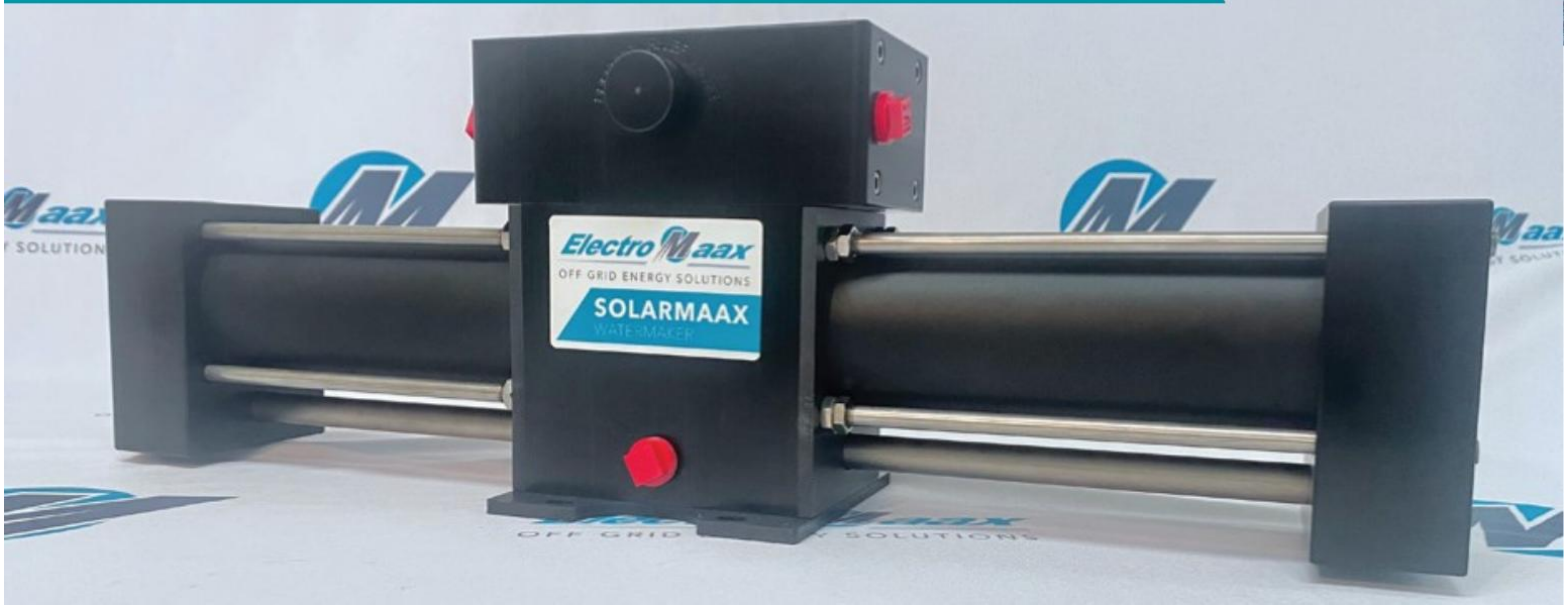
ElectroMaax

OFF GRID ENERGY SOLUTIONS

SOLARMAAX 340 GPD LEVEL 2 WATERMAKER MANUAL



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INTRODUCTION

The team at ElectroMaax thanks you for your purchase of our *SolarMaax 340* reverse osmosis watermaker with Level 2 automatic control and the latest in energy recovery technology; the *Enhanced Clark Pump*.

The addition of a low energy watermaker can be a life-changing upgrade for your cruising experience. Used properly, you will never have to go out your way just to get questionable and/or expensive water or need to lift jerry cans out of the dingy. The *SolarMaax 340* can easily make enough for you and your crew to shower every day, in addition it can pay for itself by being able to rinse salts off your boat and gear, reducing maintenance and replacement costs.

The *SolarMaax 340* design is based on decades of real-world product testing and engineering from both Marine and Military applications ranging from supporting military operations in the mountains of Afghanistan, serious offshore yacht racing as well as tranquil anchorages around the world.

We are confident that you will be completely satisfied with your new system and stand behind our product with an industry leading warranty and customer support.

GENERAL WARNINGS

There are several things which the installer or operator of the ***SolarMaax 340*** can do incorrectly, which can **seriously** damage the ***SolarMaax 340*** water maker, dramatically shorten the operational life span of the system, and in some cases cause personal **injury**. Knowing the things to avoid is critical to a good ***SolarMaax 340*** installation and operation. We will cover the following items again during the appropriate section later in the manual, however, due to their importance it is worth giving the following items extra attention.

WARNING: THE SOLARMAAX IS DESIGNED TO BE USED IN TYPICAL SEA WATER. USING TASTE TO TEST THE QUALITY OF THE PRODUCT WATER ONLY WORKS WITH A SEA WATER FEED. OPERATING IN FRESHWATER WITHOUT STERILIZING THE PRODUCT COULD RESULT IN SICKNESS OR DEATH.

WARNING: WHEN DISASSEMBLING THE PRESSURE VESSEL, DO NOT TOUCH THE TREADS ON THE ENDS OF THE TUBE. THERE MAY BE FIBERGLASS SPLINTERS.

NOTICE: NEVER ALLOW CHLORINATED WATER TO COME IN CONTACT WITH THE RO MEMBRANES. OXIDANTS SUCH AS CHLORINE AND/OR BLEACH WATER WILL PERMANENTLY RUIN THE RO MEMBRANE.

NOTICE: NEVER RUN THE SOLARMAAX 340 LEVEL 2 IN OILY WATER. OIL WILL PERMANENTLY RUIN THE RO MEMBRANE.

NOTICE: DO NOT INSTALL THE RO MEMBRANE MODULE IN AN AREA WHERE THE RO MEMBRANES CAN BECOME HEAT SOAKED TO TEMPERATURES ABOVE 113°F/45

NOTICE: THE RO MEMBRANE MODULE IS SHIPPED IN A SEALED PACKAGE CONTAINING A STORAGE/PRESERVATIVE SOLUTION WHICH MUST BE PURGED AT SYSTEM START UP

NOTICE: GOOD ELECTRICAL SUPPLY TO THE FEED PUMP IS MANDATORY FOR PROPER SYSTEM OPERATION.

NOTICE: NEVER USE A 5 MICRON “CARBON” FILTER IN PLACE OF THE SUPPLIED 5 MICRON PREFILTER ELEMENT.

NOTICE: ONLY USE THE STORAGE CHEMICAL SUPPLIED BY ELECTROMAAX. OTHER BRANDS MAY DAMAGE THE SYSTEM.

PARTS LIST

1. Clark Pump and Pressure Vessel Assembly
2. RO Membrane Elements
3. Feed Pump Assembly (Feed Pump, Prefilter, L2 Pump Control Module)
4. Carbon Filter with Solenoid Valve for Automatic Freshwater Flush
5. Accumulator Tank with fittings (depressurized for shipping)
6. 3/4” Sea Strainer and Mount Bracket
7. Prefilter Status Gauge
8. 30’ Coil 5/8” Tube, Black (Feed)
9. 10’ Coil 5/8” tube, Clear (Flush)
10. 30’ Coil 1/2” Tube, Red (Brine)
11. 30’ Coil 1/4” Tube, Blue (Product)
12. 10” Coil Flush Valve 14/2 Power Cable

SMALL PARTS LIST:

1. Handheld Salinity Sensor
2. Filter Wrench
3. Tubing Cutter
4. Tube Extractor Tool
5. Teflon Tape
6. Silicone Grease Packet
7. Container Memstor
8. 3/4” NPT to 3/4” Hose Barb – (Inlet Strainer)
9. 3/4” Check Valve – (Attached, Flush System)
10. 2X 5/8” Tube Tee – (Flush system, accum. tank)
11. 2X 1/2” 3 way Service Valves (Service Access)
12. 1X 1/4” 3 way Product Service Valve
13. 3X 3/4” NPT to 5/8” Tube Fitting (Strainer and Check Valve)
14. 3X 1/2” NPT to 5/8” Tube Fittings (Intake Service Valve)
15. 4X 1/2” NPT to 1/2” Tube Fittings (Brine Service Valve/Clark Pump)
16. 5/8” Tube Elbow Fitting (Clark Pump Stem Fitting)
17. 1X 1/4” Tube Fittings Elbow
18. 1X 1/4” Tube Fitting Straight
19. 1X 1/2" to 1/4" Bushing
20. 18X 5/8” locking rings
21. 8X 1/2” locking rings
22. 8X 1/4” locking rings
23. 1/2“NPT to 5/8” Tube Stem (Check Valve attached)
24. 3/4” NPT to 1/2” NPT Bushing (Strainer, Attached)
25. 6X 5/8” Tube Elbow Fittings (Feed line)
26. 2X 1/2” Tube Elbow Fittings (Brine line)
27. 4X plastic U clamps (Service Valve Mounts)
28. 3/4" NPT short nipple (Check Valve, Strainer, Attached)
29. 3X 1/2” NPT Short Nipples (Service Valves)
30. 2X 1/8” NPT to 1/4” Tube Elbow Fittings

SOLARMAAX 340 SPECIFICATIONS

Production Rate: 7-14 Gallons per hour, 26-53 liters per hour
The production rate is set by the displacement of the Enhanced Clark Pump energy recovery device and the feed flow rate. The ***SolarMaax 340 Level 2*** uses a 10% displacement Clark Pump so 10% of the feed water flow is turned into product water. Water temperature and salinity affects operating pressure but has little effect on production rate. Changes in feed flow does have an effect, the more feed flow the more product. Supplying good voltage to the feed pumps gives the best production rate. Running the system while the batteries are bulk charging gives the highest production rate.

RO Membrane: The SolarMaax 340 Level 2 Watermaker is equipped with Reverse Osmosis Membranes
Membrane Type: Polyamide Thin-Film Composite
Membrane Model: two SW2521
Range of Operating Pressures: 650 to 1000 psi (45 to 69 bar)
Normal Operating Pressure: Automatically set by feed water conditions and feed flow rate.
Salt Rejection rate: 99.4%
Maximum Operating Temperature: 113F (45°C)
Minimum Storage/Operating Temp: 32F (0°C)
Maximum Operating Pressure: 1,000 psi, (69 bar)
Maximum Pressure Drop: 15 psi (1 bar)
pH Range, Continuous Operation: 2-11
pH Range, short-term cleaning: 1-12
Free Chlorine Tolerance: <0.1ppm

Electrical Power Requirements:
8.0 – 20.0 amps @ 12.5-14.4 VDC
4.0 – 10.0 amps @ 25.0 – 28.8 VDC

The Enhanced Clark Pump Hydraulic Pressure Intensifier:

Manufactured by ElectroMaax for marine and military use. The Enhanced Clark Pump uses the Feed pump flow pressure to intensify the pressure of the flow through the RO membranes high enough for reverse osmosis to occur. There are no electrical components.

Displacement: 10 %
Feed Flow range: 1.0 gpm (3.78 lpm) to 4.0 gpm (15.14 lpm)
Maximum Inlet pressure: up to 125 psi (8.6 bar)
Maximum Working Pressure: 1000 psi (68.9 bar)
Maximum operating temperature: 113°F (45°C)
Maximum storage temperature: 140°F (60°C)
Pump Dimensions: 26.38” (67cm) W, 5.75” (14.6cm) D, 8.0” (20.32cm) H
Pressure Relief Valve: Manually open ½ turn CCW for priming and servicing

Feed Pump:
Motor: Permanent magnet type, fully enclosed, 1/8 hp
Pump Body: Thermoplastic
Pump Type: 3 chamber diaphragm
Typical Amp Draw each: 8 to 10 amps, 12VDC 4 to 5 amps 24VDC
Recommended fuse size: 25 amps, 12VDC 15 amps, 24VDC
Flow Rate: 1.6 gpm (6.05 lpm) open flow

Pressure Vessel:
Filament wound fiberglass/epoxy compound with non-metallic wetted surfaces. Easily removable end caps for membrane replacement with larger than standard internal porting and fittings for increased energy efficiency. The most compact complete assembly available.

Max pressure - 1000 psi (69 Bar)
Burst pressure - 3000 psi (207 Bar)

Prefilter and Auto Freshwater Flush Filter housings:
Industry standard, 10-inch, plastic, filter housings. Accepting 9.75” by 2.5” pleated filters and high flow carbon filter elements.

Clark Pump and Pressure Vessel Assembly, 2-21” Membranes:
Dimensions: 16.3” (413 mm) W, 24.7” (630 mm) L, 8.4” (213 mm) H
Weight: 40.0 lbs. (18.2 kg)

Feed Pump Assembly:
Dimensions: 14.2” (361 mm) W, 8.4” (213 mm) D, 12.6” (320 mm) H
Weight: 24.0 lbs. (11 kg)

Shipping:

3 Boxes
30” x 12” x 12” -- 42lbs
18” x 18” x 16” – 37lbs
12” x 12” x 14” – 12lbs

The *SolarMaax 340 Level 2* is simple to install. When all the components are connected in the right order the system will perform as designed and give all the freshwater you need for years. Every installation is going to be different in where and how the components are mounted so forethought is necessary for the ideal layout for your installation. If you are already familiar with watermakers without an energy recovery device like the Clark Pump, please try to forget what you know as much won't apply to this system and may lead you astray. Please read the instructions and don't make assumptions based on older types of systems.

Here is a simplified drawing of the *SolarMaax 340 Level 2* layout to familiarize yourself with how the major components interconnect.

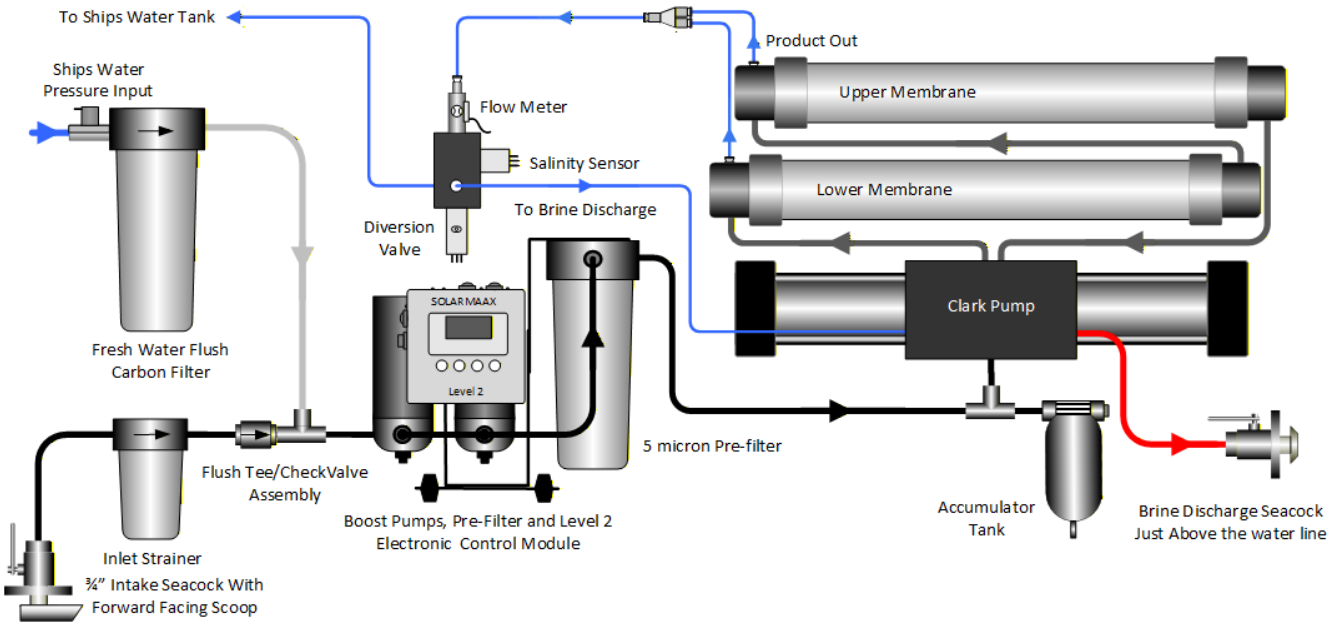


Figure 1: Simplified Component and Plumbing Layout

When installing the SolarMaax 340 Level 2 in your boat; here are the top factors to consider:

A. Make access for service, removal, and repair as easy as possible
B. Minimize the use of right-angle fittings to reduce water flow drag
C. Water will spill when servicing filters. Do not mount over sensitive equipment
D. Keep wire runs as short as possible and oversize the wire to minimize voltage drop
E. Though quiet for a watermaker, consider the noise when placing the components
F. **Factory sealed membrane element(s) are shipped separate. Keep sealed and install just before use. See Membrane Replacement, page 37, for installation instructions.**

INSTALLATION INSTRUCTIONS

Prior to beginning the actual **installation** process, please **read the entire** installation procedure and take a moment to consider the following installation notes to ensure the best performance, life, ease of operation, and maintenance of your *SolarMaax 340 Level 2* system.

Every boat is different, if any questions arise, please contact us via email (support@electromaax.com). We are here to help you, so there's no need to proceed with the installation if you have any doubts or questions. We would much rather walk you through any questions you have now, than after everything mounted in place and screw holes are drilled into your boat! **In this manual, step by step instructions are numbered, Notes are lettered.**

Installation Notes:

A. When selecting a mounting location, consider the parts that will require periodic **access,** such as the Pressure Relief Valve on the Clark pump, pre-filters, membrane replacement, flush filter and service valves.
B. The boost/feed pumps require a 25 amp fuse or breaker for 12 VDC, 15 amp for 24 VDC.
C. Both the high pressure and low-pressure water lines must be **routed** through the boat in such a way that does **not** expose them to chafing or with tight radius bends that could cause the lines to kink and inhibit flow.
D. Use only Teflon tape or Loctite #55 sealing cord in the installation of any pipe thread fittings and do not coat the first thread. Pastes type sealants are more likely to get into the system and cause damage to the membrane and Clark Pump
E. The RO membranes can have their performance degraded by **exposure** to temperatures above 113°F (45°C). Select a mounting location where it will not be exposed to ambient temperatures in excess of 113°F (45C) when the *SolarMaax 340* is non-operational. If operating and being cooled by sea water, higher ambient temperatures up to 120°F (49°C) are tolerable.
F. All of the assembly inlets and outlets are **labeled** clearly in the manual making the assembly process as "**plug and play**" as possible. Refer to the installation schematic for a detailed pictorial flow chart of the assembly.
G. As with most projects on a boat, the key to a good installation **is planning and component layout**. We recommend that the components first be loosely **(dry fit)** in place for **verification of how the plumbing will go** before permanently mounted.
H. Avoid sharp 90 degree fitting turns. The shortest length of tubing between two components may not be the most efficient if it has to have hard 90-degree fittings. A longer but smoother turning tube has less flow drag.
I. **The electrical connections should be performed by a person with proper knowledge and experience in the installation of 12 and 24 vdc systems.**
J. Voltage drop at the unit will degrade performance. Use the recommended wire size or larger.
K. For further assistance, Email first to bring our techs up to speed with the issue at support@electromaax.com

COMPONENTS IN ORDER OF WATER FLOW

In this section, each component's function and how it is installed is explained.

INTAKE SEACOCK:

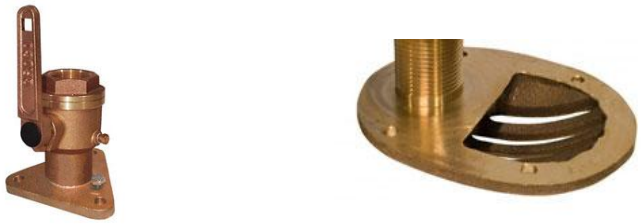


Figure 2: ¾" Intake Seacock and Scoop, Owner supplied

Install a dedicated ¾" seacock with a forward-facing scoop, placed as low and in the middle of the boat as possible. Avoid placing the seacock near or downstream of a head outlet or sink drain. Have a yard do the installation during a haul out. Sharing a through hull with another system is not recommended, but in certain cases is acceptable. Use ¾" hose barbs that match the valve material and ¾" ID hard walled reinforced below waterline rated hose leading to the Sea Strainer. The Seacock and Hose are not included in the *SolarMaax 340* kit.

SEA STRAINER:

Arrow on housing shows flow direction

Figure 3: ¾" Sea Strainer and Mounting Bracket

The Sea Strainer is used to protect the check valves in the Feed Pumps from being jammed by debris. The Sea Strainer is placed between the Intake Thru-hull Valve and the Flush Water Flush Tee or the intake Service Valve, whichever is placed next in line. Ideal placement is just above the waterline. Use ¾" hard wall reinforced rubber hose between the Intake Through Hull and Sea Strainer and double clamp the hose connections. If mounted below the waterline, use the reinforced water hose with double clamps from the strainer to the next fitting mounted above the waterline. Make sure there is enough room below the bowl for removal clearance. Water will be spilled when servicing; avoid mounting over sensitive equipment. After selecting a location, screw down the mount bracket. Identify the flow direction by the arrow on the housing then install the hose and tube fittings through the bracket into the strainer body. The fittings hold the strainer body in the bracket. When servicing the strainer, be careful not to lose the bowl gasket. Make sure the Strainer Bowl is screwed tight, so no air is allowed to enter.

FRESHWATER FLUSH ASSEMBLY:

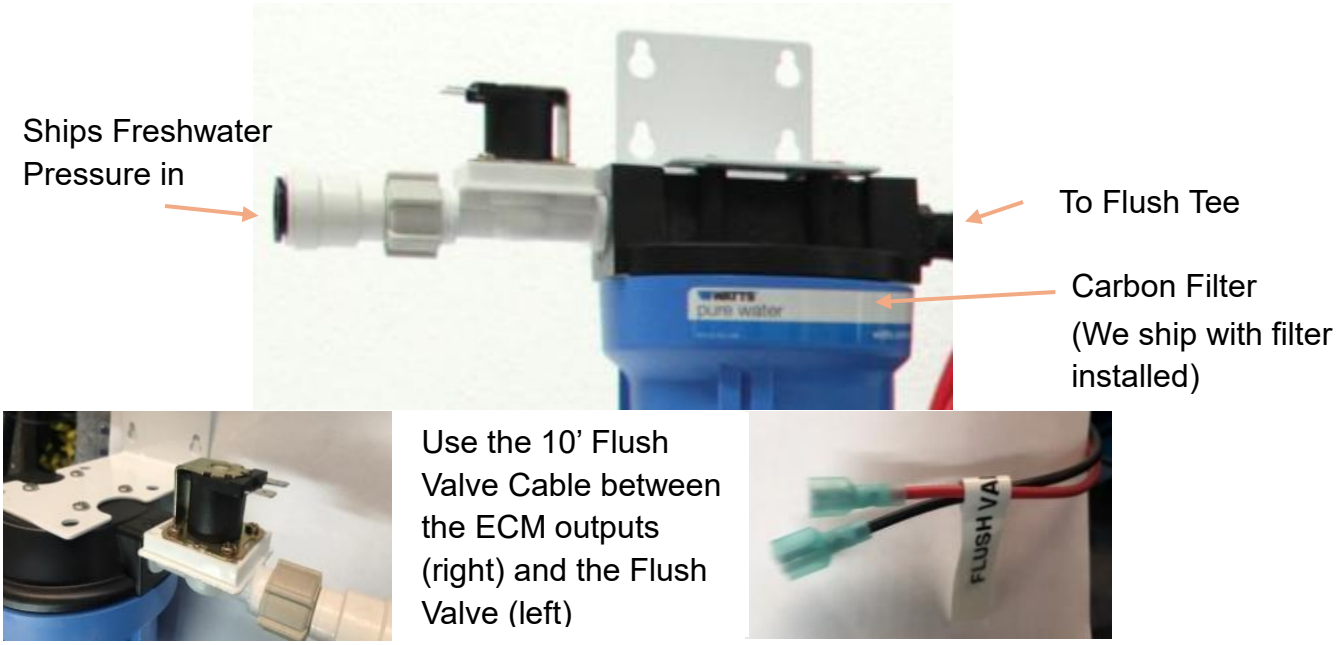


Figure 4: Freshwater Flush Assembly

The Auto-Flush function is used to flush seawater out of the system after use. A carbon filter is used to remove any chlorine that may be in the ship's water tank that will damage the membrane. Mount **vertically** using the integral mounting bracket. Be sure to leave at least 2 inches **below** the assembly to allow for opening filter housing. Freshwater will spill during filter replacement. The inlet is connected to the ship's pressure water system with owner supplied hose/tube and Tee-fitting to match the ship's plumbing. The outlet from Flush Filter is plumbed to a Tee placed in the feed line before the feed pump. Replace the Carbon Filter every 6 months of use or when the system is brought out of long-term storage. **The connections to the electrical "Flush Valve" at the Flush Filter Assembly are NOT polarity sensitive.** The wires can connect to either spade at the valve and the Electronic Control Module or ECM.

The Flush Check Valve keeps the pressurized filtered flush water from going out the intake through hull and directs it to the Feed Pump. Ideal placement is close to the Flush Tee so there is no place for salt water to sit between the valve and the Tee. Fittings included allow for an inline placement or connected directly to the Tee using the 3/4" NPT to Stem fitting that will push into the Tee making it a single assembly.

Figure 5: Freshwater Flush Check Valve

FEED PUMP ASSEMBLY:

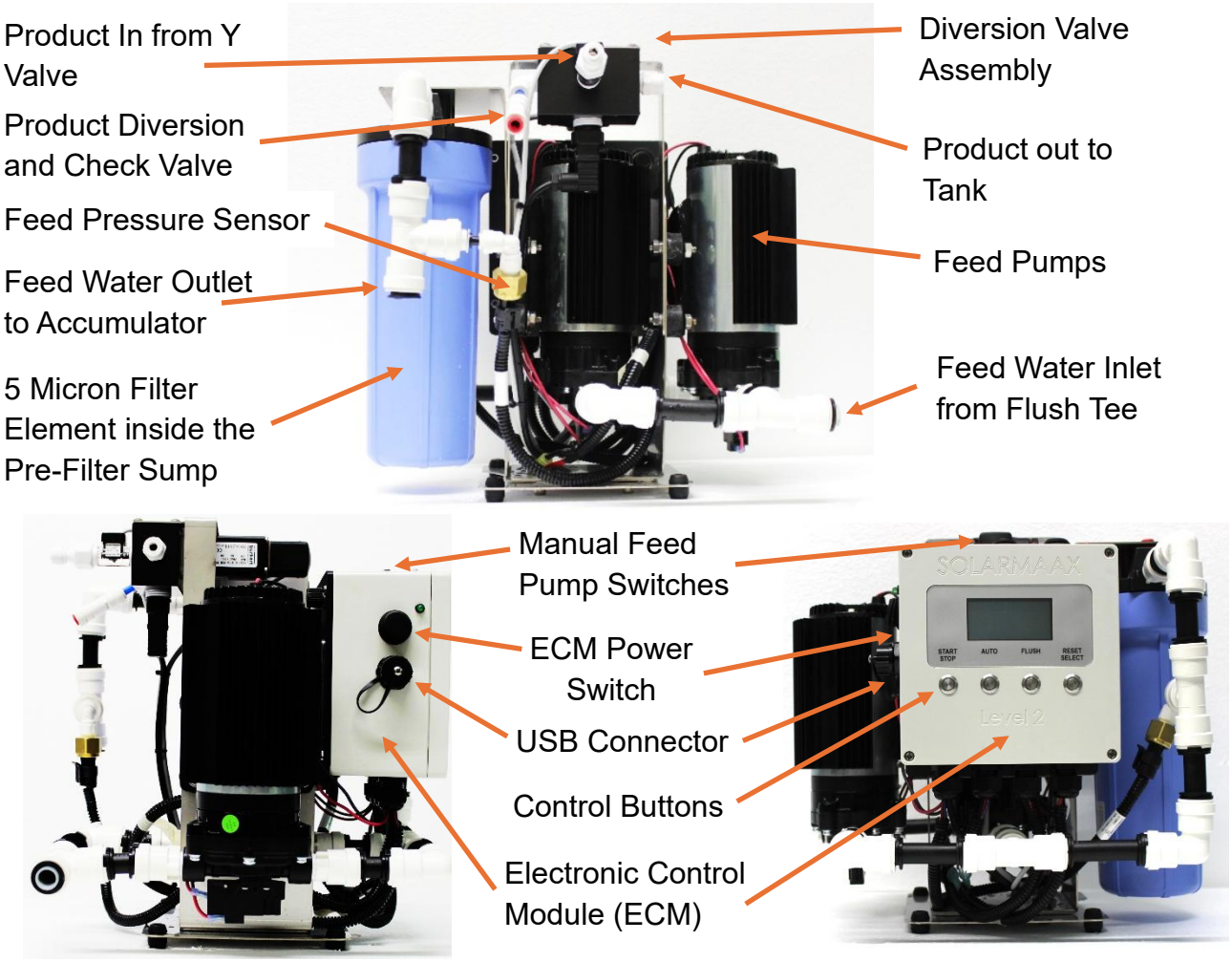


Figure 6: Feed Pump Assembly

The Pump Assembly has two 3 chambered positive displacement diaphragm Feed Pumps, a 5-micron prefilter and the Electronic Control Module. The pumps are similar to marine and RV demand pumps but generate higher pressure. They are self-priming but can't prime if the common outlet is under pressure. The *Pressure Relief Valve* on the Clark Pump **must be open ½ turn CCW** and the pumps primed individually. Mount on a horizontal surface in a dry location below the waterline to 3 feet (1m) above if a priming valve is installed. Have access to the manual pump switches, room for the pre-filter wrench to loosen the sump and enough space in front of the control box to remove the cover to access the electrical connections. Have enough space around it to dissipate the heat and/or place vents below and above the pumps to allow for convection currents to take away the heat. If the components must be separated, mount the pumps with the pump heads down, the Prefilter with at least 2 inches of space under the Sump and the Pump Control Module in a dry area close to the Feed Pumps.

MOUNTING THE FEED PUMP ASSEMBLY:

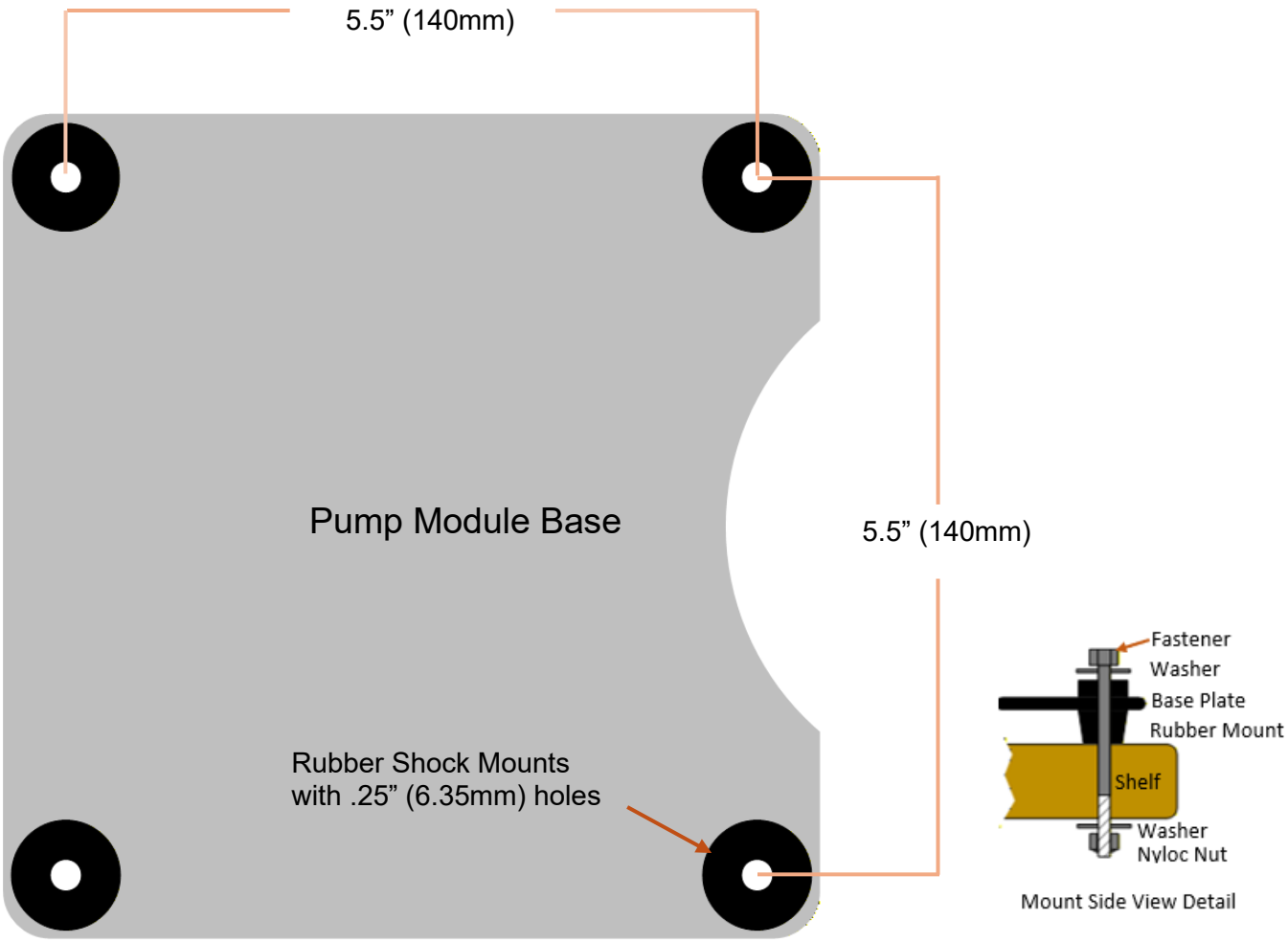


Figure 7: Feed Pump Assembly Foot Mount Drawing

The Pump Module is designed to mount on a horizontal surface that can handle water spillage. To mount the Feed Pump Assembly, set the Pump Module in the desired location and use the base as a pattern marking through the holes in the rubber mounts. Remember to leave enough space in front of the Pump Control Module to access the fuses and wiring connections plus access for the filter wrench to the prefilter housing. If mounting in a tight enclosed space, make sure there are vents in the upper area and lower area of the locker, preferably on opposite sides, to vent heat from the feed pump. Use round or hex head ¼” or 6mm stainless steel bolts or #12 to #14 wood screws suitable for the platform material. If bolting, use Nyloc nuts over flat washers. Place washers under the heads of the fasteners to bare on the rubber mounts to keep the heads from pulling through the rubber mount. Tighten the screws or bolts just enough to have the rubber mounts lightly touch the shelf, don’t crush the rubber mounts. The bolts won’t be very tight so the use of Nyloc nuts is important to keep them from vibrating loose.

FLOW SENSOR, SALINITY, DIVERSION VALVE ASSEMBLY:

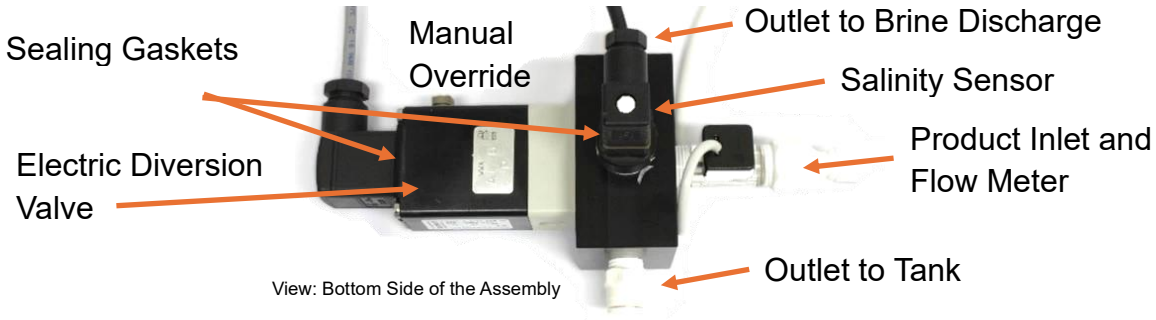


Figure 8: Flow Sensor, Salinity Sensor, Diversion Valve Assembly

ACCUMULATOR TANK:

Figure 9: Accumulator Tank

The Accumulator Tank must be pressurized to 60 psi before use. It is Teed into the Feed Tube close to the Clark Pump. Water flows in and back out, not through. It absorbs pressure spikes in the Feed Water flow during a Clark Pump “shift” which can affect the Pressure Switches on the Feed Pumps. Mount in any position so the Schrader Valve (bicycle tire valve) is accessible to check pressure. Due to shipping restrictions, the Accumulator is not pressurized and requires being pressurized to 60 psi (14.1 Bar). Use a bicycle pump to fill to a higher pressure and then use an accurate tire pressure gauge to set it to 60 psi. If the Clark Pump shifts are making the Feed Pumps stop and start, check the pressure while the system is off and the Pressure Relief Valve on the Clark Pump is open.

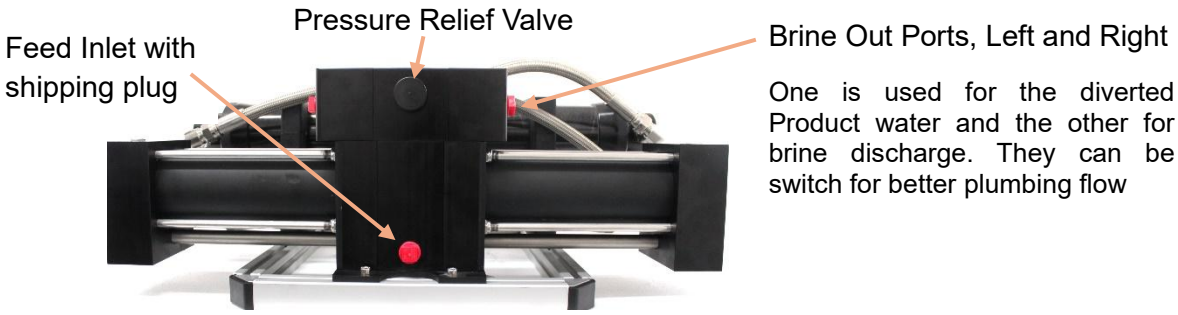


Figure 10: Front view

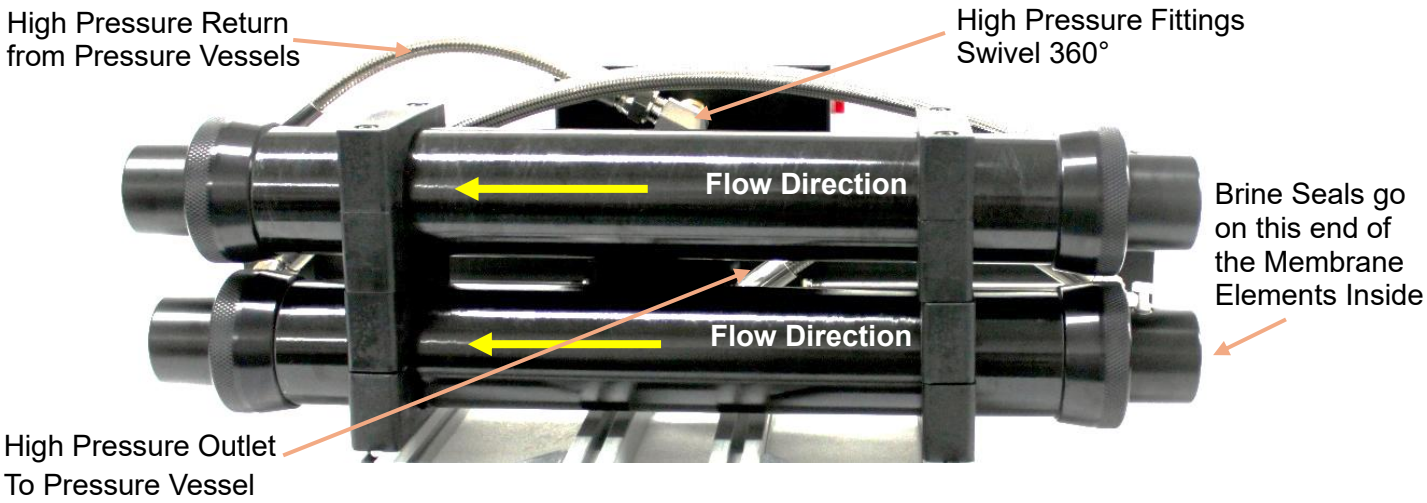


Figure 11: Rear view

Locate the Clark Pump and Membrane Assembly for easy access to the Pressure Relief Valve and access to the Pressure Vessels for Membrane replacement. The Clark Pump can be mounted in any orientation but if the Pressure Vessel Array is mounted vertically, the inlet of the Array needs to be on the bottom to purge air out the top. The membrane elements will be installed just before commissioning.

The Clark Pump has two brine discharge ports. One is connected to the Product Diversion Valve with blue Product Tube and the other is for the Brine Discharge connection. They're plugged at the factory for shipping. Their placement can be swapped if desired for better plumbing flow.

The Pressure Relief Valve is all plastic and is only finger tightened. **Do not overtighten.** Leave the Pressure Relief Valve open ½ CCW turn for the initial commissioning.

Before first start up, have the Black Feed Tube to the Clark Pump ready but do not connect yet. The first water through the system is discarded to purge any possible debris before connecting to the Clark Pump.

PRESSURE VESSEL & RO MEMBRANE ASSEMBLY

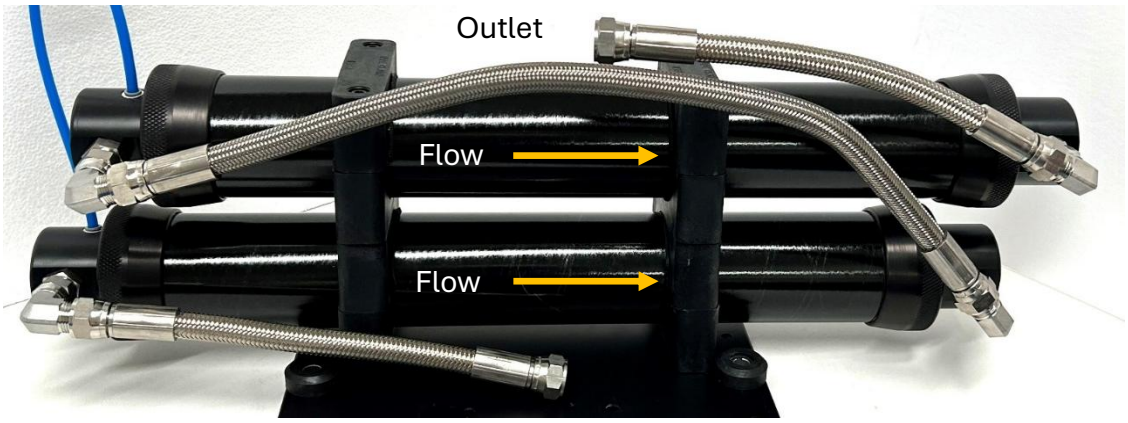


Figure 12: Pressure Vessel and RO Membrane Assembly

***Important!* The RO Membrane Elements are shipped separately in factory sealed bags. Install them into the pressure vessels just before commissioning. The Membrane element(s) should never be allowed to dry out. Follow the Membrane Replacement instructions, page 34, to install in the pressure vessels. On the first start up, the residual storage solution needs to be purged before making water.**

The Pressure Vessels with the RO Membranes inside them, are designed to be as compact as possible for tight installations. They're specifically designed for low water flow drag for energy efficiency, minimal metal exposed to salt water and ease of membrane replacement. If mounted with one end up, place the Inlet end below the Outlet end with the flow going uphill to help purge air. The stainless-steel flare fittings threaded into the plastic end caps have straight threads and O-ring seals. They are only lightly tightened into the plastic after they bottom out, *completely* burying the O-ring. They may move a little if the hose is pulled on but that is OK. If there is a leak between the fitting and the endcap, there is a problem with the O-ring seal. *Tightening will not help unless the O-ring is not seated and you can see it between the fitting and cap.*

The Product Outlet End Caps can be positioned at either end as desired. See ***Membrane Replacement*** for end cap removal and reinstallation. The Product Outlet Fitting is a 1/4" Push to Fit for the product tubing.

The flow through a Pressure Vessel/Membrane is directional due to a "Brine" seal placed on one end of the membrane element. This makes it the inlet end. The seal directs the flow through the membrane and stops any flow around the outside. If the placement of this seal is somehow lost, remove one end of the Pressure Vessel End Caps. Grasp and shake the end of the membrane. If it wobbles around easily the seal is at the other end. If it hardly moves, the seal is at that end which should be the flow inlet.

ELECTRONIC CONTROL MODULE (ECM)

The SolarMaax 340 Level 2 is equipped with the Level 2 Electronic Control Module with manual pump override switches. The Electronic Control Module allows for push button operation of the system in different modes of operation, remote operation through a smart phone and display operating information.

The manual override allows for easy priming, servicing and emergency operation of the system in the event of an electronic failure.

Figure 13: Electronic Control Module (ECM)

ECM has the following features / functions, interfacing with the Feed Pumps.

- ON / OFF Switch on the side with an LED to indicate status
- USB port on the side with a cover for custom programming
- Manual Override Switches for the Feed Pumps on top with LED indicators
- Start/Stop button to run with manual shut off or full tank sensor cut off
- Auto Run button for limited timed operation
- Flush button for single or auto re-flush.
- Reset/Select button for alarm reset and screen scrolling
- Digital display
- Auto Flush mode indicator LED
- Can be remote controlled by a smart phone
- It can interface with a local network and be accessed from a remote computer

3-WAY SERVICE VALVE

Figure 14: 3-way Service Valve

Two 3-way service valves are provided for access to the seawater Feed Line and Brine Discharge Line. They are used to facilitate membrane storage and cleaning procedures. They should be placed so their alternant Service Tubes can reach a Service Pail at the same time.

A. The Intake Service Valve can be placed anywhere between the strainer and the Feed Pump. It can be hard mounted directly to the sea strainer with the fittings supplied. **The Intake Tubing and the Intake Service Valve should not be mounted higher than the top of the Feed Pump Module for ease of priming the system.**
B. The Discharge Service Valve is located anywhere in the Brine Discharge Line including mounting directly on the Clark Pump Brine Outlet Port.

Note: The valve will always introduce a 90-degree turn in the water flow. There is no straight through position.

DISCHARGE THROUGH HAUL

Figure 15: Brine Discharge Through Haul Fittings (Owner Supplied)

The red Brine Discharge Tube from the 3 way Brine Service Valve is led to a dedicated Owner Supplied ½" or larger through hull fitting just above the waterline. It is possible to tee it into an existing drain above the waterline but there is a good chance it will cause gurgling noise and flood the boat if the drain through hull valve is closed. Sharing a discharge is highly discouraged for those reasons. Being able to see the brine discharge come out of the side of the boat can help in trouble shooting.

TANK FILL SELECTOR VALVE

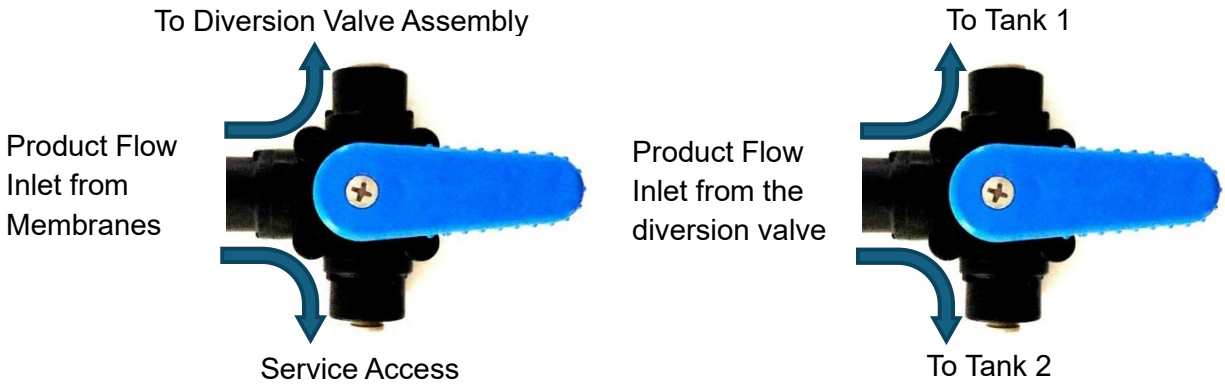


Figure 16: Optional Tank Fill Selector Valve

Special non-dead heading Product 3 Way Valves are used for manual Product Water access for servicing and to select between two tanks to be filled. The Product Service Valve is mostly used to fill the service pail for pickling and cleaning or sampling the product water when operating in Manual Mode. The same type of valve is used to select between two tanks. Two valves are needed to fill three tanks. The valves can be mounted in a panel or fastened to a wall by drilling out the mounting holes.

Caution: Do not use any type of selector valve that can block the flow in any way, even momentarily, or damage to the system *will* happen.

TDS TESTER AND TESTING PRODUCT WATER QUALITY

Figure 17: Handheld TDS Tester

The L2 control system uses a salinity sensor that measures the Total Dissolved Solids (TDS) measured in Parts Per Million (ppm) in the product water. When the sensor measures the ppm below the industry standard of 500 ppm for drinking water, a diversion valve in activated to send water to the tank. Product water above 500, the diversion valve is not activated diverting the product water to the Brine Discharge.

The Held Salinity/TDS Meter is included as a bank up to this system in case the automatic system fails or used to compare the readings for trouble shooting. When the system is run in Manual Override, use the Product Service Valve to sample the Product Water ppm using the Handheld Salinity Sensor and when within good parameters, use the manual override knob on the diversion valve to send water to the tank. To manually “TEST" the product, complete the steps on the next page.

HANDHELD TDS TESTER MEASUREMENT INSTRUCTIONS:

1. Start and run the system, making, and diverting the product water, for at least a minute.
2. Remove the protective cap.
3. Turn the TDS meter on. The ON/OFF switch is located next to the readout.
4. In a clean cup, **rinse 3 times** then take a sample to about 2.5" deep.
5. Immerse the meter into the water/solution up to the max immersion level (2").
6. Lightly stir the meter to dislodge any air bubbles.
7. Wait until the display stabilizes. Once the reading stabilizes (approx. 10 seconds), press the HOLD button to view the reading out of the water if needed.
8. If the meter displays a flashing "x10" symbol, multiply the reading by 10.
9. After using it, shake off any excess water from your meter. Replace the cap.
10. In Manual Operation, When the water reads below 500 ppm, turn the knob on the Product Diversion Solenoid Valve 90 degrees to manually send Product Water to the tank. Remember to turn the knob back to its normal position after manual operation.

    If the water isn't below 500 ppm or the water tastes bad, let the system run for ½ hour in manual mode and test again. If the water quality continues to be poor, the membrane will need to be cleaned or replaced. See membrane cleaning and replacement sections.

    If the system has been flushed with freshwater after use (recommended) the first water will not be that salty and should clear quickly. If it has been sitting with salt water even for a few minutes, the first flow will be very salty and should be diverted so it doesn't go into the tank.

    Warning: In a Level 2 system, the automatic salinity sensor/diversion valve system is always testing the water. When running the system, periodically check the TDS reading on the display. If the TDS is getting high, double check the reading using the Handheld Salinity Sensor to check the accuracy of the automatic system.

    Warning: If operating in freshwater, the Product Water TDS should read at 10 ppm or less if the membranes are functioning well. In fresh water with a TDS below 500 ppm, the automatic or the Handheld systems cannot tell if a membrane is bad and letting pathogens into the Product Water. A "Taste" test is also not reliable when operating with a freshwater feed. In salt water, if the membrane is damaged enough to let a pathogen through it will show up as very high TDS in the product water but **not in freshwater**. An Ultra Filtration or UV light Product Water Sterilizer is recommended for continuous freshwater operation.

PURE SILICONE GREASE PACKET:

Use only pure silicone grease for lubing components when needed. A grease packet of the proper type of grease is provided.

MOUNTING THE COMPONENTS

A. Dimensions for the main component modules are on page (42).

B. Follow the flow diagram and the mounting notes in the component descriptions. Note how the 3-way valves are plumbed, **they will always introduce a 90° turn in the flow.** A set of U brackets are supplied to mount the larger valves to a bulkhead if desired.

C. When mounting the components, check the thickness of the bulkhead and cabinet panels and size the fasteners appropriately. If using through bolts, use Nylock nuts and washers. Use fasteners that match the mounting holes in the components or one size under at most.

D. The length of the feed and discharge tubes do not affect the performance that much, but many right-angle turns will. Long sweeping turns are better.

E. Place the Clark Pump/Pressure Vessel assembly for easy access to the Pressure Relief Valve while operating the system and with consideration for how to replace the membranes which means either there is enough room off of one end of the Pressure Vessels to remove the membranes in place or if the Pressure Vessels will need to be removed to allow access. Allow wrench access to the High-Pressure fittings at the ends of the membrane for removal. The HP fittings require 2 wrenches for assembly or removal. The flexible HP hoses and the swivel fittings in the Clark Pump allow for installation options for fitting access.

F. The 3-way Service Valves should be located in the same area where a Service Pail can be securely placed, and the Service Tubes can all reach it at the same time. This is important for ease of use and maintenance. The Service Tubes can be removed or tucked away when not in use.

G. The Product water must be dropped into the top of the tank without any back pressure. Do not connect it at the bottom outlet of the tank as the head pressure may try to push product water backwards through the membrane when the system is off. Tee into the tank vent or fill line or ideally, add a port into the top of the tank.

H. Make sure the tank vent is not clogged. If the tank is overfilled, the product will flow harmlessly out of the vent. This should be tested at commissioning to make sure the vent is open and there are no leaks on the top of the tank.

I. The Feed Pump Assembly should be mounted to a rigid horizontal surface in a dry area below the waterline or up to 3 feet (1m) above the waterline. Best is at or below the waterline. If the Feed Pump Assembly is close or 3 feet above the waterline, do not have any other system components higher than the Feed Pump Assembly. In some cases, a bleed valve placed between the Pump Module and the Clark Pump may be needed to easily prime the Feed Pumps.

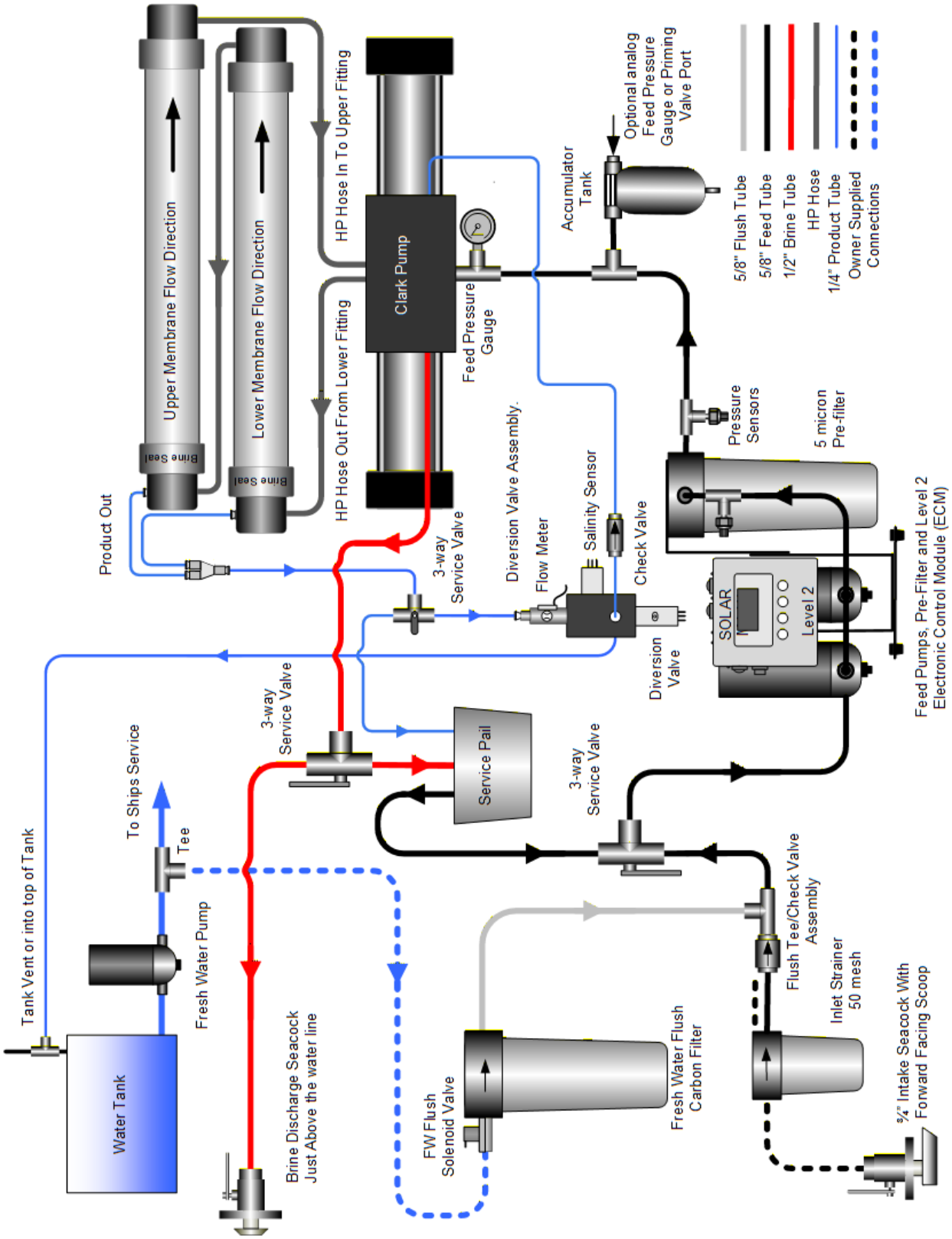


Figure 18: Complete Plumbing Diagram

LOW PRESSURE TUBE AND FITTINGS:

Plastic Pipe Threads:

Use 3 to 4 wraps of Teflon Tape on the threads, leaving the first thread bare. Tighten fittings until snug. Overtightening will bottom out the fittings and leak. If a pipe thread is too loose and bottoms out easily, use Loctite 55 thread cord to build up the threads.

Tubing Color Coding:

The **low** pressure (pressures listed on chart pg.6) tubing has been **color coded** depending upon where it's used in the system. All plastic tubing is linear low density *polyethylene* tubing (LLDPE) approved for drinking water use.

Black 5/8" tubing is used for the raw water plumbing from the outlet of the ship's sea strainer to the inlet of the Clark Pump.

Red 1/2" tubing is used for the brine discharge from the Clark Pump to the discharge through hull.

Blue 1/4" tubing is used for the freshwater product discharge from the RO membrane assembly which is led to the Control Panel then to the ships water tank or Service Pail through the Product Diversion Valve on the Panel.

Black 1/4" tubing is used to plumb the Feed Pressure Gauges from the fittings on the inlet and outlet of the Pre-filter.

Clear 5/8" tubing is used from the carbon filter to the Tee in the feed for the freshwater flush.

TUBE CUTTER:

Figure 19: Tube cutter

A tube cutter is supplied with every ***SolarMaax 340*** system. This cutter allows the tubing to be cut squarely to allow for a leak free seal on "**Push-to-Connect**" fittings. The above photo shows the correct placement of the tubing into the tubing cutter. The cutter has a **hinge** on one end and once the tubing is placed in the cradle the ends are **squeezed and rotated** together to cut the tubing. Breaking the cut OD edge with a fingernail or other tool can help assembly.

TUBING CONNECTION:

All low-pressure fittings are "**Push-to-Connect**", high grade, double "O" ring, NSF 58 certified, lead free, polypropylene G.A. Murdock fittings. The ***SolarMaax 340*** system comes with the push-to-connect fittings pre-installed on the larger components. Additional fittings are supplied to be able to customize installation as needed. The figure below shows the "Push-to-Connect fitting, locking clip, and tubing.

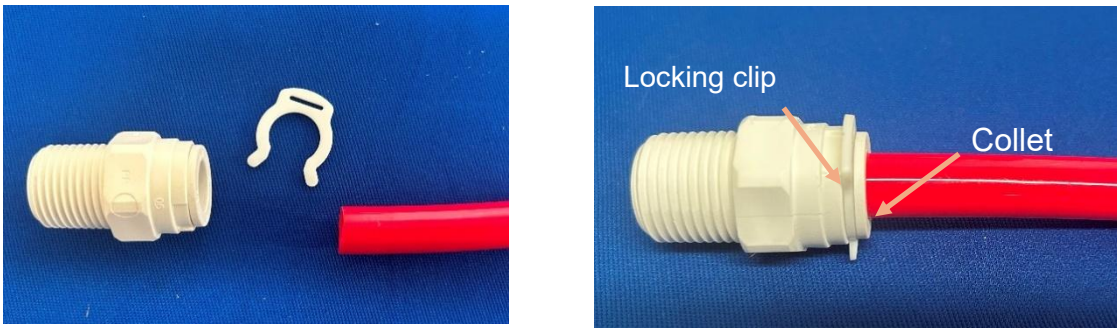


Figure 20: Fitting, Locking Clip & Tubing Installation

Tubing Installation:

The tubing is **pushed** into the fitting until the tubing seats onto the internal stop of the fitting. The tube goes in easily then push hard to get past the collet and the O-ring seals. The collet keeps the tube in. The locking clip is installed between the body and the collet to prevent accidental tube separation.

It is **recommended** that tubing installations are inspected at least annually, and parts replaced as needed.

Tubing Removal from Fittings:

Figure 21: Tubing Removal Assist Tool

To **remove** the tubing from the fitting the locking clip **must** be removed. Using the Tubing Removal Assist Tool, **press** the notched side of the proper size opening against the collet of the fitting and while holding the collet up against the fitting evenly, **pull** on the tube to remove. Fingers can be used to push the collet down but it's easier using the tool.

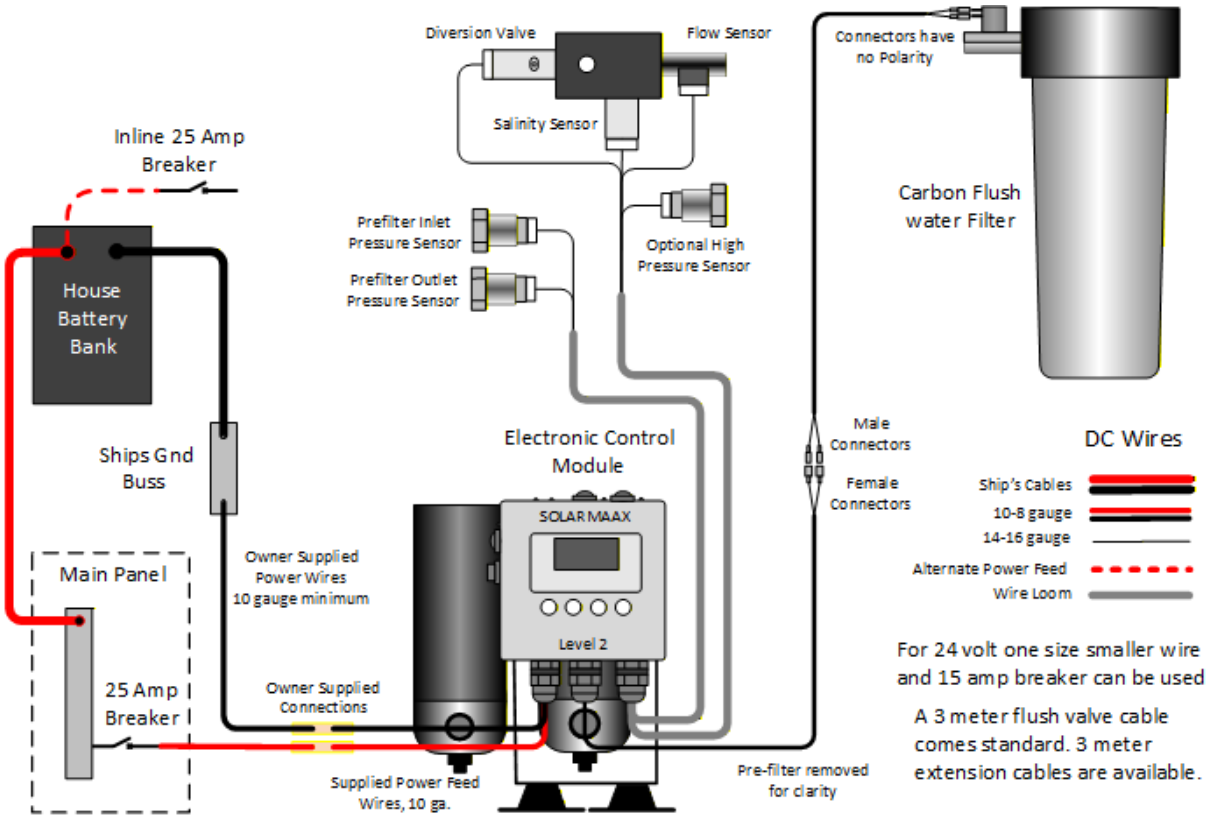


Figure 22: Electrical Diagram

Proper wiring is important to minimize voltage drop between the batteries and the Feed Pumps. Use Marine grade tinned multi strand wire. Pick one of the methods above, taking power from a breaker on the panel or wire an inline breaker directly from the house batteries, whichever is closer. Use 10-gauge yellow butt connectors with heat shrink. If wire size 8 gauge or over is needed, place a covered power terminal strip sized for the larger wire by the ECM to make the connections.

Wire gauge size between the power source and the SolarMaax ECM:

(Note: Consult Current ABYC Wire Size Tables)
10 gauge for distances up to 10 feet
8 gauge up to 20 feet
6 gauge up to 40 feet

The Flush Valve two conductor cable attaches to the two wires with female spade terminals coming through the small gland and connects to the Flush Valve on the Carbon filter. 10' extensions for the cable are available for purchase through ElectroMaax. The Valve/Sensor wire loom from the ECM has connectors already attached and are marked to where they go.

CONTROL SYSTEM:

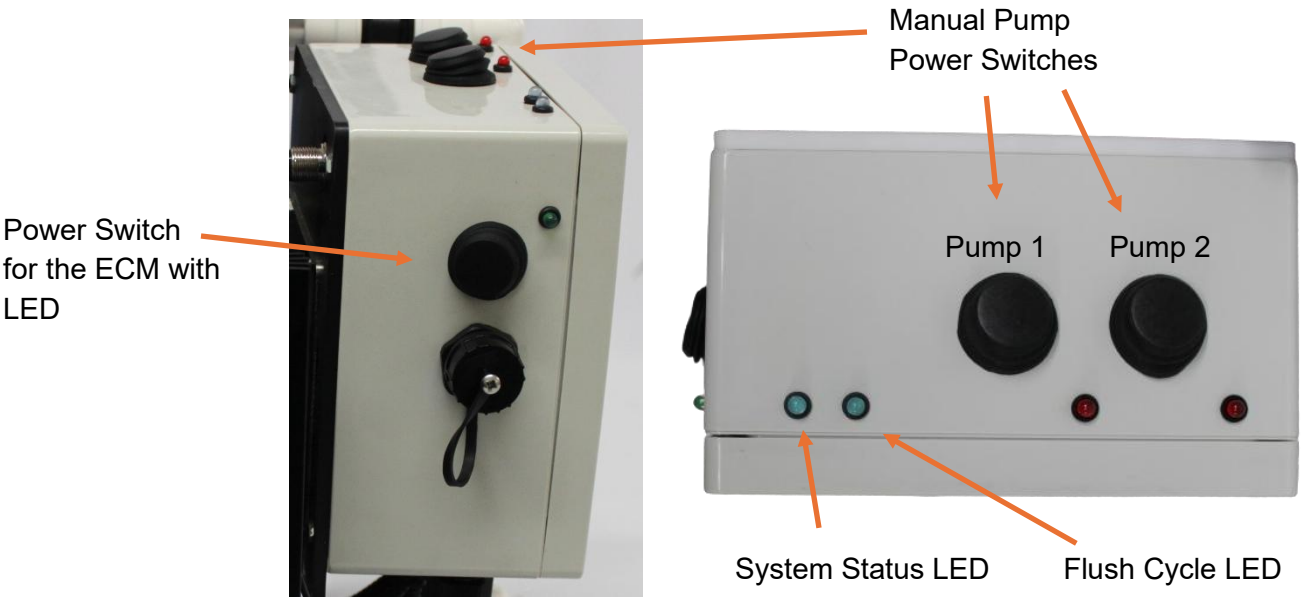


Figure 25: Electronic Control Module (ECM)

Control Operation:

Turn on the power feed from the ship's batteries. Test Manual Feed Pump function by momentarily activating each Manual Pump Power Switch on the top of the ECM enclosure. Activate the Power Switch on the side of the ECM enclosure. An LED by the switch will flash when the power is on. The LED has three states:

ON *(Flashing 1 / sec.) - system is operating normally*

ON (Steady) – Electronic failure - unit requires factory repair

OFF – when switch is on, no power supplied to the ECM

Figure 26: Electronic Control Module (ECM) Button Detail

For more information on the Electronic Control System see Appendix A on page (41)

Control Buttons on the ECM:

The Run, Auto Run, Flush and Display functions are controlled by the Panel Buttons. The Power Switch on the side of the ECM activates the Panel Buttons

1. Start/Stop Button: Use this button to start the system in continuous mode. The system will run until the button is pressed again or a “tank full” sensor turns it off.
2. Auto Button: Use this button to set a pretimed run with an Auto Flush at the end. First press starts the system to run for 1 hour. Each press after adds another hour.
3. Flush Button: This starts a single or timed re-flush of the system.
4. Reset/Select Button: Use this to scroll through the Display Screens and to reset an alarm indication.

Freshwater Flush: (Auto and Single)

It is recommended to fresh water flush the system after each use. There are 2 flush modes available: *Auto and Single*. The Flush process activates one of the Boost Pumps and a Solenoid Valve on the Carbon Flush Filter, injecting filtered freshwater from the vessel’s pressure water system to flush out the salt water. The Manual Pump switches need to be off before starting a flush.

Single Flush:

Single Flush mode is activated by pressing the Flush Button; this will start a single-event programmable duration (default 3-minute) flush. A Blue LED on the top of the ECM lights steady during the Flush process. After the flush the LED goes out. **NOTE:** A Flush can **only** be enabled when both Feed Pumps are off. If a Manual Pump Switch is turned on during a Flush cycle, the Flush and Auto Flush will be canceled.

Auto Re-Flush:

A 3 second press and hold of the Flush Button on the ECM starts a programmable duration timed (default 3 minutes) flush then a programmable re-flush interval typically set between 3 to 9 days. The LED (blue) on top of the ECM will light steady during the flush process. After completing the initial flush, the LED will flash slowly indicating it remains in Auto Re-flush stand-by mode.

NOTE: A Flush can **only** be enabled when the Feed Pump is off. If a pump switch is turned on during a Flush cycle, the Flush and Auto Flush will be canceled.

Deactivating a Flush:

To cancel the Auto Re-Flush or Single Flush press the Flush Bottom again or start the system.

COMMISSIONING

The Commissioning Procedure should be performed at a new system start up. The main function is to prime the Feed Pumps, look for leaks, and purge the system of chemicals.

1. Open the watermaker intake and discharge through hull valves.
2. Turn on ships pressure water system.
3. Set the Intake and Brine Discharge 3 Way Valves to normal run. (See Plumbing Diag. Pg. 22)
4. Set the Product 3 Way Valve to “TEST”. Put the Test Port Tube into a container.
5. Open the Pressure Relief Valve 1/2 turn CCW from a finger tight closed position.
6. Place the loose end of the black Feed Tube to the Clark Pump in a container.
7. Turn on the Main Power Breaker (ship’s system).
8. Turn on the Power Switch on the ECM to activate the Control Panel funtions.
9. Press Flush to start a flush cycle. Listen for the flush water to reach the feed pump. Look for leaks in the system. If any leaks are found, turn off the system and repair them before continuing. Watch for water to fill the container by the Clark Pump.
10. Press the Stop button to stop the flush and connect the Feed Tube to the Clark Pump. **This one-time step clears any debris between the Prefilter and Clark Pump.**
11. Press the “Pump 1” manual switch on the ECM to start Feed Pump 1. Look for water flowing through the Inlet Strainer. As the Feed Pump is pulling in the seawater, its sound will smooth out as the air is purged. Pressure will start to build in the feed pressure gauge, and the Clark Pump will make its first “shift” at it starts to circulate water through the membrane. The shifts should start to even out as air is purged. They may be hard to hear, watch for a rise and fall of boost pressure as the Clark Pump shifts.
12. With the Feed Pump **running**, make a visual inspection to ensure that the connections are all **leak** free. If any leaks are found, turn off the system, flush then repair before continuing.
13. Turn off Pump 1 and turn on Pump 2. Let it purge until it runs smooth.
14. Restart Pump 1 so both are running. Continue to run the unpressurized system (Pressure Relief Valve open) for 20 minutes to purge the storage solution from the

membrane elements. The Feed pumps should be running smoothly now. If not, there may be an air leak in the Strainer, Flush systems or fittings before the Feed Pumps. Fix before continuing.

15. After 20 minutes and the system is running smooth with regular shifts in the Clark Pump, close the Pressure Relief Valve. The sound of the Feed Pumps and the Enhanced Clark Pump shifts will change as high pressure is generated in the Membrane and Product Water will start to flow through the Product Service Valve and out the Test Port Tube.

16. Check for leaks at the high-pressure hose connections and around the Clark Pump, Membrane end fittings. Recheck the Feed system for leaks. If leaks are found, stop the unit, flush and correct as needed.

17. Run the system with the Product Water diverted for 10 minutes to purge the Product Water side of the Membrane to clear any remaining Storage Chemical.

18. Test the Product Water with the Handheld Salinity Sensor. It should be below 500 ppm.

19. Turn off both pumps and switch the Product Service Valve back to normal position to send water to the Diversion Valve and Sensor Assembly. The system is ready to run.

20. ***Important!*** Always rinse any leaked saltwater from the system and surrounding area.

Notes

NORMAL START UP:

Note: If there is any question about the service history of the system, perform a “Restart after Long Term Storage” (pg. 34) procedure first.

1. Turn on the Ship’s Main and ECM power.
2. Check the boat’s Inlet and Brine Through Hulls are open and the sea strainer is free of debris.
3. Open the Pressure Relief Valve on the Clark Pump 1/2 turn **or**, if the system has been recently run and is well primed, the Pressure Relief Valve can remain closed.
4. Push the Start/Stop or Auto button to start the system. Listen for the Feed Pumps to run smoothly and the Clark Pump is shifting normally. The display will read “waiting for product water to become good”
5. Close the Pressure Relief Valve finger tight if opened.
6. When the Product Water is good, the Diversion Valve will open and send water to the tank. The display will switch to its default readout.
7. If the water tank overfills, the water will overflow out the vent but should not cause a problem.
8. If started with the Start/Stop button the system will run until the Start/Stop switch is pressed again or signal from an optional tank full sensor. If started with the Auto Button, the one press will run the system for an hour (default time setting). Pressing the Auto button again adds an hour of run time each time it’s pushed. The system will auto stop and flush itself at the end of the selected run time.

NORMAL RUN:

A. Depending on the selected run mode during initial programming (see Appendix A) in “Normal” mode, the feed pumps run together but if the feed pressure gets too high, one of the pumps will shut down to lower the feed pressure. In “Eco” mode, both pumps always run together but slow down to keep the feed pressure below a programmed set point.

B. Watermakers like to run. The best practice is to run until the tanks are full, shut down with a freshwater flush, then restart when the tanks are down after a few days. Flushing is important because what biological growth that can happen inside the membrane in saltwater will not survive in freshwater and vice versa.

C. Monitor the display. Filter elements clean better if they are cleaned as soon as they **start,** or even better, *before* they start to restrict the flow.

D. In rough sea conditions and hard sailing, watch for air getting into the system causing the feed pumps to lose their prime and the feed flow has stopped. Open the pressure relief and prime each pump separately again then close. If this happens often, wait until better conditions to run the system. This is more likely to happen if the through-hull is not down by the keel of the boat or excessive boat speed.

E. Oil in a membrane will ruin it. It’s usually not a problem as oil normally floats on the surface but if an oil slick is encountered at sea in rough conditions it can get into the system. Avoid running the system.

F. The system can be run from a brackish or freshwater feed source without having to make any adjustments. A good membrane works equally well in fresh or salt water. The feed pressure will be lower operating in freshwater.

Warning: Testing the Product Water with the Handheld TDS Tester while operating is freshwater should read 10 ppm or less of TDS if the membrane is good. A “Taste” test is not reliable when operating with a freshwater feed. If the membrane is damaged enough to let a pathogen through it will show up as very high TDS in the product water while operating in salt water but ***not in freshwater***.

SHUT-DOWN PROCEDURES:

The system automatically shuts down with a single Auto Fresh Water Flush at a Tank Full signal in Auto Mode or at the end of the run time selected in Timed Auto Mode. The Pressure Relief Valve should always be closed during a flush to limit the flush flow through the carbon filter.

NORMAL SHUT-DOWN, NO FRESHWATER FLUSH:

1. Turn off the system with the Start/Stop button. Main and ECM power can stay on.
2. The Pressure Relief Valve can be left closed.
3. Do not leave it unflushed for more than a day without running or flushing.
4. On restart, watch the display to see if the system is producing good water.

A watermaker is happiest running for a long time then flushed every time it's turned off but there are times where it shouldn't be flushed. For offshore racing, the watermaker may only be run a short time each day to make the minimum amount of water needed to save weight. Flushing uses about 5 gallons of freshwater so flushing every time after short runs uses up most **or more** of the water just made. Being used every day, fouling is minimal so only do a One Time Flush every 5 days or so on an offshore race after making enough water for it.

NORMAL SHUT-DOWN WITH A ONE TIME FLUSH:

After shut-down, momentarily push the Flush Button. A one-time flush will start. The LED will be on solid while the Flush is going. Scroll the display to see system pressures. Watch for the pressures to drop and stabilize at a lower pressure as the salt water is flushed from the membrane. If the pressures remain steady, the flush is not working. Check if the freshwater pressure is functioning, the Flush Valve wire connections are good and the carbon filter isn't clogged. A flush uses about 5 gallons.(19 L)

The ***SolarMaax 340*** can now sit idle for typically **5 days** before:

A. The next use.

B. An additional freshwater re-flush.

C. Pickling for extended system storage.

AUTO RE-FLUSH EVERY 3 TO 9 DAYS FOR TEMPORARY STORAGE:

1. Initiate after the system is stopped. Use 3 days in a hot climate, 9 days in a cold climate.
2. Make sure the ship's Freshwater Pressure System is on, with plenty of water in the tank.
3. With the Pressure Relief Valve closed, push and hold the Flush Button for 3 seconds. The LED "fast" blinks to indicate flushing in Auto Re-flush mode. Scroll the display to see system pressures. Watch for the pressures to drop and stabilize at a lower pressure as the salt water is flushed from the membrane. If the pressures remain steady, the flush is not working. Check if the freshwater pressure is functioning, Flush Valve wire connections are good and the carbon filter isn't clogged.
4. After the initial flush the LED will "slow" blink to indicate it's in Auto Flush mode.
5. The Pressure Relief Valve should be left closed, and the system restarted when needed.

Caution: The Ships pressure freshwater system must on with plenty of water in the tank when the *SolarMaax 340* is in Auto Flush mode. If the boat is to be left unattended it is recommended to put the system into long term storage "Pickle".

PICKLING FOR LONG-TERM STORAGE:

1. Using the Product Service Valve, make 2 gallons of product water into the Service Pail. 2 gallons of distilled will work too if the system shouldn't be run on the local seawater
2. Perform a freshwater Flush as detailed in the Freshwater Flush procedure.
3. Wearing gloves, thoroughly mix an 8 oz package of Memstor Storage Chemical into the water in the Service Pail. This may take some time to fully dissolve the powder.
4. Put the 3 service tubes (See Plumbing Diagram pg. 22) into the Service Pail. Secure the tubes if necessary to keep them in place.
5. Turn the Feed and Brine 3 way Valves to their Service positions.
6. Turn the Product Valve to its Service position.
7. **Important! Open the Pressure Relief Valve**. Do not run the System under pressure while circulating the Storage Chemical.
8. Start one Feed Pump manually until it's primed, stop it and start the other until it's primed then run both to circulate the Memstor. Let it run for 20 minutes to thoroughly saturate the membrane
9. While still running, turn the Brine Service Valve back to the Normal Run position. Almost empty the pail but try not to draw in air then turn the system off.
10. Turn the Feed 3 Way Valve back to the Normal Run position.
11. Leave the Product Service Valve in the Service position.
12. Close the Intake and Brine Through Hulls, drain, clean and dry the Intake Strainer, Pre-Filter and Flush Filter. Reinstall clean or new dry elements.
13. Turn off the Power Breaker and make a label stating when the System was Pickled.

WINTERIZING:

1. Instead of the Memstor, put 2 gallons of the -100° alcohol free RV potable water antifreeze into the service pail then follow steps 4 through 12 for Long-Term Storage.

   WARNING: DO NOT use automotive antifreeze.

RESTARTING AFTER LONG-TERM STORAGE

1. Open the Intake and Brine Discharge Through Hulls.
2. Check the Intake strainer is clean and the sump tight
3. Open the Prefilter Sump to check for a clean 5 Micron Filter Element. If the filter is wet and smelly the system may have not been Pickled properly or not at all. Install a new filter if bad.
4. Replace the Carbon Flush Filter if over 6 months old or age is unknown.
5. *Make sure* the Pressure Relief Valve on the Clark Pump is open 1/2 turn from finger tight.
6. Check the Intake and Brine 3 Way valves are in the Normal Run position.
7. Set the Product Valve to “TEST” and have the Product Service Tube able to drain properly.
8. Turn on the Main Power Breaker and the ECM Power switch on the ECM.
9. Turn on Pump 1 manually. Allow Pump 1 to prime and is running smoothly then turn off.
10. Turn on Pump 2. Allow Pump 2 to prime and is running smoothly. Restart Pump 1
11. Let the system run unpressurized for 20 minutes to purge the Pickling Solution.
12. After 20 minutes, close the Pressure Relief Valve finger tight.
13. Check the Feed pressure and Product flow rate are normal.
14. Bypass the Product Water for another 10 minutes then stop the pumps
15. Move the Product Service Valve to the “Normal” position.
16. The system is now ready to run.

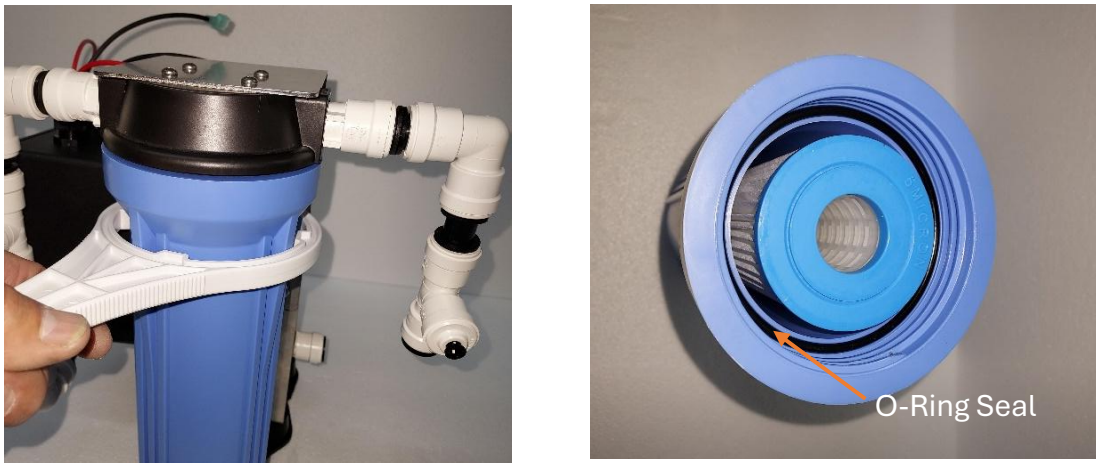


Figure 27: Micron Pre-Filter

The Clark Pump and the RO Membrane must only operate on 5 Micron filtered Feed Water. Not all “5 Micron” filter elements are the same. Some come with Carbon in them which can let off Carbon “fines” with first use. These Fines will ruin the Clark Pump and Void the Warranty. Use only high quality 5 micron 10” by 2.5” synthetic pleated Sediment Filter Elements. The Filter Status Display will tell you the condition of the filter while operating. See appendix A. If a filter is going to be cleaned and reused, change Filters when the bar graph just starts, or better yet, before it starts to show restriction. Cleaning will be more successful if the particulates are not embedded in hard. Never take off the filter housing, pull out the filter and “look at it” without rinsing out the filter and sump before putting it back together. Dirt gets loose when a filter is lifted out of the sump to look at.

To Open the Filter Sump, first open the Pressure Relief Valve on the Clark Pump to release any residual pressure. Use the supplied Filter Wrench to unscrew the sump. Support the sump as it comes loose and lower down carefully to avoid spilling. Put your hand over the Filter Element and drain the sump. Make sure the Sump O-ring seal hasn’t come loose. Clean the Sump then **unwrap** and install a new Filter Element. They go in either way. Check the O-ring, then install the Sump with the Filter and hand tighten only. At start up, Check for a leak. If there is, stop the system and open the Pressure Relief Valve before checking the seal. Tightening it harder with the Filter Wrench is not recommended but may be necessary in some cases.

Filters can be cleaned several times if done carefully with water pressure and a soft brush. They can be cleaned under way by running a line through the filter and tying a stopper knot to hold it on the line. Drag it behind the boat when cruising below 5 knots. If there are any signs of wear on the Filter Pleats, replace the Filter with a high quality pleated synthetic 5-Micron Filter Element. The Brine discharge flow can be used to clean the filters too.

MEMBRANE CLEANING

Your membranes **could** require cleaning if you see a 10 psi. **rise** in the feed pressure over the baseline and/or an increase in your TDS levels. The membrane cleaning procedure is a **two-step** process that first uses an alkaline solution to remove any organic fouling **followed by** an acid solution to dissolve and remove scale deposits.

CAUTION: The membrane cleaning process utilized acids and alkaline and proper personal protective equipment should always be worn when handling the cleaning solutions and brine and product water discharge.

Resistant gloves and eyewear are critical for personal safety.

A. The cleaning solutions work better if heated to 95°F, 35°C. Maximum temperature is 107°F, 42°C.
B. Have plenty of water in the ship's water tank for flushing.
C. Run the system and record the operating pressure and product flow before the cleaning.
D. Have clean Prefilter elements installed.
E. New membranes are not that expensive. Replacing the membrane may be more economical than cleaning.

1. Follow the Long Term Storage procedures steps 1 through 7 but use the Alkaline Cleaning Chemical instead of the Memstor.
2. Prime then run both Feed Pumps to recirculate the cleaner unpressurized for at least 1 to 3 hours.
3. Stop the system and let it soak for at least 2 to 8 hours
4. Start both Feed Pumps and let it recirculate the cleaner for another hour.
5. While still running, switch the Brine Discharge Service Valve to the Normal Run position.
6. Drain the Pail and shut down.
7. Turn the Feed Service Valve to the Normal Run Position.
8. Perform a "Restart from Long Term Storage Procedure" then record the Feed Pressure and Product flow.
9. Perform a Freshwater Flush
10. Rinse out the Service Pail
11. Repeat the cleaning procedure steps 1 to 8 using the Acid Cleaning Chemical.
12. If the performance is acceptable the system is ready for use.

After performing both cleanings, compare the 3 performance readings. This will give you an indicator of what type of fouling is affecting the membrane and how well the cleaning has worked. If there was no increase in performance on the Alkaline cleaning but was on the Acid cleaning, just try the Acid cleaning next time. If an Alkaline cleaning is performed, always follow with an Acid cleaning.

The easiest way to replace the membrane is to remove the Pressure Vessel from its mounts for the procedure. It can be done in place but only if there is room enough on the **outlet** end of the Pressure Vessel to pull the membrane out. When the High Pressure Hoses are disconnected from the End Caps, the hoses are free to be moved out of the way as the special HP fittings in the Enhanced Clark Pump are designed to swivel freely without leaking. The new Membrane element comes sealed in plastic. Don't break the seal until you are ready to insert it. Take a picture of the membrane assembly before starting. Use the packet of silicone grease provided to *lightly* lube the inner edge of the pressure tube before re-assembly.

Warning: Do not touch the threads on the ends of the Pressure Vessel Tube. It is possible to get fiberglass splinters.

Figure 28: Pressure Vessel Assembly

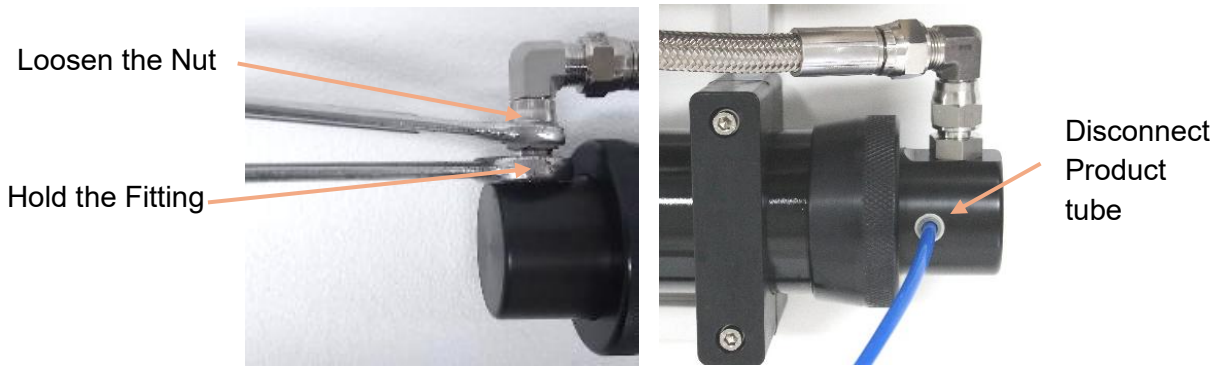
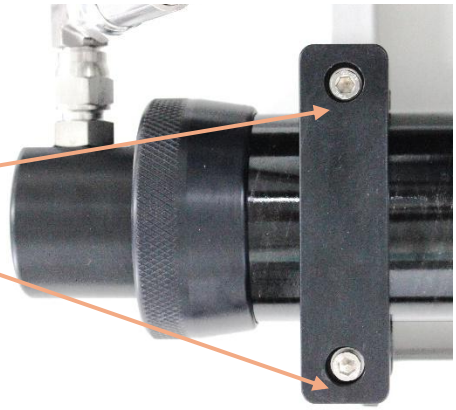


Figure 29: Disconnecting the HP hoses and Product tube

Using two wrenches, hold the fitting threaded into the End Cap and loosen the 90° flare fitting connected to the End Cap fitting. Don't let the fitting in the End Cap move. Disconnect the Product Tube. See page (24).

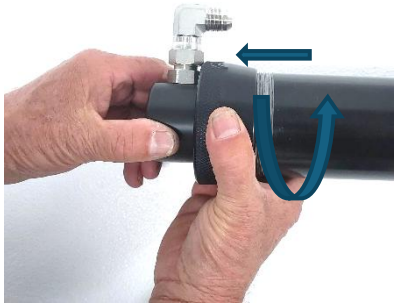
Remove the 4 Bolts holding the Pressure Vessel Mount Caps



The Pressure Vessel does not have to be removed if there is room off the Outlet end for the Membrane Element to come out.

Figure 30: Removing the Pressure Vessel

1. Grasp Metal Ring of Outlet End



2. Unscrew until the ring hits the fitting

3. Twist and pull the End Cap to free seal

4. Continue unscrewing the Ring until free

Figure 31: Removing the Outlet Endcap

The End Caps are held on by the metal threaded rings. They are only put on hand tight but can be hard to break loose after the Vessel has been pressurized. If they don't loosen by hand, use the Strap Wrench to loosen. Starting with the Outlet end, unscrew the ring until it meets either the SS HP fitting or the Product Tube fitting. Pull on the End Cap while twisting to start it moving out of the tube and come up against the ring. Keep unthreading the ring while alternately pulling on the end cap until the assembly is free. The Membrane Element is now exposed.

Figure 32: Pulling the Membrane Element Out

Using your hand, grab the white Product Collecting tube in the middle of the membrane to put. If it doesn't want to come it's because the Brine and Product Collecting Tube seals are holding it. If the membrane element is going to be discarded, use pliers to pull it out. If it still doesn't want to come out or the element is to be reused and not damaged by the pliers remove the Inlet End Cap. The element can now be pushed from its outlet end to remove it from the Inlet end of the Pressure Vessel Tube. Don't mix up the End Caps so they can be reinstalled in the same place.

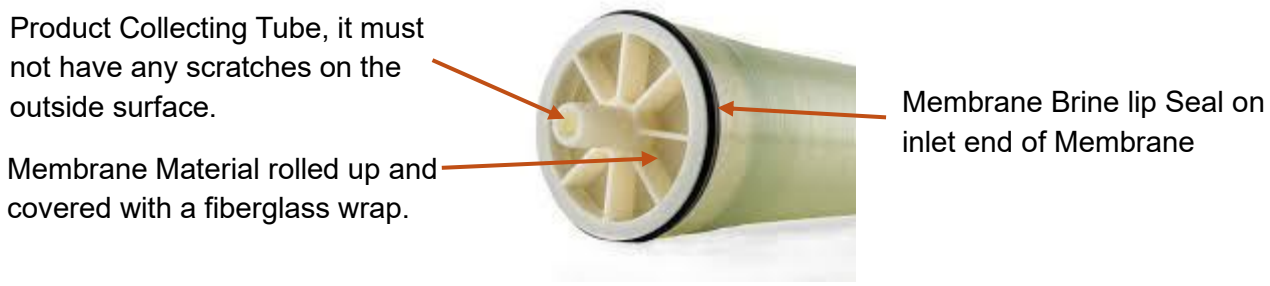


Figure 33: Parts of the Membrane

The Membrane Element has no set Feed Flow direction until a Brine Lip Seal is placed on one end. The end with the Brine Seal is placed at the flow inlet of the Pressure Vessel. The Brine Seal directs the Feed Flow through the middle of the Membrane. The Product Water inside the Product Collection Tube is separated from the high pressure salt water by an O-ring in the End Cap. The Tube must not be scratched to make this important seal. These two Product O-ring seals are all that separates the high pressure salt water from the product water. These seals rarely fail as the high pressure helps them make a seal but scratches in the product tube can let some saltwater leak through and affect the Product TDS. Check for scratches even on new membranes.

1. Insert Membrane into the Outlet end of the Pressure Vessel Tube

2. Place Seal into the Tube at an angle

3. Press the lip into the Tube

4. Align the Membrane with the Tube and push the rest of the way in

Figure 34: Inserting the Membrane

Reinstall the ***Inlet*** End Cap on the Pressure Vessel Tube if it was removed (see Reinstalling End Cap instructions). The Membrane Element is inserted, Brine Seal first, into the ***Outlet*** end of the Tube. *Lightly* lube the Brine Seal, the inner edge of the Vessel Tube, and the OD of the Product Collecting Tube with pure Silicone Grease from the Grease Packet provided. Place the Membrane in the tube at a slight angle so most of the seal is already inside. Push the last of the seal lip in as the Membrane is aligned with the tube. After the seal slips in, push the Membrane in the rest of the way until it bottoms out. You should feel the Product Tube push past the O-ring seal in the Inlet End Cap.

1.Line up the Ring and start threading on the Tube

2. Thread the Ring on until the End Cap Seal contacts the Tube

3. Twist and push the End Cap until the Seal goes in the Tube

4. Finish threading the Ring on and hand tighten just snug

Figure 35: Reinstalling the End Cap

Lightly lube the Product Tube O-ring in the center bore of the end cap and the inner edge of the Vessel Tube with pure silicone grease from the Grease Packet provided. Carefully thread the End Cap Ring onto the Pressure vessel. Do not force the threads. When they engage properly, the ring is easy to turn. Thread on the Ring until End Cap meets the Vessel Tube and resistance is felt. Push and twist the End Cap until the O-ring seal engages with the Vessel Tube and the product tube or hose fitting butt up against the Ring. Continue to thread on the Ring while alternately pushing in the End Cap until it bottoms out and the Ring comes tight against the End cap making it harder to twist. That is as tight as it needs to be. Rotate the End Cap until the HP fitting is at the same orientation as it was before it was removed.

Reinstall the Pressure Vessel in the reverse order it was removed making sure to use two wrenches on the HP fittings so the fitting in the End Cap isn't turned. If the End Cap fitting does get loosened, screw it back in until it becomes snug only. Do not keep tightening and drive it into the plastic. It is sealed by an O-ring and only needs to be snug up against the plastic. Put a VERY light coating of lube on the flare faces.

MODULE DIMENSIONS

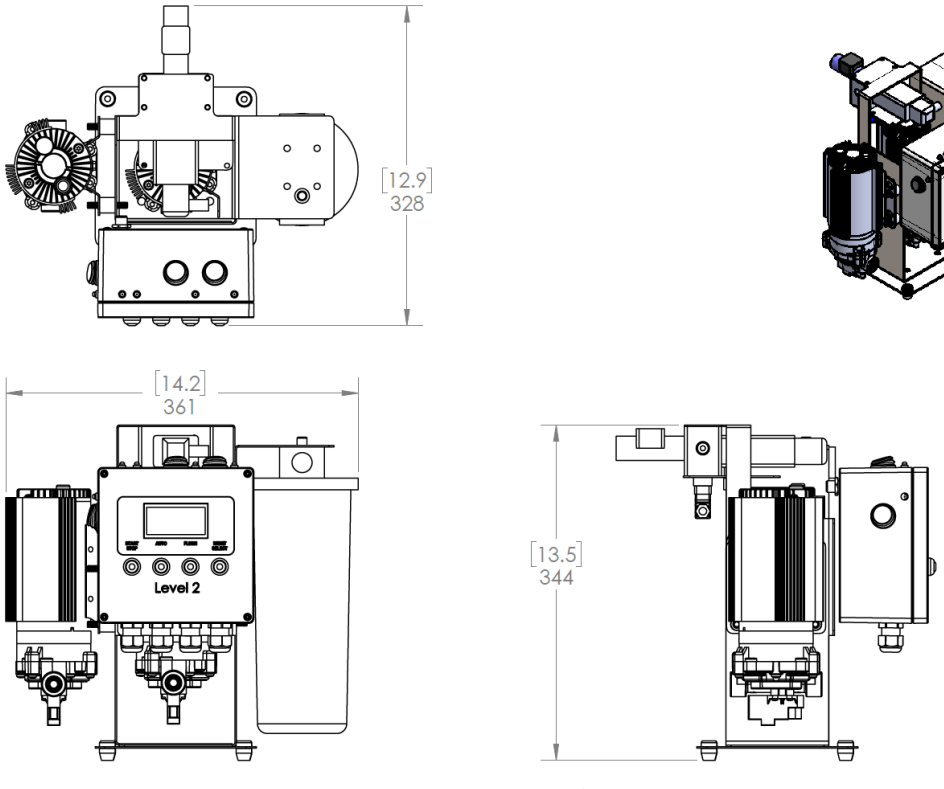


Figure 36: Feed Pump Assembly

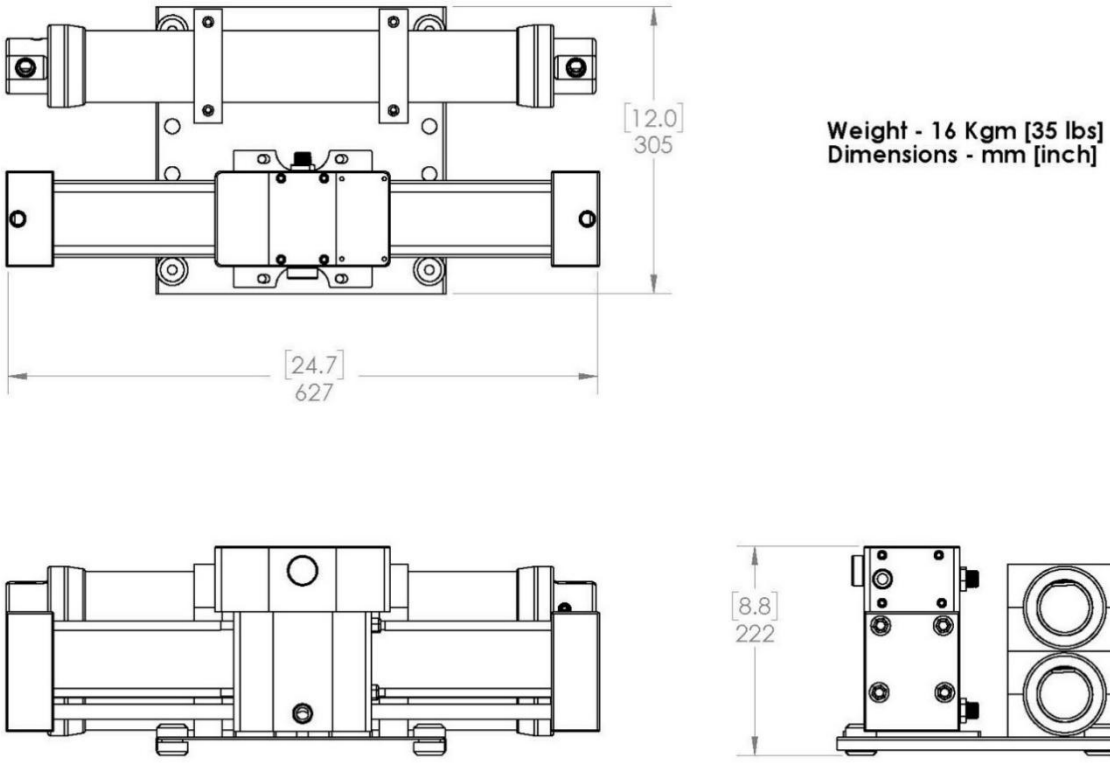


Figure 37: High Pressure Module, Dual 21” Membrane Dimensions and Weight

TROUBLE SHOOTING

Symptom	Cause	Remedy
No product Flow	Pressure Relief Valve open	Close the pressure relief valve
	Feed pump not primed	Open the pressure relief valve until the system primes then close the valve
	Feed pump won't prime, air getting into the feed line before the Feed Pump	Check all connections and strainer bowl seal in front of the boost pump. Draw water from the service pail to help isolate the leak
Low Product Flow	Low Voltage	Voltage range: 12.5 to 14.4 VDC
	Incomplete prime on the feed pump	Turn on the freshwater flush to help prime Temporarily remove the tube from the prefilter to reduce back pressure. Mount feed pump vertically with the pump head down
	Pressure Relief Valve not completely closed	Close the Pressure relief valve finger tight
	External HP leak	Check HP hose connections and pressure vessel end caps for leaks
	Internal leaks in the Clark Pump	Rebuild the Clark pump
Uneven product flow between Clark Pump "Shifts"	Reversing Valve leaking in one position	Rebuild the Clark Pump
	Leaking Check Valve	Rebuild the Clark Pump
Feed Pump cycles ON and OFF every time the Clark pump shifts	Excessive feed pressure spikes	Set Accumulator pre-charge to 60 psi (4 bar)
Feed Pump cycles ON and OFF	Excessive feed pressure	Too cold and/or salty feed water. Fouled membrane, clean or replace.
	Excessive Prefilter inlet/outlet feed pressure differential	Clogged prefilter, replace
High Products TDS Saltwater leaking into the product	Bad or missing Membrane Product Tube O-ring seals	Check the product tube O-ring and O-ring grooves in the end cap
	Scratch on the membrane product tube	Remove the scratch with 600 grit sandpaper
	Poor RO salt rejection	Clean or replace the membrane

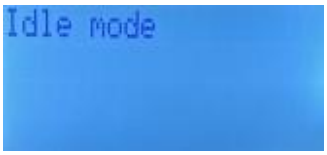
APPENDIX A CONTROLLER OPERATION

The ***SolarMaax*** watermaker is available with 3 electronic control systems (Level 1, 2 & 3); all controls have a manual override. The manual override allows for emergency operation of the system in event of an electronic failure or when priming the system to remove air on initial start-up.
This manual refers to the Level 2 control which provides the following automated control functions;

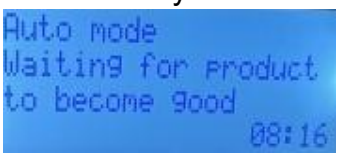
- Auto-Start
- Auto-stop at tank full
- Auto-flush… single and multiple
- Pressure regulated feed flow
- Filter status monitoring
- Membrane pressure monitoring (option)
- System diagnostics
- Array of Error messages for fault diagnostics
- Auto-product diversion based on salinity
- Product flow rate
- ECO mode

OVERVIEW:

The primary interface is the LCD screen with the 4-button array in the Control Box.; the following menu screens are available. The system's main power switch is on the left side which when enabled the adjacent green LED will flash. The main screen will light and proceed through a self-check concluding in the "Idle" screen. **Idle mode** – System powered waiting operation-

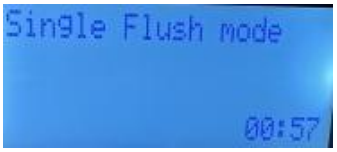


START/STOP (Button) – Pressing this button will initiate the auto-fill program which depends on a "tank full" signal to conclude the operation. The screen will indicate "Auto mode" **Auto mode** –Waiting for product quality to reach user setting TDS value. System starts with all sensors and valves functioning…it will produce water until stopped (manually or by tank full signal) or a fault (error message) occurs. The time value (user adjustable) in the bottom right corner indicates the maximum time to wait for good product before the system times-out and stops.



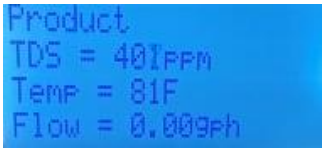
AUTO (Button) - This button initiates a **Timed Auto mode**-Time indication is shown on LCD screen (once the system has achieved product quality) additional time in 1-hour increments can be added by pressing the "AUTO" button to a maximum of 9 hours, additional pressing will return to 1. This value will remain in the settings as the "Timed Auto mode duration until changed. The system completes the user defined time cycle and then automatically proceeds to a Flush cycle. A fault condition will stop the process and NO flush will occur, the "Tank Full" signal is considered a fault, so no flush will occur.

FLUSH – A short press initiates a single flush cycle whereas a “press & hold (3 seconds) ” initiates a multi-flush. The **Single Flush mode** / **Multi Flush mode** function based on user settings for *Flush duration* and *Auto Flush Timeout*. Multi-Flush will continue on the User defined program until cancelled by turning off the power switch or a long press of the FLUSH button. The Flush LED will flash slowly during the “Multi- Flush” wait interval.

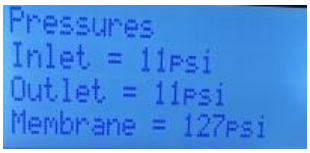


RESET / SELECT – When pressed the following screens 5 are shown in sequence; these screens can be used to verify status of the various pumps, sensors and hardware. This button also functions to clear any error messages.

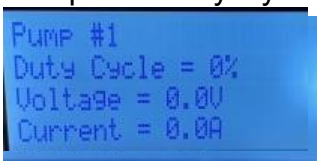
Product / TDS…Temp …Flow – displays values for Product water



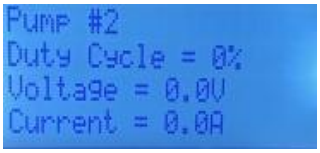
Pressures – Inlet …Outlet …Membrane – Pressures at various points in the system



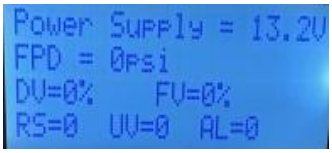
Pump#1….Duty Cycle / Voltage …Current – Pump electrical parameters



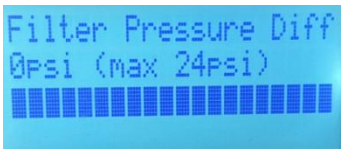
Pump#2….Duty Cycle / Voltage …Current - Pump electrical parameters



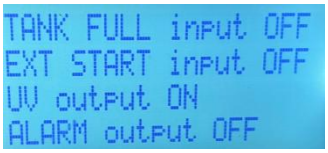
Power Supply Voltage ….DV (% of Diversion Valve voltage).....FV (% of Flush Valve Voltage) RS(Remote Start State) = 0.. (1=ON 0= OFF)….UV (UV control output state)=0 (1=ON 0= OFF)….AL(Alarm State)=0 (1=ON 0= OFF)



FPD (Filter Pressure Differential)= # psi



Inputs and Outputs



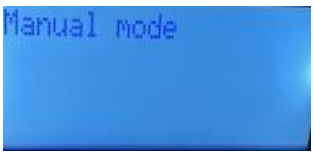
State of the 2 Valves

Connection Status Information

If the system detects a problem **System Stopped/ Error** message will appear on the screen. The Error # (Fault has occurred and Error message number is shown…refer to "Error Messages" in the manual for identification of the specific error). Some errors may also show a description with the Error #.

MANUAL MODE:

The system can be operated in Manual Mode by pressing one (or both) of the Pump buttons on the top of the control box. The system will run indefinitely until the pump button(s) is switched off.



Note: Diversion valve must be manually operated. See "Manual Override", Pg. 16. The fullness of the water tank must be monitored to avoid overflow and the diversion valve returned to "normal position" after manual operation.

PC USER INTERFACE

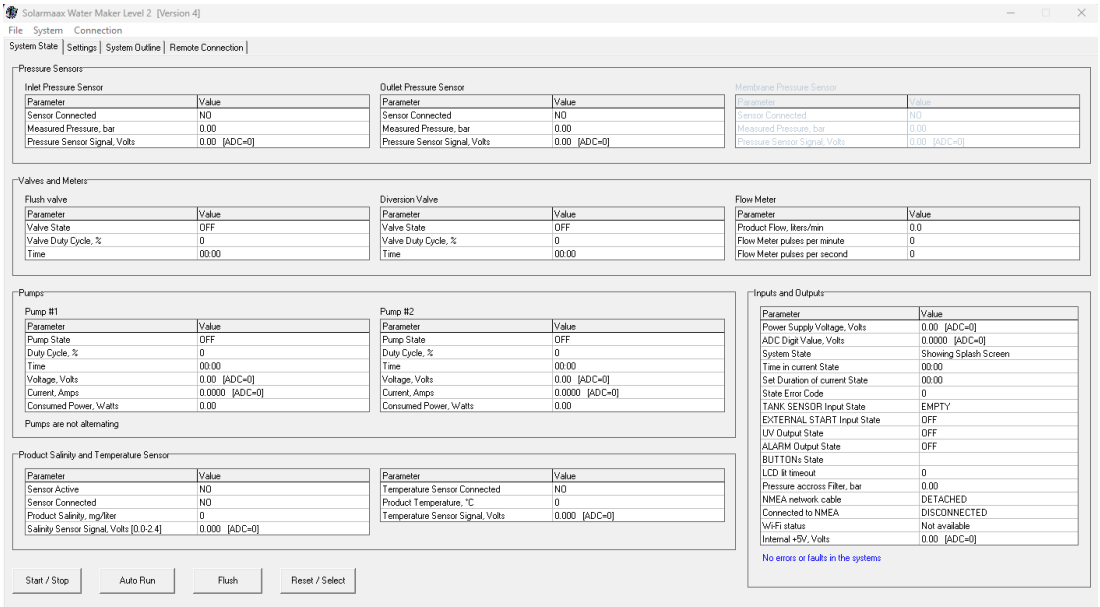
A PC based user interface can be accessed via a USB connection and the *SolarMaax* app, this interface allows user settings changes and various status screens that can be useful for diagnostic purposes.

SYSTEM STATE

A USB connection on the lower left side of the Control Box provides the PC connection point, once connected launch the "*SolarMaax WaterMaker*" app. The PC connection provides much greater detail of the system functionality hence diagnostic capability; the 3 screens (tabs) available are;

"***System State" / Settings / System Outline***" ….;

The System State provides current operating conditions providing valuable information for optimizing the process. The System State is also useful for diagnostics in the event of a concern or error message.



The ***System State*** tab shows 5 main sections;

1. Pressure Sensors- Inlet / Outlet / Membrane
2. Valves and Meters – Flush Valve / Diversion Valve / Flow Meter
3. Pumps – Pump #1 / Pump#2
4. Product Salinity and Temperature Sensor -
5. Inputs and Outputs

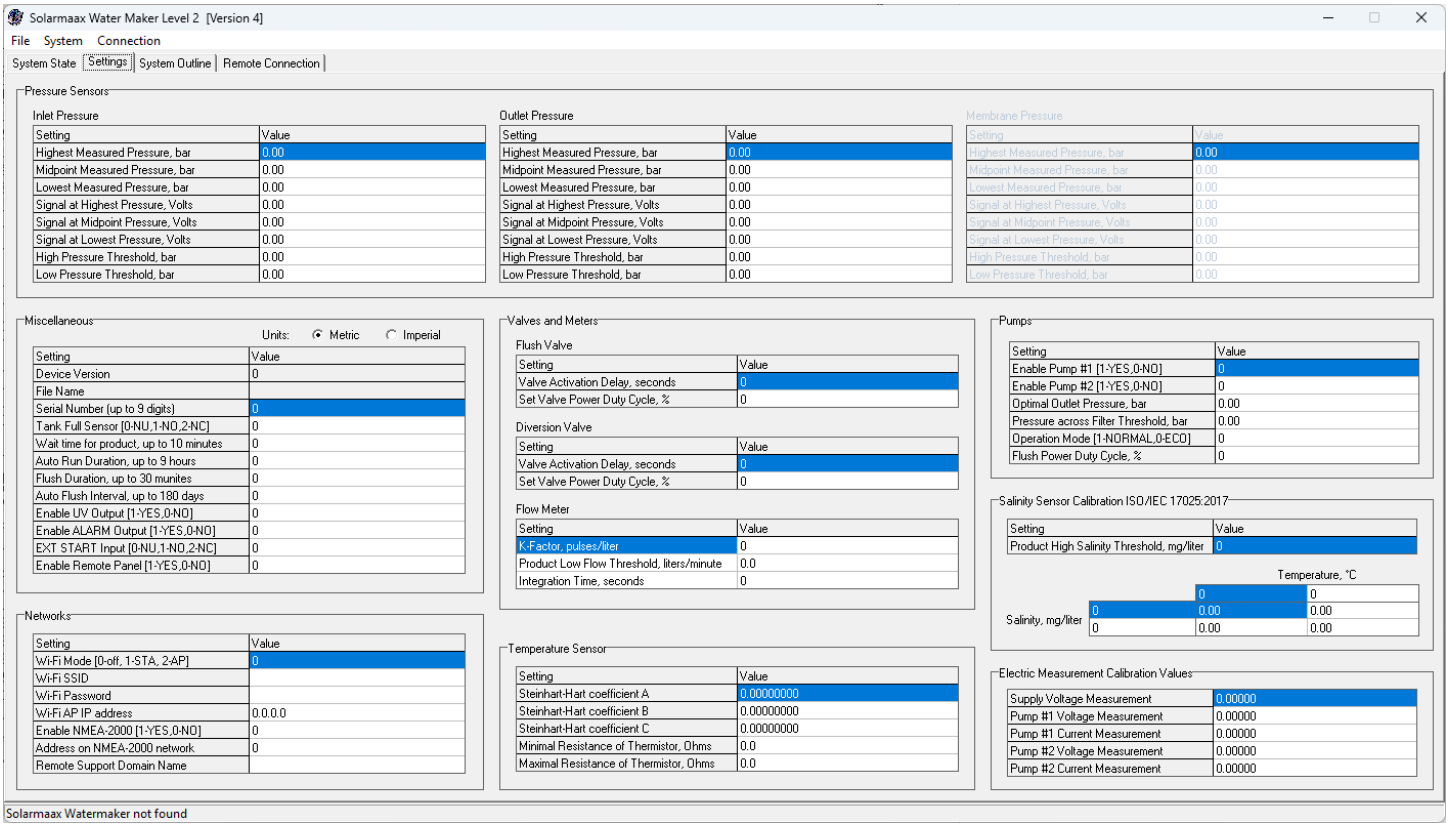
The *System State* screen values must be loaded from the Control…click on the "Read All Settings From System" to load the values…. if any changes are made, update by clicking "Write All Settings to System". Several system fields for factory use, are accessible only via the "Advanced Settings Mode" requiring a Password.

FACTORY RESET

The system can be returned to “Factory Settings”, which represent a good starting point if operational concerns develop due to questionable user settings. Select “*Reset Settings to Default Values*” from the System menu.

SETTINGS:

The Settings tab allows the user to modify the Production and Flush cycles as well as the set-points to the pressure, flow sensors and valves. Control states for several ancillary devices can also be defined. Certain fields are factory changeable only and require access through the above shown “*Advanced Settings Mode*”.

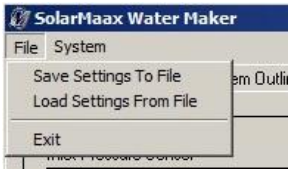


ElectroMaax
OFF GRID ENERGY SOLUTIONS

The ***Settings*** has 10 sections (tables);

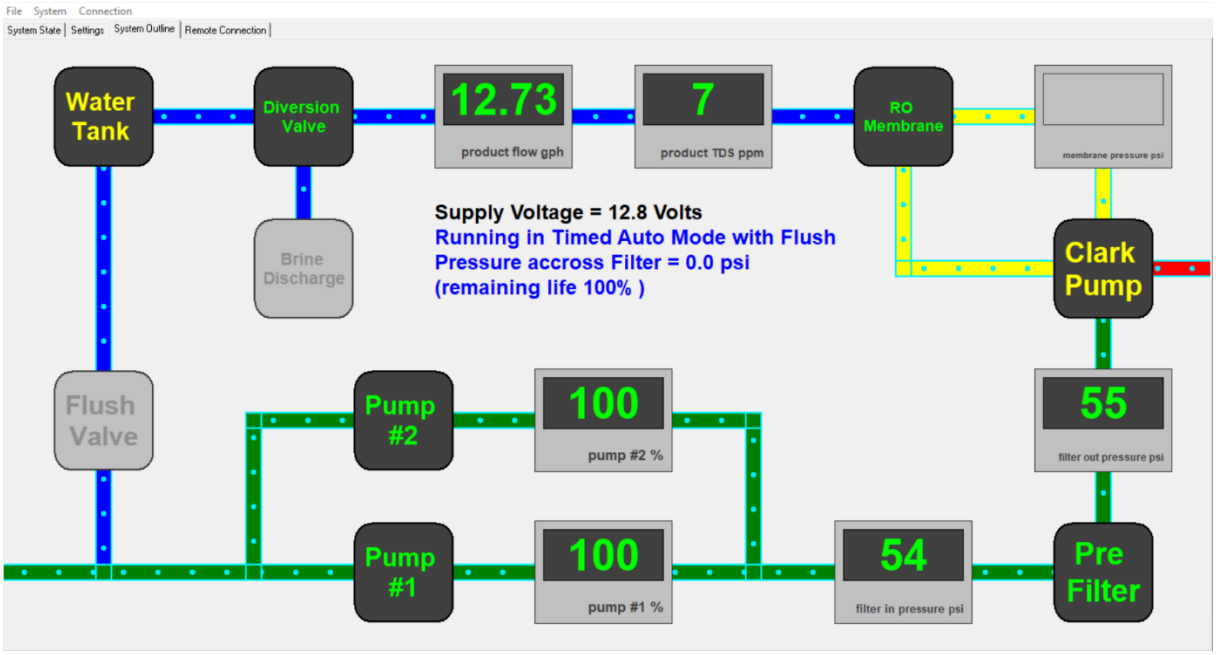
1. Pressure Sensors–
    a. Inlet
    b. Outlet
    c. Membrane Pressure
2. Miscellaneous
3. Valves and Meters
4. Temperature Sensor
5. Salinity Sensor Calibration
6. Pumps
7. Networks
8. Electric measurement Calibration Values

The Settings can be saved as a file to the PC. Settings can also be loaded from a file to the system from a saved settings file. Click on the “System” tab to show the drop-down menu then click on “Load Settings From File”…if any changes are made to Settings click “Save Setting to File” this will update the saved file.

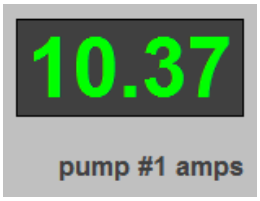


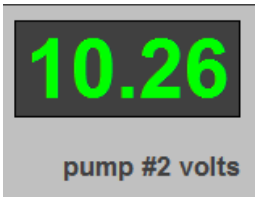
SYSTEM OUTLINE:

The graphical display provides a dynamic overview of the system’s performance. The water flow is from bottom left counterclockwise to top left. The piping is colour-coded and changes with function. The center field indicates the current run mode. The graphical display is a valuable diagnostic tool to identify the status-points of the system.

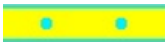


Right Clicking on the rectangular display boxes will show alternative parameters such as;





The system "piping" is shown as colour–coded and will change as the function changes;

Sea-water -  ***High Pressure -***  ***Brine Discharge -*** 

Product (Fresh Water)- 

Note: When the Flush cycle is active the incoming sea-water  piping display will change to Fresh Water  since it is supplied from the Fresh Water tank.

NORMAL VS ECO MODE:

The Level 2 control has 2 production modes; the mode can be selected from the "Operation Mode" field of the *Pumps* section of the *Settings* screen. 

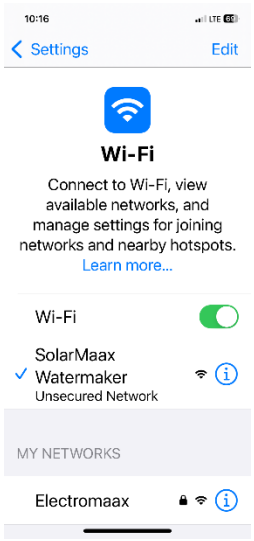
NORMAL – this mode prioritizes product output with energy consumption secondary. To enable enter 1 in the field.

ECO – prioritizes energy consumption by reducing pump output, also reducing noise level. To enable enter "0" in the field.

WIRELESS CONNECTIVITY:

A "mobile" version of above app-based screens can be accessed wirelessly via either a PC or mobile device.

The default Wi-Fi Mode is AP (**A**ccess **P**oint) Mode, in this mode the SolarMaax creates its own wireless network, (*SolarMaax Watermaker*) select this network from the list of available networks (see right) in the Wi-Fi settings of phone or PC, it may indicate "No internet Connection" which is normal as this is a local network.



Access Point Mode (default) does not require any passwords to connect to it. The IP address of the server is "192.168.0.1". To connect, open an internet browser (Safari / Chrome / Fox) and type the IP address (192.168.0.1) in the address bar, click "go" (enter). This connection will display four screens; *Graphic / Basic / Detailed* and *Settings.* The primary functions are the same as described the with a USB connection.

STATION MODE:

The SolarMaax can be added to a local existing local network via “Station Mode”.

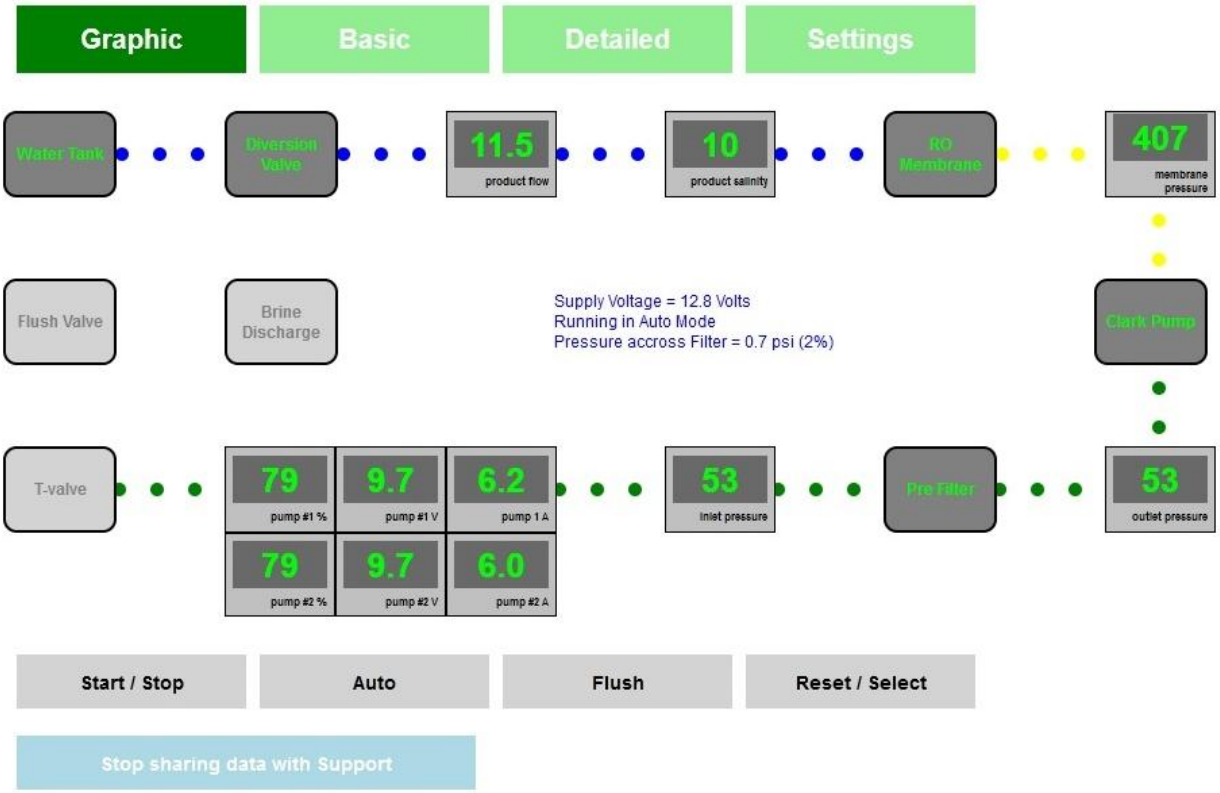
When using an SOLARMAAX Wi-Fi in Station Mode (the “Wi-Fi Mode” parameter is set to 1), the SOLARMAAX connects to an existing wireless network as a device, and acts as a dynamic server on it. The “Wi-Fi SSID” and “Wi-Fi STA Password” parameters must be set according to the wireless network’s settings.

The local IP address of the SOLARMAAX’s web server is set by the host network it is connected to. The “Wi-Fi AP IP Address” parameter has no meaning in the Station Mode. The network router would show the local IP address of the SOLARMAAX under the value of the “Device Name” parameter.

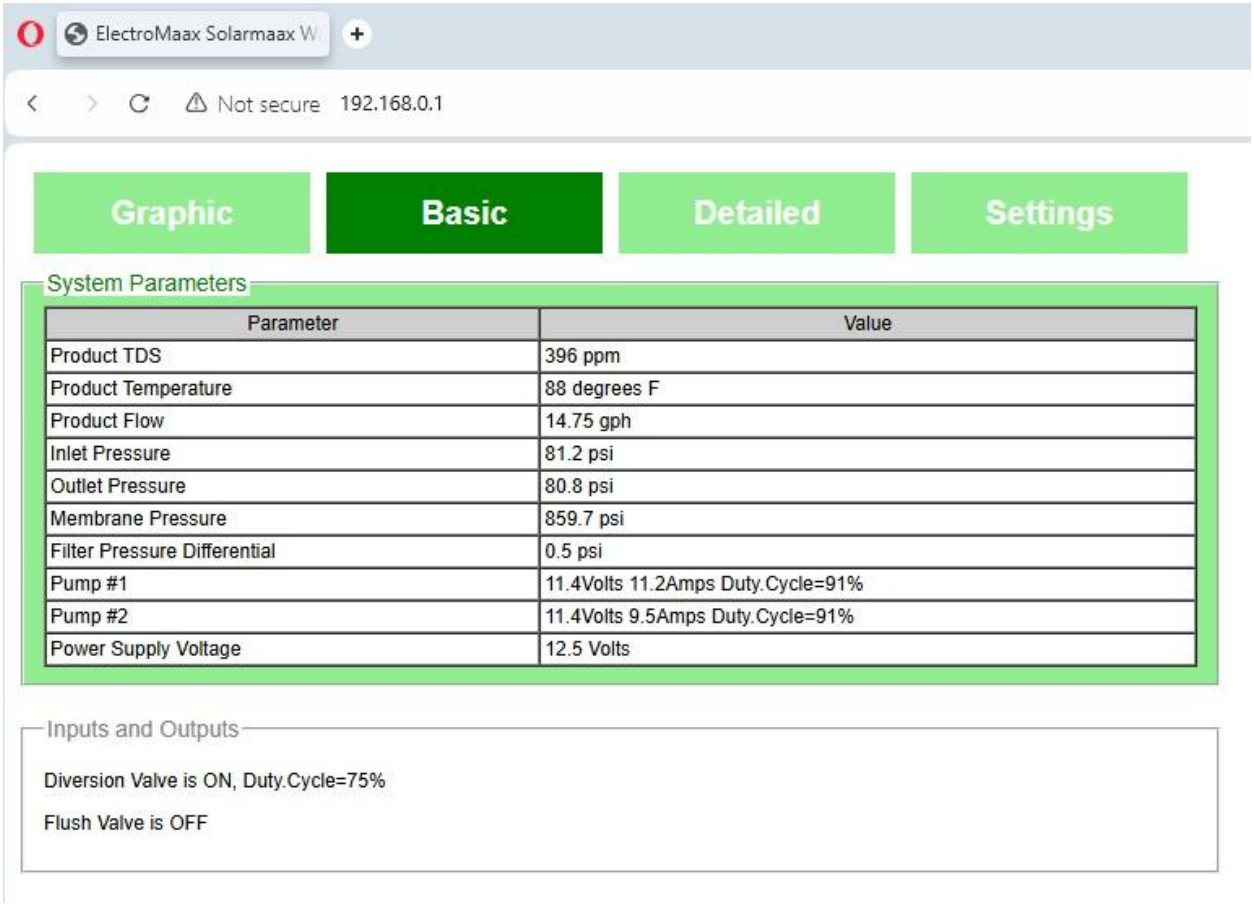
The SOLARMAAX tries to connect to an existing network for 10 seconds. If the connection was not successful, it defaults to the “*Access Point Mode*” with the network SSID “SOLARMAAX” and no password. Local IP address is set to “192.168.0.1”. This is to allow the users to revise the connection settings and try to connect again

Four screens are available; *Graphic / Basic / Detaile*d and *Settings.* The primary functions are the same as described the with a USB connection.

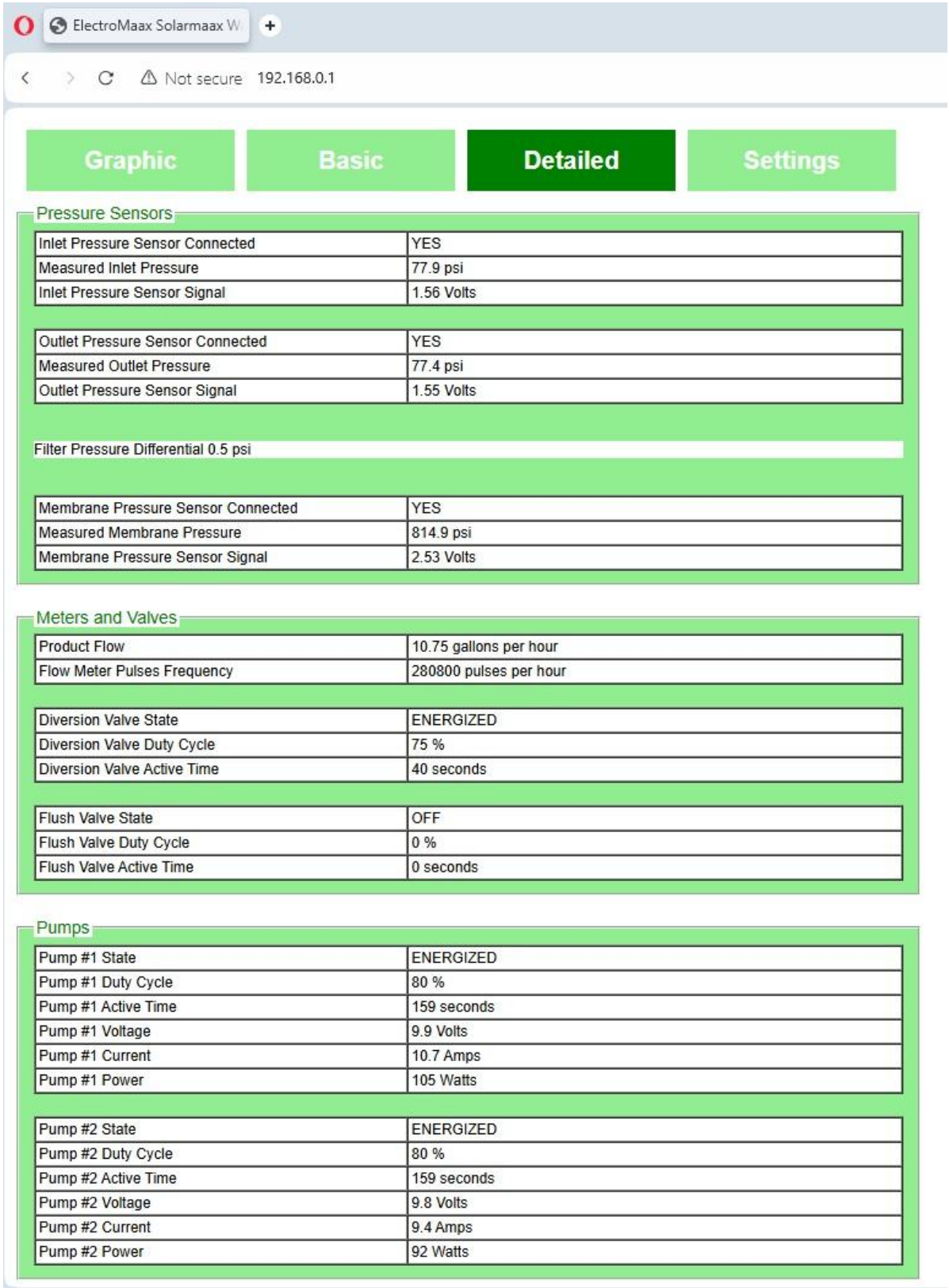
GRAPHIC:



BASIC:


ElectroMaax Solarmaax W
Not secure 192.168.0.1
Graphic
Basic
Detailed
Settings
System Parameters
Parameter
Value
Product TDS
396 ppm
Product Temperature
88 degrees F
Product Flow
14.75 gph
Inlet Pressure
81.2 psi
Outlet Pressure
80.8 psi
Membrane Pressure
859.7 psi
Filter Pressure Differential
0.5 psi
Pump #1
11.4Volts 11.2Amps Duty.Cycle=91%
Pump #2
11.4Volts 9.5Amps Duty.Cycle=91%
Power Supply Voltage
12.5 Volts
Inputs and Outputs
Diversion Valve is ON, Duty.Cycle=75%
Flush Valve is OFF

DETAILED:



Pressure Sensors

Inlet Pressure Sensor Connected	YES
Measured Inlet Pressure	77.9 psi
Inlet Pressure Sensor Signal	1.56 Volts

Outlet Pressure Sensor Connected	YES
Measured Outlet Pressure	77.4 psi
Outlet Pressure Sensor Signal	1.55 Volts

Filter Pressure Differential 0.5 psi

Membrane Pressure Sensor Connected	YES
Measured Membrane Pressure	814.9 psi
Membrane Pressure Sensor Signal	2.53 Volts

Meters and Valves

Product Flow	10.75 gallons per hour
Flow Meter Pulses Frequency	280800 pulses per hour

Diversion Valve State	ENERGIZED
Diversion Valve Duty Cycle	75 %
Diversion Valve Active Time	40 seconds

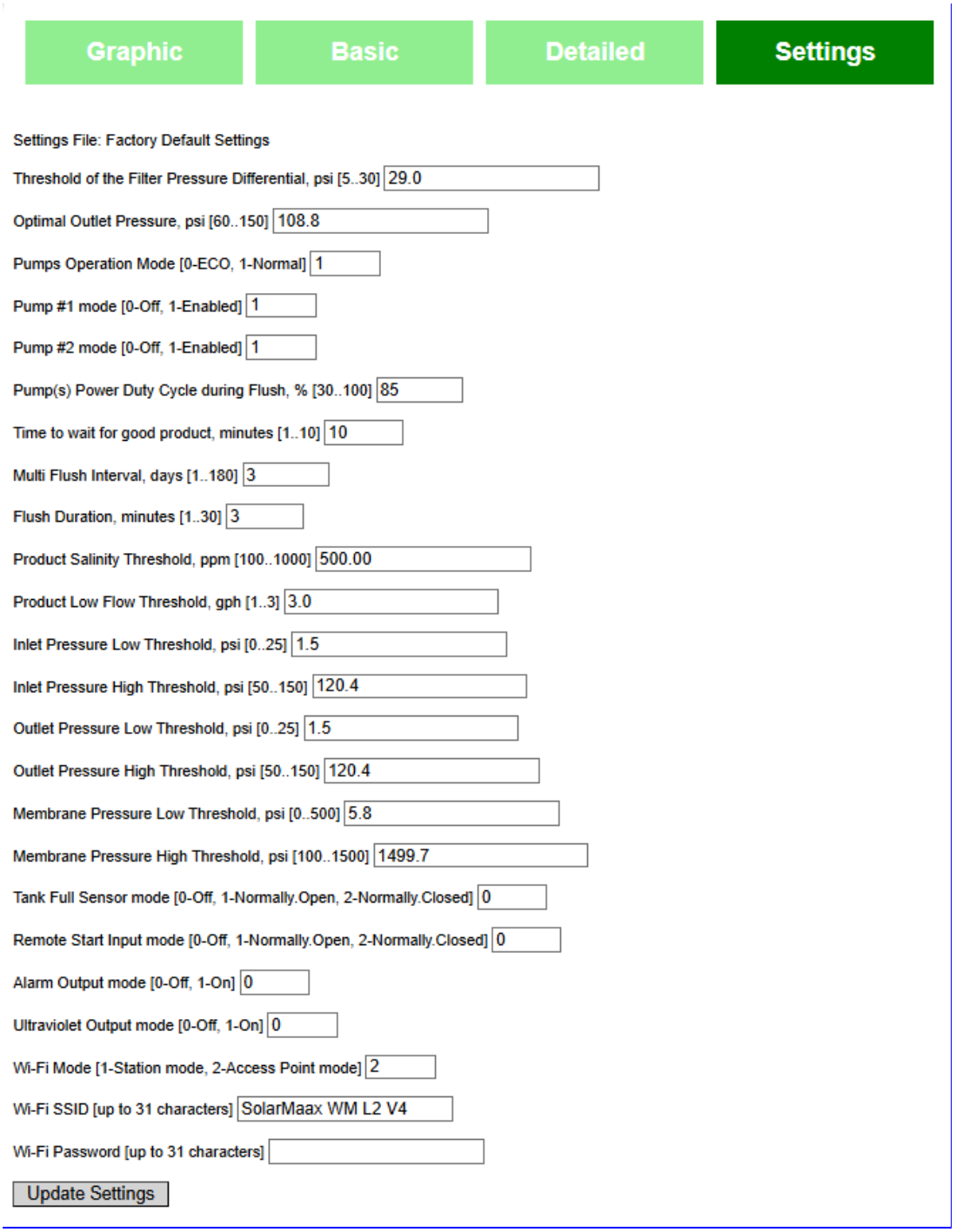
Flush Valve State	OFF
Flush Valve Duty Cycle	0 %
Flush Valve Active Time	0 seconds

Pumps

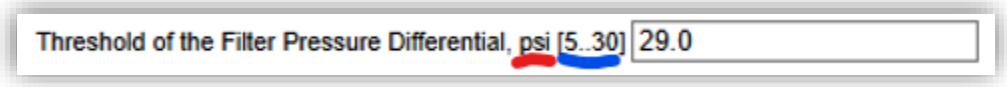
Pump #1 State	ENERGIZED
Pump #1 Duty Cycle	80 %
Pump #1 Active Time	159 seconds
Pump #1 Voltage	9.9 Volts
Pump #1 Current	10.7 Amps
Pump #1 Power	105 Watts

Pump #2 State	ENERGIZED
Pump #2 Duty Cycle	80 %
Pump #2 Active Time	159 seconds
Pump #2 Voltage	9.8 Volts
Pump #2 Current	9.4 Amps
Pump #2 Power	92 Watts

SETTINGS VALUES:



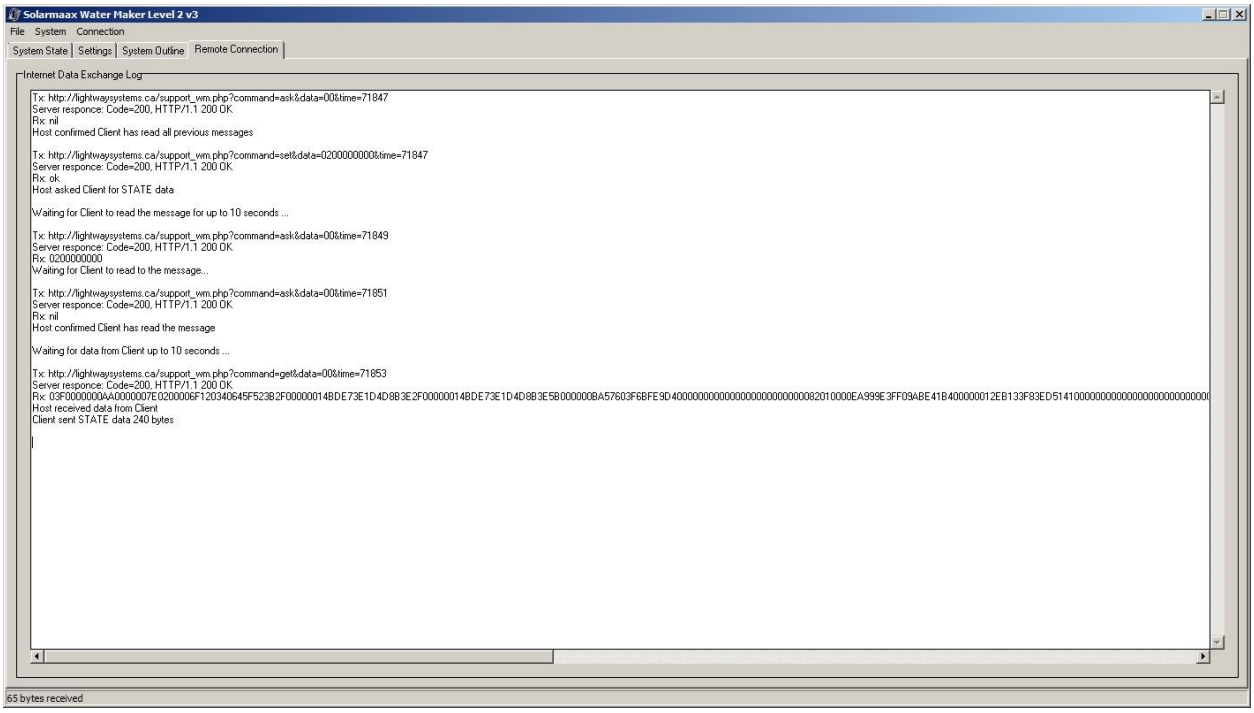
The various parameters lines indicate units of measurement and operational range;



REMOTE CONNECTION:

When Solarmaax is connected to an existing local network in the Station Mode, and the local network has access to the Internet, it is possible for the water maker's software to connect remotely to it to provide support. The remote customer must activate SHARE DATA WITH SUPPORT button the webpage interface, and the support technician must select **Connection – Remote via Internet**. Also, the domain name of the server must match the one on the settings of the water maker being supported.

When active, the software commands in the System menu become available for remote execution. The data exchange can be viewed in the Remote Connection tab of the software screen.



ERROR MESSAGES:

The Level 2 control provides an extensive array of Error messages. These messages are invaluable in maintaining system optimization and diagnosing potential problems. The Error code # and the associated message will appear on the LCD screen;

Error code	Message	Meaning	Possible Fix
11	Inlet Pressure has not reached its target	Pump(s) could not develop the acceptable minimal inlet pressure within specified timeout.	System has not been primed; Water intake into the system is limited; Check the seacock and the strainer.
12	Inlet Pressure too low	The inlet pressure went below its range of valid values	Water intake into the system is limited; Check the seacock and the strainer.
13	Inlet Pressure too high	The inlet pressure went above its range of valid values	Service the pre-filter
14	Inlet Pressure Sensor malfunction	Signal from the inlet pressure sensor went outside of its range of valid values	Check sensor connection
21	Outlet Pressure has not reached its target	Pump(s) could not develop the acceptable minimal outlet pressure within specified timeout.	Service the pre-filter
22	Outlet Pressure too low	The outlet pressure went below its range of valid values	Service the pre-filter
23	Outlet Pressure too high	The outlet pressure went above its range of valid values	Water intake into the Clark's pump is limited
24	Outlet Pressure Sensor malfunction	Signal from the outlet pressure sensor went outside of its range of valid values	Check sensor connection
31	Membrane Pressure has not reached its target	Clark's pump could not develop sufficient pressure at the membrane within specified timeout.	Check Clark's pump
32	Membrane Pressure too low	Pressure at the membrane went below its threshold value	Check Clark's pump

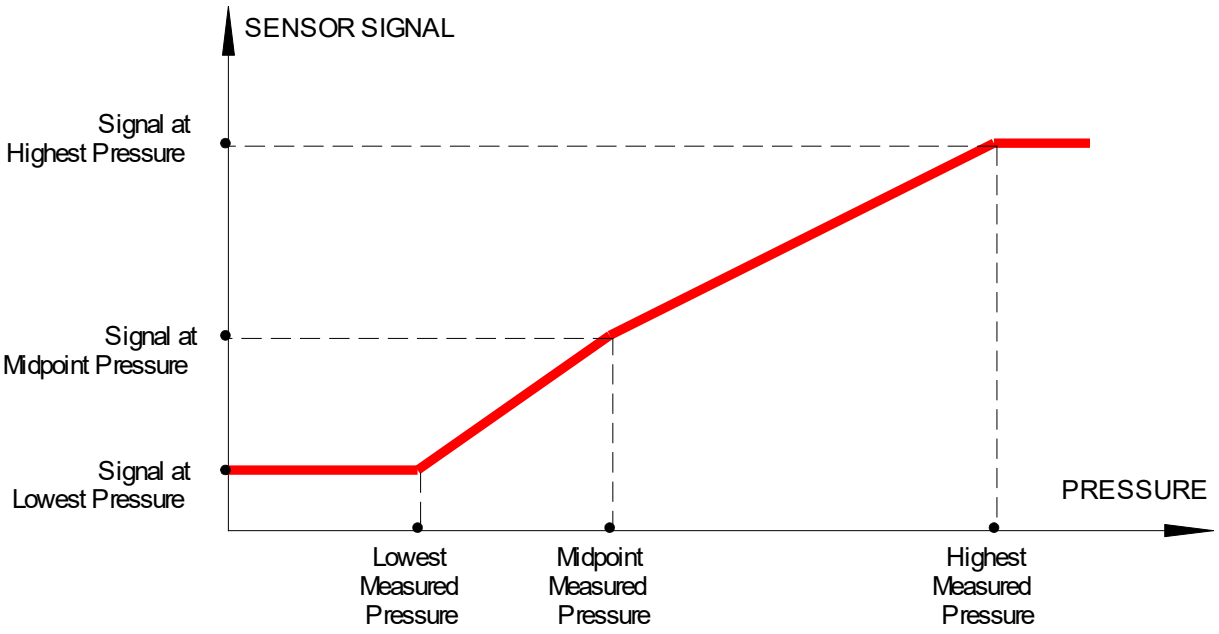
33	Membrane Pressure too high	Pressure at the membrane went above its threshold value	Check membrane
34	Membrane Pressure Sensor malfunction	Signal from the membrane pressure sensor went outside of its range of valid values	Check sensor connection
41	Product Salinity has not reached its target	System could not achieve acceptable product salinity within specified timeout.	Water making stops, check membrane
42	Product Flow has not reached its target	System could not develop sufficient product flow within specified timeout.	Water making stops, check membrane
43	Product Salinity too high	Product salinity went above its threshold value	Water making stops, check membrane
44	Product flow too low	Product flow went below its threshold value	Water making stops, check membrane
45	Salinity/Temperature Sensor malfunction	Measured resistance of the temp sensor is outside of the limits set in Settings [Minimal Resistance of Thermistor] [Maximal Resistance of Thermistor]	Check sensor connection
51	Power Supply Voltage too low	System cannot operate below 10V	Check battery voltage
52	Pressure drop across Pre-Filter too high	Pre-filter pressure differential is too large	Service the pre-filter
53	Pump #1 malfunction	Measured voltage at the pump #1 is below 1.0 Volts when the pump is expected to be active.	Wiring issues Blown fuse
54	Pump #2 malfunction	Measured voltage at the pump #2 is below 1.0 Volts when the pump is expected to be active.	Wiring issues Blown fuse

SETTINGS:

Settings	Meaning	Typical values
Units	The system works in metric units (grams, liters, bars, degrees centigrade). If needed, the values are re-calculated before shown based on the setting.	IMPERIAL or METRIC
Serial Number	Numeric Serial Number value, up to 9 digits	0-999999999
Tank Full Sensor	Usage of the TANK FULL sensor signal	0 – sensor is not used 1 – signal is HIGH when tank is full 2 – signal is LOW when tank is full
Time to wait for good product	Time given to the system to start making the good product in terms of the salinity and flow	Value in seconds
Auto Run Duration increment	Time between scheduled auto flushes	Value in seconds
Flush Duration	Duration of the flush	Value in seconds
Auto Flush Timeout, seconds'	Time lapse between scheduled auto flushes	Value in seconds
Enable UV Output	Usage of the UV relay	0 – do not use UV output 1 – UV output is active when good product is sent to the water tank
Enable ALARM Output	Usage of the ALARM relay	0 – do not use ALARM output 1 – ALARM output is active when the system is in Error state.
REMOTE START Input [0-NU,1-NO,2-NC]	Usage of the REMOTE START input.	0 – do not use REMOTE START input 1 – REMOTE START input is active when it is HIGH 1 – REMOTE START input is active when it is LOW
Enable Remote Panel [1-YES,0-NO]	Usage of the Remote Panel (if equipped – option)	
Enable Pump #1 or Enable Pump #2	Usage of the electric pumps **Note:** Make sure at least one pump is used in the system	0 – pump is absent or disconnected 1 – pump is used and wired in

Optimal Outlet Pressure	Pressure the system should provide to the Clark pump	Used when the pump(s) are in the ECO mode
Pressure across Filter	Maximal allowable filter pressure differential	< 25 psi
Operation Mode		1 (NORMAL) – all power is sent to the pump(s) 0 (ECO) – power sent to the pump(s) is regulated While making product: Optimal Outlet Pressure While Flushing: Flush Power Duty Cycle
Flush Power Duty Cycle	Flush mode is single pump only	
UV Output	The output is a pair of dry normally open relay contacts capable of switching currents up to 2 Amps at 100V	
ALARM Output	The output is a pair of dry normally open relay contacts capable of switching currents up to 2 Amps at 100V	
REMOTE START Input	Single-ended non-isolated input; can be set at the factory as current sink (must apply voltage above 10V to activate), or current source (must connect the 2 leads to activate).	

PRESSURE SENSORS SETUP:

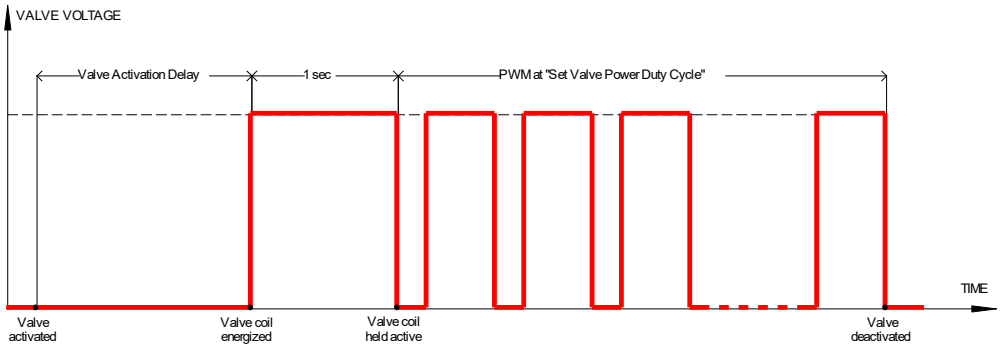


Settings	Meaning	Typical values
Highest Measured Pressure	Maximum measurable pressure	Taken from datasheet
Midpoint Measured Pressure	Typical system feed pressure	75 to 90 psi
Lowest Measured Pressure	Minimal measurable pressure	Taken from datasheet
Signal at Highest Pressure	Electrical signal	Taken from datasheet
Signal at Midpoint Pressure	Electrical signal – volts	1-3 volts
Signal at Lowest Pressure	Electrical signal	Taken from datasheet
High Pressure Threshold	Maximal allowable pressure the system can handle at the sensor's location	1200 psi – membrane 100 psi - feed
Low Pressure Threshold	Minimal pressure the system must maintain at the sensor's location	0

Note: If using 4-20mA output sensors, the factory installs 220 Ohms load resistors. So, set the Signal at Highest Pressure to 4.4 Volts [0.020 A * 220 Ohms], and set the Signal at Lowest Pressure to 0.88 Volts [0.004 A * 220 Ohms]

SETTINGS FOR THE VALVES:

To enhance valve life and reduce energy consumption a supply voltage process of PWM (Pulse Width Modulation) is used. The following graph shows the concept, where the voltage supply is rapidly switched on and off, effectively lowering the voltage.



Settings	Meaning	Typical values
Valve Activation Delay	Delay between sending the command to the valve and actual valve's activation to allow product to reach the valve.	Depends on system's plumbing, 2 -5 seconds
Set Valve Power Duty Cycle, %	Amount of energy sent to the valve to keep it activated and to avoid overheating. System uses same valves for both 12V and 24V systems.	Set to ~75% for 12 V systems Set to ~35% for 24V systems

SETTINGS FOR FLOW METER:

Settings	Meaning	Typical values
K-Factor	Amount of pulses the flow meter produces per unit of volume Make sure you enter the vales per liter or per gallon based on the units' selection.	Listed in specs from manufacturer
Product Low Flow Threshold	Minimal acceptable product flow after the membrane	Set to ½ of system's capacity
Integration Time	Time interval to count flow meter pulses	

SALINITY AND TEMPERATURE SENSOR SETUP:

The SolarMaax allows the use of salinity sensors from any manufacturer but a calibration process must be completed. Contact factory for instructions.

Direct replacement of a ElectroMaax salinity sensor requires no calibration or adjustment.

ELECTRICAL MEASUREMENTS SETUP:

The SolarMaax provides precise electrical measurements but a calibration process must be completed. While in the *Advance Settings Mode*, it is possible to calibrate the measurements for the power supply and pumps' voltages as well as the pumps' currents. When a pump is running, right mouse click on an appropriate cell to enter the actual measured values of the voltages or currents and hit OK. The calibration coefficients will be calculated automatically and the software will offer to save them onto the device.

SYSTEM START:

Turn on the main power switch on the Control box….the following functions are available.

Button	Function
Start Stop	**Start**- the Auto Mode sequence…all sensors and valves function. The system produces continuously until Tank-full signal or fault (error message) interrupts. **Stop**- the system at any stage and returns to Idle
Auto	Starts the ***Timed*** Auto Mode; as above but is stopped after the designated time "period" and a Flush cycle starts. Once the system is producing quality water each press of the ***Auto*** button adds an additional time "period" as per user setting
Flush	Starts Single Flush (single press) Pressing and holding (3 seconds) the button again activates "Multi Flush" based on the user settings and indicates "Multi Flush" in the LCD screen…once the Flush is completed the screen will show "Waiting for Next Flush" the Flush LED will flash slowly during the wait interval.
Reset Select	Resets alarms and returns to Idle While making product, sequences through the various screens to display the current system state
Mode	**Info**
Idle	System inactive All pumps, valves, and outputs are inactive.
Manual Mode	System detected that any of manual pump switches has been activated. This mode used mainly for priming the system, or for maintenance. Diversion and Flush valves remain inactive.
Waiting for the Product quality	System makes product but does not send it to the water tank until the flow and salinity conditions are met. It errors on time out, or automatically switches into Auto Mode when product becomes good, (quality setting are met.) Diversion and Flush valves are inactive in this stage.
Auto Mode	Timeless mode when water is produced until it is stopped, or the tank is full, or an error encountered. Diversion valve is active in this stage.
Timed Auto Mode with Flush	Timed mode when water is produced until it is stopped, or the tank is full, or an error encountered; followed by Flush cycle. On a 2 pump system only 1 pump is started for the Flush cycle. Diversion valve is active in this stage.
Timed Single Flush	Flushing the system for set amount of time and then returning to Idle. Diversion valve is active in this stage when the product quality is good. Flush valve is active in this stage.

Flushing the System and waiting for auto Flush	Flushing the system for set amount of time and then returning to wait for the next Flush Diversion valve is active in this stage when the product quality is good. Flush valve is active in this stage.
Waiting for next auto Flush	Doing nothing, with countdown to commence the next Flush Diversion and Flush valves remain inactive.
Outputs Check	Short 10 seconds all-output enabled period to check the system integrity All pumps, valves, and outputs are active.
Error mode	System stalls, shows info message and activates ALARM output until reset to Idle All pumps, valves, and outputs are inactive.

MANUAL OVERRIDE:

In the event of electronic failure or the need to prime the system, Manual mode initiates pump operation via the Pump buttons on the top of the Control box, the adjacent LED's will light, this will override any auto control function…all sensors will report (if functional and Controller is switched ON) but will **not** be interactive. One or both pumps can be started as desired.

Valve – Manual (Latched) Position

Valve – Normal (Released) Position

NOTE: The product diversion valve must be switched manually (green circle below) as the Product diversion valve will remain in the divert to waste position unless manually changed. The diversion valve has a manual override button (green circle below) that should to be pressed and turned to latch (red circle). The salinity sensor or handheld TDS reading can be used to determine when to manually change the diversion valve position from waste to tank. Taste is also a good indicator.

The manual valve switching must be reset to normal position (green circle) after manual operation is complete or the product (regardless of quality) will be continually diverted to the fresh water holding tank.

ELECTRICAL CONNECTIONS:

The primary power connections must be made to circuit board using the connectors…. wires are routed through the glands on the bottom of the enclosure.

Working from right to left along the bottom edge of the PCB there are following connections points:

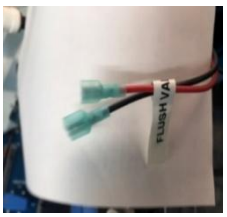
B- Battery negative
P2- Pump 2 negative
P2+ Pump 2 positive
B2 Button 2 (Pump 2)
B2 Button 2 (Pump 2)
B+ - Battery positive
B1 Button 1 (Pump 1)
B1 Button 2 (Pump 1)
P1+ Pump 1 positive
P1- Pump 1 negative

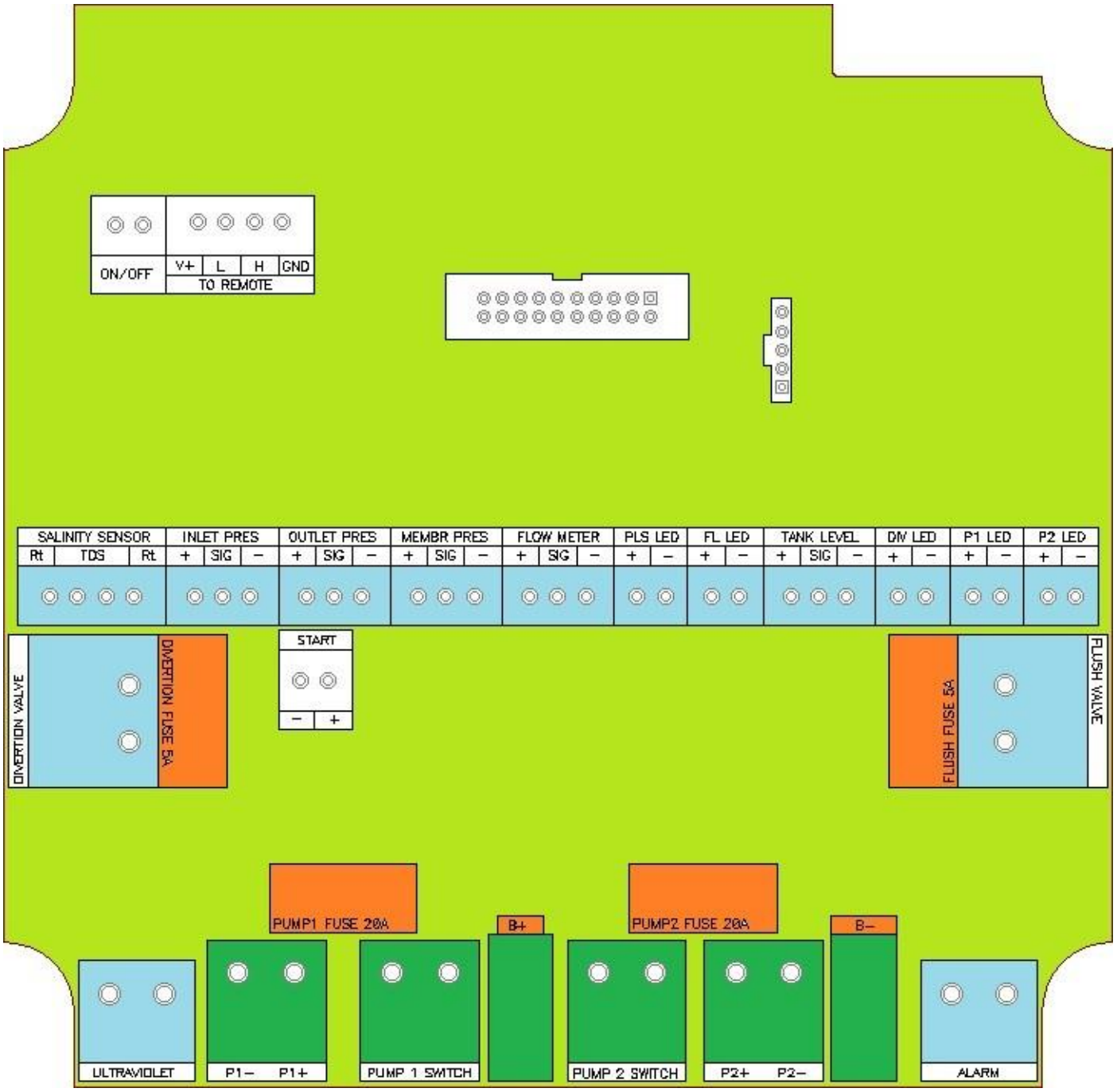
The multiple sensors and pump(s) are connected to the plug-in connectors on the main circuit board; as per the labeling (below).

The Flush water supply solenoid valve is connected to the terminal pair in the right side of the PCB, labeled “Flush Valve”.

The connection to the electrical “Flush Valve” at the filter module is NOT polarity sensitive; wires can be in either position on the valve.

Solenoid





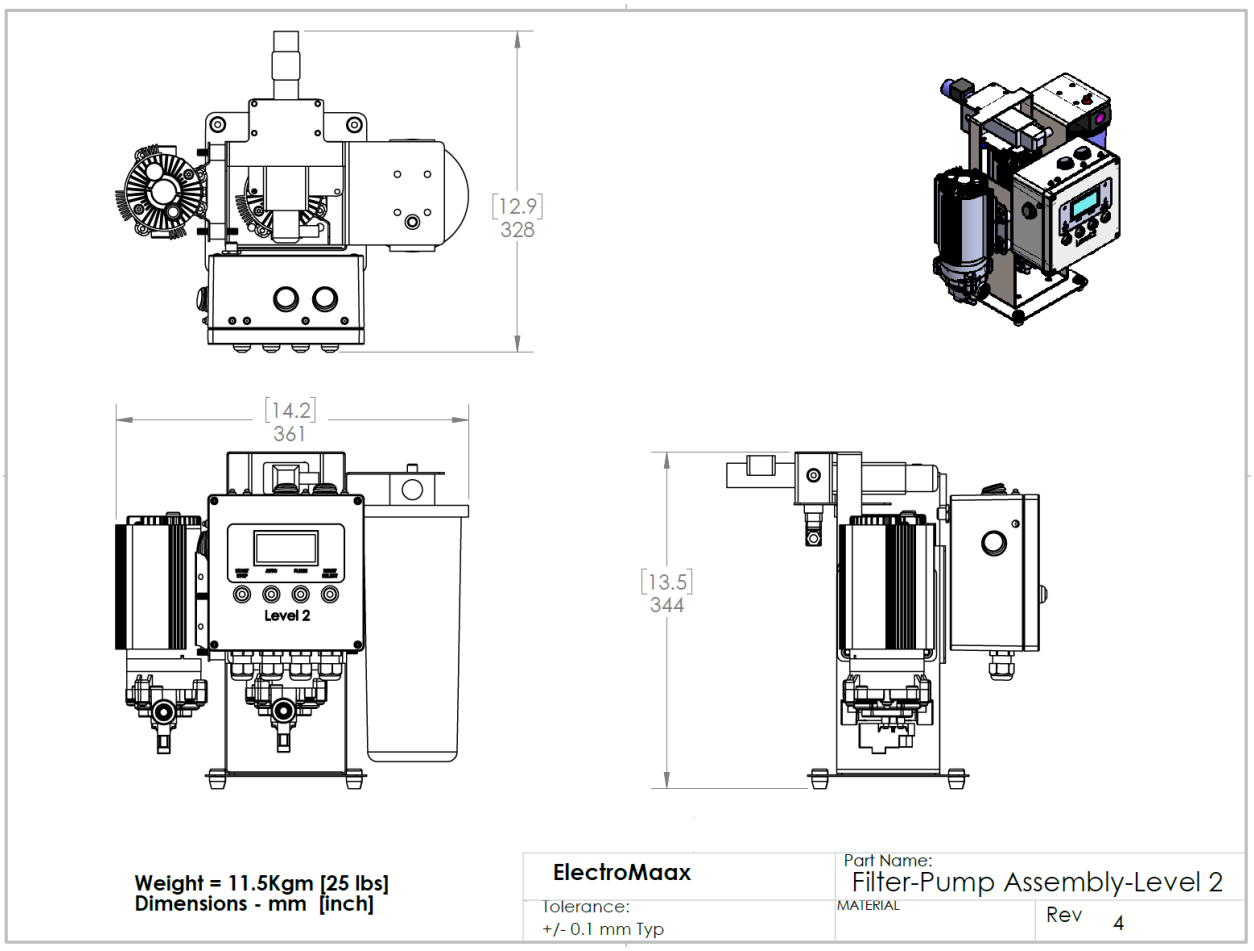
PRODUCT DIVERSION VALVE:

The Product diversion is accomplished using a 3-way (non-dead-heading) electrically operated solenoid valve; when the quality product signal occurs (based on user setting) the valve diverts product from waste to the holding tank. Manual operation requires the manual switching and resetting of this valve.

MECHANICAL INSTALLATION:

The pump module should be mounted to a rigid horizontal surface via the 4 rubber vibration feet. Use the complete module to check the location for fit and service access. The rubber mounting feet should have #6 screws or ¼" (6 mm) bolts on a 140 mm by 140 mm (5.5") pattern.

See Page 13 for the Pump Module Mounting Pattern



PUMP MODULE MOUNTING PATTERN

SUMMARY:

The SolarMaax WaterMaker equipped with the Level 2 electronic control provides the optimized operating conditions based on the environmental conditions. The ***ECO*** mode optimizes energy consumption and reduces pump noise, whereas ***Normal*** mode provides maximum product production.