TUHORSE

SOLAR PUMP SPECIALISTS

USER MANUAL

AC/DC-EXT SOLAR HYBRID SUBMERSIBLE PUMPS

Document Control & Revision History

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This document is controlled and maintained in accordance with Tuhorse's quality management system. It is the responsibility of the user to ensure they are referencing the current revision. Updates and changes are recorded in the revision history. For the latest version, please contact admin@tuhorse.com.au.

Revision History

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1.0	01.06.2025	First release of new UM	EC

Accreditation/Certification

Tuhorse is a Responsible Supplier registered under the EESS in Australia. Our pumps are manufactured in facilities accredited with ISO 9001 quality management systems, ensuring each product is rigorously tested to meet stringent safety and performance standards

Contents

1.0 - Introduction

Thank you for choosing Tuhorse!

Tuhorse solar pumps are designed to deliver high-quality, reliable, and efficient water pumping solutions, built to withstand the demanding conditions of Australian agriculture. Our advanced technology ensures ease of installation and operation while maintaining exceptional performance and durability

To get the most out of your Tuhorse pump, it is essential to understand its capabilities and installation requirements. This manual provides all the necessary details on system setup, operation, and maintenance to ensure safe and efficient use.

Our AC/DC Solar Submersible Pump's must be installed by a licensed professional. We strongly recommend reading this manual carefully to ensure you get the best performance from your system. If you require further assistance, please contact our support team on (02) 8005 2823, Monday to Friday 9am to 5pm AEST.

2.0 - Precautions before Installation

- **Read the full manual before starting your pump**
- **The pump and the Control Box** must be installed by a licensed professional
- **Always disconnect power before servicing.**
- **Solar panels generate live DC current when exposed to sunlight**

⚠️ *Treat all solar wiring as live. This poses a serious shock or fire hazard. Use caution when handling solar connections and avoid working in direct sunlight when wiring solar arrays.*

- **Pay attention to the pump wiring.**
- **"L" and "N" are AC power input terminals, "P+" and "P-" are DC power input terminals.** Do not connect power cables to terminals "1", "2", and "3", otherwise the Controller will be damaged when the power is turned on.
- **The solar panel/power supply voltage** should not exceed the maximum Open Circuit Voltage (Voc) of the Controller of 430V DC or 240V AC. Do not share the load of the power supply with other equipment as it can damage the Control box.
- **The electrical specifications of the pump** must match the output power specifications of the Controller
- **The pump and control box must be grounded**
- **Always use a Stainless-Steel safety cable** to support and raise/lower the pump
- **Recommended max submersion** depth is 100m
- **Install a lightning arrestor** at the highest point of the solar panel assembly
- **Before powering on**, it is essential to use a Multimeter to detect the open-circuit voltage of the solar panel or apply the knowledge of series and parallel connections to calculate the open-circuit voltage of the solar array.

Whilst the pump is running

- **Do not disconnect** the pump from the Controller whilst in operation – this will cause irreversible damage to both the pump and the Controller
- **Do not touch** or inspect the components of the circuit board when the Controller is running. If you need to open the Control box, ensure there is no power going into the Control box.
- **Do not touch** the radiator or other hot parts when the Controller is running to avoid burns
- **The installation and servicing** must be completed by a licenced professional
- **Beware of the sharp edges** on the radiator

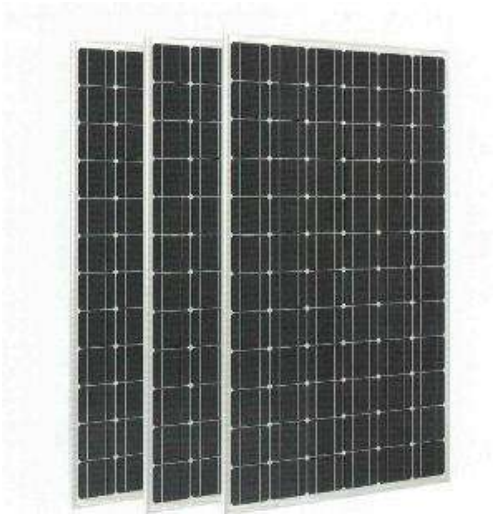
3.0 - System Components

Your Tuhorse AC/DC pump system includes:

Submersible Pump + 3m Pump Power Cable
Designed for high-efficiency water pumping.

Pump Control Box
Manages power distribution and pump operation.

Solar Panels (not included in some packages)
Converts sunlight into DC power.



Water Level Sensor
Pump Protection Sensor (low bore level)
Water Tank-full Sensor (high tank level)

You may be interested in these additional accessories to supplement your pump –
Call us on 02 8005 2823 if any of these items interest you

4.0 Pump and Control Box specifications

Specifications	Output
Power	2200W
Wide voltage input	DC 70-380V AC 90—240V/50HZ
The maximum input open-circuit voltage (Voc) of the Control Box	430VDC
Solar array connection	Series
Current range	1.5-14A
Rotational speed range	500-4500RPM
Insulation class	F
Protection class	IP68
Ideal liquid PH range	5 ~ 9
Ideal liquid temp	0 ℃ to 40 ℃
Maximum sediment concentration	0.1% by volume

Ideal pumping liquid:

This product is suitable for liquids that are non-viscous, clean, non-corrosive, non-explosive, and free of solids or long-fiber particles that are large like sand.

4.1 Characteristics and main functions of water pumps

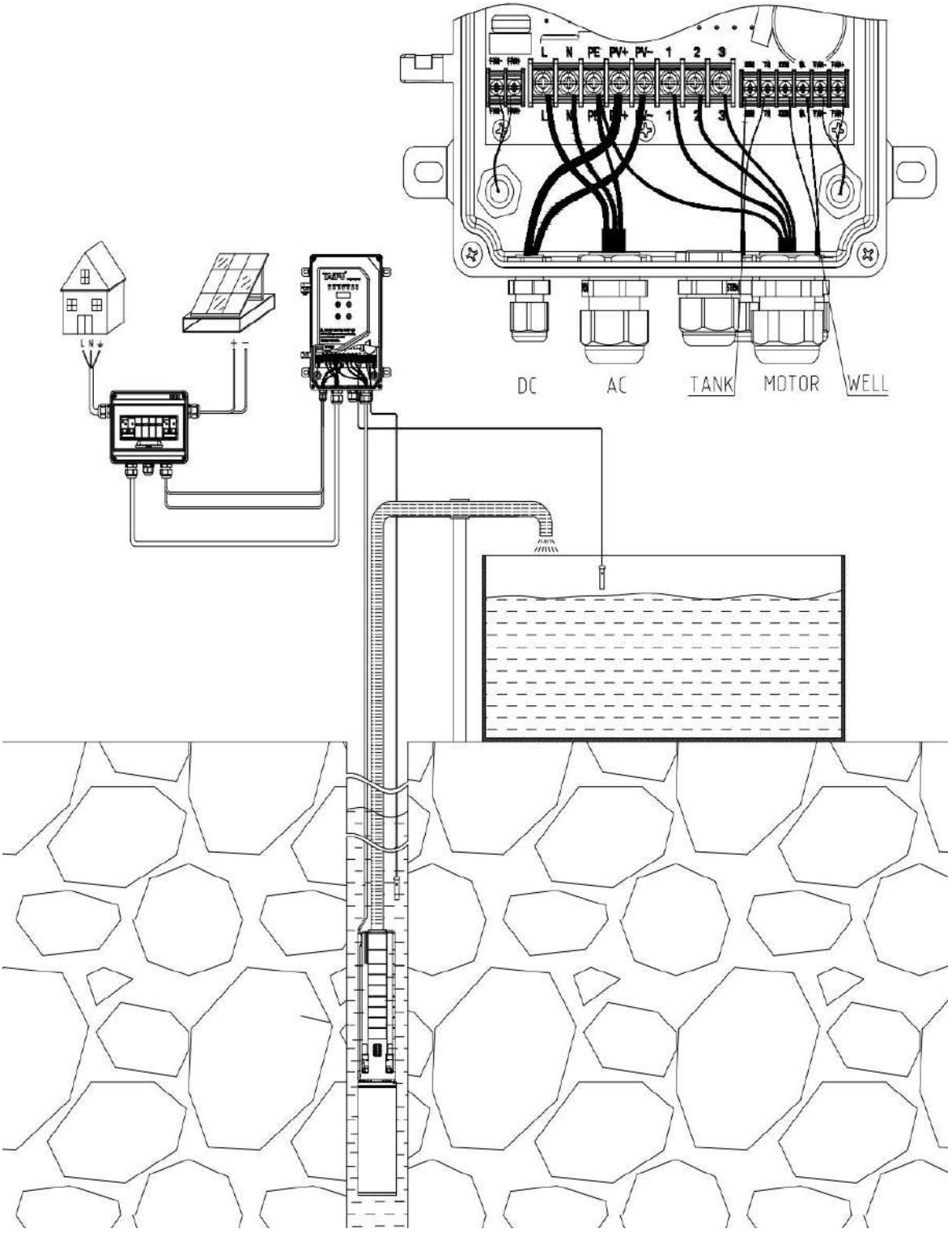
- Brushless permanent magnet double-shielded motor frequency converter and FOC motor controller
- Soft start operation extends the service life of the system
- Powered by AC/DC, the power supply voltage range is 60-430 VDC or 90-240VAC/50Hz
- The MPPT function can track the maximum power of solar energy to over 99%
- The PFC function can ensure that the AC power factor is above 0.99
- The FOC has high efficiency, and the motor has high efficiency
- No-load protection, overload (load) protection, over-temperature protection, overcurrent protection device, overvoltage protection, phase loss protection, and locked rotor protection.

4.2 Description of Controller protections

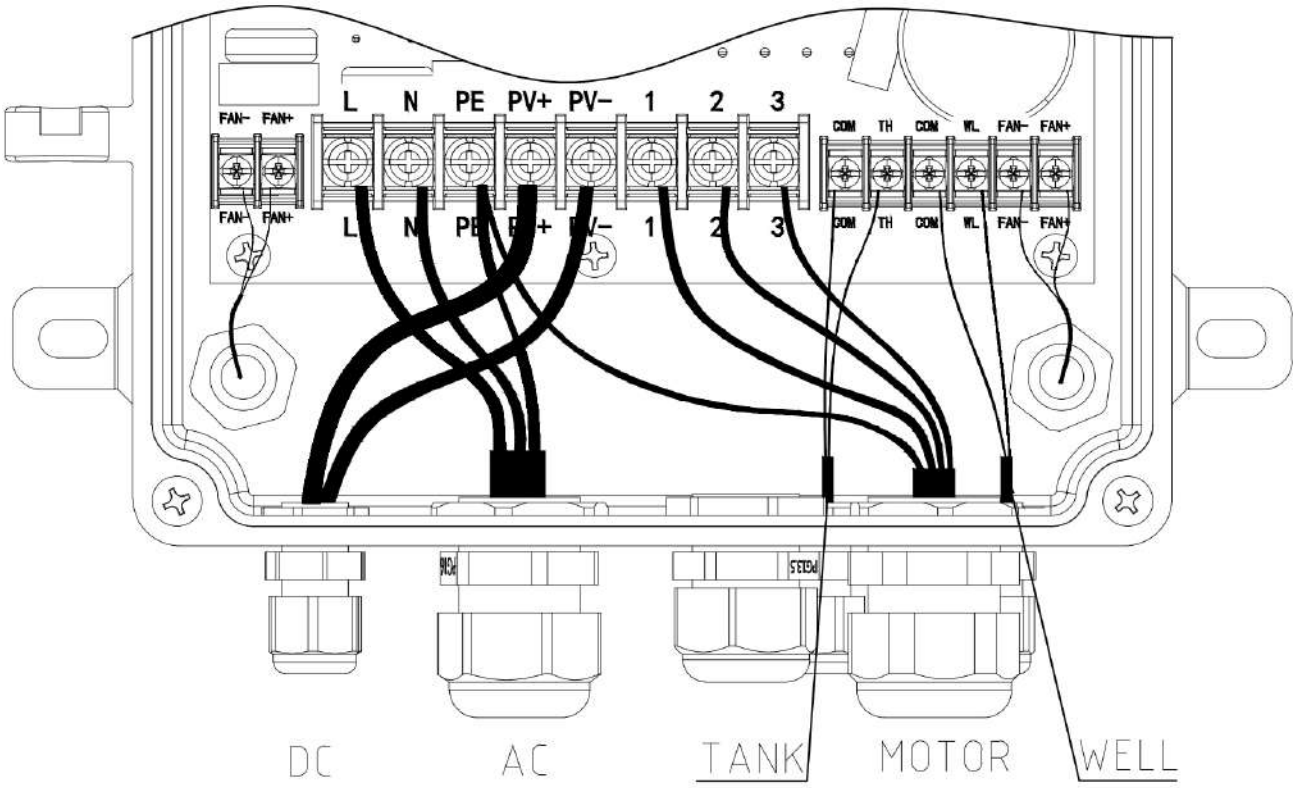
Function	Detailed introduction
Reverse connection protection	DC = “P+”, “P-” & AC = “L”, “N” Input "p+" and "p-" for solar panels; The AC input "L" and "N" are connected regardless of polarity
Overload and short circuit protection	If the peak current exceeds 20A or hardware short-circuits at startup, the Controller will stop immediately and will be restored only after troubleshooting.
Over temperature protection for IPM	When the external temperature of the IPM reaches 105℃, Controller will automatically stop and resume when the internal temperature drops to 70℃.
Over/Under voltage protection	Over voltage protection: Controller stops automatically when the input voltage exceeds 430VDC, and resumes working when the input voltage drops to 400VDC. Under voltage protection: Controller stops automatically when the input voltage is less than 60VDC, and resumes working when the input voltage rises to 75VDC or greater.

5.0 Installation guidance

Installation instructions: It is recommended to install a surge protector at the front end of the Controller. The surge protector needs to be grounded.



5.1 Control box terminal connections



Terminal	Connection
L	Connect to Live
N	Connect to Neutral
PE	Connect to the ground
PV+	Connect to the positive pole of the solar panel
PV-	Connect to the negative pole of the solar panel
1	connect to pump wire 1 (black cable)
2	connect to pump wire 2 (blue cable)
3	connect to pump wire 3 (brown cable)
COM	Connect with water level sensor of tank
TH	Connect with water level sensor of tank
COM1	Connect with water level sensor of well
WL	Connect with water level sensor of well
FAN-	Connect the negative terminal of the fan
FAN+	Connect the positive terminal of the fan

5.2 Light Indicators in the Control Box

Lights	Details	Description	Recovery time
SYS	Light on	The system starts normally	
	Light off	The Controller is off.	
PUMP	Light on	The water pump begins to start.	
MPPT	Flash	Pump is generating power	
ERR_I	Flashing	The digital display will show the error code, please refer to specific error details	
WATER	Light on	Either the water tank is full, or the well is low	
	Flashing	In recovery mode	≥15min
AC	Light on	The Controller has been connected to AC power	
	Flashing	AC electricity is being used	
DC	Light on	The Controller has been connected to DC power	
	Flash	DC electricity is being used	
Note: In forced mode, the light flashes uniformly and slowly. In automatic mode, it lights up and flashes quickly			

5.3 AC/DC automatic switching mode

When both AC and DC power sources are both connected, it defaults to supporting automatic power source selection. In this mode, the DC input is prioritized.

In DC input mode, if the running power is consistently below 450W for a long duration (approximately half an hour) or if it enters an undervoltage state multiple times, it will automatically switch to AC input.

In AC input mode, after the first two switches, it will attempt to reconnect DC power after a half-hour interval. If the DC power can sustain operation for more than one hour, the accumulated switch count will be cleared. If the running conditions are still not met, it will switch back to AC. If the number of switches exceeds three, it will attempt to switch back to DC mode after a one-hour interval.

5.4 Variable pump speed adjustment

	Button	Control
1		Start or stop the water pump
2		When the countdown ends after startup, press briefly to enter the speed and power Setting. **Hold down again** to **save** the changed power/speed settings
3		**In setting mode**: it increases the value. **Outside of setting mode**: this button cycles through the display of voltage, current, power, and running accumulated time.
4		**In setting mode**: it decreases the value. **Outside of setting mode:** this button cycles through the display of voltage, current, power, and running accumulated time.

6.0 Introduction of water level sensor

Water level sensor for tank: The tank level sensor detects the water level of the tank. Once the water level of the tank is too high and reaches the water sensor, the pump will be stopped. During installation, the "COM" and "TH" are connected to the water level sensor and installed near the top of the water tank. When the water level drops below the well sensor, the pump will restart automatically after 15 minutes (±2 minutes) to prevent continuous stop/start.

Water level sensor for well: The well level sensor detects the water level of the well. Once the water level of the well is too low and drops below the sensor, the pump will be stopped. During installation, the "COM1" and "WL" are connected to the water level sensor and installed more than 500mm above the position of pump outlet. When the water level increases and resubmerges the sensor, the pump will restart automatically after 30 minutes (±2 minutes). (Note: If the water level sensor is not connected, the "COM1" terminal and the "WL" terminal needs to be bridged.)

7.0 Key inspection items before operation

- Check whether the fixing screws of the Controller are tightened and whether the connectors are loose.
- Check whether the line connection is correct, focus on the power connection.
- Ensure that there is no short circuit

8.0 Maintenance

Precautions during maintenance

- Cut off the input power of the Controller before maintenance
- Disassembled metal accessories should not be placed in the controller to prevent short circuit of the circuit board
- After maintenance or repair, keep the inside of the Controller clean to prevent the intrusion of dust or liquid.

Regular inspection items

- Check that the voltage of each panel in the solar module system is in the corresponding normal range.
- Check the terminals and connectors to ensure they are not loose
- Check and clear any dust, iron filings and corrosive liquid inside the Controller
- Check for abnormal sound or vibration of the water pump during operation

9.0 Control Box Error Codes

Error code	Meaning	Solution	Display priority
E 003	The DC input is under-voltage	Check Voltage of Power Supply	1
E 009	The AC input is under-voltage	Check Voltage of Power Supply	2
E 001	IPM overcurrent	Board is corrupted - replace the circuit board	3
E 002	Software overcurrent	Board is corrupted - replace the circuit board	4
E 004	Dc input overvoltage	Check Voltage of Power Supply	5
E 005	Phase loss	Check the output cable of the pump motor	6
E 006	Blocked rotor, failed to start	Front slack guide motor	7
E 008	Over-temperature	Check the fixing screws of the fixed drive board	8
E 011	Low power, Bus under-voltage	Check Voltage of Power Supply	9
E 010	PFC overcurrent	Board is corrupted - replace the circuit board	10
E 012	The current sampling bias is abnormal	Board is corrupted - replace the circuit board	11
E 013	MCU corrupted	Board is corrupted - replace the circuit board	12
E 014	The input power supply has lost power	Check the input power supply	13
E 015	The AC input power supply is abnormal	Check the input power supply	14
E 016	The DC input power supply is abnormal	Check the input power supply	15
E 017	Software dry running protection	There is no load on the pump – check water source	16
E 018	Overvoltage of the AC input	Check Voltage of Power Supply	17
E 019	Bus Overvoltage	Check Voltage of Power Supply	18
E 020	Bus Undervoltage	Check Voltage of Power Supply	19

Note: When there is no water in the hardware or the hardware slot is full, the EER_I indicator light does not light up. The ERR_I indicator light for low-power protection flashes frequently, while the rest of the faults remain on constantly. If several faults occur simultaneously, they will be displayed first in the order of ranking.

10.0 Site selection and setting up your Solar Array

In most parts of Australia, the sun's position in the sky changes throughout the year, which can impact the performance of your solar pump system. However, for simplicity and reliability, we recommend installing the solar array in a fixed position.

For installations in the southern hemisphere, including all of Australia, solar panels should face true north for optimal exposure to sunlight year-round.

To achieve the best overall performance throughout the year, mount the panels at a fixed tilt angle equal to the **LATITUDE** of the installation site. This setup offers a good balance between summer and winter solar gain, without requiring any manual adjustments.

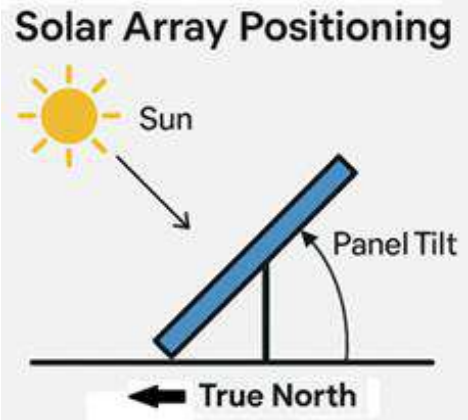


Figure 1: Panel installation diagram in Australia

Recommended Fixed Tilt Angles by Location in Australia

You can refer to Google Maps on your phone for your specific location's Latitude.

Location	Latitude (°S)
Darwin	12°
Brisbane	27°
Sydney	34°
Canberra	35°
Melbourne	38°
Hobart	43°
Adelaide	35°
Perth	32°