

# System Manual

## MV Turnkey Station

SG3425UD-MV/SG3600UD-MV





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# 1 About This Manual

## 1.1 Validity

This manual is intended for the following product:

- SG3425UD-MV
- SG3600UD-MV

Hereinafter it will be referred to as " MV Station" unless otherwise specified.

## 1.2 Content

This manual contains the following information:

<b>Content</b>	<b>Description</b>
Safety instruction	Safety instructions concerning the installation, operation, maintenance and troubleshooting of the MV Station
Product Description	The appearance and internal components of the MV Station
Delivery	Delivery and inspection after receiving the MV Station
Installation	Mechanical transport, installation, and electrical connection of the MV Station
Commissioning	Safety notices and commissioning process when the MV Station is powered on for the first time
Start/Stop	Steps to start and stop the MV Station internal devices during normal maintenance or troubleshooting
Operation of LCD Display	Function and use of the MV Station HMI
Functions	Descriptions of the MV Station main functions
Troubleshooting	Simple troubleshooting of the MV Station
Daily operation	Instructions and guide of the daily operation of the MV Station

## 1.3 Target Group

This manual is for technical personnel who are responsible for the transport, installation and other operations of the MV Station. Only qualified personnel can perform the installation, maintenance and troubleshooting of the MV Station. Unauthorized persons should not perform any operation on the MV Station and should be away from the MV Station to avoid potential hazards. Qualified personnel are:

- Equipped with certain electrical, electrical wiring and mechanical knowledge and familiar with electrical and mechanical principle diagram.
- Familiar with the construction and working principle of the PV grid-connected power generation system.
- Familiar with the construction and working principle of the MV Station upstream and downstream equipment.
- Trained specifically for electrical device installation and commissioning.
- Equipped with the ability to cope with the dangerous and emergency situations during installation and commissioning.
- Familiar with the country/regional standards and specifications.
- Familiar with this manual.

## 1.4 Symbols Explanation

This manual contains important safety and operational instructions that must be accurately understood and respected during the installation and maintenance of the equipment.

To ensure the optimum use of this manual, note the following explanations of the symbols used.

### DANGER

**DANGER** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

### WARNING

**WARNING** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

### CAUTION

**CAUTION** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

### NOTICE






**NOTICE** indicates a situation which, if not avoided, could result in equipment or property damage.



**NOTE** indicates additional information, emphasized contents or tips to help you solve problems or save time.



The symbols below may be found on the electrical parts of the inverter. Make sure to read the following symbols and fully understand them before installing the equipment.

Symbol	Explanation
	Lethal voltage inside! Do not touch!
	Hot surface! Do not touch the hot surface of the device.
	After the inverter is disconnected, you need to wait 5 minutes before touching the internal conductive devices.
	Protective earth(ground). Earthing(grounding) securely to ensure personal safety.
	When working on the device, wear hearing protection.

## 1.5 How to Use this Manual

Read this manual and other related documents before transporting and installing the device. Documents must be stored at hand and available at all times.

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The contents of the manual will be periodically updated or revised due to the product development. It is probably that there are changes of manual in the subsequent edition.

## 1.6 Terminology

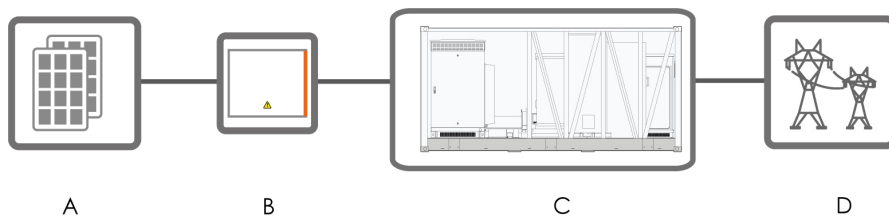
Name	For short
MV Turnkey Station	MV Station
Inverter	Inverter
Module unit	Unit
Intelligent power distribution cabinet	Intelligent PMD or PMD

The foregoing devices are expressed in the abbreviation form in this document unless otherwise specified.

## 2 Safety Instructions

### 2.1 Intended Usage

The MV Station, designed and manufactured by Sungrow, is mainly applied to large-and-medium PV power stations. The MV Station can meet the requirements of modular design and quick installation for large-and-medium PV power stations, and can ensure long-term, reliable, and safe feed-in operation.



No.	Name
A	PV array
B	PV array combiner box
C	MV Station
D	Utility grid

#### **⚠ WARNING**

**Installation of the MV Station not in compliance with the description in this manual or installation or modification of the device without authorization from Sungrow may lead to personal injuries or device damages and may void pertinent warranty claims from Sungrow.**

### 2.2 Important Safety Instructions

Read the safety instructions carefully before installing the MV Station. Refer to corresponding manuals for the safety instructions on the internal devices.

## 2.2.1 General Safety Rules

### DANGER

**Touching of the terminals or contactors connected to the grid may lead to electric shock hazards!**

- **Do not touch the terminals or conductors connected to the grid.**
- **Respect all safety instructions on the grid connection.**

### DANGER

**Lethal voltages are present inside the device!**

- **Pay attention and follow the warning signs on the device.**
- **Respect all safety instructions in this manual and other pertinent documents.**

### DANGER

**Electric shock or fire may occur due to the device damage or system fault.**

- **Visual inspect for device damages or other hazards**
- **Check if the external devices and circuit connections are safe.**
- **Only operate the device when it is safe to do so.**

### WARNING

**All installations and operations on the MV Station must be in full accordance to the national and local regulations and standards.**

## 2.2.2 Manual Storage

Product manuals are indispensable part of the product. Very important information about the transport, installation, maintenance and troubleshooting of the MV Station is included in this manual. All the descriptions in this manual, especially those safety-related items, must be complied with. Read all the instructions thoroughly prior to any operation work on the MV Station.

- Transport, install, maintain and service the MV Station by strictly following the descriptions in this manual. Device damage, personal injury, or property loss may be caused if otherwise
- This manual and relevant documents should be available for relevant persons at all times.

### 2.2.3 PV Arrays Hazards

**⚠ DANGER**

**DC high voltage! Electric shock hazards!**

**When exposed to sunlight, PV array will produce voltage, which is very high in large-scale power stations.**

**Death from burning and electric shock due to touching the PV array**

During installation, maintenance and troubleshooting of the device, ensure:

- Station is disconnected from the PV array.
- Necessary warning signs are in place to prevent accidental reconnection. Necessary warning signs are in place to prevent accidental reconnection.

### 2.2.4 Ground Fault Protection

**⚠ DANGER**

**If a ground fault occurs in the PV system, some parts that are supposedly voltage-free may carry lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before operation and take proper protection measures.**

### 2.2.5 Live Line Measurement

**⚠ DANGER**

**High voltages are present inside the device. Death resulting from burning and electric shock upon touching the live components of the MV Station. During live line measurement,**

- wear suitable protective equipment, for example dielectric gloves, and
- accompany by other persons.

### 2.2.6 Measuring Instrument

Instrument for measurement of the electrical parameters should meet the requirements listed below:

**⚠ WARNING**

- Instrument for measurement of the electrical parameters should be high quality instrument with sufficient measuring range.
- Make sure the connection and use of the instrument are correct to avoid arc and other dangerous situations.
- Use suitable protective equipment, for example dielectric gloves if live line measurement is required.

### 2.2.7 Volt-free Operations

Perform operations on the MV Station only when all devices inside the MV Station, especially the MV Station is completely voltage-free.

- Avoid any accidental re-connections.
- Verify that no voltage or current is present with appropriate measurement instrument
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid accidental contact.
- Ensure sufficient escape room.
- Wait at least 5 minutes to have the capacitors discharge completely before performing operations on internal components.

### 2.2.8 ESD Protection

#### CAUTION

**Devices may be damaged irreversibly by electrostatic discharge (ESD).**

- **Avoid unnecessary touching of the PCB.**
- **Observe all the ESD-related safety instructions. Wear proper PPE, such as safety glasses, safety footwear, and safety gloves.**

### 2.2.9 LCD Parameter Setting

Some settable parameters on the LCD are closely related to the operations of the MV Station and internal devices. Therefore these parameters can only be set after reliable evaluation of the system.

#### WARNING

- **Improper parameter setting may affect the functionality of the device.**
- **Only qualified personnel can set the parameters.**

### 2.2.10 Sand and Moisture Protection

Do not open the MV Station door in sand storm, thunderstorm, strong wind or hail days or when the ambient humidity is above 95%.

### 2.2.11 Symbols on the Device Body

Symbols on the devices body contain important information on the safe operation of the MV Station and its internal devices. Do not tear or damage them!

**NOTICE**

**Do not damage or tear the symbols.**

- **All symbols on the device body must be clearly visible.**
- **Replace the symbols once any damaged or uncleanliness is detected.**

### 2.2.12 Safety Warning Signs

During transport, installation, maintenance and troubleshooting of the MV Station, keep non-related persons away.

- Post warning signs near the MV Station upstream and downstream switches to prevent accidental connection.
- Place necessary warning signs or barriers near the on-site operation areas.

### 2.2.13 Daily Operation and Maintenance

Make sure the MV Station doors are closed and locked during daily operation to prevent internal devices from damages by rain or rodents.

Routine check and maintain the MV Station and internal devices to ensure long and reliable operation of the MV Station.

**⚠ WARNING**

**Take proper insulation protection measures during live line operation. At least two persons are required until the operation is performed.**

**Proper field rescue facilities are required since most PV stations are installed in places far away from the urban areas.**

Take the followings into consideration during daily operation and maintenance:

- The nameplate is pasted on the MV Station body. It contains very important parameter information about the devices. Protect the nameplate during all operations.
- Heating components may exist inside the MV Station. When the device stops, the heating components may still be hot. Wear proper glove when working on them.
- Wear proper PPE, such safety glasses, safety footwear and safety gloves if necessary.
- Necessary auxiliary measures are recommended to ensure personal and device safety.

### 2.2.14 Disposal of Waste

When the MV Station or internal devices is end of life, it cannot be disposed of together with household wastes. Some components inside can be recycling and some components can cause environment pollution.

Contact the local authorized collection point.

### 2.2.15 Manual Description



For user's convenience, there are a large number of pictures in this manual. These pictures are indicative only. For details about the device, refer to the actual product you receive.



Keep this manual at a convenience place near the device for future reference during installation, operation, maintenance and troubleshooting of the device.



All the descriptions in this manual are based on the standard MV Station, and the actual product you receive may differ. If necessary, specify your requirements when placing the order.

This manual may not cover all possible situations. Should a specific problem occur that is not explained in this manual, contact Sungrow.

## 3 Product Description

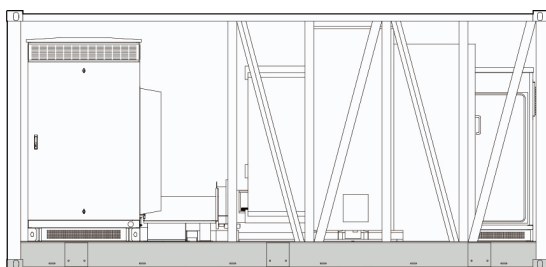
### 3.1 Brief Introduction

The MV Station mainly applies to medium and large-scale PV generation systems. Based on standard-sized outdoor container, the MV Station integrates inverter, transformer, power distribution and monitoring unit to meet with the requirements of modular design and fast installation of the PV systems. The MV Station converts DC current generated from the PV array into grid-compatible AC current, which can be directly fed into the medium voltage grid.

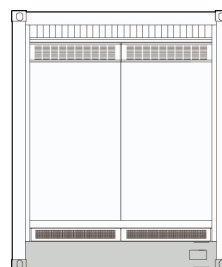
### 3.2 External Design of the MV Station

#### 3.2.1 MV Station Views

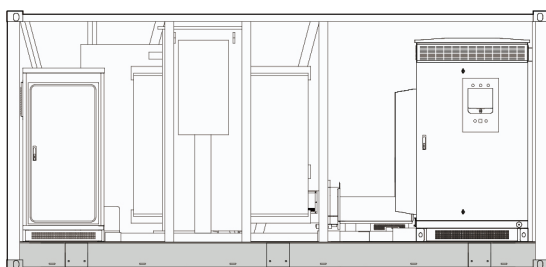
Four views of the MV Station are as follows:



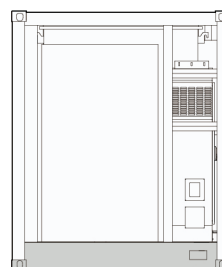
Front



Left



Back



Right

#### Control and Monitoring Window

The Control and Monitoring window is located on the back side of the inverter.

As shown in the figure below, the LED indicators are at the upper part, the color liquid crystal (LCD) touchscreen is at the middle part, and the emergency stop button is at the lower part.



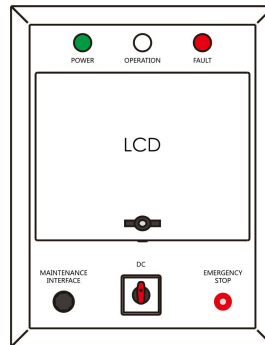


figure 3-1 Control and Monitoring window

The LEDs at the upper side of the Control and Monitoring Window: POWER indicates power-on state; OPERATION indicates normal operation; and FAULT indicates the occurrence of faults.

The working status of the MV Station can be acquired through these LEDs.

LED	Color	Description
POWER	Green	The control circuit power supply is supplying power.
OPERATION	White	MV Station is in stop mode.
	Green	MV Station is in grid-connected run mode.
	Yellow	MV Station is in alarm run mode.
FAULT	Red	A fault occurs and has not been removed. The indicator will be off when the fault is cleared.

### Buttons

The functions of each button are shown in the table below.

Button	Description
DC	Turn this knob switch to disconnect/connect the DC switch
EMERGENCY STOP	When an emergency occurs, the DC load break switches and AC circuit breakers disconnect automatically after pressing the emergency stop button.

### The MAINTENANCE INTERFACE

The cover plate of the LCD can only be opened with the key. Remove the key and store it properly after use.



The cover plate of the LCD can only be opened with the key. Remove the key and store it properly after use.

## 3.2.2 Mechanical Parameter

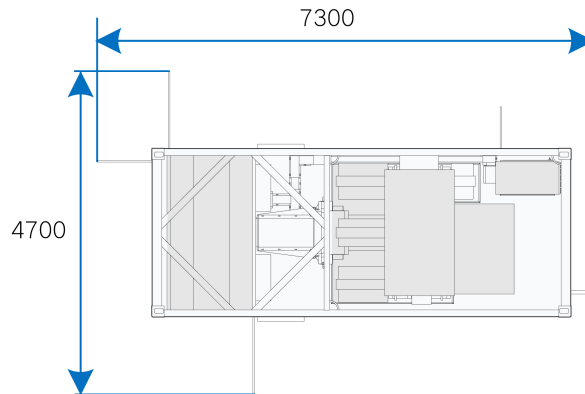
### Dimensions

External dimensions are shown in figure below.



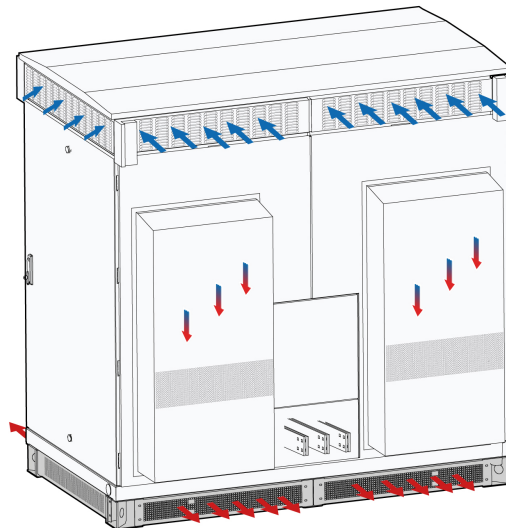
### Clearance Spaces

The clearances around the inverter should be sufficient for the doors to be opened.



### 3.2.3 Ventilation Design

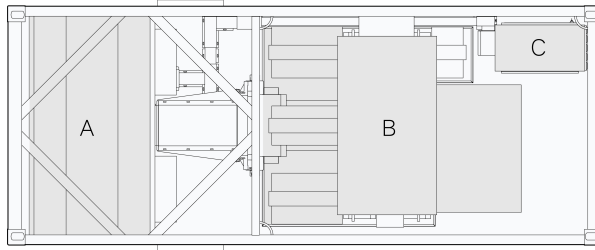
The ventilation system is designed as the cool air comes inside from the top of the inverter and hot air gets outside from the bottom of the inverter.



### 3.3 Internal Design of the MV Station

#### 3.3.1 Internal Components

Figure below shows the bottom view of the major electrical components inside the MV Station:



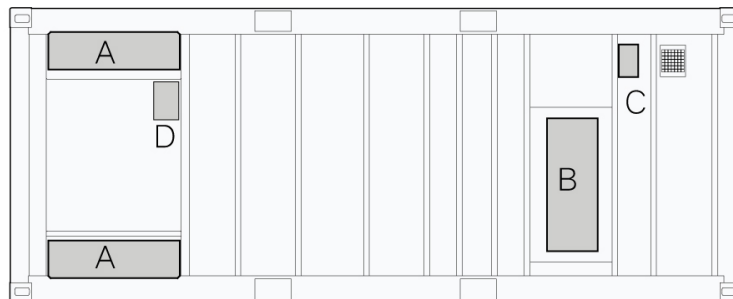
No.	Device	Description
A	Inverter	Convert the DC current generated from the PV array into AC current.
B	MV transformer	Convert low-voltage AC current output from the inverter into grid-compatible medium-voltage current.
C	Intelligent PMD	—

#### 3.3.2 Cable Entry Design

For easier onsite cable connection, all cables between the internal devices have been connected before delivery.

All cables between the MV Station and the external are routed through the bottom of the MV Station. All cables coming into or out of the MV Station should be protected properly, for example, use cable pipe to prevent damage by rodents. After cable connection, all cable entries should be sealed by fireproof mud or other appropriate materials.

The MV Station bottom cable entries are shown below.



Function of each opening is shown below:

No.	Name	Description
A	DC cable inlet	DC cables connect to the inverter through these holes.
B	AC cable outlet	AC cables connect to the MV transformer through this hole.
C	Communication, power distribution, and grounding cable entry	Communication and power distribution cables of the intelligent PMD come inside the MV Station through this hole.
D	Reserved	-

### 3.3.3 Internal Devices of the Inverter

The inverter contains the DC cabinet, the module cabinet, the AC cabinet. The DC cabinet, the AC cabinet are all equipped with wiring terminals and operation switches

#### DC Cabinet

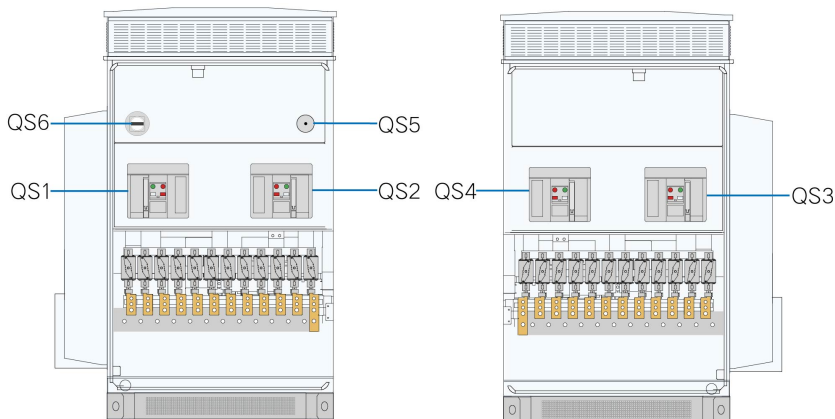


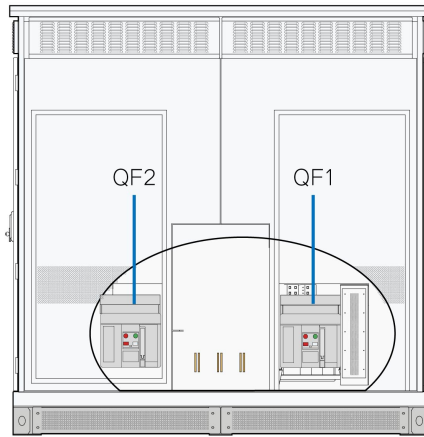
figure 3-2 DC cabinet

\*The figure above is indicative only.

Remark	Name	Description
QS1 QS3	DC load break switch	Connecting/disconnecting the DC side of the inverter.
QS2* QS4*	Energy storage device switch	Connecting/disconnecting the energy storage device.
QS5	DC maintenance switch	Disconnect the switch before maintaining DC cabinet components.
QS6	AC maintenance switch	Disconnect the switch before maintaining AC cabinet components.

\* is optional.

**AC Cabinet**

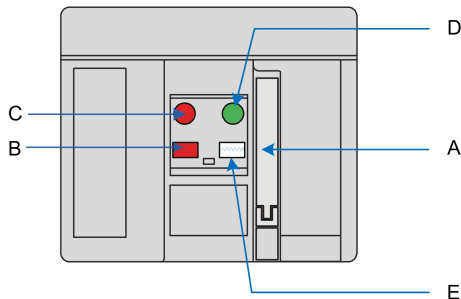


**figure 3-3** AC cabinet

Remark	Name	Description
QF1	AC circuit breaker	Connecting/disconnecting the AC side of the inverter
QF2		

**3.3.4 Operations on the DC and AC Side**

DC load break switches and AC circuit breakers are provided on inverter.



No.	Name	Description
A	Manual energy storage handle	When the circuit breaker has no energy, manually store energy through this button.
B	Circuit breaker state indicator	Display the present state of the circuit breaker, OPEN or CLOSED
C	Push OFF button	The breaker is switched off when this button is pressed
D	Push ON button	The breaker is switched on when this button is pressed
E	Energy storage state indicator	Display the present energy storage state, CHARGED SPRING or DISCHARGE SPRING



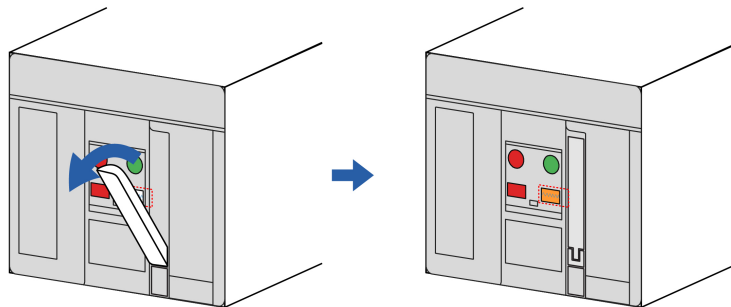
The DC load break switches/AC circuit breakers can be used together with a micro-motor. When there is the power supply on the AC side of the inverter, the energy can be stored to the breaker through this motor. When there is no power supply on the AC side of the inverter, manually store the energy through the manual energy storage handle.

The operation steps are briefly described by taking the load break switches as an example.

- Switch on

Press the Push ON button on the panel to switch on.

Before switching on, check if the energy storage state displayed on the panel is CHARGED SPRING. If the state is DISCHARGED SPRING, store the energy manually by turning the manual energy storage handle down until the breaker panel displays CHARGED SPRING.



After the breaker is switched on, the breaker panel displays CLOSED.

**⚠ DANGER**

**Never manually connect the AC circuit breaker when the AC side carries voltage.**

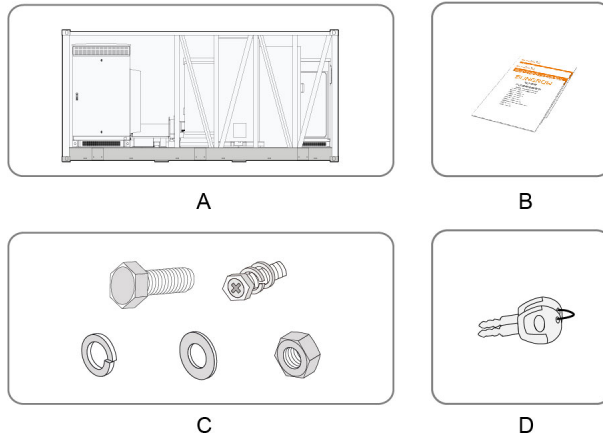
- Switch off

Press the Push OFF button on the breaker panel to switch off the breaker.

After the breaker is switched off, the breaker panel displays OPEN

# 4 Delivery

## 4.1 Scope of Delivery



No.	Device	Note
A	MV Station	-
B	Enclosed documents	System manual, warranty card, quality certificate, and FQC test report
C	Bolt	M12×55 Hexagon head bolt (for DC side)
		M10×25 Stainless steel hexagon head bolt (for container grounding)
		M8×25 Hexagon head bolt (for fuse fixing)
		M6×20 Cross combination bolt (for grounding copper bar conductor)
		M12 (for DC side)
C	Standard spring washer	M10 (for container grounding)
		M8 (for fuse fixing)
		M12 (for DC side)
C	Flat washer	M10 (for container grounding)
		M8 (for fuse fixing)
C	Nut	M12 (for DC side)
D	Keys	Inverter door key
		Monitor window key
		Emergency stop button key
		Inverter enclosure key

\* Spring washer and flat washer are used together with bolts and nuts of the same specification.



The foregoing components are based on the standard MV Station, and those of the actual product may differ. Specifically, refer to the enclosed packing list.

## 4.2 Identifying the MV Station

Identify the MV Station via its nameplate. The nameplate contains the following information: MV Station model, major technical parameters, marks of conformity, origins, and serial number which are available and recognized by Sungrow.

### WARNING

**Very important technical parameters and MV Station related parameters are contained in the nameplate.**

**Protect the nameplate at all times!**

## 4.3 Checking for Transport Damages

The MV Station has been strictly inspected and tested before delivery. Despite robust packaging, the container or inside devices may be damaged during transport. Therefore, once receiving the MV Station, perform a detailed inspection

If any damage is found, contact the shipping company or Sungrow immediately.

- Check the scope of delivery described in "[4.1 Scope of Delivery](#)" for completeness.
- Check that the MV Station and internal devices match the models included in the original order.
- Check thoroughly the MV Station and internal devices for any possible damages caused during transport.

### WARNING

**Install and commission the MV Station only when it is technically faultless! Make sure before installing the MV Station that**

- **MV Station is intact without any damage;**
- **all devices inside the MV Station are intact without any damages.**

## 4.4 Storage Requirements

### 4.4.1 Storage Environment

- The inverter should be stored in an environment with a temperature ranging from -40°C to 70°C. If the ambient temperature is too low, take necessary heating measures for the inverter's internal devices.



- The inverter should be stored in a warehouse with a humidity of less than 55%. If the average ambient humidity is lower than 55%, it is suggested to change the desiccants every three months; if the humidity is higher than 55%, change the desiccants every month. The montmorillonite desiccant should be used. Each inverter unit requires 4 bags of desiccant, 200g per bag. Before grid connection, take the desiccants out of the inverter.
- Keep the product on a dry, flat, and solid ground that has sufficient bearing capacity and is not covered by vegetation. The ground where the product is kept should be flat, with a horizontal error of less than 0.25%, and have an overall slope of less than 5 degree.
- Avoid storing the inverter in places where it may come in touch with rainwater, or in low-lying places, to prevent the accumulated rainwater from getting into it. If the inverter must be stored outdoors due to restrictions on site, elevate its base off the ground to a certain height. The height should be decided according to the geological, meteorological, and other conditions on site.
- Avoid storing the inverter in places where corrosive gas or dust may be produced or accumulated, or in places within 30 km (20 miles) of saline-alkaline land or pollution-generating industrial complex such as chemical plants and power plants (chemical gas class: 1C1, solid particle level: 1S2). Avoid storing the inverter in environments contaminated with halogen and sulfur pollutants.
- Do not install the inverter in places with vibration or a magnetic field strength of over 30A/m.
- Do not store the inverter in environments with flammables and explosives.
- To prevent the inverter from being stored for an overly long period of time, please apply the "first-in, first-out" method to product storage.

#### 4.4.2 Protection During Storage

- During the process of product handling and storage, impacts or collisions to the product must be avoided.
- Before storage, make sure the doors of the product and its internal devices are all locked. During storage, avoid opening the doors, unless it is necessary.
- Seal off the product's air inlet/outlet and the DC cable inlet area. During the period of storage, make sure the protective films on the air inlet/outlet are intact. Meanwhile, take effective measures to prevent the ingress of rainwater, dust, and sand into the product.
- Do not have the inverter stressed with heavy weights. The containers should not be stacked in more than four layers, and heavy weights are not allowed on the top of the inverter, power distribution cabinet, transformer, and protective cover for low-voltage copper bars.

#### 4.4.3 Routine Inspection for Long-term Storage

- Perform regular inspection, at least once every half a month. Check whether the dust cover is damaged and whether the product and its internal devices are intact.
- It is suggested that units that have not been put into operation (from the date of receipt by the customer) and the units shut down temporarily (from the date of shutdown) should not be stored for more than three months. If stored for a long period of time, sealing

measures and necessary tests and inspections are required for the product. For products shut down temporarily, put desiccants inside them. It is needed to open the door and visually inspect the product and its internal devices for damage first.

- For a product shut down/stored for over six months, inspect its electrical components (- IGBT module, switch, etc.), and take dehumidification and dedusting measures for the whole product. For detailed operation, please contact SUNGROW.

## 5 Mechanical Installation

### WARNING

**Respect all local standards and requirements during mechanical installation.**

### 5.1 Transport

All devices are installed inside the MV Station before delivery. The MV Station should be transported as a whole. Transport the MV Station by crane with sufficient load capacity. The MV Station is delivered to the user by a forwarding company. After unloading, the MV Station will be transported to the installation site by the plant staff.

### WARNING

**Local standards and regulations on the container transport and loading & unloading, especially those safety instructions, should be observed at all times.**

- **All the accessory appliances to be used during transport should be maintained beforehand.**
- **The transport of the MV Station must be performed by qualified personnel. Qualified personnel are those who have been trained, especially in safety operation.**

### NOTICE

**Keep in mind the dimensions and total weight of the MV Station at all times!**

Ensure that the following requirements are met:

- All the doors are locked.
- Choose appropriate crane or hoist to transport the MV Station. The crane or hoist must be sufficient to bear the weight of the MV Station.
- An additional traction vehicle may be required for uphill/downhill road transport.
- Anything, which may hinder the transport, like trees, cables (or similar), should be removed.
- Transport the MV Station on fine weather days as far as reasonably possible.
- Warning signs or barriers must be posted near the transport areas to avoid accidental injuries.

Additionally, the following should be met when the MV Station is placed on the ground:

- Place the MV Station carefully and gently. Do not pull or push the MV Station on any surface.
- The place should be firm and flat, has good drainage and has no obstacles or outshoots. The MV Station should be placed and supported by the four feet.

## 5.2 Hoisting the MV Station

### 5.2.1 Safety Precautions

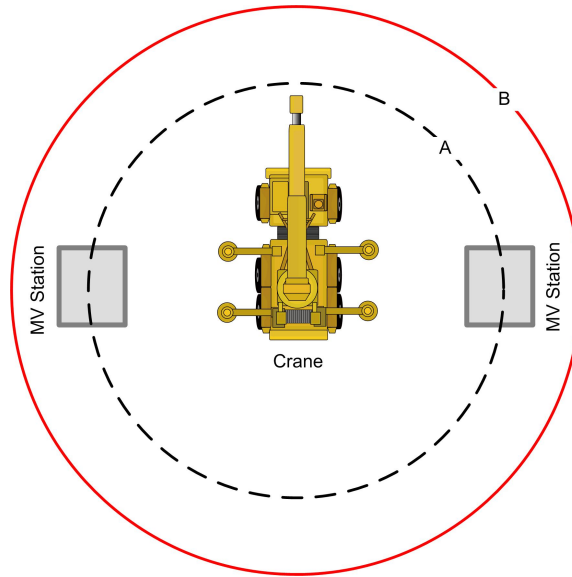
#### **⚠ WARNING**

- **Observe the safety operating rules of the crane at all times.**
- **Standing within 5 to 10 meters of the hoisting areas is strictly forbidden! Anybody standing under the boom or Station is strictly forbidden in the whole hoisting process.**
- **The hoisting work must be stopped in violent weather days. For example, in strong wind, heavy rain, or thick fog conditions.**

Carefully observe the following items:

- All safety requirements must be met.
- A professional instructor is needed in the whole hoisting process.
- All the slings used must have the load-bearing capacity of at least 50,000kg/110200lbs.
- The crane should have sufficient arm length and radius of gyration.
- All the connection point must be firmly connected.
- The length of the slings can be adjusted appropriately according to on-site conditions.
- Transport the MV Station in a level, smooth and steady way.
- Transport the MV Station by connecting the four top corner fittings.
- Some accessories may be needed to ensure the hoisting safety.

The following figure illustrates the hoisting operations. Circle A indicates the work areas of the crane. Anybody standing inside the circle B is forbidden for safety considerations.

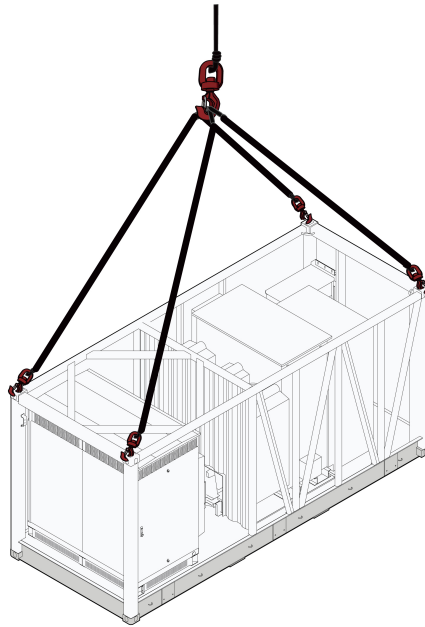


### 5.2.2 Hoisting

In the whole hoisting process, observe following rules:

- Hoist the MV Station in a vertical manner. Do not drag or drop the MV Station on any surface.
- When the MV Station has been hoisted for about 300mm from the ground, stop to check if all the connections are still firm. After confirmation, continue hoisting the MV Station.
- When transported to the final location, the MV Station should be put down slowly and steadily.
- The final location should be firm, level, and well-drained. The MV Station is supported by four bottom fittings on the ground.

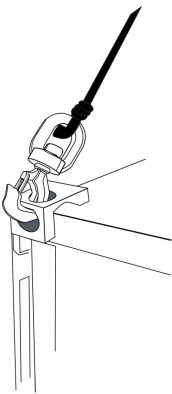
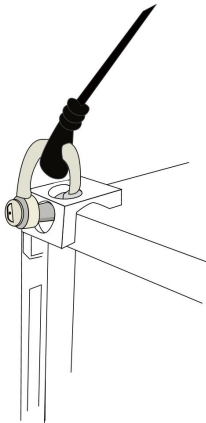
The MV Station should be hoisted by using four top corner fittings as shown in the following figure.



### 5.2.3 Fastening of Connectors

Use slings with hooks or U-hooks to hoist the MV Station.

The lifting devices should be connected correctly to the MV Station.

Lifting device	Hook	U-hook
Connections		
Notice	Insert the hook from inside to outside.	Lateral pin of the U-hook should be tightened.

#### **⚠ WARNING**

- National and local safety rules should be observed at all times.
- Regardless of relevant safety rules may void pertinent warranty claims from Sungrow.

## 5.3 Foundation

### 5.3.1 Selection of Installation Site

When selecting the installation site, consider at least the following requirements:

- Ambient and geological conditions, such as stress wave emissions, the level of underground water table, etc. should be taken into account.
- The ambient environment should be dry, well ventilated, and far away from inflammable materials.
- The ground at the installation site must be compacted enough. Relative compaction of the ground should be equal or greater than 98%. take proper methods to strengthen the ground if otherwise.

### 5.3.2 Foundation Requirements

#### WARNING

**Pay attention to the heavy weight of the MV Station. Check thoroughly the conditions of the installation site (mainly the geographical and environmental conditions). Then design and construct the foundation.**

Improper foundation construction may affect the place of the MV Station, open & close of the door and later maintenance of the MV Station. Therefore, the foundation must be designed and constructed according to related standard. The dimensions, weight of the MV Station, the cable route and later maintenance should be considered at all times.

The following conditions must be fulfilled:

- The bottom of foundation should be firm enough.
- The foundations must be suitable for the weight of the MV Station.
- The foundation should be higher than the solid ground on site to avoid the rain damaging the base or the inside of the MV Station.
- In foundation construction, take appropriate drainage measures according to local geological conditions.
- Sufficient cross-sectional area and depth of the foundation should be maintained. The depth is designed according to local soil conditions.
- Cable route should be taken into account.

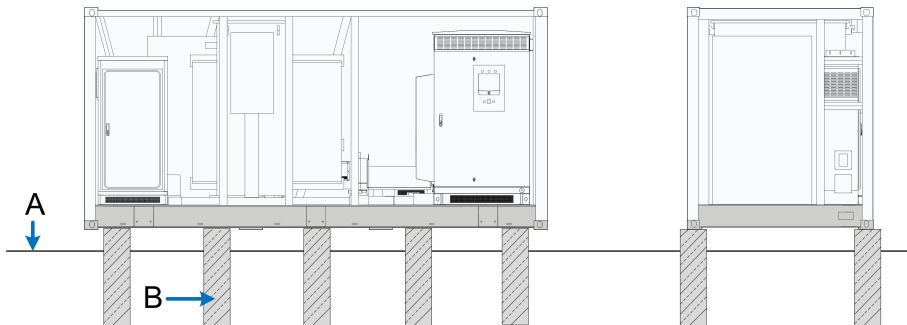


According to the cable design of MV Station and for easy electrical connection, establish cable trenches on bottom of the MV Station, i.e. reserve the cable trenches inside the foundation and pre-bury the wire pipes.

The material dug out should be cleared immediately.

### 5.3.3 Recommended Foundation Construction Method

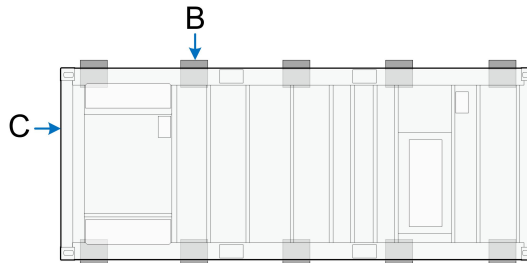
The overall diagram is shown in the following figure.



No.	Name
A	Pea gravel ground
B	Foundation

#### Constructing the Foundation

It is recommended to construct the foundation as the following solution.



No.	Name
C	MV Station base

#### Fixing the MV Station

Hoisting the MV Station to the desired location and welded.

After completion, anti-corrosion treatment should be done on the welding position.

## 5.4 Installing the Drain Valve/Oil-Water Separator

There are two design schemes at the bottom of MV Station. Drain valve or oil-water separator can be installed according to customized requirements.

#### NOTICE

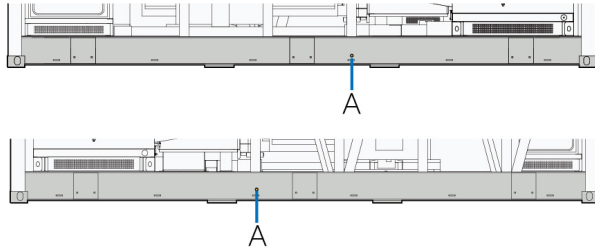
**For ease of installation, it is recommended to install the drain valve or oil-water separator before hoisting the MV Station to the installation position.**



### 5.4.1 Installing the Drain Valve(Optional)

#### Overview

The installation positions of the drain valve are reserved at the bottom of the MV Station, which are located on the front and back of the MV Station, as shown in figure A below.

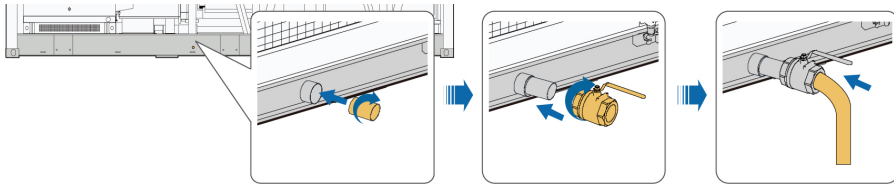


#### Installation Parts

Before installing the drain valve, the required parts:

- Connector(in the scope of delivery)
- Drain valve(in the scope of delivery)
- Oil pipe (beyond the scope of delivery)

#### Installation Methods



**Step 1** Screw the connector into the mounting hole at the bottom of the MV Station.

**Step 2** Install the drain valve on the connector.

**Step 3** (Optional operation) Connect the oil pipe to the drain valve.

-- End

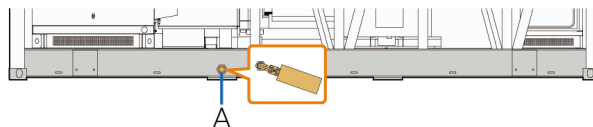
#### Precautions

- If the oil pipe is connected, the drain valve needs to be opened.
- If the oil pipe is not connected, the drain valve needs to be closed.

### 5.4.2 Installing Oil-Water Separator (Optional)

#### Overview

The installation position of the oil-water separator is reserved at the bottom of the MV Station, which are located on the front of the MV Station, as shown in figure A below.

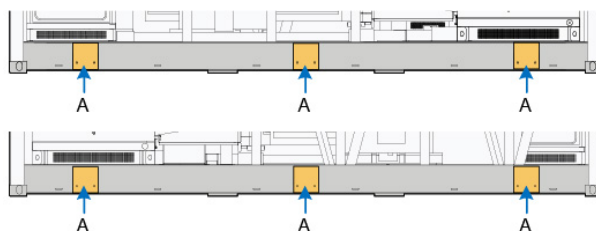


If the installation of the oil-water separator is needed, please contact SUNGROW customer service or designated partners.

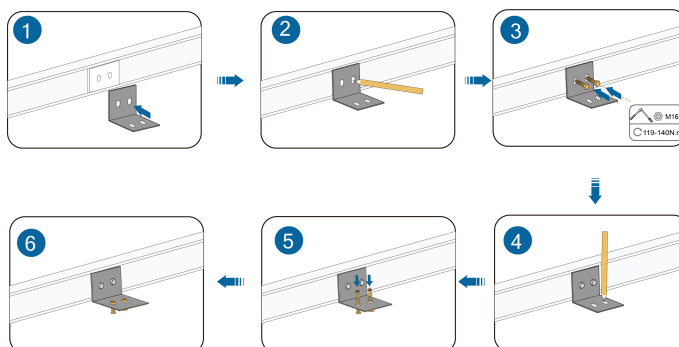
## 5.5 Fixing the MV Station

If the foundation is constructed as the above plan, the MV Station needs to be hoisted to the desired location and welded.

If the foundation is not constructed as the above plan, it is necessary to fix the fixing point at the bottom of the inverter (shown as A below) with the existing operating platform using L mounting parts.

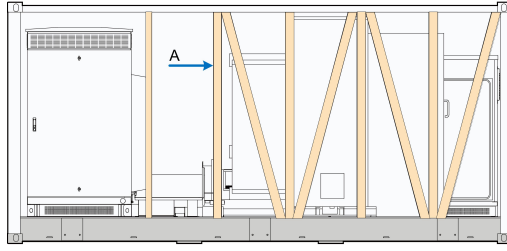


The steps to fixing the L mounting parts is shown in the following figure.

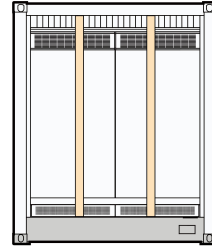


## 5.6 Removing the Supporting Plates

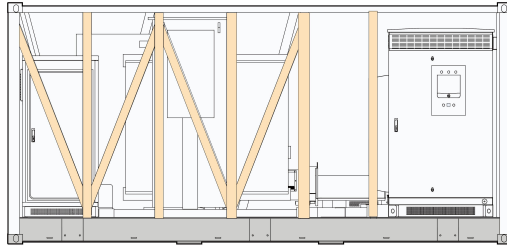
Before putting the inverter into operation, remove the support plates of the MV Station, shown as A in the figure below.



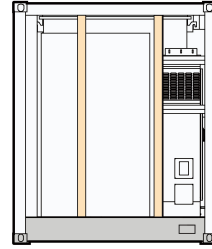
Front



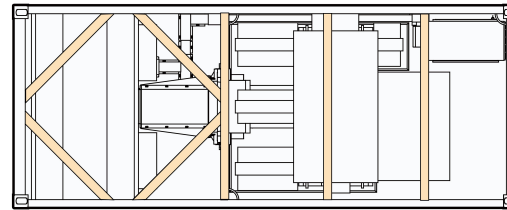
Left



Back



Right



Top

# 6 Electrical Installation

## 6.1 Safety Instructions

### 6.1.1 Generals Rules

#### DANGER

High voltage! Electrical shock hazards!

- Do not touch the live components of the device.
- Make sure the AC and DC sides are voltage-free before installation.
- Never put flammable materials in the vicinity of the MV Station.

#### DANGER

If a ground fault occurs in the PV system, some parts that are supposedly voltage-free may carry lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before operation and take proper protective measures.

#### WARNING

- Observe all the country-specific standards and regulations.
- Connect the MV Station to public grid only after receiving authorization from the local network operator.

#### WARNING

Only professional electricians can perform the operations described in this chapter.

Observe all the instructions during electrical connection.

#### WARNING

Check to make sure all AC and DC switches are disconnected before electrical connection.

**⚠ WARNING**

**Sand and moisture penetration may affect the performance of electric devices inside the MV Station!**

- **Do not perform electrical connection in sandy season or when the ambient relative humidity is above 95%.**
- **Perform electrical connection at fine weather days.**

**⚠ WARNING**

**Improper torque used may cause fire to the connection point!  
Strictly observe the torque requirements in this manual during electrical connection.**

**⚠ WARNING**

**Too small bending radius or excessive intertwine may damage the fiber!  
When selecting fiber as the communication cable, follow the related requirements of the fiber manufacturer about the min. permissible bending radius.**

**⚠ WARNING**

**Only professional electricians can perform the electrical connection. Professional electricians should meet the related requirements listed in "[2 Safety Instructions](#)" in this manual. Sungrow shall not be held liable for any personal injury or property loss caused by ignorance of the safety instructions.**

**⚠ WARNING**

**Ensure the electrical insulation meets requirements before laying the cables.  
Follow the EMC regulation and lay the power cable and communication cable in different layers. Provide support and protection to the cables to reduce the stress of the cables when necessary.**

**⚠ WARNING**

**Strictly follow all the instructions when connecting the cables.**

**⚠ WARNING**

- **The installation and design of the MV Station must fulfill national and local standards and regulations.**
- **Sungrow shall not be held liable for the MV Station or system fault caused by ignorance of the description in this manual.**



Select optical fibers as the external communication cable to lower the signal interference.

### 6.1.2 Five Safety Rules

During electrical connections and other operations on the inside device, observe the following Five Safety Rules:

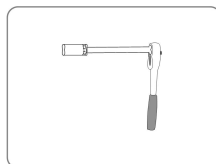
- Disconnect all the external connections and disconnect the MV Station internal power supply.
- Avoid any accidental re-connections.
- Verify that no voltage or current is present with appropriate measurement instrument.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid accidental contact.

## 6.2 Preparation before Electrical Connections

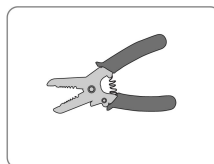
Electrical connections between devices inside the MV Station have been performed before delivery. On site, the connections between the MV Station and external devices need to be performed, including DC connection, AC connection and communication connection.

### 6.2.1 Installation Tools

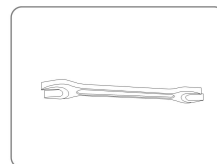
Installation tools include but are not limited to the following recommended ones, and other auxiliary tools or components can be used on site when necessary.



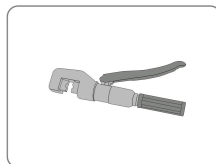
Torque wrench



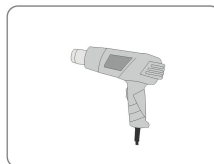
Wire stripper



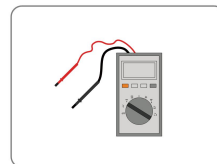
Allen wrench  
for terminal fixing



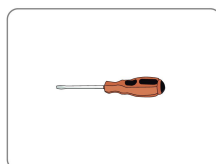
Terminal crimper



Heat blower



Megger and multimeter

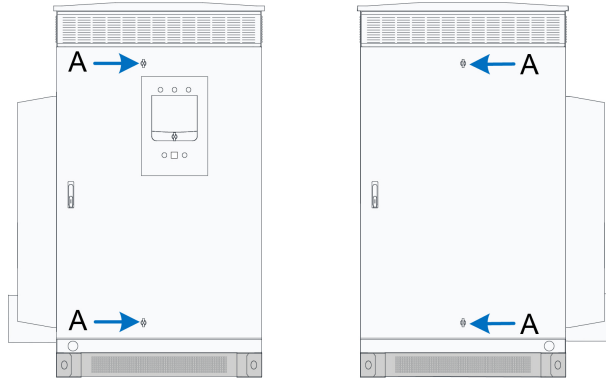


Screwdriver

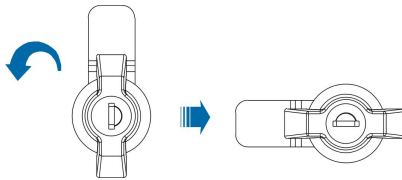
## 6.2.2 Opening the Inverter Door

### Opening the Enclosure

The locks are installed on the inverter enclosure (Figure A below).

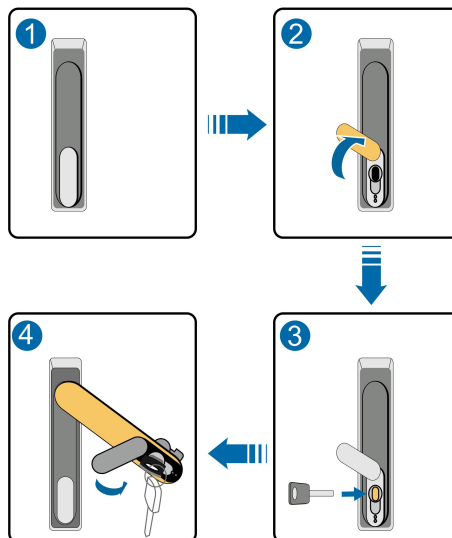


- 1 Open the protective cover on the door lock.
- 2 Insert the key.
- 3 Turn the handle counterclockwise to unlock the door.



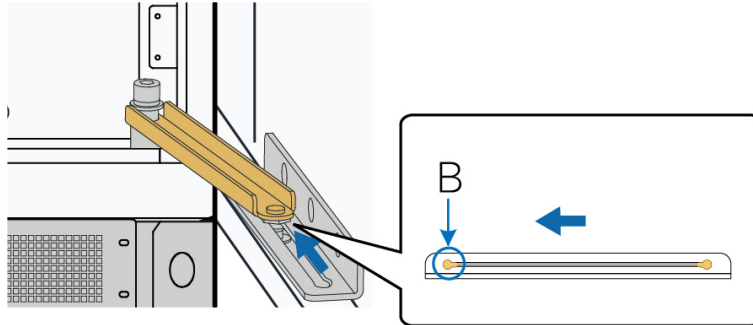
### Opening the Door Lock

Open the doors before cable connection.



### Fixing the Enclosure

When the cabinet door is opened, the studs slide naturally. When the stud slides to the gourd hole (Figure B), the limit rod is automatically fixed.



#### 6.2.3 Checking the Cables

**⚠ WARNING**

Check to ensure the intactness and insulation of all cables before electrical connection. Poor insulation or damages in the cables may cause hazards. Replace them if necessary.

#### 6.2.4 During Connection

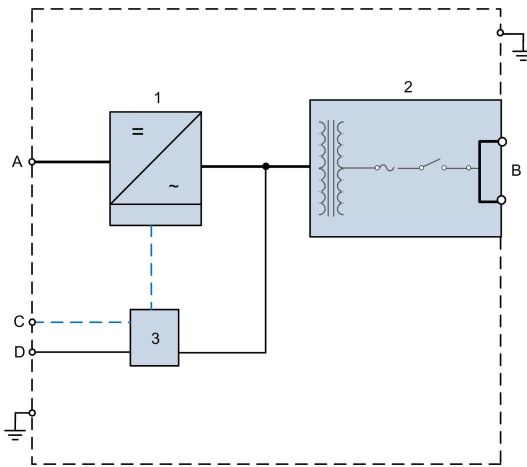
**⚠ WARNING**

- Make sure the DC cables are correctly routed before connection.
- Do not pull the cables hard during connection.
- Make sure there is enough wire bending space for all connection cables.
- Take proper methods to reduce the stress of cables.
- Check carefully to ensure the correctness and fastness of the connections.



## 6.3 Circuit Diagram and Cable Connection

### 6.3.1 Circuit Diagram



1–Inverter; 2–Transformer; 3–Intelligent PMD

table 6-1 Ports in the figure above

No.	Name
A	DC input
B	AC output
C	External communication port
D*	External 3-phase power supply

### 6.3.2 Cable Specifications

Choose cables according to the rules below:

- All the cables must have sufficient ampacity. The ampacity of the conductor can at least be influenced by environmental conditions, conductor insulation materials, laying, wire materials, cross-sectional areas, etc.
- All the cables must be chosen according to the maximum current of the inverter.
- Cables for one polarity or phase should be of the same type and specification.
- Flame retardant and fire resistant cables are recommended.

#### **⚠ WARNING**

**Overloading operation of cables is strictly forbidden.**

## 6.4 Ground Connection

### Brief Introduction

#### **⚠ WARNING**

**Observe the country-specific regulations and standards at all times!**

Generally, the ground connection can be divided into two parts, equipotential connection of MV Station internal devices and MV Station external grounding.

#### **Equipotential Connection of MV Station Internal Devices**

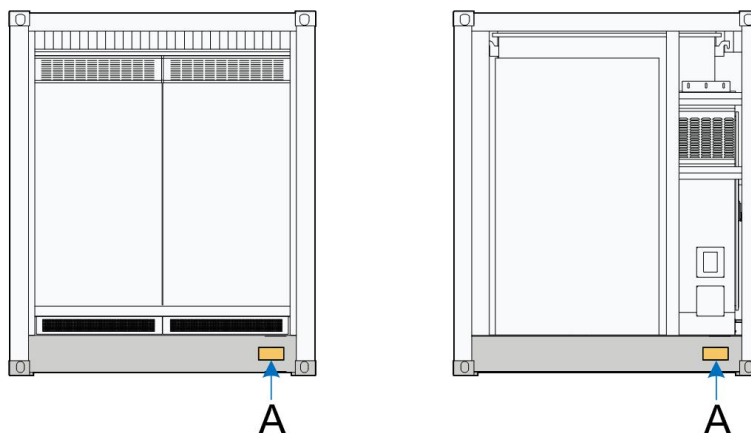
All electrical devices inside the MV Station should be connected equipotentially through the total equipotential connection copper bar inside intelligent PMD. The grounding terminal of all the main electrical devices should connect to the total equipotential connection copper bar.

The connection of the internal main electrical devices to the ground copper bar has been finished before delivery.

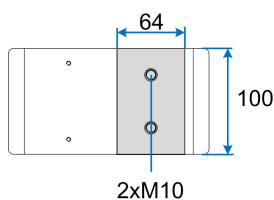
On site, if grounding connection is required, the 16mm<sup>2</sup> cable is recommended.

#### **External Grounding**

For ease of onsite cable connection, two grounding points are designed at the exterior of the MV Station, as shown in the figure below. On site, reliably connect both or either of the two grounding points according to actual conditions.



The dimensions of the grounding copper point are as follows:



The external grounding points of the MV Station can be grounded in the following two manners:

- Connect the grounding cable to the external grounding points with M10 bolts, where the recommended cable is of 50 mm<sup>2</sup> to 95 mm<sup>2</sup>.
- Weld the grounding steel flat onto the external grounding point, after which anti-corrosion processing needs to be performed.

Perform the external grounding according to the on-site situation and the instructions of the plant staff.

It is recommended that two points of the MV Station should be connected to the ground system of the PV plant.

The grounding resistance should be determined according to local standards and regulations.



The grounding resistance should be obtained from local standards and regulations.

#### WARNING

**If you have any problems in relation to the ground cable connection, contact the related technical personnel in time. Any installations not following the standards or the installation and alternation without permission may lead to safety incidents or damage to the devices. Sungrow shall not be held liable for the damages caused.**

## 6.5 AC Connection

### 6.5.1 Safety Instructions

#### WARNING

**Electrical shock hazards!**

- **Do not touch the live components.**
- **Disconnect the AC switches and ensure all terminals are voltage-free.**
- **The connections to the downstream devices must be carried out only after receiving approval from the distribution utility as required by national and state interconnection regulations.**

#### WARNING

**Strictly follow all the instructions when connecting.**

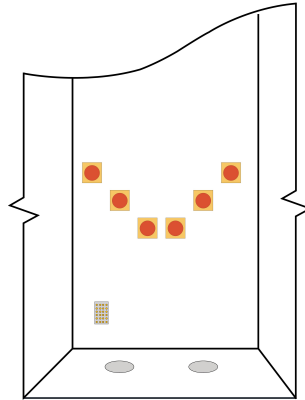
### 6.5.2 AC Cable Connection

#### Prerequisites

- Check and ensure that the AC side of the inverter is disconnected.

- Disconnect the load switch of the transformer with the dedicated operation bar, where reference can be made to the user manual of the transformer.
- Open the operation box of the transformer, and get the key to the HV cabinet door as well as the bolts required for wiring.
- Remove the protection jacket from the HV tube.
- Check and ensure that the tube and copper bar in the wiring area of the HV cabinet are intact without any deformation or cracks.

### Wiring Area



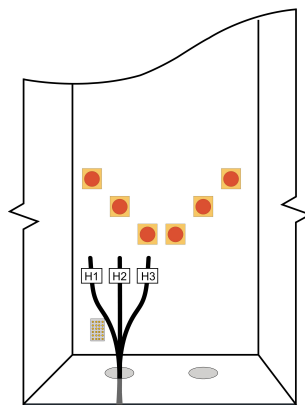
Note: The figure is for reference only, and the actual product may differ.

### Wiring Steps

**Step 1** Drill holes on the bottom sealing plate of the HV cabinet according to local standards and regulations.

**Step 2** Lead external cables inside through the bottom cable entries.

Each of the three-phase (phase H1, phase H2, and phase H3) cables is led inside through the same cable entry.



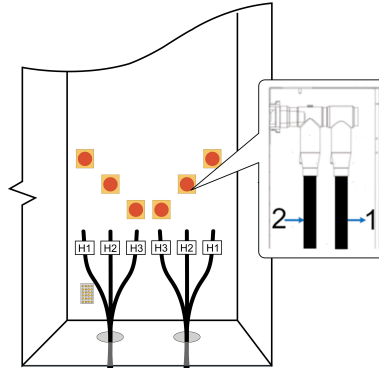
**Step 3** Prepare the terminals and install them tightly, where reference can be made to the installation manual of the cable connector.

Both copper-core cable and aluminium-core cable are applicable.

In case of copper-core cables, use copper wiring terminals.

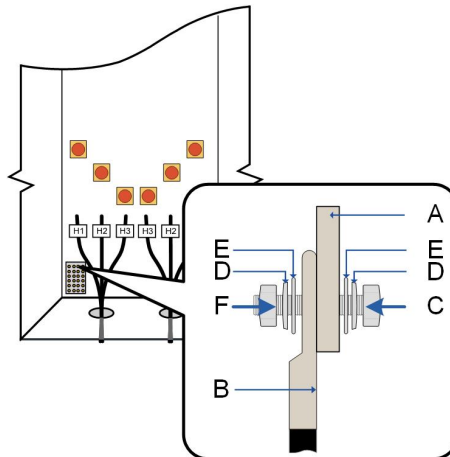
In case of aluminium cables, use copper-to-aluminium adapter terminals.

A maximum of 2x2 output cables can be connected to the HV wiring copper bars, i.e., the outer copper bar (shown by 1), and the inner copper bar (shown by 2).



On site, determine the number of output cables and the wiring scheme according to actual situation.

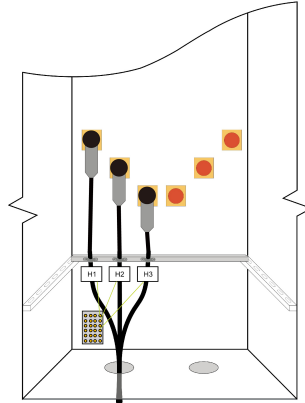
After wiring, reliably connect the cable connector to the grounding copper bar inside the high-voltage room according to local standards and regulations, where the fastening torque is 60~70N.m.



A	B	C	D	E	F
Copper bus	Cable lug	Bolt(M12)	Disc spring washer	Flat washer	Nut

-- End

**Further Operations**



After completing wiring, fix the cable on the beam (not included in the scope of supply) to avoid excessive stress on the cable.

Seal the bottom cable entries with fireproof mud (foaming materials), remove debris in the HV cabinet, close and lock the cabinet door.

Remove the key to the HV cabinet door, and store it in the operation box.

## 6.6 DC Connection

### 6.6.1 Checking before Connection

Check the following items before cable connections.

- Check the open-circuit voltage of the PV array to ensure the open-circuit voltage is less than the max. DC voltage of the inverter.
- Mark the negative and positive polarity of the cable.
- Check the PV modules for possible ground fault.

#### **⚠ WARNING**

- **Open-circuit voltage of the PV array should not exceed the max. DC voltage of the inverter. The inverter may be damaged if otherwise.**
- **If a ground fault is detected, remove it before performing any DC connection.**

#### **⚠ WARNING**

**Strictly follow all the instructions when connecting the cables.**

#### **⚠ WARNING**

**Observe all the safety rules specified by the PV array manufacture.**

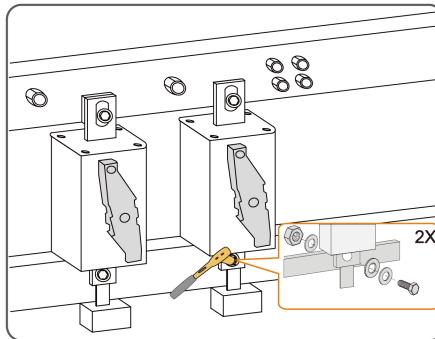
Start DC connection only when all checks and measurements meet requirements.

## 6.6.2 Preparation Before Wiring

According to the actual site, it may be necessary to install DC fuses and PC board before DC wiring.

### 6.6.2.1 Install DC Fuses(Optional)

Use M8×30 bolt to fasten new fuse with a socket spanner. Fastening torque:18~23N.m.



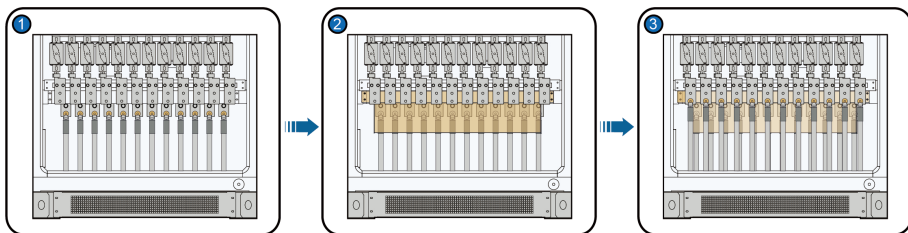
### 6.6.2.2 Installing PC Board

Installing PC board before cable connections.

**Step 1** Install the negative DC cable.

**Step 2** Fix the PC board to the bracket.

**Step 3** Install the positive DC cable.



-- End

## 6.6.3 DC Cable Connection

### Overview

DC wiring terminals are located at the bottom of the DC cabinet.

### DC Connection Area

DC wiring terminals are located at the bottom of the DC cabinet.

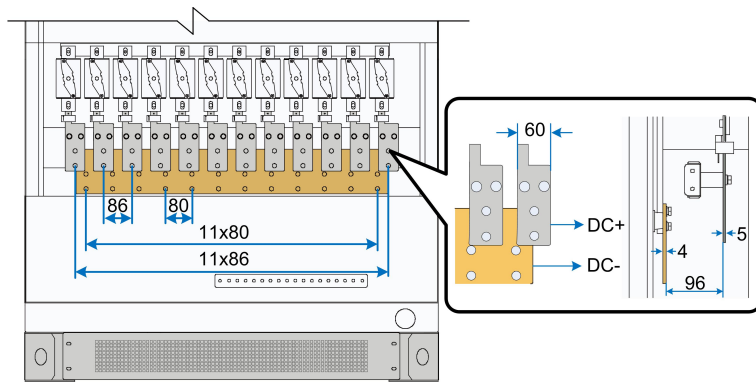


figure 6-1 DC input(n≤24 )

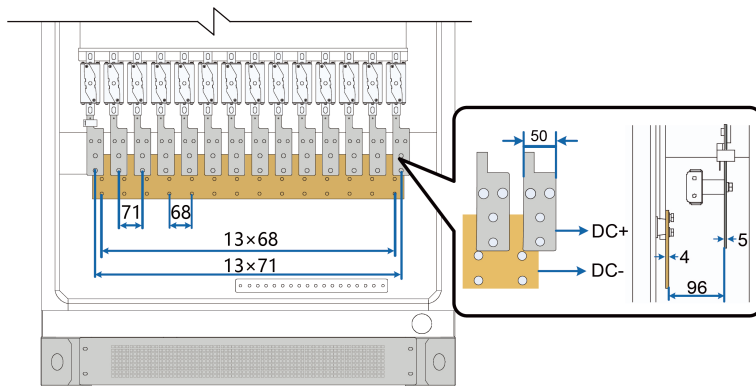


figure 6-2 DC input(n > 24 )

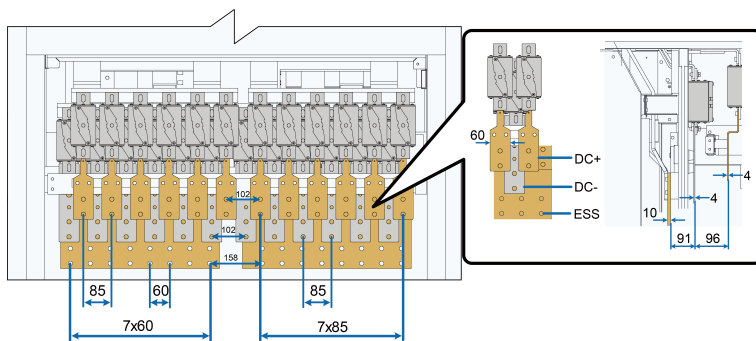


figure 6-3 DC connection area with energy storage system ports

No.	Description
DC+	DC positive cable connection area
DC-	DC negative cable connection area
ESS	Energy storage system port

**Cable Requirements**



- The maximum cross-sectional area of the aluminum/copper cable is 400mm<sup>2</sup>/750Kcmil.
- Fasten the wiring terminal with the bolts in the scope of delivery. And the torques are shown in following table.

Bolt	Torque
M12×55	60~70N.m/531~619.5lbf.inch

### ⚠ WARNING

The number of PV modules connected to the two inverter units should be as balanced as possible.

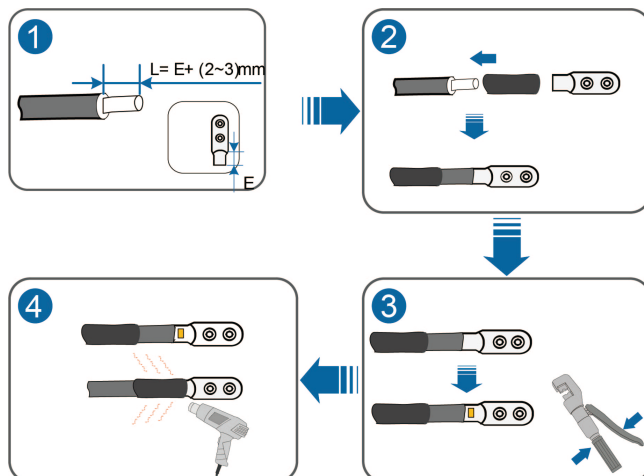
### Cable Connection Steps

Proceed as follows to connect the DC cables:

- Step 1** Make sure the switch upstream of the combiner box is in the OFF position.
- Step 2** Lead the cable into the wiring area through the inlet hole, and mark the cable polarity.
- Step 3** Strip the protective layer of the cable to expose the copper core of the wire with strippers.
- Step 4** Install the OT/DT terminal to the wire and crimp them with a crimping tool.

### NOTICE

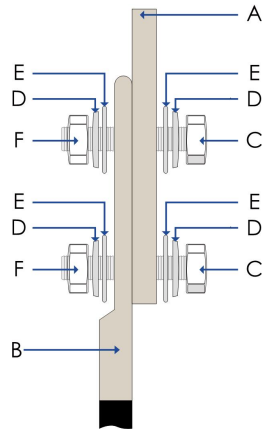
Recommended to wrap the exposed copper core with heat shrink tubing.



**Step 5** Connect the cable.

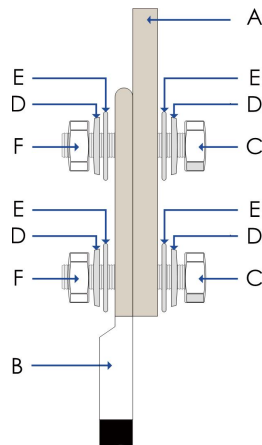
- 1 Select bolts matching with the cable lug.
- 2 Attach the cable lug to the DC connection copper bar.

If copper wires are used, connect the spare parts as described below:



No.	Name	No.	Name
A	Copper bus	D	Disc spring washer
B	Cable lug	E	Flat washer
C	Bolt	F	Nut

When the aluminum wire is selected, a copper-aluminum adapter terminal is needed as shown below:



No.	Name	No.	Name
A	Copper bus	D	Disc spring washer
B	Copper-aluminum adapter terminal	E	Flat washer
C	Bolt	F	Nut

- 3 Fasten the bolts with screwdriver or spanner.

#### ⚠ WARNING

- **Incorrect connection sequence may cause fire. Pay maximum attention to the connection sequence.**
- **Ensure the firmness of the cable connection. Poor connection or oxidation of the surface may cause over-heating or fire.**

#### NOTICE

- **Long bolts may affect the insulation and may cause short circuit.**
- **Remove the heat-shrink tubing between the cable lug and the copper bar if necessary. Poor contact or over-heating may follow if otherwise.**

**Step 6** Confirm that all cable connections are secure.

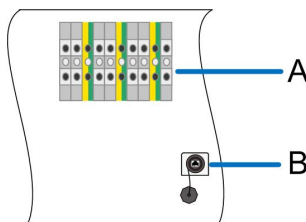
-- End



To reduce safety risks, it is recommended to use heat shrink tubing when wiring.

## 6.7 Communication Connection

The communication terminals are located in lower part of the intelligent PMD, as shown in the figure below.



No.	Description
A	XB21 terminal blocks, RS485 communication port
B	Ethernet port

On site, perform cable connection according to internal terminal markings.

## 6.8 External Equipment Connection

The power distribution cabinet is divided into two versions: 5KVA and 35KVA. The actual MV Station received may be equipped with one of these versions, and the specific agreement shall prevail.

If 5KVA is chosen, please refer to "6.8.1 5KVA Power Distribution Cabinet" to perform the connection.

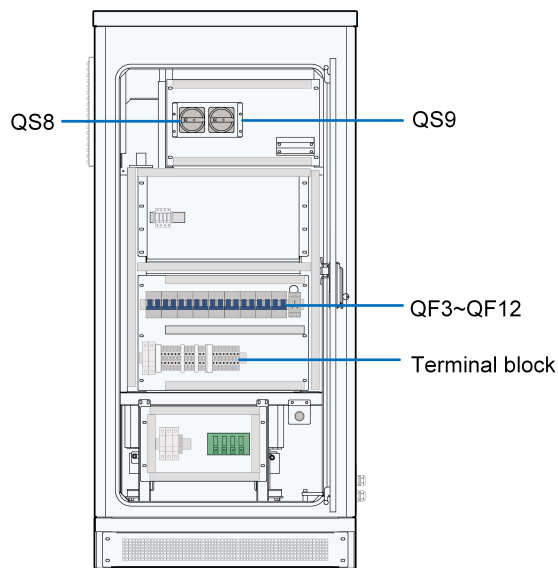
If 35KVA is chosen, please refer to "6.8.2 35KVA Power Distribution Cabinet" to perform the connection.

**⚠ WARNING**

**Unless the MV transformer disconnect switch is open, 630V AC may be present in the Power Distribution Cabinet.**

### 6.8.1 5KVA Power Distribution Cabinet

#### Internal Components

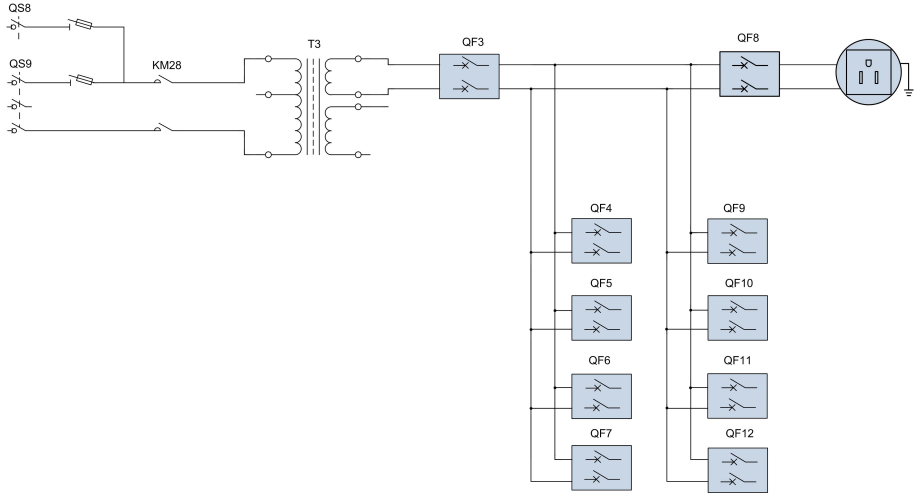


No.	Name
QS8*	Control switch for self-constructed grid
QS9	Control switch for auxiliary transformer
QF3	Control switch for 120Vac power supply
QF4	Reserved for 120Vac power supply
QF5	Reserved for 120Vac power supply
QF6	Reserved for 120Vac power supply
QF7	Reserved for 120Vac power supply
QF8	Control switch for power socket
QF9	Reserved for 120Vac power supply
QF10	Reserved for 120Vac power supply
QF11	Reserved for 120Vac power supply
QF12	Reserved for 120Vac power supply

\* is optional.

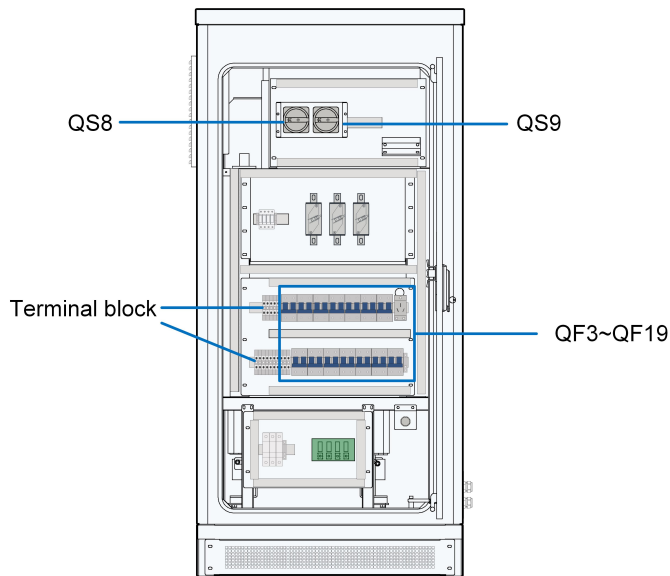
### Wiring diagram

The wiring diagram of external power supply is shown in the figure below. Perform cable connection according to this diagram.



### 6.8.2 35KVA Power Distribution Cabinet

#### Internal Components



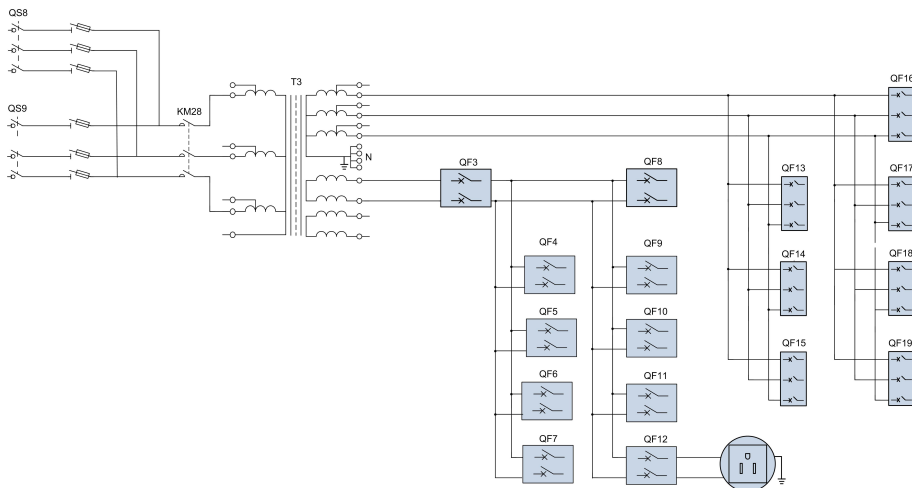
No.	Name
QS8*	Control switch for self-constructed grid
QS9	Control switch for auxiliary transformer
QF3	Control switch for 120Vac power switch
QF4	Reserved for 120Vac power supply
QF5	Reserved for 120Vac power supply

No.	Name
QF6	Reserved for 120Vac power supply
QF7	Reserved for 120Vac power supply
QF8	Reserved for 120Vac power supply
QF9	Reserved for 120Vac power supply
QF10	Reserved for 120Vac power supply
QF11	Reserved for 120Vac power supply
QF12	Control switch for power socket
QF13	Reserved for 480Vac power supply
QF14	Reserved for 480Vac power supply
QF15	Reserved for 480Vac power supply
QF16	Reserved for 480Vac power supply
QF17	Reserved for 480Vac power supply
QF18	Reserved for 480Vac power supply
QF19	Reserved for 480Vac power supply
AC277V-N	277Vac—PEN Terminals

\* is optional.

### Wiring Diagram

The wiring diagram of external power supply is shown in the figure below. Perform cable connection according to this diagram.



## 6.9 Finishing Electrical Connection

 **WARNING**

**After the electrical connection, check the connections of all cables for correctness and firmness.**

After checking that all connections are correct and firm,

- Close the cable entries on the bottom of the module by following the reversed procedure in opening the cable entries.
- The gap at the cable inlet/outlet at the bottom of the MV Station should be sealed with fireproof mud.
- Water-proof treatment should be performed on the foundation of the MV Station.

# 7 Commissioning

## 7.1 Safety Instructions

### DANGER

**High voltage! Electric shock!**

- Wear proper protection equipment before all operations on the device.
- Do not touch the live terminals or conductors.
- Respect all safety instructions attached on the device and described in this manual.
- Respect all safety instructions prescribed by the manufacturer of devices connected to the MV Station.

### WARNING

**Grid-connection of the MV Station can be performed only after receiving approval from the local utility grid company and by qualified personnel.**

### WARNING

**After the MV Station is operating, make sure there are no flammable materials at least 5 meters around the installation site.**

**Local/national standards about the min. electric clearance around the MV Station should be respected.**

### CAUTION

**Make sure the installation is correct and no spare parts or tools are left inside the device.**

### NOTICE

**Close the doors of the MV Station and the internal devices if the commissioning process is stopped.**

## 7.2 Requirements of Commissioning

Before commissioning, installation of all the devices inside the MV Station should be checked thoroughly.



- Ensure all cables are connected securely and all bolts are fixed properly.
- Ensure DC side voltage meets inverter requirements and the polarity is correct.
- Ensure AC side voltage meets inverter requirements.
- Ensure all cable connections meets related standards and requirements.
- Ensure the system is properly grounded. Ground resistance is important for the whole system so that before commissioning, make sure the ground resistance is less than  $4\Omega$ .

**⚠ WARNING**

**Make sure the emergency stop button inside the monitoring window is released, all AC & DC switches are disconnected and all micro-circuit breakers inside the intelligent PMD are disconnected before commissioning.**

**NOTICE**

**All commissioning operations must be performed only by qualified personnel.**



Commission the device when it is sunny and the environmental conditions are stable to ensure the successful commissioning.

## 7.3 Checking before Commissioning

### 7.3.1 Checking the Cable Connection

- Check cables for any possible damages or cracks.
- Check that all cables are connected securely according to the cable connection diagram. Adjust the cable connection if necessary.
- Ensure all cable connections are firmly enough. Fix the bolts if necessary.
- Check the PE equipotential connection. Ensure the PE ground copper bar has connected to the equipotential connection point in the electrical room and properly grounded. The ground resistance should be no more than  $4\Omega$ .

### 7.3.2 Checking the Inverter

- Ensure that the DC and AC switches are in the "OFF" position.
- Check whether the electric switches and buttons of the MV Station and its upstream and downstream devices can be operated flexibly.

### 7.3.3 Checking PV Array

**⚠ WARNING**

**Ensure the measuring devices are connected and used correctly. Otherwise, there will be electric arc.**

**⚠ WARNING**

**DC side voltage should be no more than the max. DC input voltage of the MV Station.**

**Too high DC voltage may damage the module even cause safety incident.**



To ensure system reliability and device operation, PV cells on the DC side of the MV Station should be from the same manufacturer and the number of PV cells in each string should be the same.

Check the PV arrays before grid-connection. The voltage of each DC main cables should be the same and no more than the max. permissible DC voltage. Check carefully the polarity of each DC main cable. Once the polarity in one DC main cable is incorrect, the PV arrays may be damaged.

Make sure the environmental condition is stable since the voltage of PV array may change with the solar radiation and the temperature of the PV cells. Record the PV array status via the U-1 curve. Commission the device when the PV array output situation is stable.



The PV field circuit fault (module fault or module numbers deviation in certain array), cable damages or connection looseness may cause the voltage deviation exceeding 3% under stable environmental conditions.

- Record the environmental parameters (temperature, radiation, etc.).
- Measure the resistance of cables (between the terminal box and the module).
- Record accurately all the measured datas.

### 7.3.4 Checking Grid Voltage

- Measure accurately the grid 3-phase line-to-line voltages: L1-L2, L1-L3, and L2-L3. The voltages should not exceed the grid permissible voltage, and the three phases are in balance.



Adjust the transfer ratio of the transformer by qualified personnel if the grid voltage deviation is serious.

- Measure and record the grid frequency. Measured datas should not exceed the grid permissible frequency.
- Measure the THD and check the curve if possible. Inverter will stop running if the THD is not correct.
- Record accurately all the measured datas.

## 7.4 Preparation before Starting

- Place the disassembled protection grills to their original positions and ensure the connection is secure.
- Close and lock the cabinet door.
- Clean the device site. Make sure the position is clean without flammable or explosive materials.
- Ensure the ventilation of the installation place.
- Recheck and ensure whether inverter and switches upstream and downstream can meet the requirements flexibly .

## 7.5 LCD Parameter Setting

When the LCD is on, set the display language, date and time, communication parameters, active power limitation, etc. according to Chapter "9 LCD Menu Operation" in this manual and view the running information and perform related operation.

## 7.6 Completing Commissioning

If all the start-up procedures have been performed, check the operating condition of the MV Station.

- Check whether there are anomalies of the module: abnormal noise, overheating, smoking or unusual odor.
- Check that the grid-connected voltage, current, and THD of the MV Station are stable.
- Check the grounding of the MV Station enclosure.
- Check the functionality of the LCD display.
- Record accurately the operation data during commissioning.

The duration of commissioning depends on the plant scale, plant location, on-site environmental conditions and so on. Usually, if the in-site condition is good, the commissioning can last for 1 week, i.e. 168 hours.

The commissioning of the MV Station is completed. MV Station operates normally.

### WARNING

**After successful commissioning, the MV Station will be put into operation. Local/national standards about the min. electric clearance around the MV Station should be respected.**

**NOTICE**

**MV Station needs no manual control in daily operation. Open the cabinet door only for maintenance or troubleshooting and by qualified personnel only.**

**Keep the door closed and locked and store the keys of the door by appointed personnel during normal operation.**

# 8 Starting/Stopping

## 8.1 Starting

### 8.1.1 Inspection before Starting

After the maintenance or service work, inspect the following items, and then start the MV Station,

- All connections are performed by strictly following the installation manual and circuit diagram.
- The coverings of the internal devices are fixed and secured.
- The cabinet door is closed.
- The emergency stop button is released.
- Make sure, by using suitable instruments, that there is no ground fault in the PV array.
- Measure the DC and AC voltages with a multi-meter to check if the start-up conditions are met, and ensure no overvoltage hazard.

**⚠ WARNING**

**After longtime storage, a thorough and professional test is necessary before starting the MV Station.**

### 8.1.2 Start Steps

When the abovementioned conditions are fulfilled, proceed as follows to start the MV Station:

**Step 1** Close the upstream PV combiner box and downstream transformer switches of the MV Station.

**Step 2** Close the QS6 AC maintenance switch, and QS5 DC maintenance switch.

**Step 3** Turn the DC knob switch to the ON position.

**Step 4** Check to make sure the QS9 is connected, and QS8 is disconnected.

**Step 5** Stop the inverter through the touch screen.

**Step 6** Manually close the QS1 and QS3 DC load break switches. If the inverter was equipped with energy storage ports, close QS2 and QS4 as well.

**Step 7** Perform the start operation through the touch screen, and the MV Station starts grid-connected operation.

-- End



Specific switch position , refer to "3.3.3 Internal Devices of the Inverter" and "6.8 External Equipment Connection".

After startup, the MV Station will automatically check if parameters of the DC and AC side meet the grid-connection requirements. If so and the set time have been reached, the MV Station will turn to the OPERATION mode and feed the generated AC current to the grid.

#### WARNING

- **MV Station needs no manual control in daily operation. Only qualified personnel are allowed to open the cabinet door for maintenance or troubleshooting.**
- **Keep the door closed and locked and store the keys of the door by appointed personnel during normal operation.**

## 8.2 Stopping

Stop the MV Station when maintenance and service work is required or a fault occurs.

### 8.2.1 Normal Stop

Proceed as follows to stop the MV Station during normal maintenance and service work as follows:

**Step 1** Stop the MV Station through the stop instruction on the LCD panel.

**Step 2** Turn the DC knob switch to the OFF position.

**Step 3** Check to make sure the QS1 and QS3 DC load break switches are disconnected. If the inverter was equipped with energy storage ports, make sure the QS2 and QS4 are disconnected as well.

**Step 4** Disconnect the QS6 AC maintenance switch, and QS5 DC maintenance switch.

**Step 5** Check to make sure the QS8 and QS9 are disconnected.

**Step 6** Check to make sure the QF1 and QF2 AC circuit breakers are disconnected.

**Step 7** Disconnect the MV transformer switches.

**Step 8** Disconnect the switches of the PV combiner boxes.

**Step 9** MV Station stops running.

-- End



Specific switch position , refer to "3.3.3 Internal Devices of the Inverter" and "6.8 External Equipment Connection".

### 8.2.2 Stop in Case of Fault

Proceed as follows to stop the MV Station when a fault or emergency occurs as follows:

**Step 1** Press the emergency stop button.

**Step 2** Turn the DC knob switch to the OFF position.

**Step 3** Disconnect the QS6 AC maintenance switch, and QS5 DC maintenance switch.

**Step 4** Check to make sure the QF1 and QF2 AC circuit breakers are disconnected.

**Step 5** Check to make sure the QS8 and QS9 are disconnected.

**Step 6** Disconnect the switches of the MV transformer.

**Step 7** Disconnect the switches of the PV combiner boxes.

**Step 8** MV Station stops running.

-- End



Specific switch position , refer to "[3.3.3 Internal Devices of the Inverter](#)" and "[6.8 External Equipment Connection](#)".

#### WARNING

- **Press the emergency stop button only when emergency or a fault occurs. Under normal conditions, stop the MV Station via the stop instruction on the LCD panel.**
- **Press the emergency stop button immediately in case of emergency to make a timely response.**

#### WARNING

**The emergency stop button will stay in lock state once you press it. Release it with the key.**

# 9 LCD Menu Operation

## 9.1 LCD Touch Screen

The eye-level LCD touchscreen inside the monitoring window on the back side of the inverter is used to view data and set parameters.

**i** For user convenience, a large number of figures of the LCD interface are provided in this chapter. The parameters and other details in those figures are indicative only. The actual product you receive may differ.

**i** If the time shown on the LCD panel is different from the actual local time after time calibration, check and replace the button cells on the back of the LCD panel.

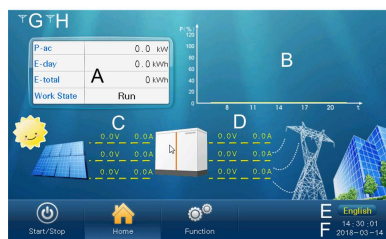
## 9.2 Default Screen

### 9.2.1 Initialization

The LCD is initialized when the intelligent PMD is power on and then enters into the starting menu.

Appears every time the MV Station is energized. After initialization, the default screen follows.

### 9.2.2 Default Screen Introduction



No.	Description
A	Yield data. The first line on the top indicates the present active power; work state is the transient state of the MV Station.
B	Today's active power curve to indicate the power percentage (power value divides the MV Station nominal power value).
C	DC side voltage and current of the MV Station respectively.
D	AC side line-to-line voltage and phase current.



No.	Description
E	Language selection button. Click to change among English, Chinese and the like.
F	Present date and time.
G	Success rate of the MV Station internal communication.
H	Success rate of communication between the MV Station and PC.

Enter the following submenus from the default menu.

#### WARNING




**LCD screen contains lots of parameters pertinent to the MV Station operation. All parameter configurations must be performed by appointed personnel. Do not modify any parameters without full understanding of the relevant action or without consulting Sungrow Customer Support.**

### 9.2.3 Backlight and Screensaver

If no operation has been performed on the screen for more than 5 minutes, the backlight will go off. Tap the screen to activate the backlight so that the latest interface reappears.

## 9.3 Overview of LCD Menu and Icon

### 9.3.1 Overview of Submenu and Icon

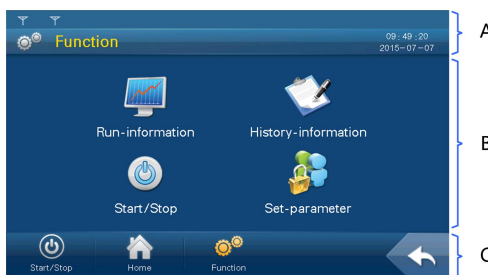
There are three buttons on the lower left side of the touch panel: **"Start/Stop"** , **"Home"** , **"Function"** . The user can perform related operations via these buttons.

Main Menu	First sub-menu	Second sub-menu	Third sub-menu
Start/Stop	Start	—	—
	Stop	—	—
Home	—	—	—
	Run-information	Real Time Data	—
		Power curve	—
E-histogram		—	
Function	History-information	His-event	—
		His-fault	—
		His-data	—
		His-alarm	—
Start/Stop	Start/Stop	Start	—
		Stop	—
Set-parameter	Sys-parameter	Language & Firmware Ver.	—
		Time	—
		Remote/Local control	—

Main Menu	First sub-menu	Second sub-menu	Third sub-menu
			E-adjust
			Load default
		Run-parameter	—
		Pro-parameter	—
		Com-parameter	Address
			Serial port param.
			Network param.


### 9.3.2 Layout of the submenus

The layout of submenus is the same as that shown below except for the default menu.



No.	Description
	Title bar
A	The first line from the top is the present success rate of communication. The left side of the second line is the name of the present page, while the right side is the present date and time.
B	Data display or parameter configuration.
C	From left to right, there are three main icons and a return button which is used to return to the previous menu.

For convenience's sake, the operations on the menus are referred to as the menu name

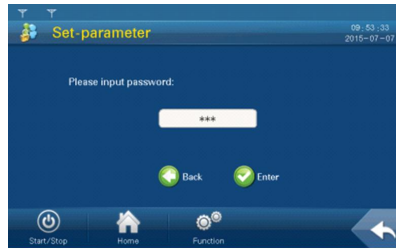
with quotation marks. For example, the  menu will be referred to as "Set-parameter".

## 9.4 Entering Password

MV Station parameters are protected by password. User can enter into the "Set-parameter" sub-menu only after entering the correct password. Proceed as follows to enter the password:

**Step 1** Tap "Function" from the default menu.

**Step 2** Tap “Set-parameter” and the password entering window pops up.

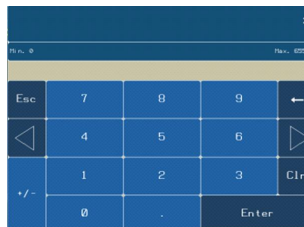


**Step 3** Tap the white edit box and a keypad pops up.

**Step 4** Enter the password 1111 through the keypad.

If the entered password is correct, the parameter setting page pops up, and the user can set system parameters, running parameters, protection parameters, and communication parameters.

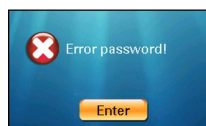
Button	Function
←	Backspace key, delete the digit input
Clr	Clear the digitals input
Esc	Escape and close the keypad
Enter	Confirm the password entered
Max./Min.	The maximum and minimum value can be input; digital outside this range is invalid



If the input password is 1111, user can enter into the normal parameter setting page and set the system parameters, running parameters, protection parameters and communication parameters.

**Step 5** Press “Enter” to confirm the password entered.

**Step 6** If the password is incorrect, an “Error password” window will appear. Tap “Enter” and re-enter the password.



-- End

## 9.5 Setting Language

User can set the language by either of the following two ways:

### 9.5.1 Conventional Way

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Sys-parameter” after entering the correct password.

**Step 4** Tap “Language & Firmware Ver.” and enter into the language and firmware version sub-menu.

**Step 5** Select the desired language.

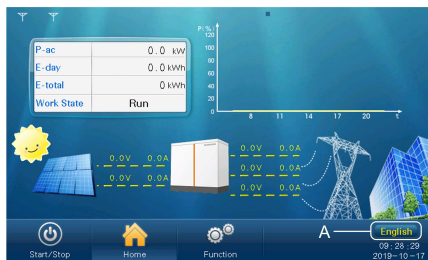
-- End

### 9.5.2 Shortcut

The language setting shortcut (shown by A) is in the lower right corner of the Home menu. Select either language by tapping the language button.

By tapping the button, the language will switch among English, Chinese and the like.

Language on the button is the present display language of the display.



## 9.6 Setting Date and Time

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Sys-parameter” after entering the correct password.

**Step 4** Tap “Time” and enter into the date and time setting sub-menu.

**Step 5** Set the “Year”, “Month”, “Date”, “Hour”, “Minute” and “Second”. Tap the corresponding field and the keypad will appear.

**Step 6** Set the time and date by tapping the keypad and confirm setting by tapping “Enter”.

-- End

## 9.7 Energy Output Deviation Adjustment

Energy output deviation adjustment is useful when the total power output displayed in LCD (E-total) is different from the reading value of the external power measuring device.

(Energy-adj value)= (Real measured value)-(E-tot reading value).

**Step 1** Tap "Function" from the default menu;

**Step 2** Tap "Set-parameter";

**Step 3** Tap "Sys-parameter" after entering the correct password;

**Step 4** Tap "E-total adjust" and enter into the energy output deviation adjustment sub-menu;

Tap the cell below the "Compensation" and the keypad appears. Enter the energy compensation by tapping the keypad;

**Step 5** Tap "Enter" to confirm the setting.

-- End

## 9.8 Checking Running Information

Running information contains all data related to the operation of the MV Station:

### Real-time Data

The real time running information of the inverter can be checked.

The output power, DC voltage & current, power factor, reactive power, efficiency, daily/monthly/annual power yields, internal temperature, positive/negative insulation resistance to the ground, running time, amount of CO<sub>2</sub> reduction, grid frequency, AC phase/line voltage, inverter temperature, AC & DC switches states, bypass switches/fuse state, power supply mode are included.

### Power Curve

The output power curve shows the power yield on that particular day in percentage of the nominal power. The data is updated every several seconds and all the diagram data will be cleared at the beginning of a new day.

### E-histogram

The histogram shows the power yields of the present day.

Proceed as follow to view the running information:

**Step 1** Tap "Function" from the default menu.

**Step 2** Tap "Run-information" and switch among "Real Time Data", "Power curve" and "E-histogram".  
The default display is "Real Time Data".

**Step 3** Tap "Power curve" and enter into the power curve sub-menu.

**Step 4** Tap “E-histogram” and enter into the electricity histogram sub-menu.



The value displayed is indicative only and cannot be used as a basis for billing.

-- End

## 9.9 Checking History Information

There are four kinds of history information: History event, history fault, history data and history alarm.

### 9.9.1 Checking History Event

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “History-information” and enter into the history information sub-menu.

**Step 3** Tap “His-event” and enter into the history event sub-menu.

History events can be viewed from this sub-menu, with up to 5 records can be shown in one page. The upper left side of the event table is the total number of the current event records. Tap “Prev” or “Next” to turn pages up or down.

-- End

### 9.9.2 Checking History Data

System can record the MV Station running information for the latest 90 days with the records updated every 15 minutes per day.

History data displays the data related to the power yields and the electric quantity of the MV Station. Proceed as follows to check the history information:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “History-information” and enter into the history information sub-menu.

**Step 3** Tap “His-data” and enter into the history data sub-menu.

Tap “Prev” or “Next” to turn pages up or down.

-- End

### 9.9.3 Checking History Fault

When a fault occurs, the user can view the fault and the history fault records via the LCD screen, and the steps are as follows:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “History-information” and enter into the history information sub-menu.

**Step 3** Tap “His-fault” and enter into the history fault sub-menu.

History faults can be viewed from this sub-menu, with up to 5 records can be shown in one page. The upper left side of the event table is the total number of the current fault records. Tap “Prev” or “Next” to turn pages up or down.

-- End

#### 9.9.4 Checking History Alarm

Proceed as follows to check the history warn information:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “History-information” and enter into the history information sub-menu.

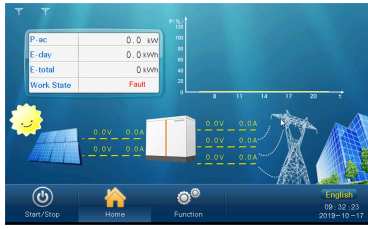
**Step 3** Tap “his-alarm” and enter into the history alarm sub-menu.

History alarms can be viewed from this sub-menu, with up to 5 records can be shown in one page. The upper left side of the event table is the total numbers of the current warn records. Tap “Prev” or “Next” to turn pages up or down.

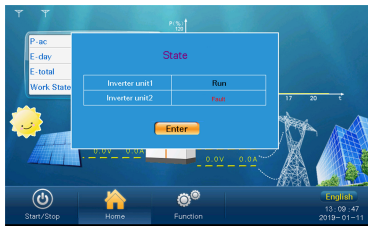
-- End

### 9.10 Checking Present Fault Information

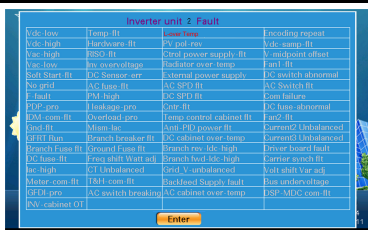
There may be one or more than one fault occurs to one or more than one unit inside the MV Station at the same time which can be viewed through the LCD screen. Follow the description in this chapter to view the fault information when faults occur.



If there is a fault, the “Work State” will show “Fault”. Tap the “Fault” cell.



The state column of the unit that has fault will display “Fault”. As shown in the left figure, a fault occurs to module unit 2. Tap the fault cell of module unit 2 to check the present fault.



The fault interface of module unit 2 will appear with the fault item in red.

### 9.11 Starting/Stopping



Usually, the MV Station will start automatically when the grid-connected requirements are met.

Start/stop the MV Station through the LCD screen in either of the following manners:

- Tap “Start/Stop” from the default menu.
- Tap “Start/Stop” from the Function menu.

By tapping the start/stop button on the screen, all the MV Station will start or stop at the same time. A confirm operation interface will appear after tapping the corresponding buttons. The instruction takes effect after confirmation; or the user can cancel the operation by tapping “Cancel”.

### 9.12 Load Default

Proceed as follows to restore factory defaults:

- Step 1** Tap “Function” from the default menu.
- Step 2** Tap “Set-parameter”.
- Step 3** Tap “Sys-parameter” after entering the correct password.



**Step 4** Tap “Load default” and the password inputting window appears.

-- End

## 9.13 Checking Firmware Version

User can view the firmware version of LCD and DSP as follows:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Sys-parameter” after entering the correct password.

**Step 4** Tap “Language & Firmware Ver.” and enter into the language and firmware version sub-menu.

**Step 5** The firmware versions of LCD and DSP are displayed at the bottom of the page.

-- End

## 9.14 Parameters of LCD

### 9.14.1 Communication Parameters

#### WARNING

**Improper communication parameter configuration may lead to communication failure!**

**Follow strictly the instructions of the plant staff in configuring the communication parameters.**

Proceed as follows to set the communication parameters:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Com-parameter” after entering the correct password.

- Set parameter from the Address interface for address.
- Set parameter from the Serial Port Parameter interface for baud.
- Set parameter from the Network Parameter interface for IP address, subnet mask, etc.

-- End

### 9.14.2 Running Parameters

#### Setting Running Parameters

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Run-parameter” after entering the correct password.

**Step 4** Set the running parameter by tapping the pop-up keypad and tap ENTER to confirm setting. Tap “Prev” or “Next” to turn pages up or down.

-- End

### 9.14.3 Protection Parameter

#### Setting Protection Parameter

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Pro-parameter” after entering the correct password.

**Step 4** Set the protection parameter by tapping the pop-up keypad and tap ENTER to confirm setting. Tap “Prev” or “Next” to turn pages up or down.

-- End

# 10 Main Functions

## 10.1 Operation Mode

### 10.1.1 Mode Change

After being energized, the MV Station switch among different modes as shown in the figure below.

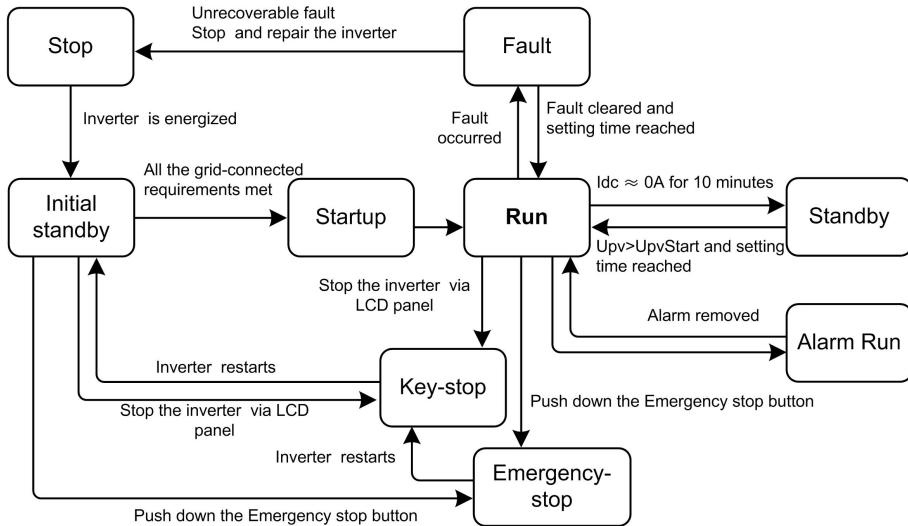


figure 10-1 Operation modes change



$U_{pv}$  is the DC input voltage of the module.

$U_{pvStart}$  is the module DC side startup voltage.

### 10.1.2 Operation Mode Description

#### Stop

This is the initial state of the module. The module DC and AC switches are in the “OFF” position; the upstream and downstream connections are disconnected. The module is therefore electricity-free.

#### Initial Standby

When the module upstream and downstream connections are connected and the DC switches are in the “ON” position, the module turns to the **Initial Standby** mode.

Module will continuously check if the PV array and the grid meet the grid-connection requirements. If the module DC input voltage is higher than the module startup voltage and the startup time is reached, whilst the requirements of the grid side parameter are satisfied, module will turn from the **Initial Standby** mode into the **Startup** mode.

### Startup

This is the transient process between the **Initial Standby** mode and the **Run** mode. Once the **Startup** mode is complete, module will start powering the grid.

### Run

In this mode, module converts the DC energy into AC energy and feeds it to the grid by way of MPPT.

Module tracks the PV arrays' maximum power point (MPP) to maximum the output energy.

### Standby

In **Run** mode, module will enter into the **Standby** mode if the DC side current is as low as 0A for a while.

Module will continuously check if the PV array meets the grid-connection requirements. If the module DC startup voltage and the startup time are reached, module will turn into the **Run** mode.

### Fault

If a fault occurs during operation, module will enter into the **Fault** mode. LCD panel will display the fault type with the "Fault" indicator on until the fault is removed. After the fault is removed, the MV Station reverts to **Run** mode.

During this period, if you want to start the module manually, first confirm the stop clear protection program from the LCD panel and then start the module.

If the fault is unrecoverable, stop the MV Station and perform maintenance work. Module will automatically check if the fault is recoverable.

### WARNING

**When a DSP fault or a module fault occurs, never restart the MV Station through the LCD. Perform a power-off check before reenergizing the MV Station. Otherwise, the module may be damaged.**

### Emergency-stop

Stop the module by pressing the emergency stop button inside the monitoring window when a fault or emergency occurs.

If the module is stopped by the emergency stop button, the DC load break switches and the AC circuit breakers trip off immediately and the modules will disconnect from the grid. To restart the modules, release the emergency stop button, push the DC load break switches to the ON position, and then operate according to the normal start process.

### Key-stop

When maintenance or service work is required, the MV Station turns from the **Run** mode to the **Key-stop** mode after the user sends a stop instruction via the LCD panel.

### Alarm Run

In **Alarm Run** mode, module can keep running but send alarm signal. User can check the present alarm information through the Working state on the LCD default screen or check the

latest history alarm information through “Function”->“History information”->“his alarm”.  
Module automatically turns to **Run** mode when the alarm is removed.

## 10.2 Complete Control Strategy(Optional)

The following three control strategies are provided for user to perform control functions and configure relevant parameters.

- “Remote”: The control codes can be sent only by the remote control machine.
- “Local”: The control codes can be sent only by the LCD screen.
- “Remote/Local”: Both “Remote” and “Local” codes are effective.

Proceed to set the control strategy on the LCD screen as follows:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Sys-parameter” after entering the correct password.

**Step 4** Tap “Remote/Local control” and enter into the Remote/Local control sub-menu.

**Step 5** Select the control method through the pull-down list.

-- End

## 10.3 Active Power Limitation

### 10.3.1 Introduction to Active Power Limitation

Cases in which power limitation is required are as follows:

- Potential threatens to the MV Station safety operation
- Over-load of the grid branch connected to the MV Station
- Islanding
- Factors affecting the stability of the stable grid status and dynamic grid status
- Frequency rising affects the system stability
- Grid maintenance
- Grid management

### 10.3.2 How to Realize Power Limitation

#### WARNING

**Improper parameter configuration may affect the normal operation of the MV Station!**

**Only authorized personnel can configure these parameters.**

**Should any questions or doubt occur, contact Sungrow.**

User can adjust the MV Station active power output through the LCD display:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Run-parameter” after entering the correct password.

**Step 4** Set the “Limit Power (%)” parameter by tapping the pop-up keypad.

**Step 5** Tap “Enter” to confirm setting.

-- End



Parameters related to power limitation “P-rise rate (%/s)” and “P-decline rate (%/s)” are also included in the running parameter setting sub-menu and can be set accordingly.

## 10.4 Reactive Power Adjustment

MV Station can provide reactive power output. User can open or close the reactive power adjustment switch and set the reactive power output through the LCD screen.

Reactive power limitation is performed through the running information sub-menu as follows:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Run-parameter” after entering the correct password.

**Step 4** Turn the page down to select the “Q-adjust switch”. Tap the pull-down list and the options:

- Close: reactive power cannot be adjusted
- Pf: adjust the reactive power by setting power factor
- Q-limit: adjust the reactive power by setting reactive power percentage
- QU mode: the reactive power changes with the grid voltage
- QP mode: the PF changes with the output power of the inverter
- V-auto-adj: reserved.

**Step 5** If Pf is selected, the power factor can be set in the “Run-information” sub-menu;

- if “Q-limit” is selected, the “Q-limit (%)” can be set in the “Run-information” sub-menu.
- if “QU mode” is selected, QU-related parameter can be set on the running parameter interface, where the parameter name begins with “QU”, for example, QU operation mode.

-- End

**⚠ WARNING**

**Improper parameter configuration may affect the normal operation of the MV Station!**

**Only authorized personnel can configure these parameters.**

**Should any question or doubt occurs, contact Sungrow.**

## 10.5 Low Voltage Ride Through (LVRT)

**Technical Requirements for Connecting Photovoltaic Power Station to Power System** requires medium-and-large PV plant should be equipped with Low Voltage Ride Through (-LVRT) ability.

LVRT requires: PV plant can operate normally within certain voltage drop range and duration when the voltage of the grid-connected point drops due to the power system failure or disturbance; PV plant can provide the dynamic reactive power support during the period.

### Active Power Recovery

If the power station still connects to the grid during power system failure, the active power will recover from the moment the fault is removed at the speed of at least 30% nominal power/second.

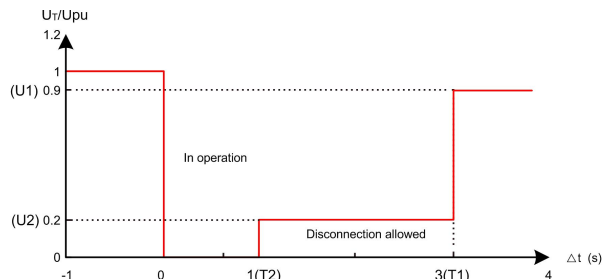
### Dynamic Reactive Current Support

During LVRT, power station should feed reactive current to the power system as per requirements. For a station whose 500kV or 750kV voltage is stepped up from the 220kV or 330kV voltage and then connects to the power station group, it should feed reactive current to the grid when a short-circuit occurs and the voltage drops.

### Zero Voltage Ride Through

When the grid-connection point voltage drops to zero, power station can operation normally for 0.25 second.

Note:  $U_T$  is the grid-connection point voltage;  $U_{pu}$  is the grid-connection point nominal voltage.



**figure 10-2** Lower voltage withstand requirements

Note: T1, T2, U1, and U2 are all settable parameters.

Sungrow's MV Station meets the abovementioned requirements.

## 10.6 High Voltage Ride Through (HVRT)

**Technical Requirements for Connecting Photovoltaic Power Station to Power System** requires PV plant should be able to operate as required within certain voltage range.

Grid-connection pint voltage	Requirements
$1.1U_{pu} < U_T < 1.2U_{pu}$	Operate for at least 10s
$1.2U_{pu} \leq U_T \leq 1.3U_{pu}$	Operate for at least 0.5s

Note:  $U_T$  is the grid-connection point voltage;

$U_{pu}$  is the grid-connection point nominal voltage.

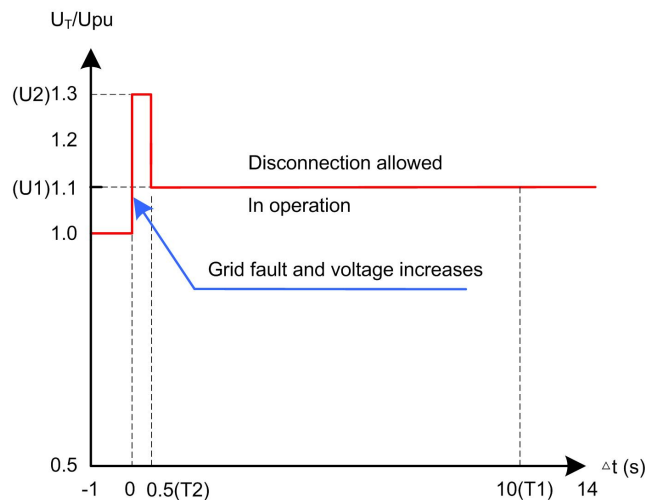


figure 10-3 High voltage withstand requirements

Note:  $T_1$ ,  $T_2$ ,  $U_1$ , and  $U_2$  are all settable parameters.

Sungrow's MV Staion meets the abovementioned requirements.

## 10.7 Self-constructed Grid

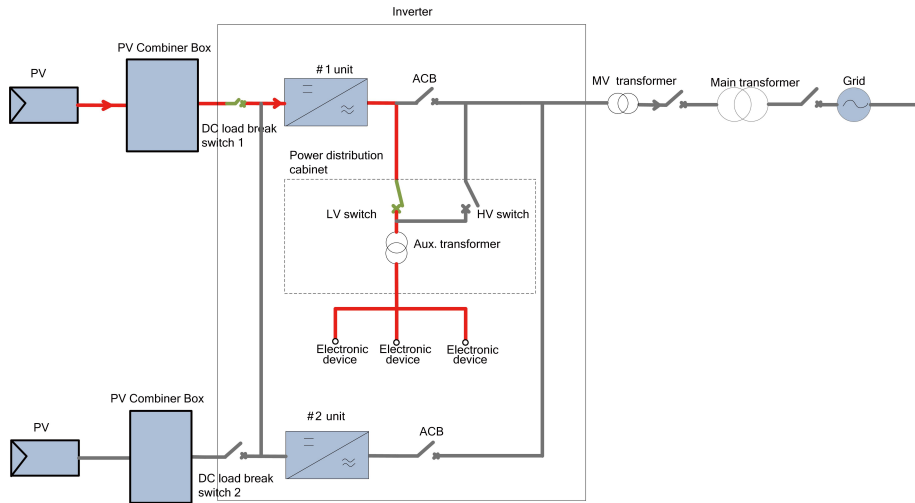
In the early stage of power station commissioning, when the inverter has no AC power or the grid cannot transmit power for some reason, the on-site equipment can not be commissioned because there is no power supply. At this time, the inverter's self-constructed grid function can be enabled. By controlling the inverter to work in high-voltage and low-voltage modes, AC power supplies of different voltage levels are constructed to supply power to the equipment debugging, which facilitates on-site communication and joint debugging, thereby shortening the pre-commissioning time of the power station.

### 10.7.1 Low Voltage Mode

#### Applicable Scenario

The low-voltage mode is suitable for powering debugging tools and test equipment when the grid cannot transmit power.





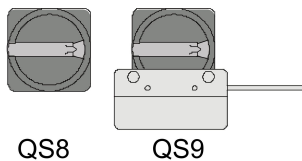
### Prerequisites

#### ⚠ WARNING

**Before operation, make sure that all isolating switches and miniature circuit breakers in the intelligent power distribution cabinet are in the off state.**

### Operation Method

- Step 1** Disconnect the load-break switch of the MV transformer and close the output switches of upstream PV combiner boxes of inverter.
- Step 2** Close the DC load break switch 1 of inverter(QS1).
- Step 3** After the inverter LCD is powered on, stop the inverter through the LCD.
- Step 4** Disconnect the HV switch (QS9) inside the intelligent power distribution cabinet, and close the LV switch (QS8).



- Step 5** Via the LCD screen of inverter, click "Function" -> "Set-parameter" -> "Run-parameter" -> "Off-grid mode", and set to "Low voltage mode".

Parameter	Settings
Off-grid mode	Low voltage mode
Off-grid output volt (%)	100%
Slope of off-grid output volt (%)	Set according to the capacity of the transformer.
Off-grid output frequency(Hz)	60

**Step 6** Start the #1 unit via the LCD of the inverter.

At this time, the intelligent power distribution cabinet can supply power for debugging tools, test equipment, etc.

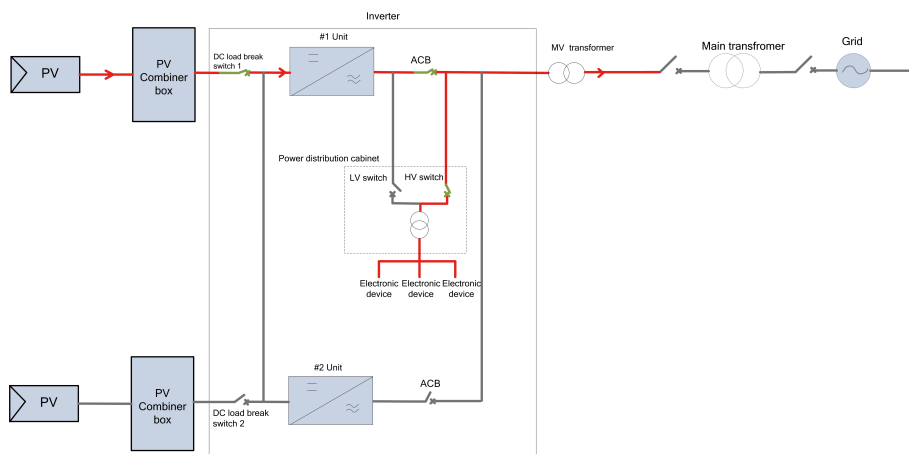
-- End

**Subsequent Processing**

- 1 After debugging, disconnect all the micro-circuit breakers of the power distribution cabinet.
- 2 Stop the #1 unit through the LCD screen of inverter.
- 3 On the LCD screen of inverter, click "Function" -> "Set-parameter" -> "Run-parameter", and set "Off-grid mode" to "disable".
- 4 Disconnect the LV switch (QS8) inside the intelligent power distribution cabinet, and close the HV switch (QS9) of the power distribution cabinet.

**10.7.2 High-voltage Mode****Applicable Scenario**

The high-voltage mode is suitable for debugging the MV side when the grid cannot transmit power.

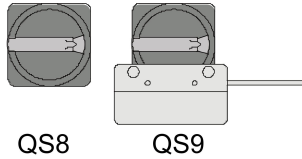
**Safety Precautions****⚠ WARNING**

**Before operation, be sure to confirm that the main circuit is allowed to be electrified and not loaded.**

**Operation Method**

- Step 1** Disconnect the circuit breaker of the MV transformer, close the output switches of upstream PV combiner boxes of inverter.
- Step 2** Close the DC load break switch 1 of inverter (QS1).
- Step 3** After the inverter LCD screen is powered on, stop the inverter through the LCD screen.

**Step 4** Close the HV switch (QS9) inside the intelligent power distribution cabinet, and disconnect the LV switch (QS8).



**Step 5** Via the LCD screen of inverter, click "Function" -> "Set-parameter" -> "Run-parameter" -> "High voltage mode".

Parameter	Settings
Off-grid mode	High voltage mode
Off-grid output volt (%)	100%
Slope of off-grid output volt (%)	Set according to the capacity of the transformer.
Off-grid output frequency(Hz)	60

**Step 6** Start the #1 unit through the LCD screen of inverter.

**Step 7** The AC circuit breakers will close automatically.

At this point, the inverter can be debugged.

**-- End**

#### Subsequent Processing

- 1 Check and confirm that all the micro-circuit breakers inside the intelligent power distribution cabinet are in off state.
- 2 Stop the #1 unit through the LCD screen of inverter, click "Function" -> "Set-parameter" -> "Run-parameter" -> "Off-grid mode", and set to "Disable".
- 3 Check and confirm that the LV switch (QS8) inside the intelligent power distribution cabinet is in off state and the HV switch (QS9) is in on state.

## 10.8 MPPT

Maximum Power Point Tracking (MPPT) is a technique that the MV Station uses to get the maximum power from the PV arrays. PV arrays have a complex relationship between solar irradiation, temperature and total resistance that produces a non-linear output efficiency known as the I-V curve.

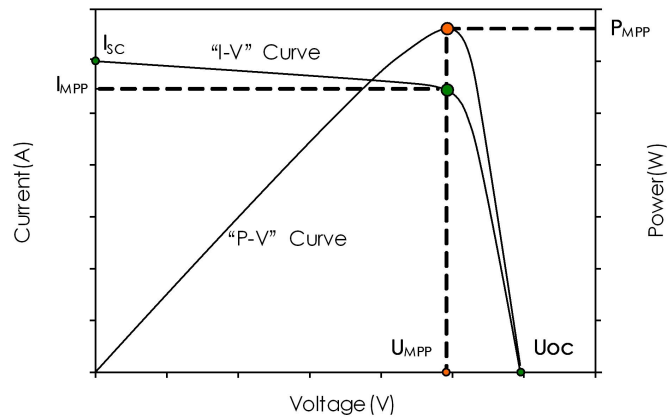


figure 10-4 MPPT

## 10.9 Intelligent Temperature-Control Technology

MV Station will continuously detect the IGBT temperature and adjust the fan speed accordingly. When the module temperature is low, MV Station will decrease the fan speed to lower the device noise and decrease the device operation consumption. As the module temperature increases, the MV Station will increase the fan speed for better heat dissipation. The intelligent temperature-control technology can synchronize the speed of fan and temperature of the IGBT module and thus optimize the module temperature and other conditions.

## 10.10 Anti-PID Effect Function (Optional)

### 10.10.1 Introduction to PID Effect

Potential Induced Degradation (PID) of the solar module is a performance degradation caused by high negative voltage. The PID effect can occur with all crystalline silicon solar cells that are embedded in glass-foil modules, leakage currents can result under unfavorable conditions (accelerated by high humidity and temperature) where the module joins with the frame and causes short-circuits that lower the overall performance of the system.

This MV Station is equipped with optional anti-PID function to effectively prevent the PID.

### 10.10.2 Anti-PID Function Setting

#### **⚠ WARNING**

**For MV Station with optional anti-PID function, the enable and disable of this function can only be performed by personnel from Sungrow. Contact Sungrow if you need to switch this function.**

Proceed as follows to set the mode if the Anti-PID mode is enabled:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Pro-parameter” after entering the correct password.

**Step 4** Click Next to find the page with “Anti-PID mode” and select the mode by the drop-down list (Suppression/Repair).

Select according to the on-site situation.

-- End

### 10.10.3 PID Repair

#### WARNING

**Make sure the “Anti-PID mode” in the protection parameter of the MV Station is “Repair” when enabling the PID repair function.**

If the MV Station is in deep standby state or the repair process is interrupted, user can enable the repair function manually from the LCD as follows:

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Pro-parameter” after entering the correct password.

**Step 4** Click Next to find the page with “PID repair” and click to enable the manual repair.

-- End



If there is Key stop or Emergency stop or a device fault during the repair process, the repair process will automatically stop.

## 10.11 Insulation Monitoring Function

### 10.11.1 Introduction

Insulation resistance is a parameter important for safety operation. If the insulation resistance is low, the direct contact protection and indirect contact protection may be failed; meanwhile the fault current against the ground and the short circuit caused by low insulation resistance may lead to electric fire, device damage or even physical hazards. Sungrow's MV Station is equipped with insulation resistance monitoring function to detect the system insulation resistance in real time. If the resistance is detected to be low, it will send alarm at the first time to remind the user and prevent potential hazards.

Insulation monitoring can be enabled by two modes, described below:

- **Automatic mode:** Upon first power-on, the equipment will be in negative pole grounding mode. After transfer from operating mode to standby mode, in the morning of the second day, when DC voltage exceeds insulation monitoring starting voltage, the equipment will exit negative pole grounding mode and enter insulation monitoring mode. If abnormal resistance is monitored, the equipment will report “insulation resistance” fault, and monitoring of resistance will continue till it becomes normal. If monitored resistance is normal, the equipment will exit insulation monitoring mode and negative pole grounding mode will be restored.
- **Manual mode:** Without shutdown conditions of the equipment, on the touch screen parameters setup interface, enable “manual insulation monitoring”. If current DC voltage exceeds insulation monitoring starting voltage, the equipment will exit negative pole grounding mode and enter insulation monitoring mode. If abnormal resistance is monitored, the equipment will report “insulation resistance” fault. If monitored resistance is normal, the equipment will exit insulation monitoring mode and enter negative pole grounding mode again. Upon pressing of shutdown key during manual monitoring, if current resistance is normal, the equipment will exit insulation monitoring mode and enter negative pole grounding mode again.

### 10.11.2 Simple Troubleshooting

Regardless of the MV Station setting, when the insulation resistance is below the threshold (settable from the LCD display), MV Station will send alarm signal and the Operation LED will turn to yellow. After receiving the “low insulation resistance” alarm signal, user should stop the device and check the specific insulation resistance from the LCD screen “Function”->”Run-information”->”Real time data”.

- If the insulation resistance recovers to normal, the fault loop is in the AC side.
- If the insulation resistance is still low, the fault loop is in the DC side.
- Whether the fault is on the DC side or AC side, switch off the system and perform a thorough checking and troubleshooting.

## 10.12 Emergency Stop Button functions

The emergency stop button is located inside the monitoring window.

In emergency situation, open the monitoring window, press down the emergency stop button to stop all the inverters inside the MV Station immediately.

## 10.13 Tripping Functions of the DC Main Switches

There are two selections (Enable/Disable) for the parameter “Trip” in the running parameter of the LCD touch screen. If the “Enable” options is chosen, all DC main switches of MV Station will trip immediately. If required, observed the following steps.

**Step 1** Tap “Function” from the default menu.

**Step 2** Tap “Set-parameter”.

**Step 3** Tap “Run-parameter” after entering the correct password.

**Step 4** Click Next to find the page with “Trip” and select “Enable” .

Before the MV Station is put into operation again, set the parameter “Trip” as “Disable” first, then close all the DC main switches of the MV Station.

-- End

## 10.14 Protection Function

MV Station has complete protection functions to protect itself when input voltage or grid is abnormal until the anomaly is removed and the MV Station can operate normally.

### 10.14.1 DC Over-voltage Protection

When the DC voltage of the PV array exceeds the max. DC voltage, MV Station will stop operating, send warning signal and display the fault type on the LCD screen.

MV Station can detect the abnormal voltage and respond quickly.

### 10.14.2 AC Over/under-voltage Protection

When the MV Station AC output voltage exceeds the permissible range, MV Station will stop feeding the grid, send warning signal and display the fault type on the LCD screen.

MV Station can detect the abnormal voltage and respond quickly.

### 10.14.3 Frequency Anomaly Protection

When the grid frequency exceeds the permissible range, MV Station will stop feeding the grid, send warning signal and display the fault type on the LCD screen.

MV Station can detect the abnormal frequency and respond quickly.

### 10.14.4 Islanding Protection

Islanding is a condition that can occur if the utility grid is disconnected while the MV Station is operating and the local load of the MV Station is similar to the present output power.

“Islanding” is a potential threaten to devices and operators.

- In the event of grid outage, if the MV Station still feeds power to the public grid, death or injury may occur to the maintainers during maintenance.
- In the event of grid fault, if the MV Station still feeds power to the public grid, a surge current may occur and damage devices once the grid resumes.

MV Station is equipped with anti-islanding protection function.

#### WARNING

**In anti-islanding protection state, high voltage is still present. Disconnect the main switch and wait the device to discharge completely before testing or maintenance.**

#### **10.14.5 Overload Protection**

When the PV array output power exceeds the MV Station permissible maximum input power, MV Station will limit the power yield at maximum AC power point. If the temperature exceeds the permissible value, MV Station will automatically stop operating unless the condition resumes normal.

#### **10.14.6 Ground Protection**

The grounding cables are equipped with the leakage current sensor. When the leakage current is detected to exceed the setting value, system will send instruction to stop the module and display the fault type on the LCD screen.

#### **10.14.7 Module Over-temperature Protection**

IGBT modules inside the MV Station uses thermal sensor with high-precision to monitor the real-time module temperature. Once the module temperature is detected to be high, DSP will send direction to stop the MV Station or derate the output.

#### **10.14.8 Internal Over-temperature Protection**

The MV Station is equipped with high-precision thermal sensor to monitor the internal temperature of the MV Station. Once the over-temperature is detected, the DSP will send an instruction to stop the MV Station and keep safe operation.



# 11 Troubleshooting

## 11.1 Safety Instructions

### DANGER

Lethal voltages are present inside the MV Station when a fault occurs.

- Only qualified personnel can perform the troubleshooting described in this chapter. Qualified means that the operator has received professional training on devices troubleshooting.
- Do not perform any troubleshooting other than that specified in this manual.
- Respect all safety instructions during troubleshooting.

### WARNING

The electrical components inside the MV Station must be replaced by components from the same manufacturer.

The model number can be acquired from the marking of the MV Station or the component itself. If otherwise, contact Sungrow.

### WARNING

If the field work needs to replace the components with products from other manufacturer or with different model number, a prior analysis and confirmation by Sungrow is needed.

Failure to follow this procedure may lead to physical injury or death and void all warranty from Sungrow.

### WARNING

Disconnect all AC and DC Switches before troubleshooting.

## 11.2 Checking Fault

If any power output anomaly is detected, check the following items before contacting Sungrow.

- Open-circuit voltage of the PV arrays
- State of the emergency stop button
- Power limitation state

If there is any questions or doubts that are not covered by this manual, contact us.

With the following information provided, Sungrow shall diagnose and solve the problem more easily:

- Type and serial number of the MV Station and internal devices
- Manufacturer, model, and configuration of the PV arrays and upstream & downstream combiner devices connected to the MV Station
- MV Station communication solution
- Fault and brief description of the fault phenomenon
- A picture of the fault if necessary

### 11.3 Fault and Troubleshooting on the Inverter

The fault information of the inverter can be viewed on the home page of the LCD screen. Specifically, refer to the chapter "[9.10 Checking Present Fault Information](#) "

Fault severities of the inverter are defined as follows:

- Major: The MV Station shuts down and stops feeding power into the grid.
- Minor: Some components are faulty, but the MV Station can still feed power to the grid.
- Warning: Functions of the MV Station are normal, but the output power drops due to external factors.


The fault severity of fault names and their corresponding solutions are shown in the following table.

Fault name	Explanation	Fault severity	Measures
Module Fault	The drive board is faulty or hardware overcurrent occurs.	Major	1. Check whether the AC/DC side of the module is short-circuited. 2. Check whether the grid is normal. 3. Check whether the appearances of modules inside the inverter are normal.
Cntr-flt	The contactor is faulty.	Major	Disconnect the AC and DC switches of the module, allow the module capacitors to discharge completely, and then check whether the appearance of the AC contactor is normal.
Mism-lac	The AC current is unbalanced.	Major	Check whether the grid is normal or whether phase loss occurs.

Fault name	Explanation	Fault severity	Measures
L over-temp	The reactor temperature is excessively high.	Major	<ol style="list-style-type: none"> <li>1. Check, with a thermodetector, whether the present ambient temperature is within the permissible range of the module.</li> <li>2. Check that the air inlets of the MV Station are not obstructed. Clean the filters when necessary.</li> <li>3. Check, in the <b>Stop</b> mode, whether fans inside the module are clogged by foreign materials.</li> </ol>
Temp control cabinet flt	Faults occur due to excessively high temperature inside the control cabinet.	Major	<ol style="list-style-type: none"> <li>1. Check the grid voltage, and inspect whether the grid voltage harmonic is normal.</li> <li>2. Check whether the fans operate normally.</li> <li>3. Check the AC filtering system, and inspect whether the AC filter capacitor is damaged, for example, cracked. Check whether the 3-phase current of the capacitor is in balance when necessary.</li> </ol>
Vdc-Low	The DC input voltage is excessively low.	Major	<ol style="list-style-type: none"> <li>1. Check, in the <b>Stop</b> mode, whether the DC voltage displayed on the LCD is consistent with the voltage actually measured.</li> <li>2. In the event of inconsistency, check whether the circuits on the DC side are short-circuited or connected incorrectly.</li> </ol>
Bus undervoltage	The DC bus voltage is excessively low.	Major	Refer to the measures for "Vdc-Low".
V-midpoint offset	Neutral point potential shifting occurs on the DC side of the module.	Major	<ol style="list-style-type: none"> <li>1. Check whether the DC side of the module is short-circuited, the input voltage falls beyond the permissible range, and the grid voltage is normal.</li> <li>2. Check the history fault screen of the LCD to ensure whether faults such as DC overvoltage/undervoltage, PDP, and AC overcurrent exist at the same time. If so, refer to the corresponding measures.</li> </ol>

Fault name	Explanation	Fault severity	Measures
Temp-flt	The fault occurs when the temperature at the air inlet is higher than the protective threshold.	Major	<ol style="list-style-type: none"> <li>1. Ensure the ambient temperature. Check, with a thermodetector, whether the present ambient temperature is within the permissible range of the module.</li> <li>2. Check that the air inlets of the MV Station are not obstructed. Clean the filters when necessary.</li> <li>3. Check, in the <b>Stop</b> mode, whether fans inside the module are clogged by foreign materials.</li> </ol>
DC cabinet over-temp	The temperature in the DC cabinet is excessively high.	Major	Refer to the measures for "Temp-flt".
Vac-high	The grid voltage is higher than the set protective threshold.	Major	<ol style="list-style-type: none"> <li>1. Tap "Set-parameters" -&gt; "Pro-parameters" on the LCD to check whether the protection parameter is in compliance with the local standards and regulations.</li> <li>2. Disconnect the AC switches, and check whether the actual grid voltage is within the normal range.</li> <li>3. Check, in the <b>Stop</b> mode, whether the grid voltage displayed on the LCD is consistent with the voltage actually measured.</li> </ol>
Vac-low	The grid voltage is lower than the set protective threshold.	Major	Refer to the measures for "Vac-high".
F-fault	The grid frequency is abnormal.	Major	<ol style="list-style-type: none"> <li>1. Tap "Set-parameters" -&gt; "Pro-parameters" on the LCD to check whether the Protection parameter is in compliance with the local standards and regulations.</li> <li>2. Check, in the <b>Stop</b> mode, whether the grid frequency displayed on the LCD is consistent with the actual grid frequency.</li> </ol>

Fault name	Explanation	Fault severity	Measures
Island/No grid	Grid blackout occurs or AC transient voltage exceeds the protective threshold.	Major	<ol style="list-style-type: none"> <li>1. Check whether the grid is normal.</li> <li>2. Check whether power outage occurs on the AC side.</li> <li>3. Check whether the AC circuit breakers of the module are connected.</li> </ol>
Ctrol power supply flt	The control power supply is abnormal.	Major	<ol style="list-style-type: none"> <li>1. Check whether the control switches of both the internal and external power supply are in the ON or OFF positions. If all switches are in the ON position, disconnect a switch. If all switches are in the OFF position, connect a switch.</li> <li>2. Check whether the internal and external power supply terminals are loose or poorly contacted. Fasten the terminals when necessary.</li> </ol>
Vdc-samp-flt	The fault of DC voltage sampling occurs.	Major	Check, in the <b>Stop</b> mode, whether the DC voltage displayed on the LCD is consistent with the voltage actually measured.
Soft start-flt	Failed to start the inverter.	Major	Check whether the grid is normal, for example, whether the grid harmonic and grid voltage are balanced.

Fault name	Explanation	Fault severity	Measures
DC-SPD fit	The SPD on the DC side of the module is faulty.	Major	<p>The state window of the SPD is as follows:</p>  <ol style="list-style-type: none"> <li>1. When the window colour is turned red from green, it indicates that the SPD is damaged (perhaps, due to thunderstorms). In this case, measure the AC and DC parameters, including positive and negative pole voltages to ground, and replace the SPD when the parameters recover to normal value.</li> <li>2. When the window is in normal colour, the fault may be caused by poor contact between the SPD and its base. In this case, reinstall the SPD to ensure good contact.</li> </ol>
AC SPD fit	The SPD on the AC side of the module is faulty.	Major	<ol style="list-style-type: none"> <li>1. Refer to the measure for "DC-SPD fit".</li> <li>2. Check whether the micro circuit breaker connected in series to the SPD is disconnected.</li> <li>3. If the micro circuit breaker is disconnected, measure the AC and DC parameters. If the values measured are normal, reconnect the micro circuit breaker.</li> </ol>
Vdc-high	The DC voltage of the module exceeds the protective threshold.	Major	<ol style="list-style-type: none"> <li>1. Disconnect the DC switches of the module, and check whether the open-circuit voltage of the PV array is normal. If it is abnormal, the alarm may result from PV array configuration.</li> <li>2. Ensure that the LV side of the transformer is connected in the Y type, and the neutral point is not grounded.</li> <li>3. Check, in the <b>Stop</b> mode, whether the DC voltage displayed on the LCD is consistent with the voltage actually measured.</li> </ol>

<b>Fault name</b>	<b>Explanation</b>	<b>Fault severity</b>	<b>Measures</b>
PV pol-rev	Polarity on the DC input side is reserved.	Major	Check whether the polarity on the DC of the module is correct.
Hardware-ft	Interior hardware of the module is faulty.	Major	Measure the DC voltage of the MV Station, to check whether short circuit occurs inside the MV Station.
lac-high	AC current of the inverter is excessively high.	Major	<ol style="list-style-type: none"> <li>1. Check whether the AC and DC cables of the inverter are firmly in place.</li> <li>2. Check the insulation of the cables for intactness.</li> <li>3. Check whether the wiring terminals are short-circuited to ground.</li> </ol>
Overload-pro	Output overload occurs.	Major	Refer to the measures for "lac-high".
I leakage-pro	The sampling value of the AC leakage currents exceeds the protective threshold.	Major	<ol style="list-style-type: none"> <li>1. Check whether the AC cables are damaged.</li> <li>2. If the LV side of the transformer is connected in the Y type, ensure that the neutral point is unconnected.</li> </ol>
PM-high	The temperature of modules inside the module room is excessively high.	Major	<ol style="list-style-type: none"> <li>1. Check the air inlets.</li> <li>2. Check whether the air outlets of the MV Station are obstructed by foreign materials. Clean the filters when necessary.</li> <li>3. Check whether the fans function normally during the operation of the MV Station.</li> </ol>
Fan1-ft/ Fan2-ft	Fan 1 or fan 2 inside the inverter is faulty.	Major	<ol style="list-style-type: none"> <li>1. Check whether the grid voltage is normal. Measure the grid voltage with a multimeter, and check whether phase loss occurs.</li> <li>2. Check whether the fans are normally supplied with power. Measure the three-phase power source with a multimeter to ensure the nominal input voltage is 400 Vac.</li> </ol>

Fault name	Explanation	Fault severity	Measures
Gnd-fit	Grounding fault.	Major	1. Check the DC cables. Check whether positive DC cables connected to the ground are damaged. Check whether the impedance to ground of the DC cable is normal. 2. Check the AC cables. Check whether voltages to ground of all the three phases are the same. In addition, check whether SPDs on the inverter side and transformer side are damaged.
AC Switch fit/ AC breaker fit	The AC switches are faulty.	Major	1. Check whether AC switches have tripped. 2. Check whether AC switches are damaged. 3. Check whether AC switches are connected/disconnected normally. 4. Check AC switches for conductivity with a multimeter.
Radiator over temp	The temperature of the heat sink inside the inverter is excessively high.	Major	Check whether the fans are normal. If the fans are normal, check whether the air ducts are obstructed.
DC fuse fit	DC fuses are abnormal.	Major	Refer to the measures for "DC fuse-abnormal".
GFDI pro	DC grounding protection is abnormal.	Major	1. The negative pole of the MV Station is not securely grounded. 2. Check whether the negative grounding fuses blow.
AC fuse fit	AC fuses are abnormal.	Major	Check the AC fuses.
Grid_V_unbalanced	Grid voltage is unbalanced.	Major	Measure the grid voltage, and check whether grid voltage unbalance exists.



<b>Fault name</b>	<b>Explanation</b>	<b>Fault severity</b>	<b>Measures</b>
Current2 Unbalanced/ Current3 Unbalanced	AC current unbalance	Major	Measure the grid voltage, to check whether phase loss occurs.
AC switch breaking	AC switch is disconnected.	Major	Connect the AC switch, after which the alarm is cleared.
AC cabinet over-temp	The temperature in the AC cabinet exceeds the protective threshold.	Major	<ol style="list-style-type: none"> <li>1. Check whether fans in the AC cabinet function normally.</li> <li>2. Check whether air inlets of the AC cabinet are obstructed.</li> <li>3. Check whether filters at the air inlets of the AC cabinet are dusty. Clean the filters when necessary.</li> </ol>
Anti-PID power fit	Anti-PID power supply is abnormal.	Minor	<ol style="list-style-type: none"> <li>1. Check the insulation of AC cables.</li> <li>2. Check AC SPD.</li> <li>3. Check the neutral point on the LV side of the transformer and ensure it is not grounded.</li> </ol>
External power supply	External power supply of the MV Station is abnormal.	Minor	Measure the external power supply voltage with a multimeter to check whether the voltage is within the normal range.
Branch breaker fit	Circuit breakers on DC branch circuits are abnormal.	Minor	Check whether all the branch circuit breakers are closed, and check whether the circuit breaker state displayed on the Run-Information screen of the LCD is "ON/Closed".
CT Unbalanced	The three-phase grid current is unbalanced.	Minor	Check, via the LCD, whether the AC three-phase current is in balance.

Fault name	Explanation	Fault severity	Measures
Ground Fuse fit	Grounding fuse is abnormal.	Minor	<p>Wait the capacitor to discharge completely, and then remove the negative grounding fuse. Check whether the fuse has blown.</p> <p>If so, check whether the neutral point of the transformer is unconnected, and whether the neutral point of the PT/CT on the LV side of the transformer is grounded.</p>
Meter-com-fit	Communication of the energy meter is abnormal.	Minor	<ol style="list-style-type: none"> <li>1. Check whether communication cables connected to the energy meter and metering board are damaged.</li> <li>2. Check whether communication terminals of the energy meter and metering board are securely fastened.</li> </ol>
DC fuse-abnormal	DC fuses of the inverter are abnormal.	Minor	<p>Check whether the DC fuse have blown. If so, contact Sungrow and replace the fuses.</p>
Branch Fuse fit	Branch fuses of the inverter are abnormal.	Minor	<p>Refer to the measures for "DC fuse-abnormal".</p>
RISO fit	The insulation resistance is excessively low.	Minor	<ol style="list-style-type: none"> <li>1. Check whether insulation layers of positive and negative DC cables to ground are damaged.</li> <li>2. Check the insulation resistance to ground of AC three phases.</li> <li>3. Check the connection of the neutral point on LV side of the transformer to ensure the neutral point is not grounded.</li> </ol>
Freq shift Watt adj	The active power of the inverter is adjusted according to the change of grid frequency.	Warning	<p>Check, via the LCD, whether the over frequency derating function is enabled. If the function is enabled, it indicates over frequency occurs during the operation.</p>

Fault name	Explanation	Fault severity	Measures
Volt shift Var adj	The reactive power of the inverter is adjusted according to the change of grid voltage.	Warning	Tap "Set-parameters" -> "Running parameter" -> "Q-adjust switch" on the LCD, to check whether the "Q-adjust switch" is in the "QU mode".
GFRT Run	When a grid fault occurs, the inverter can ride through the time interval.	Warning	Check whether the grid voltage exceeds the HVRT or LVRT threshold.
DC breaker flt/ DC switch abnormal	DC switches of the inverter are abnormal.	Minor	Refer to the measures for "Branch breaker flt". Check whether the DC switch is connected.
I leakage- pro	The sampling value of the AC leakage currents exceeds the protective threshold.	Major	1. Check whether the AC cables are damaged. 2. If the LV side of the transformer is connected in the Y type, ensure that the neutral point is unconnected.



If the fault still exists, contact Sungrow Service.

If the following fault occurs, immediately contact Sungrow Service. (referred to as "Sungrow" hereinafter).

Fault name	Explanation	Fault severity	Measures
Carrier synch flt	The transmission of carrier communication signals is abnormal.	Major	Contact Sungrow.
Drive board fault	Interior drive board of the inverter is faulty.	Major	Contact Sungrow.

<b>Fault name</b>	<b>Explanation</b>	<b>Fault severity</b>	<b>Measures</b>
Com-Failure	Internal communication of the inverter is abnormal	Major	Contact Sungrow.
Encoding repeat	Addresses of the interior modules are repeated.	Major	Contact Sungrow.
Backfeed Supply fault	Reverse charging device is out of service.	Major	Contact Sungrow.
IDM-com-flt	The communication of the tributary board inside the inverter is abnormal.	Minor	Contact Sungrow.
DC Sensor-err	DC sensors of the inverter are abnormal.	Minor	Contact Sungrow.
Branch fwd-Idc-high	Branch forward current is excessively high.	Minor	Contact Sungrow.
Branch rev-Idc-high	Branch reverse current is excessively high.	Minor	Contact Sungrow.
T&H-com-flt	The communication of the temperature & humidity board is abnormal.	Minor	Contact Sungrow.
DSP-com-flt	The communication between control board and metering board inside the inverter is abnormal.	Minor	Contact Sungrow.

## 11.4 Fault and Troubleshooting on the MV Transformer

Successively tap "Function" -> "Run-information"-> "Transformer" on the LCD screen to view the fault information of the MV transformer.

<b>Fault name</b>	<b>Explanation</b>	<b>Fault severity</b>	<b>Measures</b>
Trans-oil-T trip	The temperature in the oil tank of the transformer is abnormal, and tripping occurs.	Major	Contact Sungrow.
Pressure release valve trip	The pressure relief valve of the transformer is faulty.	Major	Contact Sungrow.
Low oil level trip	The oil level of the transformer is excessively low, and tripping occurs.	Major	Contact Sungrow.
Heavy gas trip	The gas is excessively high, and tripping occurs.	Major	Contact Sungrow.
Trans-oil-T-alarm	The temperature in the oil tank of the transformer is abnormal, and an alarm is triggered.	Minor	Contact Sungrow.
Heavy gas alarm	The gas is excessively high, and an alarm is triggered.	Minor	Contact Sungrow.
Pressure release valve alarm	The pressure relief valve of the transformer sends alarm signals.	Minor	Contact Sungrow.
Low oil level alarm	The oil level of the transformer is excessively low, and an alarm is triggered.	Minor	Contact Sungrow.

Note: For more troubleshooting information of the MV transformer, refer to the enclosed manual.

## 11.5 Other Fault and Troubleshooting

Fault	Possible Reason	Measures
The MV Station shuts down shortly after start-up.	DC input voltage just reaches the MV Station start-up voltage. Voltage will decrease and the MV Station will stop when it is under load.	Design the serial and parallel connection in accordance with the open circuit voltage; increase the input DC voltage; avoid adopting the critical voltage
Failure to start or stop the MV Station via the LCD.	Communication malfunction between the LCD display and the DSP; LCD power supply malfunction	Check the connection between the LCD display and the DSP when the MV Station is voltage-free
Failure to communicate with PC.	Possible reasons are various. Refer to the "Measures".	<p>Check if the address and the Baud rate of the LCD are the same as those of PC.</p> <p>Check to ensure the circuits are properly connected and if the RS485 communication is adopted, the A and B ports are connected correctly.</p> <p>Check if the communication converters are matched. Communicate again after replacing the converter.</p> <p>The monitor software is installed incorrectly. It is recommended to reinstall the software.</p> <p>If all the above-mentioned items are correct and this fault continues, contact Sungrow.</p>

# 12 Routine Maintenance

## 12.1 Overview

### NOTICE

For maintenance items beyond this manual, please confirm with SUNGROW or contact SUNGROW for maintenance, and unauthorized operation is strictly prohibited.

## 12.2 Safety Instructions

Due to the effect of ambient temperature, humidity, dust and vibration, the MV Station and the internal components will age and wear. To ensure the system safety and maintain the efficiency of the MV Station, it is necessary to carry out routine and periodic maintenance.

All measures, which can help the MV Station in good working conditions, are within the maintenance scope.

The minimum maintenance distance around the MV Station should be reserved at all times.

### 12.2.1 General Safety Rules

#### WARNING

**Lethal voltage inside the MV Station!**

**Wait at least 5 minutes after MV Station stops before opening the cabinet door.**

**Make sure the device internal is completely voltage free before any work on the MV Station.**

#### WARNING

**Only qualified personnel can perform the work described in this chapter.**

**Do not leave any screws, washers or other metallic parts inside the module to avoid damages to the module.**

#### WARNING

**Sand and moisture penetration may affect the performance of electric devices inside the MV Station!**

- **Do not perform electrical connection in sandy season or when the ambient relative humidity is above 95%.**
- **Perform electrical connection at fine weather days.**

**⚠ WARNING**

**Disconnection of the AC & DC switches in no way implies that there is no voltage of the cable connection terminals inside the AC and DC cabinet. To avoid the risk of electric shock before maintenance work,**

- **Disconnect the AC & DC switches;**
- **Disconnect the upstream and downstream switches of the module.**

### 12.2.2 Five Safety Rules

Respect the following five rules in maintaining or servicing the MV Station.

- Disconnect the module from all the external connections and internal power supplies.
- Ensure that the module will not be started accidentally.
- Verify that the module interior is discharged completely with a multimeter.
- Perform necessary ground and short circuit connection.
- Cover the adjacent electrical components with insulation cloth during operation.

## 12.3 Maintenance

### 12.3.1 Introduction

The MV Station can be installed outdoors. Harsh environment condition or long-time operation, however, may cause age and damage of the MV Station. Check and maintain the MV Station periodically and replace the aged components can effectively enlarge the service life and increase the device performance inside the MV Station.



Unscheduled maintenance is also required, esp., when the system performance is poor.

### 12.3.2 Maintenance Interval

Maintain the MV Station and internal electric devices periodically to ensure the good performance of the MV Station.

The maintenance interval described in this chapter is indicative only. The actual interval depends on the on-site environment condition. If the MV Station is located in harsh environment places, for example desert arrears, the maintenance interval shall be shortened. Particularly, cleaning and anti-corrosion processing should be performed more frequently.

If the MV Station is located in desert areas, it is advisable to check thoroughly the MV Station inside and outside and clean completely after the sand storm.



**⚠ WARNING**

**Check the module fans inside the MV Station periodically and the fans on top of the cabinet for abnormal operation and abnormal noise. If so, there may be dust penetrating inside the module. Stop the module and clean the dust.**

**Wait at least 5 minutes after the module discharge completely. Before cleaning, make sure, with multimeter, the module internal is discharged completely to avoid electric shock.**

**⚠ WARNING**

**Before performing maintenance, remove the internal protective grid. Make sure to reassembly the grid and fasten all the screws after the maintenance work.**

**Make sure all bolts are securely fixed.**

**⚠ WARNING**

**Repair immediately any anomalies found during routine maintenance. If any doubts arise, contact Sungrow.**

**Maintenance (once every three years)**

Check item	Check method
Transformer monitoring protection devices	<ul style="list-style-type: none"> <li>• Oil thermometer: alarm and tripping temperature</li> <li>• Pressure relief device contact check</li> <li>• Oil level device: Oil level is filled to the normal level</li> <li>• Pressure gauge: Pressure gauge are at the normal level.</li> </ul>
Transformer Leakage check	<ul style="list-style-type: none"> <li>• Off-load tap-changer</li> <li>• Pressure relief device</li> <li>• Pressure gauge</li> <li>• Oil level device</li> <li>• Temperature pocket</li> <li>• Bushings</li> <li>• Drain valve and oil sample</li> <li>• Welding seams</li> </ul>

**Maintenance (once every two years)**

Check item	Check method
System status and cleaning	<p>Check the following items and make corrections if necessary:</p> <ul style="list-style-type: none"> <li>• Check whether the MV Station and its internal devices are damaged or deformed.</li> <li>• Check whether the device makes abnormal noise or sound during operation.</li> <li>• Check whether the interior temperature or enclosure temperature of the MV Station is excessively high.</li> <li>• Check whether the humidity and dust inside the MV Station are within normal ranges, and dust the MV Station if necessary.</li> <li>• Check whether the air inlet and outlet are blocked.</li> </ul>
Warning labels and marks	Check whether the warning labels and marks are firmly attached and clearly legible. Replace them if necessary.
Shield ground wires	Check whether the shield ground wires are in good contact with the insulating sleeves and ground copper bars.
Connection between splice box and Ethernet switch*	Check whether the splice box and the Ethernet switch are correctly connected.
Lightning proof device and fuses	Check whether the lightning proof device and fuses are in good status and can be used.
Corrosion	Check whether the interior of the MV Station is corroded or oxidized.

**Maintenance (once every year)**

Check item	Check method
Container exterior	<p>Check the following items and make corrections if necessary:</p> <ul style="list-style-type: none"> <li>• Check whether there are any inflammable or combustible materials and other threats around or on the top of the MV Station that may affect the normal operation.</li> <li>• Check whether the MV Station and the steel plate are firmly welded, and whether there is any corrosion.</li> <li>• Check whether any mechanical damage, painting damage, oxidation, or the like occurs on the enclosure of the MV Station.</li> <li>• Check whether the monitoring window and the doors close and open flexibly.</li> <li>• Check whether the sealing strip is firmly in place.</li> </ul>
Container interior	<p>Check whether there is any dust, foreign objects, dirt, or condensation inside the container.</p>
Air inlet/outlet	<p>Check whether the air inlet filters and ventilation ducts of the MV Station and its internal devices are normal, and clean or clean the filters if necessary.</p>
Cable connection and routing	<ul style="list-style-type: none"> <li>• Check the MV Station when the internal devices are completely voltage-free! Make corresponding corrections once any anomaly is founded.</li> <li>• Check whether all cables and wires are properly routed and without short circuit. Make corrections if case of any anomaly.</li> <li>• Check whether all cable entries are sealed properly.</li> <li>• Check whether there is water leakage inside the MV Station.</li> <li>• Check whether the power cable is firmly connected. If necessary, refasten the cable with the torque specified in this manual.</li> <li>• Check whether the power cable and control cable are damaged, especially if the surface contacting the metal is cut.</li> <li>• Check if the insulation tape on the power cable terminal is damaged or invalid</li> </ul>

Check item	Check method
Grounding and equipotential connections	<ul style="list-style-type: none"> <li>• Check whether the grounding connection is performed properly and the grounding resistance meet the requirements of local standards and regulations.</li> <li>• Check whether the equipotential connections inside the MV Station are performed properly.</li> <li>• Check whether the equipotential connection of the oil tray is performed properly.</li> </ul>
Fan	<ul style="list-style-type: none"> <li>• Check the running status of the fans.</li> <li>• Check whether the fan blades have cracks.</li> <li>• Check whether the fan makes abnormal noise during running.</li> </ul>
Screws	Check all screws inside the MV Station.

#### Maintenance (once every 6 months to a year)

Check item	Check method
Safety function	<ul style="list-style-type: none"> <li>• Check the stop functions of the emergency stop button and the LCD.</li> <li>• Simulate shutdown</li> <li>• Check the warning labels and other device symbols for completeness and legibility, and replace them in time if necessary.</li> </ul>
Software maintenance	Inspect all parameter settings.
Module cleanness	<ul style="list-style-type: none"> <li>• Check the temperature and cleanness of the radiator. If necessary, clean the radiator with a vacuum.</li> <li>• If necessary, clean the filter.</li> <li>• Note: Check the ventilation performance of the air inlet. Otherwise, a fault may occur in the module due to overheat caused by poor ventilation.</li> </ul>
LCD time display	<ul style="list-style-type: none"> <li>• Check whether the time displayed on the LCD is correct.</li> <li>• After calibration, if the time is still incorrect, replace the button cell on the back of the LCD.</li> </ul>
Component maintenance	<ul style="list-style-type: none"> <li>• Regularly check whether the metal components are corroded (once every 6 months).</li> <li>• Annually check the contactors (auxiliary switch and micro switch) to ensure normal operation.</li> <li>• Check the running parameters (especially the voltage and insulation)</li> </ul>

Note: \* indicates optional.



The frequency of maintenance operations could be increased according to the environmental conditions of the place where the MV Station is suited, plant capacity and on-site situations.

The maintenance interval should be shortened if the sand or dust deposition around the operation site is serious.

## 12.4 Cleaning the MV Station

### 12.4.1 Introduction

The cleaning of the MV Station surrounding areas and the MV Station interior is important for the maintenance of the MV Station.

Due to ambient temperature, humidity, dust and vibration, there may be dust deposition inside the MV Station blocking the air entries and penetrating inside the MV Station internal devices. This may cause damage to the internal devices of the MV Station, shorten the service life, and reduce power yields.

During device normal operation, check and clean the device periodically to make sure the internal devices are in a comparatively good condition to a certain degree.

### 12.4.2 Cleaning Interval

The cleaning interval depends on the operation conditions of the MV Station, for example, the weather condition and etc. it is necessary make sure the MV Station exterior and interior areas are clean. If the operation conditions are severe, in desert area for instance, the cleaning interval shall be every half a month or even shorter. The cleaning of the MV Station inside devices and the air inlet and outlet shall be more frequent.

### 12.4.3 Cleaning the Internal Dust

Use a vacuum cleaner instead of a broom to clean the dust inside the MV Station.

### 12.4.4 Cleaning the Foundation

The foundation is designed with maintenance entry. Enter the foundation to check the cleanness periodically. Use a vacuum cleaner to clean the foundation if necessary.

### 12.4.5 Checking and Cleaning the Air Inlets/outlets

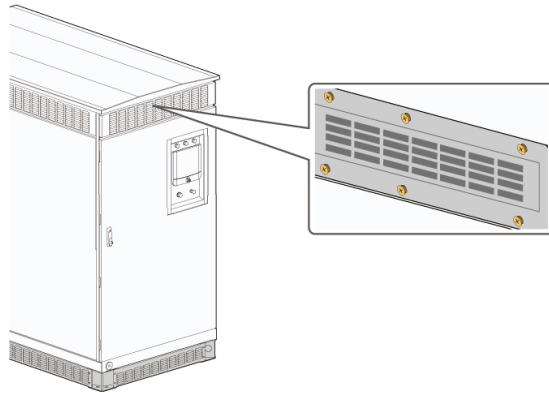
#### 12.4.5.1 Air Inlets

##### Brief Introduction

The air inlets are located at the top of the inverter. It is recommended to clean the air inlet regularly, to avoid blocking.

### Procedure

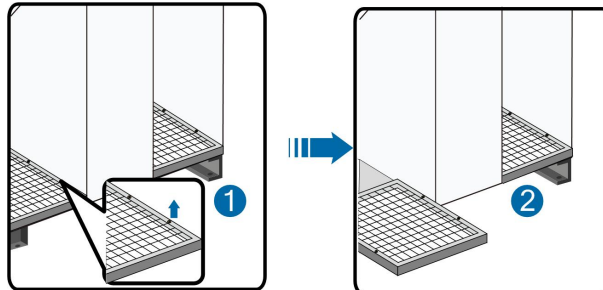
Clean the air inlets with a vacuum.



#### 12.4.5.2 Air Outlets

##### Brief Introduction

The lower air outlet is located at the lower part of the inverter. It is recommended to clean the filter screen of the air outlet regularly.



##### Procedure

Unscrew the bolts at the bottom of the inverter, to remove the bottom plate. Remove the filter screen, clean them, and reassemble them when they are dry. Replace the filter screen if there is any damage.

##### Further Processing

After cleaning and replacement, reinstall the bottom plate and secure it with bolts.

#### 12.4.6 Cleaning the Surface of the MV Station

If there is corrosion on the surface of the MV Station, clean it with abrasive paper or brush.

If the dust deposition is serious on the surface of the MV Station, use mop or big rag to clean the surface of the MV Station. It is recommended to clean the top before cleaning the side. Alternatively, clean it with or without water.

### 12.4.7 Checking the Lock and Hinge

Check the functionality and state of the lock and hinge of the MV Station after the cleaning work. Lubricate the lock and hinge if necessary.

### 12.4.8 Checking the Sealing Strip

The sealing strip is used to prevent the water penetrating insider the MV Station. Check it carefully for damage. Replace the faulty lighting devices in time.

## 12.5 Painting Make-up Measures

Check for the damages of the MV Station appearance:

**Situation 1:** smudginess on the surface caused by water and dust that can be cleaned


**Situation 2:** smudginess on the surface & damage to the finishing coat that cannot be cleaned

**Situation 3:** the undercoat is damaged and the primer is revealed

#### Maintenance and Operation Steps for Situation 1:

Materials:




- Cleaning cloth
- Water
- Alcohol or other non-corrosiveness detergent

Figure	Step
	<p>1. Clean the smudginess on the surface by using a cleaning cloth (or other cleaning tool) with water.</p> <hr/> <p>2. If the smudginess cannot be cleaned by water, use 97% alcohol until the surface is clean enough to accept. (Or try other local frequently-used non-corrosiveness detergent)</p>

#### Maintenance and Operation Steps for Situation 2:

Materials:

- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Hairbrush
- Paint RAL7035 / Munsell color JN-82 N8.2

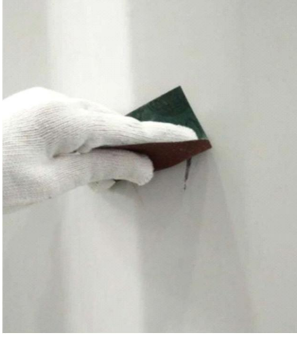

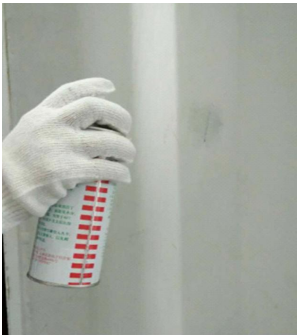
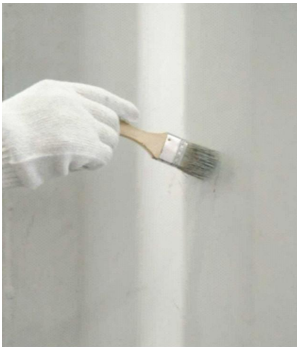
Figure	Step
	<p>1. Polish the rough paint surface or the scratched parts by abrasive paper until the surface is smooth.</p>
	<p>2. Clean the target parts by cleaning cloth with water or use 97% alcohol.</p>
	<p>3. When the surface is clean and dry, paint the scratched parts of the paint by banister brush and make sure the painting is as uniform as possible</p>

### Maintenance and Operation Steps for Situation 3:

#### Materials:

- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Zinc primer
- Hairbrush
- Paint RAL7035 / Munsell color JN-82 N8.2



Figure	Step
	1. Polish the damaged parts of the paint to remove the surface rust or other roughness.
	2. Clean the target parts by cleaning cloth with water or use 97% alcohol to clean the surface dust and dirty.
	3. When the surface is clean and dry, paint the base material revealed parts with zinc primer (or other local primers with the same function) for protection. The paints should cover the revealed primer completely.
	4. Paint the scratched parts by banister brush when the primer is dry, and make sure the painting is as uniform as possible.



Check the protective paint on the module surface for peeling off. re-paint the MV Station surface if necessary.

Re-spray the protective paint every 5 years to the MV Station surface.

## 12.6 Replace DC Fuses

### WARNING

The electrical components inside the MV Station must be replaced by components from the same manufacturer.

The model number can be acquired from the marking of the MV Station or the component itself. If otherwise, contact Sungrow.

### WARNING

If the field work needs to replace the components with products from other manufacturer or with different model number, a prior analysis and confirmation by Sungrow is needed.

Failure to follow this procedure may lead to physical injury or death and void all warranty from Sungrow.

### WARNING

Strictly observe the instructions in this chapter to replace the fuse.

Any personal injury or property damage caused by the disobedience of this chapter may void pertinent warranty claims from Sungrow.

### WARNING

Only qualified technical persons who have fully understood the description in this chapter can perform the operations in this chapter.

### WARNING

The fuse must be replaced with one of the same model and from the same manufacturer.

Obtain the model from the marking on the fuse. Contact us if otherwise.

### WARNING

Without our confirmation, do not replace the fuse with the one from another manufacturers or of a different model.

Otherwise, Sungrow shall not be responsible for any possible personal injury or property damage.

### 12.6.1 Preparation Before Replacement

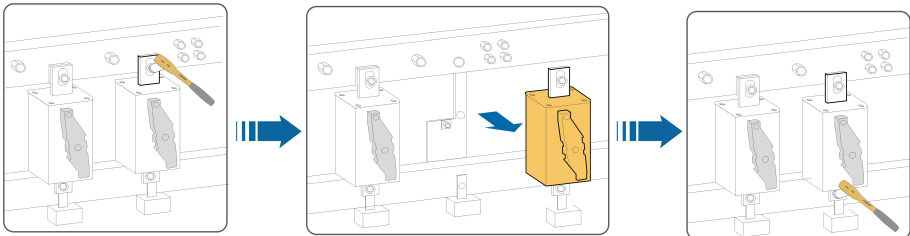
Follow the procedure below to replace the fault fuse.

- 1 Stop the inverter via the stop instruction on the LCD screen.
- 2 Turn the DC knob switch to the OFF position.
- 3 Disconnect DC output switches of all PV array combiner boxes upstream.
- 4 Disconnect the DC load break switch, disconnect AC and DC maintenance switch, and perform Step 5 about 5 minutes later when the capacitor inside the machine discharges completely.
- 5 Use a multimeter with a measuring range of 1500Vdc to check whether voltages of the connection terminal on the DC side of the inverter are zeros, where the voltages include the voltage between the positive and negative poles, the positive to ground voltage, and the negative to ground voltage.
- 6 Open the door with the key and remove the protective grid in the DC fuses area.
- 7 Measure each DC input voltage by using the multimeter, and perform the next step after ensuring the wiring terminal is completely voltage-free.

### 12.6.2 Procedure

**Step 1** Identify the faulty fuse, use a socket wrench to unscrew the fastening bolt of the fuse to be replaced, and remove the faulty fuse.

**Step 2** Secure the new fuse with M8×30 bolts with a tightening torque of 18 ~ 23 N.m.



-- End

# 13 Cyber Security Protocol

## 13.1 Password Change Requirements

**⚠ WARNING**

After initial login, change the HMI password (1111) to a site-unique password with 4 numbers.

**⚠ WARNING**

It is recommended to change the password every 6 months. If the password needs to be reset, please contact Sungrow.

## 13.2 Port Protection and Isolation

**⚠ WARNING**

Ensure that the inverters are installed such that the network zone has ingress protection and minimized port exposure. The network should have an independent subnet that is physically isolated.

**⚠ WARNING**

Ensure that network security protections are in place to ensure physical isolation of the Firewall and Ports.

**⚠ WARNING**

If a DNS service is used, ensure that the inverter has access to this site-specific DNS server. Change the DEFAULT DNS server to local DNS service provider.

## 13.3 Network Cables and Tamper Evident Seals Inspection

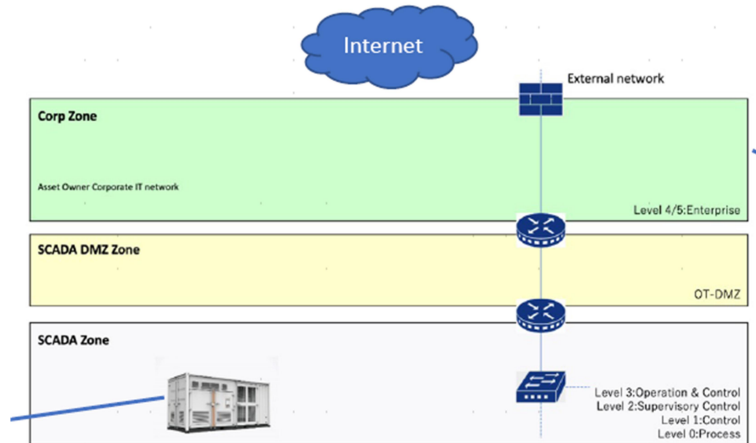
**⚠ WARNING**

When tamper evident seals are broken, ensure that these are removed and replaced.

**⚠ WARNING**

**Ensure that all RS-485 data cables are inspected periodically for damage, wear and tear.**

## 14 Cybersecurity Best Practice



### NOTICE

It's important to locate the Inverter in a secure network zone (e.g., SCADA network or PCN), that is blocked from direct communication with the Internet and/or Corporate IT networks by network security devices (e.g., firewalls). This network isolation concept is a best practice recommendation based on the Purdue Reference Model (PRM), an industry leading Industrial Control System (ICS) cybersecurity model adopted by standards and frameworks such as the ISA 62443, NIST Cybersecurity Framework, and NERC CIP.

### NOTICE

For more information, please reference "Secure Network and Firewall Deployment Recommendations for SCADA Systems" by the Cybersecurity and Infrastructure Security Agency (CISA) <https://uscert.cisa.gov/ics/Abstract-Firewall-Deployment-ICS-Networks-RP>

# 15 Appendix

## 15.1 System Parameter

<b>Input (DC)</b>	<b>SG3425UD-MV</b>	<b>SG3600UD-MV</b>
Max. PV input voltage	1500V	
Min. PV input voltage	875 V	915V
Startup input voltage	915 V	955 V
Available DC fuse sizes	250A, 315A, 400A, 450A, 500A	
MPP voltage range	875 ~ 1300 V	915 ~ 1300 V
No. of independent MPP inputs	1	
No. of DC inputs	20 (optional: 22 / 24 / 26 / 28)	
Max. DC short-circuit current	10000 A	
PV array configuration	Negative grounding or floating	
<b>Output (AC)</b>		
AC output power	3425 kVA @ 45 °C (113 °F)	3600 kVA @ 45 °C (113 °F)
	3083 kVA @ 50 °C (122 °F)	3240 kVA @ 50 °C (122 °F)
Nominal grid frequency	60 Hz	
Grid frequency range	57 ~ 63 Hz	
THD	< 3 % (at nominal power)	
Power factor at nominal power	0.99	
Adjustable power factor	0.8 leading ~0.8 lagging	
<b>Efficiency</b>		
Inverter Max. efficiency	98.9 %	
Inverter Euro. efficiency	98.5 %	
<b>Transformer</b>		
Transformer rated power	3425 kVA	3600 kVA
Transformer max. power	3425 kVA	3600 kVA
LV / MV voltage	0.6 kV / (12 – 35) kV	0.63 kV / (12 – 35) kV
Transformer vector	Dy1 or Dy11	
Transformer cooling type	ONAN (Optional: KNAN)	
<b>Protections &amp; Functions</b>		
DC input protection	Load break switch + fuse	
Inverter output protection	Circuit breaker	
AC MV output protection	Load break switch + fuse	
Overvoltage protection	DC Type II / AC Type II	
Grid monitoring / Ground fault monitoring	Yes / Yes	

Insulation monitoring	Yes
Overheat protection	Yes
<b>General Data</b>	
Dimensions (W x H x D)	6058 x 2896 x 2438 mm 238.5" x 114.0" x 96.0"
Weight	18000 kg/ 39683.2 lbs
Degree of protection	NEMA 4X( Electronic for Inverter) / NEMA 3R (Others)
Auxiliary power supply	5kVA, 120Vac/240Vac/ Optional: 30kVA, 480Vac/ 277Vac
Operating ambient temperature range*	-35 to 60 °C (> 45 °C derating) / optional: -40 to 60 °C (> 45 °C derating) -22 to 140 °F (> 113 °F derating) / optional: -40 to 140 °F (> 113 °F derating)
Permissible relative humidity range	0 ~100 %
Cooling method	Temperature controlled forced air cooling
Max. operating altitude	1000 m (Standard) / > 1000 m (Customized) (3280.8 ft (standard) / > 3280.8 ft (Customized))
DC-coupled storage interface	Optional
Charging power from the grid	Optional
Display	Touch screen
Communication	Standard: RS485, Ethernet/Optional: optical fiber Q at night function (optional), L/HVRT, L/HFRT,
Grid support	Active & reactive power control and power ramp rate control, Volt-var, Frequency-watt

\*Parameters may vary subject to specific project requirement.

## 15.2 Tightening Torques

Tighten the cable with proper torque shown below to prevent the poor contact, high contact resistance, or fire caused by the looseness of cable lugs:

Screw	Torque(N.m)	Torque(lbf.inch)
M3	0.7~1	6.195~8.85
M4	1.8~2.4	15.93~21.24
M5	4~4.8	35.4~42.48
M6	7~8	61.95~70.8
M8	18~23	159.3~203.55
M10	34~40	300.9~354
M12	60~70	531~619.5
M16	119~140	1053.15~1239



Secure the cable in proper place to reduce pressure of cable lug.

### 15.3 Exclusion of Liability

The content of these documents is periodically checked and revised where necessary. Call us or check our website [www.sungrowpower.com](http://www.sungrowpower.com) for the latest information. No guarantee is made for the completeness of these documents. Contact our company or distributors for the latest version.

Guarantee or liability claims for damages of any kind are excluded if they are caused

- Improper or inappropriate use or install of the product
- Install or operate the product in unintended environment
- Install or operate the product without observing relevant safety regulations in the deployment location
- Ignore the safety warnings or instructions contained in all documents relevant to the product
- Install or operate the product under incorrect safety or protection conditions
- Alter the product or supplied software without authority
- Product malfunctions due to operation attached or neighboring devices running out of the allowed limit values
- Unforeseen calamity or force majeure

The use of supplied software produced by Sungrow Power Supply Co., Ltd. is subject to the following conditions:

- Sungrow Power Supply Co., Ltd. assumes no liability for direct or indirect damages arising from the use of Software. This also applies to the provision or non-provision of support activities.
- Software used for commercial purposes is prohibited.
- Decompiling, decoding or destroying the original program, including Software and the embedded software, is prohibited.

### 15.4 Contact Information

In case of questions about this product, please contact us.

We need the following information to provide you the best assistance:

- Model of the device
- Serial number of the device
- Fault code/name
- Brief description of the problem

For detailed contact information, please visit: <https://en.sungrowpower.com/contactUS>

