SG2500U-MV
MV Turnkey Station
System Manual
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1 About This Manual

1.1 Preface

Thank you for purchasing the MV Turnkey Station from Sungrow Power Supply Co., Ltd. We hope that the device will meet your satisfaction. Your commands and feedbacks on the performance and function of the device are very important for our further improvement.

1.2 Validity

This manual is applicable to the MV Turnkey Station product of SG2500U-MV (hereinafter it will be referred to as "MV Station" unless otherwise specified).

1.3 Content

This manual contains the following information:

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

1.4 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 to 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 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

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

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

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

**NOTICE** indicates a 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 pasted on the electrical parts of the MV Station or its inside device. Make sure to read the following symbols and fully understand them before installing the equipment.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Lethal voltage inside! Do not touch!</td>
</tr>
<tr>
<td>⚠️</td>
<td>Hot surface! Do not touch the hot surface of the device.</td>
</tr>
<tr>
<td>🔧</td>
<td>Protective earth. Earthing securely to ensure personal safety.</td>
</tr>
</tbody>
</table>
1.6 How to Use this Manual

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

Additional documents are also available to the users:

- Manual of the Transformer

All rights reserved including the pictures, markings and symbols used. Any reproduction or disclosure, even partially, of the contents of this manual is strictly forbidden without prior written authorization of Sungrow.

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 MV Station edition. The latest manual can be acquired via visiting the website at www.sungrowpower.com.

Please read over this manual and other related manuals before installation and operation of the devices inside the MV Station.

1.7 Terminology

<table>
<thead>
<tr>
<th>Name</th>
<th>For short</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV Turnkey Station</td>
<td>MV Station</td>
</tr>
<tr>
<td>Intelligent power distribution cabinet</td>
<td>Intelligent PMD or PMD</td>
</tr>
</tbody>
</table>

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, R & D and manufactured by Sungrow, is mainly applied to large-and-medium PV power station. The MV Station integrates the DC cabinet, module cabinet, medium voltage transformer, monitoring & power distribution units, firefighting system, lighting devices, and security & protection system to meet the modular design and quick installation requirement of the large-and-medium PV power station as well as ensure the long-time, reliable and safe grid-connected power generation.

The PV power generation system with MV Station is shown in the following figure.

![Figure 2-1 Application of MV Station to the PV Power System](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>PV Array</td>
</tr>
<tr>
<td>B</td>
<td>PV Array Combiner Box</td>
</tr>
<tr>
<td>C</td>
<td>MV Station</td>
</tr>
<tr>
<td>D</td>
<td>Utility Grid</td>
</tr>
</tbody>
</table>

**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 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.
- Visually 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 parts 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. Please 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 follow 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 a large-scale power station.
Death resulting from burning and electric shock upon touching the PV array.

During installation, maintenance and troubleshooting of the device, please ensure:
2 Safety Instructions

- MV Station is disconnected from the PV array.
- 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 were voltage-free before may contain lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before operation and take proper protective 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,
- use 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, esp. the MV Station are completely voltage free.

- Avoid any accidental re-connections.
- Verify that no voltage or current is present with appropriate testing devices.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid accidental contact.
- Ensure sufficient escape room.
- Wait at least 5 minutes after the MV Station stops completely to operate the module.
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. Take proper personal protective equipment (PPE), like wear wrist strap.

2.2.9 LCD Parameter Setting

Certain LCD settable parameters are closely related to the MV Station and internal devices operation, 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 device 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 unclarity 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

Make proper insulation protection during live line operation. At least two persons are required until the operation is done.
Proper field rescue facilities are necessary since the location of most MV Station is far away from the urban areas.

Take the followings into consideration during daily operation and maintenance:

• Nameplates are pasted on the MV Station internal devices, like the module, DC cabinet and etc. They contain very important parameter information about the devices. Protect the nameplates 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.
• Maintain the cooling fans inside the MV Station and inside the MV Station only when the fans stop rotating.
• Wear proper PPE, such as safety glasses, safety footwear and safety gloves if necessary.
• All necessary auxiliary measures are advisable to ensure the 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 environmental pollution.

Please 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, please refer to the actual product you receive.

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

All the descriptions in this manual are for the standard MV Station. Please inform us in the purchase order if you have specific requirements. The actual product you receive may differ.
This manual may not cover all possible situations. Should a specific problem occur that is not explained in this manual, please contact Sungrow.

2.3 Safety Instructions of Each Working Area

The MV Station can be divided into MV Station room, and transformer room. To make sure the device safety and efficient operation, the abovementioned two parts are designed relatively independently. Please follow corresponding safety instructions when working in the three areas.
2.3.1 Safe Operation of the MV Station room

**WARNING**

Perform the operations in this section before any operation on the MV Station room. Physical injury or device damage may follow if otherwise.

**Step 1** Identify the MV Station and read the safety instructions on the MV Station cabinet carefully.

**Step 2** Disconnect all power supplies from the MV Station, including MV Station upstream and downstream devices and other connected power supplies. In addition, place warning signals to prevent accidental reconnection.

1. Stop the module. Wait at least 5 minutes after the MV Station is stopped. Open the cabinet door after all the internal capacitor is discharged completely.

2. Disconnect the transformer downstream switch. Disconnect other power supplies connected to the MV Station, for example, the grid and sub-stations in parallel connection.

3. Disconnect all DC power supply to the MV Station. Disconnect the output circuit breakers of the MV Station upstream combiner box.

**Step 3** Make sure all operation areas are voltage-free. Measure the MV Station AC and DC connection terminals and other operational areas using multimeter to make sure they are all voltage-free.

**Step 4** Temporarily ground the AC and DC sides of the two modules by using proper temporary grounding devices.

2.3.2 Safe Operation of the Transformer Room

**WARNING**

Perform the operations in this section before any operation on the transformer room. Physical injury or device damage may follow if otherwise.

**Step 1** Identify the transformer and read the safety instructions on the transformer cabinet carefully.

**Step 2** Disconnect all power supplies from the transformer, including transformer upstream and downstream devices and other connected power supplies. In addition, place warning signals to prevent accidental reconnection.

1. Stop the module.

2. Disconnect the transformer downstream switch. Disconnect other power supplies connected to the transformer, for example, the grid and sub-MV Stations in parallel connection.

**Step 3** Make sure all operation areas are voltage-free.

**Step 4** Make sure the transformer is voltage-free. High voltage side connection terminals, low voltage side connection terminals and all possible auxiliaries are voltage-free.

**Step 5** Measure the high voltage terminal with proper high voltage tester to make sure the high voltage side is voltage free; measure the low voltage side terminal with proper test probe to make sure the low voltage side is voltage free.

**Step 6** Ground the MV Station

1. Temporarily ground the AC side of the two modules by using proper temporary grounding devices.

2. Turn the earthing switch to the earthed position.
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 DC cabinet, module cabinet, transformer, security system and firefighting equipment 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 MV Station Internal Construction

The MV Station is made up of the following two parts:

![Fig. 3-1 MV Station internal construction](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Module room</td>
<td>Integrate DC cabinet, MV Station cabinet, and etc. Convert the DC current generated from the PV array into AC current.</td>
</tr>
<tr>
<td>2</td>
<td>Transformer room</td>
<td>Integrate one transformer. Convert the output low-voltage AC current into grid-compatible medium-voltage level.</td>
</tr>
</tbody>
</table>
3.3 Overall Design of the MV Station

3.3.1 MV Station Views

<table>
<thead>
<tr>
<th>View</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front view</td>
<td>A is the LCD protective box.</td>
</tr>
<tr>
<td>Back view</td>
<td></td>
</tr>
<tr>
<td>Left view</td>
<td></td>
</tr>
<tr>
<td>Right view</td>
<td></td>
</tr>
</tbody>
</table>
Control and Monitoring Window

The Control and Monitoring window is located on the front door.

On the top is the LED indicator; in the middle is the color liquid crystal touch screen and on the bottom are the emergency stop button, the “AC” knob switch, the “DC” knob switch, “AUX SUPPLY” knob switch, the maintenance interface and etc. Please refer to the figure below.

LED indicator

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

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER</td>
<td>Green</td>
<td>The control circuit power supply is supplying power.</td>
</tr>
<tr>
<td>OPERATION</td>
<td>Green</td>
<td>The MV Station is in grid-connected run mode.</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>The MV Station is in alarm run mode.</td>
</tr>
<tr>
<td>FAULT</td>
<td>Red</td>
<td>A fault occurs and has not been removed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The LED will be off when the fault is cleared.</td>
</tr>
</tbody>
</table>

Buttons

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

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>Press this button to disconnect the DC switch</td>
</tr>
<tr>
<td>AC</td>
<td>Press this button to disconnect the AC switch</td>
</tr>
<tr>
<td>AUX. SUPPLY</td>
<td>Press this button to disconnect the auxiliary power supply of the intelligent power distribution cabinet</td>
</tr>
<tr>
<td>EMERGENCY STOP</td>
<td>When an emergency occurs, the DC and AC circuit breakers disconnect automatically after pressing the emergency stop button.</td>
</tr>
</tbody>
</table>

The MAINTENANCE INTERFACE

The MAINTENANCE INTERFACE on the bottom is the standard Ethernet port for maintenance only.

The cover plate of the LCD can only be opened by special key. Please remove the key and store it properly after the operation to the LCD.
3.3.2 Mechanical Parameter

**Dimensions**

External dimensions (without the flashings) are shown in the figure below.

![Fig. 3-2 Appearance and dimensions of the MV Station](image)

<table>
<thead>
<tr>
<th>Width</th>
<th>Height</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>6058mm</td>
<td>2896mm</td>
<td>2438mm</td>
</tr>
</tbody>
</table>

**The Clearance Spaces**

The clearance spaces around the MV Station should be sufficient for the doors all opened.

![Clearance Spaces Diagram](image)
3.3.3 Ventilation Design

Six air intake grills (In-1, In-2, and In-3 in the figure below), located in the MV Station room, are the entries of fresh air.

Exhaust air of the MV Station is extracted via Out-1, and Out-2.

3.4 Interior Design of the MV Station

3.4.1 Internal Components

The figure below shows the top view of the major electrical components inside the MV Station:

<table>
<thead>
<tr>
<th>Item</th>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>DC cabinet</td>
<td>DC cables connect to the corresponding area of this cabinet after entering the MV Station.</td>
</tr>
<tr>
<td>B</td>
<td>Intelligent PMD</td>
<td>All ports for communication between the MV Station and external devices are designed on this device.</td>
</tr>
<tr>
<td>C</td>
<td>Transformer</td>
<td>Convert the MV Station output voltage to medium voltage level.</td>
</tr>
<tr>
<td>#1 &amp; #2</td>
<td>Module 1</td>
<td>The two modules are of the same model; Hereinafter the two modules will be referred to as #1 and #2 respectively</td>
</tr>
<tr>
<td></td>
<td>Module 2</td>
<td></td>
</tr>
</tbody>
</table>
### 3.4.2 Cable Entry Design

For convenient cable connection in the field, all cables among the MV Station internal devices are connected before delivery.

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

The MV Station bottom cable entries are shown below.

![Fig. 3-3 Cable entries of the MV Station](image)

Function of each opening is shown below:

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole-1</td>
<td>DC cable inlet</td>
<td>DC cables connect to the MV Station through these two holes.</td>
</tr>
<tr>
<td>Hole-2</td>
<td>Reserved hole</td>
<td>-</td>
</tr>
<tr>
<td>Hole-3</td>
<td>Communication cable inlet</td>
<td>Communication and power supply cables connecting the MV Station go in/out through this hole</td>
</tr>
<tr>
<td>Hole-4</td>
<td>AC cable outlet</td>
<td>AC cables of transformer high voltage side connect to the downstream public grid through this hole</td>
</tr>
</tbody>
</table>

Dimensions of the holes

![Dimensions diagram](image)
3.4.3 Internal Devices of the MV Station

**DC cabinet**

DC connection areas are in this cabinet, as shown in the figure below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>DC+ input copper bar</td>
</tr>
<tr>
<td>B</td>
<td>DC- input copper bar</td>
</tr>
</tbody>
</table>

**Intelligent PMD**

The ports between the MV Station and external devices are designed on this cabinet. The locations of the ports are shown in the following figure.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>RS485 ports</td>
</tr>
<tr>
<td>B</td>
<td>Ethernet port</td>
</tr>
<tr>
<td>C</td>
<td>Socket for commissioning</td>
</tr>
<tr>
<td>D</td>
<td>External power supply micro breaker</td>
</tr>
<tr>
<td>E</td>
<td>Grounding copper bar (for N wire)</td>
</tr>
</tbody>
</table>
3.4.4 Operations on the DC circuit breakers

The MV Station is equipped with electrically-controlled air circuit breakers on the DC side. The appearance of the circuit breaker panel is shown in the figure below.

The DC Switch can be used together with a micro-motor. When there is the power supply on the MV Station AC side, the energy can be stored to the breaker through this motor; when there is no power supply on the MV Station AC side, you need to store the energy through the manual energy storage handle.

The operation steps are briefly described in followings.

- **Switch on**
  
  Press the Push ON button on the breaker panel to switch on the breaker.

  Before switching on the breaker, you need to check if the energy storage state displayed on the panel is CHARGED SPRING. If the state is DISCHARGED SPRING, you need to 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.

- **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 Identify and Store the MV Station

4.1 Identifying the MV Station

Identify the MV Station from its nameplate. The nameplate contains the following information: MV Station model, major technical parameters, marks of certification institutes, 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!

4.2 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 you receive the MV Station, a detailed inspection is necessary.

If any damage is detected, contact the shipping company or Sungrow immediately. A relevant photo is preferred. We will provide you with the fast and best service.

- Examine the contents of the shipment to check if there is anything missing according to the scope of delivery.
- Check to make sure the MV Station and inner devices are the models placed in your order;
- Check thoroughly the MV Station and inner devices for any possible damages 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.

4.3 Storage of the MV Station

If it is not to be installed immediately after delivery, store the MV Station appropriately:

- Store the MV Station indoors, for example large warehouse or workshop to prevent possible condensation or damp;
  - If the MV Station has to be stored outdoors, elevate the MV Station base according to the field geological and ambient conditions. And when the ambient temperature is too low, heat the MV Station internal devices.
- Temperature: -40°C~+70°C;
Relative humidity: 0 ~ 95%, non-condensation
Store the MV Station in a dry, clean and solid ground with sufficient load capacity. The ground should be flat without water, bumps or plantings.
• Lock the MV Station internal devices and the MV Station during storage.
• Take proper protection method to prevent the water and dust penetrating inside the MV Station internal. At least protect the MV Station air inlets and outlets.
Routine check the MV Station and internal devices at least once every half a month.
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 used during transport should be maintained beforehand.
- The transport of the MV Station must be done by qualified personnel. Qualified means the operators must have relevant training experience, especially those safety-related ones.

### 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 needed when the road has a gradient.
- Anything, which may hinder the transport, like trees, cables (or similar), should be removed.
- If possible, choose fine weather days to transport the MV Station.
- 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 MV 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.

Please 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 30t.
- 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 describes the work areas of the crane. Anybody standing inside the circle B is forbidden for safety considerations.

![Fig. 5-1 Hoisting the MV Station](image URL)
5.2.2 Hoisting

In the whole hoisting process, please 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 four top corner fittings as shown in the following figure.

![Fig. 5-2 Hoisting from top fittings](image-url)
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.

<table>
<thead>
<tr>
<th>Lifting device</th>
<th>Hook</th>
<th>U-hook</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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, like stress wave emissions, the level of underground water table and 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 to 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 at least 100mm higher than the pea gravel ground on site to avoid the rain damaging the base or the inside of the MV Station.
- Each foundation has the following width: 500mm to 600mm.
- The length of each foundation must be at least 200 mm longer than the width of MV Station on each side.
- 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, please establish cable trenches on the 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 plan

The overall diagram is shown in the following figure.

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Foundation</td>
</tr>
<tr>
<td>B</td>
<td>Pea gravel ground</td>
</tr>
<tr>
<td>C</td>
<td>Solid ground, e.g. gravel</td>
</tr>
</tbody>
</table>

**Foundation**

The distances between the MV Station support points (item P) are shown in the following figure.
Refer to the above distances to construct the foundation.

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Foundation</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Pea gravel ground</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Pre-embedded 20# channel steel</td>
<td>$H \times W \times S = 200 \times 75 \times 90$ mm</td>
</tr>
</tbody>
</table>

**NOTICE**

The foundation plan described in this chapter is for reference only; please consult on-site professional project personnel before project construction.
20# channel steel is pre-embedded on the front and back side of the foundation surface so that the foundation of MV Station can be welded with the foundation after the mechanical installation.

The pre-embedded channel steel must be horizontal with the rest part of foundation upper surface; the pre-embedded steel sheet must be firm and reliable.

According to the on-site actual conditions, water discharge system is designed and constructed at the bottom of foundation to avoid steeper.

The oil groove of oil-immersed transformer is designed at the bottom of foundation. Adequate support is prepared for the oil groove. The grounding design of oil groove is in accordance with the local standard or code.

An exclusive oil discharge outlet is designed for the oil groove.

In the construction of foundation, the grounding body is pre-embedded. One end of the grounding body is welded with the main grounding network of power plant while the other end is welded with the pre-embedded channel steel in the foundation to assure firm welding quality. The embedded grounding pole must be in accordance with the installation codes.

The maintenance entry is designed for the foundation; if needed, the working personnel can enter into the foundation for required operation.

It is recommended to build up steps at the inlet of MV Station for convenient access. The step width and level are reasonably selected according to the on-site actual conditions.

For convenient late maintenance and repair work, a proper maintenance area is constructed around the foundation according to the on-site actual conditions. The maintenance area enjoys an adequate bearing capacity and levelness and conforms to the local standard/code.

Both ends of all the pre-embedded pipes are temporarily sealed to prevent impurities; otherwise, it is inconvenient for laying cables in the late period.

Upon connection of all the electrical cables, the cable inlet and outlet and joint are sealed by refractory mud or other appropriate materials to prevent entrance of rodents.

Please refer to the said drawing and other related drawings for the rest recommended dimensions.

| Pre-bury grounding units according to relevant standards of the country/region where the project is located. |

5.3.4 Other Precautions

**NOTICE**

A drainage system should be designed on the installation site to prevent the MV Station from being immersed in water during heavy rainfalls.

**NOTICE**

Do not plant any trees near the MV Station installation site to prevent the damage of MV Station by tree leaves or stems.

5.4 Removing Flashings and Cover Plates

The flashings and cover plates are attached to the enclosure of the MV Station to prevent moisture penetration during transportation. Locations of the flashings and cover plates are shown by A and B respectively in the figure below. Remove the flashings and cover plates
before commissioning.

**NOTICE**

The cover plate and the flashings are heavy; therefore, please make sure this procedure is performed by at least two persons.
6 Electrical Installation

6.1 Safety Instructions

6.1.1 Generals rules

⚠️ DANGER
High voltage! Electrical 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 module.

⚠️ DANGER
If a ground fault occurs in the PV system, some parts that were voltage-free before may contain 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 to connect the wires.

⚠️ WARNING
Disconnect all AC and DC Switches 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.
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.

**WARNING**

Improper torque used may cause fire to the connection point!
Fix the bolts by strictly following 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, please follow the related requirements of the fiber manufacturer about the min. allowable 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 should hold no liability for any personal injury or property loss caused by ignorance of the safety instructions.

**WARNING**

Ensure the electrical insulation is satisfied 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.

**NOTICE**

- The installation and design of the MV Station must fulfill national and local standards and regulations.
- Sungrow should hold no liability 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.
• Verify that no voltage or current is present with appropriate testing devices.
• Ground and short-circuit whenever necessary.
• Cover possible live parts to avoid accidental contact.

6.2 Parts for Cabling

**WARNING**
Incorrect connection of power cables will cause fires. Follow the sequence when connecting the power cables.
Ensure the fastness of the connection parts. Poor contact or oxidation of the contact surface may cause fire.

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

Clean the connection terminals before cable connection. Do not touch the terminal after cleaning.

Spare parts required for power cables connection like the screws are within the scope of delivery. Please respect the description in this chapter during connection.

6.2.1 Copper Wire Connection
If copper wires are used, connect the spare parts as described below:

![Copper Wire Terminal Connection Sequence](image)

**Fig. 6-1 Copper wire terminal connection sequence**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Bus</td>
<td>Cable Lug</td>
<td>Bolt</td>
<td>Spring washer</td>
<td>Flat washer</td>
<td>Nut</td>
</tr>
</tbody>
</table>
6.2.2 Aluminum Wire Connection

When the aluminum wire is selected, a copper-aluminum bi-metallic lug is needed as shown below:

![Diagram of aluminum wire connection]

Aluminum cable connections for the transformer please refer to transformer manual.

6.3 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:

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

6.4 Preparation before Electrical Connections

Cables inside the MV Station have been connected before delivery. The electrical connection in this chapter is mainly the power cable, communication cable and power supply cable related to the MV Station.
6.4.1 Installation Tools

Prepare the following tools before installation:

- Torque wrench
- Screwdriver
- Wire stripper
- Terminal crimping device
- Alcohol blast burner (or hot air blower)
- Allen wrench
- Meg-ohmmeter or multimeter
- Other auxiliary tools or spare parts

6.4.2 Opening the MV Station door

All the MV Station doors are standard container doors. Open the doors, the relevant devices can be seen.

For cable connection areas of transformer, please refer to transformer manual.

6.4.3 Removal of the Protective Grid

The MV Station is equipped with protective grid inside to maintain safe operation. Remove the grid prior to electrical connections.

**NOTICE**

All cables are connected to the MV Station through the bottom cable entries.

The protective grid is located on the lower part of the MV Station cabinet.

**Step 1** Open the door and find the protective grid.

**Step 2** Unscrew the bolts on sides of the protective grid, and then remove the protective grids.

Store properly the tightening screws. Reassemble the protective grid after the cable connection.

6.4.4 Removing Sealing Tapes of Cable Inlet holes

To prevent sea-water or moisture penetrated inside the MV Station during ship transport, all the cable inlet holes (except for cable glands) of the MV Station are equipped with sealing tapes.

Please remove these sealing tapes before electrical connections.

6.4.5 Checking the Cables

**WARNING**

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

**WARNING**
- Make sure the DC cables and AC 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.

6.5 MV Station Circuit Diagram and Cable Connection

6.5.1 Circuit Diagram

Devices in the above figure are:

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>DC input</td>
</tr>
<tr>
<td>B</td>
<td>AC output</td>
</tr>
<tr>
<td>C</td>
<td>External power supply port</td>
</tr>
<tr>
<td>D</td>
<td>External communication port</td>
</tr>
<tr>
<td>E</td>
<td>DC cabinet</td>
</tr>
<tr>
<td>#1 / #2</td>
<td>#1 module/ #2 module</td>
</tr>
<tr>
<td>TR</td>
<td>Transformer</td>
</tr>
<tr>
<td>K</td>
<td>Intelligent PMD</td>
</tr>
</tbody>
</table>

6.5.2 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 and cross-sectional areas and etc.
- All the cables must be chosen according to the maximum current of the relevant device.
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.

### 6.6 General principles for cable connections

Based on the cable entries design on the bottom of the MV Station, cables inside and outside the MV Station should be laid between the MV Station base and MV Station bottom. Pass the cables to each device through the cable entries on the bottom of the MV Station. The cable length should be designed properly to avoid redundancy.

Connect the power cable first, and then connect the control and communication cables. Please refer to corresponding manuals for the specific cable connections of transformer.

### 6.7 DC Connection

#### 6.7.1 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 within the max. DC voltage of the MV Station.
- 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 MV Station. The MV Station may be damaged if otherwise.
- If the ground fault is found, it must be removed before any DC connection.

**WARNING**

Strictly follow all the instructions when connecting the cables.

**WARNING**

Observe all the safety rules required by the PV array manufacture.

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

#### 6.7.2 DC Cable Connection

The location and size of the wiring copper bar on the DC side is shown in the following figure, unit: mm.
Cable requirements:
- 21 input cables can be connected to the DC side
- The maximum cross-sectional area of the aluminum/copper cable is 750kcmil.
- Fasten the wiring terminal with the bolts in the scope of delivery. And the torques are shown in following table.

<table>
<thead>
<tr>
<th>Bolt</th>
<th>Torque(N.m)</th>
<th>Torque(lbf.inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12×40</td>
<td>60~70</td>
<td>531~619.5</td>
</tr>
</tbody>
</table>

Connection
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** Strip off the insulation cover of the cable with a tripped length of 5mm longer than the depth of the cable lug;

**Step 3** Crimp the cable lug. It is advisable to select DT-XXX cable lug. XXX is cross-sectional area of DC cables.
1. Put the stripped cable inside the cable lug;
2. Tighten the cable lug with relevant tools. The crimping number should be more than two.
Step 4 Insert the heat-shrinkable tubing;
1. A tubing with length 2cm longer than the depth of the cable lug is recommended;
2. Insert the heat-shrinkable tubing into the cable lug;
3. Shrink the tubing with a hot air blower.

Cable protectors are advisable in the cable crosses if the multi-core cables are used.

Step 5 Connect the cable;
1. Select bolts matching with the cable lug;
2. Attach the cable lug to the DC connection copper bar following the sequence in 6.2 Parts for Cabling;
3. Fasten the bolts with screwdriver or spanner.

**WARNING**
- Incorrect connection sequence may cause fire. Please 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-shrinkable 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.

6.8 AC Connection

6.8.1 Safety Notices

**WARNING**
Incorrect AC connection may cause damages to the MV Station.
**WARNING**

Electrical hazards!
- Do not touch the live components.
- Disconnect the AC switches and ensure all terminals are voltage-free.
- The connection to the public grid 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 the cables.

| i | Strictly follow all device internal instructions when closing/opening the AC switches. |

### 6.8.2 AC Cable Connection

Please strictly observe transformer manuals to connect AC side cables to the downstream device.

### 6.9 Ground Connection

#### 6.9.1 Brief Introduction

**WARNING**

The country-specific regulations and standards must be observed at all times!

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

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

Locations of the grounding copper bars inside the MV Station are shown by A in the following figure.
All devices inside the MV Station should be connected equipotentially. The connection of the MV Station main electrical devices to the ground copper bar has been finished before delivery. Please perform the following operation on-site:

- Measure the electrical conductivity between the device ground terminals and the ground copper bar to ensure the effectiveness of the internal ground connection;
- Ground the shielding layers and protection layers of the cables connected to the MV Station outside.

### 6.9.3 External grounding

Locations of external grounding points of the MV Station are shown in the following figure.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Left view" /></td>
<td>Left view&lt;br&gt;The location of the external grounding point is shown in the left figure.</td>
</tr>
<tr>
<td><img src="image" alt="Right view" /></td>
<td>Right view&lt;br&gt;The location of the external grounding point is shown in the left figure.</td>
</tr>
</tbody>
</table>

Note: The unit is in mm.
Perform the external grounding according to the on-site conditions and instructions from the plant staff.

The following two methods are recommended to fix the grounding flat steel to the external grounding points of the Station:

- Use M10 bolts to fix the grounding flat steel to the external grounding points of the Station.
- Fix the grounding flat steel to the external grounding points of the Station by means of welding. After welding, take anti-corrosion measures for the welding point.

The grounding resistance should be no more than 4Ω. 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 obtained from local standards and regulations.

### 6.10 Communication Connection

Two types of communication ports are designed for the Intelligent PMD, RS485 ports and Ethernet port. Locations of these two ports are shown by A and B respectively in the following figure.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>RS485 ports</td>
</tr>
<tr>
<td>B</td>
<td>Ethernet port</td>
</tr>
</tbody>
</table>

On site, perform cable connection according to port definitions.
6.11 **External Power Supply Connection**

The location of external power supply port of the MV Station is shown in the following figure. On site, perform cable connection according to port definition.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Recommended Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>External power supply micro breaker and the corresponding terminals</td>
<td>Max. 10mm² or 8AWG</td>
</tr>
<tr>
<td>D</td>
<td>XK1 terminals (for N wires or grounding)</td>
<td>Max. 6mm² or 12AWG</td>
</tr>
</tbody>
</table>

**The wiring diagram of external power supply**

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

⚠️ WARNING
After the electrical connection, check the connection of all cables. Make sure all connections are correct and firm.

After checking that all connections are correct and firm,

• Tighten all the cable entries.
• The gap at the cable inlet/outlet at the bottom of the MV Station should be sealed with fireproof mud or other appropriate materials.
• Water-proof treatment should be done 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 inside the device and 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 done 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 for Commissioning

Before commissioning, installations inside the MV Station should be checked thoroughly.
- Ensure all the cable connections are secure and all bolts are fixed properly.
- Ensure DC side voltage meets MV Station requirements and the polarity is correct.
- Ensure AC side voltage meets MV Station 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 4Ω.

**NOTICE**

All operation during commissioning must be performed by qualified personnel only.

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 PE ground copper bar has connected to the equipotential connection point and properly grounded. The ground resistance should be no more than 4Ω.

#### 7.3.2 Checking the module

• Ensure that the DC and AC switches are in the “OFF” position.
• Check and ensure MV Station and switches upstream and downstream meet the requirements and flexible enough.

#### 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 MV Station max. input DC voltage. Too high DC voltage may damage the MV Station even cause safety incident.

To ensure the system reliability and device operation, the MV Station should employ PV cells from the same manufacturer and the numbers 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. allowable 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. Use the U-I curve to record the PV array situation. Commission the device when the PV array output situation is stable.

- Record the environmental parameters (temperature and radiation intensity, etc.).
- Measure the resistance of cables (between the terminal box and the MV Station).
- Record accurately all the measured data.

### 7.3.4 Checking Grid Voltage

- Measure accurately the grid 3-phase line-to-line voltage: L1-L2, L1-L3, and L2-L3. Measured data 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 data should not exceed the grid permissible frequency.
- Measure the THD and check the curve if possible. The MV Station will stop running if the THD is serious.
- Record accurately all the measured data.

### 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 the switches upstream and downstream meet the requirements and flexible enough.

### 7.5 Starting the Device

If all tests and measurements have been performed, and all measured values lie within the acceptable range, the device can be switched on for the first time. Proceed as follows to start the two modules inside the MV Station:

**Step 1** Close the upstream and downstream switches of the MV Station.

**Step 2** Turn the “AUX SUPPLY” knob switch to the ON position.

**Step 3** Manually close the auxiliary power supply switch inside the MV Station and wait the touch screen to power on.
Step 4 Stop the MV Station through the touch screen.

Step 5 Turn off the “Trip Enable”, and turn off the “Door-protect enable” through the screen.

Step 6 Turn the “AC” knob switch to the ON position and manually close the two AC switches inside the MV Station to display the key off state.

Step 7 Turn the “DC” knob switch to the ON position and the DC switches inside the DC cabinet.

Step 8 Perform the start operation through the touch screen, and the MV Station starts grid-connected operation.

To ensure normal operation for the first time, please measure the DC input voltage of the MV Station beforehand. When the DC side voltage meets the start-up requirement, i.e. DC voltage is steadily higher than DC start-up voltage.

Start the MV Station for the first time.

7.6 LCD Parameter Setting

When the LCD is on, set the LCD display language, data and time, communication parameters, and active power limitation etc. according to Chapter 9: LCD Operation in this manual. You can also view the running information and perform pertinent operation.

7.7 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 MV Station: abnormal noise, overheating, smoking or unusual odor.
- Check the grid-connected voltage of the MV Station, current and THD for unstableness.
- Check the grounding of the MV Station enclosure.
- Check the functionality of the LCD display.
- Record accurately the MV Station 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.

After commissioning, plant starts power generation and enters daily maintenance process.

**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.
<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV Station needs no manual control in daily operation. Open the cabinet door only for maintenance or troubleshooting and by qualified personnel only.</td>
</tr>
<tr>
<td>Keep the door closed and locked and store the keys of the door by appointed personnel during normal operation.</td>
</tr>
</tbody>
</table>
8 Starting/Stopping

8.1 Starting

8.1.1 Inspection before starting

After the maintenance or service work, you may start the MV Station. Inspect the following requirement before starting the MV Station:

- All connections are done by strictly following the relevant 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 and the Start/Stop switch is in the "Stop" position.
- Make sure, via suitable instruments, that there is no ground fault of the PV modules.
- Measure the DC and AC current with multimeter to check if they fulfill the MV Station startup conditions and there is no overvoltage hazard.

**WARNING**

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

8.1.2 Starting Steps

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

**Step 1** Close the upstream and downstream switches of the MV Station.

**Step 2** Turn the "AUX SUPPLY" knob switch to the ON position.

**Step 3** Manually close the auxiliary power supply switch inside the MV Station and wait the touch screen to be on.

**Step 4** Stop the MV Station through the touch screen.

**Step 5** Turn off the "Trip Enable", and turn off the "Door-protect enable" through the screen.

**Step 6** Turn the "AC" knob switch to the ON position and manually close the two AC switches inside the MV Station to wait the MV Station to display the key off state.

**Step 7** Turn the "DC" knob switch to the ON position.

**Step 8** Perform the start operation through the touch screen, and the MV Station starts grid-connected operation.

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

MV Station stops during normal maintenance and service work or when 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 operation on the LCD panel

**Step 2** Disconnect the DC, AC and Auxiliary power supply switches.

**Step 3** Disconnect the MV Station downstream switches.

**Step 4** Disconnect the MV Station upstream switches.

**Step 5** MV Station stops.

**WARNING**

During normal operation, disconnection of AC or DC switch is strictly forbidden. Otherwise, the switch can be damaged and the MV Station may also be damaged.

8.2.2 MV Station Stops when A Fault Occurs

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** Disconnect the DC, AC and Auxiliary power supply switches.

**Step 3** Disconnect the MV Station downstream switches.

**Step 4** Disconnect the MV Station upstream switches.

**Step 5** MV Station stops.

**WARNING**

- Use the emergency stop button only when emergency or a fault occurs. Under normal conditions, stop the MV Station by perform the stop command in the LCD panel.
- Press the emergency stop button directly in times of crisis to ensure timely response.
9 LCD Menu Operation

9.1 LCD Touch Screen

The LCD touch screen, located at the eye-level inside the monitoring window on the front side of the MV Station is used for user to view the data and set related parameters.

For user's convenience, there are a large number of pictures about the LCD interface in this chapter. The parameters and other details in those pictures are indicative only. The actual product you receive may differ.

If the time shown on the LCD panel is different from the actual local time after time calibration, please 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 and then enters into the starting menu. The initialization screen appears every time the MV Station is energized. After initialization, the default screen follows.

9.2.2 Default Screen Introduction

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yield data. The first line from the top is the present active power; work state is the transient state of the MV Station.</td>
</tr>
<tr>
<td>B</td>
<td>Today's active power curve to indicate the power percentage (power value divides the MV Station nominal power value).</td>
</tr>
<tr>
<td>C</td>
<td>DC side voltage and current of the MV Station.</td>
</tr>
<tr>
<td>D</td>
<td>AC side line-to-line voltage and phase current</td>
</tr>
<tr>
<td>E</td>
<td>Language selection button. Click to change among English, Chinese, French, and Italian.</td>
</tr>
<tr>
<td>F</td>
<td>Present date and time</td>
</tr>
<tr>
<td>G</td>
<td>Success rate of the MV Station internal communication</td>
</tr>
<tr>
<td>H</td>
<td>Success rate of communication between the MV Station and PC</td>
</tr>
</tbody>
</table>

Accessing to submenus mentioned below starts from the default menu.
9.2.3 Backlight and Screensaver

If there is no operation to the screen for more than 5 minutes, the backlight will be off. Activate the backlight by tapping the display and the display will return to the menu operated previously.

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 for user to operate “Start/Stop”, “Home”, “Function”. The logical structures of these menus are shown below:

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>First sub-menu</th>
<th>Second sub-menu</th>
<th>Third sub-menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start/Stop</td>
<td>Start</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Stop</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Home</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Function</td>
<td>Run-information</td>
<td>Real Time Data</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power curve</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E-histogram</td>
<td>-</td>
</tr>
<tr>
<td>History-information</td>
<td>His-event</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>His-fault</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>His-data</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>His-alarm</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Start/Stop</td>
<td>Start</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Stop</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Set-parameter</td>
<td>Sys-parameter</td>
<td>Language &amp; Firmware Ver.</td>
<td>Time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Load default</td>
</tr>
<tr>
<td></td>
<td>Run-parameter</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pro-parameter</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Com-parameter</td>
<td>Serial-port param.</td>
<td>Ethernet param.</td>
</tr>
</tbody>
</table>

9.3.2 Layout of the submenus

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
</table>
| A    | Title bar  
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: the three main icons; the return button to return to the previous menu by tapping it.  
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 out;

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

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

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>←</td>
<td>backspace key, delete the digit input</td>
</tr>
<tr>
<td>Clr</td>
<td>clear the digits input</td>
</tr>
<tr>
<td>Esc</td>
<td>escape and close the keypad</td>
</tr>
<tr>
<td>Enter</td>
<td>confirm the password input</td>
</tr>
<tr>
<td>Max./Min.</td>
<td>the maximum and minimum value can be input; digital outside this range is invalid</td>
</tr>
</tbody>
</table>
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 input.

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

### 9.5 Language Setting

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 target language.

#### 9.5.2 Shortcut

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

By tapping the button, the language will switch among English, Chinese, French and Italian. Language on the button is the present display language of the display.
9.6 Date and Time Setting

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 cell and the keypad will appear;
Step 6 Set the time and date by tapping the keypad and confirm setting by tapping “Enter”.

9.7 Running Information Checking

Running information contains all data pertinent to the MV Station operation:

Real-time data
The real time running information of the modules 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 CO₂ reduction, grid frequency, AC phase/line voltage, MV Station temperature, AC & DC switches states, bypass switches/fuse state, power supply mode are included.

Internal statistics
The total power yields, monthly power yields, total running hours and the running time in minutes per day are included.

Power curve
The output power curve shows the power yield on that particular day in percentage of the nominal power. The data are updated every several seconds and the total diagram data will be cleared at the beginning of a new day.
**E-histogram**

The power yields of the present day in histogram.

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 display value is directive only and must not be used as a basis for invoicing.

### 9.8 History Information Checking

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

#### 9.8.1 History Event Checking

**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.
Up to 100 history events can be viewed from this sub-menu, with up to 5 records can be shown on 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.

9.8.2 History Data Checking

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.

9.8.3 History Fault Checking

When a fault occurs to the MV Station, user can view the present fault via the LCD screen and the history fault records 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.

Up to 100 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.
9.8.4 History Alarm Checking

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.

Up to 100 history alarms can be viewed from this sub-menu, with up to 5 records can be shown on 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.

9.9 Present Fault Information Checking

There may be one or more than one fault occurs 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 MV Station that has fault will display “Fault”. As shown in the left figure, a fault occurs in unit 1. Tap the fault cell of unit 1 to check the present fault.

The fault interface of unit 1 will appear with the fault item in red.
9.10 Starting/Stopping

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

Follow either of the two ways below to start/stop the MV Station through the LCD screen:

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

Start or stop all the two modules at the same time by tapping the start/stop button on the screen.

A confirm operation interface will appear after tapping the corresponding buttons. The instruction is effective after confirmation; cancel the operation by tapping “Cancel”.

9.11 Load Default

Proceed as follows to perform the load default:

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;

The password is “1111”. The system will be reset after entering the password.

9.12 Firmware Version Checking

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 version of LCD and DSP is shown at the bottom of the page.

9.13 Parameters of LCD

9.13.1 Communication Parameters

WARNING

Improper communication parameter configuration may lead to communication failure!

Follow strictly the instructions of the plant staff to configure the communication parameters.

There are the RS485 communication and Network communication. User can set the communication address and protocol through the LCD screen when the hardware connection is complete and the device is energized.

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 Serial Port Parameter interface for RS485 serial communication;
- Set parameter from the Network Parameter interface for Network communication

Serial Port Parameter Setting

Click “Serial port param” to enter the following interface.
Two parameters pertinent to RS485 serial port communication can be set according to the parameter range shown on the display.

“Address” is prescribed by the plant staff and the address for each device must be unique when there is more than one device. “Baud” is selected according to the communication method adopted on-site.

**Network Parameter Setting**

Click Network Parameter to enter the following interface.

Six parameters pertinent to the Network communication can be set. DNS address 1 and DNS address 2 can be set to the default value. Other parameters are assigned by plant staff.

Set parameter with the aid of the pop-up keypad.

### 9.13.2 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 the setting. Tap “Prev” or “Next” to turn pages up or down.
## Description of Running Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vmppt-max (V)</td>
<td>Maximum MPPT voltage</td>
</tr>
<tr>
<td>Vmppt-min (V)</td>
<td>Minimum MPPT voltage</td>
</tr>
<tr>
<td>T-start-wait (s)</td>
<td>The time from the AC/DC parameters meet the grid-connection conditions to the MV Station begins to generate power.</td>
</tr>
<tr>
<td>T-stop-delay (s)</td>
<td>The time from the LCD display or upper computer sends stop command to MV Station performs the stop command</td>
</tr>
<tr>
<td>Stop slope (%/s)</td>
<td>Active power decline rate from MV Station performs stop command to MV Station stops</td>
</tr>
<tr>
<td>Limit Power (%)</td>
<td>Percentage that the active power output accounted for the nominal output power (%)</td>
</tr>
<tr>
<td>Pf cosφ</td>
<td></td>
</tr>
<tr>
<td>Q-limit (%)</td>
<td>Percentage that the reactive power rise accounted for the nominal power (%)</td>
</tr>
<tr>
<td>Q-adjust switch</td>
<td>Refer to 10.3</td>
</tr>
<tr>
<td>Power-off saved (Pf)</td>
<td>If the power factor setting can be saved when the LCD screen is powered off</td>
</tr>
<tr>
<td>Power-off saved (P-limited)</td>
<td>If the limit power(%) setting can be saved when the LCD screen is powered off</td>
</tr>
<tr>
<td>SVG switch **</td>
<td>If the reactive power compensation is activated or deactivated</td>
</tr>
<tr>
<td>T-recover (s)</td>
<td>Automatic recovery time when fault occurs</td>
</tr>
<tr>
<td>P-rise rate (%/s)</td>
<td>Percentage that the active power rise per second accounted for the nominal power (%/s)</td>
</tr>
<tr>
<td>P-decline rate (%/s)</td>
<td>Percentage that the active power decline per second accounted for the nominal power (%/s)</td>
</tr>
<tr>
<td>Q-rise rate (%/s)</td>
<td>Rate of rise of the reactive power</td>
</tr>
<tr>
<td>Q-decline rate (%/s)</td>
<td>Rate of decline of the reactive power</td>
</tr>
<tr>
<td>Trip Enable</td>
<td>Trip the DC main switches of two modules</td>
</tr>
<tr>
<td>Fgrid-derating switch</td>
<td>Control switch for over-frequency derating</td>
</tr>
<tr>
<td>Fgrid-derating start(Hz)</td>
<td>Start frequency for over-frequency derating (the Fgrid-derating control switch is on)</td>
</tr>
<tr>
<td>Fgrid-derating kap(%)</td>
<td>Derating slope during over-frequency derating (the Fgrid-derating control switch is on)</td>
</tr>
</tbody>
</table>

** at night when the MV Station enters standby mode (but not enters the deeper standby mode with lower power consumption), the SVG function needs to be activated: first stop the MV Station by the LCD button and then start; set the SVG switch to “Enable”. The SVG is an optional function for this MV Station.
Running parameter range and default value are shown in the following table.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vmppt-max (V)</td>
<td>800~1300</td>
<td>1300</td>
</tr>
<tr>
<td>Vmppt-min (V)</td>
<td>800~1300</td>
<td>800</td>
</tr>
<tr>
<td>T-start-wait (s)</td>
<td>0~600</td>
<td>60</td>
</tr>
<tr>
<td>T-stop-delay (s)</td>
<td>0~600</td>
<td>0</td>
</tr>
<tr>
<td>Stop slope (%/s)</td>
<td>0.1~100</td>
<td>100</td>
</tr>
<tr>
<td>Limit Power (%)</td>
<td>0~110</td>
<td>110</td>
</tr>
<tr>
<td>Pf</td>
<td>-0.8<del>1/0.8</del>1</td>
<td>1</td>
</tr>
<tr>
<td>Q-limit (%)</td>
<td>-100~100</td>
<td>0</td>
</tr>
<tr>
<td>Q-adjust switch</td>
<td>Close/Pf/Q-limit/Q-operation</td>
<td>Pf</td>
</tr>
<tr>
<td>Power-off saved (Pf)</td>
<td>Not Save/Save</td>
<td>Save</td>
</tr>
<tr>
<td>Power-off saved (P-limited)</td>
<td>Not Save/Save</td>
<td>Not Save</td>
</tr>
<tr>
<td>SVG switch **</td>
<td>Disable/Enable</td>
<td>Disable</td>
</tr>
<tr>
<td>T-recover (s)</td>
<td>20~600</td>
<td>60</td>
</tr>
<tr>
<td>P-rise rate (%/s)</td>
<td>0.05~100</td>
<td>10</td>
</tr>
<tr>
<td>P-decline rate (%/s)</td>
<td>0.05~100</td>
<td>10</td>
</tr>
<tr>
<td>Q-rise rate (%/s)</td>
<td>0.05~100</td>
<td>10</td>
</tr>
<tr>
<td>Q-decline rate (%/s)</td>
<td>0.05~100</td>
<td>10</td>
</tr>
<tr>
<td>Trip Enable</td>
<td>Disable/Enable</td>
<td>Disable</td>
</tr>
<tr>
<td>Fgrid-derating control switch</td>
<td>Disable/Enable</td>
<td>Disable</td>
</tr>
<tr>
<td>Fgrid-derating start(Hz)</td>
<td>50.2<del>55/60.2</del>65</td>
<td>50.6/60.6</td>
</tr>
<tr>
<td>Fgrid-derating kap(%)</td>
<td>0~100</td>
<td>20</td>
</tr>
</tbody>
</table>

Please refer to the LCD screen for the specific setting ranges of these parameters.

9.13.3 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.

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.
### Description of Protection Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Vgrid-max(%)</td>
<td>Set the grid over-voltage protection I value. Protection is activated when voltage exceeds this value.</td>
</tr>
<tr>
<td>II. Vgrid-max(%)</td>
<td>Set the grid over-voltage protection II value. Protection is activated when voltage exceeds this value.</td>
</tr>
<tr>
<td>III. Vgrid-max(%)</td>
<td>Set the grid over-voltage protection III value. Protection is activated when voltage exceeds this value.</td>
</tr>
<tr>
<td>IV. Vgrid-max(%)</td>
<td>Set the grid over-voltage protection IV value. Protection is activated when voltage exceeds this value.</td>
</tr>
<tr>
<td>V. Vgrid-max(%)</td>
<td>Set the grid over-voltage protection V value. Protection is activated when voltage exceeds this value.</td>
</tr>
<tr>
<td>Recover_Vgrid-max(%)</td>
<td>The inverter recovers normal operation when grid voltage is below this value.</td>
</tr>
<tr>
<td>I. T-Vhigh trip(ms)</td>
<td>Grid over-voltage protection I trip time</td>
</tr>
<tr>
<td>II. T-Vhigh trip(ms)</td>
<td>Grid over-voltage protection II trip time</td>
</tr>
<tr>
<td>III. T-Vhigh trip(ms)</td>
<td>Grid over-voltage protection III trip time</td>
</tr>
<tr>
<td>IV. T-Vhigh trip(ms)</td>
<td>Grid over-voltage protection IV trip time</td>
</tr>
<tr>
<td>V. T-Vhigh trip(ms)</td>
<td>Grid over-voltage protection V trip time</td>
</tr>
<tr>
<td>I. Vgrid-min(%)</td>
<td>Set the grid under-voltage protection I value. Protection is activated when voltage is below this value.</td>
</tr>
<tr>
<td>II. Vgrid-min(%)</td>
<td>Set the grid under-voltage protection II value. Protection is activated when voltage is below this value.</td>
</tr>
<tr>
<td>III. Vgrid-min(%)</td>
<td>Set the grid under-voltage protection III value. Protection is activated when voltage is below this value.</td>
</tr>
<tr>
<td>IV. Vgrid-min(%)</td>
<td>Set the grid under-voltage protection IV value. Protection is activated when voltage is below this value.</td>
</tr>
<tr>
<td>V. Vgrid-min(%)</td>
<td>Set the grid under-voltage protection V value. Protection is activated when voltage is below this value.</td>
</tr>
<tr>
<td>Recover_Vgrid-min(%)</td>
<td>The inverter recovers normal operation when grid voltage is above this value.</td>
</tr>
<tr>
<td>I. T-Vlow trip(ms)</td>
<td>Grid under-voltage protection I trip time</td>
</tr>
<tr>
<td>II. T-Vlow trip(ms)</td>
<td>Grid under-voltage protection II trip time</td>
</tr>
<tr>
<td>III. T-Vlow trip(ms)</td>
<td>Grid under-voltage protection III trip time</td>
</tr>
<tr>
<td>IV. T-Vlow trip(ms)</td>
<td>Grid under-voltage protection IV trip time</td>
</tr>
<tr>
<td>V. T-Vlow trip(ms)</td>
<td>Grid under-voltage protection V trip time</td>
</tr>
<tr>
<td>I. Fgrid-max(Hz)</td>
<td>Set the grid over-frequency protection I value. Protection is activated when frequency exceeds this value.</td>
</tr>
<tr>
<td>II. Fgrid-max(Hz)</td>
<td>Set the grid over-frequency protection II value. Protection is activated when frequency exceeds this value.</td>
</tr>
<tr>
<td>III. Fgrid-max(Hz)</td>
<td>Set the grid over-frequency protection III value. Protection is activated when frequency exceeds this value.</td>
</tr>
<tr>
<td>IV. Fgrid-max(Hz)</td>
<td>Set the grid over-frequency protection IV value. Protection is activated when frequency exceeds this value</td>
</tr>
<tr>
<td>V. Fgrid-max(Hz)</td>
<td>Set the grid over-frequency protection V value. Protection is activated when frequency exceeds this value.</td>
</tr>
<tr>
<td>Recover_Fgrid-max(Hz)</td>
<td>The inverter recovers normal operation when grid frequency is below this value.</td>
</tr>
<tr>
<td>I. T-Fhigh trip(ms)</td>
<td>Set the grid over-frequency I tripping time</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ⅱ_T_Fhigh trip (ms)</td>
<td>Set the grid over-frequency II tripping time</td>
</tr>
<tr>
<td>Ⅲ_T_Fhigh trip (ms)</td>
<td>Set the grid over-frequency III tripping time</td>
</tr>
<tr>
<td>IV_T_Fhigh trip (ms)</td>
<td>Set the grid over-frequency IV tripping time</td>
</tr>
<tr>
<td>V_T_Fhigh trip (ms)</td>
<td>Set the grid over-frequency V tripping time</td>
</tr>
<tr>
<td>I_Fgrid-min (Hz)</td>
<td>Set the grid under-frequency protection I value. Protection is activated when frequency exceeds this value</td>
</tr>
<tr>
<td>Ⅱ_Fgrid-min (Hz)</td>
<td>Set the grid under-frequency protection II value. Protection is activated when frequency exceeds this value</td>
</tr>
<tr>
<td>Ⅲ_Fgrid-min (Hz)</td>
<td>Set the grid under-frequency protection III value. Protection is activated when frequency exceeds this value</td>
</tr>
<tr>
<td>Ⅳ_Fgrid-min (Hz)</td>
<td>Set the grid under-frequency protection IV value. Protection is activated when frequency exceeds this value</td>
</tr>
<tr>
<td>V_Fgrid-min (Hz)</td>
<td>Set the grid under-frequency protection V value. Protection is activated when frequency exceeds this value</td>
</tr>
<tr>
<td>Recover_Fgrid-min (Hz)</td>
<td>The inverter recovers normal operation when grid frequency is above this value</td>
</tr>
<tr>
<td>Ⅰ_T_Flow trip (ms)</td>
<td>Set the grid under-frequency I tripping time</td>
</tr>
<tr>
<td>Ⅱ_T_Flow trip (ms)</td>
<td>Set the grid under-frequency II tripping time</td>
</tr>
<tr>
<td>Ⅲ_T_Flow trip (ms)</td>
<td>Set the grid under-frequency III tripping time</td>
</tr>
<tr>
<td>IV_T_Flow trip (ms)</td>
<td>Set the grid under-frequency IV tripping time</td>
</tr>
<tr>
<td>V_T_Flow trip (ms)</td>
<td>Set the grid under-frequency V tripping time</td>
</tr>
<tr>
<td>LVRT switch</td>
<td>Enable or disable the LVRT switch</td>
</tr>
<tr>
<td>LVRT T1 (ms)</td>
<td>Refer to Fig. 10-2: Low / High voltage withstand requirements, T1</td>
</tr>
<tr>
<td>LVRT T2 (ms)</td>
<td>Refer to Fig. 10-2: Low / High voltage withstand requirements, T2</td>
</tr>
<tr>
<td>LVRT voltage1 (%)</td>
<td>Refer to Fig. 10-2: Low / High voltage withstand requirements, U1</td>
</tr>
<tr>
<td>LVRT voltage2 (%)</td>
<td>Refer to Fig. 10-2: Low / High voltage withstand requirements, U2</td>
</tr>
<tr>
<td>LVRT dynamic Var Kf factor</td>
<td>Ratio of reactive power compensation and voltage dropping depth during LVRT</td>
</tr>
<tr>
<td>HVRT switch</td>
<td>Enable or disable the HVRT switch</td>
</tr>
<tr>
<td>HVRT T1 (ms)</td>
<td>Refer to Fig. 10-2: Low / High voltage withstand requirements, T1</td>
</tr>
<tr>
<td>HVRT T2 (ms)</td>
<td>Refer to Fig. 10-2: Low / High voltage withstand requirements, T2</td>
</tr>
<tr>
<td>HVRT voltage1 (%)</td>
<td>Refer to Fig. 10-2: Low / High voltage withstand requirements, U1</td>
</tr>
<tr>
<td>HVRT voltage2 (%)</td>
<td>Refer to Fig. 10-2: Low / High voltage withstand requirements, U2</td>
</tr>
<tr>
<td>Recover T-grid(s)</td>
<td>The grid under-/over-voltage and under-/over-frequency protection are enabled. When the grid turns normal and the set time is reached, the fault will be removed.</td>
</tr>
<tr>
<td>Temperature settings(℃)</td>
<td>Set the temperature for the temperature and humidity controller (optional function)</td>
</tr>
<tr>
<td>Humidity settings(％RH)</td>
<td>Set the humidity for the temperature and humidity controller (optional function)</td>
</tr>
<tr>
<td>Active Islanding</td>
<td>Enable or disable the islanding protection function</td>
</tr>
<tr>
<td>I leakage-pro (A)</td>
<td>Leakage current protection setting value</td>
</tr>
<tr>
<td>Door-protect enable</td>
<td>Enable or disable the door control protection</td>
</tr>
<tr>
<td>Fault manual restart</td>
<td>Manual fault restart. If this function is enabled, the inverter can reconnect to the grid only after the fault is removed manually.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Grid_V-unbalanced protect value(%)</td>
<td>3-phase grid voltage unbalance protection threshold value</td>
</tr>
<tr>
<td>Grid_V-unbalanced protect time(S)</td>
<td>3-phase grid voltage unbalance time reaches to the set value. Protection is activated</td>
</tr>
<tr>
<td>Ins monitor measure time(S)</td>
<td>Insulation monitoring time</td>
</tr>
<tr>
<td>Ins monitor protect threshold(K)</td>
<td>Insulation monitoring protection threshold value</td>
</tr>
<tr>
<td>Ins monitor Vdc-start(V)</td>
<td>Insulation monitoring startup voltage. When the DC voltage reaches to this set value, the insulation monitoring enables.</td>
</tr>
<tr>
<td>Ins monitor manual</td>
<td>Insulation monitoring manual trigger button. Press this button and the insulation monitoring function enables.</td>
</tr>
</tbody>
</table>

Protection parameter range and default value are shown in the following table.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_Vgrid-max(%)</td>
<td>105~150</td>
<td>110</td>
</tr>
<tr>
<td>II_Vgrid-max(%)</td>
<td>105~150</td>
<td>115</td>
</tr>
<tr>
<td>III_Vgrid-max(%)</td>
<td>105~150</td>
<td>117.5</td>
</tr>
<tr>
<td>IV_Vgrid-max(%)</td>
<td>105~150</td>
<td>120</td>
</tr>
<tr>
<td>V_Vgrid-max(%)</td>
<td>105~150</td>
<td>120</td>
</tr>
<tr>
<td>Recover_Vgrid-max(%)</td>
<td>105~150</td>
<td>105</td>
</tr>
<tr>
<td>I_T-Vhigh trip(ms)</td>
<td>40~600000</td>
<td>1100</td>
</tr>
<tr>
<td>II_T-Vhigh trip(ms)</td>
<td>40~600000</td>
<td>600</td>
</tr>
<tr>
<td>III_T-Vhigh trip(ms)</td>
<td>40~600000</td>
<td>300</td>
</tr>
<tr>
<td>IV_T-Vhigh trip(ms)</td>
<td>40~600000</td>
<td>100</td>
</tr>
<tr>
<td>V_T-Vhigh trip(ms)</td>
<td>40~600000</td>
<td>100</td>
</tr>
<tr>
<td>I_Vgrid-min(%)</td>
<td>10~95</td>
<td>90</td>
</tr>
<tr>
<td>II_Vgrid-min(%)</td>
<td>10~95</td>
<td>75</td>
</tr>
<tr>
<td>III_Vgrid-min(%)</td>
<td>10~95</td>
<td>65</td>
</tr>
<tr>
<td>IV_Vgrid-min(%)</td>
<td>10~95</td>
<td>45</td>
</tr>
<tr>
<td>V_Vgrid-min(%)</td>
<td>10~95</td>
<td>45</td>
</tr>
<tr>
<td>Recover_Vgrid-min(%)</td>
<td>10~95</td>
<td>95</td>
</tr>
<tr>
<td>I_T-Vlow trip(ms)</td>
<td>40~600000</td>
<td>3100</td>
</tr>
<tr>
<td>II_T-Vlow trip(ms)</td>
<td>40~600000</td>
<td>2100</td>
</tr>
<tr>
<td>III_T-Vlow trip(ms)</td>
<td>40~600000</td>
<td>400</td>
</tr>
<tr>
<td>IV_T-Vlow trip(ms)</td>
<td>40~600000</td>
<td>240</td>
</tr>
<tr>
<td>V_T-Vlow trip(ms)</td>
<td>40~600000</td>
<td>240</td>
</tr>
<tr>
<td>I_Fgrid-max(Hz)</td>
<td>50.2<del>55/60.2</del>65</td>
<td>50.6/60.6</td>
</tr>
<tr>
<td>II_Fgrid-max(Hz)</td>
<td>50.2<del>55/60.2</del>65</td>
<td>51.6/61.6</td>
</tr>
<tr>
<td>III_Fgrid-max(Hz)</td>
<td>50.2<del>55/60.2</del>65</td>
<td>51.7/61.7</td>
</tr>
<tr>
<td>IV_Fgrid-max(Hz)</td>
<td>50.2<del>55/60.2</del>65</td>
<td>51.7/61.7</td>
</tr>
<tr>
<td>V_Fgrid-max(Hz)</td>
<td>50.2<del>55/60.2</del>65</td>
<td>51.7/61.7</td>
</tr>
<tr>
<td>Recover_Fgrid-max(Hz)</td>
<td>50.2<del>55/60.2</del>65</td>
<td>50.2/60.2</td>
</tr>
<tr>
<td>I_T-Fhigh trip(ms)</td>
<td>40~600000</td>
<td>180100</td>
</tr>
<tr>
<td>II_T-Fhigh trip (ms)</td>
<td>40~600000</td>
<td>30100</td>
</tr>
<tr>
<td>III_T-Fhigh trip(ms)</td>
<td>40~600000</td>
<td>100</td>
</tr>
<tr>
<td>IV_T-Fhigh trip (ms)</td>
<td>40~600000</td>
<td>100</td>
</tr>
<tr>
<td>V_T-Fhigh trip(ms)</td>
<td>40~600000</td>
<td>100</td>
</tr>
<tr>
<td>I_Fgrid-min(Hz)</td>
<td>45<del>49.8/55</del>59.8</td>
<td>49.4/59.4</td>
</tr>
</tbody>
</table>
### Parameter	| Range | Default |
---|---|---|
| II \_Fgrid-min(Hz) | 45~49.8/55~59.8 | 48.4/58.4 |
| III \_Fgrid-min(Hz) | 45~49.8/55~59.8 | 47.8/57.8 |
| IV \_Fgrid-min(Hz) | 45~49.8/55~59.8 | 47.3/57.3 |
| V \_Fgrid-min(Hz) | 45~49.8/55~59.8 | 47/57 |
| Recover \_Fgrid-min(Hz) | 45~49.8/55~59.8 | 50.2/60.2 |
| I \_T-Flow trip(ms) | 40~600000 | 180100 |
| II \_T-Flow trip (ms) | 40~600000 | 30100 |
| III \_T-Flow trip(ms) | 40~600000 | 7600 |
| IV \_T-Flow trip (ms) | 40~600000 | 840 |
| V \_T-Flow trip (ms) | 40~600000 | 100 |
| LVRT switch | Enable/Disable | Enable |
| LVRT T1(ms) | 2500~3500 | 3000 |
| LVRT T2(ms) | 500~1500 | 1000 |
| LVRT voltage1(%) | 85~90 | 90 |
| LVRT voltage2(%) | 5~40 | 20 |
| LVRT dynamic Var Kf factor | 0~3 | 1.5 |
| HVRT switch | Enable/Disable | Enable |
| HVRT T1(ms) | 100~20000 | 10000 |
| HVRT T2(ms) | 100~5000 | 500 |
| HVRT voltage1(%) | 110~120 | 110 |
| HVRT voltage2(%) | 120~140 | 130 |
| Recover T-grid(s) | 1~600 | 10 |
| Temperature settings(℃) | -5~10 | 0 |
| Humidity settings(%RH) | 70~100 | 80 |
| Active Islanding | Enable/Disable | Disable |
| I leakage-pro(A) | 1~10 | 5 |
| Door-protect enable | Enable/Disable | Disable |
| Fault manual restart | Enable/Disable | Disable |
| Grid\_V-unbalanced protect value(%) | 3~20 | 3 |
| Grid\_V-unbalanced protect time(s) | 0.1~600 | 0.1 |
| Ins monitor measure time(s) | 30/150/300/600 | 150 |
| Ins monitor protect threshold(K) | 15~100 | 50 |
| Ins monitor Vdc-start(V) | 220~780 | 220 |
| Ins monitor manual triggered mode button | default: Disable |

**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, please contact Sungrow.

Please refer to the LCD screen for the specific setting ranges of these parameters.
10 MV Station 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.

![Operation modes change diagram]

**Fig. 10-1 Operation modes change**

- **Stop**
  - The MV Station is energized
  - The MV Station DC and AC switches are in the “OFF” position; the upstream and downstream connections are disconnected. The MV Station is therefore electricity-free.

- **Initial Standby**
  - When the MV Station upstream and downstream connections are connected and the AC & DC switches are in the “ON” position, the MV Station turns to the **Initial Standby** mode.
  - The MV Station will continuously check if the PV array and the grid meet the grid-connection requirements. If the MV Station DC input voltage is higher than the MV Station startup voltage and the startup time is reached, whilst the requirements of the grid side parameter are satisfied, MV Station will turn from the **Initial Standby** mode into the **Startup** mode.

**Stop**

Stop the MV Station via LCD panel

**Startup**

Stop the MV Station via LCD panel

**Run**

Stop the MV Station via LCD panel

**Standby**

Fault cleared and setting time reached

**Fault**

Unrecoverable fault
Stop and repair the MV Station

**Emergency-stop**

Fault occurred

**Key-stop**

Alarm Run

**Alarm Run**

Turn the Start/Stop switch to “Stop” or push down the Emergency stop button

**Upv** is the DC input voltage of the MV Station.

**UpvStart** is the MV Station DC side startup voltage.

10.1.2 Operation Mode Description

**Stop**

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

**Initial Standby**

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

The MV Station will continuously check if the PV array and the grid meet the grid-connection requirements. If the MV Station DC input voltage is higher than the MV Station startup voltage and the startup time is reached, whilst the requirements of the grid side parameter are satisfied, MV Station 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, MV Station will start powering the grid.

**Run**

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

The MV Station tracks the PV arrays’ maximum power point (MPP) to maximize the output energy.

**Standby**

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

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

**Fault**

If a fault occurs during operation, MV Station will enter into the Fault mode. LCD panel will display the fault type with the “Fault” indicator on until the fault is removed and MV Station turns into the Run mode.

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

If the fault is unrecoverable, MV Station must be stopped to perform maintenance work. MV Station will automatically check if the fault is recoverable.

---

**WARNING**

When there is a DSP fault or MV Station fault, restart of the MV Station through the LCD is strictly forbidden. A power-off check is required before reenergizing the module. Otherwise, the MV Station may be damaged.

---

**Emergency-stop**

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

The emergency stop button is used to disconnect the AC switch and the DC switch. To release the emergency stop state, please remove the emergency stop instruction by the special key.

**Key-stop**

In Run mode, MV Station will enter into the Key-stop mode by sending stop instruction via the LCD panel if user needs to conduct maintenance or service work.

**Alarm Run**

In Alarm Run mode, MV Station 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 100 history alarm information through Function/History information/his alarm. MV Station automatically turns to Run mode when the alarm is removed.
10.2 Complete Control Strategy

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.

10.3 Active Power Limitation

10.3.1 Introduction to Active Power Limitation

Situations, call for power limitation, are listed below:

- 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]

**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, please 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 the setting.

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 there are three 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

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.

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, please contact Sungrow.
10.5 L/HVRT

The Electric Rule 21, 2015 defines the L/HVRT requirements according to the figure and table below.

For mandatory operation regions, the MV Station shall be considered in compliance if it provides an average current greater than or equal to 80% of the pre-disturbance current or other percentage defined in the requirements documents during the ride-through event in each of the voltage ranges specified in the SRD(s), and returns to at least 80% of the pre-disturbance current level within the time specified in the local standards or regulations.

For momentary cessation regions, the MV Station shall be considered in compliance if it provides an average active current less than or equal to 10% of the MV Station rated current during the ride-through event in each of the voltage ranges specified in the SRD(s), and returns to the pre-disturbance current level or percentage as defined in the
requirements document within the time specified in the local standards or regulations. Sungrow's MV Station meets the abovementioned requirements.

### 10.6 Temperature Derating

When the ambient temperature is below 45°C, the MV Station can operate at 110% of the overload condition. When the temperature reaches 50°C, MV Station can keep the nominal power output. When the temperature is above 60°C, MV Station enters into protection mode.

![Fig. 10-3 MV Station temperature derating function](image)

<table>
<thead>
<tr>
<th>Ambient temp. T</th>
<th>Operation situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&lt;30°C</td>
<td>The MV Station starts with the aid of auxiliary heater</td>
</tr>
<tr>
<td>-30°C&lt;T≤45°C</td>
<td>Operate for a long time at 110% of the overload condition</td>
</tr>
<tr>
<td>45°C&lt;T≤50°C</td>
<td>Operate with derating at 2%Pn/°C</td>
</tr>
<tr>
<td>50°C&lt;T≤60°C</td>
<td>Operate with derating at 10%Pn/°C</td>
</tr>
<tr>
<td>T&gt;60°C</td>
<td>Enter protection mode; Automatically restart when temperature drops below 50°C</td>
</tr>
</tbody>
</table>

### 10.7 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.
10.8 Intelligent Temperature-Control Technology

MV Station will continuously detect the IGBT temperature and adjust the fan speed accordingly. When the MV Station temperature is low, MV Station will decrease the fan speed to lower the device noise and decrease the device operation consumption. As the MV Station temperature increases, MV Station will increase the fan speed for well ventilation.

The intelligent temperature-control technology can synchronize the speed of fan and temperature of the IGBT MV Station and thus optimize the MV Station temperature and other conditions.

10.9 Insulation Monitoring Function

10.9.1 Introduction

Insulation resistance is an important parameter related to safe 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.

10.9.2 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.
- No matter is fault is in the DC side or in the AC side, a thorough checking and troubleshooting after the system is power down is necessary.
10.10 GFDI Function

The DC Cabinet is equipped with the GFDI (Ground Fault Detection and Interruption) function. The GFDI fuse, with a certain cutoff limit, is installed on the negative pole of DC input side.

10.11 Vs-U Curve

The relationship between the MPPT lower limit Vs reactive power and AC voltage Uac is shown in the figure below.

![Vs-U Curve](image)

Fig. 10-5 Vs-U Curve

10.12 Protection Function

The 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.

10.12.1 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.

10.12.2 AC over/under-voltage protection

When the MV Station AC output voltage exceeds the allowable 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.

10.12.3 Frequency anomaly protection

When the grid frequency exceeds the allowable 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.

10.12.4 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 threat to devices and operators.
- If the MV Station continues power supply after the grid is out of power supply, death or injury may occur to the maintainers during maintenance.
- When power grid fails, the MV Station continues power supply. Once the grid resumes, a surge current may occur and damage devices.

MV Station is equipped with anti-islanding protection function.

DANGER

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

10.12.5 Reverse polarity protection
When the PV array inputs' polarities are connected reversely, MV Station will stop and protect itself against damage and resume normal operation after the connection is corrected.

10.12.6 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.

10.12.7 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 MV Station and display the fault type on the LCD screen.

10.12.8 Module over-temperature protection
IGBT modules inside the MV Station use 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.

10.12.9 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, DSP will help to maintain the safe operation of the MV Station by sending instruction to stop the MV Station.

10.13 Firefighting

10.13.1 General Introduction
Respect the national and local firefighting rules and regulations.
Periodically check and maintain the firefighting devices.

10.13.2 Smoke Detector
Smoke detector, located on roof of the MV Station, is a device that detects smoke, typically as an indicator of fire. When smoke is detected, detector will issue a local audible or visual alarm and a warning signal. The installation of smoke detector can protect the electrical
devices and maintainers and operators.
The warning signal can connect to the fire alarm system of the PV system directly.
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 the same components from the same manufacturer and with the same model number.
The model number can be acquired from the marking of the MV Station or the component itself. If otherwise, please 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 are required.
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.

_for troubleshooting of transformer, please refer to corresponding manuals._

11.2 Fault Checking

If any power output anomaly is observed, you may check the following items before contacting Sungrow.
- Open-circuit voltage of the PV arrays
- State of the emergency stop button
- Power limitation state
Should any questions or doubts arise that are not covered by this manual, please contact Sungrow.
us.

If you provide our customer service assistant the following information, it will be of great help for us to diagnose and solve the problem in your system:

- 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 LCD screen

This section is dedicated to the faults shown on the LCD, possible reasons and troubleshooting. In case the fault cannot be removed following the instructions in this section, please contact Sungrow.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Vdc-high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible reason</td>
<td>DC voltage exceeds the max. DC voltage</td>
</tr>
<tr>
<td>Measure</td>
<td>Check the configuration of the PV array and reduce the open-circuit voltage of the PV array</td>
</tr>
<tr>
<td>Remark</td>
<td>Please contact the installers of the PV arrays</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fault</th>
<th>Vac-high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible reason</td>
<td>The grid voltage is above the max. grid voltage</td>
</tr>
<tr>
<td>Measure</td>
<td>Check the grid voltage (or if the grid-connected wire is too thin)</td>
</tr>
<tr>
<td>Remark</td>
<td>The MV Station automatically reconnects to the grid once the grid voltage recovers normal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fault</th>
<th>Vac-low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible reason</td>
<td>The grid voltage is below the min. grid voltage</td>
</tr>
<tr>
<td>Measure</td>
<td>Check the grid voltage Check if the AC cables are securely connected.</td>
</tr>
<tr>
<td>Remark</td>
<td>The MV Station automatically reconnects to the grid once the grid voltage recovers normal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fault</th>
<th>Cntr-flt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible reason</td>
<td>Contactor connected to the grid failure</td>
</tr>
<tr>
<td>Measure</td>
<td>Check the contactor after the device is voltage-free</td>
</tr>
<tr>
<td>Remark</td>
<td>Stop the MV Station if this fault occurs 5 times per day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fault</th>
<th>Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible reason</td>
<td>Islanding detected</td>
</tr>
<tr>
<td>Measure</td>
<td>The MV Station enters into anti-islanding protection state automatically</td>
</tr>
<tr>
<td>Remark</td>
<td>The MV Station automatically reconnects to the grid once the grid becomes normal</td>
</tr>
<tr>
<td>Fault</td>
<td>Possible reason</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>F-fault</td>
<td>The grid frequency is outside the permitted range</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault</td>
<td>PDP-pro</td>
</tr>
<tr>
<td></td>
<td>Internal fault</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault</td>
<td>Gnd-flt</td>
</tr>
<tr>
<td></td>
<td>The MV Station AC side leakage current to the ground exceeds the set value (default: 5A)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault</td>
<td>Iac-high</td>
</tr>
<tr>
<td></td>
<td>Internal short-circuit or internal components damages</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault</td>
<td>Meter-com-flt</td>
</tr>
<tr>
<td></td>
<td>Measurement board communication abnormal. This inversion module stops.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault</td>
<td>GFDI-pro</td>
</tr>
<tr>
<td></td>
<td>GFDI fault</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault</td>
<td>Temp-flt</td>
</tr>
<tr>
<td></td>
<td>The MV Station internal temperature exceeds the permitted value</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Alarm: RISO-flt

<table>
<thead>
<tr>
<th>Possible reason</th>
<th>The MV Station DC side insulation resistance is lower than the set value.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>Check the PV panel insulation to the ground when the MV Station is voltage-free</td>
</tr>
<tr>
<td>Remark</td>
<td>Only alarm display. The MV Station can operate normally.</td>
</tr>
</tbody>
</table>

### Fault: PM-high

<table>
<thead>
<tr>
<th>Possible reason</th>
<th>Module temperature exceeds the permitted value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>Check the module and ventilation after the device is voltage-free</td>
</tr>
<tr>
<td>Remark</td>
<td>Stop the device if this fault occurs 5 times per day</td>
</tr>
</tbody>
</table>

### Fault: I leakage pro

<table>
<thead>
<tr>
<th>Possible reason</th>
<th>The ground protection is activated when the MV Station AC leakage current to the ground is more than 5A (value can be set through the LCD).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>-</td>
</tr>
<tr>
<td>Remark</td>
<td>The MV Station can automatically reconnect to the grid and start operation when the leakage current to the ground returns normal.</td>
</tr>
</tbody>
</table>

### Fault: Overload pro

<table>
<thead>
<tr>
<th>Possible reason</th>
<th>Capacity of the DC side panel is overload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>It is advisable to stop the device and disconnect half of the DC switches.</td>
</tr>
<tr>
<td>Remark</td>
<td>Contact Sungrow</td>
</tr>
</tbody>
</table>

### Fault: Soft Start flt

<table>
<thead>
<tr>
<th>Possible reason</th>
<th>A fault occurs during the soft start process.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>Stop the device to check and service.</td>
</tr>
<tr>
<td>Remark</td>
<td>Contact Sungrow</td>
</tr>
</tbody>
</table>

### Fault: T&H-com flt

<table>
<thead>
<tr>
<th>Possible reason</th>
<th>Temperature and humidity sensor communication fault.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>Stop the device to check and service the temperature and humidity sensor and the cable connection.</td>
</tr>
<tr>
<td>Remark</td>
<td>Contact Sungrow</td>
</tr>
</tbody>
</table>

### Fault: L over-temp

<table>
<thead>
<tr>
<th>Possible reason</th>
<th>Reactor temperature exceeds the permitted value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>Check the reactor after the device is voltage-free</td>
</tr>
<tr>
<td>Remark</td>
<td>-</td>
</tr>
</tbody>
</table>

### Fault: PV pol-rev

<table>
<thead>
<tr>
<th>Possible reason</th>
<th>The positive and negative polarities of the DC side are connected reversely.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>Check the DC connection to for reverse connection after the MV Station voltage-free</td>
</tr>
<tr>
<td>Remark</td>
<td>-</td>
</tr>
<tr>
<td>Fault</td>
<td>Possible reason</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Fault</td>
<td>Control power supply - flt</td>
</tr>
<tr>
<td>Fault</td>
<td>AC SPD flt</td>
</tr>
<tr>
<td>Fault</td>
<td>DC SPD flt</td>
</tr>
<tr>
<td>Fault</td>
<td>Grid-V-unbalanced</td>
</tr>
<tr>
<td>Fault</td>
<td>Encoding repeat</td>
</tr>
<tr>
<td>Fault</td>
<td>Vdc-samp-flt</td>
</tr>
<tr>
<td>Fault</td>
<td>AC switch breaking</td>
</tr>
<tr>
<td>Fault</td>
<td>Fan1-flt</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 11.4 LCD Display Alarm Information and Troubleshooting

During alarm running state, the MV Station can operate normally and send warning signal. User can check the alarm information through the Work state on the default menu or through the Function->History-information->His-alarm interface to check the latest 100 history alarm information. The module will recover normal operation once the alarm is removed.
<table>
<thead>
<tr>
<th>Alarm</th>
<th>Possible reason</th>
<th>Measure</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVRT Run</td>
<td>Grid voltage is below 0.9Un and the LVRT function is enabled</td>
<td>Alarm will disappear automatically when grid voltage recover normal</td>
<td></td>
</tr>
<tr>
<td>CT Unbalanced</td>
<td>Current transformer (CT) on the MV Station control cabinet is abnormal</td>
<td>Check and service the CT on the measuring board when 1.25MW module is voltage-free</td>
<td>Operation LED will keep green when this alarm occurs</td>
</tr>
<tr>
<td>DC Sensor-err</td>
<td>The MV Station DC sensor abnormal</td>
<td>Check and service the DC sensor when the MV Station is voltage-free</td>
<td></td>
</tr>
<tr>
<td>DC switch abnormal</td>
<td>DC switch is abnormal</td>
<td>Stop the device to check and service the DC switch</td>
<td></td>
</tr>
<tr>
<td>IDM-com-flt</td>
<td>The MV Station internal communication abnormal</td>
<td>Check the IDM when the MV Station is voltage-free</td>
<td></td>
</tr>
<tr>
<td>Branch rev-ldc-high</td>
<td>The reverse current of the branch on the DC side is detected to exceed the permissible range</td>
<td>Check the abnormal branch when the MV Station is voltage-free</td>
<td>Before device stops, the non-abnormal branches can work normally and the MV Station can operate in grid-connection normally</td>
</tr>
<tr>
<td>Branch fwd-ldc-high</td>
<td>The forward current of the branch on the DC side is detected to exceed the permissible range</td>
<td>Check the abnormal branch when the MV Station is voltage-free</td>
<td>Before device stops, the non-abnormal branches can work normally and the MV Station can operate in grid-connection normally</td>
</tr>
</tbody>
</table>
### 11.1 Alarm

<table>
<thead>
<tr>
<th><strong>Alarm</strong></th>
<th>Branch breaker flt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible reason</strong></td>
<td>Circuit breaker of the branch on the DC side is abnormal and this branch cannot work normally</td>
</tr>
<tr>
<td><strong>Measure</strong></td>
<td>Check the abnormal circuit breaker when the MV Station is voltage-free</td>
</tr>
<tr>
<td><strong>Remark</strong></td>
<td>Before device stops, the non-abnormal branches can work normally and the MV Station can operate in grid-connection normally</td>
</tr>
</tbody>
</table>

### 11.5 Other Faults

#### Fault
The MV Station shuts down shortly after start-up

| **Possible reason** | 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. |
| **Measure** | Design the serial and parallel connection in accordance with the open circuit voltage; increase the input DC voltage; avoid adopting the critical voltage |
| **Remark** | - |

#### Fault
LCD Display Cannot Start or Stop the MV Station

| **Possible reason** | Communication malfunction between the LCD display and the DSP; LCD power supply malfunction |
| **Measure** | Check the connection between the LCD display and the DSP when the MV Station is voltage-free |
| **Remark** | - |

#### Fault
Communication Failure with PC

| **Possible reason** | Possible reasons are various. Please refer to the Measure for troubleshooting |
| **Measure** | • Check if the address and the Baud rate of the LCD are the same with that of PC  
• Check to ensure the circuits are properly connected and if the RS485 communication is adopted, the A and B ports are connected correctly  
• Check if the communication converters are matched. Communicate again after replacing the converter  
• The monitor disk is installed incorrectly. It is recommended to reinstall the disk  
• If all the above-mentioned items are correct and this fault continues, please replace the PC communication module on the LCD display |
| **Remark** | The monitor disk might be incompatible with the antivirus software and thus cannot be installed correctly. You are recommended to disable the antivirus software and then install the monitor software. If the fault still occurs, please contact Sungrow |
12 Routine Maintenance

12.1 Safety Instructions

Due to the effect of ambient temperature, humidity, dust and vibration, the MV Station and the inner components will be aging and worn out. 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.

For maintenance of transformer, please refer to corresponding manuals.

12.1.1 Safety Instructions

**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 MV Station 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.
12.1.2 Five Safety Rules

Respect the following five rules during maintenance or service on the MV Station to ensure the safety of the maintainer.

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

12.2 Maintenance

12.2.1 Introduction

With IP54 protection degree, 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.

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

12.2.2 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. Esp. the cleaning of the MV Station outside and anti-corrosion & anti-rust work should be more frequent.

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 MV Station 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 MV Station and clean the dust.

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

**WARNING**

Almost all maintenance work needs to remove the internal protective grid during maintenance. Make sure to reassemble the grid and fasten all the screws after the maintenance work.

Make sure all bolts are securely fixed.
## WARNING

Once any unconformity is found during routine maintenance of the MV Station and internal devices please make correction immediately. If any doubts arise, please contact Sungrow.

<table>
<thead>
<tr>
<th>Item</th>
<th>Method</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External checking</strong></td>
<td>Make correction immediately once the following items are found:</td>
<td>Every quarter</td>
</tr>
<tr>
<td></td>
<td>• Check if there are flammable materials on top of and around the MV Station; and if there are other factors that may impair the system operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the MV Station and the foundation are firmly connected and if there is rust</td>
<td></td>
</tr>
<tr>
<td><strong>System states and cleaning</strong></td>
<td>• Check the MV Station and internal devices for deformation and damages</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check the MV Station and internal devices for abnormal noise</td>
<td>Every six months</td>
</tr>
<tr>
<td></td>
<td>• Check if the MV Station internal and device enclosure temperature is too high</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the MV Station internal humidity and dust deposition are too heavy. Clean the MV Station.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the air inlet and outlet are blocked;</td>
<td></td>
</tr>
<tr>
<td><strong>MV Station cleaning</strong></td>
<td>• Check if the circuit board and the component are clean;</td>
<td>From every six months to annually depending on the dust deposits.</td>
</tr>
<tr>
<td></td>
<td>• Check the temperature and dust of the heat-sink. Use vacuum cleaner to clean the MV Station if necessary;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Replace the air filter if necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Notice! Check the air inlet and outlet. The device may be damaged by overheating.</td>
<td></td>
</tr>
<tr>
<td><strong>Warning labels</strong></td>
<td>• Check if the warning labels are clearly visible. Replace them if necessary</td>
<td>Once per year</td>
</tr>
<tr>
<td><strong>Cable connection</strong></td>
<td>Check the cable connection after the MV Station and internal devices are voltage free. Make correction once unconformity is found.</td>
<td>Once per year</td>
</tr>
<tr>
<td></td>
<td>• Check if all cable entries are sealed properly;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if there is water leakage inside the MV Station; check if MV Station windows and doors can close and open flexibly; check if the sealing strip is sealed properly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the power cable connections are loose. Relighten them with the torque specified in the manual if necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the power cables and control cables, especially the surface in contact with the metal are damaged;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the wrap belt of the connection terminals is strip-off</td>
<td></td>
</tr>
<tr>
<td><strong>Air inlet/outlet</strong></td>
<td>Check if the air inlet filter and ventilation ducts of the MV Station and internal devices are normal</td>
<td>Every six months or maintain according to real situation</td>
</tr>
<tr>
<td></td>
<td>Clean or replace the filter</td>
<td></td>
</tr>
</tbody>
</table>
### Fan
- Check the running state of the fan inside the MV Station
- Check if there is crack in the fan blade
- Check if there is abnormal noise during the running of the fan:

| Every six months or maintain according to real situation |

### Device maintenance
- Routine check the corrosion of the metal components (once six months)
- Annually check the contactors (auxiliary switches and micro-switches) to ensure the optimal operation
- Check the running parameters (esp., voltage and insulation)

| From every six months to annually |

### Safety function
- Check the emergency stop button and the LCD stop function;
- Simulation shutdown
- Check the warning labels and other markings for damage or uncleanness. Replace them if necessary

| From every six months to annually |

### Software maintenance
- Optimize software
- Check each parameter setting

| From every six months to annually |

### LCD time display
- Check if the time displayed on the LCD display is correct;
- Replace the button cells on the back of the LCD panel if time is incorrect after calibration.

| From every six months to annually |

### Firefighting device
- Check the functionality of the firefighting devices

### Other devices
- Replace the damaged lighting devices in time

| When necessary |

---

**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.**

### 12.2.3 Filter checking and cleaning
- It is recommended to check and clean the MV Station filter at least every six months.

| The maintenance interval should be shortened to once every three months or shorter if the dust deposition is heavy. |

- The air inlets located on the front and back sides of the MV Station are entrances of cool air. Periodically clean and replace the filter cotton and filter screen to ensure the air circulation and proper temperature inside the MV Station.

- Cleaning and replacing operation are performed on the air inlet window outside the MV Station:

  **Step 1** Push the two spring lock catches toward the middle of the air inlet window to open the outside shutters of air inlet window.
**Step 2** Remove the air filter cotton inside the air inlet window, and shake the dust off;

**Step 3** Clean the filter screen with warm water and degreaser if necessary;

**Step 4** If the filter is broken, replace it. Put a proper new one when the old filter is removed.

**Step 5** When the filter cotton and screen are clean and dry, reassemble them in reverse order.

Filter cotton can be ordered from Sungrow. Depending on the filter type and model, user can cut out small cotton from the larger ones.

**12.2.4 Cleaning MV Station Air Inlet Window**

It is recommended to check and clean the MV Station air inlet window at least once every six months. The maintenance interval should be shortened to once every three months or shorter if the dust deposition is heavy.

Cool air comes into the MV Station from the front and hot air is exhausted from the MV Station from the top. There are two air inlet windows on the lower front side of the MV Station cabinet. Proceed as follows to clean or replace the filter (as marked by item “A” in the following figure) periodically.
Produce as follows to clean or replace the filter:

**Step 1** Remove the six screws used to fix the frame of the air inlet window;

**Step 2** Remove the filters and clean them with warm water and detergent, and wait until it is completely dry; if the filter needs to be replaced, remove the old filter and place the new one.

**Step 3** Reassemble the filter according to the reverse procedure shown above.

Filter cotton can be ordered from Sungrow. Depending on the filter type and model, user can cut out small cotton from the larger ones.

### 12.2.5 Replacement of the electrical components

**WARNING**

The electrical components inside the MV Station must be replaced by the same components from the same manufacturer and with the same model number.

The model number can be acquired from the marking of the MV Station or the component itself. If otherwise, please 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 are required.

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

### 12.3 On-site painting make-up measures

Check for the damages of the MV Station appearance:

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

**Situation 2**: smudging 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:

- Rag
- Water
- Alcohol or other non-corrosiveness detergents

<table>
<thead>
<tr>
<th>Step</th>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Clean the smudginess on the surface by rag (or other cleaning tools) with water</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>If the smudginess cannot be cleaned by water, use 97% alcohol until the surface is clean enough to accept. (Or try other local commonly used non-corrosiveness detergent)</td>
</tr>
</tbody>
</table>

Maintenance and operation steps for situation 2:

Materials:

- Abrasive paper
- Rag
- Water
- Alcohol
- Hairbrush
- Oil paint
<table>
<thead>
<tr>
<th>Step</th>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1.png" alt="Polish" /></td>
<td>Polish the rough oil paint surface or the scratched parts by abrasive paper until the surface is smooth</td>
</tr>
<tr>
<td>2</td>
<td><img src="image2.png" alt="Clean" /></td>
<td>Clean the target parts by rag with water or use 97% alcohol</td>
</tr>
<tr>
<td>3</td>
<td><img src="image3.png" alt="Paint" /></td>
<td>When the surface is clean and dry, paint the abraded parts of the oil paint by banister brush and make sure the painting is as uniform as possible</td>
</tr>
</tbody>
</table>

**Maintenance and operation steps for situation 3:**

**Materials:**
- Abrasive paper
- Rag
- Water
- Alcohol
- zinc primer
- Hairbrush
- Oil paint
<table>
<thead>
<tr>
<th>Step</th>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1.png" alt="Figure 1" /></td>
<td>Polish the damaged parts of the oil paint to remove the surface rust or other roughness</td>
</tr>
<tr>
<td>2</td>
<td><img src="image2.png" alt="Figure 2" /></td>
<td>Clean the target parts by rag with water or use 97% alcohol to clean the surface dust and dirty</td>
</tr>
<tr>
<td>3</td>
<td><img src="image3.png" alt="Figure 3" /></td>
<td>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</td>
</tr>
<tr>
<td>4</td>
<td><img src="image4.png" alt="Figure 4" /></td>
<td>Paint the abraded parts by banister brush when the primer is dry, and make sure the painting is as uniform as possible</td>
</tr>
</tbody>
</table>
Check the protective paint on the MV Station surface for peeling off. Please re-paint the MV Station surface if necessary.
Re-spray the protective paint once every 3-5 years to the MV Station surface.

12.4 Replacement of the electrical components

⚠️ WARNING
The electrical components inside the MV Station must be replaced by the same components from the same manufacturer and of the same model.
The model can be found on the marking of the MV Station or the component itself.
If otherwise, please contact Sungrow.

⚠️ WARNING
If the components needs to be replaced with products from other manufacturers or of different model on site, a prior analysis and confirmation by Sungrow is required.
Failure to follow this procedure may lead to physical injury or death and void all warranty from Sungrow.
13 Appendix

13.1 MV Station System Parameter

13.1.1 Input data (DC side)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. DC voltage</td>
<td>1500Vdc</td>
</tr>
<tr>
<td>Startup voltage</td>
<td>840V</td>
</tr>
<tr>
<td>MPPT voltage range under full load</td>
<td>800V~1300V</td>
</tr>
<tr>
<td>Min. DC voltage</td>
<td>800V</td>
</tr>
<tr>
<td>Max. DC power</td>
<td>2800kW</td>
</tr>
<tr>
<td>Max. input current</td>
<td>3508A</td>
</tr>
</tbody>
</table>

13.1.2 Output data (Grid side)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal output power</td>
<td>2500kW</td>
</tr>
<tr>
<td>Max. continuous output power</td>
<td>2750kW @45°C; 2500kW @50°C;</td>
</tr>
<tr>
<td>Max. continuous output current</td>
<td>46A</td>
</tr>
<tr>
<td>Nominal output voltage</td>
<td>34.5KV</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>30.36~37.95KV</td>
</tr>
<tr>
<td>Nominal grid frequency</td>
<td>60Hz</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>59.8~60.5 Hz</td>
</tr>
<tr>
<td>THD</td>
<td>&lt;3% at nominal power</td>
</tr>
<tr>
<td>DC current injection</td>
<td>&lt;0.5% at nominal output current</td>
</tr>
<tr>
<td>Output power factor rating</td>
<td>0.99</td>
</tr>
</tbody>
</table>

13.1.3 Mechanical parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (W×H×D)</td>
<td>238.50inch<em>114.02inch</em>95.98inch (6058mmx2896mmx2438mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>39683.20lb (18,000kg)</td>
</tr>
</tbody>
</table>

13.1.4 System data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. efficiency</td>
<td>98.8%</td>
</tr>
<tr>
<td>CEC efficiency</td>
<td>98.5%</td>
</tr>
<tr>
<td>Protection Class</td>
<td>TYPE 3R</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-22°F to 140°F(-122°F derating)</td>
</tr>
<tr>
<td></td>
<td>-30°C to +60°C (&gt;50°C derating)</td>
</tr>
<tr>
<td>Cooling method</td>
<td>Temperature controlled air cooling</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0 ~ 95% (non-condensing)</td>
</tr>
<tr>
<td>Max. working altitude</td>
<td>13123ft(&gt;6561ft derating) 4000m (&gt;2000m derating)</td>
</tr>
<tr>
<td>Communication port/protocol</td>
<td>RS485, Modbus, Internet</td>
</tr>
</tbody>
</table>
13.2 Exclusion of Liability

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- 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

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- Software used for commercial purposes is prohibited.
- Decompiling, decoding or destroying the original program, including software and the embedded software, is prohibited.

13.3 Contact Information

Should you have any questions or queries about this product, please contact us through the following information. We will be more than happy to assist you!

| Company:     | Sungrow Power Supply Co., Ltd.                      |
| Website:     | www.sungrowpower.com                                |
| Email:       | Info@sungrow.cn                                     |
| Address:     | No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, P. R. China. |
| Zip:         | 230088                                              |
| Telephone:   | +86 551 6532 7834, +86 551 6532 7845               |
| Fax:         | +86 551 6532 7856                                   |