R100020G1 Charging Module

User Manual

Issue	05
Date	2021-11-16

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About This Document

Purpose

This document describes the product in terms of the overview, transportation, storage, installation, maintenance, and technical specifications. Before operating the charging module, ensure that you are familiar with its features, functions, and safety precautions provided in this document.

Figures provided in this document are for reference only.

Intended Audience

This document is intended for charging module operation personnel and qualified electrical technicians.

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or other unanticipated results. NOTICE is used to address practices not related to personal injury.
NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in previous issues.

Issue 05 (2021-11-16)

Added descriptions about the module ports, input connector directions, and product replacement.

Added descriptions about the status code display and error codes, and marked tolerances in the figure showing the installation clearances.

Issue 04 (2021-08-06)

Optimized the illustration about the input connector directions.

Issue 03 (2021-01-18)

Updated the technical specifications, button operations, and power cable temperature resistance.

Issue 02 (2020-09-03)

Updated the technical specifications and installation requirements.

Issue 01 (2020-06-30)

This issue is the first official release.

Contents

1 Safety Precautions

General Safety

- Before installing, operating, or maintaining the company's equipment, read through this manual and follow all the safety instructions.
- When installing, operating, and maintaining the equipment, observe all the safety instructions on the equipment and in this document to prevent personal injury and equipment damage.
- The "DANGER", "WARNING", and "CAUTION" statements in this document do not cover all the safety instructions. They are only supplements to the safety instructions.
- Ensure that the equipment is used in environments that meet its design specifications. Otherwise, the equipment may become faulty, and the resulting equipment malfunction, component damage, personal injury, or property damage will not be covered under the warranty.
- Follow all the safety precautions and instructions provided by the company. The safety precautions given in this document do not cover all safety precautions. The company will not be liable for any consequence caused by violation of the safety operation regulations and design, production, and usage standards.

Declaration

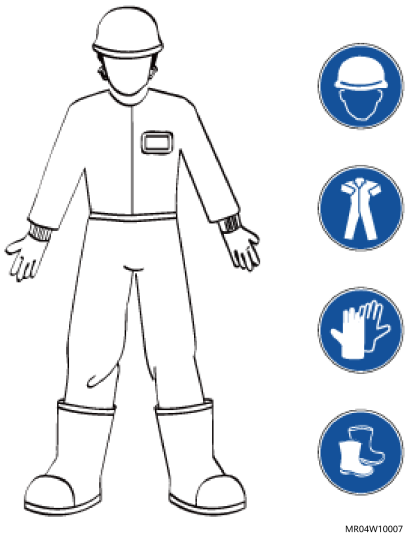
The company will not be liable for any consequences in any of the following circumstances:

- Damage during transportation
- No barcode or incomplete barcode within the warranty period
- Storage conditions that do not meet the requirements specified in this document
- Incorrect storage, installation, or use
- Installation or use by unqualified personnel
- Failure to follow the operation instructions and safety precautions on the product and in this document
- Operation beyond the conditions specified in this document

- Operation beyond the specified parameter ranges
- Unauthorized modifications to the product or software code or removal of the product
- Equipment damage due to force majeure (such as lightning, earthquakes, fire, and storms)
- Warranty expired and not extended
- Installation or use in environments which are not specified in relevant international standards
- The charging module cannot prevent battery reverse connection, which needs to be detected by the charging machine (pile). The module failure caused by battery reverse connection is not covered under the warranty.
- When installing the charging module, ensure that all mounting holes on the module panel are secured by screws. The module failure caused by loose connection is not covered under the warranty.

Common Safety

- Personnel who plan to install, operate, or maintain the equipment need to receive thorough training, obtain required job qualifications, understand all necessary safety precautions, and be able to correctly perform all operations.
- Follow local laws and regulations when installing, operating, or maintaining the equipment. The safety instructions in this document are only supplements to local laws and regulations.
- If there is a probability of personal injury or equipment damage during installation, immediately stop the operations, report the case to the project owner, and take feasible protective measures.
- Do not install, use, or operate the equipment outdoors (including but not limited to transporting the equipment, installing cabinets, and installing power cables) under bad weather conditions such as thunderstorms, raining, snowing, or strong winds.
- Before installing, operating, or maintaining the equipment, remove conductive objects such as watches, bracelets, bangles, rings, and necklaces.
- When installing, operating, or maintaining the equipment, use insulated tools and wear personal protective equipment such as insulation gloves, safety clothing, safety helmet, and safety shoes, as shown in the following figure.



- Follow the specified procedures for installation, operation, and maintenance.
- Before handling a conductor or terminal, measure the contact point voltage with a multimeter and ensure that there is no risk of electric shock.
- Ensure that all slots are installed with boards or filler panels. Avoid exposure of hazardous voltages or energy on boards. Ensure that the air channel is normal, control electromagnetic interference, and prevent dust and other foreign matter on the backplane, baseplate, and boards.
- After installing the equipment, remove the packing materials such as cartons, foam, plastics, and cable ties from the equipment area.
- In the case of a fire, immediately leave the building or the equipment area and activate the fire alarm or call emergency services. Do not re-enter the building or affected area until it has been deemed safe by qualified professionals.
- Do not stop protective devices. Pay attention to the warnings, cautions, and precautionary measures in this document and on the nameplates. Promptly replace warning labels that have worn out.
- Keep irrelevant people far away from the equipment.
- Use insulated tools or tools with insulated handles.

Personnel Requirements

- Personnel who plan to install, operate, or maintain the equipment need to receive thorough training, understand all necessary safety precautions, and be able to correctly perform all operations.
- Only qualified professionals and trained personnel are allowed to install, operate, and maintain the equipment.
- Only qualified professionals are allowed to remove safety facilities and inspect the equipment.
- Personnel who will operate the equipment, including operators, trained personnel, and professionals, should possess the local national required qualifications in special operations such as high-voltage operations, working at heights, and operations of special equipment.

NOTE

- Professionals:

  Personnel who are trained or experienced in equipment operations and are clear of the sources and degree of various potential hazards in equipment installation, operation, and maintenance
- Trained personnel:

  Personnel who are technically trained, have required experience, are aware of possible hazards in certain operations, and are able to take protective measures to minimize the hazards on themselves and other people
- Users or operators:

  Anyone except the trained personnel and professionals, including operators, customers, and common people that may come in contact with the equipment

Electrical Safety

DANGER

- Do not perform non-standard or improper operations to prevent fire or electric shocks.
- Do not install or remove power cables with power on. Transient contact between the core of a power cable and a conductor may generate electric arcs or sparks, which may cause fire or eye injury.

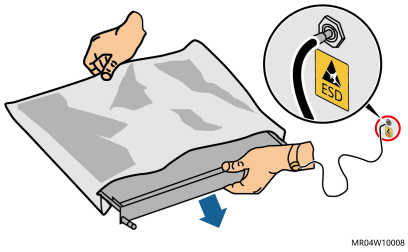
- If the power supply to the equipment is permanently connected, install an easily accessible disconnector at the exterior of the equipment.
- Before making electrical connections, switch off the disconnector on the upstream equipment to cut the power supply if people may contact energized components.
- If a "high electricity leakage" tag is attached on the power terminal of the equipment, you must ground the protective ground terminal on the equipment enclosure before connecting the AC power supply; otherwise, electric shock may occur.
- Before installing or removing a power cable, turn off the power switch.
- Before connecting a power cable, check that the label on the power cable is correct.
- Before connecting the power supply, ensure that electrical connections are correct.
- If the equipment has multiple inputs, disconnect all the inputs before operating the equipment.

ESD

NOTICE

The static electricity generated by human bodies may damage the electrostatic-sensitive components on boards, for example, the large-scale integrated (LSI) circuits.

- To prevent electrostatic-sensitive components from being damaged by static from human bodies, wear a grounded electrostatic discharge (ESD) wrist strap or ESD gloves when touching circuit boards.



- Hold the board edge without touching any components, especially chips.

Liquid Prevention

- Do not place the equipment in areas prone to water leakage, such as under air conditioner vents, ventilation vents, or feeder windows of the equipment room. Ensure that there is no condensation or water inside the equipment. Otherwise, short circuits may occur.
- If any liquid is detected inside the equipment, disconnect the power supply immediately and contact the administrator.

Environment Requirements and Tool Insulation

- Do not operate the equipment or cables during thunderstorms.
- In the case of a fire, immediately leave the building or the equipment area, and activate the fire alarm or call emergency services. Use a dry powder extinguisher, instead of a fluid fire extinguisher, to put out the electrical fire; otherwise, electric shocks may occur. Do not re-enter the building or affected area until it has been deemed safe by qualified professionals.
- Do not stop protective devices. Pay attention to the warnings, cautions, and precautionary measures in this document and on the nameplates. Promptly replace warning labels that have worn out.
- Keep irrelevant people far away from the equipment.
- Before operating the equipment, wear insulation shoes and gloves, and take measures to protect your eyes. Remove conductive objects such as jewelry and watches to avoid electric shock or burns.
- Use insulated tools or tools with insulated handles.

Label Protection

- Do not remove the warranty label or barcode from the charging module. Otherwise, product warranty will be forfeited.
- Do not scrawl or damage the nameplate on the back of the charging module because it contains important product information.

2 Overview

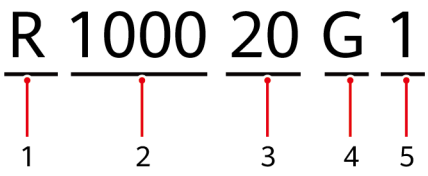
2.1 Overview

Function

The R100020G1 is an AC-DC charging module that features high efficiency and power density. It supports three-phase four-wire input of 260–528 V AC (line voltage). The output voltage ranges from 150 V DC to 1000 V DC, and the rated output power is 20 kW.

The charging module uses the isolated controller area network (CAN) communications port and communicates with the system monitoring module over the CAN protocol. You can set the output voltage mode of the charging module on the system monitoring module and perform voltage adjustment, current limiting, and startup or shutdown for the charging module.

Figure 2-1 Model number



Model number description

No.	Meaning	Description
1	Module series name	Rectifier
2	Maximum output voltage	1000 V DC
3	Rated output current	20 A
4	Efficiency type	G (Green), green efficient module
5	Module version	1

Working Mode

The R100020G1 charging module supports low-voltage and high-voltage modes and provides full power output to be compatible with various vehicle models and ensure fast charging. The charging module can be set to silent mode or standard mode according to noise requirements.

Table 2-1 Working mode

Voltage Mode	Noise Mode	
	Silent Mode	Standard Mode
Automatic switching	Supported	Supported
Manual switching to high voltage	Supported	Supported
Manual switching to low voltage	Supported	Supported

The charging module works in automatic switching mode by default. It automatically switches to the low-voltage or high-voltage mode based on the output port voltage, preset voltage, or battery voltage reported by the monitoring module.

The automatic switching mode of the charging module can be set to any of the following:

1. Automatic switching based on the module output port voltage (factory default)
2. Automatic switching based on the preset voltage
3. Automatic switching based on the battery voltage reported by the monitoring module

Manual switching is also supported. You can manually switch to the low-voltage or high-voltage mode on the system monitoring module.

- Low-voltage mode: The output voltage ranges from 150 V DC to 500 V DC. At 20 kW constant power, the output voltage ranges from 300 V DC to 500 V DC.
- High voltage mode: The output voltage ranges from 150 V DC to 1000 V DC. At 20 kW constant power, the output voltage ranges from 500 V DC to 1000 V DC.

The charging module works in standard mode by default. You can set it to silent mode on the system monitoring module based on the noise reduction requirements.

- Silent mode: The power is derated in this mode. The noise of the charging module does not exceed 55 dB in any scenario.

- Standard mode: The module supports 20 kW full power and its noise does not exceed 60 dB under rated conditions.

Display Panel

The display panel of the charging module consists of three indicators, three nixie tubes, and two buttons.

- The indicators show the running status of the charging module.
- The nixie tubes display the output voltage, output current, hardware address, group number, startup/shutdown status, software version, or error code of the charging module.
- The buttons allow you to set the output voltage, output current, hardware address, and group number, and to start or shut down a charging module.

NOTE

If the hardware addresses and group numbers of two modules are the same, the modules report an alarm indicating that the hardware addresses are duplicate.

Grouping and Address Allocation

- You can set the groups for charging modules on the system monitoring module. Charging modules in a group can automatically implement current sharing control.
- Software addresses are automatically allocated to the charging modules in a group to facilitate module identification. Note that the software address may be different from the slot number of the charging pile.
- The hardware address of a charging module can be set to stay consistent with the slot number of the charging pile. The charging module saves the hardware address upon power-off.

NOTE

- The software address will be reallocated after adding, reducing, or replacing a charging module.
- If an alarm is generated indicating that the hardware address of the module is duplicate after the charging module is moved from one charging pile to another, reset the hardware address first and then the group number of that module. After the hardware address is modified, the group number is restored to the default value.

2.2 Key Features

- Wide input voltage range: 260–528 V AC
- Wide operating temperature range: –35°C to +75°C
- Rated output voltage: 1000 V DC
- High output efficiency: peak efficiency up to 96.55%
- Maximum output power: 20 kW
- Hot swappable
- Intelligent adjustment of fan speed
- CAN bus communication

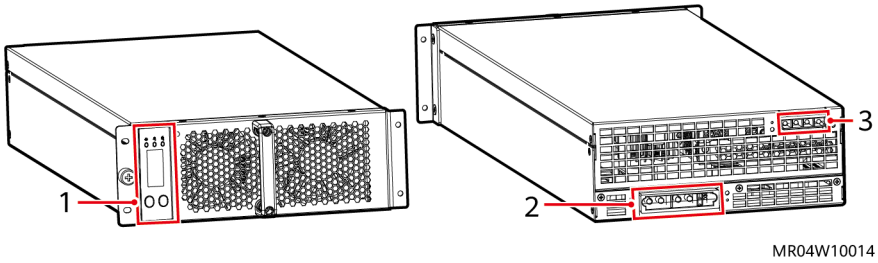
- Alarm display on the LED and nixie tubes
- Voltage adjustment, current limiting, and current sharing
- Comprehensive protection
  - Ambient overtemperature/undertemperature protection
  - Input: overvoltage/undervoltage protection and three-phase imbalance protection
  - Output: overvoltage protection and short circuit protection
  - Output backfeed isolation
- Grouping
  - Control of modules in different groups on the bus by the system monitoring module
  - Storage of group numbers and hardware addresses upon power-off

2.3 Appearance

NOTICE

Do not remove the warranty label or barcode. Otherwise, the product warranty will be forfeited.

Figure 2-2 Charging module



(1) Display panel (2) DC output and signal ports (3) AC input ports

2.4 Display Panel

2.4.1 Display Panel

Figure 2-3 Display panel

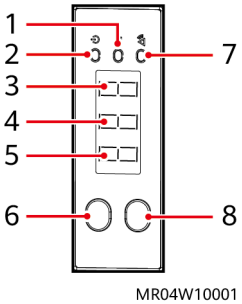


Table 2-2 Display panel

No.	Item
1	Alarm indicator (yellow)
2	Power indicator (green)
3	Low-order nixie tube
4	Middle-order nixie tube
5	High-order nixie tube
6	Left button
7	Fault indicator (red)
8	Right button

2.4.2 Indicators

Table 2-3 Charging module indicators

Indicator	Status	Description
Power indicator (green) 	Steady on	Normal: The charging module has AC input.
	Off	The charging module has no AC input.
	Blinking at 4 Hz	Querying in progress
	Blinking at 0.5 Hz	Module hibernation (standby)
Alarm indicator (yellow) 	Off	Normal: The charging module does not generate any protection alarms.

Indicator	Status	Description
	Steady on	• Ambient overtemperature protection • Ambient undertemperature protection • Internal overheating • Fan fault • AC input overvoltage, undervoltage, phase failure, or severe voltage imbalance • Slight or severe current imbalance • Incorrect or duplicate module hardware address • Output capacitance imbalance • Output relay alarm • Poor output connection • Communication failure between the charging module and external devices • Air filter blockage alarm • Output short circuit alarm
Fault indicator (red) 	Off	Normal: The charging module is normal.
	Steady on	• Lockout due to output overvoltage • Lockout due to output short circuit • Communication failure between the primary side and the secondary side • Abnormal discharge circuit of the output capacitance • Unrecoverable no-output breakdown

NOTE

- If the charging module has no output due to mains failure (no AC input), the indicators are off.
- Indicators are not mutually exclusive. The three indicators can turn on at the same time if conditions are met.
- During software loading, the green, yellow, and red indicators turn on in turns. After the loading is complete, all indicators stop blinking.

2.4.3 Nixie Tube Display

The nixie tubes display the current output voltage by default (**000** is displayed when there is no output). An error code is displayed when fault occurs.

Table 2-4 Nixie tube description

Display	Description
Output voltage	• No decimal places. The precision is 1 V when the voltage ranges from 0 V to 999 V. There is no precision requirement when the voltage is greater than 999 V. The minimum displayed value is 000 V and the maximum displayed value is 999 V. • Parameters can be set using buttons only in the setting mode but the settings are not saved upon power failure.
Output current	• The last digit is a decimal with the precision of 0.1 A. The minimum displayed value is 00.0 A and the maximum displayed value is 99.9 A. • Parameters can be set using buttons only in the setting mode but the settings are not saved upon power failure.
Hardware address	• **Adr** is displayed by default. Hold down the button to enter the address display screen (static). • On the setting screen (blinking), flip the first digit to enter the **CCC** screen. The default hardware address **127** (decimal) can be restored. • After the hardware address is modified, the group number is restored to the default value. • Parameters can be set using buttons and the settings are saved upon power failure.
Group number	• **GrP** is displayed by default. Hold down the button to enter the group number display screen (static). • The group number is displayed in decimal format. • Parameters can be set only under the company protocol. Setting is not supported under third-party protocol. • Parameters can be set using buttons and the settings are saved upon power failure.
Error code	• The high-order character is displayed as **E**, and the middle- and low-order characters are displayed as digits. • Parameters cannot be set using buttons.
Startup/Shutdown	• **on**: startup; **oFF**: shutdown • Parameters can be set using buttons only in the setting mode but the settings are not saved upon power failure.
Software version	• The value is displayed as digits. • Parameters cannot be set using buttons.

Display	Description
Mode	• **Auo** is displayed by default in standard mode. The charging module works under the system monitoring command. • **dEG** indicates the setting mode. 1. The output voltage, output current, and startup/shutdown can be set only in this mode. The settings become invalid upon mode exiting. 2. The charging module can run properly without being connected to the system monitoring module. • The **Auo** and **dEG** modes can be switched using buttons.
Status code	• The high-order character is displayed as **H**, and the middle- and low-order characters are displayed as digits. • Parameters cannot be set using buttons.

Table 2-5 Status code mapping

Status Code	Status Description
H00	Default status
H01	Silent mode
H02	Input derating
H03	Temperature derating
H04	Air filter blocked
H05	Manual switching mode
H06	250 kbps baud rate
H07	Customer version configuration mode

2.4.4 Button Operations

The buttons allow you to set the output voltage, output current, hardware address, and group number, and to start or shut down the charging module.

- Press the left button (for at least 0.25s) to turn the displayed screen or switch the high-, middle-, and low-order nixie tubes.
- Press the right button (for at least 0.25s) to turn the displayed screen or increase or decrease digits.

- Hold down the left or right button (for at least 3s) to enter the parameter setting state or save the current settings.

NOTE

Hold down the left or right button to enter the parameter setting state. If no operation is performed within 60s, the setting state is automatically exited and the parameter settings are not saved.

Setting the Output Voltage

- The output voltage can be set only after the mode is switched from Auo to dEG.
- The voltage settings of the charging module are not saved upon power failure.
- If the mode is switched from dEG to Auo, the charging module outputs according to the system monitoring command.

Table 2-6 Procedure description

Procedure	Operation	Nixie Tube Display
1	Press the left or right button to switch to the mode display state.	Auo (static)
2	Hold down the left or right button to enter the setting state.	Auo (blinking)
3	Press the right button to switch to the dEG mode.	dEG (blinking)
4	Hold down the left or right button to enter the display state.	dEG (static)
5	Press the left or right button to switch to the output voltage display state.	Current output voltage (static)
6	Hold down the left or right button to enter the setting state.	Current output voltage (high-, middle-, or low-order nixie tube blinking)
7	Press the left button to switch between the high-, middle-, and low-order nixie tubes. Press the right button to adjust the value.	Adjusted output voltage (high-, middle-, or low-order nixie tube blinking)
8	Hold down the left or right button to save the settings.	Actual output voltage (static)

Setting the Hardware Address

- To set the hardware address, you do not need to switch to the dEG mode.
- The hardware address settings of the charging module are saved upon power failure.

Table 2-7 Procedure description

Procedure	Operation	Nixie Tube Display
1	Press the left or right button to switch to the hardware address display screen.	Adr (static)
2	Hold down the left or right button to enter the hardware address display screen.	Hardware address (decimal, static)
3	Hold down the left or right button to enter the hardware address setting screen.	High-, middle-, or low-order nixie tube blinking (decimal)
4	Press the left button to switch between the high-, middle-, and low-order nixie tubes. Press the right button to adjust the value.	Adjusted hardware address (high-, middle-, or low-order nixie tube blinking)
5	Hold down the left or right button to save the settings.	Hardware address (static). Then, the voltage display screen is displayed.

Setting the Group Number

- To set the group number, you do not need to switch to the dEG mode.
- The group number settings of the charging module are saved upon power failure (only for the company protocol).

Table 2-8 Procedure description

Procedure	Operation	Nixie Tube Display
1	Press the left or right button to switch to the group number display screen.	GrP (static)
2	Hold down the left or right button to enter the group number display screen.	Group number (decimal, static)
3	Hold down the left or right button to enter the group number setting screen.	Middle- or low-order nixie tube blinking (decimal)

Procedure	Operation	Nixie Tube Display
4	Press the left button to switch between the high-, middle-, and low-order nixie tubes. Press the right button to adjust the value.	Adjusted group number (middle- or low-order nixie tube blinking)
5	Hold down the left or right button to save the settings.	Group number (static). Then, the voltage display screen is displayed.

2.5 Module Ports

Figure 2-4 DC output and signal ports

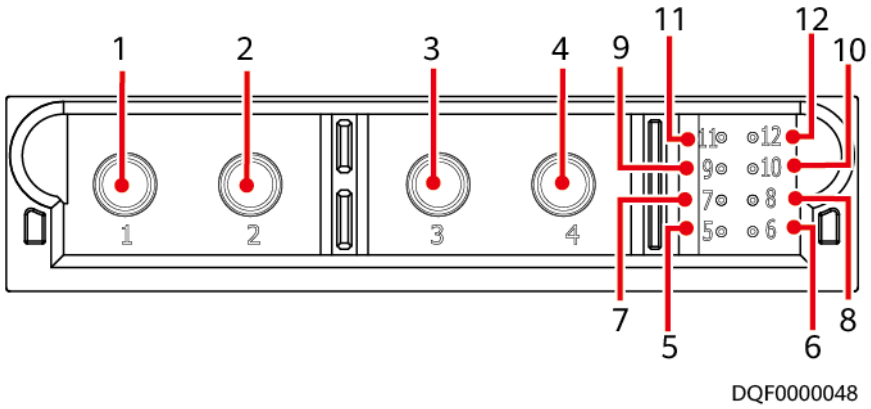


Table 2-9 Output port definition

Pin	Item	Function
1, 2	1000 V DC–	Negative output (pins 1 and 2 must be connected in parallel)
3, 4	1000 V DC+	Positive output (pins 3 and 4 must be connected in parallel)
5	CANBH	CAN high-level signal
6	CANBL	CAN low-level signal
7	CANBH	CAN high-level signal
8	CANBL	CAN low-level signal
9	CAN_GND	Signal ground
10	LINK_CHECK_OK	Insertion and removal control
11	URGENT_TURN_OFF+	Emergency shutdown+

Pin	Item	Function
12	URGENT_TURN_OFF–	Emergency shutdown–

Figure 2-5 AC input ports

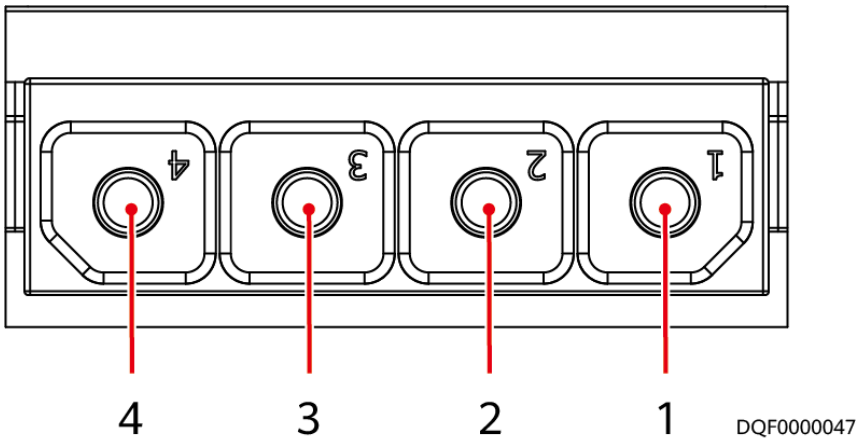


Table 2-10 Input port definition

Port	Item	Function
1	PE	Connects to the ground terminal in the system.
2	L1	AC input
3	L2	AC input
4	L3	AC input

2.6 Input and Output Connectors

2.6.1 Input Connector

The model of the connector for AC input power cables is Huafeng DY98-02Z01. You need to check the connector dimensions and prepare it by yourself. Install the connector based on the requirements of the manufacturer.

NOTICE

Before connecting a cable, pay attention to the direction of the connector, especially the silkscreen on the front and the chamfer on the rear of the connector to ensure that the cable is correctly connected.

Figure 2-6 Input connector

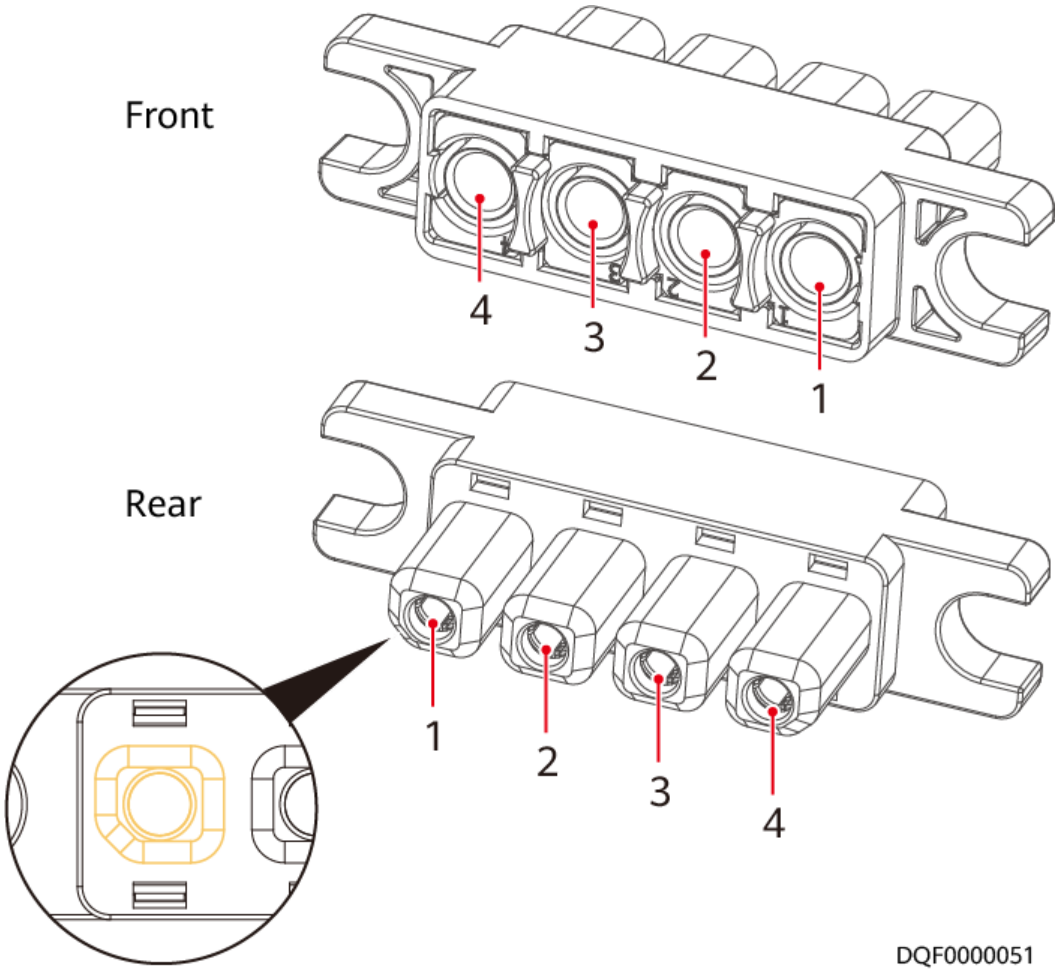


Table 2-11 Input connector definition

Port	Item	Function
1	PE	Connects to the ground terminal in the system.
2	L1	AC input
3	L2	AC input
4	L3	AC input

2.6.2 Output Connector

The DC output power cables can be connected in either of the following ways:

- Output connector with welded board on signal pins: The connector model is Huafeng DY98-01Z03. Install the external adapter board (provided by the customer) on the signal terminal, weld and secure the board, and then connect the communications cable.

- Output connector with crimped cables on signal pins: The connector model is Huafeng DY98-01Z02. Crimp the communications cable (prepared by the customer), connect the cable to the metal jack, and then insert the cable into the corresponding pin of the output connector.

Figure 2-7 Output connector (DY98-01Z03, output connector with welded board on signal pins)

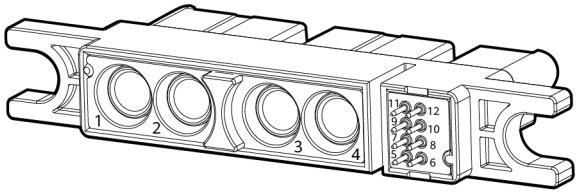


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Figure 2-8 Output connector (DY98-01Z02, output connector with crimped cables on signal pins)

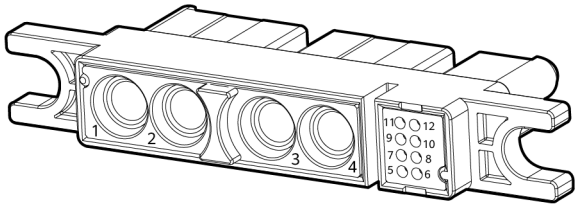

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Table 2-12 Output connector definition

Pin	Item	Function
1, 2	1000 V DC–	Negative output (pins 1 and 2 must be connected in parallel)
3, 4	1000 V DC+	Positive output (pins 3 and 4 must be connected in parallel)
5	CANBH	CAN high-level signal
6	CANBL	CAN low-level signal
7	CANBH	CAN high-level signal
8	CANBL	CAN low-level signal
9	CAN_GND	Signal ground
10	LINK_CHECK_OK	Insertion and removal control
11	URGENT_TURN_OFF+	Emergency shutdown+
12	URGENT_TURN_OFF–	Emergency shutdown–

CAUTION

Pin 9 and pin 10 of the DC output connector must be short-circuited. Otherwise, the charging module cannot be started.

3 Transportation and Storage

Transportation

During transportation, the product must be securely placed in a packing case. The packing case must comply with related international standards and be printed with marks such as "Handle with care" and "Keep dry". The packing case must be protected against rains, snows, and mechanical impact during transportation.

Storage

Unused products should be stored in packing cases and placed in a dry, well-ventilated warehouse where the temperature ranges from –10°C to +40°C, the relative humidity is not greater than 80%, and no corrosive gas exists. The product can be stored up to one year.

4 Installation

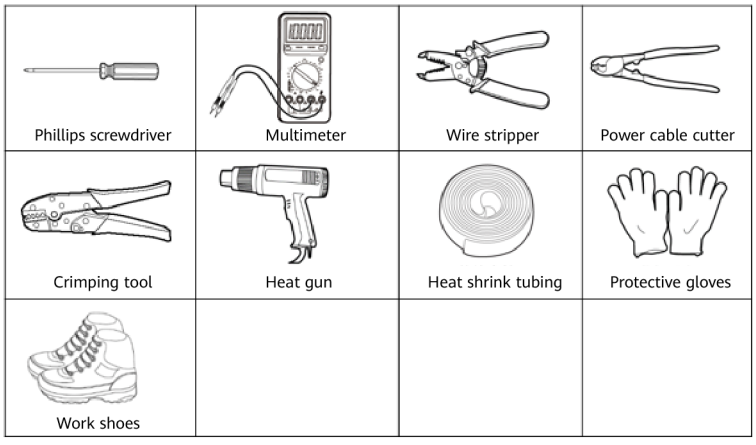
4.1 Installation Preparations

Checking Before Installation

- Before unpacking the charging module, check the outer packing materials for damage, such as holes and cracks, and check the model of the charging module. If any damage is found or the model is not what you required, do not unpack the charging module but contact the dealer as soon as possible.
- After unpacking the charging module, check whether the deliverables are intact and complete. If any item is missing or damaged, contact your dealer.

Tools

Figure 4-1 Tools



Cables

CAUTION

- Determine the temperature resistance level of the cable insulation materials based on the ambient temperature. Insulation materials of power cables and communications cables must be able to resist temperatures higher than or equal to 105°C.
- You need to prepare input connectors, output connectors, and cables by yourself.

Table 4-1 Cable requirements

Cable	Recommended Specifications	Remarks
DC output power cable	Recommendation 1: flame-retardant cable with withstand voltage ≥ 1000 V DC, temperature resistance ≥ 105°C, and conductor cross-sectional area of 16 mm^2 (for example: ISO 6722, 1500 V DC, 125°C, 16 mm^2, single-core unshielded cable) Recommendation 2: flame-retardant cable with withstand voltage ≥ 1000 V DC, temperature resistance ≥ 105°C, and conductor cross-sectional area of AWG 6 (for example: UL 10269, AWG 6)	Two positive cables and two negative cables. If the cable surface temperature is higher than 90°C, use high-temperature cables.
AC input power cable	Recommendation 1: flame-retardant cable with withstand voltage ≥ 600 V AC, temperature resistance ≥ 105°C, and conductor cross-sectional area of 10 mm^2 (for example: ISO 6722, 600 V AC, 125°C, 10 mm^2, single-core unshielded cable) Recommendation 2: flame-retardant cable with withstand voltage ≥ 600 V AC, temperature resistance ≥ 105°C, and conductor cross-sectional area of AWG 8 (for example: UL 3386, AWG 8)	If the cable surface temperature is higher than 90°C, use high-temperature cables.

Cable	Recommended Specifications	Remarks
CAN communications cable (crimped with signal pins)	Recommendation 1: twisted-pair shielded flame-retardant cable with withstand voltage ≥ 60 V DC, temperature resistance ≥ 105°C, and conductor cross-sectional area of 0.128–0.325 mm^2 Recommendation 2: twisted-pair shielded flame-retardant cable with withstand voltage ≥ 60 V DC, temperature resistance ≥ 105°C, and conductor cross-sectional area of AWG 26–22	/

4.2 Installation Requirements

NOTE

Application scope: charging machine (pile) or charging cabinet

- The charging machine (pile) or charging cabinet should meet the protection level requirements in section 10.5.1 of GB/T 18487.1-2015 and the environment protection requirements in section 7.3 of NB/T 33001-2018. The protection level of charging piles should be at least IP32 (indoor) or IP54 (outdoor).
- Avoid using the product in sea environments or outdoor land environments (with simple shielding measures) near heavy pollution sources. Otherwise, the product may be corroded or penetrated with water. The resulting functional exceptions or component damages are not covered under the warranty. Pollution sources refer to the following areas:
  - Areas within 0.5 km of salt water such as the sea
  - Areas within 3 km of serious pollution sources, such as metallurgic plants, coal mines, and heat and power plants
  - Areas within 2 km of medium pollution sources, such as chemical factories, rubber plants, and electroplating factories
  - Areas within 1 km of light pollution sources, such as food factories, tanneries, and heating boilers
- When used in offshore environment, the module enclosure may be rusted or the service life of the entire system may be shortened. Therefore, exercise caution and consult the technical support when using modules in such environment. The offshore area ranges from 0.5 km to 3.7 km away from salt water (such as the sea).
- The charging machine (pile) should be equipped with an air filter or dust-proof cotton to prevent large particles or flocs from blocking the air channel of the module. The resulting functional exceptions or component damages are beyond the warranty scope.
- It is recommended that the ventilation area for a single charging module be 13800 mm^2, and the minimum ventilation area be 10800 mm^2. The

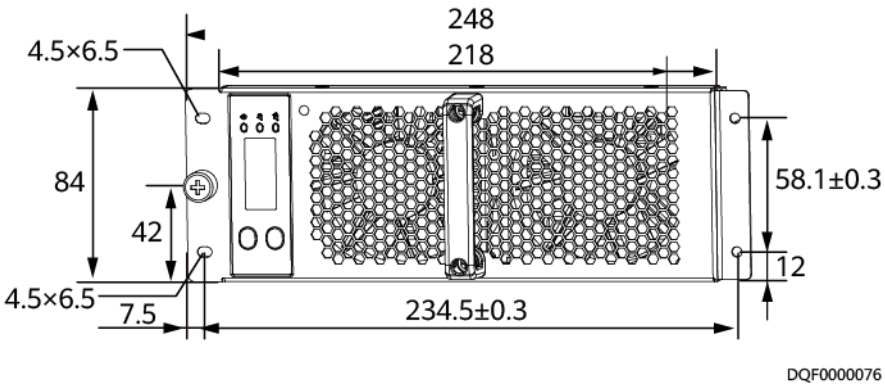
ventilation area of the system is calculated based on the number of modules. (The data is the heat dissipation area required for the charging module only.)

- It is recommended that the space reserved at the air intake vent and exhaust vent of the charging module be at least 40 mm and 85 mm respectively. The actual space depends on the system air channel.
- The installation environment must meet the environmental specifications. For details, see "Technical Specifications."

4.3 Installing a Charging Module

Installation Clearances

Figure 4-2 Installation clearances (unit: mm)



Installation Procedure

CAUTION

Do not keep the installed charging module in the standby or power-off state for an extended period.

NOTE

- Ensure that all the mounting holes on the panel are secured by screws.
- Ensure that the nixie tubes are on the left side of the charging module during horizontal mounting. Ensure that the nixie tubes are on the upper side of the charging module during side mounting.
- The charging module supports horizontal-mounting and side-mounting installation. Select the installation mode based on the actual situation. The horizontal-mounting installation mode is recommended.

Step 1 Slowly push the charging module into the slot.

Figure 4-3 Installing a charging module (horizontal mounting)

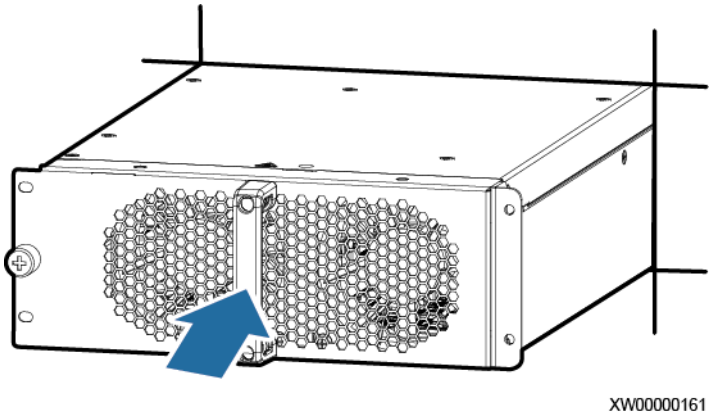
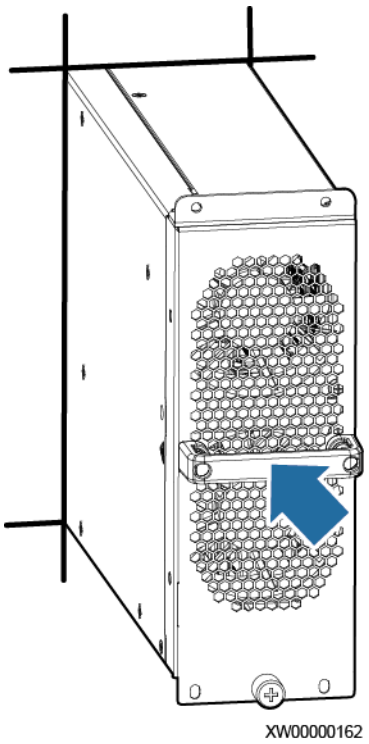


Figure 4-4 Installing a charging module (side mounting)



Step 2 Tighten the screws in the middle of the panel, and install and tighten the screws on the upper and lower parts of the panel and the screws on the mounting ear.

Figure 4-5 Securing a charging module (horizontal mounting)

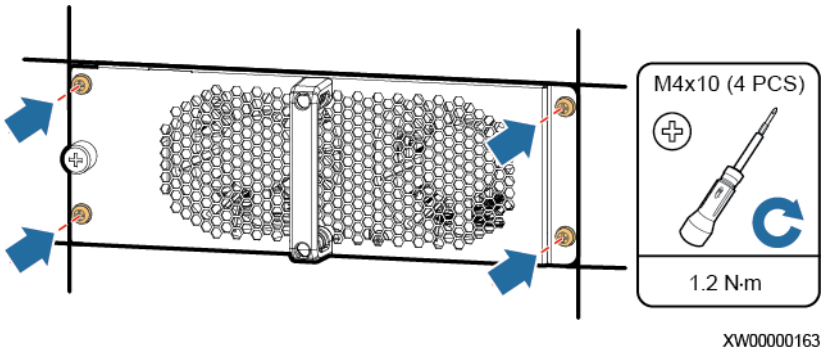
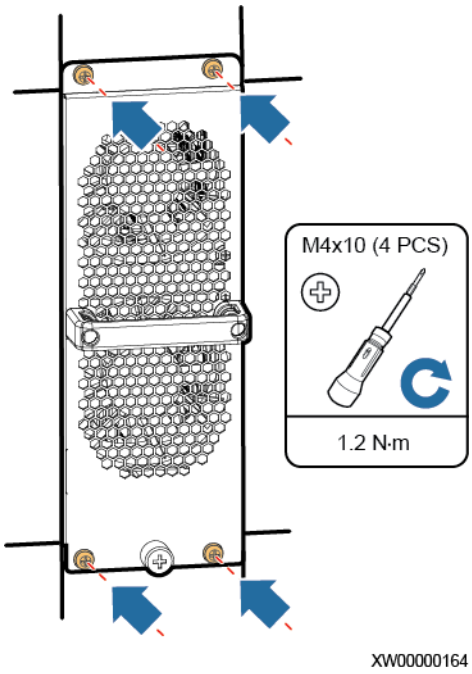


Figure 4-6 Securing a charging module (side mounting)



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4.4 Connecting Cables

4.4.1 Connecting DC Output Power Cables

- The metal socket is delivered with the DC output connector.
- Check whether the metal socket is reliably crimped. The minimum pull-out force is 500 N for 6 AWG cables or cables with a cross-sectional area of 16 mm^2.
- The front end of the heat-shrink tubing should not exceed the scale on the metal socket. The outer diameter of the metal wire covered with the heat-shrink tubing is less than or equal to 9.1 mm.

NOTICE

- You can perform emergency shutdown of the charging module by connecting pin 11 to the positive pole of the external power supply (9–15 V), and pin 12 to the negative pole.
- Pin 9 and pin 10 of the DC output connector must be short-circuited. Otherwise, the charging module cannot be started.

Step 1 Connect the negative and positive DC output power cables.

Step 2 Connect cables.

- Output connector with welded board on signal pins: Install the external adapter board (prepared by the customer) on the signal terminal, weld and secure the board, and then connect the communications cable.
- Output connector with crimped cables on signal pins: Crimp the communications cable (prepared by the customer), connect the cable to the metal socket, and then insert the cable into the corresponding pin of the output connector.

Figure 4-7 Connecting DC output cables and signal cables (welded)

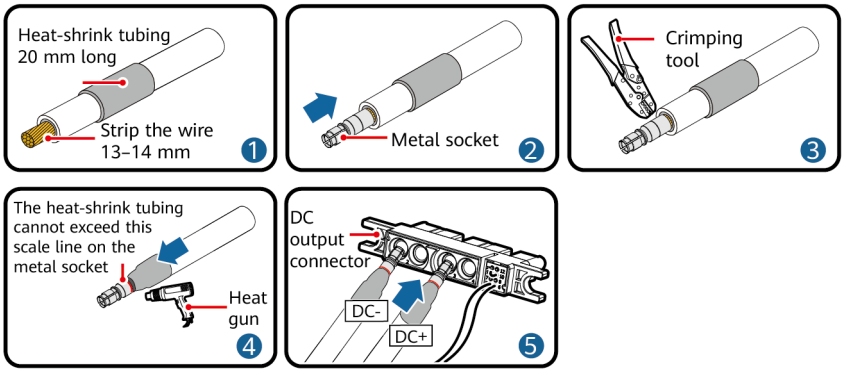

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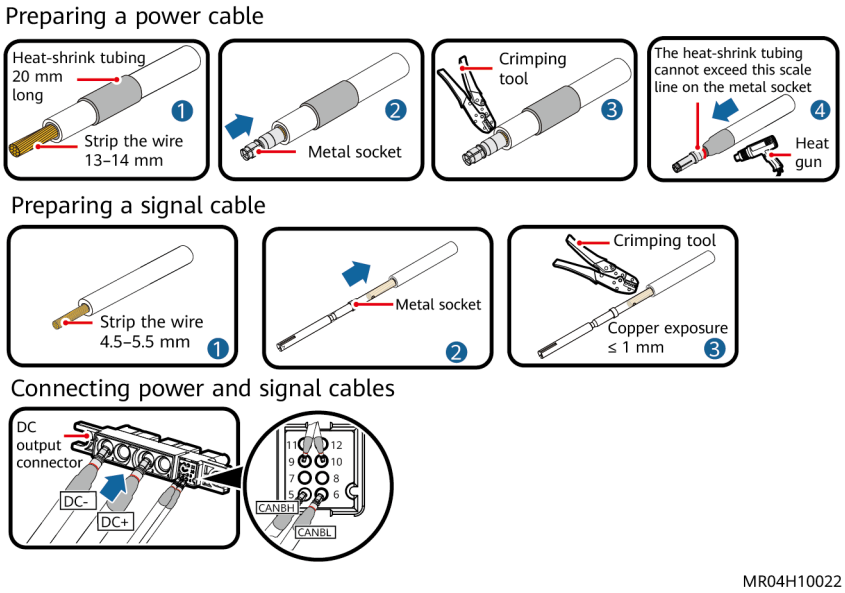
Figure 4-8 Connecting DC output cables and signal cables (crimped)



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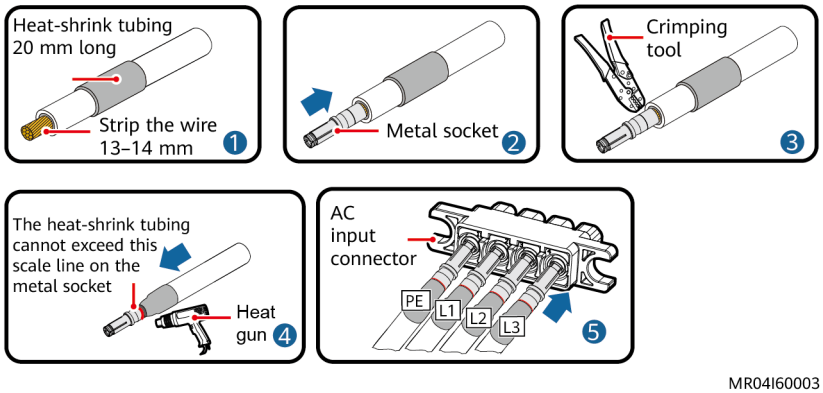
4.4.2 Connecting AC Input Power Cables

- The metal socket is delivered with the AC input connector.
- Check whether the metal socket is reliably crimped. The minimum pull-out force is 400 N for 8 AWG cables or cables with a cross-sectional area of 10 mm^2.
- The front end of the heat-shrink tubing should not exceed the scale on the metal socket. The outer diameter of the metal socket covered with the heat-shrink tubing is less than or equal to 7.5 mm.

Figure 4-9 Connecting AC input power cables



5 Powering On the Charging Module and Setting Parameters

- After the installation is complete, power on the charging module. Use a multimeter to check whether the voltage at the cabinet copper bar connected to the output connector of the charging module is within the normal range (150–500 V DC in low-voltage mode and 150–1000 V DC in high-voltage mode).
- Check that the power indicator on the charging module is steady on and the voltage displayed on the nixie tubes is the same as that measured by the multimeter.
- Set the hardware address of the charging module if grouping is required.

6 Maintenance

6.1 Routine Maintenance

To ensure that the charging module can operate properly for a long term, you are advised to perform routine maintenance on it as described in this chapter.

- The charging module is hot swappable and should be replaced if it is faulty.
- The air filter of the cabinet needs to be cleaned regularly to avoid dust buildup at the air inlet as dust can cause overheating inside the charging module.

6.2 Troubleshooting

- If the charging module is faulty, you can locate the fault based on the error code displayed on the nixie tubes.
- If no error code is displayed, locate the fault based on the indicator status.

Table 6-1 List of error codes

Error Code	Symptom	Measure
E00	No fault	N/A

Error Code	Symptom	Measure
E01	Module overtemperature and undertemperature protection	1. Check whether the ambient temperature of the charging module is too high or too low. If yes, rectify the fault. 2. Check whether the air intake vent of the charging module is blocked. If yes, rectify the fault. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 4. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
E02	Input overvoltage, undervoltage, or phase failure	1. Check whether the input voltage of the charging module is normal. If not, rectify the fault. 2. Check whether the input cables and circuit breakers of the charging module are normal. If not, rectify the fault. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 4. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
E03	Short circuit protection	1. Check whether the output of the charging module is short-circuited. If yes, rectify the fault. 2. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.

Error Code	Symptom	Measure
E04	Fan fault	1. Check whether the fan is stuck by foreign objects. If yes, rectify the fault. 2. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
E05	Duplicate hardware address	1. Reset the hardware address and group number of the module. 2. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
E06	Output overvoltage	1. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 2. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.

Error Code	Symptom	Measure
E07	Current sharing alarm	1. Check whether the preset voltages of different charging modules are the same. If not, rectify the fault. 2. Check whether the output cables and output circuit breakers of the charging module are properly connected. If not, rectify the fault. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 4. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
E08	CAN communication failure	1. Check whether the CAN communications cable and build-out resistor are correctly connected. If not, rectify the fault. 2. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
E09	Poor connection	1. Check whether the charging module is properly connected. If not, rectify the fault. 2. Check whether pin 9 and pin 10 of the output terminal are short-circuited. If not, short-circuit them. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 4. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.

Table 6-2 Troubleshooting based on charging module indicators

Indicator	Status	Description	Troubleshooting
Alarm indicator (yellow) 	Steady on	Ambient overtemperature protection	1. Check whether the ambient temperature of the charging module is too high or too low and whether the air intake vent is blocked. If yes, rectify the fault. 2. Check whether the input voltage of the charging module is normal and whether the input cables and input circuit breakers are properly connected. If not, rectify the fault. 3. Check whether the preset output voltages of different charging modules are the same and whether the output cables and output circuit breakers are properly connected. If not, rectify the fault. 4. Check whether the charging module hardware address is duplicate. If yes, rectify the fault. 5. Check whether the charging module is properly connected. If not, rectify the fault. 6. Check whether the fan of the charging module is stuck by foreign objects. If yes, rectify the fault. 7. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 8. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
		Ambient undertemperature protection	
		Internal overheating	
		Fan fault	
		AC input overvoltage, undervoltage, phase failure, or severe voltage imbalance	
		Slight or severe current imbalance	
		Incorrect or duplicate module hardware address	
		Output capacitance imbalance	
		Output relay alarm	
		Poor output connection	
		Air filter blockage alarm	

Indicator	Status	Description	Troubleshooting
		Communication failure between the charging module and external devices	1. Check whether the CAN communications cable and build-out resistor are correctly connected. If not, rectify the fault. 2. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
		Output short circuit alarm	1. Check whether the output port of the charging module is short-circuited. 2. Replace the faulty module.
Fault indicator (red) 	Steady on	Lockout due to output overvoltage	1. Check whether the air channel of the charging module is seriously blocked. If yes, rectify the fault. 2. Check whether the output of the charging module is short-circuited. If yes, rectify the fault. 3. Exchange the slot of the faulty module with that of a normal module. If the fault occurs only in the original slot, the slot is abnormal and needs to be handled. 4. Exchange the slot of the faulty module with that of a normal module. If the fault occurs again after the slot exchange, replace the faulty module or contact the technical support.
		Lockout due to output short circuit	
		Communication failure between the primary side and the secondary side	
		Abnormal discharge circuit of the output capacitance	
		Unrecoverable no-output breakdown	
Note: If the alarm persists, contact the technical support.			

6.3 Replacement

Replace the product if an unrecoverable fault occurs.

Prerequisites

- An ESD wrist strap, ESD gloves, an ESD box or bag, and required tools are available.
- The new charging module is intact.

Procedure

Step 1 Connect the ground cable of the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

Step 2 Take out the charging module.

DANGER

- Do not touch the terminals at the rear of the charging module.
- Avoid scalding due to module overheating.

1. Loosen the screws on the left side of the panel and the screws in the mounting ear on the right.

Figure 6-1 Loosening screws (horizontal mounting)

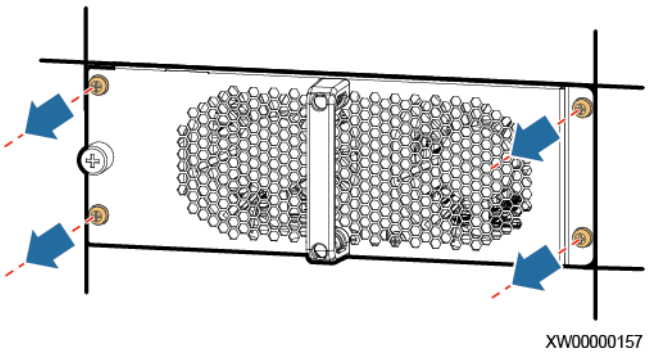
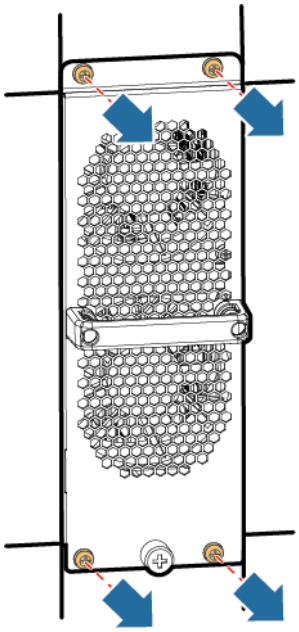


Figure 6-2 Loosening screws (side mounting)



2. Loosen the screws in the middle of the panel and remove the charging module.

Figure 6-3 Removing the charging module (horizontal mounting)

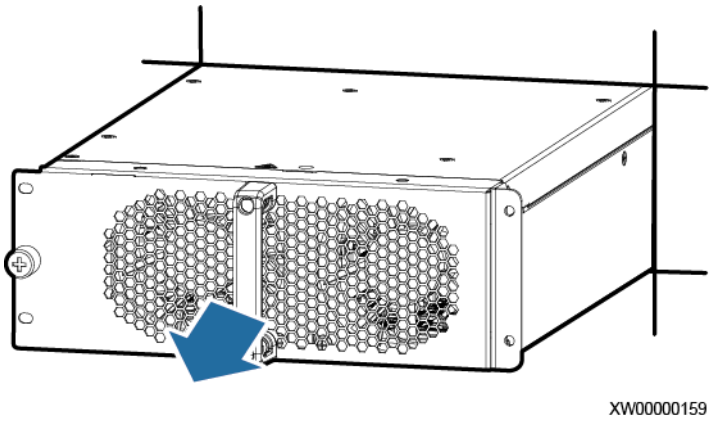
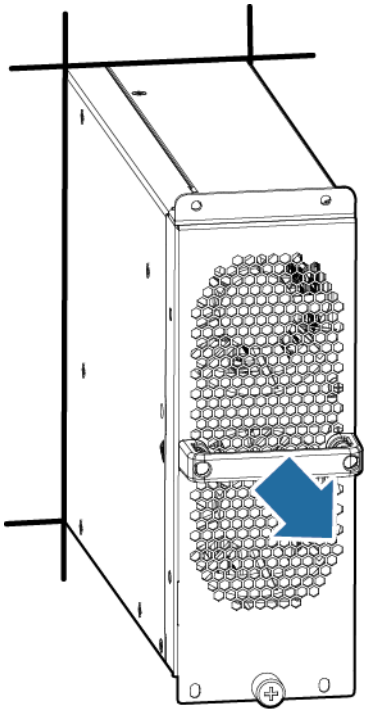


Figure 6-4 Removing the charging module (side mounting)



Step 3 Install the new charging module.

1. Slowly push the charging module into the slot.

Figure 6-5 Installing a charging module (horizontal mounting)

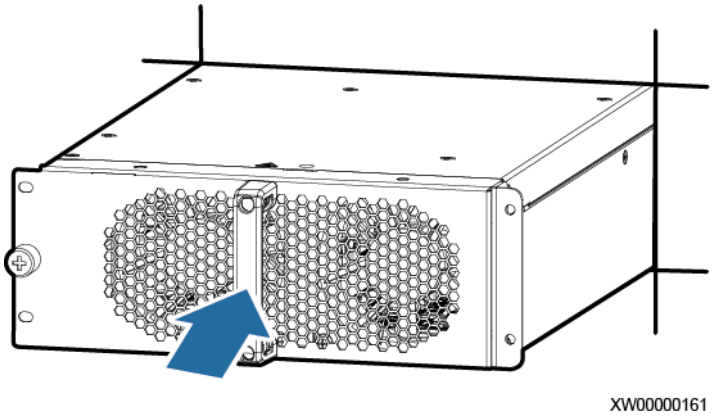
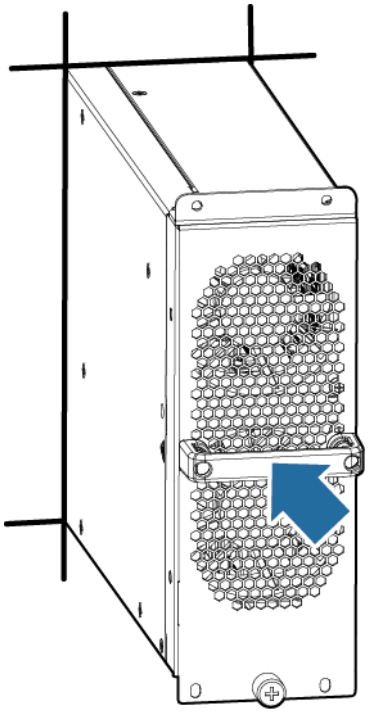


Figure 6-6 Installing a charging module (side mounting)



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2. Tighten the screws in the middle of the panel, and install and tighten the screws on the upper and lower parts of the panel and the screws on the mounting ear.

Figure 6-7 Securing a charging module (horizontal mounting)

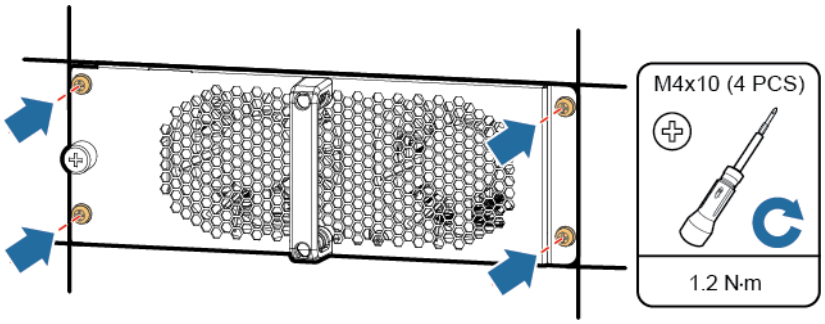

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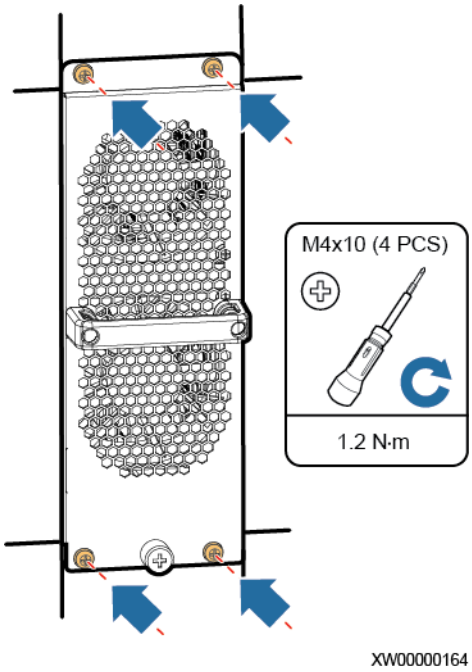
Figure 6-8 Securing a charging module (side mounting)



Step 4 Disconnect the ground cable of the ESD wrist strap, and remove the ESD wrist strap and ESD gloves.

Step 5 After the installation is complete, the system monitoring module sends a startup command to the charging module. Check that the green indicator on the charging module turns on to ensure normal running.

Step 6 Set the hardware address of the charging module if grouping is required, as described in "Button Operations."

----End

7 Technical Specifications

NOTICE

The data marked with an asterisk (*) indicates that the test is performed under the rated conditions (input voltage: 400 V/480 V AC, 50 Hz/60 Hz; output voltage: 1000 V DC in high-voltage mode or 500 V DC in low-voltage mode) when the ambient temperature is 25°C.

7.1 Structure

Table 7-1 Structure

Item	Specifications
Dimensions (H x W x D)	• 84 mm x 218 mm x 518 mm (without packaging) • 135 mm x 360 mm x 660 mm (with packaging)
Weight	• ≤ 16 kg (without packaging) • ≤ 18 kg (with packaging)
IP rating	IP20

7.2 Environment

Table 7-2 Environment

Item	Specifications
Operating temperature	–35°C to +75°C (The output power is derated when the temperature is higher than 55°C.)
Relative humidity	5%–95% RH (non-condensing)

Item	Specifications
Acoustic noise	Standard mode: ≤ 60 dBA (sound pressure) (25°C, rated condition) Silent mode: ≤ 55 dBA (sound pressure) (full working conditions)

7.3 Input

Table 7-3 Input

Item	Specifications
Operating voltage (line voltage)	260–528 V AC; rated voltage: 400 V AC/480 V AC
Frequency	40–70 Hz; rated frequency: 50 Hz/60 Hz
Input current	≤ 35 A
Power factor(*)	> 0.98 (load ≥ 50%)
THD(*)	≤ 5% (400 V AC input, load ≥ 50%)

7.4 Output

Table 7-4 Output

Item	Specifications
Rated output voltage	1000 V DC
Rated output current	20 A
Output power	Rated power: 20 kW • When the voltage ranges from the power conversion point to 260 V AC, the output is linearly derated from full load to half load. • When the voltage ranges from the power conversion point to 528 V AC, the charging module outputs at full load. (Power conversion point range: 340–380 V AC)
Output current limiting range	Maximum: 66.7 A

Item	Specifications
Highest efficiency(*)	• Input voltage: 480 V AC/50 Hz; maximum efficiency at full load: ≥ 96.3%; peak efficiency: ≥ 96.55% • Input voltage: 400 V AC/50 Hz; maximum efficiency at full load: ≥ 95.9%; peak efficiency: ≥ 96.1%
Output voltage tolerance(*)	≤ ±0.5%
Output current tolerance(*)	• ≤ ±2.5 A (I_o < 50 A) • ≤ ±5% (I_o ≥ 50 A)
Output current measurement precision	• When I_o is greater than or equal to 33.33 A, the measurement precision is less than or equal to ±(1.5% x I_{real}). • When I_o is less than 33.33 A, the measurement precision is less than or equal to 0.5 A.
Current sharing imbalance	≤ ±5% (x 20 A/40 A)
Soft start time	3–8s
Hibernation function	Supported
Standby power consumption during hibernation	≤ 10 W (tested average power consumption under 400 V AC rated input voltage at 25°C)
Hot swapping	Supported
Communications bus protocol	CAN The default CAN communication baud rate is 250 kbps. The CAN communication baud rate can be changed to 125 kbps.
Ripple and noise(*)	≤ ±5 V

7.5 Protection

Table 7-5 Protection

Item	Specifications
Input undervoltage protection	≤ 260 V AC (line voltage)
Input overvoltage protection	530–550 V AC (line voltage)

Item	Specifications
Input three-phase imbalance positive offset protection (line voltage)	Minimum: 15% (The input three-phase imbalance positive offset recovery threshold is less than or equal to 11%.)
Input three-phase imbalance negative offset protection (line voltage)	Maximum: –13% (The input three-phase imbalance negative offset recovery threshold is greater than or equal to –9%.)
Output overvoltage protection threshold	• High-voltage mode: 1020–1050 V DC • Low-voltage mode: 510–525 V DC
Output short circuit protection	Able to tolerate a short circuit for an extended period; current limiting is enabled in case of a short circuit. Lockout if three or more short circuits occur within 1 minute
Overtemperature protection	• Normal mode: The module shuts down for protection when the ambient temperature exceeds 78±5°C and does not automatically recover after the temperature becomes normal. • Silent mode: The module shuts down for protection when the ambient temperature exceeds 65±5°C and does not automatically recover after the temperature becomes normal.
Undertemperature protection	When the ambient temperature is lower than –40±5°C, the module shuts down for protection and does not automatically recover.

Figure 7-1 Efficiency curve (V_{out} @ 800 V DC)

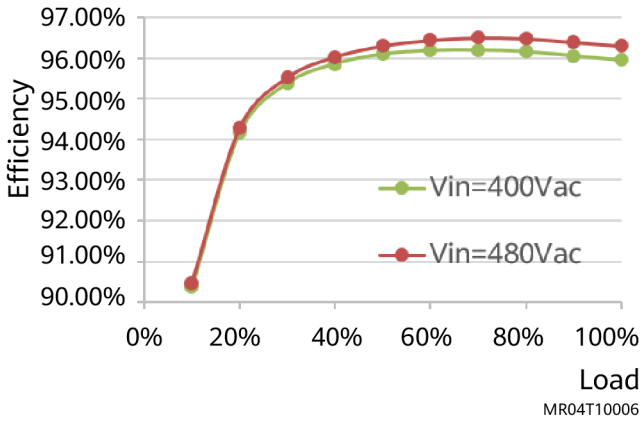


Figure 7-2 Output characteristic curve

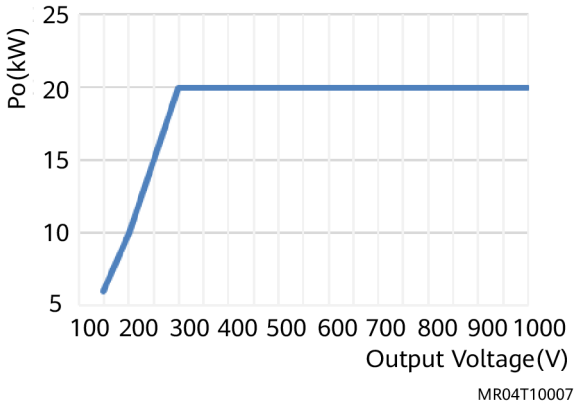
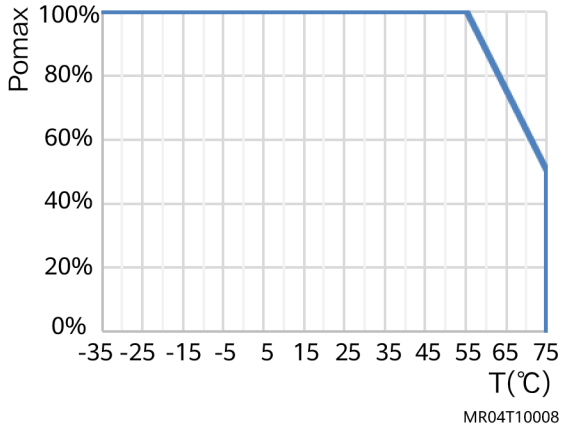


Figure 7-3 Output derating curve



A Acronyms and Abbreviations

C

CAN	Controller Area Network