

# AC Solar Pump Controller

PS3kAC, PS5kAC, PS7kAC, PS9kAC, PS15kAC, PS21kAC

Manual for Installation, Operation, Maintenance



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# 1 Safety Instruction

Safe operation of this product depends on its correct transportation, installation, operation and maintenance. Failure to follow these instructions can be dangerous and/or void the warranty.

## 1.1 Purchase Inspection



**CAUTION:** Properly check the delivery before installation. Never install the controller when you find it damaged or lack a component. Incomplete or defective installation might cause accidents.

## 1.2 Installation



**CAUTION:** To ensure effective cooling, the controller must be installed vertically with at least 10 cm space above and below the casing.



**CAUTION:** When installed in an indoor location sufficient ventilation must be ensured by a vent or ventilator or similar device. Do not install in a place which is exposed to direct sunlight.



**CAUTION:** Do not let the drilling chips fall into the controller fin or fan during installation. This might affect the heat dissipation.

## 1.3 Connection



**WARNING:** The connection of the controller must be carried out by qualified personnel only. Unqualified handling might lead to shock, burn, or death.



**WARNING:** Please double-check that input power has been disconnected before connecting the device, otherwise electrocution or fire can be caused.



**WARNING:** The earth terminal must be reliably grounded, or touching the controller shell might lead to a shock.



**WARNING:** Selection of PV module type, motor load and controller must be adequate, or the equipment might get damaged.

## 1.4 Operation



**WARNING:** The controller should only be connected to power after correct wiring, or the controller might get damaged.



**WARNING:** Do not modify the connection while the system is connected to power, or touching any part of it might cause electrocution.



**CAUTION:** Adjust partial control parameters according to the steps indicated by the manual before the first operation. Do not change the control parameters of the controller by random, or it might damage the equipment.



**CAUTION:** The heat sink gets hot during operation. Do not touch it until it has cooled down again, or you might be burned.



**CAUTION:** At altitudes of more than 1,000 m above sea level, the controller should be derated for use. Output current should be derated by 10% for every 1,500 m increment of altitude.

## 1.5 Others

Maintenance and inspection must be performed by qualified personnel only.

Do not dismantle the controller while connected to power. For conduct maintenance and inspection wait at least 5 minutes after the power has been switched off.

No serviceable parts inside the controller. Opening the controller will void the warranty.

Treat the controller as industrial waste when processing the abandoned controller. It is possible that the electrolytic capacitor will explode during incineration and that parts of components will produce toxic and harmful gas.

## 2 Introduction

### 2.1 Solar Pumping System Components

LORENTZ solar pumping systems can be applied to all forms of daily use, water pumping for drinking water supply for remote villages and farms without connection to the water grid, for agricultural use such as livestock watering, agricultural irrigation, forestry irrigation, pond management, desert control, and industrial use such as wastewater treatment etc. In recent years, with the promotion of the utilization of renewable energy resources, solar pumping systems are more and more used in municipal engineering, city centre squares, parks, tourist sites, resorts and hotels, and fountain systems in residential areas.

The system is composed of a PV module, a pump and a solar pump controller. Based on the design philosophy that it is more efficient to store water rather than electricity, there is no energy storing device such as storage battery in the system. The system is prepared to be combined with a elevated water storage, e.g. water tower or an uphill tank installation.

The PV module, an aggregation of PV cells connected in series and in parallel, absorbs solar irradiation and con-verts it into electrical energy, providing power for the whole system. The pump controller controls and adjusts the system operation and converts the DC produced by the PV module into AC to drive the pump, and adjusts the output frequency in real-time according to the variation of sunlight intensity to realize the maximum power point tracking (MPPT). The pump, driven by 3-phase AC motor, can draw water from deep wells, rivers and lakes and pour it into storage tanks or reservoirs, or be connected directly to the irrigation system, fountain system, etc. According to the actual system demand and installation condition, different types of pumps such as centrifugal pump, axial flow pump, mixed flow pump or deep well pump can be used.

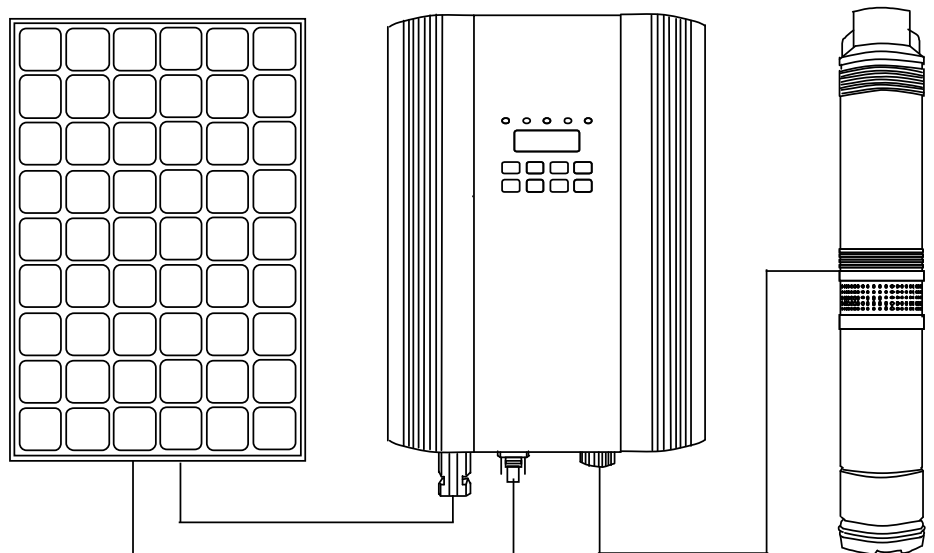
### 2.2 Product Features

LORENTZ PSk AC has the following features:

- maximum power point tracking (MPPT) with fast response speed and stable operation
- digital control for fully automatic operation, data storage and protective functions
- intelligent power module (IPM) for the main circuit
- LED display operating panel
- low water probe sensor
- protection level IP41
- ambient temperature for using: -10 to +50°C.



**CAUTION: Make sure to select the appropriate model according to PV module and motor load.**



**Figure 1: Components of a solar pumping system**

### 2.3 Technical Data

Model	Pump motor: rated power	Pump motor: rated voltage	Solar input power	Max. DC input voltage	MPP voltage	output current	frequency
	[kW]	[V]	[kWp]	[V]	[V]	[A]	[Hz]
PS3k	2.2	200–220	3.3	430	280–350	11	0–60
PS5k	3.0–3.7	380–440	5	750	500–600	9	0–60
PS7k	4.0–5.5	380–440	8	750	500–600	13	0–60
PS9k	7.5	380–440	10	750	500–600	18	0–60
PS15k	9.2–11	380–440	15	750	500–600	24	0–60
PS21k	13–15	380–440	21	750	500–600	30	0–60

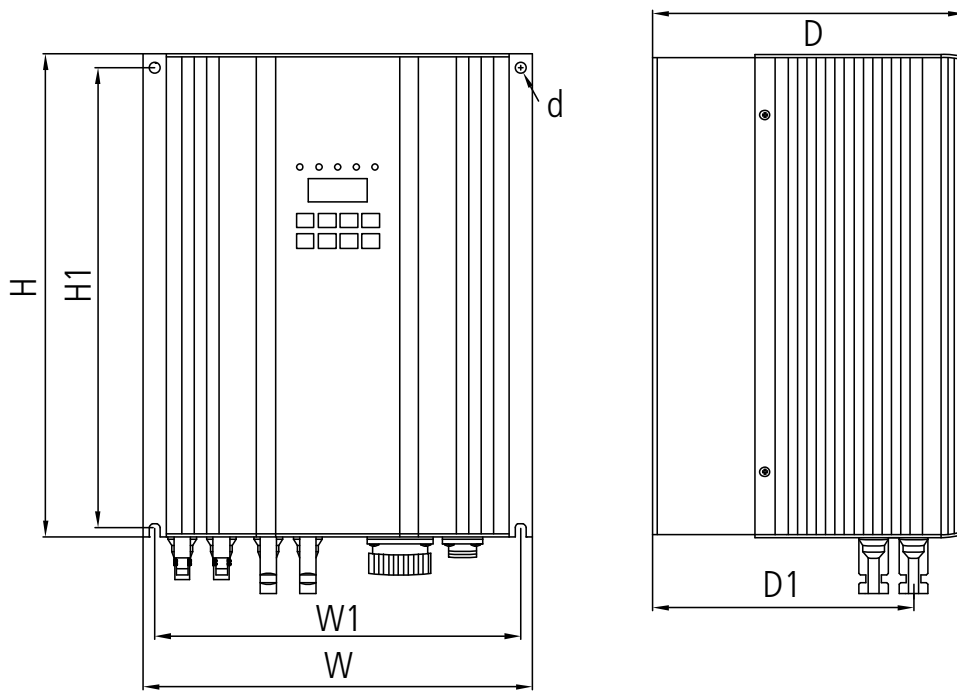
### 3 Installation and Wiring

#### 3.1 Purchase Inspection

If any abnormality is found, contact your distributor. Once you get the product, please check according to the following table.

Inspection item	Inspection method
Consistency with ordered product	Inspect the identification plate
Damage or exfoliation phenomenon	Inspect whole appearance
Completeness of main machine and accessories	Check according to the packing list
Looseness of fastening parts such as screws	If necessary, inspect with screwdriver

#### 3.2 Dimension and Weight



**CAUTION:** The PSk Controllers must be mounted to a wall. Ensure that the mounting backplane can support the weight of the controller. Controller must be protected from rain and dampness and animals. Sufficient ventilation must be provided.

Figure 2: Installation dimensions

Model	Dimension [mm]							Weight [kg]
	W	H	D	W1	H1	D1	d	
PS3k	202	244	146	187	232	113	6	4.0
all other models	250	310	200	235	295	167	7	8.0

### 3.3 Wiring

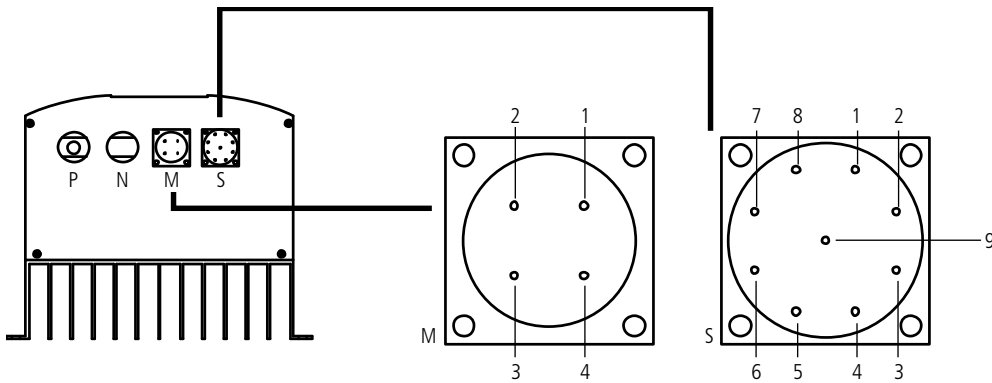


Figure 3: Wiring diagram

Socket	Terminal	Connection
DC input	P	connected to positive terminal of PV module
	N	connected to negative terminal of PV module
AC output	M-1	connected to protective ground wire
	M-2	connected to U phase of the motor
	M-3	connected to V phase of the motor
	M-4	connected to W phase of the motor
water level sensor input	S-1	ground
	S-2	water level sensor 1, controlled by PR 15
	S-3	water level sensor 2, controlled by PR 16
	S-4	water level sensor 3, controlled by PR 17
	S-5	water level sensor 4, controlled by PR 18



**CAUTION:** Ensure the exact locations of the DC input "P" and "N" sockets.



**CAUTION:** Ensure the wiring of AC output is based on the marks of the sockets.



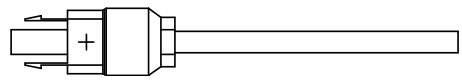
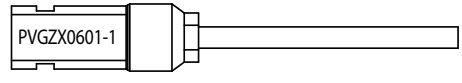
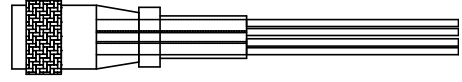
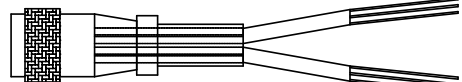
**CAUTION:** To ensure proper operation of the system, select the wire size according to the following recommended principle.

**Prompt:** Water level sensor 1 controlled by PR 15 and water level sensor 2 controlled by PR 16 can be combined to a dual switch well probe.

**Prompt:** Water level sensor 3 controlled by PR 17 and water level sensor 4 controlled by PR 18 can be combined to a dual switch well probe.

**Prompt:** Please refer to chapter 4.3 Parameter for further information on parameter settings.

3.4 External Sockets

Socket	Wires	Connection
	one-strand, black	connected to positive terminal of PV module
	one-strand, black	connected to negative terminal of PV module
	four-core wire	yellow/green wire connected to protective ground wire
		red wire connected to U phase of the motor
		yellow wire connected to V phase of the motor
		blue wire connected to W phase of the motor
	white three-core wire	red wire water tower signal wire 1
		yellow wire water tower signal wire 2
		black wire water tower ground wire
	black three-core wire	red wire well signal wire 1
		yellow wire well signal wire 2
		black wire well signal ground wire

### 3.5 Recommended Wire Sizes

Model	Controller to module (P, N) [mm <sup>2</sup> ]	Earth wire (PE) [mm <sup>2</sup> ]	Controller to motor (U, V, W) [mm <sup>2</sup> ]	Controller to water level sensor (S) [mm <sup>2</sup> ]
PS3k	2		2	
PS5k				
PS7k			4 for max. 130 m	
PS9k		2		
PS15k	4		4 for max. 90 m or AWG #10 for max. 400 ft ..... 6 for max. 140 m	0.75-1.25
PS21k		3.5	4 for max. 60 m or AWG #10 for max. 280 ft ..... 6 for max. 90 m	

### 3.6 Connecting the Well Probe

The well probe contains a mechanical float with a magnet inside. When the probe is submerged, the float rises, and the magnet actuates a switch. The switch closes (makes contact) to indicate the presence of water. If the water level drops below the probe, the float drops, and the switch opens (breaks contact): The controller will stop the pump. When the water level recovers and switch closes again, the controller will delay the restart for 15 minutes. This gives time for the water level to recover. To force a quick restart, turn the controller off, then on again. The switch is sealed, so the contacts never touch the water.

**Fixation:** The probe is packed with two stainless steel hose clamps. For a pump that is to be installed in a vertical position, clamp it to the pipe just above the pump outlet, as shown in the photo. Splice the two probe wires using the splice kit components that are packed with the probe. The assembly procedure is the same as the main pump splice.

If you are NOT using the well probe, it must be bypassed. Connect a short wire between the probe terminals in the junction box (terminals S4 and S5). Do this only if you feel certain about the reliability of the water source. Wire size: #18 AWG (1mm<sup>2</sup>) or larger.

**Potential problems with the low-water probe in surface water:** The probe has a moving float. It is highly resistant to deposits and debris. However, it may stick under some extreme conditions, especially from algae or water creatures (snails, etc.) that may be present in surface water.

Possible solutions are:

- Hang the probe independently of the pump and pipe (clamped to a weight, but not to the drop pipe). This way, it can be pulled up for inspection or cleaning without the need to pull up the pump. (This may not be feasible if the well casing is smaller than 6 in)
- Pull the probe out periodically (with the pump, if necessary) for testing and inspection. The pump should stop at the moment the probe leaves the water.
- Wrap the probe in a protective screen (fibreglass window screen, for example). Substitute a different type of float switch. You can use any switch that makes contact on rise (normally open).

**PROMPT:** Ambient temperature for the wire sizes as recommended above is ≤50°C.

**PROMPT:** High-power wall-mounting machine model uses multi-channel DC input. Wire size for DC of each channel must be selected and used as recommended in the table above.



**WARNING:** Running completely dry will damage the pump and void the warranty. The purpose of the probe system is to sense the loss of water and turn the pump off before it can run dry.



**CAUTION:** The low-water probe must be positioned vertically, within 10°. If the pump is NOT to be installed vertically, find an alternative way to mount or suspend the probe, so that it is higher than the pump, and in a vertical position.



**CAUTION:** Do not use a pressure switch with a “low water cut-out” or “loss of prime” feature as a method of dry-run protection. A helical rotor pump will maintain pressure as it runs dry, so this method will not work reliably.



Figure 4: Well probe

## 4 Operation

### 4.1 Panel Layout and Instruction

Indicator light/key	Name	Function
[RUN]	running indicator light	GREEN ON: controller is running
[STOP]	shutdown indicator light	RED ON: controller is shut down
[FAULT]	fault indicator light	RED ON: system fault
[NORMAL]	normal indicator light	GREEN ON: system normal
[WELL DRY/TANK FULL]	well/tank indicator light	RED ON: water tower or water level is abnormal

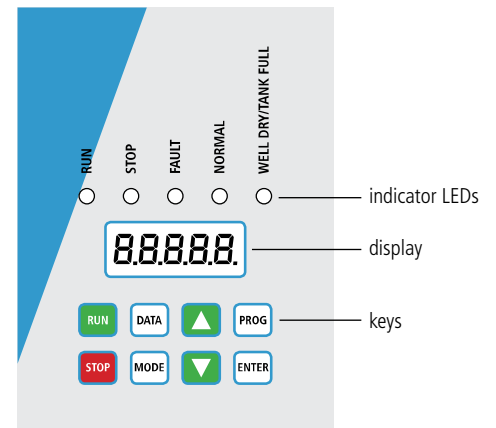











Figure 5: Keyboard layout

	run key	starting control for the controller
	stop key	shutdown control for the controller
	data inquiry key	enter or quit from displaying historical data
	mode switch key	switch between different content when viewing data switch the digit that is being edited when editing data
 	increment key decrement key	increase/decrease the parameter number or its value when editing the parameters change the historical date upward/downward or display the content of the historical data in turns when the historical data is displayed increase/decrease the output frequency or display current running data upward by turns when the data status is displayed during running
	programming key	enter or quit from editing the control parameters
	enter key	confirm the edited content confirm and save the edited parameter value
 + 	reset key	press the both keys to reset in the protection status

## 4.2 Controller Control

### 4.2.1 Instruction for Display Status

There are three kinds of status for operating panel display: 1) running data display, 2) control parameter display, 3) historical data display. The default status is the display of running data. Press the **[PROG]** key to enter the status of control parameter display, and press the key again to return to the default status. Press **[DATA]** key to enter the status of historical data display, and press the **[DATA]** key again to return to the default status.

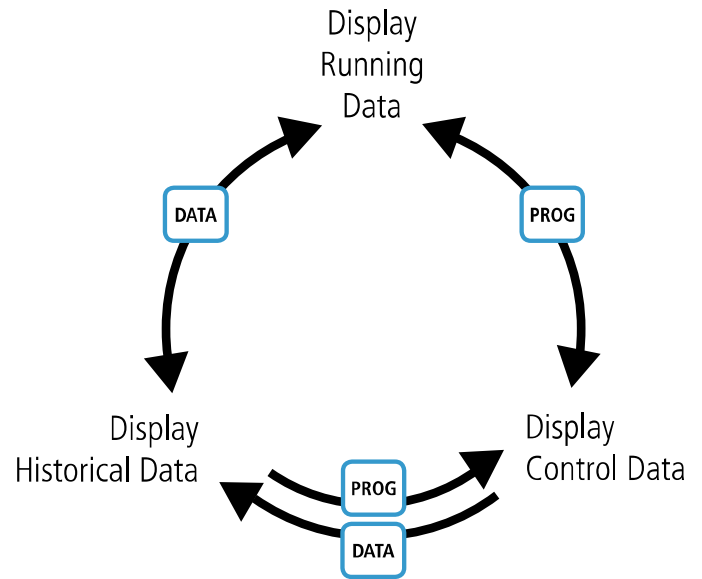






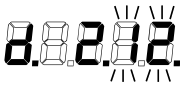


















Figure 6: Diagram for display status switching





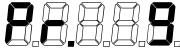









### 4.2.2 View Running Data

Operation	Data displayed	Display (e.g.)
	initial status: current running data	
<b>MODE</b>	output frequency of con-troller	<b>50.00</b> = 50.00 Hz
<b>MODE</b>	input voltage of controller	<b>340.0</b> = 340V
<b>MODE</b>	input current of controller	<b>5.000</b> = 5.00A
<b>MODE</b>	input power of controller	<b>1.500</b> = 1.50 kW
<b>MODE</b>	output current of controller	<b>6.000</b> = 6.0A
<b>MODE</b>	controller temperature	<b>37.0</b> = 37° C
<b>MODE</b>	water level sensor status	<b>8.8.8.8</b> = normal water level
<b>MODE</b>	time	<b>12.30</b> = 12.30 h

## 4.2.3 View Historical Data

Operation	Data displayed	Display (e.g.)
	initial status: non-historical data display	
	enter the data inquiry interface display: current date	 = 31st January
	select the object to be modified (day, month, year) selected digit flickers	
 	modify the date to be inquired	 = 12th February
	confirm date to be inquired	 = year 2008
	historical data: accumulated generated energy of the day	 = 9.99 kWh
	historical data: maximum power point voltage of the day	 = 320V
	historical data: maximum power of the day	 = 2.20 kW
	historical data: starting time of the day	 = 5.10h
	historical data: shutdown time of the day	 = 17.40h
	historical data: running time of the day	 = 12.5h
	quit from displaying the historical data: display: current running data	 = 50Hz

## 4.2.4 View or modify the control parameters

Operation	Operation, data displayed	Display (e.g.)
	initial status: non-control parameter display	
	enter the parameter modification interface display: parameter PRO	 = PR 0
 	select the parameter to be viewed and edited display: parameter number	 = PR 9
	confirm the parameter to be viewed or edited display: parameter value	 = 30
 	edit parameter value	 = 25
	confirm the editing and save the new value display: next parameter number	 = PR 10
	quit from the parameter display mode display: current running data	 = 50 Hz

**PROMPT: The control parameters can only be viewed while the controller is in operation. The control parameter cannot be modified until the controller is stopped.**

### 4.3 Parameters

Parameter	Name	Range	Description	Factory value	
PR 0	parameter set mode	0 to 3	0	parameter can be read and written other parameter values cannot be modified until this parameter is set to 0	1
			1	the parameter can only be read	
			2	user parameter restores its factory set value	
			3	date clock calibration: modify the PR6 to PR10 first, then set this parameter to 3	
PR 1*	maximum power point voltage	0 to PR 2	maximum power point voltage of the PV module	320V 560V	
PR 2*	open circuit voltage	PR 1+1 to 1,000	open circuit voltage of the PV module <b>Interlock function between PR1 and PR2, if necessary, needs to coordinate with the modification</b>	400V 700V	
PR 3*	rated voltage	1 to 1,000	rated voltage of the motor load	220V 380V	
PR 4*	rated current	0.1 to 300	output current of rated AC		
PR 5	start up delay	1 to 6,000	start up delay time after power up or shut down (in seconds)	30 s	
PR 6	year	2,000 to 2,999	year (must be set to actual date)		
PR 7	month	1 to 12	month (must be set to actual date)		
PR 8	day	1 to 31	month (must be set to actual date)		
PR 9	hour	0 to 23	hour (must be set to actual date)		
PR 10	minute	0 to 59	minute (must be set to actual date)		
PR 11*	resources of frequency instruction	0 to 2	0	press [RUN] key to run while the frequency is de-termined by PR12	1
			1	fully automatic operation	
			2	press [RUN] key to run, adjust the frequency auto-matically according to sunlight	
PR 12	reference frequency	0 to PR 13	target frequency when PR11 is 0	20 Hz	
PR 13*	maximum operating frequency	0.01 to 60	to protect the motor load, maximum operating frequency must be in line with rated frequency of the motor	50 Hz	
PR 14	stopping frequency	0 to 60	shut down when the output frequency is below the set value	20 Hz	
PR 15	well probe setting 1 (connection terminal S1/S8)	0 to 9	0	no well probe	0
			6	well probe normally open	
			7	well probe normally closed	
			8	well probe normally open, used with PR 16	
			9	well probe normally closed, used with PR 16	
others	Do not set other values, it may cause the inverter to work abnormally. <b>PR 16 must be set to 8 or 9 while PR 15 is set to 8 or 9, otherwise the setting is unavailable.</b>				
PR 16	well probe setting 2 (connection terminal S1/S7)	0 to 9	0	no well probe	0
			6	well probe normally open	
			7	well probe normally closed	
			8	well probe normally open, used with PR 16	
			9	well probe normally closed, used with PR 16	
others	Do not set other values, it may cause the inverter to work abnormally. <b>PR 15 must be set to 8 or 9 while PR 16 is set to 8 or 9, otherwise the setting is unavailable.</b>				

PR 17	well probe setting 3 (connection terminal S1/S6)	0 to 9	0	no well probe	0
			6	well probe normally open	
			7	well probe normally closed	
			8	well probe normally open, used with PR 16	
			9	well probe normally closed, used with PR 16	
			others	Do not set other values, it may cause the inverter to work abnormally.	
<p><b>PR 18 must be set to 8 or 9 while PR 17 is set to 8 or 9, otherwise the setting is unavailable.</b></p>					
PR 18	well probe setting 4 (connection terminal S1/S5)	0 to 9	0	no well probe	0
			6	well probe normally open	
			7	well probe normally closed	
			8	well probe normally open, used with PR 16	
			9	well probe normally closed, used with PR 16	
			others	Do not set other values, it may cause the inverter to work abnormally.	
<p><b>PR 17 must be set to 8 or 9 while PR 18 is set to 8 or 9, otherwise the setting is unavailable.</b></p>					
PR 19	total generated energy	read-only			0
PR 20 to PR 24	fault type record 1 to 5	read-only	see chapter 4 the operating code explanation		no
PR 25	rated power	0.1 to 300.00	When loss load protection is working the parameter must be set correctly, otherwise it may cause to work abnormally.		according to pump model
PR 26	pole number	1 to 10	Pole number is used to calculate the synchronous velocity.		2
PR 27	startup latency after abnormal water level	1 to 30,000	After the water level has been abnormal or idle load protection has been running, the controller will restart after this period of time (in seconds). While countdown is still higher than 999 seconds, the displayed digits flicker, delay time displayed remains at 999.		1,200
PR 28	idle load protection	0 to 1	0	unavailable	0
			1	available (delay time of idle load protection set at PR 27)	
<p><b>When idle load protection parameter is set to 1 and if the actual output frequency is higher than the frequency set at PR 14, controller activate idle load protection.</b></p>					

\*) After modification of parameters marked with \*, the next operation cannot be performed until the controller has been reset.

**PROMPT: Record is not made because of the under-voltage fault of input voltage when the sun irradiation is too low.**

## 4.4 Setup before First Operation

To ensure the efficient, reliable and stable operation of the solar pumping system, trained personnel should set partial parameters of the controller according to the system structure as following steps before first operation.

#	Set up operation	Method
1	set the control parameter to read/write	Set the PR 0 value to 1.
2	date and time	<ul style="list-style-type: none"> <li>Set PR6 to PR10 (year, month, day, hour, minute) according to actual date.</li> <li>Set the PR 0 parameter value to 3.</li> </ul>
3	PV module parameter	Set PR1 (maximum power point voltage) and PR2 (open circuit voltage) according to the PV module specifications. Note: Due to the interlock function between PR1 and PR2, the change needs to coordinate with the modification.
4	water level sensor setting	<ul style="list-style-type: none"> <li>If controller is matched with a water tower sensor, set PR15, PR16 to 8, else to 0.</li> <li>If controller is matched with a well sensor, modify the PR17, PR18 to 9, else to 0.</li> </ul>
5	rated voltage of the pump	Set PR 3 (rated voltage) according to pump specifications.
6	the maximum operating frequency	Set PR 13 (rated frequency) according to the pump specifications.
7	confirm the motor wiring	<ul style="list-style-type: none"> <li>Set PR 11 parameter value to 0.</li> <li>Set PR 12 to 30.00 (on a sunny day).</li> <li>Press the <b>[RUN]</b> key and observe water yield from the outlet.</li> <li>Press <b>[STOP]</b> key to shut down and change the order of output connection.</li> <li>Again, press the <b>[RUN]</b> key observe water yield from the outlet.</li> <li>Press <b>[STOP]</b> key to shut down, select the wiring with larger water yield to ensure the proper pump corotation.</li> </ul>
8	minimum operating frequency	<ul style="list-style-type: none"> <li>Set PR 12 to 10.00.</li> <li>Press <b>[RUN]</b> key and observe the effluent of the water outlet</li> <li>If there is no effluent from the outlet, press <b>[UP]</b> key to slowly increase the output frequency</li> <li>If there is effluent from the pump, record the operating frequency f0.</li> <li>Set PR 14 to f0 (shutdown frequency).</li> </ul>
9	operating mode of the controller	<p>User sets P11 (operating mode) according to his own demand.</p> <ul style="list-style-type: none"> <li>0 Press <b>[RUN]</b> key to operate, the initial frequency value is determined by PR12.</li> <li>Then set the output frequency by pressing <b>[UP]</b> or <b>[DOWN]</b> key.</li> </ul> <p>1 Fully automatic operation: the controller will start automatically if the sunlight is strong enough, the output frequency will track automatically according to the sunlight. The control cell array will export maximum power.</p> <p>2 Press <b>[RUN]</b> key, output frequency will track automatically according to the sunlight. The control cell array will export maximum power</p>
10	set control parameter to read-only	Set PR0 to 1 before Controller start up.



**CAUTION: Do not modify the control parameters of the controller randomly, otherwise it can cause disfunctions, inefficient operation or damage to the system components.**

**Prompt: The fan is temperature-controlled. When the temperature is higher than 55° C, the fan starts. When the device has cooled down to less than 45 degree, it stops.**












## 5 Fault Diagnosis

### 5.1 Fault Code Description and Countermeasure


LORENTZ PSk series of solar pumping Controller have various protection routines to ensure the controller and other parts of the installation are not damaged when a fault occurs. As a general protection measure the driving signal output of the motor is stopped (breakaway) immediately while restart is forbidden for a certain period of time.

The controller will automatically switch to the fault display when an error occurs. The fault code will be displayed in the last two digits and flash. If the first digit displays "P", this means protection measures have been taken and the controller is reset. Disconnect controller from power and wait until the capacitors have fully discharged. This will be indicated by the display switching off. Then reconnect. Alternatively, press the **[RESET]** key to reset. If the fault still persists after resetting, please contact the manufacturer and make relevant processing.

After the fault or protection to be reset is eliminated, the controller will conduct automatically a time-delayed restart. At this time the fault number will appear in the first and second digit nixie tubes. The last several digit nixie tubes will display the countdown of the restart, when the countdown is "0", fault display unit will disappear automatically and operating status data will be displayed.

Error Code	Error	Possible Reason	Countermeasures
	overvoltage	too high input voltage	inspect PV module voltage
	undervoltage	too low input voltage sunlight too weak	inspect PV module voltage
	overcurrent	too large pump load low PV module voltage too long motor wiring	change low-power pump load inspect PV module voltage shorten the cable between controller and motor
	overload	too large load	reduce the highest operating frequency
	overcurrent of the module	shorted output or grounding module damaged	inspect the connection turn to manufacturer for service
	overtemperature of the module	air duct blocked too high ambient temperature	clear the air duct or improve the ventilation condition
	AC CT fault	device or circuit damaged	contact manufacturer for service
	DC CT fault	device or circuit damaged	contact manufacturer for service
	data record fault	device or circuit damaged	device or circuit damaged
	communication fault	device or circuit damaged	reset device or circuit damaged
	idle load	indicates that pump has been running when water source is low, pump wire has been disconnected or pump does not match inverter	inspect water level, wire connection and whether the power of pump matches the capacity of the inverter

## 5.2 Description for Other Codes

Error Code	Description	
	parameter initialization	return to normal after resetting
	important parameter modification	return to normal after resetting
	controller type	L: 200V series, 1.50 rated power 1.5 kW
	abnormal well probe 1	The system automatically returns to normal after the well probe has returned to normal status plus restart delay (PR 5).
	abnormal well probe 2	The system automatically returns to normal after the well probe has returned to normal status plus restart delay (PR 5).
	abnormal well probe 3	The system automatically returns to normal after the well probe has returned to normal status plus restart delay (PR 5).
	abnormal well probe 4	The system automatically returns to normal after the well probe has returned to normal status plus restart delay (PR 5).
	abnormal coordination of well probe 1 and 2	The system automatically returns to normal after the well probe has returned to normal status plus restart delay (PR 5).
	abnormal coordination of well probe 3 and 4	The system automatically returns to normal after the well probe has returned to normal status plus restart delay (PR 5).
	starting time delay	countdown of the restart: 30 seconds

## 5.3 Fault Inquiry and Reset

This series of Controllers record the fault codes of the latest 5 times. Searching this information will help find the fault cause. Fault information is stored together with the control parameter, code numbers are P20 to P24. Please refer to the keyboard operation method to search and find out relevant information.

When the Controller fault occurs, by pressing **[UP]** and **[DOWN]** keys simultaneously or cutting off the power supply to restore normal operation.



**CAUTION: Completely check up on the fault cause and eliminate it before resetting. If it can not be reset or goes wrong after resetting, check up on the cause, because continuous resetting will damage the Controller.**



**CAUTION: Delay 5 minutes to reset during overload and overheat protection.**

## 6 Service and Maintenance

### 6.1 Routine Inspection and Maintenance

Affected by ambient temperature, humidity, dust, vibration and internal device aging of the controller, problems might occur during operation. To make the controller run stably, a periodic inspection must be performed **every year**.

#### Requirement of Inspection and Maintenance

1. The inspection must be performed by professional technical personnel.
2. If necessary, cut off power supply of the controller first.
3. Avoid leaving any metal components in the controller, or else they might cause damage to the equipment.
4. An electric insulation test has been made on the controller before it has left factory. A withstand-voltage test is not necessary.
5. If it is necessary to conduct insulation test on the controller, all the input and output terminals must be reliably shorted. It is forbidden to conduct insulation test on a single terminal. Use the 500V megohmmeter to conduct the test.
6. It is forbidden to use the megohmmeter to test in the control circuit.
7. When conducting insulation test on the motor, you have to dismantle the connection between motor and controller.

#### Main Points for Inspection and Maintenance

Please use the controller under environment recommended by this manual. Inspect and maintain as per the following table.

Inspect frequency		Inspection item	Inspection content	Judgment standard
Routine	Regular			
√		running environment	<ol style="list-style-type: none"> <li>1. temperature, humidity</li> <li>2. dust, gas</li> </ol>	<ol style="list-style-type: none"> <li>1. temperature &lt;50 °C</li> <li>2. humidity &lt; 90 %, no dew condensation, no peculiar smell, flammable, explosive gas</li> </ol>
	√	cooling system	<ol style="list-style-type: none"> <li>1. installation environment radiator</li> </ol>	<ol style="list-style-type: none"> <li>1. excellent ventilation in installation environment</li> <li>2. radiator air duct not blocked</li> </ol>
√		controller body	<ol style="list-style-type: none"> <li>1. vibration, temperature rise</li> <li>2. noise</li> <li>3. lead, terminal</li> </ol>	<ol style="list-style-type: none"> <li>1. stable vibration, normal temperature of the shell</li> <li>2. no abnormal noise and peculiar smell</li> <li>3. fastening screws not loose</li> </ol>
√		motor	<ol style="list-style-type: none"> <li>1. vibration, temperature rise</li> <li>2. noise</li> </ol>	<ol style="list-style-type: none"> <li>1. steady running and normal temperature</li> <li>2. no abnormal and uneven noise</li> </ol>
√		input and output parameter	<ol style="list-style-type: none"> <li>1. input voltage</li> <li>2. output current</li> </ol>	<ol style="list-style-type: none"> <li>1. input voltage in the specified scope</li> <li>2. output current under the rated value</li> </ol>

## 7 Packing List

### 6.2 Replacement of Wear Parts

#### Filter Capacitor

Pulsating current of the main circuit will influence the performance of the aluminum electrolytic filter capacitor, of which the degree will depend on the ambient temperature and application condition. The Controller used under normal condition should replace its electrolytic capacitor every 10 years. When the filter capacitor's electrolyte is leaking, safety valve bursting out or the capacitor main body expanding, replace it immediately.

#### Cooling Fan

Cooling fan's service life is about 15.000 hours. If the fan appears abnormal noise or produces vibration, replace it immediately.

1. main machine, 1 unit
2. operation manual, 1 copy
3. plug of the positive terminal of the PV module, 1 item
4. plug of the negative terminal of the PV module, 1 item
5. AC output plug, 1 item
6. well probe sensor plug, 1 item