

PS150C

Instructions for Installation, Operation and Service

for Controllers from serial # 10070901

1 Introduction

Thank you for purchasing a LORENTZ PUMP. LORENTZ has set a new standard for quality and economy in solar pumping. It incorporates the best solar pump technologies that were very expensive until its introduction in 2002.

PS150 is a highly efficient pump system which is economical for (drip-) irrigation, livestock, dugout floating pump, water transfer to remote places and many other applications.

PS150C is a submersible pump with a centrifugal pump end. The PS150 brushless DC motors are specially made for this system. The motor is using very advanced raw earth magnet technology, hand made wiring for highest copper density and does not need wearing brushes. This results in an exceptional high efficiency with low temperature dissipation.

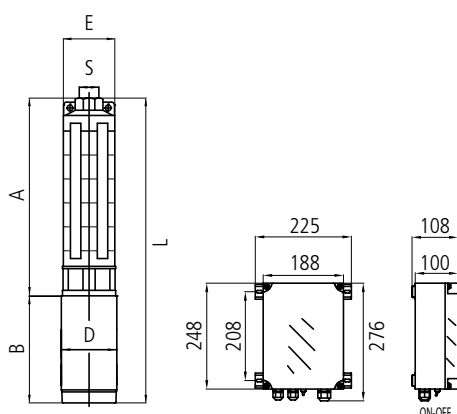
PS150 can either be used in a battery system with voltages of 12V or 24V or alternatively it can be operated as a solar-direct system using the same Controller PS150.

The solar battery is charged up during daylight hours using a separate charger. The charger works effectively during reduced sunlight conditions when direct pump operation is not possible. The energy stored in the battery is available to operate the pump at any time, day or night and during periods of bad weather. Extended bad weather periods with water demands of up to 10m³ per day will be reliably bridged due to the high system efficiency even with low capacity batteries.

The pump is manufactured from non-corrosive material (stainless steel).

3 System Dimensions

	Dimensions						Packing			
	L	A	B	D	E	S	packaging	shipping volume	net weight	gross weight
	[mm]	[mm]	[mm]	[mm]	[mm]		[mm × mm × mm]	[m ³]	[kg]	[kg]
Pump Unit C-SJ5-8	593	408	185	100	98	G 1 1/2 in	650 × 160 × 150	0.0160	12.0	12.5
Controller PS150	see drawing						320 × 240 × 160	0.0123	1.2	1.8



Before you begin, check the model numbers of all the components of your system, and verify that they are the items that you ordered. Also check against the pump specifications and performance charts to be sure the system is appropriate for your application. If you think you may have the wrong pump for your application, call your supplier immediately.

Please fill in the System Report. This will be essential information if any problems occur.

Symbols



Warning

Disregard might lead to injury or damage the installation



Caution

Recommended to avoid disfunction or premature ageing of the pump etc.

2 Warnings

- The manual contains basic instructions which must be observed during mounting, operation and maintenance. Therefore the manual should be carefully read before installation and start-up by the person in charge of the installation as well as by all other technical personnel/operators and should be available at the installation site at all times.
- **Personnel Qualification and Training** – All personnel for the operation, maintenance, inspection and installation must be fully qualified to perform that type of job. Responsibility, competence and the supervision of such personnel must be strictly regulated by the user. Should the available personnel be lacking the necessary qualification, they must be trained and instructed accordingly. If necessary, the operator may require the manufacturer/supplier to provide such training. Furthermore the operator/user must make sure that the personnel fully understands the contents of the manual.
- **Dangers of Ignoring the Safety Symbols** – Ignoring the safety directions and symbols may pose a danger to humans as well as to the environment and the machine itself. Non-observance may void any warranties. Non-observance of safety directions and symbols may for example entail the following: Failure of important functions of the machine/plant; failure of prescribed methods for maintenance and repair; endangerment of persons through electrical, mechanical and chemical effects; danger to the environment because of leakage of hazardous material; danger of damage to equipment and buildings.
- **Safety-oriented Operation** – The safety directions contained in the manual, existing national regulations for the prevention of accidents as well as internal working-, operational- and safety-regulations of the operator/user must be observed at all times.
- **General Safety Directions for the Operator/User** – If hot or cold machine parts pose a danger, such parts must be protected by the operator/user against contact with personnel. Protective covers for moving parts (e.g. coupling) must not be removed when the machine is running. Leakages (e.g. at the shaft seal) of hazardous pumping media (e.g. explosive, toxic, hot liquids) must be disposed of in such a way that any danger for personnel and the environment is removed. All government regulations must be observed at all times. Any danger to persons etc. by electrical energy must be excluded. (For details see e.g. regulations of VDE and the local utilities).
- **Safety Directions for Maintenance, Inspection and Assembly Work** – It is the user's responsibility to make sure that all maintenance, inspection and assembly work is performed exclusively by authorized and qualified experts sufficiently informed through careful perusal of the Operating Instructions. The accident prevention regulations must be observed. Basically, all work on the machine is to be performed while the machine is not in operation. The sequence for shutting the machine down described in the manual must be strictly observed. Pumps or pump units handling hazardous liquids must be decontaminated. Immediately upon completion of the work, all safety and protective equipment must be restored and activated.
- **Unauthorized Changes and Manufacturing of Spare Parts** – Any conversion or changes of the machine may only be undertaken after consulting the manufacturer. Original spare parts and accessories authorized by the manufacturer guarantee operational safety. Using non-authorized parts may void any liability on the part of the manufacturer in case of consequential damage.
- **Unauthorized Operation** – The operational safety of the machine delivered is only guaranteed if the machine is used in accordance with the directions contained in manual. Limits stated in the data sheets may not be exceeded under any circumstances.
- **Cited Standards and other Documentations** – DIN 4844 Part 1 Safety marking; Safety symbols W 8, Supplement 13; DIN 4844 Part 1 Safety marking; Safety symbols W 9, Supplement 14
- **Transportation and Intermediate Storage** – Prolonged intermediate storage in an environment of high humidity and fluctuating temperatures must be avoided. Moisture condensation may damage windings and metal parts. Non-compliance will void any warranty.



Failure to follow these instructions will void the warranty.



Before beginning installation procedures, these installation and operating instructions should be studied carefully.



The installation and operation should also be in accordance with local regulations and accepted codes of good practice.



This Instruction Manual contains maintenance information, and is the property of the pump owner. Please give this manual to the pump owner or maintenance personnel when the installation is finished.

3 Installation of the Controllers

3.1 Controllers Functions

- Controlling and monitoring of the motor
- Integrated MPP-tracking and LVD battery protection
- LVD protection (low voltage disconnect) for 12V and 24V batteries
- High-run battery function to avoid cycling of battery
- LED display of the the operating status
- Two control inputs for float- or pressure switches, remote control, etc.
- 92% max. efficiency (motor + controller)
- Adjustable maximum RPM setting

3.2 Warnings to the Installer



Motor cable strain relief: Submersible motors must use a safety rope or cable to act as a strain relief for the motor cable and to avoid losing the pump in the well if the pipe breaks.



Open circuit (no-load) voltage above 50VDC will destroy the controller. This may occur if the wrong PV modules (solar panels) are used, or if the solar array is incorrectly wired. Measure the array voltage before connecting to the controller. A 12VDC (nominal) array should produce an open circuit voltage around 22–25V under any daylight conditions. Some thin-film PV modules might produce a higher open-circuit voltage when they are new. If it is higher than 50V, do not connect the controller. Contact your dealer!



Do not run the motor without the controller.



To be installed, connected and serviced by qualified personnel only. Ensure all power sources are disconnected when making connections to this unit. Follow all appropriate electrical codes. There are no user serviceable parts inside the motor or the controller.



Install proper grounding for safety and lightning protection.



Do not touch the controller input or motor wires together to test for a spark.

3.3 Mechanical Installation

Location Place the controller close to the solar array, not the pump. This will reduce the risk of lightning damage. If it is outdoors, mount the controller in a vertical position to assure that rain will not enter the box.

Protection from heat Electronic devices are most reliable when they are protected from heat. Mount the controller in the shade of the mid-day sun. An ideal location is directly under the solar array or in a nearby shaded location. An alternative is to fold a piece of sheet metal so that it mounts behind the controller and curves over it to provide shade. This provides protection in extremely hot climates.

Battery system Place the controller near the batteries but safely isolated from the battery terminals and from corrosive gases. Batteries must be in a cool location for best longevity and enclosed for cleanliness and safety.

Connect the battery (12V or 24V) directly with the + and – terminal of the controller. Do not use the load terminals of the charge controller as they may not be strong enough to allow the start current to flow. The PS150 controller has a low voltage function to protect the batteries from deep discharge. An additional charger is needed for charging the batteries.

3.4 Electrical Installation

Power IN For PV-direct systems, a two-pole disconnect switch may be installed between the solar array and the controller. Switch it off to prevent shock and arc burn hazard during installation and maintenance, or if the system will be shut down for the season. For battery systems a 30A slow blow fuse must be installed between the controller and the battery.

Ground Connect the ground wire to the ground connection in the controller. Grounding helps to prevent shock hazard if there is a fault in the motor.

L1-L2-L3 The motor requires four-conductor (fourwire) cable between the controller and the motor. The three wires L1, L2 and L3 carry power. The fourth wire carries ground. To reverse direction of rotation reverse any two wires.

No. 1 and 2 In order to protect a pump from being damaged by dry running connect one well probe cable to each terminal. If dry run protection is not needed, short cut these two terminals.

No. 3, 4 and 5 Connect any kind of external switch (NO or NC type) for remote control of the controller. In case no switch is used the terminals No. 4 and 5 have to be connected with a short cable (factory setting). In case a NO-switch is used (connected to the terminals No. 3 and 4) the short cable (connecting the terminals No. 4 and 5) must remain installed.

No. 6 and 7 Connect these two terminals to switch the controller to battery mode. The motor will be switched OFF by the controller if the input voltage is below 11V for a 12V battery system and 22V for a 24V battery system in order to protect the battery. If the battery voltage increases to 12V or 24V the motor will be switched ON automatically. (For High-run mode at 13.3V and 26.6V.)

Table 1: Technical Data of Controller

system		PS150C
motor power	[W]	250
max. power input of PV module (Vmp)*	[V DC]	>34
open circuit voltage (Voc)	[V DC]	50
input voltage battery	[V DC]	12/24
battery low voltage disconnect	[V DC]	11/22
battery restart voltage	[V DC]	12/24
output		4–36V EC PWM 3-phase
enclosure type	controller	IP54 weatherproof (NEMA type 3R)
	motor	IPX4 weatherproof (NEMA type 3)
ambient temperature	storage	[°C] –30 to +55
	operation of controller	[°C] –20 to +50
	operation of pump	[°C] 0 to +50

*) PV modules at standard test condition: AM = 1.5, E = 1,000W/m², cell temperature: 25°C

3.5 Monitoring the System

System switched on (SYSTEM)

Green light indicates SYSTEM ON

Pump running (PUMP ON)

Green: MOTOR / PUMP ON

Red: Motor OFF caused by overload protection

PUMP SPEED

Pump speed is indicated by the blinking sequence of the PUMP ON LED:

- LED is on > 700 min⁻¹
- 1 flash > 1,200 min⁻¹
- 2 flashes > 1,600 min⁻¹
- 3 flashes > 2,000 min⁻¹
- 4 flashes > 2,400 min⁻¹
- 5 flashes > 2,800 min⁻¹

Dry-running protection (SOURCE LOW)

Red light: Water level is low. After recovering the motor will start within 20 minutes. Red light will remain ON to indicate low water level has occurred. For "Reset" press the ON/OFF switch.

TANK FULL

Red light: The motor has been switched OFF by remote switch.

BATTERY LOW

Red light flashing: "LOW VOLTAGE DISCONNECT" when battery is empty (in battery mode only)

3.6 Wiring Order for Correct Rotation

The power wires on the pump are black with white lettering to indicate L1, L2 and L3. WRITE DOWN the colours that you splice to L1/L2/L3 so you can match them with the L1/L2/L3 terminals in the pump controller.

If your pump cable has the standard GREY, BROWN, BLACK and GREEN-YELLOW colours, use this sequence:

GREY	BROWN	BLACK	YELLOW-GREEN
L1	L2	L3	Ground

The power wires on the pump may also be brown-black-grey for motors delivered from Q2 2005 on. Then use brown as L1, black as L2 and grey as L3.

Testing the pump for direction Centrifugal pumps will produce water flow even when the turn backwards. However, the backwards pumping flow will be considerably less and the lift ability lower. Make sure that the pump turns counter clockwise as indicated on the pump and motor body. If you place it in a water tank or a bucket, submerge at least 75% to observe flow.

Alternative dry test If you do not have a water vessel to test the pump in, you can test it dry by watching the pump shaft and running it for only a few seconds. The metal label on the pump has an arrow to indicate the proper direction of rotation. If the pump is new from the factory, it is lubricated so it can run dry for about 90 seconds without risk. If the pump is not new, it can be run dry safely for about 15 seconds. Either way, this is more than enough time to observe the direction of the shaft.

If you did not write down the color match (or the wind blew your note away) connect the three power wires to the controller in ANY random order. Apply power. Observe the pump shaft rotation, then turn the power off. If the direction is wrong, exchange ANY TWO of the power wires at the controller. In any case, when you are finished connecting the pump to the controller, test it to assure the proper direction.

Question The motor shaft is hard to turn by hand, and moves in a bumpy manner. Is this normal?

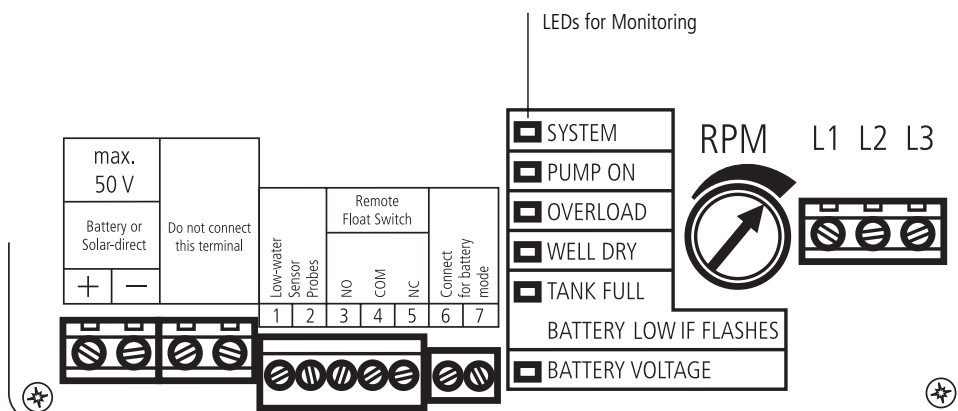
Answer YES. This is caused by permanent magnets in the motor. It is especially hard to turn when it is connected to the controller, or if the pump wires are connected together.



WARNING If the pump wires are in the wrong order, the motor will run in reverse and the pump will not function. Damage may result. Check the direction BEFORE installing the pump. The proper direction is COUNTERCLOCKWISE when viewed from above.



WARNING When testing for direction, do not run the pump dry for more than 15 seconds.



4 System Wiring

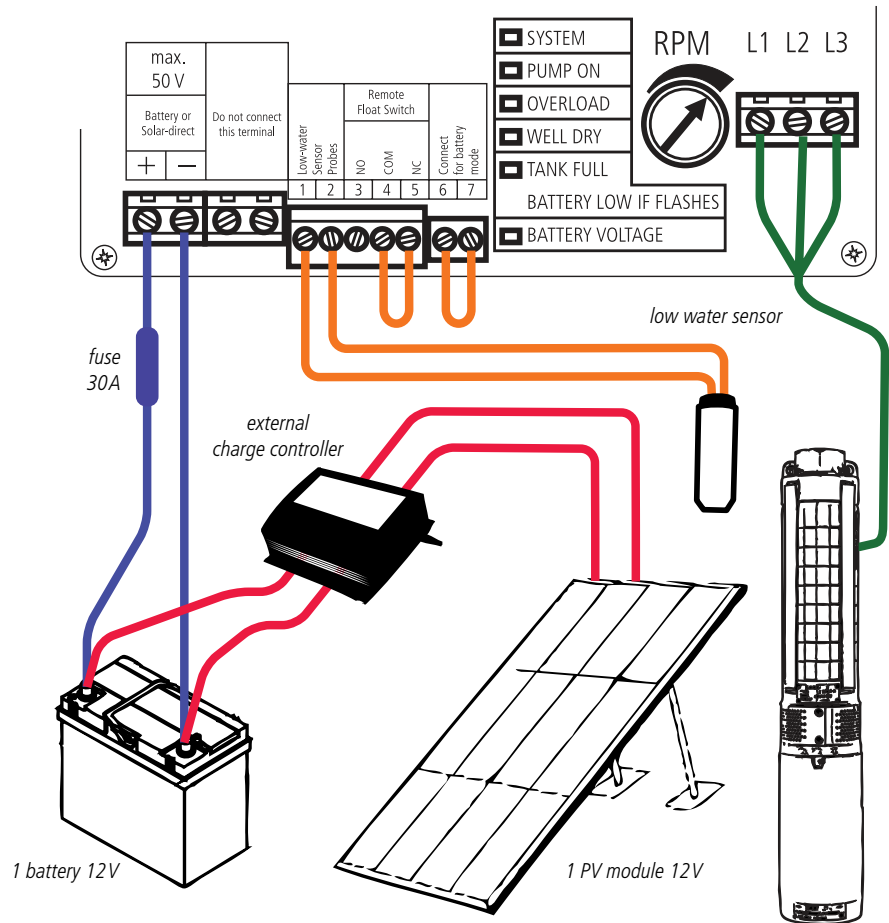
4.1 12V Battery System

12V system Voltage from panels will read 22-25 V when disconnected (open circuit). Connect the pump controller directly to battery bank.

Remote Tank Float Switch Connect float switch to terminals 4-5 of the pump controller when it breaks contact on rise, to turn the pump OFF. Otherwise use terminals 3-4 for opposite function.

Grounding Connect either battery minus or solar minus to ground, never connect both to ground!

Solar Tracking Use stranded wire for flexibility. Secure the wires to tracker with plenty of tape. Leave a good slack loop to allow free motion of tracker.



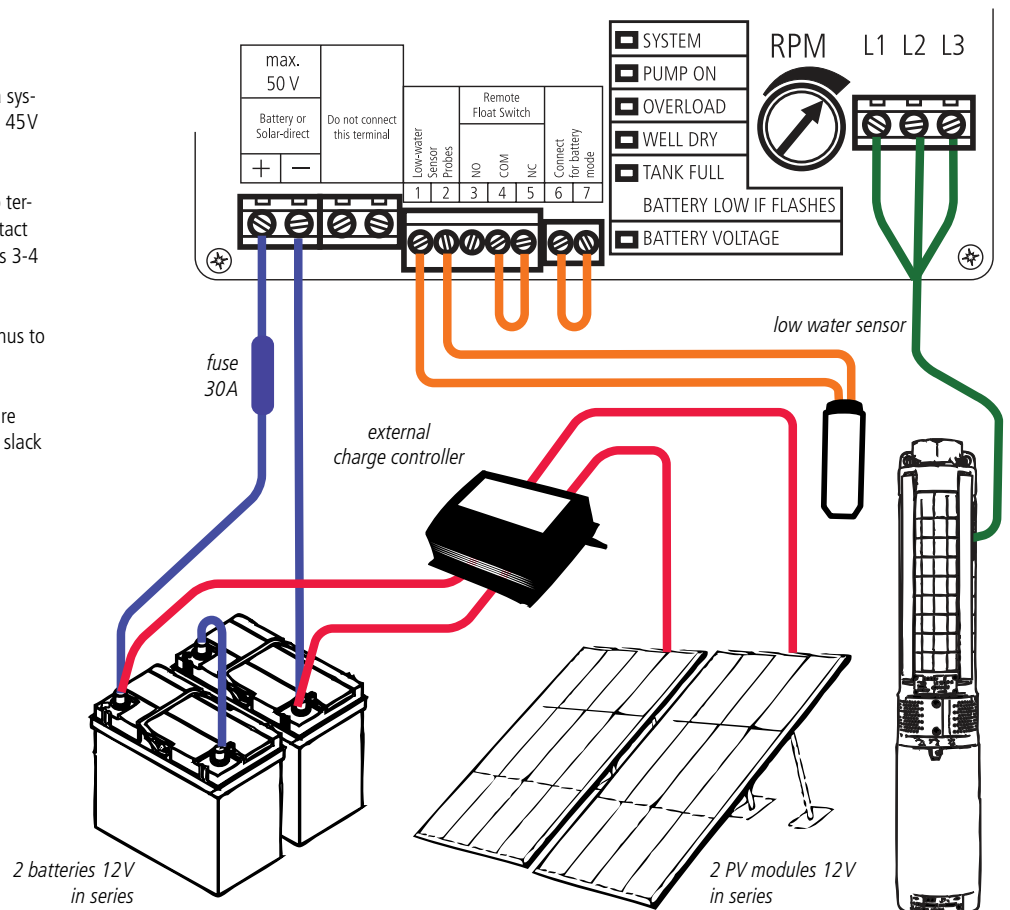
4.2 24V Battery System

24V system Wiring scheme shows serial wiring for a system of 24V nominal. Voltage from panels should read 45V when disconnected (open-circuit).

Remote Tank Float Switch Connect float switch to terminals 4-5 of the pump controller when it breaks contact on rise, to turn the pump OFF. Otherwise use terminals 3-4 for opposite function.

Grounding Connect either battery minus or solar minus to ground, never connect both to ground!

Solar Tracking Use stranded wire for flexibility. Secure the wires to tracker with plenty of tape. Leave a good slack loop to allow free motion of Co. tracker.



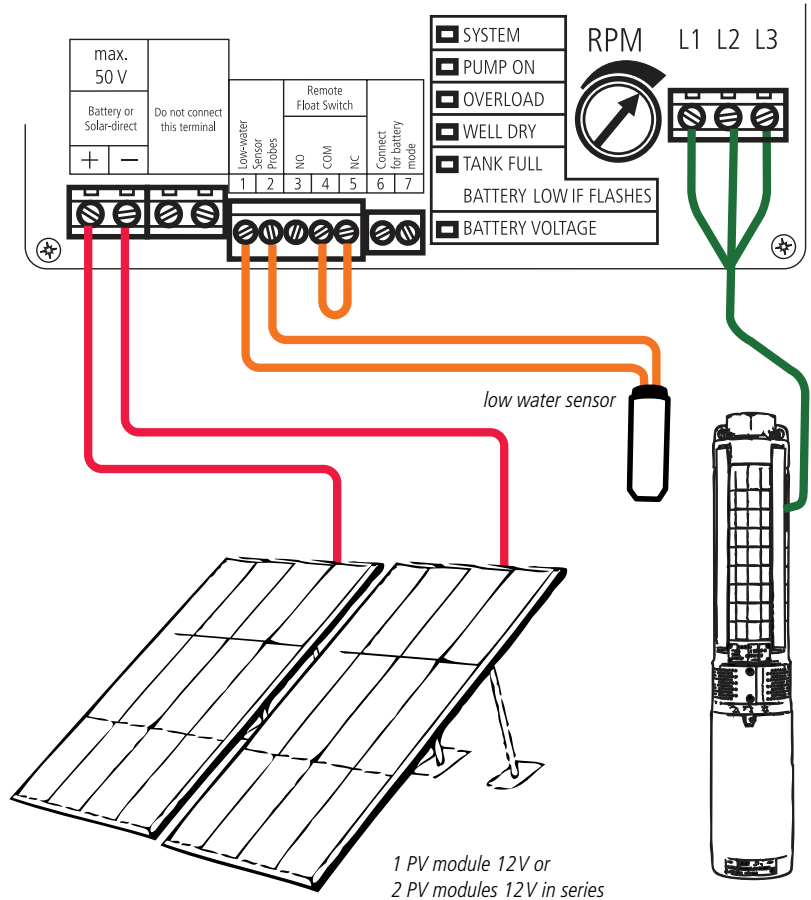
4.3 System Wiring for 12V–24V Systems in PV-direct Operation

Solar direct system Voltage from panels will read 22–45 V when disconnected (open circuit). Use the left power terminals to connect the solar array with the controller.


The jumper wire on terminal 6 and 7 must be taken out for solar direct mode.

Remote Tank Float Switch Connect float switch to terminals 4-5 of the pump controller when it breaks contact on rise, to turn the pump OFF. Otherwise use terminals 3-4 for opposite function.

Solar Tracking Use stranded wire for flexibility. Secure the wires to tracker with plenty of tape. Leave a good slack loop to allow free motion of tracker.



4.4 Jumper Setting for PS150C Mode


 **Before start-up check that jumper Jmp2 is set to PS150C mode, cf. sketch on the right.**

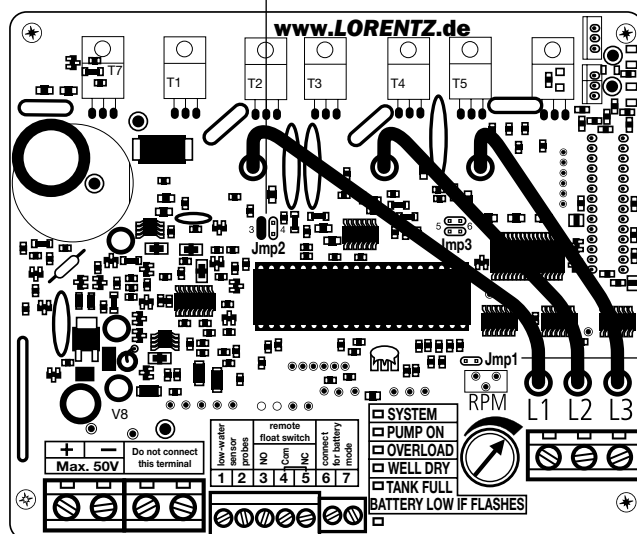
4.5 High-run Mode

In order to set the battery high-run mode set the jumper Jmp1 as shown in above picture. This will increase the Low Voltage Disconnect (LVD) settings to 12.3/24.6V and the re-start voltages to 13.3/26.6V to allow pumping only when the batteries receives charging current from the solar array. The lifetime of the battery will be increased considerably as cycling is avoided.

4.6 Power Control for PV-direct Operation

PS150 pumps require different current depending on speed and lift. When low light conditions are present, the PV array cannot supply the required current. If you don't use a controller the voltage will drop to nearly zero, and the pump will "stall" (like a truck trying to start in 4th gear). The pump controller, also called linear current booster (LCB) including Maximum Power Point Tracking (MPPT) acts like a "gear box" in your car. This device will match the power source to the load by transforming the voltage down while increasing the current delivered to the motor (like an automatic transmission).

 **Jumper Jmp2**
Make sure the two left pins are connected for PS150C mode



Jumper Jmp1
Set to activate High-run Mode

5 Trouble Shooting

Please read this section before calling for help. If you call for help, please refer to the model and serial numbers.

If The Pump Does Not Run

Most problems are caused by wrong connections (in a new installation) or failed connections, especially where a wire is not secure and falls out of a terminal. The System ON light will indicate that system is switched on and connected to the controller. It indicates that VOLTAGE is present but (in a solar-direct system) there may not be sufficient power to start the pump. It should attempt to start at intervals of 120 seconds.

Pump attempts to start every 120 seconds but doesn't run.

The controller makes a slight noise as it tries to start the pump. The pump will start to turn or just vibrate a little.

- (1) There may be insufficient power reaching the controller. A solar-direct (non-battery) system should start if there is enough sun to cast a slight shadow. A battery system should start if the supply voltage is greater than 12V (12V system) or 24V (24V system).
- (2) If the pump was recently connected (or reconnected) to the controller, it may be running in reverse direction due to wiring error. See section 4.7
- (3) If the motor shaft only vibrates and will not turn, it may be getting power on only two of the three motor wires. This will happen if there is a broken connection or if you accidentally exchanged one of the power wires with the ground wire.
- (4) The pump or pipe may be packed with mud, clay, sand or debris.
- (5) The check valve on the pump may be faulty or stuck, allowing downward leakage when the pump is off. This can prevent the pump from starting.

Pump Overload

PUMP ON – light shows red instead of green. The system has shut off due to an overload. This can happen if the motor or pump is blocked or very difficult to turn and is drawing excessive current (hard to turn). Overload detection requires at least 250W output of the solar array. This can be caused by a high concentration of solids in the pump, high water temperature, excessive pressure due to high lift or a restriction in the pipe, or a combination of these factors. The controller will make three start attempts before shutting down the system. The System ON LED will be OFF and the red OVERLOAD LED ON. The system will not reset until the ON / OFF switch is turned OFF and ON again.

6 Warranty

2 years warranty in material and workmanship. Details in separate warranty document.

7 System Report

System und Components

Date of purchase

Dealer
(full contact details)

System voltage V

Battery system yes no

Quantity of solar modules

Solar module brand

Module model #

Controller model PS150

Controller serial #

Pump end model #

Pump end serial #

Motor model #

Motor serial #

Installation

Date of installation

Installer
(full contact details)

Well depth m | ft

Pump depth m | ft

Additional vertical lift (to top of tank) m | ft

Static water level m | ft

Drawdown level m | ft

Drop pipe (vertical from the pump)

Size mm² | in

Type

Length m | ft

Additional pipe length (to tank)

Size mm² | in

Type

Length m | ft

Submersible pump cable

Wire size mm² | AWG

Length (controller to pump) m | ft

Max. RPM control

Factory setting is maximum.

yes no

If this setting was reduced,
enter setting here: