For Models VS212 - VS418

Sun Pumps Inc.

SOLAR PUMPING PRODUCTS

The Ultimate Inverter For Solar Pumping Applications

www.sunpumps.com

Table of Contents

SunPumps - Variable Speed AC/DC Pump Controller

1.1 Introduction

SunPumps Variable Speed Pump Controllers contain a multitude of features that most people never use so this manual is a simplified version that covers all the standard features that are most common. The advanced manual is available from SunPumps upon request.

1.2 Product Overview

SunPumps range of inverters were created to power traditional single phase split capacitor or three phase, AC pumping systems using photovoltaic energy. In this way it is possible to convert most existing AC pumping system to use renewable energy and still use the same pump and grid power at night or on cloudy days.

This inverter also offers complete protection against over-voltage, over-current and dry running. The MPPT (Maximum Power Point Tracking) function allows maximizing the electrical power obtained from the solar panels for maximum water production. When irradiation increases, the pump speed increases and thus the water flow increases. When the irradiation decreases the pump frequency decreases and consequently the flow rate decreases but continues to pump water until the irradiation falls below the minimum necessary for the water to reach the surface. The frequency at which the flow rate stops is the frequency you adjust the low turn-off frequency to plus 5% to 10%.

The MP (Mulit-Power) versions can be powered by photovoltaic panels, three phase AC grid power or a three phase AC generator. When installed, the HMA transfer switch automatically transfers the power from one energy source to another based on the following multiple logics that can be selected by the user:

- Irradiation level
- Time of day
- Achievement of the required daily flow rate
- Remote control via digital input

Designed to Last

Sun Pumps - Variable Speed Inverter is built entirely of aluminum to ensure maximum cooling and durability. All other metal parts are made using AISI 304 stainless steel, making them resistant to corrosion.

Two independent external fans and an internal fan provide perfect cooling. Their operation is adjusted according to actual thermal conditions, thus extending life.

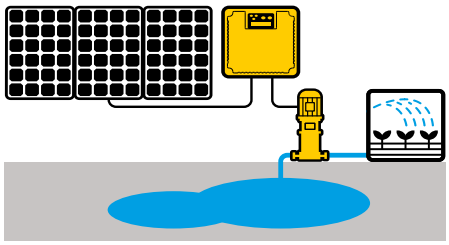
Electrical Characteristics

- Rated ambient temperature: -10 to 50 °C (14 to 122 °F).
- Operating temperature: -10 to 60 °C (14 to 140 °F).
- Max altitude at nominal load: 3280 Feet, (1000 meters).
  Power derating beyond maximum altitude of 3280 feet is -1%/328 feet, (100 meters).
- Protection degree: IP66 (NEMA 4X) (Size 2), IP54 (NEMA 12) (Size 3, 4).
- Digital outputs configurable as N.O or N.C:
  1. Motor run signal
  2. Alarm signal
- 4 digital inputs, configurable as
  N.O or N.C, for motor start/stop (**float switches**)

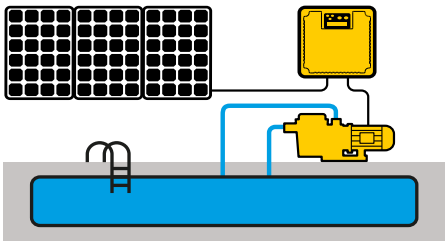
1.3 Pr3duct Applications

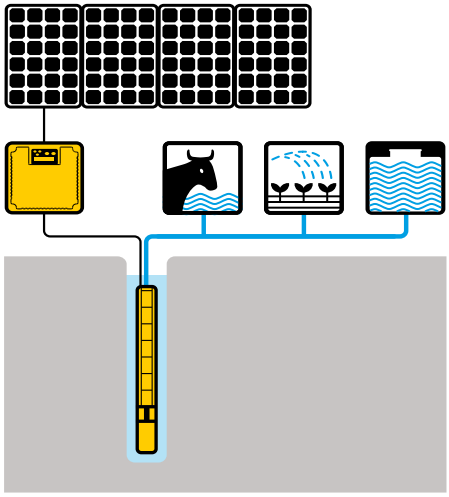
Sun Pumps - Variable Speed Controllers can be used with any type of traditional 3 phase AC pump, thereby offering maximum flexibility in several areas of application.

When using surface pumps, this device can be used for irrigation systems drawing water from a nearby water supply, or powering a pool pump at no cost.



When using submersible pumps it is possible to fill tanks for watering livestock or simply irrigating lawns or crops.

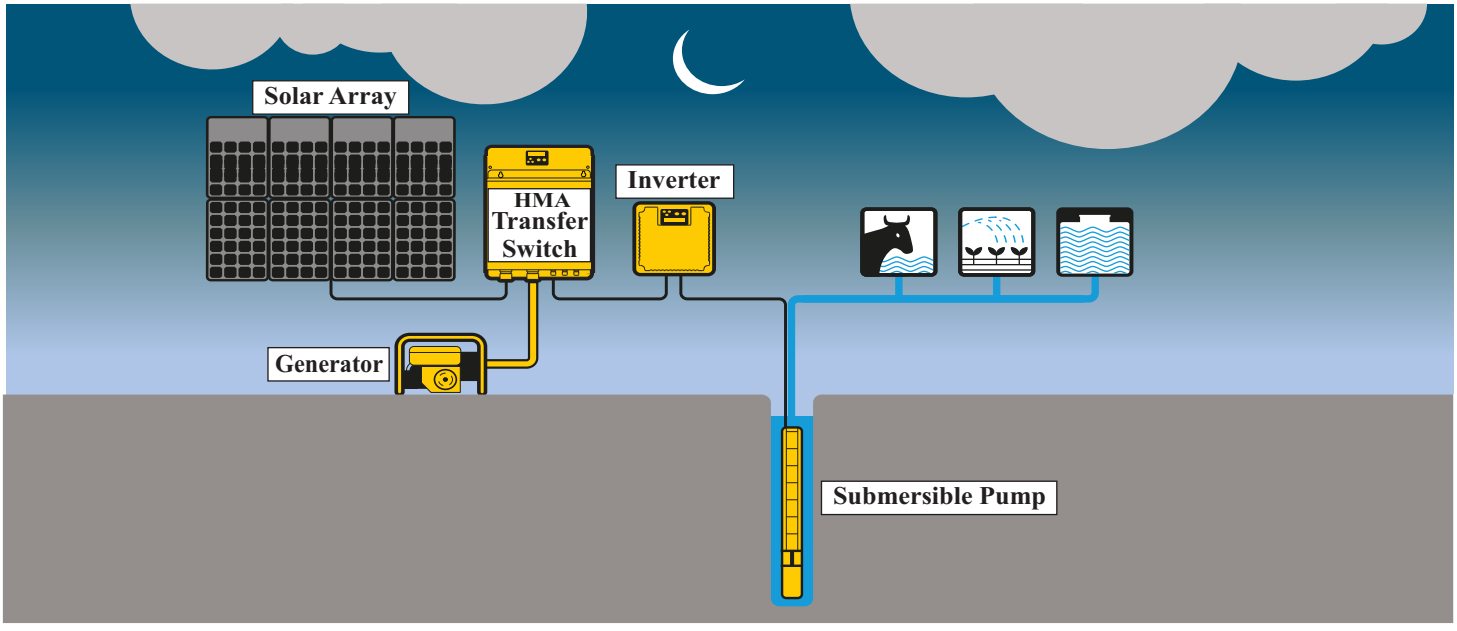




The MultiPower inverter version (MP), can be powered by DC solar panels, or by the AC grid or an AC generator.

This feature ensures that the pump will function at any time of the day by controlling the peaks of the water demand by using AC power to avoid the over-sizing of the photovoltaic array. The HMA transfer switch used in combination with the solar modules, grid power or generator. It automatically switches power from one source to another depending on several options that can be selected by the user.

- Irradiance level.
- Hour of the day
- Multiple power sources allow daily power requirements to be met.
- Remote control through digital command



1.4 General Inverter Specifications

Power supply frequency	50 - 60 HZ (+/- 2%)
Voltage unbalance between the power supply phases	+/- 2%
Maximum output frequency	300 HZ
Over-voltage category	III
IMC compliance	EN61800-3 C2
Energy efficiency class (according to EM61800-9-2)	IE2
Relative humidity of the operating environment	5 - 95% non-condensing
Workplace temperature	From14 deg. F (-10 deg. C) to 140 deg. F (60 deg. C)
Maximum workplace temperature at nominal load	122 degree F, (50 degree C)
Power derating beyond maximum temperature	-1.4% for every degree F, (-2.5%every degree C)
Maximum altitude at nominal load	3280 feet (1000 meters)
Power derating beyond maximum alitude	-1% every 328 feet (100 meters)
Protection rating	IP66 (NEMA 4X) IP54 (NEMA 12) sizes 3 & 4
Resistance to vibrations	EN60068-2-6:2008, EMEN60068-2-27:2009, EN60068-2-64-2008

WARNING
Protect the device from direct exposure to weather and sunlight.

NOTE: The maximum altitude at normal load is 3280 feet (1000 meters) so the inverter power must be derated by -1% for every 328 feet above the nominal max altitude.

Example: The installation altitude is at 7000 feet (3134 meters).
Take the workplace altitude of 7000 feet and subtract the 3280 max rating which = 3720. Then divide this by 328 feet = 11.3%.

7000-3280 = 3720 feet. 3720 /328 = 11.3% power derate factor.

If you were installing a 7.5 HP 460 VAC pump rated at 11.5 amps you would typically use a VS412 inverter rated at 12 amps. Derating the inverter by 11.3% would be as follows: 11.3% of 12 = 1.36 amps. Subtract this from the 12 amp inverter rating and this = 10.64 amps which is less than the 11.5 amp motor rating so you choose the next high rated inverter which is the VS15 rated at 15 amps.

1.5 Inverter Electrical Specifications By Model

	SunPumps Inverter Specifications							AC Fuse & Circuit Breaker Sizing		
Controller Model	Vin DC VDC	Vin Range 3 Phase VAC	* V1 Nom VDC	Controller Output Voltage Range 3 Phase-VAC	I Max Output Amps	Inverter Size	Inverter Efficiency	Recommended Fuse Size Amps	Circuit Breaker Amps	Motor Dia.
VS212	160-650	190-650	320	230-350	12	2	97%	16	16	4"
VS409	320-850	190-640	320	230-460	9	2	97%	16	16	4"
VS409	320-850	190-640	640	230-460	9	2	97%	16	16	4"
VS412	320-850	190-640	320	230-460	12	2	97%	16	16	4"
VS412	320-850	190-640	640	230-460	12	2	97%	16	16	4"
VS415	320-850	190-640	320	230-460	15	2	97%	20	20	4"
VS415	320-850	190-640	640	230-460	15	2	97%	20	20	4"
VS418	320-850	190-640	320	230-460	18	2	97%	25	25	4"
VS418	320-850	190-640	640	230-460	18	2	97%	25	25	4"
VS418	320-850	190-640	640	230-460	18	2	97%	25	25	6"
VS425	320-850	190-640	320	230-460	25	2	97%	30	32	6"
VS425	320-850	190-640	460	230-460	25	2	97%	30	32	6"
VS430	320-850	190-640	320	230-460	30	2	97%	35	40	6"
VS430	320-850	190-640	640	230-460	30	2	97%	35	40	6"
VS438	320-850	190-640	320	230-460	38	3	98%	50	50	6"
VS438	320-850	190-640	640	230-460	38	3	98%	50	50	6"
VS448	320-850	190-640	320	230-460	48	3	98%	63	63	6"
VS448	320-850	190-640	640	230-460	48	3	98%	63	63	6"
VS465	320-850	190-640	320	230-460	65	3	98%	80	80	6"
VS465	320-850	190-640	640	230-460	65	3	98%	80	80	6"
VS485	320-850	190-640	320	230-460	85	3	98%	100	100	6"
VS485	320-850	190-640	640	230-460	85	3	98%	100	100	6"
VS4100	320-850	190-640	640	230-460	100	3	98%	160	160	6"
							98%			
VS4118	320-850	190-640	640	230-460	118	3	98%	160	160	8"
VS4158	320-850	190-640	640	230-460	158	4	98%	200	200	8"
VS4198	320-850	190-640	640	230-460	198	4	98%	250	250	8"
VS4228	320-850	190-640	640	230-460	228	4	98%	250	250	8"
VS4268	320-850	190-640	640	230-460	268	4	98%	315	320	8"

Safety

2.1 Safety Cautions & Warnings

1. The installation, use and maintenance of the product are strictly for qualified personnel who have undergone appropriate training. Any use by unqualified personnel must be carried out under the approval, responsibility and close monitoring of the latter.
2. Failure to follow instructions may result in damage to the inverter, the system in which it is installed and in the worst cases, damage to property or persons with even fatal consequences.
3. During installation and use of product, comply with the general safety regulations, working in a clean dry environment free of hazardous substances and using the appropriate accident prevention tools (gloves, proper shoes and whatever else is necessary).
4. This inverter is suitable for installation in industrial environments. In case of installations in a residential environment, it is recommended to adopt all the safety precautions required by local regulations.
5. Unsuitable use of the inverter, non-original spare parts or tampering with the hardware and/or firmware of the inverter may lead to serious damage to property or persons in addition to the loss of warranty. The manufacturer waives all liability due to improper use of its products.
6. Before commissioning the inverter, ensure the installation is safe and in accordance with local regulations.
7. Use wiring of appropriate type and size according to the electrical design of the load, the ambient temperature and local regulations.
8. Any insulation tests may only be performed in accordance with the manufacturer's instruction. Failure to do so may result in damage to the inverter.
9. Electronic boards and components may be damaged by electrostatic discharge. We therefore recommend not to touch the components.
10. After disconnecting the inverter from the power supply, make sure the load is completely stopped and wait at least 15 minutes before working on it or on the load applied to it.
11. If the motor is a permanent magnet type, the inverter may be energized by the passive rotation of the motor. In this case, both the power supply and the load should be disconnected before working on the inverter.
12. Make sure the inverter is fully closed and all mounting screws are properly tightened before supplying power to it. Do not remove the protective parts for any reason while the inverter is turned on.
13. It is recommended to install the appropriate protection devices, such as circuit breakers, fuses and a residual current device (RCD).
14. Make sure the inverter and loads connected to it are properly grounded with the appropriate connection terminals before commissioning.
    Ensure the grounding system is compliant and refer to local regulations for grounding devices. Each load must be fitted with its own earth ground wire, the length of which must be as short as possible. Do not make interconnected grounding connections. Leakage may exceed 3.5 mA.
15. Do not place any interrupting switching devices between the inverter and the load. Interruption or switching during motor operation may cause serious damage to the inverter .
16. Do not perform insulation tests on the load or power wires without first disconnecting them from the inverter.
17. This inverter should only be used with **centrifugal pumps**, do not use it with other types of loads.
18. Failure to follow the instructions may result in damage to the inverter, the system in which it is installed and in worst cases, damage to property or persons with even fatal consequences.
19. If the inverter remains in stock for more than 24 months from the manufacture date shown on the packaging, it is necessary to check the mechanical integrity of its parts and supply power to it as least once every 12 months to recharge the capicators.

Failure to comply with these instructions may lead to damage to the inverter system and will void the warranty.

Mechanical Installation

3.1 Installation Environment

> **WARNING**
> The environmental specifications stated in the technical data must be strictly complied with.

> **WARNING**
> Do not install the inverter in environments with a risk of exploding, flooding or in the presence of flammable fluids or solids. Ensure sufficient ventilation in the room. Refer to local regulations when selecting the appropriate installation location.

> **WARNING**
> The degree of protection of the inverter is only ensured if at the end of the installation, the cover screws and the cable glands have been properly tightened. Close the holes of the unused cable glands with the appropriate plugs.
> Protect the inverter from direct exposure of weather and sunlight.
> Do not leave the inverter installed with the cover or the cable glands open, even if not connected to the power supply. The infiltration of dust, water or humidity may irreparably damage the circuit board.

> **WARNING**
> To ensure uninterrupted operation, the inverter can gradually and automatically reduce performance before shutting down following over-termerature. However, prolonged operation above the rated temperature leads to a reduction in the life of the inverter.

3.2 Inverter Cooling

The inverter is cooled primarily by forced air circulation through the heat sink. In addition to the heat sink, the inverter also used the remaining surfaces to cool itself. It is therefore necessary to ensure sufficient space around the inverter during installation.

In particular, the distance between the suction and the discharge side of the heat sink and the other surfaces must beat least:

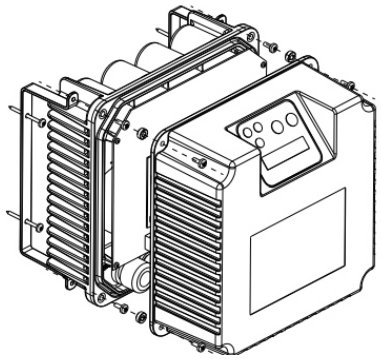
- **6” for a current rating up to 18 amps.**
- **10” for a current rating up to 118 amps**
- **12” for a current rating up to 268 amps**

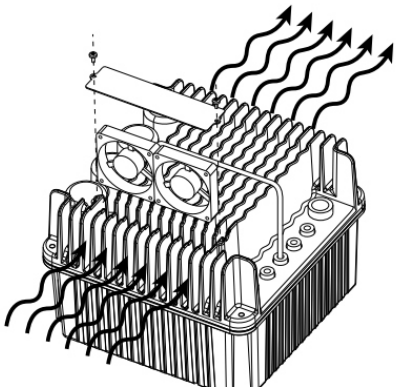
On all other sides, maintain a minimum distance of 4” to ensure cooling and to make the installation and maintenance operation easier.

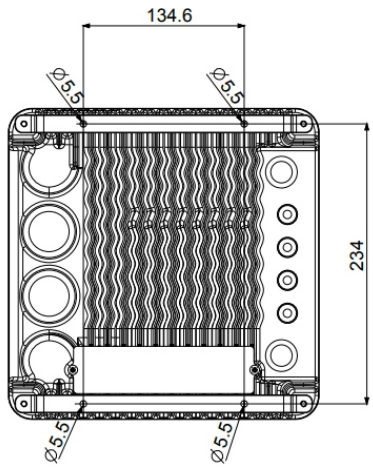
> **During operation, the surfaces of the inverter can become hot enough to cause burns. Do Not Touch Them!**

3.3 Cooling Kit Option

If the inverter is installed in a hot environment and requires additional cooling there is an optional cooling fan kit available. The following is the diagram for the wall kit for size 2 inverters.







The kit includes the following:.

2 - 12 VDC fans. To ensure the unit cools down correctly, respect the flow direction indicated on in the figure when assembling the fans.

1 - Fan cover.

2 - Screws for fastening the fan cover to the heat sink.

2 - Wall fastening brackets with relative template.

4 - M5 screws for fastening the inverter to the brackets.

Electrical Installation

4.1 Grounding

DANGER

Make sure the inverter and the loads connected to it are properly grounded with the appropriate connection terminals before commissioning.

To ensue the grounding system is compliant, refer to the local regulations for grounding devices. Each load must be fitted with its own earth ground cable, the length of which must be as short as possible. Do not make interconnected ground connections. Leakage currents may exceed 3.5 mA.

Refer to local regulations for ground wire sizes.

4.2 Protection Devices

DANGER

It is recommended to install the appropriate protection devices, such as a circuit breakers, fuses and residual current devices. (RDC).

Fuses and Circuit Breakers.

The inverter can protect the motor from overloads by digitally controlling the absorbed current against the set rated current. It is therefore not necessary to install any overload protection device between the inverter and the motor. But it is necessary to install over-current and short-circuit protection devices, such as fuses and circuit breakers, upstream of the inverter. These trigger in the event of failure of a component inside the inverter. Install safety devices on the AC side.

4.3 Wiring

> **WARNING**
> For motor drop wire lengths greater than 20 feet, the use of special **output filters** are required and are available from SunPumps.

> **WARNING**
> Always use wire with appropriate wire terminals, which may be supplied with the inverter.

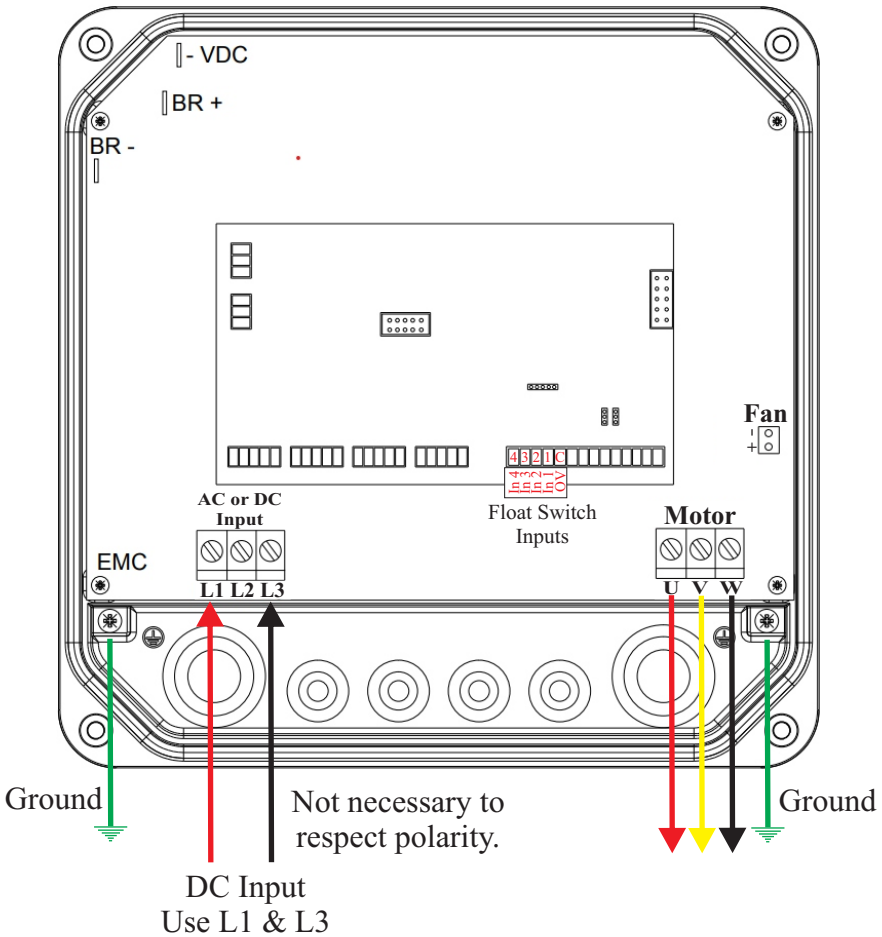
> **WARNING**
> Always use shielded cable for control wire. Install signal, motor and power cables separately from each other at a distance of 12” if possible. In the signal wires cross the power wires, cross them perpendicularly.

4.3.1 Electromagnetic Compatibility (EMC)

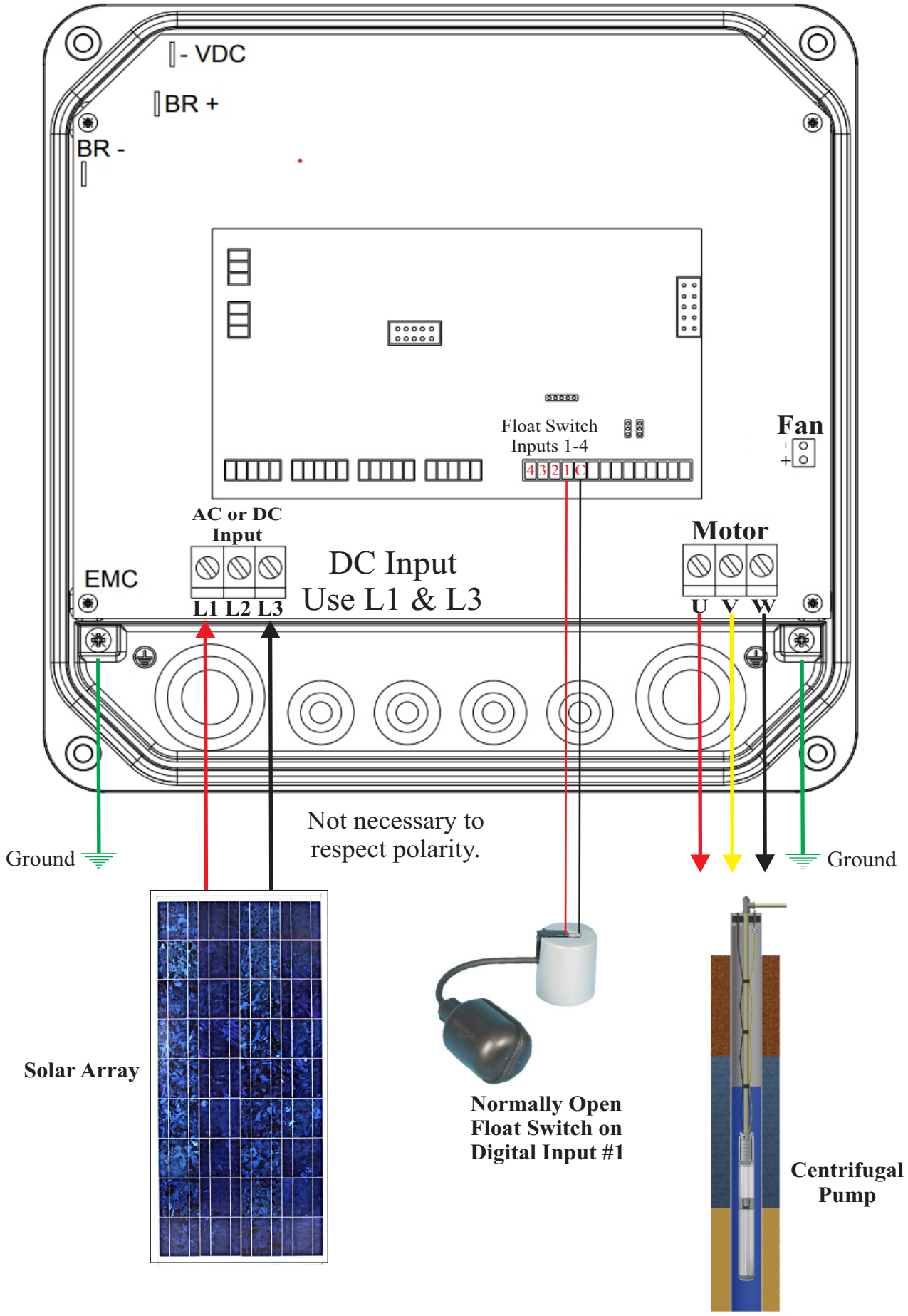
The inverter meets the requirements of electromagnetic compatibility according to the EN6 1800-3 standard. However, to ensure the electromagnetic compatibilty of the system in which it is installed, it is necessary to:

- Use ground connection cables that are as short as possible.
- Use motor drop wire that is as short as possible.
- Use shielded signal cables with the shield connected at on end only.

4.3.2 Electrical Wiring (VS212, VS409 through VS418)



4.3.3 Wiring Diagram



5.0 Pump Selection & Solar Array Sizing.

A pump system must be designed taking into account the daily volume of water required, the total dynamic head and the amount of solar irradiation. Once the flow rate has been determined it is necessary to know the following:

- Rated pump/motor power required.
- Rated motor current.
- Rated 3 phase motor voltage
  230 VAC or
  460 VAC

5.1 Pump Selection

1. Choose a single phase 230 VAC pump or a three phase 230 VAC or 460 VAC pump that meets the dynamic head and flow rate of the daily water requirements. Note the power and current rating of the motor.

2. Review the sizing chart on the following page. It lists both the inverter electrical specifications and the submersible pump electrical specifications which allows you to match the inverter specification to the submersible pump motor specifications you have chosen.

5.2 Inverter Selection

1. Now match the current rating of the inverter to the current rating of the pump motor based on the motor voltage chosen. The inverter current must be equal to or greater than the motor current. In very hot climates it is best if you choose an inverter with a higher current rating than the motor. Pushing an inverter to it's limit in hot weather may cause the inverter to overheat. The cooling fan option is also available for increased inverter cooling.

5.3 Solar Array Sizing

1. In matching a solar array to the pump/inverter system keep in mind that solar modules rarely produce the full rated power because of the efficiency losses due to module temperature and sun insolation. It is recommended that you increase the peak rated wattage (Wp) by 20%-30% and if you are in a poor sunlight area it could be more.

2. If you want the full output of the pump the solar array voltage must meet the nominal inverter input voltage (V1) listed on the chart. To calculate the proper solar array voltage multiply the pump motor rated voltage by 1.4. For example: 230 VAC motor voltage x 1.4 = 320 VDC array voltage and 460 VAC motor voltage x 1.4 = 640 VDC array voltage.

3. The open circuit voltage of each solar string (Voc) must be less than the inverter's maximum operating voltage, listed on the chart. Typically 850 VDC except for model VS 212 which is 650 VDC.

5.4 Altitude Sizing Adjustment

NOTE: The maximum altitude at normal load is 3280 feet (1000 meters) so the inverter power must be derated by -1% for every 328 feet (100 meters) above the nominal max altitude.

Example: If the installation altitude is at 7000 feet (3134 meters).

Take the workplace altitude of 7000 feet and subtract the 3280 max rating which = 3720. Then divide this by 328 feet = 11.3%.

7000-3280 = 3720 feet. 3720 /328 = 11.3% power derate factor.

If you were installing a 7.5 HP 460 VAC pump rated at 11.5 amps you would typically use a VS412 inverter rated at 12 amps. Derating the inverter by 11.3% would be as follows: 11.3% of 12 = 1.36 amps. Subtract this from the 12 amp inverter rating and this = 10.64 amps which is less than the 11.5 amp motor rating so you choose the next high rated inverter which is the VS15 rated at 15 amps.

5.5 Sizing Chart For Inverters & Submersible Pump Motors

Electrical specifications by model:

	SunPumps Inverter Specifications					Submersible Motor Specifications					
Controller Model	Vin DC VDC	Vin Range 3 Phase VAC	* V1 Nom VDC	Controller Output Voltage Range 3 Phase-VAC	I Max Output Amps	Motor 3 Phase VAC	Motor HP	Motor Dia.	**P2 Motor kW	Nominal Amps (in)	*** Surface Factor Amps
VS212	160-650	190-650	320	230-350	12	230	3	4"	2.2	9.5	10.9
VS409	320-850	190-640	320	230-460	9	230	2	4"	1.5	6.7	8.1
VS409	320-850	190-640	640	230-460	9	460	5	4"	3.7	8.0	8.9
VS412	320-850	190-640	320	230-460	12	230	3	4"	2.2	9.5	10.9
VS412	320-850	190-640	640	230-460	12	460	7.5	4"	5.5	11.5	13.2
VS415	320-850	190-640	320	230-460	15	230	3	4"	2.2	9.5	10.9
VS415	320-850	190-640	640	230-460	15	460	7.5	4"	5.5	11.5	13.2
VS418	320-850	190-640	320	230-460	18	230	5	4"	3.7	15.9	17.8
VS418	320-850	190-640	640	230-460	18	460	10	4"	7.5	17	18.8
VS418	320-850	190-640	640	230-460	18	460	10	6"	7.5	14.2	16.1
VS425	320-850	190-640	320	230-460	25	230	7.5	6"	5.5	21.8	24.6
VS425	320-850	190-640	460	230-460	25	460	15	6"	11.0	20.8	23.7
VS430	320-850	190-640	320	230-460	30	230	10	6"	7.5	28.4	32.2
VS430	320-850	190-640	640	230-460	30	460	20	6"	15.0	26.9	30.3
VS438	320-850	190-640	320	230-460	38	230	10	6"	7.5	28.4	32.2
VS438	320-850	190-640	640	230-460	38	460	25	6"	18.5	33.5	37.5
VS448	320-850	190-640	320	230-460	48	230	15	6"	11.0	41.6	47.4
VS448	320-850	190-640	640	230-460	48	460	30	6"	22.0	39.5	45.2
VS465	320-850	190-640	320	230-460	65	230	20	6"	15.0	53.8	60.6
VS465	320-850	190-640	640	230-460	65	460	40	6"	30.0	53.5	62.0
VS485	320-850	190-640	320	230-460	85	230	30	6"	22.0	79.0	90.4
VS485	320-850	190-640	640	230-460	85	460	50	6"	37.0	67.7	77.0
VS4100	320-850	190-640	640	230-460	100	460	60	6"	45.0	80.5	91.0
VS4118	320-850	190-640	640	230-460	118	460	75	8"	55.0	97	110
VS4156	320-850	190-640	640	230-460	158	460	100	8"	75.0	128	148
VS4198	320-850	190-640	640	230-460	198	460	125	8"	90.0	165	189
VS4228	320-850	190-640	640	230-460	228	460	150	8"	110.0	193	221
VS4268	320-850	190-640	640	230-460	268	460	175	8"	132.0	218	250

NOTE: AC input power is available only for MP (MultiPower) models.

* V1 The minimum inverter input voltage necessary to obtain 100% of rated motor power and thus the maximum pump flow rate.

** Nominal motor current. It is recommended to refer to the rated motor current when selecting the SunPumps - VAriable Speed COntroller model.

***Surface Factor Amps is the maximum rated motor amperage.

Inverter and Array Sizing Example 1, 460 VAC (Array series string)

Pump Specifications:	Inverter Model Selection:	Solar Module Specifications:
5 HP, 460 VAC, 3 Phase, 4”	Based on the motor information,	Wp = 250 Watts
Motor Rated Power: 3.7 kW	8 amps @ 460 VDC the most	Vmp = 31 VDC
Motor Rated Current 8 Amps	suitable model for this application	Voc = 37 VDC
	is model VS 409 rated at 9 amps.	Imp = 8.06 Amps

1. To get the solar array power requirements take the power rating of the motor and divide by .8 to add the 20% for efficiency losses. 3730 watts /.8 = 4662 Wp. This is the total solar array wattage required for this application.

2. Take the 4662 watts and divide by the solar module power rating. 4662 / 250 solar module watts = 18.6 or round up to 19 total solar modules.

3. Take the 640 nominal voltage and divide by the module Vmp. 640 / 31 = 20.6, or round up to 21. This is the number of solar modules wired in series to achieve the nominal required voltage for the full pump output.

Inverter and Array Sizing Example 2, 460 VAC (Array series / parallel)

Pump Specifications:	Inverter Model Selection:	Solar Module Specifications:
10 HP, 460 VAC, 3 Phase 4”	Based on the motor information,	Wp = 250 Watts
Motor Rated Power: 7.5 kW	17 amps @ 460 VDC the most	Vmp = 31 VDC
Motor Rated Current 17 Amps	suitable model for this application	Voc = 37 VDC
	is model VS 409 rated at 9 amps.	Imp = 8.06 Amps

1. To get the solar array power requirements take the power rating of the motor and divide by .8 to add the 20% for efficiency losses. 7500 watts /.8 = 9375 Wp. This is the total solar array wattage required for this application.

2. Take the 9375 Wp watts and divide by the solar module power rating. 9375 / 250 solar module watts = 37.5 or round up to 38 total.

3. Take the 640 nominal voltage and divide by the module Vmp. 640 / 31 = 20.6, or round up to 21. This is the number of solar modules wired in series to achieve the nominal required voltage for the full pump output.

4. Now check the open circuit voltage to make sure it does not exceed the maximum voltage rating of the inverter. 21 X 37 Voc = 777 which is under the maximum Inverter rating of 850 VDC.

5. This example requires 42 solar modules for the required power and 21 in series to achieve the correct voltage so it requires two series strings wired in parallel.

Inverter and Array Sizing Example 3, 230 VAC

Pump Specifications:	Inverter Model Selection:	Solar Module Specifications:
3 HP, 230 VAC, 3 Phase, 4”	Based on the motor information,	Wp = 250 Watts
Motor Rated Power: 2.2 kW	12 amps @ 230 VDC the most	Vmp = 31 VDC
Motor Rated Current 9.5 Amps	suitable model for this application	Voc = 37 VDC
	is model VS 212 rated at 12 amps.	Imp = 8.06 Amps

1. To get the solar array power requirements take the power rating of the motor and divide by .8 to add the 20% for efficiency losses. 2200 watts /.8 = 2750 Wp. This is the total solar array wattage required for this application.

2. Take the 2750 watts and divide by the solar module power rating. 2750 / 250 solar module watts = 11total.

3. Take the 320 nominal voltage and divide by the module Vmp. 320 / 31 = 10.3, or round up to 11. This is the number of solar modules wired in series to achieve the nominal required voltage for the full pump output.

4. Now check the open circuit voltage to make sure it does not exceed the maximum voltage rating of the inverter. 11 x 37 Voc = 407 which is under the maximum inverter rating of 650 VDC.

3.? Inspection on delivery.

Upon receipt of the product, check the following:

- The integrity of the packaging.
- The integrity of the contents.
- The presents of all components.

In case of problems, notify the forwarder immediately.

> **WARNING**
> SunPumps declines all responsibility for damage to the product due to transport.

3.? Handling.

The product must be handled by hand or using suitable lifting equipment in relation to its weight and the local regulations.

If necessary, use dedicated handling equipment (cranes, ropes & pulleys, etc.), using the lifting points in the product.
During handling it is recommended to:

- Handle with care.
- Keep away from suspended loads.
- Always wear accident prevention equipment.

Be carful not to damage electrical cables.
(Do not handle the product using the electrical cables as lifting gear.)

Upon receipt of the product, check the following:

- The integrity of the packaging.
- The integrity of the contents.
- The presents of all components.

In case of problems, notify the forwarder immediately.

4.0 Commissioning

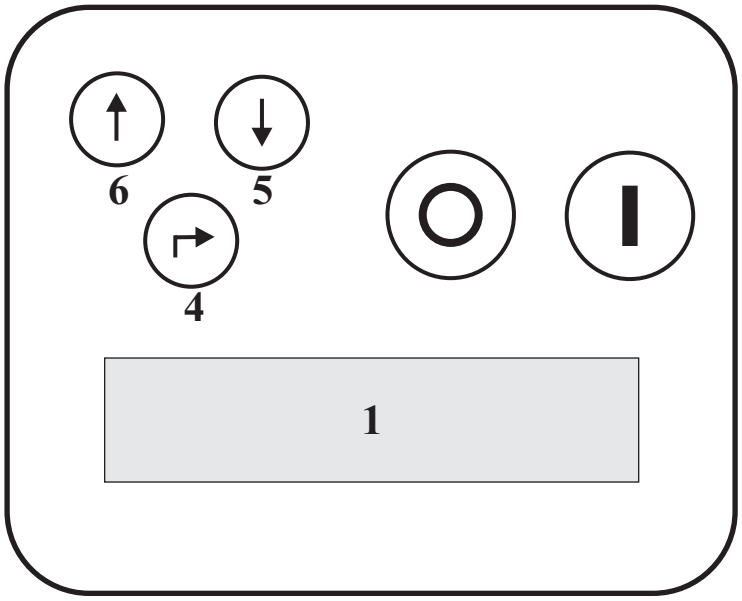
4.1 Preliminary checks.

Before connection power to the device, carry out the following electrical and mechanical checks.

- Check the device specifications with the motor control according to its data plate to see if the comply.
- Verify proper grounding of the device, of the load and of the entire system.
- Check the correct connection of the power supply cable and the motor cable, paying particular attention to any connection reversal.
- Check the correct connection of the power and signal cables, paying particular attention to any polarity reversal.
- Check the connection terminals of the power and signal cables are correctly tightened.
- Check the implementation of electromagnetic compatibility (EMC) regulations and the correct connection of cable shields. (Cable shields should only be grounded on one end.)
- Make sure any protective devices are present and correctly installed.
- Make sure the mechanical installation is correct, sturdy and complies with environmental and cooling requirements.
- Make sure the seals are intact and correctly installed.
- Make sure the cable glands and screws are properly tightened.
- Make sure any controller device is completely closed and that live parts are not accessible.

WARNING
Before connecting power to the device, make sure you have read, understand and implemented all the safety, mechanical and electrical installation instructions.

Keyboard and display

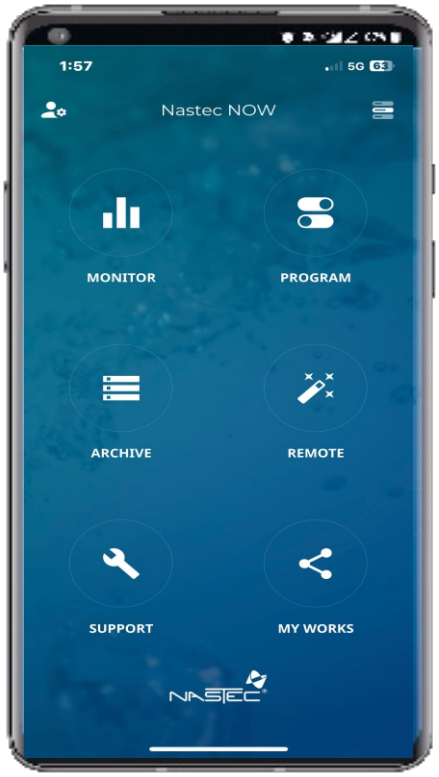


1. **DISPLAY**
2. **START: Motor start.**
3. **STOP: Motor stop /alarm reset / exit the menu.**
4. **+: Parameter scrolling / parameter editing.**
5. **-: Parameter scrolling / parameter editing.**

4.? Control via NOW App.

Using NASTEC NOW App makes it is possible to communicate with all SunPumps Smart Blue Tooth devices.

This inverter can be controlled using a smart phone or tablet equipped with Bluetooth BTLE connectivity and with the NOW App installed. the App is available for Android and iOS and my be downloaded, free of charge, from the online App store. The App is called **NASTEC Now.**



Through the NASTEC Now App it is possible to:

- Easy inverter programming using the NOW App.
- Monitor multiple operating parameters simultaneously on the wide, high-definition color screen of your smart phone or tablet.
- Get the energy consumption statistics and check the alarm log.
- Develop programs, save them in the archive, copy them to other devices and share them among multiple users.
- Create reports with the possibility of adding notes and images and e-mail or store them in the digital archive.
- Remotely control a SunPumps device via Wi-Fi or GSM by using a smart phone placed near by as a modem.

4.? Initial set-up.

The first time the device is switched on, the initial set-up is entered directly, through which it is possible to perform a quick and complete programming of the device in relation to the pump and system in which it is installed. Failure to complete the initial set-up makes it impossible to use the device. In any case, it is possible to repeat the initial set-up at any time. For example, if you decide to install the device in a newsystem.

The device suggests default values for each parameter. If you wish to modify the basic setting, simply press the ENTER button, wait for the parameter to start flashing and use the scroll keys. Press ENTER again to save the selected value, which stops the flashing.

During the initial set-up the device control mode is automatically set to Control Mode = MPPT. A detailed description of the different parameters encountered during the initial set-up is provided below.

Parameter	Default	Description
Language xxxxxxxxx	English	Language of communication with the user.
Open Circuit Voltage V = xxx (VDC)		Open circuit voltage of the solar array series string.
Units xxxxx	Bar	Units of measurements, (bar,%, ft, in, cm, m, K, F, C, gpm, l/min, m3/h, atm, psi).
Motor Type xxxxx	3 Phase asyn	Type of motor connected and control used. 1. Single phase *PSC: Control for single phase 2 wire PSC motors. 2. Three phase asyn: Control for three phase asynchronous motors. 3. Synchronous PM: Control for permanent magnet synchronous motors. 4. Scalar: V /f scalar control. * PSC = Permanent Split Capacitor
Rated motor amps I = xx.x (Amps)		Motor rated current according to its data plate increased by 5%. The voltage drop across the inverter may result in a current absorption greater than the motor rated current indicated on the data plate. It is necessary to check the motor service factor amps to verify the + 5%.

Parameter	Default	Description
Rated motor frequency f = xxx (HZ)	50 HZ	Rated motor frequency according to its data plate.
Motor Tuning ENT to access		If the device is “FOC” ready, motor calibration must be carried out before commissioning. **(Read the chapter dedicated to the FOC motor control.)**
Motor test START / STOP		By using START /STOP it is possible to carry out a running test of the pump at the desired working frequency. **(Make sure the pump can be started without causing damage to it.)**
Rotation sense ----> / <----	---->	Running direction of the motor. Should the motor run in the wrong direction, it is possible to reverse the running direction without having to change the phase connection sequence.
BTLE connection ON / OFF	ON	Enable BTLE communication.
Auto-restart ON / OFF	OFF	By selecting ON, when the main power is restored after a power failure, the device will return to the same start is was in before the power failure.
Initial Setup Completed		This message informs the user that the initial set-up procedures have been successfully completed. The parameters set during this procedure are saved in the device. These values can be subsequently modified from the appropriate menus.

4.? FOC Motor Control

4.?.1 Introduction

The FOC (Field Oriented Control) motor control will automatically tune inverter to match the characteristic of the motor and provide the following benefits:

- Ideal control of the current at each operating point.
- Quick and accurate speed adjustment.
- Lower energy consumption.
- Reduction of torque fluctuations (vibrations) for smoother and more regular operation throughout the frequency range and less system noise.
- Less mechanical stress on the motor, pump and hydraulic system.

The FOC control of “FOC ready” devices can be used with:

- Three phase asynchronous motors.
- Permanent magnet three phase sysnchronous motors.

The control is “sensorless” and therefore does not require the use of any sensor.

4.?.12 FOC control calibration

To enable the inverter to perform the FOC check it is necessary to:

1. Carry out all system wiring. Connect the motor to the inverter using a cable of suitable length and any dv / dt or sine wave filter.
2. Power up the system and follow the initial set-up procedure specifying the following:
   a. Motor type: Three phase asynchronous or permanent magnet synchronous motor.
   b. Rated voltage of the motor according to its data plate.
   c. Rated frequency of the motor according to its data plate.
   d. Rated motor current + 5% compared to the value on the data plate.
3. Carry out the Auto Tuning process to allow the inverter to learn the electrical characteristics of the load connected including the motor, wiring and dv/dt filter - if any.
4. Wait for the calibration process to be completed successfully. **(The calibration process can take up to 1 minute).**

WARNING

The calibration process must be performed in the final electrical configuration of the system, that is after the motor, wire and any filter have been installed.

If a change is made to the motor, wire or filter once they have been installed, the calibration process must be repeated.

CAUTION

1. **Incorrect setting of the motor voltage, frequency and rated current leads to incorrect results in the calibration process and consequently to motor malfunction.**

2. **Setting the rated current of the motor too high compared to the value on the data plate can seriously damage both the motor and the inverter.**

3. **The motor cannot be started until the calibration process has been completed and indicates it has been.**

4.?.? Initial Display

When the device is switched on, the control firmware version (LCD = XXX) and the power firmware version (INV = X.XX are communicated to the user. Subsequently, or as soon as the first initial set-up has been completed, the initial view opens.

The first line in the display shows the status of the device:

- Inv: ON XX.X HZ If the inverter is enabled for the control and the motor is running at the indicated frequency.
- INV: OFF Mot: OFF If the inverter is not enabled for the motor control, which is therefore stopped.

4.?.? Operating Parameters

Parameter	Description
f = xx.x (HZ)	Parameter f represents the frequency (HZ) with which the inverter is powering the motor. If the control mode is set on "fixed frequency", it is possible to make a real-time variation of the working frequency by means of the ENTER key while the symbol set appears on the display. Press the ENTER key again to exit this mode, as evidenced by the disappearance of the symbol set, this also saves the new working frequency.
V_in=XXX [V] / I = xx.x (A)	Parameter V represents the power supply voltage. This appears only while the motor is in the OFF state. In the ON state, parameter I is displayed instead of the supply voltage, which represents the intensity of current (A) absorbed by the motor.
cosphi = X.XX	The cosphi parameter represents the cosine of the phi phase displacement angle between voltage and current. It is also the power factor.
P = XXXXX [W]	Provides an estimate of the active electrical power absorbed by the motor.
STATUS: NORMAL	In the absence of alarms, the STATUS is NORMAL. Otherwise, the alarm message flashes an intermittent acoustic signal is emitted which can be silenced by pressing the STOP key. Press ENTER key to access the Diagnostics menu. To return to the initial display, simply press the ENTER key.
MENU ENT to access	Press the ENTER key to access the menu display.

4.?.? Diagnostics

Parameter	Description
Inverter Life XXXXX h : XX m	Inverter Life
Motor LIfe XXXXX h : XX m	Motor Life
%f 25 50 75 100 %h XX XX XX XX	Operation statistics based on frequency and hours.
All. XXXXXXXXX XXXXXXX h : XX m	Alarm log (up to 8) in relation to the life of the inverter.

4.?.? Menu

To access the Menu selection, press the ENTER key on the MENU / ENT to access the screen.

To exit the Menu section, press the STOP key several times until you go back to the Initial View.

> ⚠ **NOTE**
> The motor must be completely stopped before entering the MENU section.

Access to the menus is password-prodteted at two levels:

1. **Installer Level:** Allows editing the parameters related to pump operation in the hydraulic system on which it is installed. **Password 1= 001**

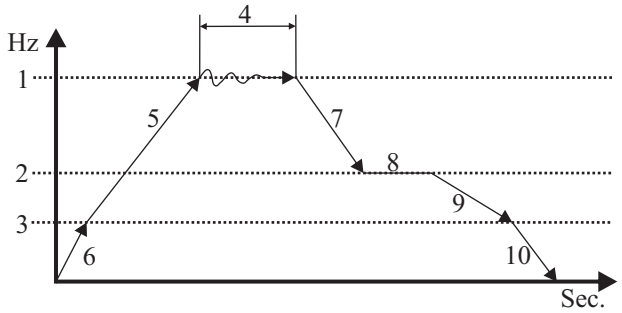
2. **Advanced Level:** Allows editing the parameters that so critical that they may compromise the life of the inverter. the pump and the system if they are set incorrectly. **Password 2 = 002**

When an incorrect password is entered to access both the installer and advanced level, the parameters can only be displayed but not edited.

Do not change the Advanced Parameters unless you understand and are familiar with the motor characteristics. Damage to the motor and the controller can result if programmed incorrectly. This will void the warranty.

Menu	Description	Level	Default Password
Control Parameter	Menu of parameters for controlling the pump in the hydraulic system in which it is installed.	Installer	001
Motor Parameters	Menu of parameters for motor control.	Advanced	002
IN / OUT Parameters	Menu of parameters for analog and digital inputs and outputs.	Installer	001
Connect Parameters	Menu of parameters for connectivity and external communication.	Installer	001
Change Init. Set	Initial configuration menu.	Advanved	002

4.?.? Motor Parameters

Parameter	Default	Description
Motor Type XXXXXXXXXX	3 Phase ASYN	Type of motor connected and control used: ● Single phase PSC: Control for single phase 2 wire permanent split capacitor motors. ● Three phase asyn. Control for three phase asynchronous motors. ● Synchronous PM: Control for permanent magnet asynchronous motors. ● Scalar: V /f scalar control.
Rated motor voltage v = xxx [V]		Rated voltage of the motor according to its data plate. The average voltage drop across the inverter is 20 to 30V RMS depending on the load conditions.
Voltage boost v = xx.x (%)		Motor starting voltage increase to favor the starting torque.
Rated motor amps v = xxx [A]		Motor rated current according to its data plate increased by 5%. The voltage drop across the inverter may result in a current absorption greater than the motor rated current indicated on the data plate. It is necessary to check the motor service factor amps to verify the + 5%.
Rated motor frequency f = xxx [Hz]	50 HZ	Rated motor frequency according to its data plate.
Max motor frequency f = xxx [Hz]	50 HZ	Maximum frequency intended to power the motor. Reducing the maximum motor frequency reduces the flow rate and the maximum current consumption.
Min motor frequency f = xxx [Hz]	30 HZ	Minimum motor frequency. When using submersible motor with Kingsbury type thrust bearings, it is recommended not to go below 1750 RPM's so as not to damage the thrust bearing . To adjust the minimum motor frequency, note the frequency at which the pump stops producing water. This is where the minimum motor frequency should be set + 5 - 10 Hz.
Ramp up time t = xx [sec]		Motor start ramp from minimum frequency (Min motor freq.) to maximum frequency (Max motor frequency). Slower ramps cause less strain on the motor and pump and therefore promote longer life. On the other hand, response times are longer. Excessive fast start-up ramps may lead to a current overload in the inverter.
Ramp F min mot. t = xx [sec]		Tim in which the motor reaches the minimum frequency from standstill (Min motor freq.) and vice versa.  1; Max motor freq.; 2: Freq. min. control; 3: Min motor freq.; 4: PI control; 5: Ramp-up time; 6: Ramp f min mot.; 7: Ramp down time; 8: Stop relay; 9: Control ramp; 10 Ramp f min mot.
PWM f = xx [kHz]		Inverter modulation frequency. It is possible to choose between 2.5m4,6,8 & 10 kHz depending on the inverter model. Higher values correspond to a more faithful reconstruction of the sine wave. When using very long motor cables (> 65 feet), the appropriate output filter, available upon request, should be used between the inverter and the motor and correct value of the PWM parameter according to the type of filter and length of the cable should be programmed in. This reduces the possibility of voltage spikes at the motor input while safeguarding the winding insulation. Lower values reduce the heating of the inverter.

4.?.? Motor Parameters Cont.

Parameter	Default	Description
V/f lin.-> quad. f = xx (kHz)	80%	This parameter allows changing the V/f characteristic with which the device supplies the motor. The linear characteristic corresponds to a constant torque characteristic with varying revolutions. The quadratic characteristic corresponds to a variable torque characteristic and is generally suitable for use with centrifugal pumps. The toque characteristic must be must be chosen ensuring smooth operation, reduced energy consumption and lower heating and motor noise. With single phase motors, we recommend setting linear V/f (0%).
Rotation sense ---> / <---		Running direction of the motor. Should the motor run in the wrong direction, it is possible to reverse the running direction without having to change the phase sequence in the inverter.
Motor tuning ENT to access		The inverter is “FOC-ready”, so motor calibration must be carried out before commissioning. **Carefully read the chapter dedicated to the FOC control.**
Auto-restart ON / OFF	OFF	By selecting ON, when the main power is restored after a power failure, the device will return to the same start is was in before the power failure. This means that if the pump was running, it will start running again when the power is restored.
Change password		By pressing th ENT key it is possible to change the installer level password (level 1) default (001).

4.?.? Pump stops under low irradiation conditions

Centrifugal pumps develop the head in relation to their running speed (frequency). If the irradiation is too low, the pump may continue to run without generating flow since the developed head is lower than the minimum head necessary to produce the flow.

Since the water flow passing over the motor is responsible for cooling the submerged motor, stopping the water flow past the motor would lead to dangerous overheating of the motor. This is why you need to adjust the minimum motor frequency properly.

Minimum motor frequency.

This requires setting the Minimum Frequency to be at a level where the pump flow rate almost but does not completely stop. To do this, watch the frequency when the sun is going down and record the frequency at which the water stops flowing. Then add 5 to 10 Hz to make sure the pump turns off with the water still slightly flowing.

When using submersible motor with Kingsbury type thrust bearings, it is recommended not to go below 1750 RPM’s so as not to damage the thrust bearing. Keep this in mind when adjusting the minimum motor frequence so you do not go below the 1750 RPM which is about 30 Hz on a 3450 RPM motor.

4.?.? Alarms

Parameter	Description	Possible Solution
LINE <-> MOT INV	Reverse the connection of any two wires on the motor connection.	Correct the connection of the motor cables.
A01 OVERCURRENT MOT	The current absorbed by the motor exceeds the value set in the parameter Rated Motor AMP. **Reset Mode:** ● Automatic reset after 10 seconds for up to 7 attempts, after which you must wait for 60 minutes. ● Disconnect the power supply.	● Verify that the value set for the parameter Rated Motor Amp corresponds at least to the rated current of the motor according to its rating data plate. **NOTE** The voltage drop across the inverter (varies between 20 and 40 VAC) causing the motor voltage to be slightly lower than stated on the data plate. Therefore the current absorbed my the motor could be slightly higher than the rated current and to obtain the maximum performance, it is necessary to increase the parameter Rated Motor Amps between 5% and 10%. Make sure to check the Service Factor Amps listed on the sizing chart or check with the motor manufacturer to verify you do not exceed its max current rating. ● Check that all motor phases are correctly connected and the connection is suitably configured in Star or Delta. ● Check that the motor parameters are correctly set. ● In devices with FOC control, perform a new motor calibration. ● In the presents of the output filters (dv/dt or sinusoidal) check that they are correctly connected and in the devices with FOC control, check that you have correctly set the parameters PWM and FOC dynamics in relation to the length of the motor cable and type of filter used. ● Make sure the pump is turning in the correct direction. ● Make sure the motor is free to rotate and check any mechanical issues. ● Adjust parameter Voltage Boost.
A03 OVER TEMP. INV.	The temperature reached by the inverter is higher than the maximum allowed value. **Reset Mode:** ● Automatic Reset.	● Make sure the ambient temperature is within the allowed limits. ● Make sure the inverter is protected from direct sunlight or any other heat source. ● Check both the external and internal cooling fans (if present) to verify they are working properly. ● Make sure the heat sink dissipation channels are clean. ● Reduce parameter PWM as much as possible. **NOTE** To ensure uninterrupted operation, the inverter automatically reduces the maximum frequency, and thus the power, when the internal temperature reaches a certain threshold. If such frequency reduction is not sufficient to keep the temperature below the maximum permitted value, the inverter will stop the motor and trigger the alarm A03 OVER TERM. INV..
A04 DRY RUN COSPHI	The warning W26 NO WATER appears 5 consecutive times following the automatic reset attempts. **Reset Mode:** ● Alarm reset by STOP key. ● Disconnecting the power supply..	**WARNING!** When the warning W26 NO WATER appears, the inverter will automatically restart the motor after a time equal to the value set in the parameter Restarts delay multiplied by the number of attempts made. At eh end of the fifth attempt, the inverter will stop the motor producing the alarm A04 DRY RUN COSPHI. **The alarm must be reset manually.**

4.?.? AlarmsCont.

Parameter	Description	Possible Solution
A05 UNDER VOLTAGE	• Supply voltage below the minimum allowed value. • Insufficient input power to power the motor. **Reset Mode:** • Automatic reset if parameter Autorestart = ON.	• Check the value of the solar array voltage both under no-load and loaded conditions. • Verify the power source (solar array) to make sure it is producing enough power to run the pump at full load.
A06 OVER VOLTAGE A08 LOCKED ROTOR	Supply voltage above the maximum allowed value. **Reset Mode:** • Automatic reset if parameter Autorestart = ON.	• Check the value of the solar array voltage both under no-load and loaded conditions. • Increase parameter Ramp downtime. • Increase parameter Ramp f min mot. • In case of a permanent magnet motor, make sure the load is not subjected to passive movement.
A08 LOCKED ROTOR	The automatic frequency limitation created by the inverter following an excessive absorption by the motor (beyond the value set in the parameter Rated moto Am.) causes a reduction of the frequency below the average value between Min motor freq. and Max motor freq.. **Reset Mode:** • Alarm reset by STOP key. • Disconnect the power supply.	• Make sure the rated current of the motor is lower than the rated current of the inverter. • Make sure the motor is free to rotate and check for any mechanical issues. • Increase the value of parameter Ramp up time. • Increase the value of the parameter Ramp f min mot.. • Adjust the parameter Voltage Boost. • Check the value of the power supply voltage both under no load and loaded conditions.
A09 OVERLOAD INV.	The current absorbed by the motor exceeds the rated current of the inverter. **Reset Mode:** • Alarm reset by STOP key. • Disconnect the power supply.	• Make sure the rated current of the motor is lower than the rated current of the inverter. • Make sure the motor is free to rotate and check for any mechanical issues. • Increase the value of parameter Ramp up time. • Increase the value of the parameter Ramp f min mot.. • Adjust the parameter Voltage Boost. • Check the value of the power supply voltage both under no load and loaded conditions. **NOTE** **The inverter can supply power to the motor at 101% for 10 minutes and 110% of the rated current for 1 minute.**
A10 IGBT TRIP ALARM	The current absorbed by the inverter instantaneously exceeds the maximum current protection of the inverter power module. **Reset Mode:** • Automatic reset after 10 seconds for up to 3 attempts, after which you must wait for 60 minutes. • Disconnect the power supply.	• Check the possible solutions for alarms A01 OVERCURRENT MOT. INV.. • Make sure there are no short circuits between the output phase and the ground insulation. • Make sure the system is properly gorunded. • Check for electrical noise from other devices connected to the • system.
A11 NO LOAD	The current absorbed by the inverter is too low in relation to the parameter Rated motor Amp.. **Reset Mode:** • Alarm reset by STOP key. • Disconnect the power supply.	• Check the possible solutions for alarms A01 OVERCURRENT MOT. INV..

4.?.? AlarmsCont.

Parameter	Description	Possible Solution
A15 KEYBOARD FAULT	One of the keyboard keys was held down for more than 30 seconds. **Reset Mode:** ● Alarm reset by STOP key. ● Disconnect the power supply.	● Make sure the keys are mechanically free.
A16 CPU ALARM	Communication error between the control part and the power part or error in the CPU. **Reset Mode:** ● Automatic reset.	● Check the value of the solar array voltage both under no-load and loaded conditions. ● Check for electrical noise from other devices connected to the system. ● Check the integrity of the communication cable between the control board and the power board.
A19 OUT OF STEP	With parameter Motor type set to Synchronous PM, the loss of motor control occurs. **Reset Mode:** ● Automatic reset if parameter Autorestart = ON.	● Check the possible solutions for the alarm A01 OVERCURRENT MOT.
A20 INPUT PHASE LOSS	Absence of power supply phase. **Reset Mode:** ● Automatic reset if parameter Autorestart = ON.	● Make sure that all three power phases are present. ● Check the balance of the power supply phases.

4.? Warnings

Warning	Description	Possible Solution
W20 TEMP. DERATE	The inverter is limiting the maximum motor frequency to keep the inverter temperature below the maximum limit.	● Check the possible solutions for alarm A03 OVERTEMP. INV..
W24 LOW PV ENERGY	The energy from the photovoltaic array is insufficient to drive the motor until it reaches its minimum frequency. The inverter attempts an automatic restart every 5 minutes. **Reset Mode:** ● Alarm reset by STOP key. ● Disconnect the power supply.	● Check the available photovoltaic array power in relation to the motor and pump power requirements. ● Check the series and parallel connections of the PV array. ● Check the photovoltaic array open circuit voltage (Voc) and the short circuit current (Isc). **The short circuit current is proportional to the available solar irradiation.** ● Check the available power in relation to the available solar irradiation. ● Make sure all the solar modules are clean and free from shade (even partial). ● Make sure the Minimum Motor Frequency is not too high compared to the Maximum Motor Frequency. It usually doesn't exceed 80%. ● Check the other motor parameters that they have all been set correctly.

4.? Warnings Cont.

Warning	Description	Possible Solution
W26 NOT WATER	The power factor (cosphi) of the motor read by the inverter is permanently below the value set in the parameter Dry run cosphi..	• Make sure the pump is under the water or properly primed. • Make sure the pump is rotating in the correct direction. • Make sure the parameter Dry run cosphi is set correctly.
W27 BLOCK START / STOP	The START / STOP buttons have been locked.	• Press the START or STOP button and hold for at least 5 seconds to release the lock.

NOTE

With three phase asynchronous motor, the correct value to which parameter Dry run cosphi is to be set depends on the following:

- The type of motor (construction and winding data). Generally, three phase surface motors have a higher rated coshi than submersible motors having the same power rating.
- The type of pumps (hydraulic performance and power consumption curve).
- The power supply characteristics (voltage and frequency).

In general, the parameter Dry run cosphi may be set fo 60%of the nominal cosphi shown on the pumps data plate.

Parameter Dry run cosphi must also be determined empirically at the end of the installation. In the presence of centrifugal pumps with three phase asynchronous motor, a simple method consists in starting the pump at the rated frequency and pay attention to the sustainability of the system, completely closing the discharge pipe and then reading the measured cosphi value on the display (or the App). Parameter Dry run cosphi must therefore be set to 10% less than the cosphi value read under the closed flow condition.

CAUTION

The electronic dry run protection based on parameter Dry run cosphi works correctly only with centrifugal pumps equipped with three phase asynchromous motors.

With permanent magnet motors it is not possible to base the dry run protection feature on the cosphi reading, it must be gased on the absorbed power instead.

When parameter Motor type is set to Synchronous PM, parameter dry run cosphi takes on the meaning of a percentage of the absorbed power.

In the presents of other types of pumps and motors, it is advisable to contact SunPumps technical support service.

WARNING

If parameter Dry run cosphi is set too low, the electronic low water protection may no longer be effective.

Typically, it is recommended not to go below the value of 0.5 with centrifugal surface pumps and 0.4 with centrifugal submersible pumps equipped with asynchronous three phase motors.

Setting parameter Dry run cosphi to 0 completely excludes the dry run protection feature.

1.2 Warranty

SunPumps guarantees that the products accompanied by this warranty are free from material or workmanship defects. The Company has the right to inspect any product returned under warranty and confirm that the product contains a material or workmanship defect. The Company has the exclusive right to decide whether to repair or replace defective equipment, parts or components. To qualify for the warranty coverage, the buyer must return the product to SunPumps factory.

Subject to the terms and conditions listed below, the Company agrees to repair or replace any part of this product that has material or workmanship defects. The Company will evaluate products under warranty for 12 months from the date of invoice.

IN NO EVENT shall the Company be liable for any other costs incurred by the customer in removing or replacing any product, parts or any component thereof. The Company reserves the right to change or improve its products or any part thereof without being obligated to provide such a change or improvement for products previously sold. THIS WARRANTY DOES NOT APPLY to products damaged by natural events, including lighting, normal wear and tear, normal maintenance services or any other condition beyond the control of the Company.
THIS WARRANTY WILL BE VOIDED if any of the following conditions occurs:

- The product is used for purposes other than those for which it was designed and manufactured.
- The product has not been installed in accordance with applicable codes and rulings.
- The product has not been installed by qualified personnel.
- The product has been damaged due to negligence, abuse, misapplication, tampering, alteration, improper installation, operation, maintenance and storage.

For Helical Rotor (HR) pumps:

- The installer must use the Loctite, included in the pump box, on the shaft threads and the stator housing threads during assembly, as per instructions. The pump may come apart if the thread lock sealant is not used.
- The installer must use the SunPumps water tight splice kit, included with the pump, to attach the drop wire to the motor leads. Any water intrusion into the motor leads, caused by an improper splice, may damage the motor and will void the warranty. **When returning the pump, make sure you leave the splice kit attached to the motors leads, so a proper splice can be verified.**

If the customer wishes to make a warranty claim, it is necessary to:

- Call SunPumps and request a “Return Materials Authorization” (RMA) form.
- Return the pump with the splice kit still attached to the motor lead.
- Put the RMA form inside the box and place the RMA number on the outside of the box by the address.
- SunPumps must receive the product for inspection in order to establish the potential warranty.

Following the analysis of the returned product, SunPumps will establish the existence or absence of the warranty conditions. If the warranty is applicable, SunPumps will repair or replace the product at their discression.

In absence of a warranty, SunPumps will make an offer to repair or refurbish the product.

SunPumps does not cover any warranties provided by the buyer to third parties, without prior authorization.

After 60 days from the offer, if no response is received from the buyer, Sunpumps will scrap the product.

.

WARNING
Failure to follow instructions may result in damage to the product, the system in which it is installed and in the worst cases, damage to property or persons with even fatal consequences.

Warranty

3.2. Warranty SunPumps guarantees that the products accompanied by this warranty are free from material or workmanship defects. The Company has the right to inspect any product returned under warranty, and confirm that the product contains a material or workmanship defect. The Company has the exclusive right to decide whether to repair or replace defective equipment, parts or components. To qualify for the warranty coverage, the buyer must return the product to the SunPumps factory.

Subject to the terms and conditions listed be low, the Company agrees to repair or replace any part of this product that has material or workmanship defects. The Company will evaluat e products under warranty for 12 months from the date of purchase.

IN NO EVENT shall the Company be liable for any othe r costs incurred by the custo mer in removing and/or installing any product, part or component thereof. The Company reserves the right to change or improve its products or any part thereof, without being obliged to provide such a change or improvement for p roducts previously sold. THIS WARRANTY DOES NOT APPLY to products damaged by natural events, including lightning, normal wear and tear, normal maintenance services, or any other condition beyond the control of the Company. THIS WARRANTY WILL BE VOIDED if a ny of the following conditions occurs:

• The product is used for purposes other than those for which it was designed and manufactured.

• The product has not been installed in accordance with applicable codes and rulings.

• The product has not been insta lled by qualified personnel.

• The item has been damaged due to negligence, abuse, misapplication, tampering, alteration, improper installation, operation, maintenance and storage.

• The installer must use the Loctite included with the pump, on the shaft threads and the stator housing threads during assembly, as per instructions.

• The installer must use the SunPumps water tight splice kit included with the pump. Any water intrusion into the drop cable caused by an improper splice will void the warranty.

If the customer wishes to make a warranty claim, it is necessary to:

• Contact SunPumps and request a “Return Material Authorization” number. Return the pump with the **splice kit still attached** and with the RMA number listed on the outside of the box.

• Wait for the result from the SunPumps technical support service analysis. The product must be inspected in order to establish the potential warranty

The outcome may be as follows:

• SunPumps will analyze the product failure to determine if it is to be replaced or repaired under warranty.

Following the analysis of the returned product, SunPumps will establish the unquestionable existence or absence of the warranty conditions by providing a detailed report on the damage found and its origins. If t he warranty is applicable, SunPumps will replace or repair the device. In the absence of a warranty, SunPumps will make an offer to repair and/or refurbish the device. After 60 days from the offer, if no response is received from the buyer, SunPumps will scrap the product upon notice. SunPumps does not cover any warranties provided by the buyer to third parties.