PDS51 Solar Pump Controller

User Manual

Data Code：PDS51-E-V04-2411

Preface

Thank you for choosing PDS51 solar pump controller. This mstructions and detailedanual provides you with relevant operating in explanations of parameters. Please read this manual carefully before installation, operation, maintenance, or inspection.

Before using, be sure to confirm whether the wiring is correct and whether the rotation direction of the pump is correct.

Contents

Safety Precaution

■Arrival Inspection

◎If the controller is damaged or parts are missing, do not install or operate it. Otherwise, it may result in equipment damage or personal injury.

■Installation

◎When installing and moving, please hold the bottom of the product, not just the casing, to prevent injury or damage to the controller.

◎The controller should be kept away from flammable and explosive objects, away from heat sources, and installed on flame retardant objects such as metal.

◎When installing the controller, avoid direct sunlight, it can be installed under the solar panel arrays.

◎The wiring must be completed by qualified professional electrical engineers and comply with local electrical regulations, otherwise it may cause electric shock or damage to the controller.

◎Before starting wiring, make sure that the power supply is disconnected, otherwise it may cause electric shock or fire.

◎The grounding terminal should be grounded reliably.

◎Do not touch the input wire of the controller and the connection terminals of the water pump, otherwise there is a danger of electric shock.

■Running

◎The controller can be powered on after the wiring is completed and the cover is installed. It is strictly forbidden to remove the cover when the power is on, otherwise it may cause electric shock.

◎The water pump must be installed before testing the steering of the water pump. The water pump should not be allowed to do dry run for a long time. To test the steering of the water pump, the maximum running time of dry running should not exceed 15s.

◎If the rotation of the water pump is reversed, any two of the three cbales of the controller output side can be changed.

◎When the water pump stops due to weak sunlight or sudden shadow, it will restart after 300s.

◎If there is a water level probe installed in the well, the pump will stop running when it is lower than the water shortage level.

■Maintenance and Inspection

◎ Please designate qualified electrical engineers for maintenance, inspection or replacement of parts.

◎Wait at least 10 minutes after the power is turned off or after confirming that there is no residual voltage before maintenance and inspection, otherwise it may cause personal injury.

■Others

◎ If the controller is damaged due to failure to follow the above instructions, the warranty service will not be available.

Chapter 1 System Introduction

1.1 System Overview

The PDS51 solar water pump system can supply water to remote areas with no or unstable power supply. The solar pump controller can convert the DC power generated by the solar panels into AC power to drive various three-phase water pumps. The system can pump water continuously when the weather is good. The system does not have energy storage devices such as batteries, so it is recommended to pump water to the reservoir for subsequent use. The water source can be natural or special water sources such as rivers, lakes, wells or channels. The system can install a float switch in the reservoir or water tower to control the running of the pump. A low water level probe can be installed in the well to detect the water level in the well so that the pump can be stopped when the water level in the well is low. Figure 1-1-1 shows a typical PDS51 solar water pump system. The main parts and components of the system are listed after Figure 1-1-1.

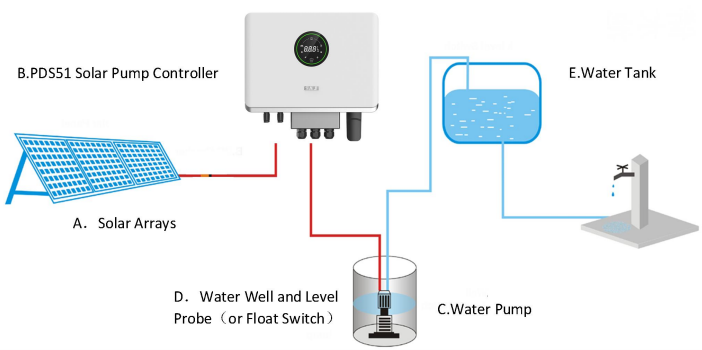


Figure 1-1-1 Solar Pump System

1.2 System Combination

■ **PDS51 Solar Water Pump System Combination:**

A、Solar Arrays

B、PDS51 Solar Pump Controller

C、Water Pump

D、Water Well and Optional Level Probe

E、Water Tank

The PDS51 solar pump controller can start the water pump smoothly and match the changing power provided by the solar panel. The benefit of soft start is that the pump/motor has no surge and energy shock during startup, which helps reduce wear and tear on the motor and pump system.

■**Requirement for Check Valve:**

Note: To ensure maximum reliability of the system and water supply, check valves must be installed in the output pipe. The first check valve must be installed on the water pump outlet, and the remaining check valves should be installed on the vertical pipeline every 30 meters (100 feet) behind the pump.

1.3 System Function

■ **System Diagnose**

The PDS51 solar water controller continuously monitors the performance of the system and can detect various abnormal conditions. In many cases, the controller will provide compensation as needed to maintain uninterrupted running of the system. If there is a possibility of equipment damage, the controller will protect the system and display the fault status; if possible, the controller will restart after the fault status is eliminated. For information on fault codes and corrective actions, see the Diagnosse and Troubleshooting chapter.

■ **Soft Start of Motor**

Typically, the PDS51 solar pump controller will run when there is a demand for water and electricity is available. Every time the PDS51 solar pump

controller detects a water demand, the controller always slowly increases the motor speed while gradually increasing the motor voltage. Compared with the traditional water supply system, the motor temperature and starting current of the solar water pump system are lower. Since the controller has a soft start function, there is no damage to the motor.

■ Overheat Monitoring

The PDS51 solar pump controller can also run at full power when the ambient temperature reaches 45° C. At temperatures above 45° C, the controller reduces the carrier frequency （switching frequency of IGBT）and maintains operation as much as possible.

■ Level Probe (or Float Switch)

The PDS51 solar pump controller can be connected to 2 water level detection switches to remotely control the operation of the water pump. The water level switch is optional for the PDS51 solar water pump controller, but not mandatory.

Chapter 2 Product Information

The PDS51 solar pump controller is a speed-adjustable motor driver designed for three-phase asynchronous motors and permanent magnet synchronous motors. The PDS51 solar water pump system converts the high-voltage DC power from the solar arrays into AC power to drive the water pump to supply water to remote areas. When the solar energy is insufficient, the controller can automatically switch to a backup single-phase or three-phase AC power source, such as generator and grid power. The controller provides fault detection, motor soft start and speed control. PDS51 solar pump controller is designed with plug-and-play function and easy installation.

PDS51 solar pump controller is a high standard and high reliability product. In weak light conditions, the controller will also try to drive the pump to lift water. If the light continues to be weak, the controller will decrease the pump speed to protect the components of the system from damage, and only shut down in extreme cases. When the abnormal situation disappears, the controller will re-drive the pump to run.

2.1 Inspection

Before usage， check the PDS51 solar pump controller . Make sure that the information on using the device is correct and that the device was not damaged in transit.

Note: The PDS51 solar pump controller is an integral part of the PDS51 solar water pump system, which has two other optional components, the solar arrays and the water pump.

2.2 Description and Features

The PDS51 solar pump controller is designed based on the standard PDS51 platform, which is powered by solar arrays or an optional backup generator and controls a standard three-phase asynchronous motor or permanent magnet synchronous motor to drive the water pump.

The PDS51 solar water pump controller continuously monitors system performance and integrates multifunctional pumping system protection. When a fault occurs, the PDS51 solar water pump controller displays the fault type

through the display on the front cover of the controller and can automatically reset the normal faults.

We have optimized the pumping function of the PDS51 solar water pump system under the condition of poor solar array input power supply as follows: Internal diagnostics allow for lower input voltages. Whenever possible, the controller will maximize the output of the solar array to drive the water pump. Provides users with an easy-to-use interface for enhanced configurability and remote monitoring of the system.

2.3 Protect Functions

Electronic monitoring enables the controller to monitor the system and automatically shut down when:

① The well level is low.

② The water tower (or water tank) is full of water

③ The pump is blocked or overloading.

④ High voltage surge

⑤ Low voltage input

⑥ Motor phase loss

⑦ Short circuit

⑧ Controller inner overheating

NOTE: This controller provides overload protection for the motor by preventing motor current from exceeding rated current and limited load operation at low water levels. The controller does not provide motor overheat detection.

2.4 Model Description

PDS51 - 4 T 5R5
① ② ③ ④ ⑤

Item	Content	Description
①	Solar Pump Drive	PDS
②	Series	5: IP65, 1: 1st generation
③	Pump Rated Voltage	2: 220V 3 phase, 4: 380V 3 phase
④	Voltage Range of Solar Arrays	S: Rated 330VDC, recommended 200VDC-400VDC(Note1) T: Rated 560VDC, recommended 400VDC-750VDC(Note2)
⑤	Rated Power of Pump	004:4kW; 5R5:5.5kW; R:Decimal Point
Note 1: Supports rated single phase AC 220V input, into L & N terminals Note 2:Supports rated 3 phase AC 380V input, into R & S & T terminals		

Table 2-4-1 Model Description

2.5 Specification Selection Table

Model	PDS51-2S2R2-E	PDS51-4T2R2-E	PDS51-4T004-E	PDS51-4T5R5-E	PDS51-4T7R5-E	PDS51-4T011-E
Input Power (DC)						
Maximum Voltage(V)	450	900				
Startup Voltage(V)	100	220				
Lowest Voltage(V)	70	200				
Recommended MPPT Voltage(V)	200-450	400-750				
Best Working Voltage(V)	330	560				
Quantity of DC Input Circuits(MC4)	1			2		
Input Power (AC)						
Input Voltage Range(V)	150-230	280-480				

Input Power Frequency (Hz)	50/60					
Output Power（3 phase AC）						
Output Power（kW）	2.2	2.2	4	5.5	7.5	11
Rated Current(A)	9.0	4.8	9.9	13	17	26
Output Voltage(V)	3 phase 220V ±15%	3 phase 380V ±15%				
Output Frequency (Hz)	0-50/60					
Control Performance						
Control Mode	V/F mode & SVC (Sensorless Vector Control) mode					
Type of Motor	Asynchronous Motor , PMSM					
Overload Performance	120% Rated Current:1 min; 150% Rated Current:10 secs					
Other Features						
MPPT efficiency	99.8%					
Protection Class	IP65					
Cooling	Natural Air Cooling					
External Interface	External LED Keypad					
Communication Port	4G GPRS DTU					
Ambient Temperature	-20℃～60℃;>45℃, Derating as required					
Certification Standards	IEC 62109-1-2/IEC61683/ EN IEC 61800-3:2018/EN IEC 61800-3-2:2019/A1:2021/EN 61000-3-3:2013/A1:2019					
Altitude	Below 2000 meters, derate by 1% for each additional 100 meters above 1000 meters,					

Notes: 1. Total power of PV arrays can be 1.2~1.6 times of power of water pump as per irradiation conditions in different countries and areas.

2. Inductor is suggested to be added to the solar pumping system if the distance between solar pump controller and water pump is over 50m.

Chapter 3 Mechanical and Electrical Installation

3.1Overall Structure and Dimension Drawing（Unit：mm）

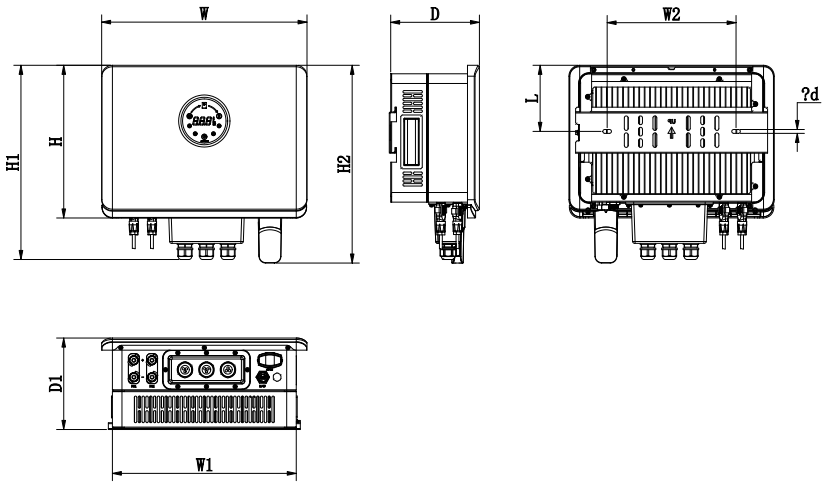


Figure 3-1-1 2.2 kW-11 kW Outline Dimension

Inverter model	Outline Dimension							Installation Dimension		Hole Size
	W	H	D	W1	H1	H2	D1	W2	L	d
PDS51-2S2R2-E	396	295	180.5	360	371	389	184	270	140	8
PDS51-4T2R2-E										
PDS51-4T004-E										
PDS51-4T5R5-E	430	315	186	385	401	408	189	270	137	8
PDS51-4T7R5-E										
PDS51-4T011-E										

3.2 Keypad Structure and Dimension Drawing

■ External Keypad Dimension (Unit: mm)

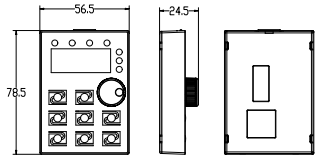


Figure 3-2-1 Keypad Dimension

3.3 Mechanical Installation

3.3.1 Overheat Protection

If installed outdoors, to prevent overheating and performance degradation of the equipment, in places with extreme heat, the high temperature may cause the controller to shut down in self-protection. For best performance, avoid placing solar panels around any obstructions that will cast shadows and reduce sunlight reaching these arrays.

Conduit is recommended to protect the wires from wildlife and natural weathering, and to bury the conduit in the ground for added protection. If conduit is not used, a higher quality outdoor cable should be used.

3.3.2 Installation Location

Although the applicable working ambient temperature of the PDS51 solar pump controller can reach 60° C, to avoid failure caused by overheating, it is recommended to install the controller in a shaded location.

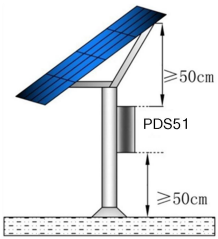


Figure 3-3-2 Installation Location

3.3.3 Whole machine wall-mounted installation

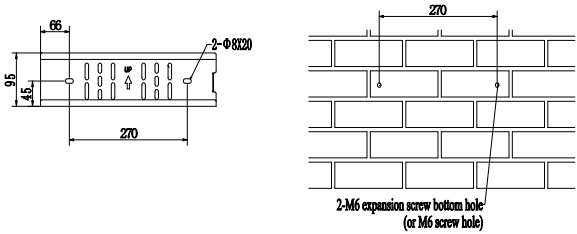


Figure 3-4-3-1 Hanging plate size and accessories requirements

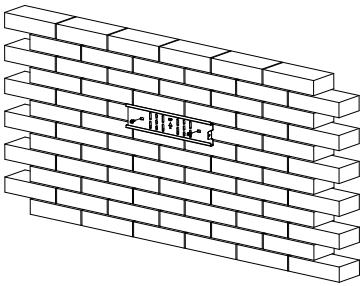


Figure 3-4-3-2 Fixed installation of hanging plate.

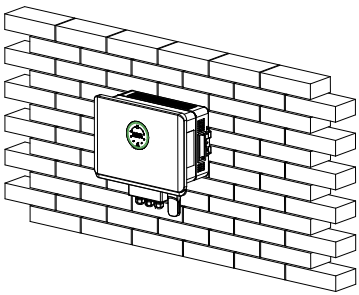


Figure 3-4-3-3 Controller hanging

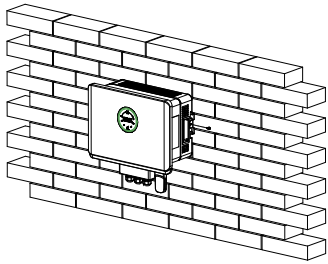


Figure 3-4-3-4 Screw fixing on the side of the controller.

3.3.4 Communication module installation

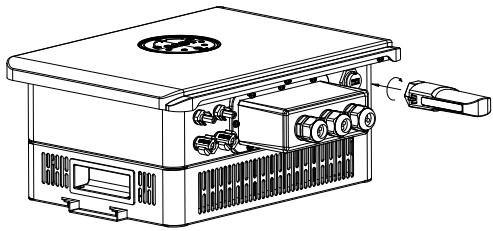


Figure 3-4-4 Remote monitoring module installation

3.3.5 DC input side wiring

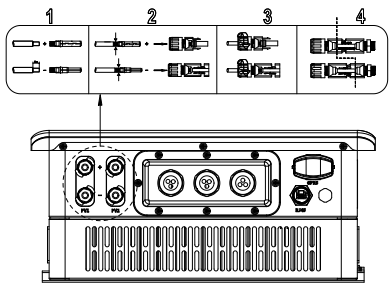
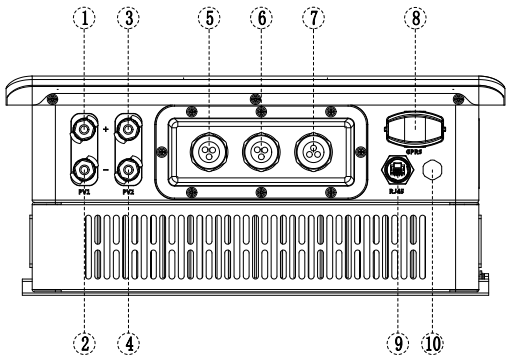


Figure 3-4-5 Connecting component terminals.

3.4 Electrical Installation

3.4.1 Wiring Ports

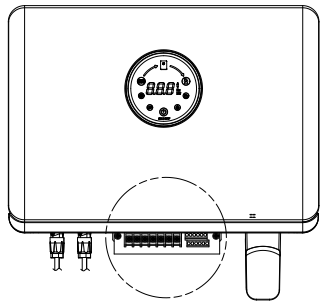
The following is a schematic diagram of the wiring port layout.

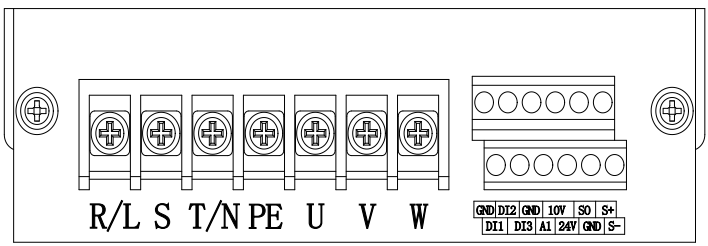


Item	Port Name	Description	Technical Features
①	PV1+	1st PV Panel Positive Input Port	≤20A
②	PV1-	1st PV Panel Negative Input Port	≤20A
③	PV2+	2nd PV Panel Positive Input Port(only available on 5.5-11kW models)	≤20A
④	PV2-	2nd PV Panel Negative Input Port(only available on 5.5-11kW models)	≤20A
⑤	AC Input	The controller with AC input function can be connected to the grid or generator	Single Phase 220V/ 3 Phase 380V
⑥	AC Output	Can be connected to pumps with ordinary asynchronous motor or permanent magnet synchronous motor (PMSM)	3 Phase 220V/380V
⑦	Signal Port	For water level signal wire or communication wire	
⑧	GPRS Module Port	Optional GPRS-2G/4G DTU module for remote monitoring	
⑨	External Keypad Port	Optional external keypad for parameter adjustment	
⑩	Breather	It can keep the pressure balance	

	Valve	inside and outside the machine and prevent condensation	

Figure 3-5-1 Main Circuit Wiring Ports





Figur 3-4-2 Controller Wiring Terminals

Symbol	Name	Technical Specifications
R/L, S, T/N	AC Input Terminals	R/L and T/N for single phase 220V input R/L and S and T/N for 3 phase 380V input
PE	Grounding Terminal	Power input and motor output ground terminal
U, V, W	AC Output Terminals	The 3-phase pump motor is connected to the U/V/W output terminals respectively. If you need to connect a single-phase motor, please refer to the specific connection instructions.
DI1～DI3	Multi functional Digital Input Terminals	1. Optocoupler isolated unidirectional input 2. ON when connected to GND, OFF when

		disconnected to GND 3. Input voltage range: 9～36VDC 4. Input impedance: 4kΩ
24V	Analog Reference Voltage	24V, ±5%, Maximum output current 100mA
10V	Analog Reference Voltage	10V, ±5%, Maximum output current 50mA
AI	Analog Input Terminal	Default as 4~20mA input, can be set to 0-10V input, the default resistance is 500Ω.
GND	Analog GND	It is the reference zero potential of the analog reference voltage.
S+/SO/S-	Communication Port for Multi Drive System (CAN Protocol)	Standard CAN communication interface, please use twisted pair or shielded wire and connect S+, SO, S- when building multi-drive system

3.4.2 DC Input Power Wiring

For the solar water pump system, after specifying the number of solar panel in strings and parallel with reference to the panel selection table, connect the PV+ of the aggregated panels to the PV+ port of the controller, and connect the PV- of the panels to the PV- port of the controller; If there are multiple ways pf panel arrays, you need to connect the positive and negative of the same way to the same input port of the controller.

3.4.3 AC Input Power Wiring

If the user has access to the grid, the connection can be made through the junction box in the middle of controller bottom. First remove the junction box, pass the AC input wire through the waterproof connector, and connect the input single-phase AC to the R/L and T/N terminal of the machine, The three-phase AC is connected to the R/L and S and T/N terminal, and the ground wire is connected to the PE terminal.

3.4.4 Ground Wiring

The ground port on the controller is marked as PE, please connect to earth, if the motor fails, proper grounding helps eliminate the risk of electric shock.

3.4.5 Motor Wiring

Connect 4 cables from the motor to the U, V, W, PE ports of the controller. It should also be connected to the controller through the waterproof connector

of the junction box. The international standard wiring of the motor is shown in the table below. Check motor wirings to ensure proper installation.

Note: If the pump is running reversely, swap any two of the cables connected to U & V & W terminals.

	U	V	W	PE
US Standard	Black	Gery	Yellow	Green or Yellow Green
International Standard	Grey	Black	Brown	Yellow Green

Table 3-5-3 Motor Wiring

3.4.6 Well Low Level Probe Wiring (Optional)

To avoid the water pump damage caused by dry running, you can connect a water well probe to the DI2 & GND terminal of the PDS51 solar pump controller to detect the level of the water well. The length of the water well probe line should not exceed 50m. The probe shall give a close signal to connect DI2 and GND terminals together when water level is too low. The well water level can also be detected through the software water shortage detection function that comes with the controller.

3.4.7 Water Tank Float Switch Wiring (Optional)

We recommend using a float switch to prevent the reservoir from overflowing, the pump will stop when the reservoir is full. The pump will restart when it falls below the low water level. It prevents overflow and reduces unnecessary pump wear. The solar water pump PDS51 controller allows the use of small signal wires to connect a remote float switch, even if the reservoir is located far away.

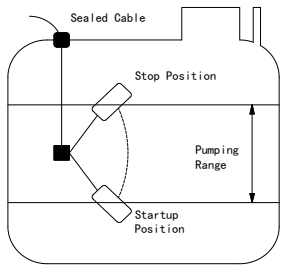


Figure 3-5-4 Float Switch

Float switch requirements:

1. The minimum wire diameter is 1mm², and the longest distance can reach 50m.

2. If the application is used in long-distance transmission, a shielded wire needs to be used. The shielding layer close to the controller end needs to be grounded, while the layer close to float switch is not required to be grounded.

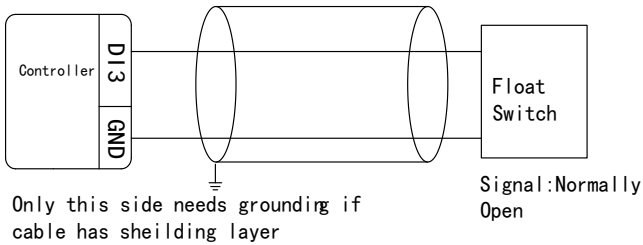


Figure 3-5-5 Wirings of Float Switch

3.4.8 Electrical Conduit Usage

When the system is installed outdoors, electrical conduit can be used to protect outdoor electrical wiring from weather, human activity, chewing animals. If electrical conduit is not used, use higher quality outdoor wire.

3.4.9 System Wiring

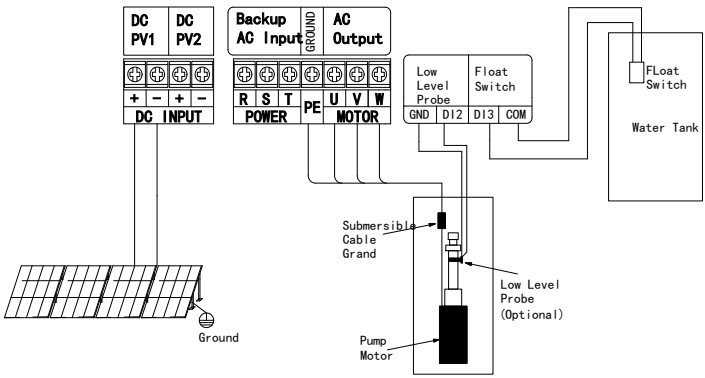


Figure 3-5-6 System Wiring

Note: 1. The 2.2kW~4kW models have only a single input PV port, and the 5.5-11kW models have dual input PV ports. The panels are installed in series and parallel according to the power size and are directly connected to the standard DC ports.

2. If there is an AC backup power supply on site, you can directly connect the single-phase 220V or three-phase 380V of the AC power supply to the controller, and it can control the conversion according to the power state.

3.4.10 Cable Standards

1. Power cable

The dimensions of input power cables and motor cables shall conform to local regulations.

Note: If the electrical conductivity of the motor cable shield cannot meet the requirements, a separate PE conductor must be used.

2. Control cable

Relay cables shall use cables with metal braided shielding layers.

The keyboard must be connected using network cables. Shielded network cables are recommended in a complex electromagnetic environment.

Shielded twisted pair cables are recommended for communication cables.

Note: Analog and digital signals are routed separately using different cables.

Note: Before connecting the input power cable to the inverter, check the insulation of the input power cable according to local regulations.

Power cable selection recommendation table for standard models:

Controller type	Recommended cable size (mm2)	
	(+)/(-)、R/S/T、U/V/W	PE
PDS51-2S2R2-E	2.5	2.5
PDS51-4T2R2-E	1.5	1.5
PDS51-4T004-E	2.5	2.5
PDS51-4T5R5-E	2.5	2.5
PDS51-4T7R5-E	4	4
PDS51-4T011-E	6	6

3.4.11 Explanations Of Symbols

Symbol	Description
	**Dangerous electrical voltage** This device is directly connected to public grid, thus all work to the Controller shall only be carried out by qualified personnel.
	**Danger to life due to high electrical voltage!** There might be residual currents in Controller because of large capacitors. Wait for 5 minutes before you remove the front lid.
	**ROHS** This product is ROSH compliant.

	**Danger of hot surface** The components inside the Controller will release a lot of heat during operation. Do not touch metal plate housing during operating.
	**An error has occurred** Please go to CHAPTER 6 “Dinagnose and troubleshooting” to remedy the error.
	**This device shall not be disposed of in residential waste** It must be disposed carefully by an approved collection and recycling facility in your area.
	**CE Mark** Equipment with the CE mark fulfills the basic requirements of the Guideline Governing Low-Voltage and Electro-magnetic Compatibility.
	**TUV Mark** This controller TUV is IEC62109-1/2 certified.

Chapter 4 Screen Display and Operation

4.1 Display Introduction

Using the display screen, you can monitor the working status of the controller, and start & stop it. Its appearance and functional area are shown in the following figure.

Figure 4-1-1 Drawing of Screen

4.2 Function of Indicators and Button

Item	Icon	Name	Function
Indic-ator		Controller State Indicator	Status distinction is realized by the color and lighting mode of the light ring on the outer ring of the display screen
		Solar Array Indicator	This indicator is on when there is DC power input
		Input Power Indicator	This indicator is on when controller is powered on
		Pump Indicator	This indicator is on when controller is running
		Communication Indicator	When the indicator is keeping on, it means that the GPRS module is connected and the communication is successful; when it is flashing, it means that the communication is failed; when it is off, it means that

Item	Icon	Name	Function
			the GPRS module is disconnected;
		Multi-Drive Indicator	In the multi-drive mode, the light is always on to indicate the communication among controllers is successful, the light is on when the communication is failed; the light is off when it is not in multi-drive mode;
		Low Level Indicator	When the low-level probe is installed, when the water level of the inlet pool is too low, the low level indicator will light up, and the LOU water shortage fault will be reported;
		Tank Full Indicator	In the case of installing the water level sensor in the water tank, when the level reaches the upper limit water level, the controller tank full indicator will light up, and the word FUL will be displayed to indicate that the tank is full of water;
Display		Output Current	In the power-on state, click the start/stop button to shift to view the running parameters, the suffix unit A is the controller output current; the suffix unit V is inner bus voltage (A DC voltage value, equals to input DC voltage ,or 1.414* input AC voltage) ; the suffix unit Hz is the controller running frequency; the suffix unit kW is the controller output power;
		Bus Voltage	
		Running Frequency	
		Output Power	
Button		Start/Stop Button	In the working state, press and hold for 3 seconds to control the start and stop of the controller, and click to switch to display the above parameters;

Table 4-2-1 Description of Indicators and Button

4.3 Display of Control Modes

DC Input Running Mode

（Green Light Ring Rotates）

DC Input Sleep Mode

（Green Light Ring Flashes）

AC Input Running Mode

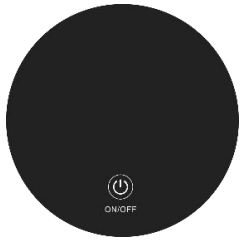
（Solar Array Disconnected）

Tank Full State

（Tank Full Indicator On）

Controller Alarm

（Red Light Ring Flashes）



Controller Off-Screen Mode

（Start/Stop Button Flashes）

4.4 Usage of External Keypad

The controller has a total of three levels of menus, which are: ① Parameter team (first level menu); ② Parameter number (second level menu); ③ Parameter set value (level 3 menu). Taking setting the power-on automatic start function FD.11=1 as an example, the following flow chart of adjusting parameters is listed:

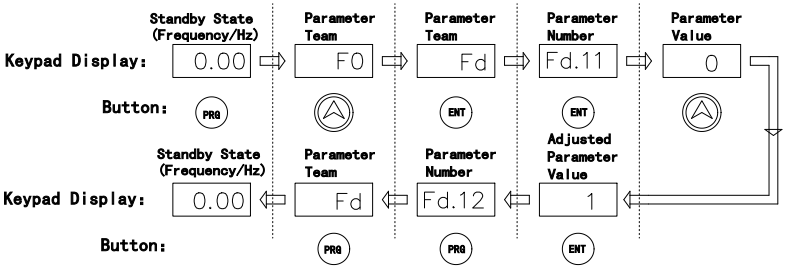


Figure 4-4-1 Schematic diagram of function parameter adjusting.

4.5 Power on and Commissioning

① Check and make sure the wiring is correct. If necessary, check motor and cable insulation with a megger.

② Use a multimeter to check whether the Voc of the solar panels from the DC switch meets the requirements or not.

③ Close the DC switch to power on the controller.

④ If necessary, modify and set the parameters of the motor as follows:

If the rated power of the motor is 60Hz, the following parameters need to be modified:

F0.10 (maximum output frequency) =60.00,

F0.12 (upper limit of running frequency) =60.00,

F2.04 (motor rated frequency) =60.00

Other related parameters are: motor rated power F2.01, motor rated voltage F2.02, motor rated current F2.03, motor rated frequency F2.04, motor rated speed F2.05.

Note: The default motor rated frequency is set as 50Hz.

⑤ Check the rotation direction of the water pump

Press the START/STOP button to start the motor briefly and slowly to check whether the rotation of it is correct. If the pump is in a dry running state, the maximum running time should not exceed 15s, otherwise the pump may be

damaged. If the direction is wrong, turn off the DC switch, then swap any two of the 3 cables connecting the motor and controller U/V/W ports.

⑥Stop to check the displayed bus voltage of the controller or use a multimeter to measure the PV open-circuit voltage and set FD.06 = actual open-circuit voltage value.

⑦Trial operation, let the system work for one hour, check the water supply capacity, if there is no problem, the commissioning is completed.

Note: When the light is insufficient, the output power of the solar panels will be reduced, and the water pump will run very slowly until it stops. The controller will try to start every 300 s, and the running indicator light will stay on during the time it tries to run. When a shadow suddenly passes through the solar array, the controller will lose track of the input voltage and the pump will stop working. But the controller will not display the fault, tit will try to restart the pump.

4.6 FD.02 Macro parameter settings

Macro parameter setting (online parameters of multiple inverters)						
Please refer to the FD.02 parameter table to debug the parameter values of the main engine and auxiliary engine.						
System parameters	Master	1# Slave	2# Slave	3# Slave	4# Slave	5# Slave
Single pump water supply setup	FD.02=1	\	\	\	\	\
Two network master settings	FD.02=2	FD.02=11	\	\	\	\
Three network master settings	FD.02=3	FD.02=11	FD.02=12	\	\	\
Four network master settings	FD.02=4	FD.02=11	FD.02=12	FD.02=13	\	\
Five network master settings	FD.02=5	FD.02=11	FD.02=12	FD.02=13	FD.02=14	\
Six network master settings	FD.02=6	FD.02=11	FD.02=12	FD.02=13	FD.02=14	FD.02=15

Chapter 5 Parameters List

○: Indicates that the set value of this parameter can be changed when the controller is in both stop and running state.

●: Indicates that the set value of this parameter cannot be changed when the controller is running.

◎: Indicates that the value of this parameter is the measured record value or the manufacturer's parameter and cannot be changed.

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
F0 Team: Basic Parameters						
F0.00	Motor Control Mode	0: SVC 1: V/F	1		●	0x000
F0.01	Start/Stop Source Option	0: Start/Stop Button 1: Terminal 2: RS485 Communication	0		●	0x001
F0.02	Speed/Tor-que Control Mode	0: Speed Control 1: Torque Control	0		○	0x002
F0.03	Main Frequency Source	0: Keypad, not retained after power-off. 1: Keypad, retained after power-off. 2: AI1 3～6: Reserved 7: Terminal UP/DOWN 8: MPPT 9: RS 485 Communication 10: Multi-Drive Communication	8		●	0x003
F0.04	Auxiliary Frequency Source	0: Keypad, not retained after power-off. 1: Keypad, retained after power-off. 2: AI1 3～6: Reserved	1		●	0x004

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
		7: Terminal UP/DOWN 8: MPPT 9: RS 485 Communication 10: Multi-Drive Communication				
F0.08	Keypad Setting Maximum Frequency	0.00～F0.10	50.00Hz		○	0x008
F0.09	Motor Rotation Direction	0: FWD 1: REV	0		○	0x009
F0.10	Maximum Output Frequency	50.00～320.00Hz	50.00Hz		●	0x00A
F0.12	Upper Limit of Running Frequency	F0.14～F0.10	50.00Hz		○	0x00C
F0.14	Lower Limit of Running Frequency	0.00～F0.12	0.00Hz		○	0x00E
F0.15	Running Mode at F0.14	0: Standby (Sleep) 1: Running at F0.14 2: Stop	0		○	0x00F
F0.16	Carrier Frequency	0.5～15.0kHz	Due to Controller Model	8.0 as maximum for SVC mode	○	0x010
F0.18	Acceleration Time1	0.0～6500.0s	Due to Controller Model		○	0x012
F0.19	Deceleration Time1	0.0～6500.0s	Due to Controller Model		○	0x013
F0.20	Recover Option	0: No Option 1: Recover all default settings, except F2 team 2: Clear all error (alarm)	0		●	0x014

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
		records 3: Recover all default settings including F2 team				
F2 Team: Motor Parameters						
F2.00	Type of Motor	0: Ordinary 3 Phase Asynchronous Motor (AM) 1:3 Phase Permanent Magnet Synchronous Motor (PMSM) 2: Single Phase Motor	0		●	0x200
F2.01	Motor Rated Power	0.4～11kW	Due to Controller Model	F2.00~F2.06 must be set according to motor nameplate	●	0x201
F2.02	Motor Rated Voltage	1～480V			●	0x202
F2.03	Motor Rated Current	0.1～50.0A			●	0x203
F2.04	Motor Rated Frequency	0.01～F0.10			●	0x204
F2.05	Motor Rated Speed	1～65000rpm			●	0x205
F2.06	Quantity of Poles	2～48	4		●	0x206
F2.07	Motor Non-Load Current	0.1～50.0A	Due to Controller Model		●	0x207
F2.08	Motor Stator Resistance	0.001～65.000			●	0x208
F2.09	Motor rotor resistance	0.001～65.000			●	0x209
F2.10	Motor Leakage Inductance	0.1～6500.0mH			●	0x20A
F2.11	Motor Mutual Inductance	0.1～6500.0mH			●	0x20B
F2.12	Motor Tuning Option	0: No Option 1: Full-Tuning 2: Quiet-Tuning	0	Option 1 for the motors which can be totally removed	●	0x20C

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
				from its load. Option 2 for the motors which cannot be totally removed from its load		
F5 Team: Function of DI Terminals						
F5.00	DI1 Function	0: No Option 1: FWD Running (FWD) 4: FWD Jog (FJOG) 9: Error Reset (RESET) 11: External Alarm (NO signal) input 47: Well Low-Level Input 48: Water Tank Full Input	1		●	0x500
F5.01	DI2 Function		47		●	0x501
F5.02	DI3 Function		48		●	0x502
F6 Team: Multiple connections Parameters						
F6.00	Network communication address	0~6	0		●	0x600
F6.02	CAN network master and slave selection.	0~1	0	0: slave 1: master	●	0x602
F6.03	Number of slave machines	0~5	0		●	0x603
F6.07	Pump delay time	0.0s~100.0s	5.0s	After the pumping delay, the slave machines are started in sequence.	☆	0x607
F7 Team: Controller Features						
F7.08	IGBT Temperature	0℃～ 100℃		.	◎	0x708
F7.09	Software Verstion	-		.	◎	0x709

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
FA Team: Alarm and Protection						
FA.00	Motor overload warning factor	20.0～250.0%	80.0%		☆	0xA00
FA.01	Motor overload protection factor	20.0～250.0%	100.0%		☆	0xA01
FA.02	Fault self-recovery interval	0.1～100.0s	30.0s		☆	0xA02
FA.03	Overvoltage Stall Gain	0 ～ 100	1	10	○	0xA03
FA.08	Phase loss protection	Ones place: output phase loss protection Ten's place: Input phase loss protection Hundreds place: Motor load loss protection Thousands place: main relay protection 0: off 1: On	0x0011		☆	0xA08
FA.20	Fault self-recovery times	0～5	3	Select 1 to 5 to enable automatic fault reset operation. When there is a fault during operation, the fault will be reset automatically after fixing for 10S. Water shortage, disconnection, high and low	☆	0xA14

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
				voltage, pipe burst, external fault, and time arrival fault are not affected by this function code.		
FD Team: Specific Solar Pump Controller Parameters						
FD.00	Solar Pump Running Option	0: Invalid 1: Valid	1		●	FD00
FD.01	Runing Mode Option	0: PV Input Mode 1: PV Priority Mode 2: Power Priority Mode	1	0: PV input refers to only PV DC power supply (No AC input); 1: PV priority mode, which means that when AC and DC input power are both connected at the same time, the PV power will be used first, and the AC will be automatically connected when the PV power is insufficient. 2: Power priority mode, when AC and DC input are both connected at the same time, real-time power complementation ensures maximum power output;	●	0xD00
FD.02	Photovoltaic water pump	0~16	0	Refer to section 4.6 "FD.02 Macro	★	0xD02

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
	multi-line macro parameters			parameter settings"		
FD.03	Host and Auxiliary Setting in Multi Drive Sytem	0: Host 1: 1st Auxiliary 2: 2nd Auxiliary	0		●	0xD02
FD.04	Screen Off Delay	0min ～ 1000min	30min	0 for never off	○	0xD03
FD.05	MPPT Voltage Source	0: Keypad Setting 1: Automatic MPPT Setting	1		●	0xD04
FD.06	MPPT Voltage Set Value	FD.14 ～ FD.15	530.0V		○	0xD05
FD.07	Weak Light Detection Time	0.0s ～ 1000.0s	100.0s		○	0xD06
FD.08	Weak Light Restart Time	0.0s ～ 3600.0s	300.0s		○	0xD07
FD.09	MPPT Startup Voltage Level	70.0% ～ 100.0%	85.00%		○	0xD08
FD.10	MPPT Voc	250.0V ～ 800.0V	750.0V		○	0xD09
FD.11	Auto Startup Option	0: Invalid 1: Valid	1		○	0xD0A
FD.12	Auto Startup Delay	0.0s ～ 100.0s	15.0s		○	0xD0B
FD.13	MPPT Initial Value Adjustment Range	0.0V ～ 50.0V	30.0V		○	0xD0C
FD.14	Software Dry Run Detection Delay	0.0s ～ 3600.0s	20.0s		○	0xD0D
FD.15	Water shortage detection	0.0% ～ 100.0%	90.00%		○	0xD0E

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
	frequency					
FD.16	Software Dry Run Detection Current Percentage	0.0% ～ 100.0% （*Motor Rated Current）	40.00%		○	0xD0F
FD.17	Dry Run Restart Delay	0min ～ 9000min	30min		○	0xD10
FD.18	Lower Limit of MPPT Voltage	250.0V ～ FD.19	500.0V		○	0xD11
FD.19	Upper Limit of MPPT Voltage	FD.18 ～ 800.0V	600.0V		○	0xD12
FD.20	Lower Limit of MPPT Output Frequency	0.0% ～ FD.21	40.00%		○	0xD13
FD.21	Upper Limit of MPPT Output Frequency	FD.20 ～ 100.0%	100.00%		○	0xD14
FD.22	MPPT Fast Decelerat-ion Speed	0 ～ 200	100	Can be set bigger if there is always weak light or low input voltage	○	0xD15
FD.23	MPPT Decelerat-ion Time	0.0s～ 6500.0s	0.5s		○	0xD16
FD.24	MPPT Adjustm Unit	0.0～30.0V	10.0V		○	0xD17
FD.25	Power Level for AC Input Coming in	0W～3000W	1000W		○	0xD18
FD.26	Power Level for AC Input Coming Out	0W～3000W	500W		○	0xD19
FD.29	Boost module voltage loop proportional	1~1000	50		☆	0xD1C

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
	gain coefficient					
FD.30	Boost module voltage loop integral coefficient	1~1000	50		☆	0xD1D
FD.31	Voltage loop integral desaturation coefficient of boost module	1~1000	50		☆	0xD1E
FE Team: User Preference						
FE.00	User Password	0 ～ 65535	1	0	○	0xE00
FE.01	Error Record Displayed Teamss	0 ～ 15	1	5	○	0xE01
E0 Team: Latest Error Record						
E0.00	Error Code	0: No Error 1: Reserved 2: Overcurrent during acceleration (E02) 3: Overcurrent during deceleration (E03) 4: Overcurrent at constant speed (E04) 5: Overvoltage during acceleration (E05) 6: Overvoltage during deceleration (E06) 7: Overvoltage at constant speed (007) 8: Snubber resistor overload (E08) 9: Low input voltage (E09) 10: Controller overload (E10) 11: Motor overload (E11)	—	—	◎	0xE000

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
		12: Input phase loss (E12) 13: Output phase loss (E13) 14: IGBT overheat (E14) 15: External alarm input (E15) 16: Communication failure (E16) 17: Snubber relay failure (E17) 18: Current detection failure (E18) 19: Motor tuning failure (E19) 21: Parameter R/W failure (E21) 22: EEPROM failure (E22) 23: Motor short to ground (E23) 24: Dry run alarm(E24) 26: Running time reached (E26) 29: Power-on time reached (E29) 30: Load loss(E30) 40: Fast current limit timeout failure (E40) 98/99: Communication failure between controller and external keypad(E98/E99)				
E0.01	Running frequency at latest error	—	—	—	◎	0xE001
E0.02	Output current at latest error	—	—	—	◎	0xE002
E0.03	Bus Voltage at latest error	—	—	—	◎	0xE003
E0.04	DI status at	—	—	—	◎	0xE004

Parameter	Name	Setting Range	Default Value	Remarks	Feature	Communication Address
	latest error					
E0.05	Reserved	—	—	—	◎	0xE005
E0.06	Controller temperature at latest error	—	—	—	◎	0xE006
E0.07	Controller state at latest error	—	—	—	◎	0xE007
E0.08	Reserved	—	—	—	◎	0xE008
E0.09	Reserved	—	—	—	◎	0xE009
E0.10	Reserved				◎	0xE00A
E0.11	Reserved				◎	0xE00B

Chapter 6 Diagnose and Troubleshooting

Even in bad weather conditions, the PDS51 solar pump controller will try to drive the water pump to lift water. To ensure reliable service life, system components must be protected from factors that can damage equipment. When severe conditions arise, the controller reduces output, if necessary, continues to pump water as long as possible, and shuts down in extreme conditions. Once the severe condition subsides, the controller will automatically attempt to resume operation.

If the controller has stopped and an error code is shown on the screen, the delay depends on the nature of the fault. The number after the letter E corresponds to the error code.

6.1 Error Codes

Code	Description	Possible Causes	Solutions
E02	Overcurrent during acceleration	There is grounding or short circuit in the output circuit of the controller	Eliminate peripheral faults and check whether there is a short circuit at the motor end
		Acceleration time is set too short	Increase acceleration time
		The controller model is selected improperly (with too small power)	Select the controller that matches the motor power and load conditions
E03	Overcurrent during deceleration	There is grounding or short circuit in the output circuit of the controller	Eliminate peripheral faults and check whether there is a short circuit at the motor end
		Deceleration time is set too short	Increase deceleration time
E04	Overcurrent at constant speed	There is grounding or short circuit in the output circuit of the controller	Eliminate peripheral faults and check whether there is a short circuit at the motor end
		Controller model is too small	Select the controller that matches the motor power and load conditions
E05	Overvoltage	Input voltage is too high	Adjust input voltage to a proper range

Code	Description	Possible Causes	Solutions
	during acceleration	Acceleration time is set too short	Increase acceleration time
		No braking unit and braking resistor installed	Install braking unit and braking resistor
E06	Overvoltage during deceleration	Input voltage is too high	Adjust input voltage to a proper range
		Deceleration time is set too short	Increase deceleration time
		No braking unit and braking resistor installed	Install braking unit and braking resistor
E07	Overvoltage at constant speed	Input voltage is too high	Adjust input voltage to a proper range
E08	Snubber resistor overload	The input voltage is not within the specified range	Adjust input voltage to a proper range
E09	Low input voltage	The input voltage is not within the specified range	Adjust input voltage to a proper range
		Abnormal bus voltage detection; abnormality of rectifier bridge, snubber resistor, drive board and control board	Seek for technical support
E10	Controller overload	Load is too large, or motor is stuch	Reduce load and check motor and mechanical condition
		Controller model is too small	Select the controller that matches the motor power and load conditions
E11	Motor overload	The motor overload protection parameters (FA.01-FA.02) are not properly set	Correctly set them
		Load is too large, or motor is stuch	Reduce load and check motor and mechanical condition
E12	Input phase loss	Abnormal three-phase input power	Check and troubleshoot existing problems in peripheral circuits
		Failure of drive board or control board	Seek for technical support
E13	Output phase loss	Motor failure	Check if the motor winding is open
		The wirings between controller and motor are abnormal	Troubleshoot peripherals

Code	Description	Possible Causes	Solutions
		When the motor is running, the three-phase output of the controller is unbalanced	Check whether the three-phase windings of the motor are normal and troubleshoot
		Failure of IGBT or drive board	Seek for technical support
E14	IGBT overheat	Ambient temperature is too high	Lower ambient temperature
		Air duct blocked	Clear air duct
		Fan failure	Replace the fan
		Failure of thermistor or IGBT	Seek for technical support
E15	External alarm input	Input external fault signal through DI terminal	Clear external fault signal
E16	Communication failure	The upper host machine is abnormal	Check the wirings between upper host and controller
		RS485 communication wire is abnormal	Check the communication wires
		Incorrect settings of communication parameter FC team	Correctly set communication parameters (communication address, baud rate, check bit)
E17	Snubber relay failure	The relay does not pick up	Replace the snubber relay or seek for technical support
E18	Current detection failure	Abnormal current detection circuit	Seek for technical support
		Control board failure	Seek for technical support
E19	Motor tuning failure	Motor parameters (F2 team) are not set according to the nameplate	Set motor parameters according to the nameplate
E21	Parameter R/W failure	Control board failure	Seek for technical support
E22	EEPROM failure	EEPROM chip failure	Seek for technical support
E23	Motor short to ground	The motor or controller output cable is short-circuited to ground	Measuring motor and output wire insulation with a tramegger
		Control board failure	Seek for technical support

Code	Description	Possible Causes	Solutions
E24	Feedback disconnected fault	1. Sensor disconnection or poor contact 2. The disconnection detection time is too short 3. The sensor is damaged, or the system has no feedback signal	1. Check sensor installation and wiring 2. Increase the disconnection detection time 3. Replace the sensor
E26	Running time reached	Accumulated running time has reached set value	Clear log information using parameter initialization function
E27	Water shortage fault	1. Water shortage 2. Check whether the water shortage detection time is set too small, and check whether the water shortage detection current ratio is too high.	1. Check and eliminate water source problems 2. Reasonably increase the water shortage time and appropriately reduce the water shortage detection current ratio value.
E29	Power-on time reached	Accumulated power-on time has reached set value	Clear log information using parameter initialization function
E40	Fast current limit timeout failure	Load is too large, or motor is stuch	Reduce load and check motor and mechanical condition
		Controller model is too small	Select the controller that matches the motor power and load conditions
E98/ E99	Inner communication failure	The cable connecting the control board and the screen is in poor contact	Re-plug the cable
		Screen failure	Seek for technical support
Lou	Well low-level alarm	The low water level probe （or float switch） terminals of the water inlet is losed ,connecting DI2 and GND terminals	Check if the well is short of water
FUL	Water tank full alarm	The high-water level float switch terminals of the water	Check if the water tank is full

Code	Description	Possible Causes	Solutions
		outlet tank are closed, connecting DI3 and GND terminals	

Table 6-1-1 Error Code Description

6.2 Troubleshooting and Countermeasures

Item	Phenomenon	Possible Causes	Solutions
1	No display when power on	Improper input power	Check if the input voltage is within the specified range
		The cable connecting the control board and the screen is in poor contact	Re-plug the cable
		The internal components of the controller are failed	Seek for technical support
2	Pump cannot run	Insufficient input power (insufficient light)	Increase the power of panels or wait until the light is sufficient before restarting
		Motor failed or stuck	Replace motor or clear mechanical issue
		Improper wirings	Re-confirm whether the wirings between the controller and the motor is correct
3	DI terminal failure	Incorrect parameter settings	Check and reset the F5 team related parameters
		Abnormal external signal	Reconnect the external signal wire to eliminate the external input fault
		Control board failure	Seek for technical support
4	Interruption from controller	Improper carrier frequency	Properly reduce the carrier frequency
		Improper grounding	Effectively ground the inverter and motor, and separate them from the grounding of peripheral equipment
		Too long cables between controller and motor	Install output reactor or reduce cable length
5	Big noise of motor	Motor damaged or mechanical failure	Replace motor or clear mechanical issue
		Improper carrier frequency	Properly increase the carrier frequency

Item	Phenomenon	Possible Causes	Solutions
6	Switch tripping	Leakage switch installed or the airbreak switch is overloading	Replace a switch without leakage protection or replace the airbreak switch with a larger capacity
		Abnormal input power	Check input power and whether there is short circuit
		Controller inner failure	Seek for technical support

Table 6-2-1 Troubleshooting and Countermeasures

Chapter 7 Recommended PV Panel Configuration

7.1 Recommended PV Panel Configuration

Controller Model	Pump Rated Power	Vmp	Voc	Vmp	Voc
		34±1V	42±1V	42±1V	50±1V
		Panel Power	Quantity	Panel Power	Quantity
PDS51-2S2R2-E	3 phase 220V/2.2kW	360W	8*1	450W	7*1
PDS51-4T2R2-E	3 phase 380V/2.2kW	360W	8*1	450W	7*1
PDS51-4T004-E	3 phase 380V/4kW	360W	15*1	450W	12*1
PDS51-4T5R5-E	3 phase 380V/5.5kW	360W	12*2	450W	10*2
PDS51-4T7R5-E	3 phase 380V/7.5kW	360W	14*2	450W	12*2
PDS51-4T011-E	3 phase 380V/11kW	360W	20*2	450W	16*2

Chapter 8 Warranty Policy

Standard Warranty Period:

The pump controller manufacturer grants a standard warranty period of 36 months (3 years) for
the pump controllers, starting from the date of shipment from manufacturer factory starting from the date of purchased invoice marked (whichever is longer).

Warranty Conditions:

If your pump controller gets fault and requires troubleshooting, please contact your distributor or
dealer directly. Alternatively, feedback briefly to manufacture service hotline for logging and
send your warranty card to our service department by fax/email to process the warranty claim.
During the warranty period, the pump controller manufacturer covers all costs for replacing any.
product or parts of the product proved to be defective in design or manufacture. To claim the
warranty under the warranty policy of pump controller manufacturer, you need to supply us with
the following information and documentation regarding the faulty pump controller:

1. Product model No. (e.g., PDS51-2S2R2) and serial No. (e.g.C121661B280H000292YA).
2. Copy of the invoice and warranty certificate of the controller.
3. Copy of the installation report and installation date.
4. Error message on LED screen (if available) or any information which would be helpful to

determine the defect.

5. Detailed information about the entire system (modules, circuits, etc.).
6. Documentation of previous claims/exchanges (if applicable).

After receiving above information, the pump controller manufacturer will decide how to

proceed the service:

☐Repaired by manufacture factory, or

☐Repaired on-site by manufacture service center, or

☐Offer a replacement device of equivalent value according to model and age.

In the case of an exchange, the remaining portion of the original warranty period will be.

transferred to the replacement device. You will not receive a new certificate, as your entitlement

is documented at pump controller manufacturer.

If the pump controller needs to be replaced following assessment, manufacture will send a

replacement unit immediately. The defective pump controller should be sent back to the closest.

manufacture service center by packing in its original package if possible.

Chapter 9 Product warranty Card

Customer info.	Company name:	
	Company address:	
	Contact:	Tel.:
	Fax:	Zip code:
Product info.	Product model:	SN code:
	Buying date:	Fault date:
	Motor power:	Application situation:
Fault info.	Fault description: Signature: Date:	