PMDE Series Energy Storage DC Converter

User Manual



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1. About the Manual

1.1 Foreword

Dear customers, thank you very much for using the energy storage DC converter developed and produced . We sincerely hope that this product can satisfy your needs and you can give more advices for properties and functions of this product. And we will continuously improve and promote the quality of this product.

1.2 Applicable Products

This manual is applicable for following models of the energy storage DC converter: PMDE050H-0050 / PMDE50H-0100 / PMDE50H-0150 / PMDE050H-020H / PMDE050H-0250H / PMDE050H-0300H. The "energy storage DC converter" described in this manual is also called as "DC converter", "energy storage converter", "charger" or "MPPT controller" in the industry.

1.3 Introduction of Contents

The manual includes following main contents:

Safety instruction: safety matters needing to notice during operation and maintenance.

Product description: the system composition used in the energy storage DC converter and the functions and operational mode of the energy storage DC converter are introduced.

Instructions: the operation of the energy storage DC converter, the use method of human-computer interface, etc. are introduced.

Routine maintenance: the daily maintenance of the energy storage DC converter and the replacement method of some spare parts.

Fault handling: faults which may appear on the energy storage DC converter and their solutions are introduced.

Others: technical data of the energy storage DC converter, quality assurance provisions and contact methods of our company are introduced.

1.4 Applicable Personnel

This manual is applicable for the personnel who operates, maintain and perform other work. Readers shall have certain electric knowledge and be acquainted with electrical schematics and characteristics of electronic components.

1.5 Use of Manual

Before using this product, please read this manual carefully. This manual shall be stored with other materials of product components and shall guarantee to be accessible for relevant workers. In addition to this User Manual, following documents are available for users:

- Installation Manual of Energy Storage DC Converter (provide the supporting manual at the time of shipment)
- Transport guide (downloaded in the website), contents of manual as well as images, logos and symbols used are owned by our company. Any persons who are not internal personnel of our company shall not reproduce whole or partial contents in public without written authorization.

1.6 Use of Symbols

In order to confirm the personal and property safety of users when using this product, or efficiently and optimally use this product, relevant information is provided and proper symbols are used for especial emphasis in this manual.

Symbols which may be used in this manual are listed as follows and following contents shall be read carefully to better use this manual.



A Danger

"Danger" indicates that there are highly potential dangers which may cause the fatality of personnel or serious injury accidents if they can't be avoided.

A Warning

"Danger" indicates that there are highly potential dangers which may cause the fatality of personnel or serious injury accidents if they can't be avoided.



A Be careful

"Be careful" indicates that there are lowly potential dangers which may cause moderate or mitigated injury accidents if they can't be avoided.

Notice

"Notice" indicates that there are potential risks which may cause the malfunction of equipment or property losses if they can't be avoided.



"Explanation" is the additional information in the manual as the emphasis and supplementary of contents and can provide skills or tips for the optimum usage of products, which can help you solve a certain problem or save your time.

Please always pay attention to danger warning identifiers. Such identifiers include:

Identifiers	Meanings of identifiers
1	This identifier indicates that there contains high voltage inside the machine body and the shock hazard may be caused in the event of touching.
	This symbol indicates that the temperature here is higher than that acceptable for human body. Please don't touch it to avoid the personal injury.
	This symbol indicates that here is the protective earthing (PE) end where dead earthing is needed to guarantee the safety of operating workers.

2. Safety Instruction

2.1 Applicable Scope of Product

This series of energy storage DC converter developed and produced by our company. is a modular product, which provides the DC busbar of interface connection for the photovoltaic module and storage battery, achieving the charge and discharge of the storage battery system and the maximum power output of the photovoltaic module. The level of protection of the energy storage DC converter is IP21 so that it is suitable for the indoor installation.

A Warning

If the energy storage DC converter is not installed in accordance with the description in this section or is privately installed or refitted without authorization, safety accidents or equipment trouble may be caused. Where losses are caused in this cause, we shall not undertake any responsibilities.

2.2 Safety Instructions

This section introduces the general rules of safety needing attention during the operation process of the energy storage DC converter. Safety instructions in specific use and maintenance procedures are shown in the warning instructions in corresponding sections.

A Danger

- Terminals or conductors connected with DC busbar shall not be touched.
- All directions or documents of safety instructions about battery connection shall be noticed.
- There is fatal high voltage inside the product!
- Warning identifiers on the product shall be noticed and complied with.
- Safety precautions listed in this manual and other relevant documents shall be complied with.

A Danger

- Damaged equipment or system fault may cause electric shock or fire accident!
- Before operation, visual inspection shall be preliminarily done to check whether there are damages or other dangers.
- The safety of other external equipment or electrical connection shall be inspected.
- This equipment can be operated only when this equipment is in the safe condition.

A Warning

Power shall be transmitted to the equipment strictly in accordance with procedures of this manual after maintenance and other work are completed.

2.3 Precautions before Operation

2.3.1 Manual keeping

This manual includes the important information about the operation of the energy storage DC converter. So, this manual shall be carefully read before operating the energy storage DC converter.

- The energy storage DC converter shall be operated strictly in accordance with the description in this manual, otherwise, equipment trouble, casualties and property losses may be caused.
- This manual shall be properly kept to ensure maintenance, repair and other operators are available at any time.

2.3.2 Personnel requirements

- Only the professional electrician or the staff with professional qualification can operate this product.
- Operators shall be fully familiar with the composition and operating principle of the whole energy storage system.
 - Operators shall be fully familiar with the User Manual of this product.
- Operators shall be fully familiar with relevant standards of the country/region where the project is located.

2.3.3 Protection of identifiers on the engine body

- Warning identifiers on and in the cabinet of the energy storage DC converter include the important information about the safe operation of the energy storage DC converter. They are forbidden to be teared up or damaged artificially!
- There are nameplates on the back shroud and the inner side of front gate of the energy storage DC converter where important parameters related to products are contained. They are forbidden to be teared up or damaged artificially!

Notice

- The identifiers on the machine body shall be ensured clear and readable at any time.
- If the identifiers on the machine body are damaged or blurry, they must be replaced.

2.3.4 Setting of safe warning identifiers

During the installation, daily maintenance, overhaul and other operation of the energy storage DC converter, in order to prevent maloperation or accidents because irrelevant personnel close to the machine, following provisions shall be observed:

- Clear identifiers shall be set in backing and post switches of the energy storage DC converter to prevent maloperation causing accidents.
 - Warning signboard or safety warning tape shall be set near the operation region.
- The key of the cabinet door must be pulled out and properly kept after maintenance or overhaul and other operations are completed.

2.3.5 Requirements of escape ways

In order to ensure that workers can quickly evacuate from the scene in the event of accidents, following provisions shall be observed:

- During the whole process of maintenance, overhaul and other various operations of the energy storage DC converter, the escape way shall be remained unblocked.
- Sundries are prohibited to be stacked in the escape way or occupy the escape way in any forms.

2.3.6 Protection of energy storage battery

In the large-scale power station, the voltage between positive and negative anodes of the energy storage battery is very high. If it is touched accidentally, electric shock and even life danger may be caused.

A Danger

- There is fatal high voltage between the positive and negative anodes of the energy storage battery pack!
- When the equipment is maintained, the connection between the energy storage DC converter and the energy storage battery pack shall be ensured fully disconnected.
- Warning identifier shall be set in the disconnected place to ensure there will be no accidental reconnection.

2.3.7 Live line measurement

A Danger

- There exists high voltage in the equipment and accident touch may cause fetal shock hazard, so workers shall during the live line measurement:
- Protect themselves well (for example, wear insulating gloves);
- Be accompanied by other workers to ensure the personal safety.

2.3.8 Use of measuring equipment

During the electrical connection, pilot run and other operations of the energy storage DC converter, in order to ensure that electric parameters meet the requirement, relevant electric measurement equipment need be used.

▲ Warning

- High-quality measurement equipment whose range, serviceable condition, etc. meet the site requirement shall be chosen.
- The measurement equipment shall be ensured to be correctly and normatively connected and used to avoid the electric arc and other danger.

2.3.9 Parameter setting of touch screen

Part of settable parameters in the touch screen are closely related to the operation of the energy storage DC converter, etc. Those parameters can be changed only after the operation condition of the system and the energy storage DC converter is reliably analyzed and evaluated.

AWarning

- Inappropriate parameter settings may influence the normal function of the energy storage DC converter.
- Only the authorized professional staff can set parameters of the energy storage DC converter.

2.3.10 Electrostatic protection

Notice

- Touch or improper operation of the printed circuit board or other static-sensitive elements may cause the damage of devices.
- Unnecessary circuit board touch shall be avoided.
- Electrostatic protection code shall be obeyed, such as, wearing antistatic wrist strap.

2.3.11 Humidity protection

Notice

The invasion of humidity is very likely to damage the energy storage DC converter! In order to guarantee the normal use of various functions of the energy storage DC converter, following provisions shall be observed:

- When the air humidity is more than 95%, the cabinet door shall not be opened.
- The cabinet door shall not be opened in the overcast, rainy and wet weather conditions for maintenance or overhaul of the energy storage DC converter.

2.3.12 Precautions in maintenance or overhaul

AWarning

Through the above shutdown operation, the energy storage DC converter has smoothly quit running, and following points shall be noted during the maintenance or overhaul of equipment:

- The energy storage DC converter shall be ensured not to be power-on again accidentally.
 - A multimeter shall be used to confirm the energy storage DC converter has fully

uncharged.

- Necessary grounding and shorted connection shall be implemented.
- Parts near the operation part which may be electrified shall be covered through insulation.
- After the energy storage DC converter quits running, it must wait for at least 15 minutes before opening the front door to maintain or troubleshoot the energy storage DC converter.
- During the whole process of maintenance and overhaul, the escape way shall be remained fully unblocked.

2.3.13 Product obsolescence

When the energy storage DC converter need be scrapped, please contact with the local authorized professional recycling agencies for disposal and it can't be disposed as a conventional waste.

2.3.14 Other precautions



All operations of the energy storage DC converter shall conform to relevant standards of the country/region where the project is located.

A Warning

- Power-on equipment is prohibited to be maintained or troubleshot or otherwise operated!
- At least 2 workers must be on the spot of the maintenance or overhaul of the equipment.

Besides, following protective or emergency measures shall be taken in accordance with field needs:

- During various operations of the equipment, such as, maintenance and overhaul, relevant workers shall take appropriate protective measures in accordance with demands, for example, wear sound-proof earplugs, insulated shoes and anti-scald gloves.
- The installation place of the energy storage DC converter is always far away from the residence zone, so relevant emergency rescue facilities shall be prepared in accordance with demands, such as, dry powder extinguisher.
- All necessary supplementary measures shall be taken to ensure the personnel and equipment safety.



All descriptions in this manual only apply to the energy storage DC converter with standard configuration. If you have any special demands, please explain to workers of the Science and us, when you order goods. Details shall subject to the actual product you received.

 This manual can't cover all possible conditions in the operation, maintenance and overhaul. If you find any conditions which are not explained in the manual, please contact with us.

3. Product Description

3.1 Introduction of System

3.1.1 Development prospect

Energy storage technology has been regarded as an important constituent part of "exploitation-generation-transmission-distribution-consumption-storage" six links in the power grid operation process. energy storage DC converter is widely applied in the energy storage micro-grid system, independent micro-grid system for isolated islands and energy transmission system, such as, PV-BESS-Diesel Generator set independent micro-grid system, PV-BESS- BatteryCharging micro-grid system and large-scale photovoltaic power station. Energy storage DC transformation not only has the function to access the PV and achieve the MPPT, but also can achieve the cascade utilization of battery, in addition, it also extends the application scenarios of the energy storage system.

3.1.2 Introduction of the energy storage DC converter

With the rapid development of photovoltaic power generation and energy storage system, in order to improve the use ratio and safe reliability of the photovoltaic power generation and achieve the energy management and dispatching of voltage of the storage battery and DC busbar, PMDE series energy storage DC converter is born at the right moment as an interface to connect the storage battery and the DC busbar, which can be applied in different situations (including photovoltaic power generation system and storage battery system of the energy-storage device) and can be applied in the energy storage link and the photovoltaic power generation system, fitting as the interface device of the DC busbar end in the AC/DC micro-grid system.

3.2 Product Features

With advanced digital control technology, optimized control performance and improved system reliability, PMDE series energy storage DC converter is suitable for the charge and discharge demand of different batteries. In addition, with the modular design in its structure, it is easily installed and maintained. Its main performance characteristics are shown as follows:

- BMS and EMS control can be received and communication modes include RS485, CAN, Ethernet, etc.:
- With three working modes: constant voltage mode, constant current mode and MPPT and two working ways: voltage boosting and reduction;
 - Long-time operation under 110% of output rating can be achieved;
- The module of the energy storage DC converter can be pulled out and plugged in on line:
- With modular design and fully frontal maintenance, it can be installed against the wall so that customer space is saved;
- Built-in primary BMS function enables the battery information can be viewed on line through the energy storage DC converter.

3.3 Appearance

Appearance and external parts of the energy storage DC converter are introduced in Fig. 3.1, 3.2 and 3.3 below.



Fig. 3. 1 Appearance of Equipment Cabinet



Fig. 3.2 Appearance of Module

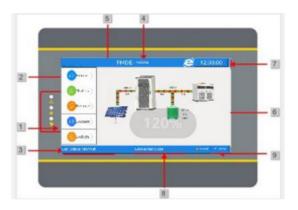


Fig. 3.3 Monitoring Touch Screen

Tab. 3.1 Monitoring Touch Screen

	Tuo: 5:1 1:10intoring Touen Serven
1	Monitoring indicator light
2	Menu bar
3	Communication status with DSP
4	Model
5	BMS communication status
6	Main interface
7	Time
8	Operation status of module
9	Warning and fault

Monitoring screen contains the menu bar, main interface, time, model, working condition of module, communication condition, warning prompt and other information. Users can view the operation information of the energy storage DC converter through the touch screen achieve some control functions. Specific functions are shown below:

- control the running status of the energy storage DC converter
- display the real-time operation data
- Display the fault information
- Adjust the operation parameters
- View the history records

Emergency power off (EPO) button

AWarning

- Emergency power off (EPO) button is used in the fault or emergency moment to disconnect the I/O DC contactor of the energy storage DC converter. This button is the red button in the left of the display screen.
- When only the EPO button is pressed, the DC side connection terminal inside the energy

- storage DC converter is still electrified!
- And there is still fatal high voltage inside the energy storage DC converter!

A Warning

- The EPO is used to close the energy storage DC converter when and only when the emergency occurs!
- Misuse of the EPO button will damage the energy storage DC converter, so the frequent use shall be avoided.

After the EPO button is pressed, the energy storage DC converter will immediately stop, at this time, the DC breaker shall be disconnected manually.

When the energy storage DC converter is restarted again, it can be electrified only after the machine is fully power off or the touch screen extinguishes, otherwise, the energy storage DC converter can't be normally operated.

DC breaker

DC breaker which controls the DC main circuit on and off can achieve the input and output of energy storage DC converter to disconnect with external part and is also a main breaking device of the energy storage DC converter. Only when the breaker is in the "ON" position can the energy storage DC converter start up.

If only the output breaker is disconnected but the input breaker of the energy storage DC converter is not cut off, the converter will still work in standby mode.

▲ Warning

- Misuse of the breaker will cause the internal damage of the energy storage DC converter.
- The frequent operation of the breaker shall be avoided.

3.4 Communication Solutions

3.4.1 RS485 communication solution

The energy storage DC converter can communicate with the PC through RS485/RS232 convertor and our energy storage system monitoring software can monitor the energy storage DC converter in the real time.

Energy Storage DC Converter



Fig. 3-4 PC Monitors the Convertor Through RS485

3.4.2 BMS (battery management system) communication solution

Energy storage DC converter can communicate with the BMS (battery management system) through CAN or RS485 bus as shown in Fig. 3-5.



Fig. 3-5 BMS Communication Function

3.5 Introduction of Principles of Main Circuit

The block diagram of the principle of the main circuit inside the energy storage DC converter is shown in Fig. 3.6, where DC-DC part uses two H bridge module cascades to constitute three-level topology.

DC converter has two application scenarios as shown in Fig. 3.7.

Application scenario I: working in MPPT mode as the MPPT controller of the photovoltaic cell panel. Application scenario II: Working in the constant voltage or constant current mode as the charging and discharging controller of the battery.

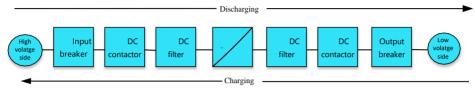


Fig. 3.6 Internal Block Diagram of Energy Storage DC Converter

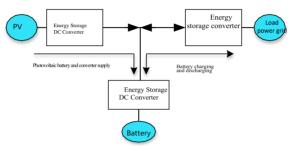


Fig. 3.7 Two Application Scenarios

4. Startup & Shutdown

4.1 Startup

4.1.1 Inspection before startup

After the maintenance or overhaul is finished, the energy storage DC converter need be started up. Before startup operation, following items shall be carefully checked and shall be ensured with no mistakes.

- All connections are based on installation manual and circuit diagrams
- The boot cap inside the equipment has been firmly installed
- The cabinet door has been closed and the key has been pulled out and handed over to a special person for safekeeping
 - EPO button is disconnected
- Breakers in input and output sides are disconnected, namely, they are located in the "OFF" position
- Multimeter shall be used to test whether the voltage of input side meets the start condition of the energy storage DC converter and confirm there are no overvoltage danger

AWarning

The energy storage DC converter with long downtime must be inspected entirely and carefully before startup and can be started up after all indexes conform to requirements.

4.1.2 Operation procedures of startup

After above items are completed, the energy storage DC converter can be started up. Operation procedures are shown as follows:

- 1. Confirm output and input are correctly connected.
- 2. Close the input breaker of the energy storage DC converter, namely, the mark is located in the "ON" position, and wait the monitoring screen to open.
- 3. Operate the "System" menu in the touch screen, entering the working mode and buck/boost setting of DC converter as shown in Fig. 4.1.



Fig. 4.1 System Setting Interface

4. Operate the "Switch" menu on the touch screen, clicking the "Switch of converter" as shown in Fig. 4.2. If it is set in the automatic mode, this procedure is unnecessary.



Fig. 4.2 Startup & Shutdown Interface

5. After the energy storage DC converter starts up, it will automatically operate.

AWarning

- When the energy storage DC converter normally runs, the human disturbance or control is not required.
- When the energy storage DC converter normally runs, the cabinet door shall be locked and the key to the cabinet door shall be pulled out and delivered to a special person for safekeeping.

4.2 Shutdown

There are two shutdown situations: shutdown of normal maintenance or overhaul and shutdown of fault or emergency. When shutdown is required, the shutdown operation shall be performed as described in this section.

4.2.1 Normal shutdown

In the case of normal maintenance or overhaul, following procedures shall be followed:

- 1. Control the shutdown of the energy storage DC converter through the shutdown operation order on the touch screen panel;
 - 2. Disconnect the output side breaker of the energy storage DC converter;
 - 3. Disconnect the input side breaker of the energy storage DC converter;
- 4. The energy storage DC converter system powers down and the shutdown is completed.

A Warning

When the machine works normally, the breaker is prohibited to be disconnected directly to avoid the electric arc danger damaging the breaker. When it is serious, it may cause the damage of the energy storage DC converter.

4.2.2 Shutdown at the moment of fault or emergency

In the case of emergency or fault, following procedures shall be followed:

- 1. Press the EPO button
- 2. Disconnect the output side breaker of the energy storage DC converter;
- 3. Disconnect the input side breaker of the energy storage DC converter;
- 4. The energy storage DC converter will quit running

AWarning

- The EPO button is just used in the case of machine fault or emergency condition. In the case
 of normal shutdown, the shutdown operation shall be carried out through the key shutdown
 order on the touch screen panel.
- In the event of emergency, please directly press the EPO button to ensure quick response.

5. Operation Modes

5.1 Basic Functions

5.1.1 Working mode

Constant voltage mode

The energy storage DC converter can work in the DC voltage source mode to output the set DC voltage. The voltage is set by the monitoring system or from the order of upper-level system and the power changes with the load. And this mode is generally used to connect the output end with the DC load.

• Constant current mode

The energy storage DC converter can work in the DC current source mode to output the set DC current. The power is set by the monitoring system or from the order of upper-level system. And this mode is generally applied on the battery end to control the charging and discharging of the battery.

• MPPT mode

Photovoltaic output can be used as the input of the energy storage DC converter and the converter will output the maximum power of PV within the range which the load allows. This mode is used for the PV side.

5.1.2 Bidirectional operation

DC energy storage converter can run in both directions either as a BUCK converter or as a BOOST converter and its current is reversible. Input and output are exactly interconverted when it works in the BUCK mode and BOOST mode.

5.2 Working Condition

5.2.1 Condition introduction

PMDE energy storage DC converter has several conditions: startup, standby, operation, EPO, fault, etc.

• Startup

Startup indicates that the input side breaker of the DC converter is closed, the auxiliary power supply of the system works and the monitoring system starts up and runs.

Standby

When the system starts up and the system begins self-inspection, or after it shuts down through the order of the monitoring screen, the system will be in the standby mode.

Operation

The system will automatically operate after the system starts up and stands by under the automatic mode, or it will also enter into the operation mode after the startup order in the startup & shutdown menu of the monitoring screen is clicked in other modes.

Notice

The normal working condition of the DC converter is that there is no abnormal signal and the input voltage is within the set range.

Default

When the energy storage system fails, the DC converter will stop working and the system will in the standby mode. At this time, the system will continuously monitor whether the fault is eliminated and it will remain in the fault mode if the fault is not eliminated; If the fault is eliminated, it will operate again.

AWarning

When the communication failure or module fault occurs, startup and reoperation on the touch screen are strictly forbidden and the system shall be inspected under power failure. After confirming that there is no problem, it can be powered on again, otherwise, the machine damage will be caused.

• EPO

EPO mode indicates that the EPO button is pressed to shut down the energy storage DC converter in the case of fault or emergency. When the system needs to start up again, the EPO button must be loosened; and the energy storage converter can be restarted after the system powers down.

Shutdown

If the energy storage DC converter is in the normal "operation" mode and users need shut down the machine for daily maintenance or overhaul, the energy storage DC converter can stop working and the input and output breakers can be disconnected through the shutdown order given by the PC.

6. Operation Manual of LCD Screen

This Chapter introduces the content distribution and operation method of LCD screen interface of the energy storage DC converter.

6.1 LCD Screen

6.1.1 Position and constitution of LCD screen

There is an LCD touch screen in the front side of the cabinet of the energy storage DC converter, which is convenient for relevant operations of users.

LCD screen is constituted by two parts in the following figure. Three LCD indicator lights show the current working condition of the energy storage DC converter and the LCD screen. Users can view and set the relevant data information through clicking the touch screen.

1	Monitoring indicator light
2	Menu bar
3	Communication status with DSP
4	Model
4	BMS communication status
5	Main interface
6	Time
7	Operation status of module
8	Warning and fault

Fig. 6-1 Position and Appearance of LCD Screen

- •
- In order to facilitate users to operate the LCD touch screen, this Chapter illustrates the picture of the
- LCD screen interface. Parameter value and other details in the picture are only used for illustration
- purposes and the display of the product received by the user shall subject to the actual display
- · of LCD screen.

6.1.2 LED indicator light area

LED indicator lights are below the data display operation area. Detailed colors and indications are shown as Table 6-1 below.

Indicator light	Function	Stadus	Meaning
RUN	Run the indicator light	Blink	The system is running
		No-blink	The system is abnormal
		The light isn't working	The system can't operate
		Normally on	The energy storage DC converter normally works
		Lamp blinks	Soft start of energy storage DC converter
		Light off	The energy storage DC converter doesn't work
ALARM	Alarm indicator light	Normally on	The system produces new alarm information

Table 6-1 Description of Meanings of LED Status

Normally off	No alarm information
Blink	DC converter fails

6.2 Menu Buttons

Buttons and their function descriptions are shown in Table 6-2.

Table 6-2 Control Buttons and Their Function Descriptions

Control Buttons	Function Descriptions	
НОМЕ	HOME mainly displays various statuses and the information of voltage and current	
RUNNING	RUNNING status includes the actual data of various functions	
RECORD	RECORD data include history records, current records and other information	
SWITCH	SWITCH controls the opening or closing of the DC converter	

A Warning

When a short beep is heard, the touch key-press takes effect.

6.2.1 Alarm buzzer

On the analog current diagram area, there is a alarm buzzer. DC converter can have three kinds of different audio alarm as shown in Table 6-3.

Table 6-3 Audio Alarm Description of Buzzer

Short single alarm	This alarm sound will be produced when any one function operation key is pressed
One alarm every other 1	This alarm sound will be produced when the DC converter reports an
second	emergency
Continuous alarm	This alarm sound will be produced when the DC converter fails

6.2.2 EPO button

The EPO button is next to the operation control and display panel of the energy storage DC converter. In order to prevent the accidental operation, the EPO button is covered by a safe shield. When EPO button is held down for about 2 seconds, all static switches will be locked (the load power will be cut off) and the DC converter will be off. Under the normal condition, the DC convertor uses the manual input breaker, so the EPO can't disconnect the input power of the DC converter. If the front end of the DC converter uses the switch with electronically controlled tripping function, the external breaker will be tripped with the help of the EPO switch drive to disconnect the input power of the DC converter.

6.2.3 Backlight function

If the user doesn't click the LCD screen for more than 5 minutes, the backlight of the LCD screen will be off. When the backlight of LCD screen is off and the user performs any click operation, the backlight of LCD screen will be on and the HOME page will be displayed.

6.3 Menu Overview

The detailed information of the menu windows and the data window of converter is shown as Table 6-4 below.

Table 6-4 Menu Information of Monitoring Screen

S/N	Menu Name	Menu Item	Parameter Function
1	DC parameter of	Voltage of high voltage	DC voltage

	high voltage side	side (V)	T
	5	Current of high voltage side (A)	DC current
2	DC parameter of	Voltage of low voltage side (V)	DC voltage
2	low voltage side	Current of low voltage side (A)	DC current
3	PV parameter	Voltage (V)	PV output voltage
3	r v parameter	Current (A)	PV output current
	Battery voltage	Battery voltage (V)	Battery voltage
4	Battery Voltage	Battery current (A)	Battery current
5	History records	The output voltage of DC converter is abnormal 20-01-2016 11:30:02 22-01-2016 13:38:06 The battery needs to be maintained 22-01-2016 13:38:02 22-01-2016 13:38: 36	It can display 512 history alarm records of the DC converter and mark the beginning and end time of every alarm. History can be displayed by scrolling on the LCD screen. The list of alarm information is shown in Table 4-8
6	Menu language	Chinese/English	Users can choose one of two kinds of languages as the display language of LCD menu.
		Date and time	It is used to set date and time (24h system)
-	Contain authin	Setting of operation modes	Constant voltalge, contant current or MPPT mode is optional
7	System setting	Setting of output voltage	Setting of output voltage in constant voltage mode
		Setting of buck and boost	Choose BUCK or BOOST
		Capacity	Setting of capacity
8	Model	Model of machine	The information of model of the energy storage DC converter is provided
9	Startup &	Startup	Control startup of the system
3	Shutdown	Shutdown	Control standby of the system

6.4 Viewing of History Information

The system will remain the name and time of latest 100 faults. The type of faults mainly includes: DC overvoltage/undervoltage, DC overcurrent, fault of auxiliary power supply, fault of DSP communication, fault of DC contactor, fault of module, over-temperature of module,

6.5 Setting of Communication Parameters

Communication parameters can set the device address (modbus address) and RS485 baud rate of PC communication. BMS communication methods of the equipment have following choices: no communication, CAN and serial port. PC communication of the equipment supports RS485 serial communication and network communication. Setting methods are shown as follows: • RS485 serial communication

The Modbus address range of the equipment is 1-247 and each equipment has one and only address. The default of baud rate of the serial communication is 9,600 bps.

• Network communication – Default of IP address 192.168.1.150 – Default of subnet mask 255.255.255.0 – Default of gateway 8.8.8.8

7. Protection Function

7.1 Temperature Derating Function

When the temperature of internal environment of the cabinet is lower than 50°C , the energy storage DC converter can operate in the working condition of 1.1 times overload for a long time; when the temperature of internal environment of the cabinet reaches to 50°C , the energy storage DC converter can still guarantee the output of rated power; When the temperature of internal environment of the cabinet is higher than 65°C , the DC converter enters into the protected mode.

Table 7-1 Temperature of Internal Environment of Cabinet and Working	Conditions
--	------------

Temperature of Internal Environment of Cabinet T	Working Condition of DC Converter
T≤45°C	The DC converter can operate in the working condition of 1.1 times overload for a long time
50°C <t≤60°c< td=""><td>When the detected temperature of module is higher than 105°C, the power will be derated at the rate of 10KW/min.</td></t≤60°c<>	When the detected temperature of module is higher than 105°C, the power will be derated at the rate of 10KW/min.
T>60°C	The DC converter enters into the protected mode and operates in derated capacity; When the environment temperature decreases to lower than 50°C, the DC converter will automatically restart and operate.

7.2 Adjustment Function of Fan Speed

The energy storage DC converter will adjust the rotation speed of the cooling fan in accordance with the current operating rating of the module so that not only can the rise of internal temperature of the module be prevented but also the internal energy consumption can be decreased.

7.3 Other Protection Functions

The energy storage DC converter has perfect protection functions. When the input voltage or the output voltage appears abnormal conditions, it can also effectively act to protect the safe operation of the energy storage DC converter and it will continue to run until the abnormal condition disappears. The protection items include:

• DC overvoltage/undervoltage protection

When the DC voltage of the energy storage battery exceeds the allowed voltage range, the energy storage DC converter will stop running, meanwhile, it will give warning signals and display the fault type on its touch screen. The energy storage DC converter can quickly detect the abnormal voltage and respond to it.



When the energy storage DC converter is under the status of the overvoltage protection, the high voltage inside the energy storage DC converter still exists, so the air switch must be cut off for electro discharge treatment before overhaul and maintenance. It must be confirmed to be in the safe state before operation.

• Overtemperature protection of module

IGBT module of the energy storage DC converter uses the high-accuracy temperature sensor which can monitor the temperature of the module in real time. When

the temperature is over high, DSP will give an order to stop the operation of the energy storage DC converter, protecting the stable operation of the equipment.

• Overtemperature protection of environment

A high-accuracy temperature sensor is equipped inside the energy storage DC converter, which can monitor the temperature inside the machine. When the temperature is over high, DSP will give an order to stop the operation or reduce the output of the energy storage DC converter, protecting the stable operation of the equipment.

1) DC overcurrent protection

When the detected DC current of the energy storage battery exceeds 1.2 times of rated current, the energy storage DC converter will stop running, meanwhile, it will give warning signals and display the fault type on its touch screen. The energy storage DC converter can normally work after it returns to normal.

2) IGBT module fault

IGBT module of the energy storage DC converter has self-protection function. When the module detects the over-current phenomenon occurs in the module, it can quickly deliver the fault information to DSP, and then DSP will give an order to stop the operation of the energy storage DC converter, meanwhile, it will give warning signals and display the fault type on the touch screen.

3) Fan fault

The fan of the energy storage DC converter has self-protection function. When the fan itself detects the fan can not rotate, it can quickly deliver the fault information to DSP, and then DSP will give an order to stop the operation of the energy storage DC converter, meanwhile, it will give warning signals and display the fault type on the touch screen.

4) Polarity reverse fault

When the energy storage battery detects that the DC input voltage is negative, the energy storage DC converter will give warning signals and display the fault type on its touch screen.

8. Routine Maintenance

Influenced by the environment temperature, humidity, dust and vibration, internal parts of the energy storage DC converter will age or wear so that the potential fault occurs inside the energy storage DC converter. Therefore, the daily and regular maintenance is necessary for the energy storage DC converter to guarantee its normal operation and service life.

All measures and methods which help the energy storage DC converter in good working condition belong to the scope of maintenance work.

8.1 Safety Precautions

8.1.1 General safety rules

AWarning

Only the qualified and authorized staff can maintain or otherwise operate the energy storage DC converter.

In the maintenance work, metal parts, such as, screw and gasket, shall not left inside the energy storage DC converter, otherwise, equipment may be damaged.

A Warning

Note that the cable connector terminal inside the energy storage DC converter is still charged after the breaker is disconnected! Before opening the cabinet door and begin formal maintenance work, the breaker shall be disconnected and the backing and post shutdown switches of the energy storage DC converter also shall be disconnected.

A Warning

After the energy storage DC converter quits running (it turns off and the indicator light is off), it must wait for at least 15 minutes before operating the machine.

8.1.2 Five safety principles

For sake of the safety of operators, following five safety principles shall be obeyed before the maintenance or overhaul and other operations of the energy storage DC converter:

- All external connections of the energy storage DC converter and the connection to the power supply inside the equipment shall be disconnected.
 - The energy storage DC converter shall not be power-on again accidentally.
- Multimeter shall be used to confirm the energy storage DC converter has fully uncharged.
 - Necessary grounding and anti-electric shock measures shall be implemented.
- Parts near the operation part which may be electrified shall be covered by the insulated material.

8.1.3 Exchange of the module of energy storage DC converter

Submodule and complete machine are mainly connected by the docking terminal. When the submodule needs to be exchanged, the machine shall be closed and the I/O breakers shall be disconnected to ensure the machine powers off. After five minutes, 4 set screws on the module front panel can be disassembled and then the red panel lock button in the top left corner of the panel shall be toggled towards the left so that the cabinet is separated from the module.

8.2 Maintenance Work and Period

The recommended routine maintenance period and work contents are shown in Table 8-1:

Table 8-1 Routine Maintenance Period and Work

Inspection Content	Inspection Methods	Maintenance Period
Save the software data	Read the data in the touch screen software. Save the operation data, parameters and logs to relevant documents. Inspect settings of parameters.	Once a month
Operation condition and environment of the system	Observe whether the energy storage DC converter is damaged or deformed or makes abnormal noise. Inspect whether the shell of the energy storage DC converter emits heat normally and use thermal imager to monitor the heating condition of the system. Observe whether the incoming and outgoing air is normal. Inspect the humidity and dust around the energy storage DC converter and filters of all air inlets are normal.	Once half a year
Cleanliness of system	Inspect the cleanliness of the circuit board, components and parts. Inspect the temperature and dust of the radiator and clean the module if necessary. Replace the air filter net.	Once half a year to once year (in accordance with the dust content of the service environment)
Power circuit connection	Inspect whether the power cable connection is loose. Inspect whether the power cable and control cable are damaged, especially, whether the skin contacting the metal surface has any cuts. Inspect whether the insulated binder of the power cable connection terminal falls off.	Once half a year after the first commissioning, and once half a year to once a year thereafter.
Terminal and wire arrangement connection	Inspect whether the control terminal screws are loose. Check whether the main circuit terminal has the condition of poor contact and the screw position is overheating. Inspect whether the color of the copper busbar changes. Examine the device end and other connections as well as the wire arrangement through visual inspection	Once a year

Inspection Content	Inspection Methods	Maintenance Period
Maintenance and replacement of fan	Inspect whether the machine touch screen displays fault of the DC fan. Listen whether there is abnormal vibration noise when the fan operates.	Once a year
Maintenance of breaker	Make routine inspection for the corrosion situation of all metal elements. The annual inspection of contactor (auxiliary switch and microswitch) guarantees its machinery runs well.	Once half a year to once year
Safety function	Inspect the stop function of the EPO button and monitoring screen. Simulate the shutdown and inspect the signal communication of shutdown. Inspect the warning identifier of machine body and other equipment identifiers and replace them in time if any blurs or damages are found.	Once half a year to once year
Maintenance of software	Optimize the software. Inspect settings of parameters.	Once half a year to once year

AWarning

Because the DC busbar contains capacitance, it should take at least 15 minutes after the energy storage converter fully powers off before maintenance work and most of the maintenance work can be carried out after protective mesh enclosures inside the machine are removed. After all maintenance work is completed, all removed maintenance mesh enclosures shall be recovered to original status. All nut bolts shall be tightened in place.

Table just shows the recommended routine maintenance period of the product. Actual maintenance periods should be determined reasonably in accordance with the detailed installation environment of the product. The maintenance period of the product will be affected by the scale of the power station, location, site environment and other factors.

If the sandstorm is large or dust is relatively thick, it is very necessary to shorten the maintenance period and increase the maintenance frequency.

8.3 Inspection and Replacement of Air Filter Screen

- 1. Carefully read the safety instruction.
- 2. Open the cabinet door.
- 3. Inspect the air filter screen and use the screw driver to remove it if it is necessary to replace it.
- 4. Inspect the cleanliness of the cabinet body. Use the soft duster cloth or vacuum cleaner to clean it if necessary.
 - 5. Close the cabinet door.

8.4 Replacement of Electronic and Electrical Components

A Warning

Electronic and electrical components inside the energy storage DC converter must be replaced with same types of components from the same factory! The type of components can be gained from the identifier of the energy storage DC converter or their own identifiers. If you can't gain it, please contact with us. If components need to be replaced with those from other manufacturers or different types from same manufacturers on site, such components must be confirmed through the analysis of the technician of us. Otherwise, we will not bear any responsibilities for casualties or property losses caused hereby.

9. Fault Handling

A Warning

- There is still fatal high voltage inside the energy storage DC converter under the fault condition!
- Only technicians who meet the requirement can perform operations described in this Chapter.
 "Meet the requirement" indicates that operators have ever participated in professional training on equipment trouble removal in the earlier stage.
- Please only perform the operation about the trouble removal described in this manual.
- All safety operation specifications should be obeyed during operation.

If problems can't be solved with the help of this manual, please contact with us We need following information to provide quicker and better services for you:

- Model of energy storage DC converter
- Serial number of energy storage DC converter
- Relevant components connecting with the energy storage DC converter and the configuration information of the energy storage battery
 - Communication connection scheme of energy storage DC converter
 - Brief description of faults
 - As much as possible detailed photos of the fault site

9.1 Troubleshooting

When the energy storage DC converter can't output as expected or its charge and discharge capacity changes abnormally, following matters shall be inspected before consulting the maintenance personnel of our company:

- Open-circuit voltage of energy storage battery
- Whether the machine is in the fault status
- Inspect the operation condition of the battery or photovoltaic module
- Inspect whether the communication of metering equipment is normal

9.2 Display Faults and Elimination Methods of Touch Screen

This section will summarize display faults of the touch screen, possible causes of faults and possible elimination methods as shown in Table 9-1. If faults are still not eliminated after operation in accordance with instructions of this section, please contact with us.

Table 9-1 Fault Information and Its Causes and Treatment Methods

Fault Type	Possible causes: Simple Treatment		Remark
Overvoltage input	DC voltage is higher than the allowed maximum DC voltage or the machine shuts down urgently at high power	Inspect the output voltage of the energy storage battery. If normal, power on to restart the DC converter; if over high, please contact with the supplier.	Contact with the customer service staff of our company
Undervoltage input	DC voltage is lower than the allowed minimum DC voltage	Inspect the output voltage of the energy storage battery and increase the open-circuit voltage of the energy storage battery pack.	Contact with the supplier of the energy storage battery

Fault Type	Possible causes: Simple Treatment		Remark	
Overcurrent input	The energy storage DC converter shorts out or internal components are damaged	Inspect the cable connection of DC side circuit of the energy storage DC converter and whether the control circuit board exists problems	Contact with the customer service staff of our company	
Overtemperture converter	The temperature of IGBT module is higher than the set value	After the internal power of the equipment is completely off, overhaul the module and the cooling fan		
Auxiliary power supply failure	Auxiliary power supply fails or the input/output breaker is cut off during operation process	Close the input circuit breaker, disconnect the output contactor and confirm whether the auxiliary power supply is damaged. If the module doesn't work (without electricity), the internal auxiliary power board needs to be replaced	Contact with the customer service staff of our company	
Fan fault	The fan has a functional failure or the fan blade is stuck	Inspect whether the fan in the air outlet is normal	Contact with the customer service staff of our company	
Drive cable fault	The hardware detects the cable connection fault	Internal drive wire is loose	Contact with the customer service staff of our company	
Open circuit of contactor	Contactor is not closed	Replace the DC contactor	Contact with the customer service staff of our company	
Short circuit of contactor	The contact point of DC contactor is stuck and can't be separated	Replace the DC contactor	Contact with the customer service staff of our company	

9.3 Other Faults

1) The machine makes a loud noise when running

Possible causes: The energy storage DC converter operates abnormally; the inductor works abnormally or the cooling fan fails.

Solutions: Inspect whether the power is in the normal range, whether the output voltage and current are normal, and whether the waveform distortion will produce loud noise and the inductor emits heat seriously; inspect and replace the cooling fan.

2) The touch screen can't start up or shut down

Possible causes: The communication between the touch screen and the DSP board fails and the charge and discharge fail (the battery can't be connected).

Solutions: Inspect whether the communication between the touch screen and DSP board is normal and whether the whether the battery can be charged and discharged (the battery can be connected).

3) Communication faults of PC

Serial communication modes:

- 1. Inspect the circuit, inspect all connections are good and A/B are inversely connected (RS485).
- 2. If the communication adapter is mismatched, try again after replacing the communication adapter.
 - 3. Inspect whether the local address and the baud rate are consistent with the PC. Network communication modes:
 - 4. Please inspect whether the IP address, subnet mask and gateway are set correctly.
- 5. Inspect whether the communication line is a through line and is completely connected.
- 6. If above inspection items are correct and error free, please try to replace the touch monitoring panel.

10. Appendix

10.1 Technical Data

10.1.1 Electrical part

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Model	PMDE50H- 0050	PMDE50H- 0100	PMDE50H- 0150	PMDE50H- 0200	PMDE50H- 0250	PMDE50H- 0300
Electrical parameters						
Rated power	50KW	100KW	150KW	200 KW	250 KW	300 KW
Maximum power	55KW	110KW	165KW	220KW	275KW	330KW
PV access	Available	Available	Available	Available	Available	Available
Quantity of MPPT	1 way	2 ways	3 ways	4 ways	5 ways	6 ways
Scope of MPPT	450-850	450-850	450-850	450-850	450-850	450-850
Maximum working current	110A	220A	330A	440A	550A	660A
System parameters	220.1	2201	00071		3307.	0007
Peak efficiency	99%	99%	99%	99%	99%	99%
Voltage accuracy	1%	1%	1%	1%	1%	1%
Current accuracy	1%	1%	1%	1%	1%	1%
Supporting batteries	Various	Various	Various	Various	Various	Various
Protection level	IP21	IP21	IP21	IP21	IP21	IP21
Attitute (full load)	3,000m	3,000m	3,000m	3,000m	3,000m	3,000m
Relative humidity	-	· ·	95% (without condensation)	95% (without condensation)	95% (without condensation)	95% (without condensation)
User interface	Touch screen	Touch screen	Touch screen	Touch screen	Touch screen	Touch screen
Communication	485, CAN	485, CAN	485, CAN	485, CAN	485, CAN	485, CAN
BMS interface	Available	Available	Available	Available	Available	Available
Protection parameters						
Input breaker	Available	Available	Available	Available	Available	Available
Output breaker	Available	Available	Available	Available	Available	Available
Isolation mode	Non- isolation	Non- isolation	Non-isolation	Non-isolation	Non-isolation	Non-isolation
Cooling technique	Forced air cooling	Forced air cooling	Forced air cooling	Forced air cooling	Forced air cooling	Forced air cooling

10.1.2 Machinery part

Model	PMDE50	PMDE100	PMDE150	PMDE200	PMDE250	PMDE300
Dimension (W*D*H mm)	600*700*1200					
Wiring method	Bottom in and bottom out					
Weight (Kg)	150KG	180 KG	210KG	250KG	300KG	350KG

10.2 Quality Assurance

Faulty products during the guarantee period will be maintained freely or exchanged with new products by us. (hereinafter referred to as our company).

1) Evidences

Our company requires customers to produce the invoice and date of purchasing the

product during the guarantee period. Meanwhile, the trademark on the product shall be clearly visible, otherwise, our company has right not to guarantee the quality.

- 2) Conditions
- Unqualified products replaced will be handled by our company
- Customers shall reserve reasonable time for our company to repair the faulty equipment
 - 3) Duty exemption

The company has the right not to guarantee the quality under following situations: The whole machine or parts beyond the free warranty period.

- Transport damages
- Incorrect installation, modification or use
- The equipment operates in very hostile environment beyond what is described in this manual
- Machine fault or damage caused by the installation, repair, modification or disassembly of service workers excluding the staff of our company
 - Any installation and use scope beyond relevant international standards
- Machine fault or damage caused by the use of non-standard or non-our brand parts or software.
- Damages caused by abnormal natural environment. If customers require maintenance service for the product fault caused by above situations, our company can provide the paid maintenance service after the determination of the service department of our company.

In order to continuously improve the customer satisfaction, products and product manuals of our company will be continuously improved and upgraded. Therefore, if the manual in your hand is inconsistent with the product, it may be caused by the version and the specific product shall prevail. If you have any questions, please contact with our company.