Roto RUDRA
ROTO PUMPS' SUSTAINABLE SOLUTIONS

USER MANUAL

SOLAR CONTROLLER
(Without Grid Option)

(0.5 HP)

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Scope:
- 0.5 HP Only Solar Controller with 1 No Monoperc Solar Module

Refer the support section for any clarifications regarding this document

CONTENTS

This manual consists of installation, commissioning and troubleshooting process for Roto Energy Systems Limited solar product offering namely – only solar controller.

The manual is intended for the use by technicians, contractors and other stakeholders that are involved in deployment and operation of Roto Energy Systems Limited products on field.

The following is covered in this document:

1. General information

Introduction

We wish to express our sincere thanks to you for choosing our product Only Solar Controller, manufactured and supplied by ROTO ENERGY SYSTEMS LIMITED.

It is scientifically designed and built to give you long and dependable service. Carefully selection of material and manufacturing assures you a satisfactory performance as per the controller rating. The controller will give you years of trouble-free performance if it is handled with due care.

Roto Energy Systems Limited make energy efficient and environmentally friendly solar controllers are used with submersible positive displacement/centrifugal pumps which satisfies the requirement for handling clear cold and fresh water. It is designed for best in class efficiency which helps in solving the water problem for irrigation, houses, as well as for livestock or other water requirements.

'ROTO ENERGY SYSTEMS LIMITED' Solar Controllers are easy to install, however detailed installation and operation manual is on following pages, for easy understanding and comprehensive first-hand information on these controllers.

Follow safety instructions carefully. Improper use and operation may cause lethal electrical shocks and/or damage to equipment.

Our products are meant for pumping water and they do not have any significant effect on environment during their use, if properly selected and used as per instructions given in the manual. Customers are advised to dispose off unusable components through appropriate disposal agencies to avoid the harmful impact (if any) on environment.

Instructions

Purchasers are cautioned to go through carefully the detailed instructions given for proper installation, use and servicing of the product and genuine spare parts as detailed in company's published literature, manuals, pamphlets or other official publications. Any deviation, if made by the customers, will void the warranty obligations and/or manufacturer's liability, if any, for any compensation consequential or otherwise. Use of trained mechanics will get you better results.

'ROTO ENERGY SYSTEMS LIMITED' Solar Controllers are assured to give delivery output as per the specifications. However, if the specifications and instructions are not followed correctly, the life of controller may reduce and also the performance of pump may get hampered.

The controllers are for pumps which in turn are for clear and cold fresh water for drinking purpose.

During installation and while starting the system, hand gloves should be worn for safety purposes.

All controller units are pre-configured with setting specific to a solar panel and motor combination. It is necessary to adhere to the requirements for correct operation.

Warning

Always take help of a qualified mechanic/electrician while commissioning and starting the system for the first time.

Ensure that the pump is properly connected with the motor and the motor is properly connected with controller.

Ensure all electric joints as well as connections are water proof and covered.

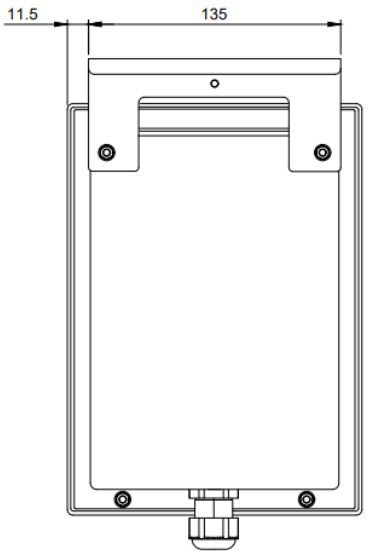
Install controller with the pump set properly as per the rated head range.

Before going for any service of the system, disconnect the power supply.

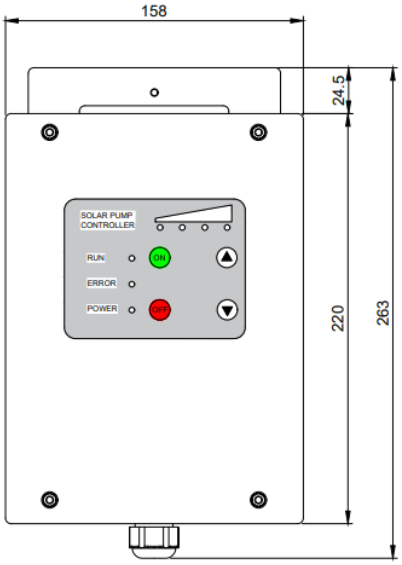
Ensure that proper earthing is given to the controller.

2. Construction

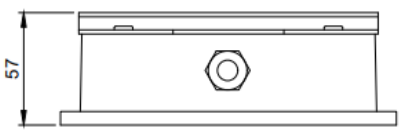
Only Solar Controller



REAR VIEW



FRONT VIEW



BOTTOM VIEW

The outer body of RESL Controllers is made with rugged, high Quality steel and is powder coated. The main external parts of the controller include:

- A LED display with 4 press keys.
- Cable gland with DC supply wires with connectors, motor connection wires, earthing wire, water level sensor wires (for overhead tank and for dry run protection).
- Mounting clamp.
- A branding sticker.
- A warning sticker.
- A product name plate sticker.

3. Technical specifications

The controller is designed for the operation and speed control of a PMSM (DC) Motor. Input DC supply is through current regulated source such as SOLAR panels or SOLAR simulators. The control strategy is based on sensor-less speed control of a permanent magnet synchronous motor (PMSM). The controller can also be configured to work in open loop V/F control mode for AC Induction motor control.

Application:

3-phase permanent magnet synchronous motors for pumping applications at river bed locations/Borewells/Agriculture/Sprinklers/Drip Irrigation/Rural & Urban water supply schemes/ High-rise building/Livestocks/Fountains/Fishery Ponds Water Circulation, etc.

Parameter	**Only Solar Controller**
Rating	
HP Rating	0.5 HP
Controller Input	
DC Power (Wp)	500
Maximum PV Array/ DC Bus Voltage (V)	50

Max. Input DC Current (A)	13
Input AC Voltage (V)	NA
MPPT Range (V)	35 – 40
Controller Output	
Maximum Three Phase Output Voltage (V rms)	30
Max. Output Current Rating (A)	12
Output Frequency (Hz)	0-300
Over Load Capacity (A)	Maximum 120% of rated current set.
Motor types which can beused	PMSM (DC)

PROTECTIONS	
DC Input	Over/Under Voltage, Reverse Polarity
Output	Output Short Circuit, Over Current
	Output Open Circuit
	Un-balance in the output
	Dry Run, dry-run-external
Temperature	Thermal Overload, Over Temperature (Inverse Over Load)
Operational	Water Level
Communication and Interface	
Communication	RS-485 with MODBUS RTU protocol. <8N1> 9600 Baud rate
	(RMU not included)

OTHERS	
Operating Ambient Temperature	-20℃ to +50℃
Humidity Range	0 to 95% RH
Protection level	IP65
Cooling	Natural Cooling
Maximum Altitude	1000 m from Sea level
Suitability for wet locations	Suitable

4. Installation

- Ensure that proper selection of the controller along with the solar modules and the pump set is done based on site conditions.

Unpacking:

- Open the controller's carton box. The contents of the box are packing materials and the controller itself. Take out the controller carefully.
- Check for physical damages. If there any visible damages to the unit, do not use it. Damages may have resulted in internal problems.
- Check and note the serial number of the controller. Verify that the specifications and material code are correct for the purposes of the installation.

Controller Mounting:

- Ensure secure fit of the controller.
- If wall mounted, examine the wall's rigidity and construction details.
- Ensure proper earthing and Attach the drive's earthing system.

Controller connection with the DC Input:

- Connect solar panel input connectors correctly. It has to be ensured that positive and negative marked MC4 connectors are connected to same respective polarities of the solar panels. Use multimeter to verify the same.

- If solar input is connected properly, all of the controller's LED will light up for 1 sec. to indicate power ON Status. RUN LED starts blinking indicating READY TO RUN state. **INTERNAL FAN IS ALWAYS ON .** If it doesn't recheck voltage and polarity of solar panels. Discard the unit if power input is correct and the system still doesn't turn on.

Controller connection with Motor-Pump Set:

- Verify that the motor name plate is compliant with controller name plate for correct operation.
- Before assembling the motor and pump, connect motor terminals to the output cables of the controller by matching the colour codes. It is advised to check the resistance of all three phase of motor before the motor is connected. There should not be a variation of more than 5% per phase. The motor should otherwise be discarded.
- Connect motor cable terminals to the motor output cable of the controllers in correct R-Y-B sequence. Connecting in wrong sequence will lead to opposite rotation and may lead to damages in certain types of pumps.
- Ensure proper earthing for the controller and the motor.

Not connecting the earthing properly may lead to motor leakage current shocks to the user and also may damage the drive in the long run.

- In case of only solar controller, start the motor by pressing the ON button in the controller.
- Ensure that the motor is running in the correct direction as per the arrow marked in the motor. (in case the motor runs in opposite direction interchange any 2 wires from the controller output to motor input)
- If the motor starts spinning without issues, ensure that it is turned off within 30 seconds.
- The motor and pump can now be coupled properly.
- The cable from the controller to be connected with cable from the motor using proper joining kit so that there is no short circuit.

- For overhead tank overflow protection yellow and black wire from the controller to be connected with suitable sensor. The sensor to be placed in a suitable position in the overhead tank.

- For dry run protection white and black wire from the controller to be connected with suitable sensor. The sensor to be placed atleast 1 meter over the pump delivery nozzle.
- The motor and pump can now be installed inside the bore.
- Turn on the system again to observe water output and proper operation.

In case the pump set fails to run properly or controller LED shows error, it could be a controller tunning issue. Verify motor-controller configuration or contact service person.

5. Operation

For an end user, operating the system is quite straightforward.

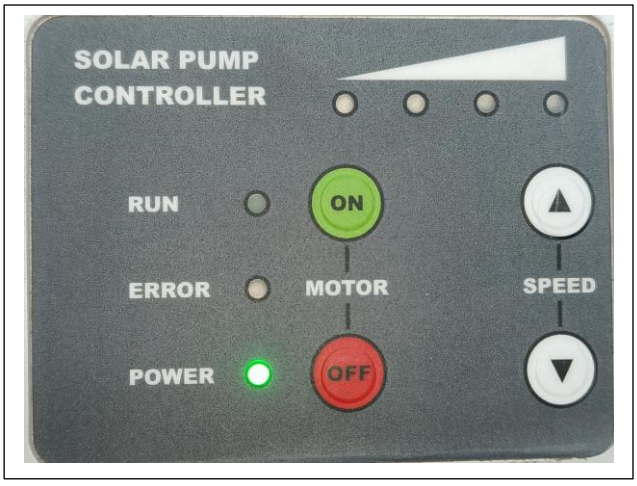
Following are the key points:

- Motor can be turned on or off by pressing the suitable ON/OFF button in the controller.
- While, Roto Energy Systems Limited controller and submersible positive displacement pumps do not require day-to-day maintenance if properly selected and installed, it is a good practice to monitor the conditions and performance of the system. Consult the pump service chart for further diagnosis of possible causes.
- If system fails to run, report the issue on the telephone number provided. Serial number and model of the controller, motor & pump along with the Invoice serial number should be kept handy while reporting the issue. If Error LED in the controller is continuously ON, it should be noted down and reported on the call.
- Alternatively, end user may report the issue to their respective system integrators/dealer who in turn can report the issue to Roto Energy System Limited.

Procedure to operate the drive controller:

- Connect drive controller SOLAR input to SOLAR PV Panels with Voc maximum 50 V and Vmp in the range of 35~42V. Ensure Red (+) positive and Black (-) Negative terminal connection from solar or from a DC source / solar input. A stiff DC source can create a huge inrush current causing input DIODE failure, so use a current limited DC Source. Also, DC input supply can be gradually increased to about 41~45V when testing with a Rectifier stiff DC Source.

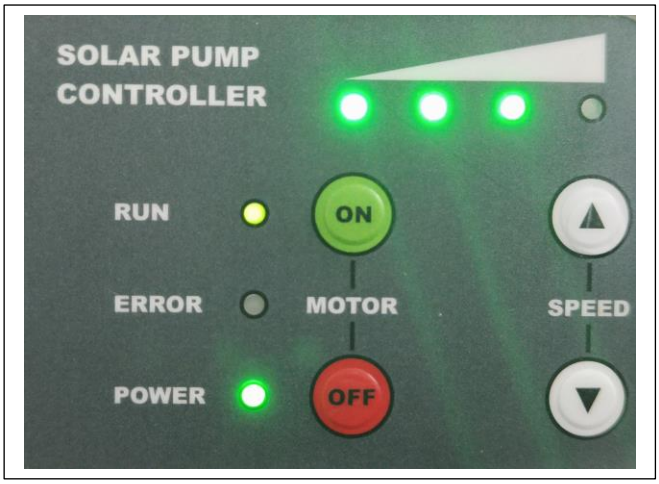
- By connecting Solar Module or switching ON the DC Source, controller comes ON with All LEDS glowing for about 1 second to indicate power ON Status. RUN LED starts blinking indicating READY TO RUN state. **INTERNAL FAN IS ALWAYS ON**



- Ensure that the Motor / pump is free to rotate, press ON Button.

- Motor starts rotating and reaches the maximum power / frequency of operation based on the Input power available. In case it is a solar input, motor runs to such a speed to attain maximum power point (MPPT Mode). In case of Stiff DC source input, motor runs to maximum speed.

- Four Numbers of SPEED LEDs indicate the frequency % at which the motor is running. As the frequency reaches maximum (250Hz), all 4 LEDs glow indicating full speed.

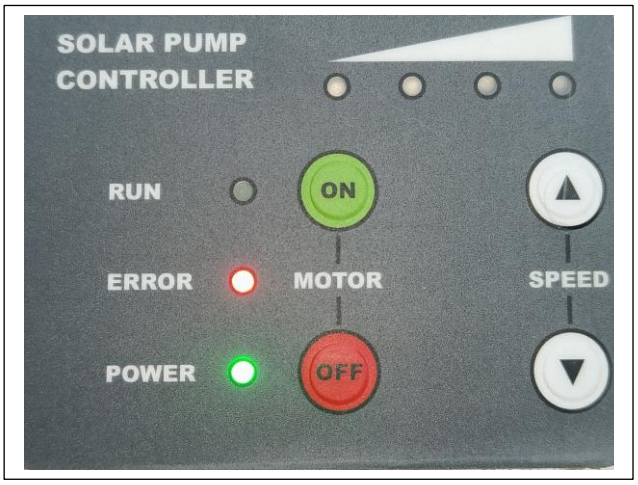


- Speed / frequency of operation is limited by the maximum operational current that is allowed from the controller. With the default settings, maximum RMS Motor currents to the range of 14~15A RMS are possible for certain duration. Whereas, 12A RMS is the continuous rated current of the drive controller.

- Press and HOLD the UP + DOWN keys together for about 6 seconds, drive enters MANUAL / Keypad control, wherein, user can adjust the speed of operation using UP/DOWN keys.

- Pressing UP DOWN keys together again for 6 seconds will set the controller back to MPPT mode of operation.

- If any fault occurs, ERROR LED/RED LED will glow and to reset the fault press OFF Button.



6. Precautions

Apart from the precautions mentioned in the rest of the sections, the following should be followed for correct and hassle-free operation:

- Handle the controller with care. Follow instructions on packaging carefully for correct handling.

- Do not stack for a more than 3 units in a column during storage or transport.

- In any case applied voltage should not exceed the permitted voltage range, it can harm the controller.

- Connect wires with standard connection procedures to avoid short circuits, voltage drops and other electrical problem. All connections should be properly done to avoid any sparking

- Ensure earthing is done correctly.

- Use correctly size cable gauges for DC, Motor and Earth connections

- Ensure that IP65 is not compromised due to damages of gaskets and the body.

- It is advisable to mount controller under the shadow of any object like solar panel.

- Do not cover the controller by any material like polythene, cloths etc. as it may cause over heating of the controller.

- The wiring work should be done by qualified electricians

- High voltages exist inside the enclosure. Wait for 10 minutes after disconnecting the power source (PV Panel input) before accessing the circuits. All LED's inside the controller should be off.

7. Faults

Sl. No.	Error LED - RED	Cause for the fault	Fault reset/ Clearing method	Fault reset time
1	DC UV Fault	Input DC < Rated	Input DC reaches rated value	Automatic
2	DC OV Fault	Input DC > Rated	Input DC reaches rated value	Automatic
3	!Over Temp!	Heatsink Temperature > 85℃	Heatsink Temperature is less than 85℃	1 Min
4	!Water Level!	Fault set when "EXT Input Set"is set to Water level sensing and it is activated	Deactivating external fault inputs	Automatic

5	!DRYRun/EXT!	When parameter “FAULTInputSel”is chosen to be ACTHi or ACTLo, Internal DRYRUN measurement is disabled and drive trips for external signal input	When externalinput command clears	Automatic
6	!Unbalance!	Output motor cable open	Proper wiring	After 1hour
7	Inverse OL	Overload fault following an inverse curve with the limits 110% for 30min and 130% for 10sec	Reducing the load within 110%	After 10 minutes
8	OC in Acceln	When motor is locked or pump jammed	Clearing Lock or Jam	After 1 hour
9	OC in RUN	Current crosses rated value while running	Clearing the Lock or JAM Proper motor wiring	After 1 hour
10	!Output SC!	Output Short Circuit	Clear Short Circuit	Power recycles
11	!Over Speed!	For PMSM only. Estimated speed is more than 3800rpm	Motor tuning parameters to be rechecked	After 1 hour
12	!OUTPUTOPEN !	For PMSM only. Motor is not connected	Check motor connection	After 1 hour
13	Motor Stall	Motor draws excessive current at lower speed than minimum speed	Mechanical assembly to be checked	After 1 hour

The warranty is void for the following conditions:

Sl No.	Conditions
1	Repair, modification or movement of the product or parts by buyer oranyone other than seller or its authorised representative or incorrect attachment to other products not provided by seller.
2	Damage resulting from Power Surges and acts of nature, including but not limited to storms, lightning, over voltage, fire, flood, pests, or other events outside the control of Seller.
3	Damage resulting from abuse, misuse, negligence, accident, action of third parties, improper or non-compliant use of operation including inadequate ventilation and circulation, improper installation, commissioning, and maintenance.
4	Damage resulting from improper start up, storage, excessive pollution,and dirt or dust intrusion into the product.
5	Installation in a highly corrosive environment.
6	Abnormal or unintended use.
7	Damage during transportation.
8	Damage resulting from the external connected equipment.
9	Damage resulting from failure to properly maintain the products.

8. Support

For sales related enquiry:
Visit www.rotoenergy.com

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