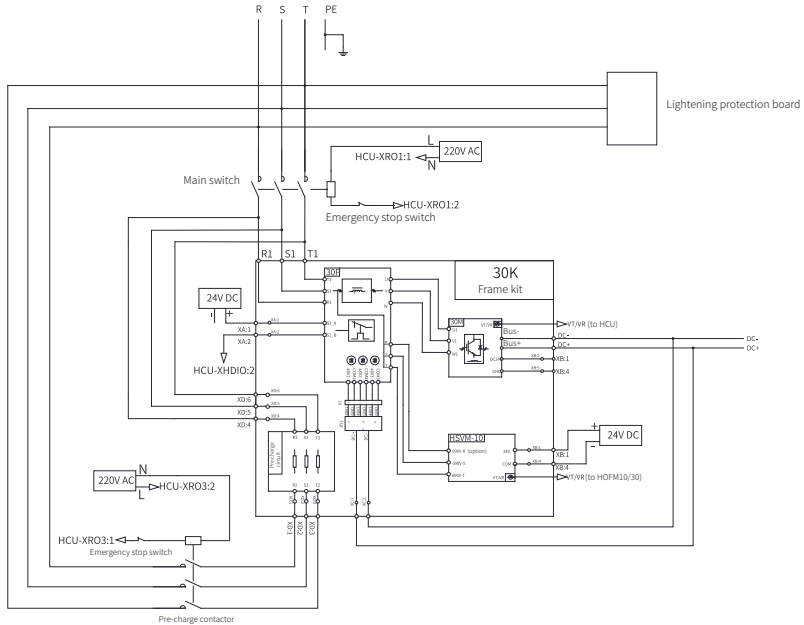


Figure 3-19 Typical cabinet wiring



NOTE

- ◆ For the details of how to use DI and DO of the HCU control module, See HCU Control Module User Guide.
- ◆ The three-phase voltage detection cable of the optional HSVM module needs to be connected to the terminals R, S, and T on the top of the regenerative rectifier filter module of the regenerative rectifier frame kit. The HSVM module can be installed on the reserved position at the left side of the frame. For the details on wiring, see "[Figure 3-14 Terminals in the L+H8 frame kit](#)" and "[Figure 3-16 Terminals in the L+2H8 frame kit](#)".
- ◆ When connecting the 1, 2, 3 of the XD terminal block, ensure that the phase sequence is correct. When connecting the 1 and 2 of the XC terminal block, ensure that the polarity of the bus is correct.
- ◆ Pre-charge contactor coil voltage 220 VAC, main contact rated current 32 A, recommended brand: Schneider LC1D32M7C.

3.8 Cable Specifications and Recommendation

Table 3-5 Recommended main circuit cables

Model	Rated Input Current (A)	Recommended Quantity and Diameter (mm ²)	Terminal
U _N : three-phase 400 VAC (range: 380–415 V)			
MD880-30M-0640-4	640	3 × 120	OT120-12
MD880-30M-0900-4	900	4 × 120	OT120-12
MD880-30M-1190-4	1190	5 × 120	OT120-12
MD880-30M-1674-4	1674	4 × 240	OT240-12
U _N : three-phase 690 VAC (range: 525–690 V)			
MD880-30M-0600-7	600	3 × 120	OT120-12
MD880-30M-0900-7	900	4 × 120	OT120-12
MD880-30M-1116-7	1116	5 × 120	OT120-12
MD880-30M-1674-7	1674	4 × 240	OT240-12



NOTE

- ◆ The cables recommended in the table are all symmetric 3-core shielded cables, which are connected to the three phases of the AC busbar. The sectional area of the PE cable must fulfill the following:
When the sectional area of the phase line $S \leq 16 \text{ mm}^2$, the sectional area of the PE cable = S ;
When the sectional area of the phase line $16 \text{ mm}^2 < S \leq 35 \text{ mm}^2$, the sectional area of the PE cable = 16 mm^2 ;
When the sectional area of the phase line $S > 35 \text{ mm}^2$, the sectional area of the PE cable = $S/2$.
- ◆ Note: $3 \times 120 \text{ mm}^2$ indicates that each phase requires 3 cables and the sectional area is 120 mm^2 .
- ◆ Note: OT/120-12 indicates a cable crimping ring tongue terminal, with a cable sectional area of 120 mm^2 and an M12 screw hole.
- ◆ Note the maximum size of the cable terminals listed in the following table. Use cable terminals within these limits. Otherwise, the mechanical stability and electrical clearance cannot be ensured.
- ◆ Derating calculations are required when using multiple cables of the same specification in parallel.

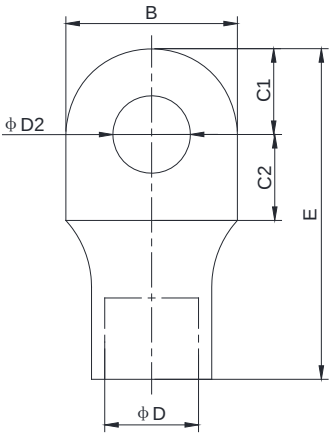


Figure 3-20 Terminal appearance

Table 3-6 Max. size of 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 Connection of HCU Control Module

For details about how to install the HCU control module and connect the control cable, see ["4 HCU Control Module"](#).

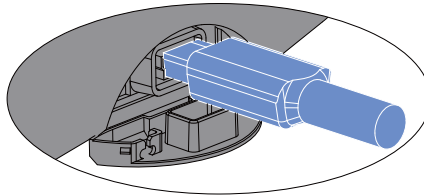
3.10 Connection between SOP-20-880 and PC

The mini-B type USB connector of the SOP-20-880 is to connect the PC, the USB cable length cannot exceed 3 m. The communication protocol is USB2.0 between the SOP-20-880 and the PC.

- 1) Open the cover at the USB connection terminal



- 2) Plug in the USB cable. It is recommended to use a cable with ferrite bead. See the following figure.



- 3) Connect the cable to the PC.

After the cable is connected to the PC, you are prompted to choose between the USB intermediate mode and USB mass storage mode.

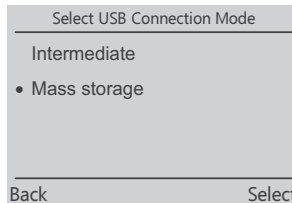


Figure 3-21 USB mode

When the USB intermediate mode is selected, the SOP-20-880 is used as an intermediate for the interaction between the PC tool and the drive; when the USB mass storage mode is selected, the SOP-20-880 can be used as a memory.

3.11 Connection between SOP-20-880 and Drive

The SOP-20-880 and the drive control board (such as the HCU) can be connected by a network cable that meets the EIA/TIA/568A or 568B standards with the RJ45 port on the back of the SOP-20-880. For details, see the HCU Control Module User Guide. Select a termination resistor through the jumper on the control board at the end of the communication network. It is recommended to use a twisted-pair shielded cable with a total length of 100 m as the bus cable of the SOP-20-880.

Table 3-7 Transmission distance, node quantity, and baud rate of SOP -20-880 bus

Distance (m)	Baud Rate (kbps)	Node Quantity	Wire Size	Remarks
100	1,000	32	$\geq 0.5 \text{ mm}^2$	When there are repeaters, the maximum number of nodes is 128;
50	2,000	32	$\geq 0.5 \text{ mm}^2$	When there is no repeater, up to 32 nodes are allowed;
25	4,000	32	$\geq 0.5 \text{ mm}^2$	When there is polarity offset, the maximum number of nodes is reduced by 4.

3.12 Installation Checklist

Use the checklist below to guide the electrical installation procedure for the cabinet. Read all the safety information in the section "[Safety Instructions](#)" before carrying out any work on the unit.

Table 3-8 installation checklist

Item	Check That	Compliance
1	Check the connection of input power and DC bus and ensure that the correct voltage is supplied.	☐
2	Check that the auxiliary power provides the correct voltage.	☐
3	For strain relief, the cables must be clamped on the cable rack.	☐
4	Check that the cables are properly connected with the required torque to the terminals provided.	☐
5	When EMC shielded cables are used, the cable shields must be secured to the shield plate in the regenerative rectifier equipment to ensure EMC compliance.	☐
6	For the regenerative rectifier, when the parallel output is connected to the DC bus, ensure that the connection is correct.	☐
7	The date of manufacture can be found on the nameplate of the regenerative rectifier. If the period from the date of manufacture to initial commissioning or the downtime of the power components is shorter than two years, the DC link capacitors do not have to be pre-charged. If the downtime is longer than 2 years, the capacitors must be pre-charged as described in " 3.3 Pre-charging the DC Link Capacitor ".	☐

Item	Check That	Compliance
8	The control cables must be connected in accordance with the interface assignment and the shield applied. To prevent interference, the control cables must be laid separately from the power cables. Cabling and connections must always comply with the relevant EMC directives.	☐
9	Check that the control cable (if any) is connected to the corresponding terminal and the terminal is tightened. Check by pulling the cable.	☐
10	Check that the input power cable is connected to the corresponding terminals, the phase sequence is correct, and the terminals are tightened. Check by pulling the cable.	☐

4 HCU Control Module

The HCU-30 control module controls the regenerative rectifier module through high-speed optical fiber, which is normally installed in the auxiliary control cabinet.

The HCU-30 control module has an external 24 V DC power supply, and internal multiple isolated power supplies which provide isolated digital power 24 VD, InoLink communication RS485 isolated power and SOP-20-880 power. It can also provide power to the function modules installed on HCU-30 expansion slots. The HCU-30 control module program can be upgraded through a PC or SOP-20-880.

4.1 Components of HCU Control Module

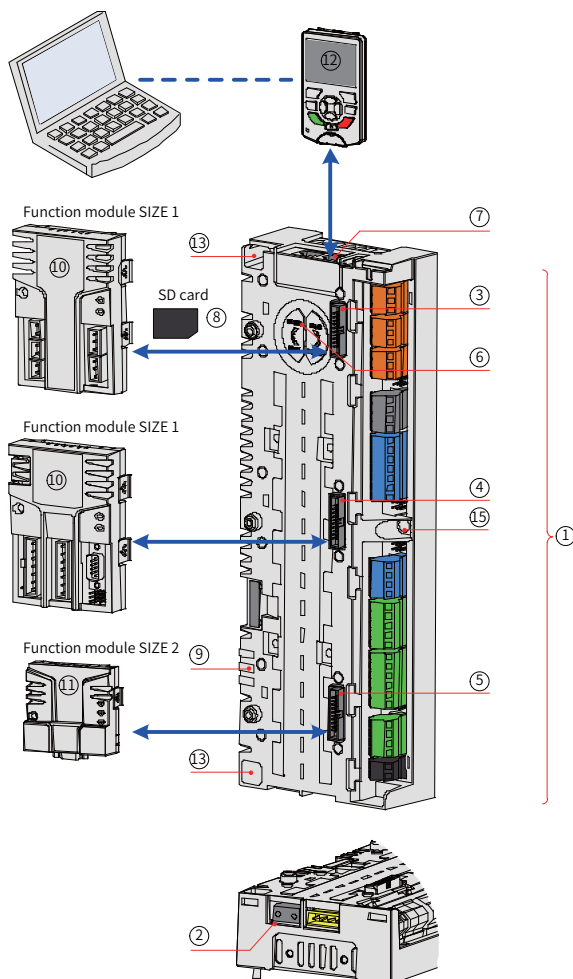


Figure 4-1 HCU control module

Table 4-1 Functions

No.	Component Name	Function
1	User terminal	Standard user input and output terminals
2	Optical fiber communication port	Optical fiber communication port between the HCU-30 and the regenerative rectifier module
3	SLOT1 slot	Function module interface: SLOT1_1, SLOT1_2 and SLOT1_3
4	SLOT2 slot	Function module interface: SLOT2_1, SLOT2_2 and SLOT2_3
5	SLOT3 slot	Function module interface: SLOT3_1
6	Battery cover	Spare RTC battery cover. The RTC battery is non-rechargeable lithium battery which must be replaced regularly
7	Smart operation panel (SOP) terminal	For connection between the HCU and SOP-20-880. The two RJ45 ports are identical and easy to cascade
8	SD card	An 8 G microSD memory card, which can be flexibly inserted and removed
9	Indicators	Power, run and fault indicators
10	Function module SIZE1	105 x 73 x 24 (mm) function module
11	Function module SIZE2	75 x 73 x 24 (mm) function module
12	SOP-20-880 smart operation panel	Display and control
13	Fixing hole	Holes for fixing the HCU. Quantity: 3



NOTE

- ◆ Functional modules are directly installed in SLOT1, SLOT2 and SLOT3. The addresses are SLOT1_1, SLOT2_1 and SLOT3_1;
- ◆ The SLOT1 and SLOT2 slots can be used with the HOFM-30 and HESD-10 to achieve slot expansion;
- ◆ SLOT3 does not support slot expansion.

4.2 LED indicator

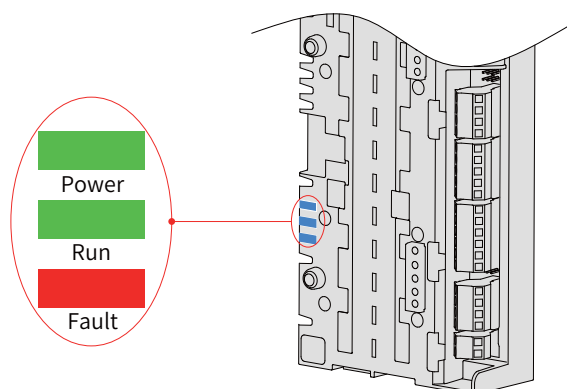


Figure 4-2 Position and Definition of LED indicators

Table 4-2 Description

No.	Name	Status	Description
1	Power	Steady ON	HCU power supply is normal
		OFF	HCU is not energized or the power supply has failed
2	Run	Steady ON	Power module is running
		OFF	Power module is not running
3	Fault	Steady ON	System fault occurs
		OFF	System is normal
		Flashing	HCU auxiliary power has failed. Check all auxiliary power supplies for short circuit or overload
4	Fault, Run	Flashing	PC or SOP-20-880 selects the HCU and ends after 10s

4.3 SD Memory Card

The HCU is internally equipped with an SD card for storing real-time data from all stages of the control module to assist in monitoring and analyzing the power module. The data is stored on a microSD memory card and analyzed by a qualified service technician.

4.4 Dimensions and Installation Instructions

4.4.1 Preparation



- ◆ Before installing or removing the HCU, the cabinet must be powered off for more than 15 minutes. The HCU input power must be disconnected to avoid damage to the HCU control module caused by live installation or removal.
 - ◆ When installing or removing a function module on the HCU, you must ensure that the HCU input power is disconnected to avoid damage to the HCU or function module caused by live installation or removal.
 - ◆ Protect the HCU module from falling or impact to avoid damage to the module;
 - ◆ Do not disassemble the HCU module, otherwise the module may be damaged;
 - ◆ Do not use excessive torque to tighten the terminals to avoid damage.
-

1) Tools

The following tools are required:

1# Phillips screwdriver

2) Tightening torques of fasteners

The following tightening torques apply to the screws used for HCU installation:

Screw	Tightening Torque
M3	0.55 N·m

4.4.3 Space

To install the HCU, certain space must be reserved as shown below. The HCU must be mounted on a conductive metal surface and ensure that the entire conductive bottom of the HCU is in good contact with the surface.

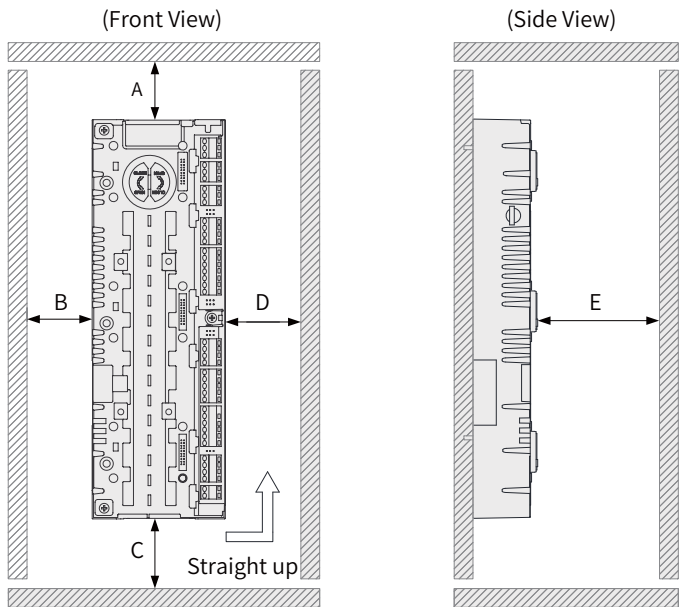


Figure 4-4 Installation space

Table 4-3 Installation space (unit: mm)

A	B	C	D	E
≥ 100	≥ 30	≥ 100	≥ 50	≥ 100

4.4.4 Installation Procedure

Step 1: Align the HCU vertically with the two positioning holes on the metal mounting plate.

Step 2: Tighten the HCU mounting screws with a 1# Phillips screwdriver (3 M4 screws are already fixed in the HCU) as shown below.

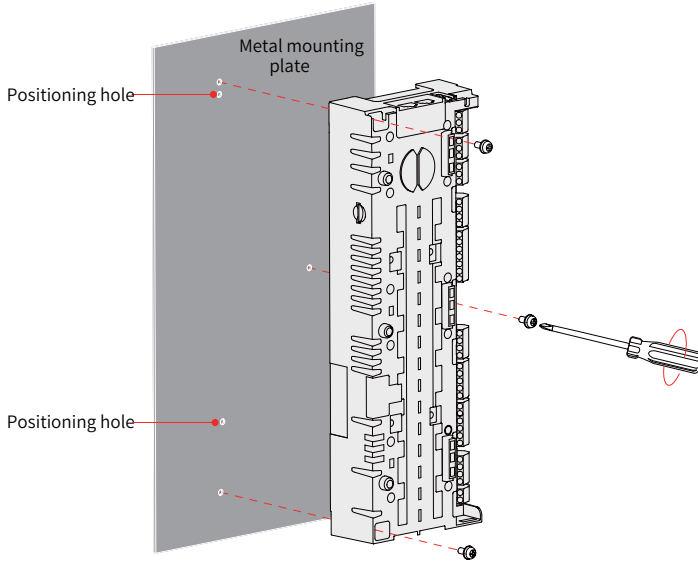


Figure 4-5 Installing the HCU control module

■ Grounding inside the cabinet

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

The HCU housing will be grounded to the cabinet housing through the screws on the mounting surface.



4.5.1 HCU Standard Terminals

Table 4-4 HCU standard terminals

Name	Mark	Description
Input Power	XPWR: 24VI	HCU power supply
Digital power output	XPWR: 24VD	Digital output power isolated from XPWR
Digital input	XDI: DI1–DI6, DIL	Input type: relay contact, NPN or PNP
High-speed digital input	XHDIO: HDI1, HDI2	Input type: NPN or PNP
High-speed digital output	XHDIO: HDO1, HDO2	Output type: open collector
Analog output	XAO: AO1, AO2	Output type: current or voltage, selected by jumper
Analog input	XAI: AI1, AI2	Input type: current or voltage, selected by jumper
relay output	XRO1, XRO2, XRO3	Relay output: NO, NC and COM
Inolink communication	XCOMM	High speed RS485, bus resistor is selected by jumper
RJ45 terminal	X11, X12	For communication with the SOP-20-880 or PC (requires RS485-RS232 converter). Both are identical for multiple HCU cascade; connection cable < 3 m
Inodrive communication	VR, VT	For communication with the regenerative rectifier module

4.5.2 HCU-30 Terminals

Table 4-5 HCU-30 default I/O terminals

No.	Terminal	Function Description	Remarks
1	XRO1	Main circuit breaker control signal	Unmodifiable
2	XRO2	Fault output signal	Default function, configurable
3	XRO3	Pre-charge contactor control signal	Unmodifiable
4	DI1	Reserved	Configurable
5	DI2	Power on signal	Default function, configurable
6	DI3	Main circuit breaker contact NC signal	Unmodifiable
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	Unmodifiable
11	DIL	Emergency stop	Default function, configurable

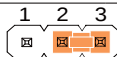


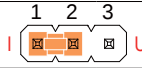
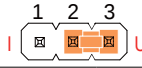
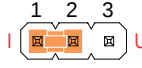
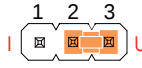
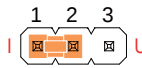
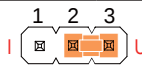
NOTE

◆ To modify the default configuration, see MD880-30 Series Regenerative Rectifier Software User Guide.

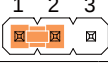
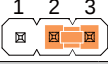
4.5.3 Detailed Description of Terminals

Table 4-6 Detailed description of HCU control module terminals

Terminal	Name	Function	Specification
XPWR: input power terminal			
1	GND	24.0 VDC±10% 2.0 A	2-core twisted pair cable is recommended Cross-sectional area: 0.5–2.5 mm ²
2	24VI		
XDPWR: DIL terminal			
1	24VD	Provide power for DI, HDI and HDO 24.0 VDC±10% 0.2 A	Twisted pair, single core Cross-sectional area: 0.5–2.5 mm ² Note: the load of 24VD must not exceed 0.2 A
2	DGND	24VD GND	
3	DICOM	DI common output; can be connected to DGND through jumper J11	
4	DIL	Digital interlock or common DI; technical parameters are the same as common DI	
Jumper J16: power supply selection			
1 2 3  By shorting 1 and 2, DI is powered by 24VD internal power supply			
1 2 3  By shorting 2 and 3, DI is powered by external power supply			
XDI: DI input terminal			
1	DI1	24 V logic level: "0" < 5 V; "1" > 15 V; Rin: 2.0 kohm Input type: NPN/PNP, relay contact Hardware filtering: 0.04 ms Imax: 15 mA	Single core cable Cross-sectional area: 0.5–2.5 mm ²
2	DI2		
3	DI3		
4	DI4		
5	DI5		
6	DI6		
XHDIO: HDIO input terminal			
1	OP	HDI common terminal	Cross-sectional area: 0.5–2.5 mm ² Shielded twisted pair cable is recommended HDO and DGND twisted pair HDI and OP twisted pair
2	HDI1	Input type: NPN, PNP 24V logic level: "0" < 5 V; "1" > 15 V; Rin: 2.0 kohm	
3	HDI2	Input voltage range: 0–30 VDC Input frequency range: 0–100 kHz HDI max. load Imax: 15 mA	
4	HDO1	Output type: OC Output frequency range: 0–100 kHz HDOmax. load Imax: 20 mA	
5	HDO2	Output voltage range: 0–26.4 VDC	

Terminal	Name	Function	Specification
XAO: AO output terminal			
1	AO1	AO1 output range: 0–20 mA, $R_{load} \leq 500 \text{ ohm}$	Cross-sectional area: 0.5–2.5 mm ² Shielded twisted pair cable is recommended AO1 and AO1_AGND twisted pair AO2 and AO2_AGND twisted pair
2	AO1_AGND	0–10 V, $R_{load} \geq 10 \text{ kohm}$	
3	AO2	AO2 output range: 0–20 mA, $R_{load} \leq 500 \text{ ohm}$ 0–10 V, $R_{load} \geq 10 \text{ kohm}$	
4	AO2_AGND	Resolution: 11 bit + sign bit Accuracy: 2% full scale range	
Jumper J19: AO1 current and voltage signal selection			
 AO1 current signal output by shorting 1 and 2			
 AO1 voltage signal output by shorting 2 and 3			
Jumper J18: AO2 current and voltage signal selection			
 AO2 current signal output by shorting 1 and 2			
 AO2 voltage signal output by shorting 2 and 3			
XAI: AI input terminal			
1	AI1-	Current input: -20 m to +20 mA, R_{in} : 500 ohm	Cross-sectional area: 0.5–2.5 mm ² Use two 2-core twisted-pair shielded cables when using two-way AI; Uses one 4-core twisted pair shielded cable for one-way AI when reference voltage is provided
2	AI1+	Voltage input: -10 V to +10 V, R_{in} : 200 kohm	
3	AI2-	Differential input, input range: $\pm 30 \text{ V}$	
4	AI2+	Sample interval per channel: 0.25 ms Hardware filtering: 0.25 ms Resolution: 11 bit + sign bit Accuracy: 1% full scale range	
5	+10 V	+10 V: $+10 \text{ V} \pm 1\%$	
6	-10V	-10 V: $-10 \text{ V} \pm 1\%$	
7	AGND	$R_{load} 1\text{--}10 \text{ kohm}$	
Jumper J14: AI1 current or voltage signal Input selection			
 AI1 current signal Input by shorting 1 and 2			
 AI1 voltage signal Input by shorting 2 and 3			
Jumper J15: AI2 current and voltage signal selection			

Terminal	Name	Function	Specification
1 2 3  AI2 current signal Input by shorting 1 and 2			
1 2 3  AI2 voltage signal Input by shorting 2 and 3			
XCOMM: InoLink RS485 communication terminal			
1	SHIELD	RS485 bus, 5 V standard level Bus resistor: 124 ohm Max. communication speed: 5 Mbps Max. number of nodes: 32 (no repeater) Max. transmission distance: 40 m	4-core shielded twisted pair cable Cross-sectional area: 0.5–2.5 mm ² When used for Inolink, the maximum number of nodes is 16, the maximum speed is 5 Mbps, and the maximum cable length is 40 m
2	C485+		
3	C485-		
4	CGND		
Jumper J10, J12: RS485 bus termination resistor selection, must select the same status			
1 2 3  Connect the termination resistor by shorting 1 and 2			
1 2 3  Disconnect the termination resistor by shorting 2 and 3			
XRO1: output terminal of relay 1			
1	RO1_NO	Output type: passive NO and NC contacts Contact parameters: 250 VAC/30 VDC, 2 A	Single core Cross-sectional area: 0.5–2.5 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 parameters: 250 VAC/30 VDC, 2 A	Single core Cross-sectional area: 0.5–2.5 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 parameters: 250 VAC/30 VDC, 2 A	Single core Cross-sectional area: 0.5–2.5 mm ²
2	RO3_COM		
3	RO3_NC		
X11, X12: SOP-20-880 RS485 communication terminal			
1, 2, 7	NC	RS485 bus, 5 V standard level Bus resistor: 124 ohm Max. communication speed: 4 Mbps Max. number of nodes: 32 (no repeater) Max. transmission distance: 100m	Standard network cable
3, 8	GND3		
4	A		
5	B		
6	15V3		
		15V3: 15 V ± 15%	

Terminal	Name	Function	Specification
Jumper J12, J15: bus resistor selection, J12 and J15 must select the same status			
 Connect the resistor by shorting 1 and 2			
 Disconnect the resistor by shorting 2 and 3			
VR, VT: transceiver			
1	VR	Receive optical fiber communication signals	Optical fiber Type: plastic optical fiber (POF)
2	VT	Transmit optical fiber communication signals	

4.6 HPCU Parallel Control Module

The HPCU is a parallel control module, which acts as an intermediate device. The HPCU can receive the driving signals and control signals delivered by the HCU and synchronously transmit them to each regenerative rectifier module; at the same time, the current, voltage, status and other information reported by each regenerative rectifier module are quickly collected and transmitted to the HCU; it also controls the synchronization, current sharing, reset, and start and stop of all paralleled regenerative rectifier modules.

Depending on system requirements, HPCU-40 (up to 4 parallel modules), HPCU-60 (up to 6 parallel modules) or HPCU-A0 (up to 10 parallel modules) can be selected.

4.6.1 HPCU Standard Terminals

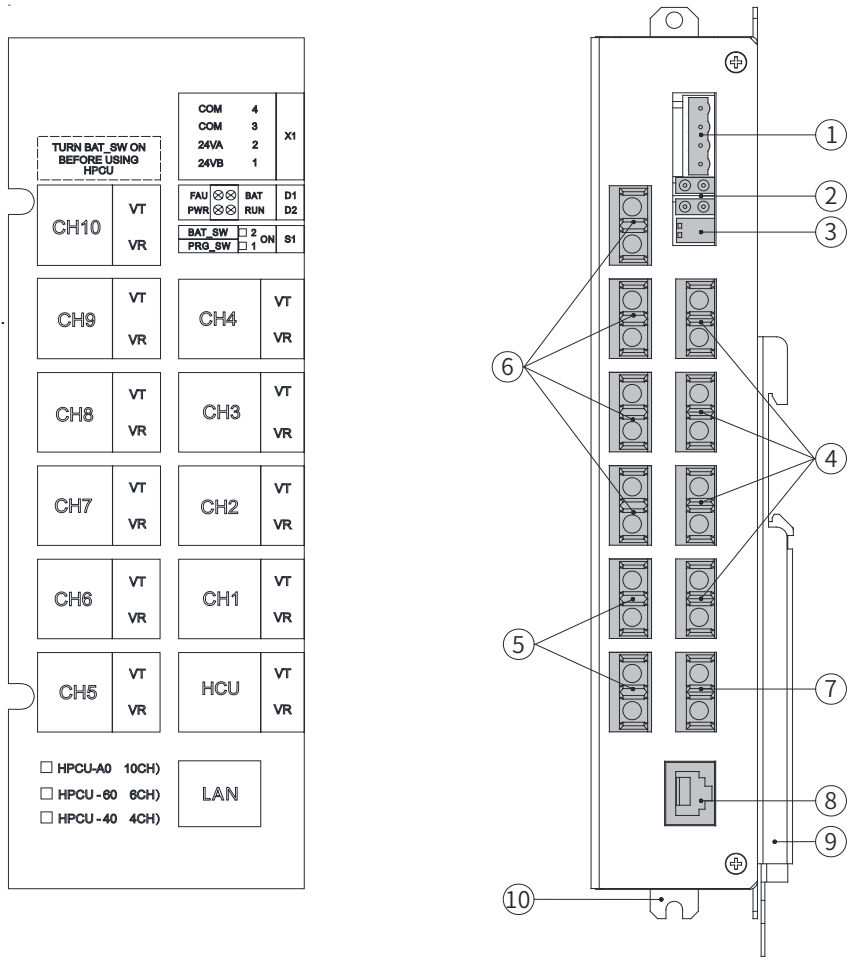


Figure 4-7 HPCU control module

Table 4-7 HPCU functions

No.	Description	Terminal	Description	Description
1	Power supply X1	COM 4	24 V GND	External power supply of HPCU X1 terminal: 5.08 mm pitch, 4-pin black pluggable terminal twisted pair cable Cross-sectional area: 0.5–2.5 mm ²
		COM 3	24 V GND	
		24VA 2	24 V+	
		24VB 1	24 V+	
2	LED indicator	PWR	Steady on in green	HPCU power supply is normal
			OFF	HPCU is not energized or the power supply has failed
		RUN	Steady on in green	Power module is running
			OFF	Power module is not running
		FAU	Steady on in red	System fault occurs
			OFF	System is normal
		BAT	Steady on in red	Battery undervoltage
			OFF	Battery is normal
3	DIP switch S1	BAT_SW	Battery switch	When the battery is not in use for a long time, switch to OFF position (in the opposite direction of ON)
		PRG_SW	Reserved	-
4	Optical fiber transceiver	CH1 to CH4	Parallel module channel 1–channel 4	VT: 50 M, transmit optical fiber communication signals VR: 50 M, receive optical fiber communication signals Optical fiber Type: plastic optical fiber (POF) HPCU-40 contains channels: CH1–CH4 HPCU-60 contains channels: CH1–CH6 HPCU-A0 contains channels: CH1–CH10
5		CH5 to CH6	Parallel module channel 5–channel 6	
6		CH7 to CH10	Parallel module channel 7–channel 10	
7		HCU	Communication between HPCU and HCU	
8	-	LAN	Commissioning terminal	Connection with PC
9	Guide rail groove	-	For guide rail installation	-
10	Mounting hole	-	4 holes for securing installation	-

4.6.2 LED Indicators

Table 4-8 Description

No.	Description	Status	Function
1	PWR	Steady on in green	HPCU power supply is normal
		OFF	HPCU is not energized or the power supply has failed
2	RUN	Steady on in green	Regenerative rectifier module is running
		OFF	Regenerative rectifier module is not running
3	FAU	Flashing in red	System fault occurs
		OFF	System is normal
4	BAT	Steady on in red	Battery undervoltage
		OFF	Battery is normal

4.6.3 Electrical Connection of HPCU

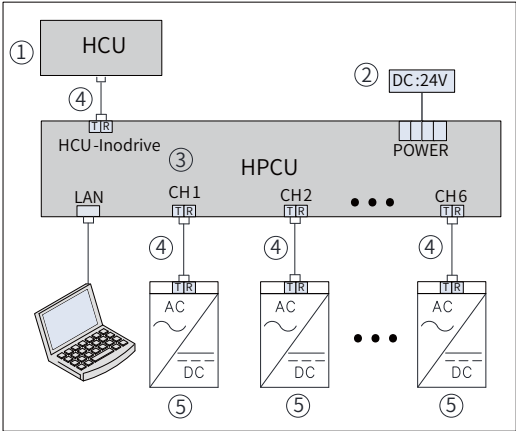


Figure 4-8 Electrical connection block diagram

Table 4-9 HPCU components

No.	Description	No.	Description
1	HCU control module	2	24 V external power supply
3	HPCU parallel control module	4	Optical fiber communication port
5	Regenerative rectifier module	-	-

4.7 Applications of HCU

4.7.1 Function Modules Used with HCU

The HCU can be used with other function modules to expand its functions. Specific information is as follows:

Table 4-10 Function modules used with HCU

No.	Description	Model	Function Description	Connection Method	Dimensions
1	I/O module	HIO-10	2 AIs 2 AOs 2 DIos One relay output	SLOT	105x73x24
2	PROFIBUS-DP module	HDP-10	PROFIBUS-DP bus adaptation	SLOT	75x73x24
3	CANbus module	HCAN-10	CANopen bus adaptation	SLOT	75x73x24
4	MODBUS RTU module	HMBA-10	MODBUS RTU bus adaptation	SLOT	75x73x24
5	EtherNet module	HETN-10	EtherNet commissioning module	SLOT	75x73x24
6	PROFINET I/O module	HPFN-10	PROFINET I/O Industrial Ethernet	SLOT	75x73x24
7	MODBUS TCP module	HMBT-10	MODBUS TCP industrial Ethernet	SLOT	75x73x24
8	Optical fiber expansion module	HOFM-10	1 pair of 50 M optical fiber cables	SLOT	75x73x24
		HOFM-30	3 pair of 50 M optical fiber cables	SLOT	75x73x24
9	Parallel control module	HPCU-40	Support 2–4 parallel modules	Optical Fiber	232x86x40
		HPCU-60	Support 2–6 parallel modules	Optical Fiber	232x86x40
		HPCU-A0	Support 2–10 parallel modules	Optical Fiber	232x86x40
10	Expansion module	HESD-10	Expand one SLOT expansion slot	Optical Fiber	105x75x70
11	Synchronous Voltage Detection Module	HSVM-10	AC voltage detection	Optical Fiber	150x100x30
		HSVM-20	DC voltage detection	Optical Fiber	150x100x30
12	SOP	SOP-20-880	Display and control	RS485	150x100x30

No.	Description	Model	Function Description	Connection Method	Dimensions
13	Optical Fiber routing control module	HOFR-50	Support data exchange between 5 HCU control modules	Optical Fiber	232x86x40
14	Pulse-by-pulse current limit module	HCBC-A0	Wave-by-wave current limiting control for parallel power modules	Optical Fiber	232x86x40



NOTE

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

4.7.2 Combination of HSVM-10 and HCU

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

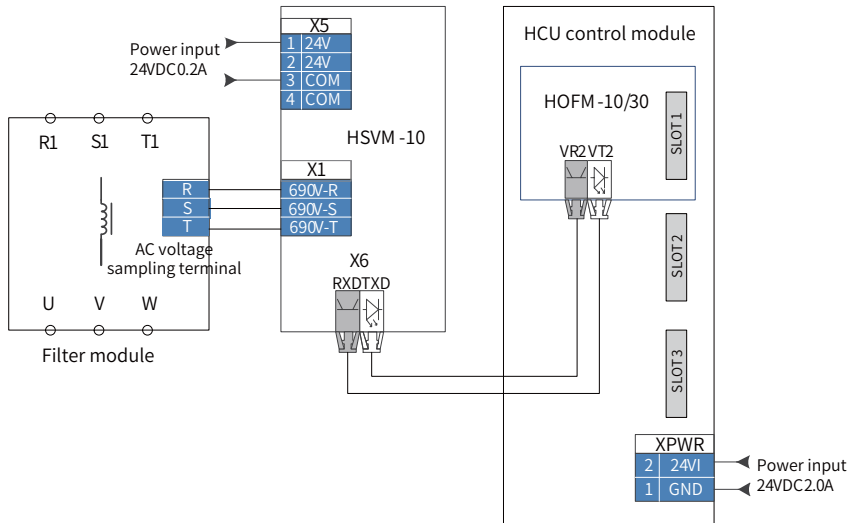


Figure 4-9 Cable connection example



NOTE

- ◆ The HSVM-10 uses 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.

4.7.3 SLOT Expansion

Different function modules are available in the HCU application. The function modules are installed directly in the SLOT slots of the HCU.

The HCU only has three SLOT slots. When more modules are needed, install HOFM and HESD expansion modules. Each HESD can connect to one function module.

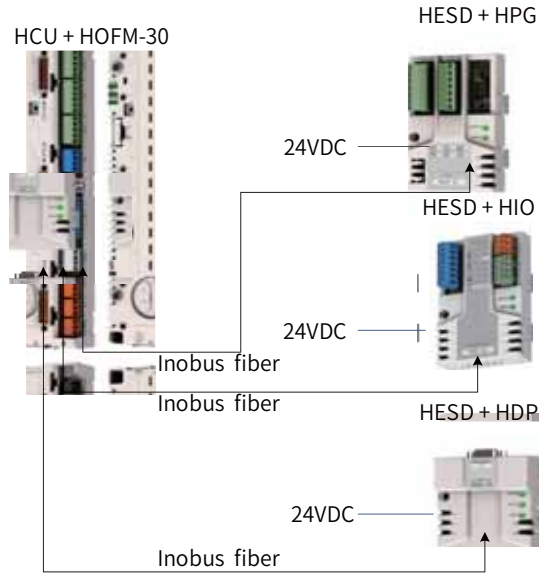


Figure 4-10 HESD wiring example



NOTE

- ◆ Functional modules can be directly installed in SLOT1, SLOT2 and SLOT3. The addresses are: SLOT1_1, SLOT2_1 and SLOT3_1 respectively;
- ◆ The SLOT1 and SLOT2 slots can be used with the HOFM-30 module to achieve three SLOT slot expansions respectively. The addresses are 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 install another HOFM optical fiber expansion module.

4.7.4 Temperature Measurement with AI and AO

AI and AO, which can be used together to detect the PT100 temperature sensor signal, are generally used for motor temperature detection, with either single PT100 or 1–3 PT100's in series. AO selects constant current output and AI selects voltage signal input.

Do not directly ground both ends of the cable shield. Directly ground one end and suspend the other end, or directly ground one end and ground the other end after passing through a string capacitor.

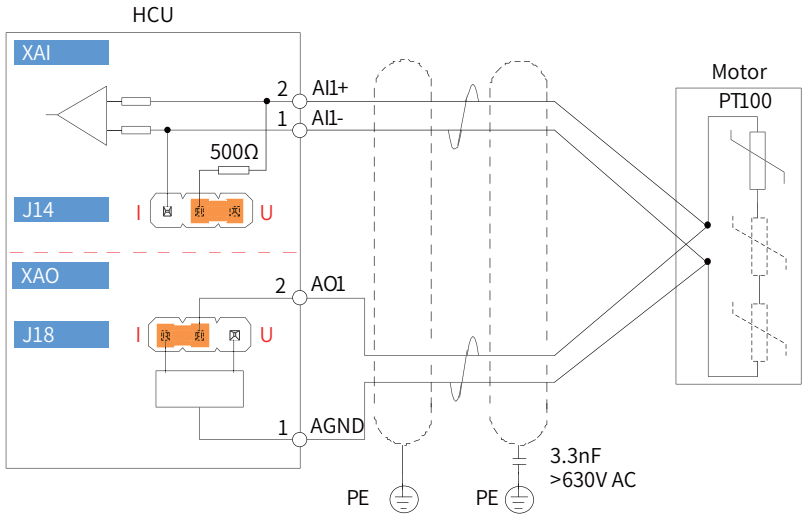


Figure 4-11 Temperature measurement with AI and AO

4.7.5 InoLink Communication Bus

When information exchange is required between several regenerative rectifier modules in the system, use an InoLink bus.

The parameters of the InoLink bus are as follows:

Baud rate: 5 Mbps

Max. number of nodes: 16

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

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

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

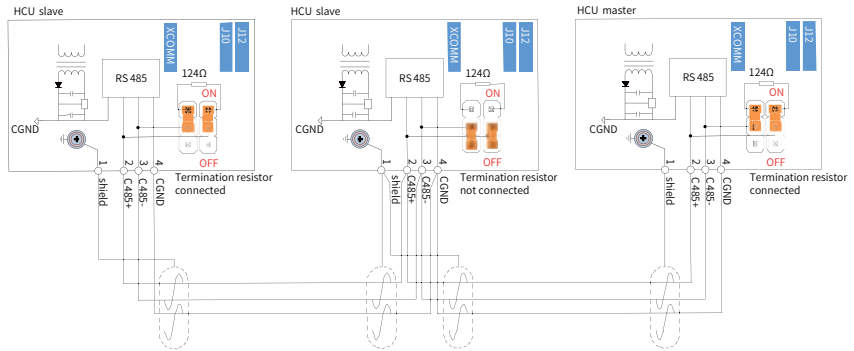


Figure 4-12 Application example

4.7.6 Communication

The communication between the HCU control module and the SOP-20-880 or PC is achieved through X11 and X12 terminals using RS485 mode, with one SOP-20-880 or PC as the master, and multiple HCUs as the slaves. X11 and X12 are RJ45 terminals with identical pin definitions for cascading.

1) Connection with SOP-20-880

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

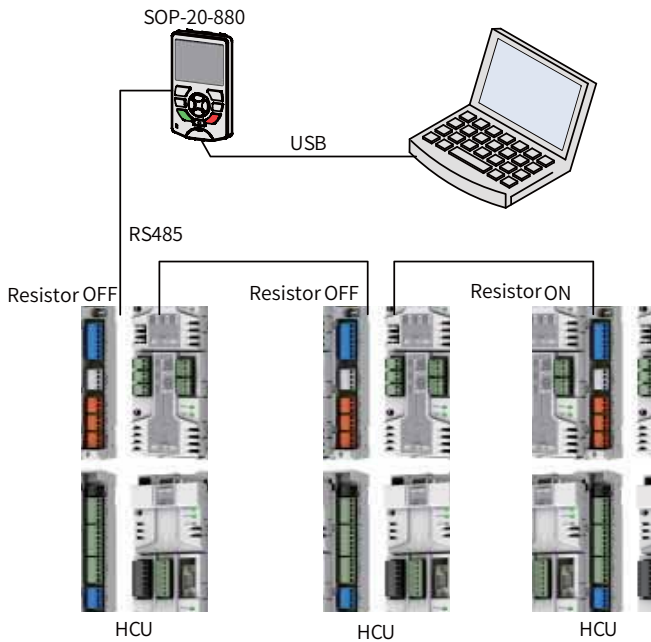


Figure 4-13 Connection with SOP-20-880

2) Connection with PC

The PC is the master, the HCU is the slave. A conversion module (RS485–RS232 converter or USB) is required between the PC and the HCU; the conversion module and the far-end HCU must be equipped with a termination resistor.

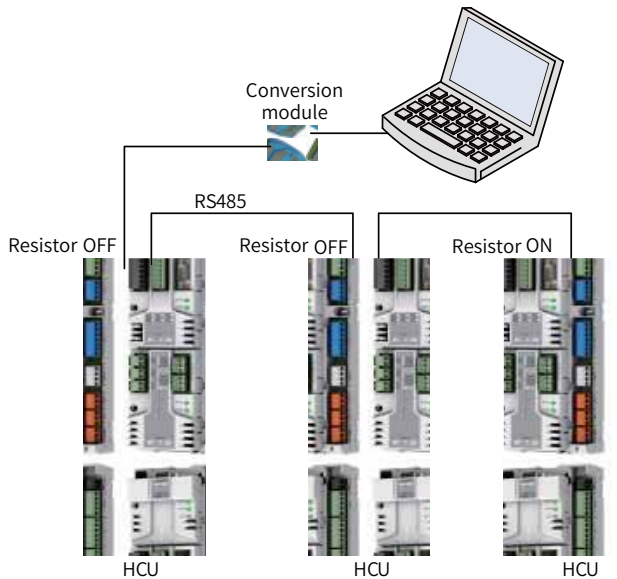


Figure 4-14 Connection with PC



- ◆ Do not connect the RJ45 ports of X11 and X12 on the HCU directly to the network port of the PC through a network cable. Otherwise, the PC or HCU may be damaged.

5 Maintenance and Inspection

5.1 Overview

This section describes:

- Cautions on maintenance and inspection:
- Periodical maintenance and inspection of components
- Replacement of components

Necessary safety measures must be taken before starting maintenance and inspection.

Safety instructions	
	DANGER
◆ Note that the regenerative rectifier module is energized with high voltage, and all connection work must be carried out with the module de-energized! ◆ Before maintenance, power off the module, wait for 15 minutes and confirm that the voltage of the module is lower than 36 VDC, otherwise the residual charge on the capacitor will cause personal injury! ◆ When external power supply is connected, hazardous voltage are still present in the cabinet and modules even if the main breaker is open. Ensure that no voltage is present before operation. ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Mount and wire the equipment in line with the national standards, industry standards and local safety codes. ◆ Some equipments are very heavy or top heavy and thus must be handled with care. If they are hoisted or transported improperly, severe personal injury or even death or severe property loss may occur. ◆ Be aware of the possibly residual rotation of the cooling fan.	

5.2 Precautions on Cleaning

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

Generally, observe the following points:

1) Dust

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

2) Ventilation

Always keep the ventilation openings of the cabinet and modules unobstructed and ensure that the cooling fan is functioning properly.

5.3 Precautions on Inspection

Inspection means taking measures to maintain normal operation of the equipment and eliminate any fault.

1) Required tools

The following tools are required to inspect and replace the components.

- Spanner or socket spanner with width across flats 6
- Spanner or socket spanner with width across flats 8
- Spanner or socket spanner with width across flats 10
- Spanner or socket spanner with width across flats 12
- Torque wrench
- Screwdriver of size 1/2
- A socket spanner kit with two extensions is recommended.

2) Service life of components

To ensure long-term normal operation of cabinet modules, regular maintenance and inspection must be performed on the electronic components according to their service life. The service life of the electronic components is influenced by the operating environment and conditions. The following tables lists the replacement interval of these components for your reference:

Table 5-1 Service life of components

Component	Standard Service Life
DC fan	3 to 5 years
Electrolytic capacitor	8 years
PCB	8 to 10 years

3) Tightening torques of connectors

When tightening the connector of conductive parts (DC bus connections, motor connections and busbar), non-conductive parts (grounding terminals and protective grounding terminals) and common steel-made parts, obey the following tightening torques.

Table 5-2 Tightening torque for current-carrying components

Screw/Bolt	Grounding Terminals, protective grounding terminals and steel connectors (N · m) (Conductive fault current)	Plastic case busbar (N · m) (Conductive operating current)
M2.5	0.3	0.3
M3	1	0.8
M4	1.2	1.2
M5	2.8	2.5
M6	4.8	4.8
M8	20	10.5
M10	40	20
M12	70	45

4) Cable terminals and fasteners

Check whether the cable terminals and screw terminals are secure. If not, re-tighten them. Check the cabling fault. If any component is damaged, replace it immediately.



NOTE

- ◆ The actual maintenance and inspection period is determined by the equipment mounting environment and operating conditions.

5.4 Replacement of Components

5.4.1 Replacement of Filter Screen



WARNING

- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.
- ◆ Before the replacement, the equipment must be de-energized to prevent the fan from sucking contaminated air from outside. When applying external power supply to the fan, be aware of the residual rotation of the fan or disconnect the external power supply.
- ◆ If the dirt filter mats are not replaced, the cabinet modules may stop due to the overtemperature fault.

1) Removing the filter screen

If the cabinet uses an IP42 air inlet kit, clean the air inlet as follows:

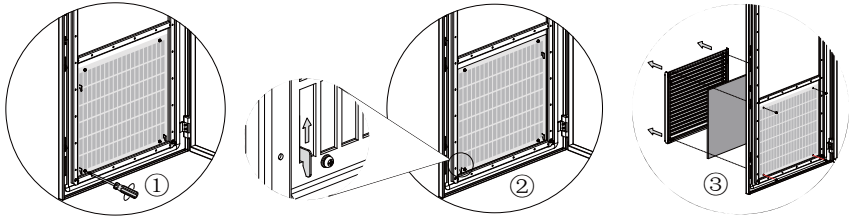


Figure 5-1 Removing the filter screen

- ① Power off the cabinet and cut off the fan power.
- ② Open the cabinet front door and remove the four M4 screws from the window blind.
- ③ Lift up the window blind and remove it.
- ④ Remove the filter screen from the window blind and clean (or replace) it.

2) Installing the filter screen

Perform the procedure above in reverse order:

- ① Insert the filter screen that has been cleaned or a new filter screen into the window blind.
- ② Snap the window blind back into the preset position.
- ③ Fix the window blind with the four M4 screws from the inside of the front cabinet door.
- ④ Replace all filter mats as described in the preceding procedure.

5.4.2 Replacing the DC Fan of The Regenerative Rectifier Module



- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.

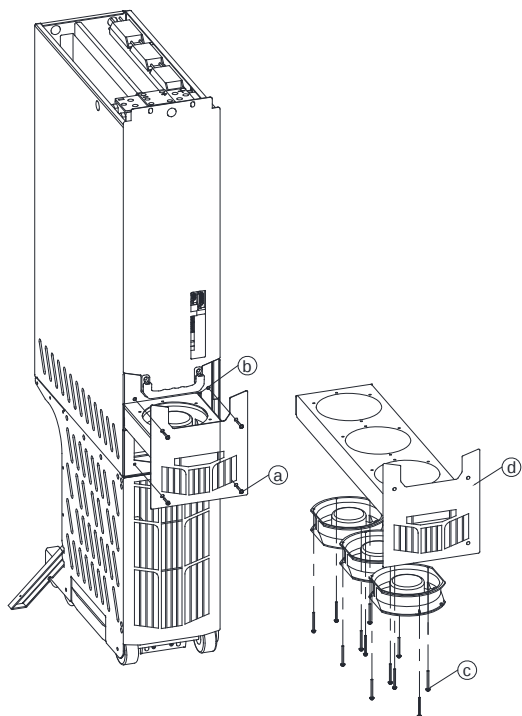


Figure 5-2 Replacing the DC fan of the regenerative rectifier module

Steps:

- ① Disconnect the DC power from the drive cabinet and ensure that the equipment is voltage-free.
- ② Open the cabinet door and use a screwdriver to remove the four M5 screws (a) from the fan assembly (d).
- ③ Pull out the fan power cable (b) while pulling out the fan assembly from the front of the module.
- ④ Remove the twelve (four in case of one fan) M4 screws from the fan assembly.
- ⑤ Install a new fan of the same specification in the reverse order.



NOTE

- ◆ The direction of the airflow is from bottom to top. Install the fan with the arrow on it pointing upwards.
- ◆ When installing the fan, be careful that the fan power cord must not be squeezed by the fan.

5.4.3 Replacing the DC Fan of The Regenerative Rectifier Filter Module



WARNING

- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.

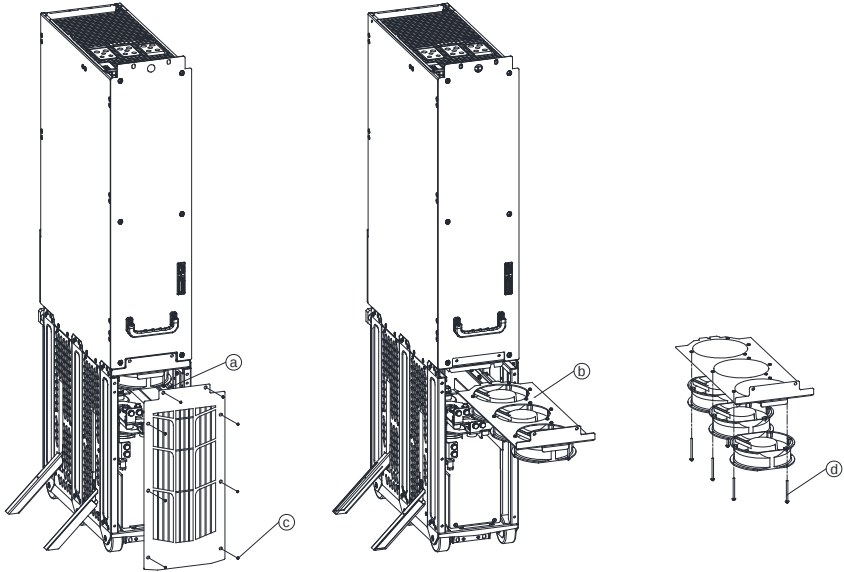


Figure 5-3 Replacing the DC fan of the regenerative rectifier filter module

Steps:

- ① Disconnect the AC power from the drive cabinet and ensure that the equipment Null voltage-free.
- ② Open the cabinet door and use a screwdriver to remove the eight M5 screws (c) from the panel and remove the panel.
- ③ Disconnect the fan wiring from the module (a).
- ④ Pull out the fan assembly (b).
- ⑤ Unscrew the twelve M4 screws (d) from the fan and remove the fan.
- ⑥ Install a new fan and new fan assemblies in reverse order.
- ⑦ Wire the fan to the power module and install the panel.



NOTE

- ◆ The direction of the airflow is from bottom to top. Install the fan with the arrow on it pointing upwards.
- ◆ When installing the fan, be careful that the fan power cord must not be squeezed by the fan.

5.4.4 Replacing the Frame Accessory Kit



WARNING

- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.

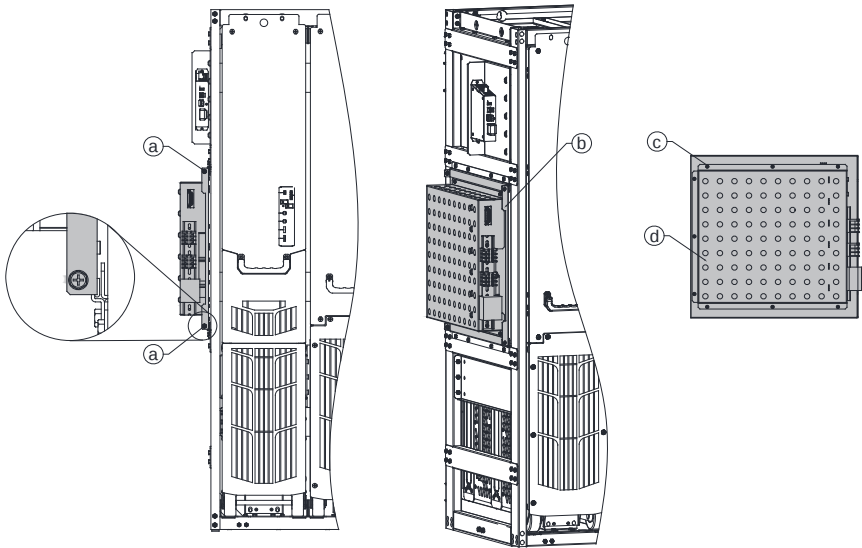


Figure 5-4 Replacing the frame accessory kit

Steps:

- ① Disconnect the AC power from the drive cabinet and ensure that the equipment Null voltage-free.
- ② Disconnect all terminals that are connected to the accessory kit.
- ③ Use a screwdriver to remove the two M6 screws (a) on the front side.
- ④ Pull the edge of the sheet metal (b) and pull out the accessory kit.
- ⑤ Use a screwdriver to remove the nine M4 screws (c) that secure the accessory kit cover, remove the accessory cover (d), maintain internal components, and connect cables.
- ⑥ Install the accessory kit in reverse order.
- ⑦ Connect cables and complete the maintenance.

5.4.5 Replacing the Fan Power



WARNING

- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.

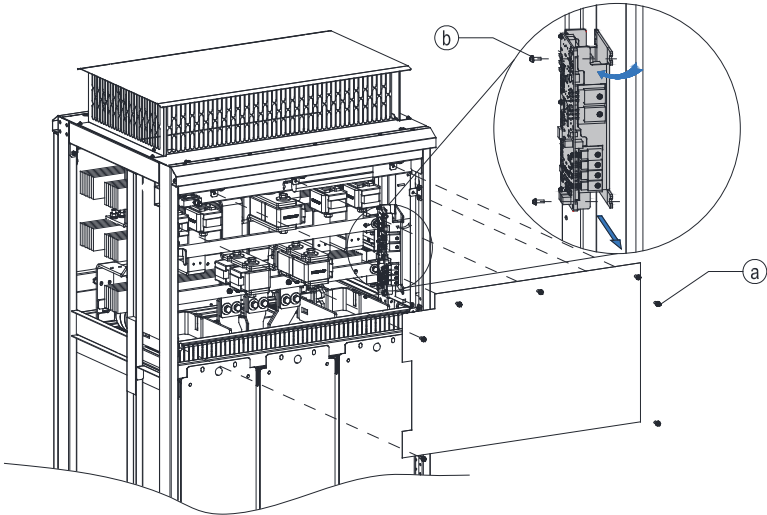


Figure 5-5 Replacing the fan power

Steps:

- ① Disconnect the AC power from the drive cabinet and ensure that the equipment Null voltage-free.
- ② Open the cabinet door.
- ③ Loosen the screw (a) on the upper cover of the cabinet and remove the cover.
- ④ Pull out the terminal of the fan power supply.
- ⑤ Remove the two screws (b) on the power supply and remove the power supply. Be careful not to drop the screws inside the module!
- ⑥ Install a new power supply in the reverse order.
- ⑦ Re-connect the power supply terminals.
- ⑧ Tighten the cover and close the door.



NOTE

- ◆ Do not damage the fastening screws: Tighten the power supply fastening screws with $1.2 \text{ N} \cdot \text{m}$.

5.4.6 Replacing HSVM-10



- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.

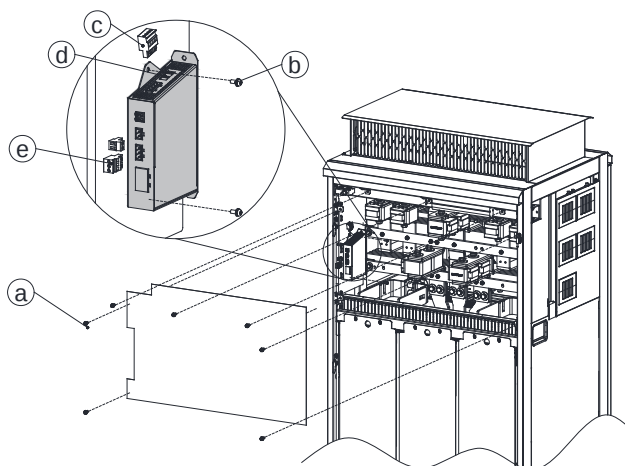


Figure 5-6 Replacing HSVM-10

Steps:

- ① Disconnect the AC power from the drive cabinet and ensure that the equipment is voltage-free.
- ② Open the cabinet door.
- ③ Loosen the screw (a) on the upper cover of the cabinet and remove the cover.
- ④ Pull out the optical fiber (d) on the top of the HSVM-10.
- ⑤ Pull out the 24 V power terminal (c) on the top of the HSVM-10.
- ⑥ Pull out the three-phase AC voltage detection terminal (e) at the front of the HSVM-10.
- ⑦ Remove the two screws (b) on the HSVM-10 and take out the HSVM-10. Be careful not to drop the screws inside the module!
- ⑧ Install a new HSVM-10 in the reverse order.
- ⑨ Tighten the cover and close the door.



- ◆ Do not damage the fastening screws: Tighten the fastening screws with 1.2 N · m.

5.4.7 Replacing the Lightning Protection Board



- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.

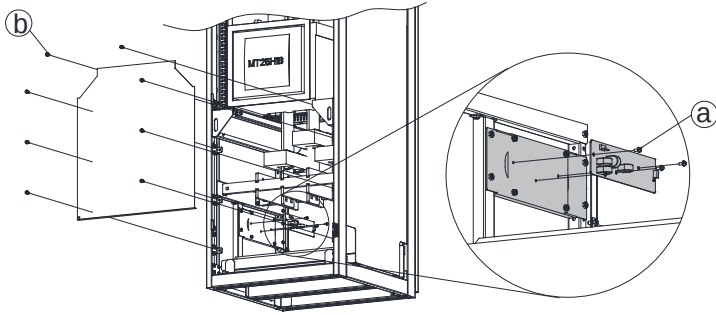


Figure 5-7 Replacing the lightning protection board

Steps:

- ① Disconnect the AC power from the drive cabinet and the isolating switch of the charging circuit. Ensure that the equipment is voltage-free.
- ② Open the cabinet door.
- ③ Loosen the screws (a) on the lower cover of the cabinet and remove the cover.
- ④ Disconnect the lightning protection board terminal and remove the fixing screws (a).
- ⑤ Install a new lightning protection board in the reverse order.
- ⑥ Re-connect the terminal.
- ⑦ Tighten the cover and close the door.



NOTE

- ◆ Do not damage the fastening screws: Tighten the fastening screws with 1.2 N · m.

5.4.8 Replacing the Fuse



- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.

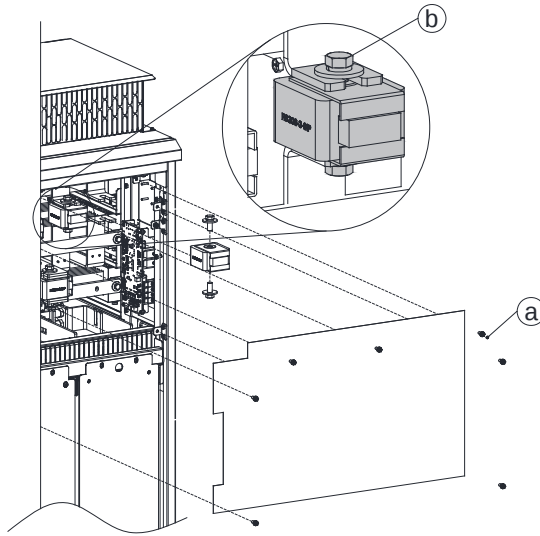


Figure 5-8 Replacing the fuse

Steps:

- ① Disconnect the AC power from the drive cabinet and the isolating switch of the pre-charge circuit. Ensure that the equipment is voltage-free.
- ② Open the cabinet door.
- ③ Loosen the screw (a) on the upper cover of the cabinet and remove the cover.
- ④ Loosen the fuse nut (b) and pull out the fuse 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 condition of the fuse. If the fuse burns out, replace all fuses and tighten the nut. The maximum tightening torque of the nut is $35 \text{ N} \cdot \text{m}$.
- ⑥ Install the cover in the reverse order and close the cabinet door.

5.4.9 Replacing the Regenerative Rectifier Module



- ◆ Only professional personnel are allowed to perform the replacement. Before maintenance and inspection, read the "Safety Instructions" section and the safety instructions given in this section. Failure to comply may result in personal injury or equipment damage.
 - ◆ Due to the heavy weight and the high center of gravity of the module, exert extreme caution when operating. The module is highly prone to rollover.
 - ◆ When removing the module, carefully pull the module out of the cabinet along the ramp plate. While holding the handle, apply a constant pressure to the base of the module 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 of the module to prevent them from getting stuck between the module and the cabinet. In addition, use one foot to apply constant pressure to the base of the module to prevent the module from falling backwards.
 - ◆ Do not tilt the module and do not place the module on a sloping floor.
-

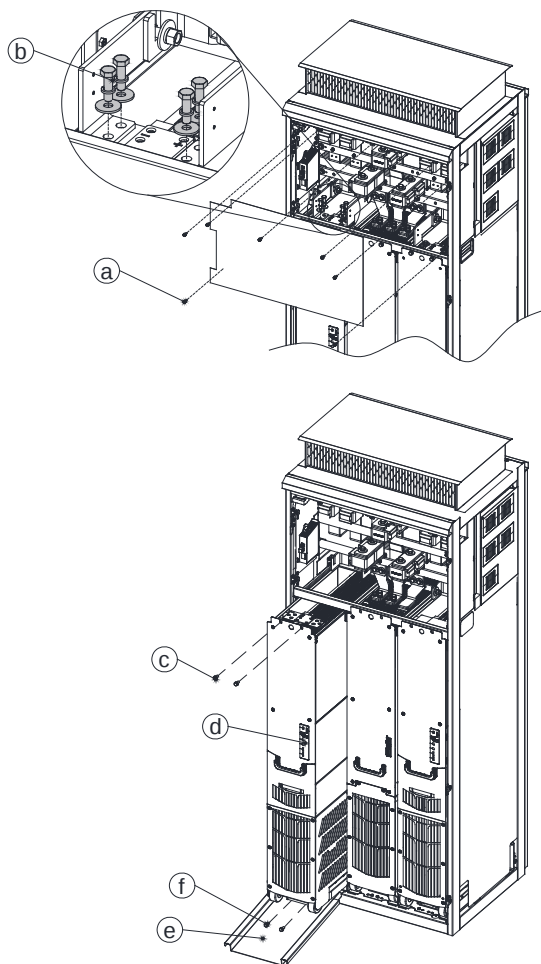


Figure 5-9 Replacing the regenerative rectifier module

Steps:

- ① Disconnect the AC power from the drive cabinet and ensure that the equipment Null voltage-free.
- ② Open the cabinet door.
- ③ Loosen the screw (a) on the upper cover of the cabinet and remove the cover.
- ④ Disconnect the two DC busbars at the top of the module (b). Do not drop the screws into the module!
- ⑤ Remove the cap (d) on the optical fiber terminal on the front of the module and pull out the fiber cable.

- ⑥ Remove the two M8 screws (f) that secure the bottom of the module to the base of the cabinet.
- ⑦ Fix the mounting rail (e): Pull the mounting rail from the cabinet base so that the base hook engages with the mounting rail hole.
- ⑧ Remove the two M8 screws (c) that secure the top of the module to the cabinet frame.
- ⑨ Carefully pull the module out of the cabinet along the rail. While holding the handle, apply a constant pressure to the base of the module with one foot to prevent the module from falling backwards.
- ⑩ Install a new module in the reverse order. Mind your fingers. Use one foot to apply constant pressure to the base of the module to prevent the module from falling backwards.
- ⑪ Reconnect the optical fiber cable and tighten the cover.
- ⑫ Remove the mounting rail and close the cabinet door.

**NOTE**

◆ Do not damage the fastening screws: Tighten the fastening screws of the module with $20 \text{ N} \cdot \text{m}$ and those of the DC busbars with $40 \text{ N} \cdot \text{m}$.

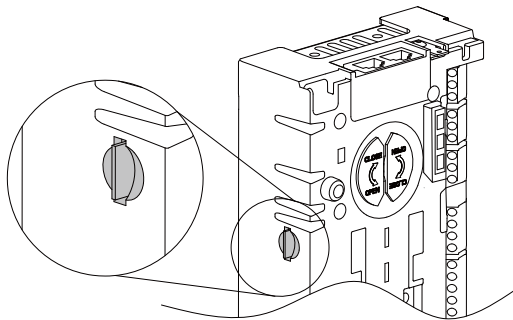
5.4.10 Maintain the HCU Control Module

1 Replace the memory card

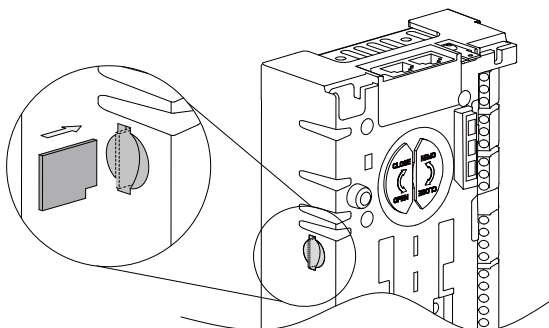
After replacing the HCU control module, the existing parameter settings can be retained by transferring the memory card from the faulty module to the new module.

Steps:

- 1) Press the SD memory card to eject it and pull it straight out of the faulty module.



- 2) Push the SD memory card in the direction as shown below into the card holder of a new module.

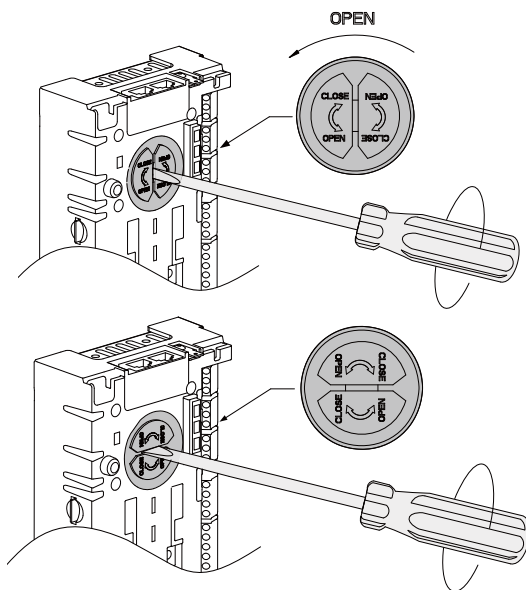


- 3) Ensure that the SD memory card is pushed into position. Otherwise, an abnormality will occur due to poor contact.

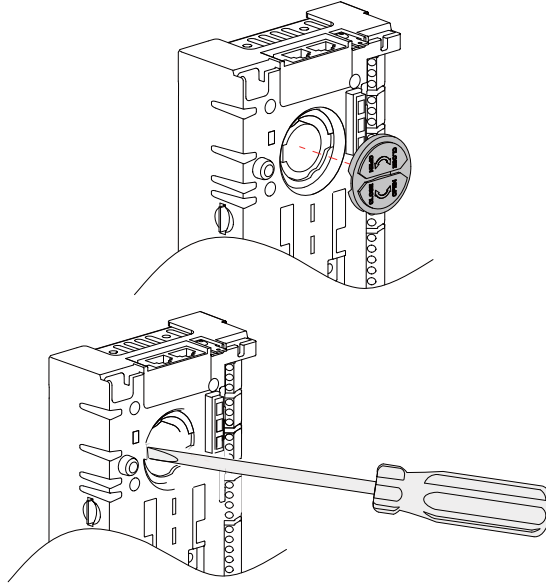
2 Replacing the battery

Steps:

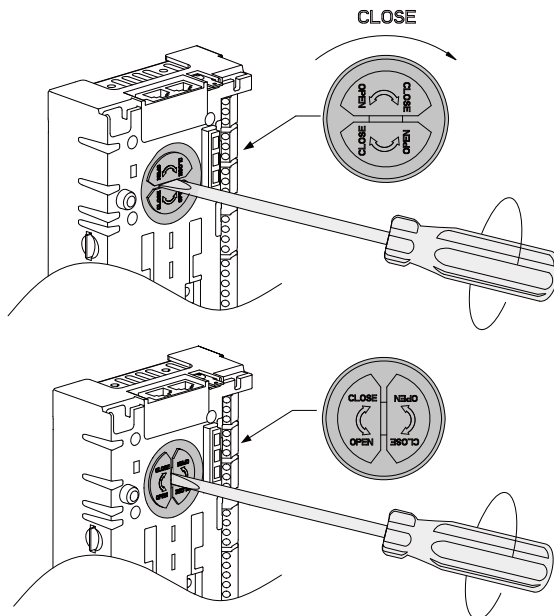
- 1) Turn the battery cover 90° counterclockwise with a 2 mm slotted screwdriver to open the cover.



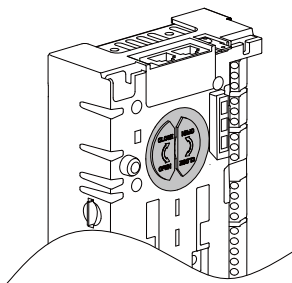
- 2) Remove the cover. Press one side of the battery with the screwdriver, and remove the battery. Install a new battery.



- 3) Close the cover and turn it 90° clockwise to secure it.



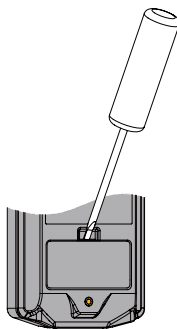
- 4) Dispose of used batteries in accordance with local disposal rules or applicable laws.



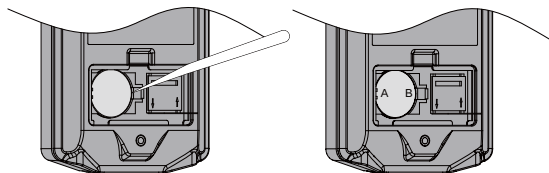
5.4.11 Replacing the Battery of SOP-20-880

Steps:

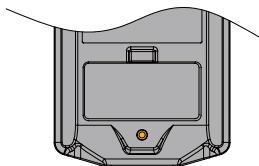
- 1) Use a slotted screwdriver or fingers to remove the battery cover.



- 2) Take out the battery with tweezers or a slotted screwdriver.



- 3) Place the battery into the clip (A side) first and then press the other end (B side) of the battery.
- 4) Put the battery cover back.



6 Ordering Instructions

6.1 Order Number

This chapter lists the model numbers and order numbers of the regenerative rectifier products.

The MD880 regenerative rectifier is available as a standard cabinet, a frame kit or a module. Table 1-2 provides the rated parameters and losses of the rectifier under different working conditions. Table 6-1 and Table 6-2 provide ordering instructions for the MD880-30 series frame kit and options.

For selection, see Table 1-2 first. Determine the regenerative rectification power and voltage class according to the actual application and derating. After the power is determined, determine the type (a frame kit (MD880-30K) or a power module (MD880-30M)) according to cabinet arrangement and quantity, and place an order with the order number and the model number provided in Table 6-1 and Table 6-2.

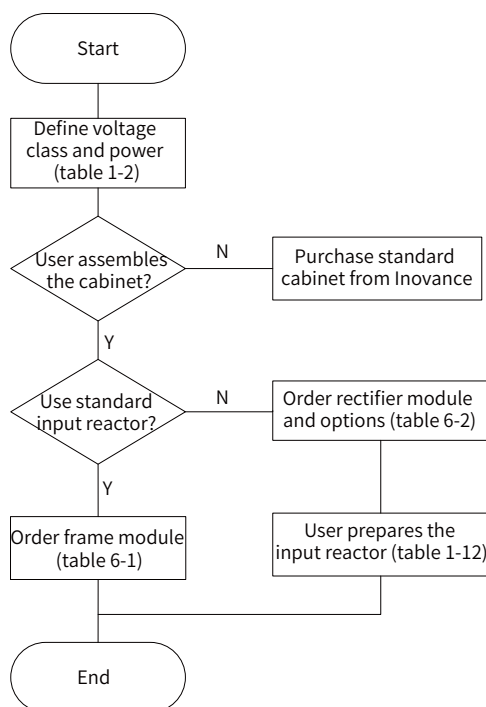


Figure 6-10 Ordering flowchart

**NOTE**

- ◆ If you need a standard cabinet, contact Unity Drive before ordering.
- ◆ If you prepare the reactor yourself, you need to purchase a 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 7-3 Ordering instructions of MD880-30K series regenerative rectifier

Model MD880-30-...	Frame	Order Number	Quantity	Remarks
0640-4	L+H8	1. MD880-30K-0640-4	1	Regenerative rectifier frame kit
		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 kit
		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 kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel control 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 kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel control module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous Voltage Detection Module

Model MD880-30-...	Frame	Order Number	Quantity	Remarks
2380-4	2*(L+2H8)	1. MD880-30K-1190-4	2	Regenerative rectifier frame kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel control module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous Voltage Detection Module
3348-4	2*(L+2H8)	1. MD880-30K-1674-4	2	Regenerative rectifier frame kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel control module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous Voltage Detection Module
5022-4	3*(L+2H8)	1. MD880-30K-1674-4	3	Regenerative rectifier frame kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-60	1	Parallel control 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 kit
		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 kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HOFM-10	1	Optical fiber expansion module
		4. HSVM-10	1	Synchronous Voltage Detection Module

Model MD880-30-...	Frame	Order Number	Quantity	Remarks
1116-7	L+2H8	1. MD880-30K-1116-7	1	Regenerative rectifier frame kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel control module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous Voltage Detection Module
1674-7	L+2H8	1. MD880-30K-1674-7	1	Regenerative rectifier frame kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel control module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous Voltage Detection Module
2232-7	2*(L+2H8)	1. MD880-30K-1116-7	2	Regenerative rectifier frame kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel control module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous Voltage Detection Module
3348-7	2*(L+2H8)	1. MD880-30K-1674-7	2	Regenerative rectifier frame kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-40	1	Parallel control module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous Voltage Detection Module
5022-7	3*(L+2H8)	1. MD880-30K-1674-7	3	Regenerative rectifier frame kit
		2. HCU-30	1	Regenerative rectifier control module
		3. HPCU-60	1	Parallel control module
		4. HOFM-10	1	Optical fiber expansion module
		5. HSVM-10	1	Synchronous Voltage Detection Module

Table 6-4 MD880-30M Series Regenerative Rectifier Optional Part (Spare Part) Ordering Instructions

Order Number	Quantity	Remarks
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
HPCU-40	1	Parallel control module
HPCU-60	1	Parallel control module
H8-quick-kit	1	Push-in mounting base

6.2 Selection Example

1) Selection of frame kits:

Determine the specifications of the regenerative rectifier based on inverter power, for example, 400 V/1674 A, and place an order accordingly.

2) The user arranges the cabinet and configures the input reactor themselves:

In the case of the single mode, specify the order number and quantity in the order 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 the case of the parallel mode, specify the order number and quantity in the order 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

Unity Drive Warranty Agreement

- 1) Unity Drive provides an 18-month free warranty to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.
- 2) Within the warranty period, maintenance will be charged for the damage caused by the following reasons:
 - a. Improper use or repair/modification without prior permission
 - b. Fire, flood, abnormal voltage, natural disasters and secondary disasters
 - c. Hardware damage caused by dropping or transportation after procurement
 - d. Operations not following the user instructions
 - e. Damage out of the equipment (for example, external device factors)
- 3) The maintenance fee is charged according to the latest Maintenance Price List of Unity Drive.
- 4) If there is any problem during the service, contact Unity Drive's agent or Unity Drive directly.
- 5) Unity Drive reserves the rights for explanation of this agreement.

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