Sun Pumps Inc.
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OPERATION AND INSTALLATION MANUAL

CM MP Control Module

Distributed & Serviced by:

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1. Introduction to HR AC/DC Submersible Pumps

The HR AC/DC is a 4" submersible pump for clean water applications. It features:

- Three phase permanent magnet motor with wet rotor and canned type resin filled stator
- Built-in inverter
- Helical rotor

The pump inverter allows the following:

- Modified pump speeds that allow the pump to run at its highest efficiency point based on the power available
- Soft start and soft stop to increase the system life and reduce the current peaks
- Protects the motor from overload, dry running, overvoltage, under voltage and possible abnormal conditions

HR AC/DC pumps can be used in residential and industrial applications with pressurized water systems that create:

- Energy savings
- Simple and quick installations
- Long life and reliability

HR AC/DC pumps can be fed either AC or DC power with a wide range of operating voltages (90-265 VAC or 90-400 VDC). This means that the same pump can be powered by photovoltaic panels, wind, generator, AC grid power, or batteries with inverters. The hydraulic performance will be adjusted automatically according to the power source and the power available.

With photovoltaic panels, an MPPT algorithm is used to maximize the pump's output based on available sunlight. Pump speeds are adjusted in relation to solar irradiation. When solar irradiation increases, the pump will run faster and pump more water. When solar irradiation decreases (clouds moving and/or different hours of the day,) the pump will reduce its frequency and slow down, but it will continue pumping until the solar irradiation reaches the minimum value necessary to keep pumping.

HR AC/DC pumps can be installed with or without the Control Module controller (CM MP). The controller records the following:

- Run time
- Input voltage, current and power
- Alarms: dry running, overload, overvoltage.
- Digital inputs make it possible to connect a float switch, a pressure switch, start and stop signal, etc...
- Running and alarm status are given by two digital outputs
- Analog inputs are used to connect sensors (i.e. flow meter)

2. Safety Instructions

Sun Pumps strongly suggests carefully reading this operation manual before using and installing its products.

Any operation (installation, maintenance and repair) must be carried out by trained, skilled and qualified personnel. Failure to observe and follow the instructions of this manual may result in fatal electric shock.

	**Disconnect the unit from the power supply before any maintenance is performed.** **Do not, for any reason, remove the cover of the CM MP and the cable guard without having visually disconnected the unit from the power supply and having waited at least 1 minute. This allows the capacitors to bleed off their stored power.**
	**CM MP and pump system must be grounded properly before operation.** **High voltage is present even if the pump is not running.** **Do not start the pump for any reason unless the pump is completely immersed in water.**

Avoid shock or serious impact during transportation.

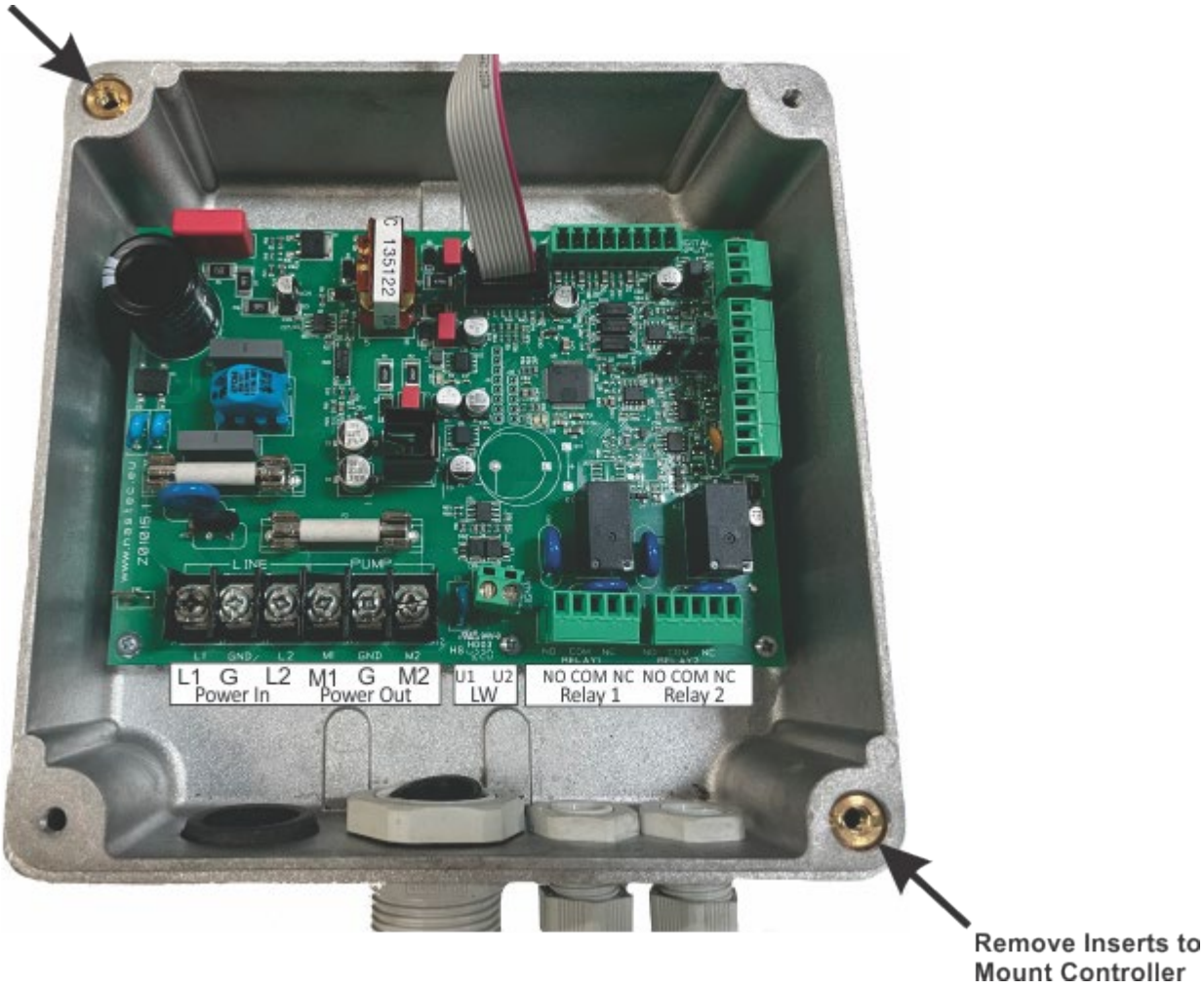
Check the product immediately upon delivery and check for damage and/or missing parts. In either case, immediately notify the supplier.

Damages due to transportation, incorrect installation, or improper use of the device will null and void the warranty. **The manufacturer cannot be held responsible for any damage to people and/or property due to improper use of its products.**

3. CM MP Installation

Remove the special inserts, shown below.

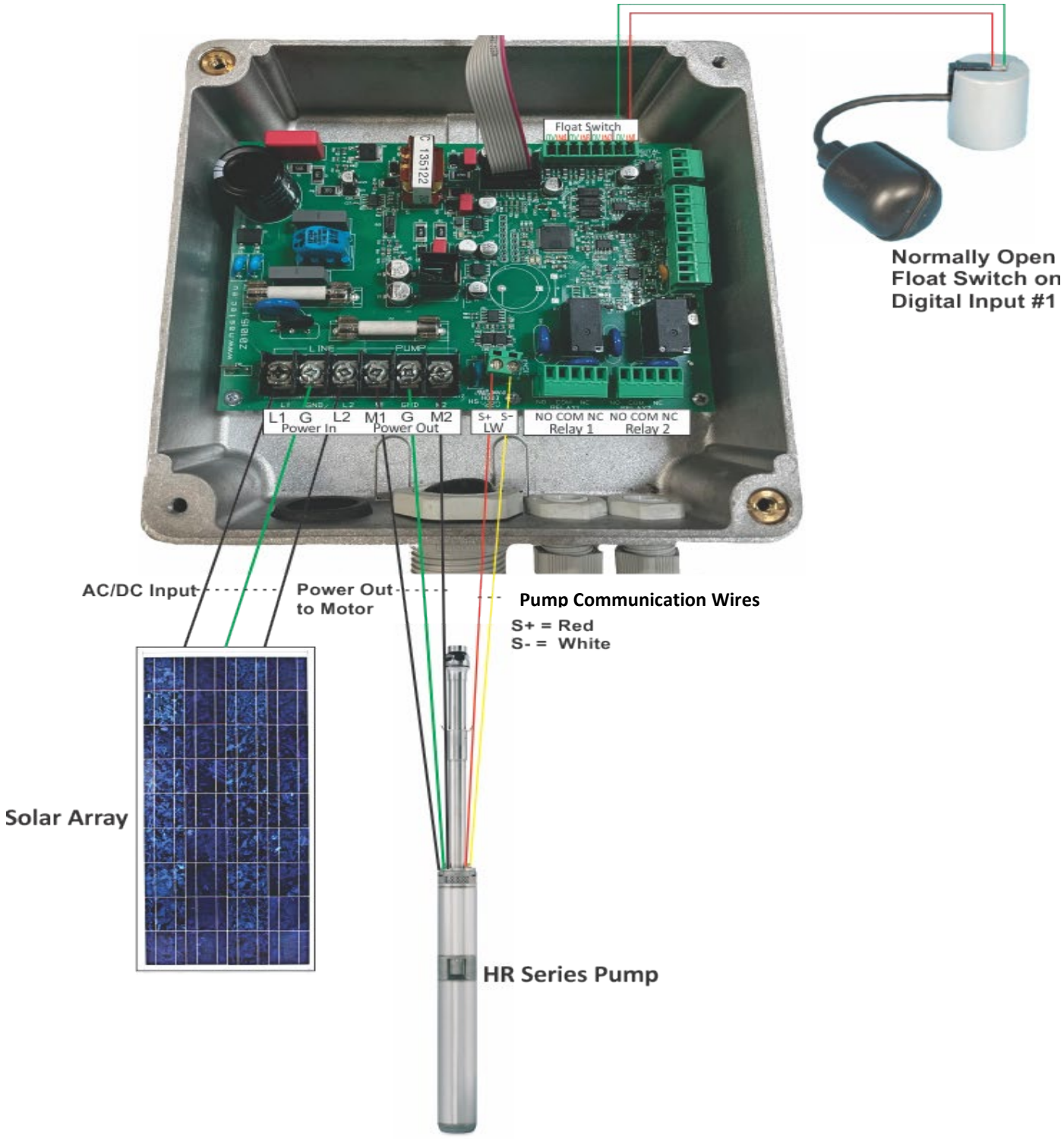
Use two screws inserted through the holes underneath the inserts to mount the CM MP in a vertical position.



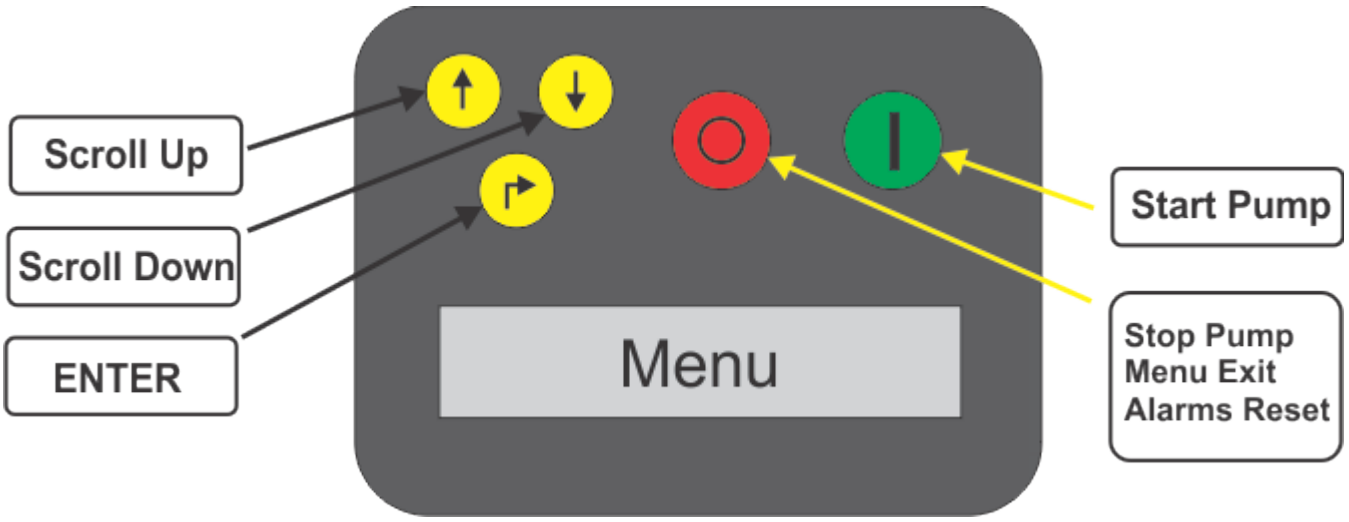
Then, replace the special inserts so the cover can be attached.

The IP55 protection rating allows the CM MP to be installed in humid and dusty environments. However it is recommended to protect the CM MP from the direct exposure to weather and sunlight.

3.1 Electrical Wiring



4.0 CM MP Use and Programming



The Sun Pumps CM MP controller has many features that are not used in most applications. All of the features and parameters are described below in section 4. The controller is already preset and ready to go for most applications. If you need to change any parameter, then the procedures are as follows:

4.1 Auto Restart Parameter

One parameter that should be checked after installing the controller is the “Auto Restart”. Make sure this parameter is set to “On” if you want the pump to restart automatically the next morning once the pump is turned off. If you want the pump to stay off after you push the Stop button, then the parameter should be set to “Off”.

The instructions are as follows:

1. Make sure controller is reading “INV OFF MOT OFF”
2. Press the UP arrow button to MENU.
3. Press ENTER (crooked arrow).
4. Press the UP arrow button to Advance Parameters.
5. Press ENTER.
6. The Password is 002 for the Advanced Parameters.
7. Press enter twice and then the UP arrow button once to change to read 002.
8. Press ENTER.
9. Press the UP arrow button approximately 9 times to Auto Restart.
10. Press ENTER.
11. Press the UP arrow button to change to ON or OFF.
12. Press ENTER.
13. Press RED/STOP Button twice to exit.

4.2 Pump Flow Adjustment (Changing the Frequency)

The pump output is controlled by the Frequency, so lowering the frequency will lower the pump RPM and thus, the flow rate of the pump. The peak frequency is already preset at 120 HZ. Both the minimum and maximum frequencies must be adjusted on the controller to lower the flow rate.

TO ADJUST MAXIMUM FREQUENCY:

1. Make sure controller is reading “INV OFF MOT OFF”.
2. Press the UP arrow to read MENU.
3. Press ENTER.
4. Press the UP arrow to Advanced parameters.
5. Press ENTER.
6. Password is 002.
7. Press ENTER button twice, then UP arrow button once to change to 002.
8. Press ENTER.
9. Press UP ARROW to MAXIMUM MOTOR FREQUENCY.
10. Default is set to 120.
11. Press ENTER.
12. Press DOWN arrow button to change to desired number. You will need to check the flow to the pump to arrive at desired number, however you cannot carry out this procedure while the pump is on.
13. Press ENTER.
14. Press RED/STOP button twice to exit.

TO ADJUST MINIMUM FREQUENCY:

1. Make sure controller is reading “INV OFF MOT OFF”.
2. Press the UP arrow to read MENU.
3. Install Parameter.
4. Press ENTER.
5. Press enter to change the Password. Password is 001. Press ENTER button twice and UP button once.
6. Press ENTER.
7. Press DOWN arrow button approximately 6 times until you come to “MINIMUM FREQUENCY CONTROL”.
8. Default is set to 80. You may need to lower as low as 25-30.
9. Press ENTER.
10. Hit the RED/STOP button twice to exit.

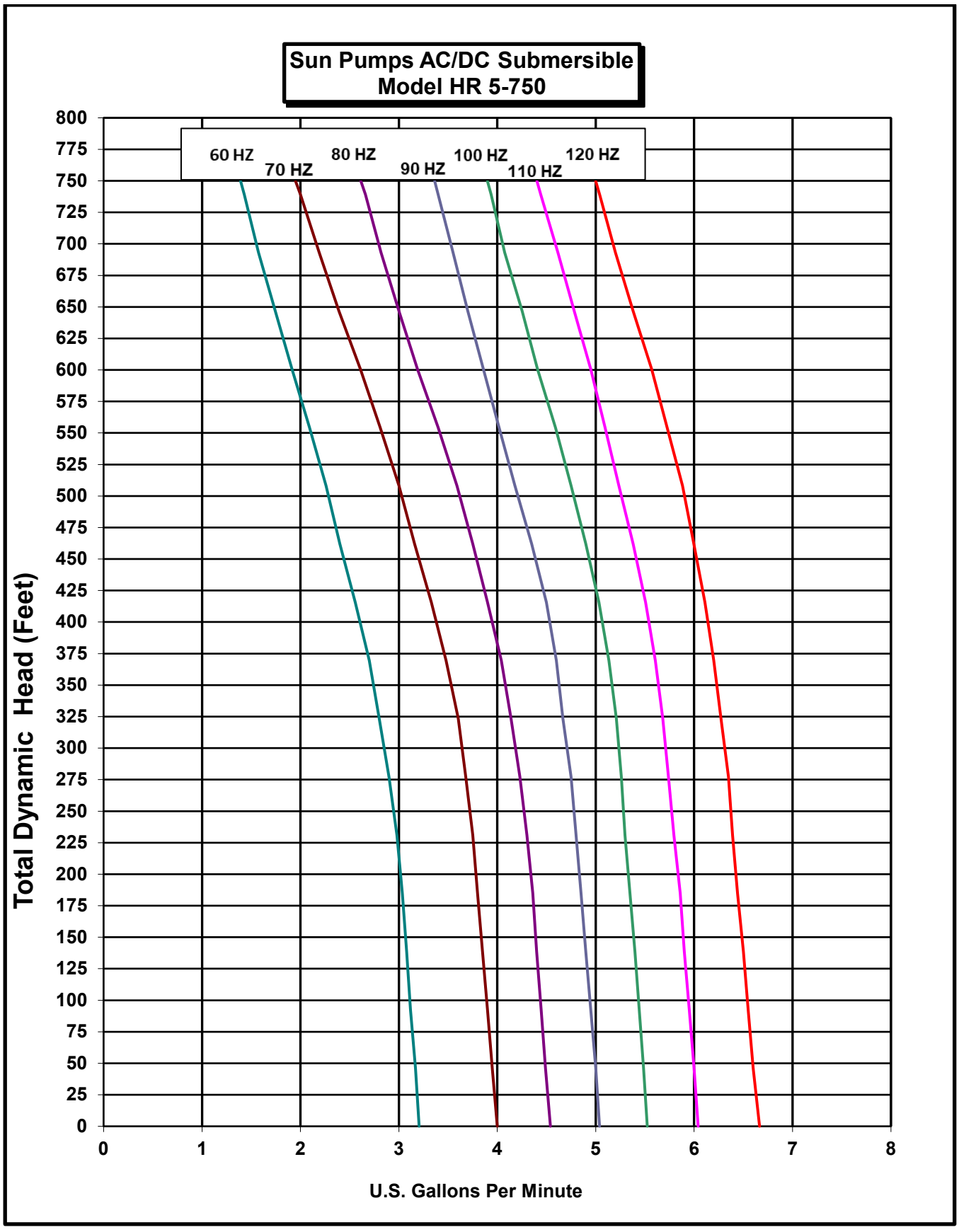
The graph on page 9 shows the pump flow rates at various pumping levels and frequencies. You can use this graph to determine what frequency you need to adjust to for the specific flow rate you require.

4.3 Controller Reset (Back to Factory Default Settings)

1. With the power connected, make sure the controller is reading “INV OFF MOT OFF”.
2. Disconnect the pump signal wires from the controller.
3. Press and hold down the red STOP button, the green ON button, and the yellow ENTER button while disconnecting the power from the system.
4. Continue holding all three buttons down for 15 seconds.
5. Continue holding all three buttons down while reconnecting power to the system.
6. Continue holding all three buttons down until you hear a beep. (10 to 15 seconds)
7. Release the buttons and the controller will reboot to the factory settings.

	**Carefully read the safety guidelines before installing the device. At the end of the installation, make sure no other objects are inside the CM MP or deposited on the electronic board. Tighten all 4 screws with the washers on the cover before powering up the device. Failure to properly ground the controller may result in electric shock or even death.**

4.4 Pump Curves at Various Motor Frequency



4.5 Normally Open and Normally Closed Relay Parameter Change.

1. Make sure the controller is reading “INV OFF MOT OFF”.
2. Press the up button once to “MENU”.
3. Press Enter. (The Crooked Arrow Button)
4. Press Enter to change the Password. (The factory Password is 001) Press the Enter button twice and UP button once.
5. Press the Enter button once.
6. Press the DOWN arrow button approximately 15 times until you come to ”Digital Input 1”.
7. Press the Enter button once.
8. Press the down arrow button, changing N.O to N.C.
9. Press the Enter button once.
10. Press the Red Stop button twice to exit.

4.6 Parameter Description

<table>
<tr>
<td>Input power line (LINE):
• L1, L2 power line
• GND ground</td>
<td colspan="2">Output power line (PUMP):
• M1, M2 power line
• GND ground</td>
<td>Pump Signal:
• S+ (red)
• S- (white)</td>
</tr>
<tr>
<td>Analog inputs (10 or 15 Vdc):
1. AN1: 4-20 mA: sensor 1
2. AN2: 4-20 mA: sensor 2
3. AN3: 4-20 mA / 0-10 Vdc (settable by jumper C.C.): external set
4. AN4: 4-20 mA / 0-10 Vdc (settable by C.C.): trimmer for frequency regulation / external set 2</td>
<td>Digital inputs (Pump start / stop):
• IN1
• OV
• IN2
• OV
• IN3
• OV
• IN4
• OV</td>
<td>Communication auxiliary (RS485):
• S+
• S-
• G</td>
<td>Digital outputs (relays):
• RELAY1: pump run signal
NO: normally open
COM: common
NC: normally closed
• RELAY2: alarm signal
NO: normally open
NC: normally closed

Relays of digital outputs are free contacts relays (no voltage). Max voltage is 250 V AC and max current is 5 A.</td>
</tr>
</table>

Inv: ON/OFF Mot: ON/OFF p = XX.X [bar]	P is the pressure value read by the pressure transducer.
Inv: ON/OFF Mot: ON/OFF V_in = XXX [V]	V_in is the line voltage.
Inv: ON/OFF Mot: ON/OFF I_in = XX.X [V]	I_in is the line current.
Inv: ON/OFF Mot: ON/OFF cosphi = X.XX	cosphi index means the angle phi between the voltage and current absorbed by the pump.
Inv: ON/OFF Mot: ON/OFF P = XXXXX [W]	P is the power absorbed from the line.
Inv: ON/OFF Mot: ON/OFF STATUS: NORMAL	Normal status means no alarms. If an alarm occurs, a message blinks on the display and an audible signal is activated. Pressing ENTER ACCESSES: Inverter lifetime, pump lifetime, consumption statistic, alarm list. To return to previous views, press ENTER.
Inverter Life xxxxx h : xx m	
Motor Life xxxxx h : xx m	
%f 25 50 75 100 %h XX XX XX XX	
XXXXXXXXXXXXXXX XXXXXXX h : XX m	
Menu ENT to access	

4.7 Installer Parameters

Pressing ENTER where you are in (Menu' / ENT to access), the following MENU is displayed:

MENU Instal. Param.	Password required to enter (default 001)

To exit the Menu level and return to INITIAL DISPLAY press STOP button.

PARAMETER	DEF.	DESCRIPTION
Control Mode: • MPPT • Constant Value • Fix Speed • Constant Value 2 Set • Fix Speed 2 Val. • External Speed	MPPT	Mode of Control: • MPPT: pump speed is adjusted in order to obtain maximum power available from PV panels • Constant Value: Pump changes its speed to keep the set value constant regardless of water demand • Fix Speed: the pump runs at set frequency • Const. value 2 set: the two values are selected by opening or closing the digital input IN2 • Fix speed 2 val: the two values are selected by opening or closing the digital input IN2 • External speed: control pump frequency by using analog input AN4
Control mode: MPPT		
Unit XXXXX	bar	Unit
F. scale sensor P = XX.X [bar]	16	Sensor full scale
Min value sensor P = XX.X [bar[]	0	Sensor minimum value
Max alarm value XXX.X [bar]	10	Maximum value allowed in the system. If the measured value goes over this value, an alarm occurs and the pump is stopped
PARAMETER	**DEF.**	**DESCRIPTION**
		Pump is automatically restarted if the measured value goes below the maximum value for a period of at least 5 seconds.
Min alarm value XXX.X [bar]	0	Minimum value allowed in the system. If the measured value goes lower than this value, an alarm occurs and the pumps is stopped. Pump is automatically restarted if the measured value goes higher than the minimum value for a period of at least 5 seconds.

PARAMETER	DEF.	DESCRIPTION
Freq. min. control XXX [Hz]	80	Minimum frequency below which the pump tries to stop
Stop delay XX [s]	60	Delay for which the pump tries to stop below freq. min. control.
MPPT: volt. gap dV = XX.X [V]	XX	MPPT voltage gap
MPPT: time gap dVt= XX.X [s]	XX	MPPT time gap
MPPT: freq. gap df= XX.X [Hz]	XX	MPPT frequency gap
Ki XX	50	Kp and Ki parameters allow the dynamic control of the system. Set values (Ki=50, Kp=005) are usually enough to get a valid dynamic control.
Kp XX	5	Kp and Ki parameters allow the dynamic control of the system. Set values (Ki=50, Kp=005) are usually enough to get a valid dynamic control.
Dry run thresh. DR_thr = X.XX	0.5	Threshold of water level sensor.
Restarts delay XX [min]	1	Restart delay after a dry running alarm. At each tentative (max 5) restart delay will be doubled.
Digital input 1 N.O./N.C.	N.O.	By selecting N.A. (normally open) CM MP runs the pump if the digital input 1 is open; pump will be stopped if the digital input 1 is closed. By selecting N.C. (normally closed) CM MO runs the pump if the digital input 1 is closed; pump will be stopped if the digital input 1 is opened.
Digital input 2 N.O./N.C.	N.O.	By selecting N.A. (normally open) CM MP runs the pump if the digital input 2 is open; pump will be stopped if the digital input 2 is closed. By selecting N.C. (normally closed) CM MP runs the pump if the digital input 2 is closed; pump will be stopped if the digital input 2 is opened.
Digital input 3 N.O./N.C.	N.O.	By selecting N.A. (normally open) CM MP runs the pump if the digital input 3 is open; pump will be stopped if the digital input 3 is closed.

		By selecting N.C. (normally closed) CM MO runs the pump if the digital input 3 is closed; pump will be stopped if the digital input 3 is opened.
Digital input 4 N.O./N.C.	N.O.	By selecting N.A. (normally open) CM MP runs the pump if the digital input 4 is open; pump will be stopped if the digital input 4 is closed. By selecting N.C. (normally closed) CM MO runs the pump if the digital input 4 is closed; pump will be stopped if the digital input 4 is opened.
Dig.in.2/3 delay T = XX [s]	3	Digital input IN2 and IN3 delay Digital input IN1 and IN4 have 1 second fix delay
Change PASSWORD1 ENT		Pressing ENT allows the installer level password (1^{st} level) (default 001) to be changed

4.8 Advanced Parameters

Pressing ENTER where you are in [MENU' / ENT to access], the following MENU is displayed:

MENU Advanced param.	Password required to enter (default 002)

To exit the Menu level and return to INITIAL DISPLAY, press STOP button.

PARAMETER	DEF.	DESCRIPTION
Max input Amp. I = XX.X [A]	16	Max input current
Max Motor freq. XXX [Hz]	XX	Maximum motor frequency. Note: by reducing the maximum motor frequency, maximum current will be reduced as well.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, the pump returns to its normal status; if the pump was running before the voltage drop, it resumes to run automatically. Warning: review the advice in Chapter 1.
Periodic autorun T = XX [h]	0	Pump periodic autorun after XX hours of inactivity. Value 0 makes function disabled. Warning: review the advice in Chapter 1.

AN1, AN2 function XXXXXX	Independent	Function logic for analog input AN1, AN2 (independent, lower value, higher value, difference 1-2).
Offset input 1 [%]	20%	Zero correction for analog input 1 (4-20 mA) **(20 mA x 20% = 4 mA).**
Offset input 2 [%]	20%	Zero correction for analog input 2 (4-20 mA) **(20 mA x 20% = 4 mA).**
Offset input 3 [%]	0%	Zero correction for analog input 3 (0-10 mA) **(10V x 00% = 0 V).**
Offset input 4 [%]	0%	Zero correction for analog input 4 (0-10 mA) **(10V x 00% = 0 V).**
Language XXXXXX	XXXX	End user communication language

5.0 Troubleshooting and Alarms

When the CM MP auto-stops, the STATUS screen will display an intermittent warning indicating the corresponding alarm. By pressing the STOP key from the STATUS display screen, it is possible to restart the pump. If the cause of the alarm has not been resolved, the CM MP resumes displaying the alarm message.

ALARM MESSAGE	ALARM DESCRIPTION	POSSIBLE SOLUTION
OVERCURRENT MOT.	Pump overload	• Check possible causes about the overload.
UNDER VOLTAGE	Supply voltage too low	• Check possible causes of under voltage
OVER VOLTAGE	Supply voltage too high	• Check possible causes of overvoltage
OVER TEMP. INV.	Inverter over temperature	• Make sure than ambient temperature is less than 35 °C.
NO WATER	Pump is running dry.	• Check water level. • Check that the level sensor is completely immersed in water. CM MP tries to run the pump after 5 minutes. . • <u>WARNING:</u> if dry running protection occurs, CM MP tries to start the pump automatically.

IGBT TRIP ALARM	Electronics overload	• Check possible causes for overload.
ALARM MESSAGE	**ALARM DESCRIPTION**	**POSSIBLE SOLUTION**
MAX. VALUE ALARM	Measured value has reached the maximum value accepted by the system.	• Check possible causes of reaching max value • Check the max alarm value setting.
MIN. VALUE ALARM	Measured value has reached the lowest value accepted by the system.	• Check possible causes reaching min value (i.e. broken pipe, open pressure relief valve, etc.) • Check the min alarm value setting.
NO COMMUNICATION	Communication between the CM MP and the pump has been interrupted.	• Check the wiring connections.
KEYBOARD FAULT	A Button on the keyboard has been pressed for more than 150 seconds	• Make sure buttons are not depressed • Call service assistance
ACTIVE DIG.IN.X	Digital input X opened / closed	• Check the input digital configuration (Installer parameters menu)