



English

Installation, Operation and Maintenance Instructions

Solar Filtration System

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Warranty

Warranty Statement

1. The Solar Filtration System manufactured by Mono Pumps are covered by warranty for a period not exceeding twenty-four months from purchase.
2. Mono Pumps will make good by repair, or at their option, the replacement of faulty parts under warranty, providing always that:
 - (a) The equipment was correctly installed and properly used in accordance with Mono Pumps Installations and Operating instruction and accepted codes of good engineering practice.
 - (b) The claim for goods under warranty arises solely from faulty design, material or workmanship.
 - (c) The repair is carried out in the Mono factory or by an authorised agent or distributor appointed by Mono Pumps.
 - (d) All freight costs to and from the factory or repair agent are to be paid by the purchaser.
3. In the case of equipment or components which are not of Mono manufacture, but supplied by them, the warranty is limited to that extended by the suppliers or manufacturers of such equipment.
4. Mono Pumps warranty does not cover any of the following:
 - (a) Claims for third party liability of damage caused by failure of any of the company's products.
 - (b) Damage caused by abnormal operating conditions, war, violence, storm cataclysm or any other force.
 - (c) Damage caused by the equipment being used for an application for which it is not recommended.
 - (d) Damage caused by sand or abrasive materials, corrosion due to salt water or electrolytic action.
 - (e) Damage to the controller, if the controller has been opened by removal of the back plate before being returned to Mono Pumps.
 - (f) Damage to the motor if the motor is found to have been disassembled before being returned to Mono Pumps.
 - (g) Damage caused by running the pump dry.
5. The decision of Mono Pumps in relation to any claims or disputes over warranty is final.
6. The warranty is in lieu of all other warranties and conditions expressed or implied, written or oral, statutory or otherwise, which are hereby negated and excluded.
7. This express warranty does not exclude any conditions or warranty implied by the Trade Practices Act 1974 or separate State laws and in addition to any other right, that the original purchasers or any subsequent purchaser may have at law.

In case of claim please contact your Authorised Mono Dealer or contact Mono Pumps (Australia) Pty. Ltd.

Introduction

Introduction

This manual will provide the user with essential information on the installation, operation and maintenance of the Mono Solar Filtration System.

It is important that the instructions and recommendations presented in this manual are followed during the installation, operation and maintenance of this system.

Throughout the manual there are various safety signs associated with certain tasks. These safety signs are to be used as a guide only and should never be used in place of a job safety risk assessment.

Intended Use

The Mono Solar Filtration System is designed to filter bacteria, viruses, pathogens and suspended solids from contaminated water to provide improved quality water for remote communities.

System Overview

The Solar Filtration System brings together the proven Mono Pump solar water pumping technology with ultra filtration technology to produce a self cleaning filtration system.

A typical solar filtration water supply system would consist of the following parts:

1. Feed pump to move water from a borehole, open well, river dam etc.
2. Dirty water storage tank.
3. Solar filtration system.
4. Filtered water storage tank.
5. Distribution pipe system.

The solar filtration system is powered by the sun's energy.

Water from a borehole, open well, river, dam etc. is pumped into the dirty water storage tank, using a separate feed pump.

Contaminated water from the dirty water storage tank enters the solar filtration membrane tank through a coarse filter. The level of water in the solar filtration membrane tank is controlled automatically by a float valve.

The solar filtration membrane tank contains an ultra filtration membrane. The ultra filtration membrane will filter bacteria, viruses, pathogens and suspended solids from the feed water. The ultra filtration membrane will not remove dissolved metals, minerals and salts from the water.

Water is drawn through the membrane by the solar filtration system's pump. Bacteria, viruses, pathogens and suspended solids contaminants are left in the membrane tank. The filtered water is then pumped into the filtered water storage tank using the solar pump.

Periodically, the membrane is backwashed to remove any accumulation of contaminants using clean water from the backwash tank.

All operations of the solar filtration system are controlled by solar filtration system's controller. The controller provides the following functions:

- Maximum power point tracking of the solar array. This technology extracts the maximum available power from the solar modules.
- Pressure monitoring and protection of the ultra filtration membrane and pump.
- Automatic control of the back-flush cycle.
- Status lights to tell the operator what the system is doing.
- Warning lights to indicate when the system requires maintenance.
- Easily accessible on/off switch.
- Interface to an optional hand held display unit.
- Variable motor speed control via front panel or the optional hand held display unit.
- Thermal overload protection.
- Input current overload protection detects if too many solar modules are connected to the controller or if high currents are supplied from a battery source.
- Low motor speed cut off to reduce pump and motor wear.

Introduction

The Solar Filtration System comprises of:

- 230L tank with lid.
- Solar Pump.
- Controller.
- All internal pipework.
- Level switches.
- Solar array.

Warnings

Warnings



Solar arrays can deliver voltage levels up to 160V DC. Always unplug the controller from the array before working on any electrical wiring. If alterations are required to the array, completely cover the front of the array with a blanket or other suitable material. Check to ensure that there is no electricity been generated.



The output voltage from the controller to the motor is 180V DC. Always unplug the controller from the array before working on any electrical wiring.



All electrical connections in the solar filtration system are made via plug and socket. The solar array must be fitted with a switched socket to accept the plug from the controller. This is to ensure that the system can be completely isolated from the power source when required.



Incorrectly connecting the positive and negative wires between array and the controller will result in damage to the electronics inside the controller.



Removing the motor plug from the controller or shorting the wires together when the controller is operating, could damage the electronics in the controller.



Any disassembly of the controller by unauthorised personnel will invalidate all warranty.



Dry running of the pump will damage the rubber stator in the pump. Damage resulting from dry running is not covered by warranty.

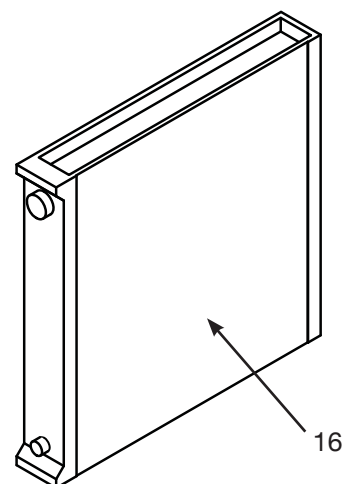
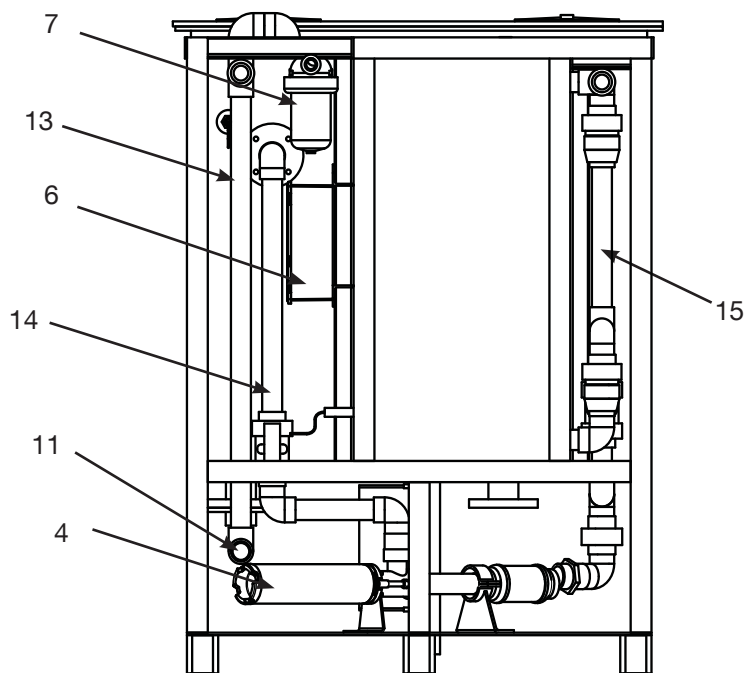
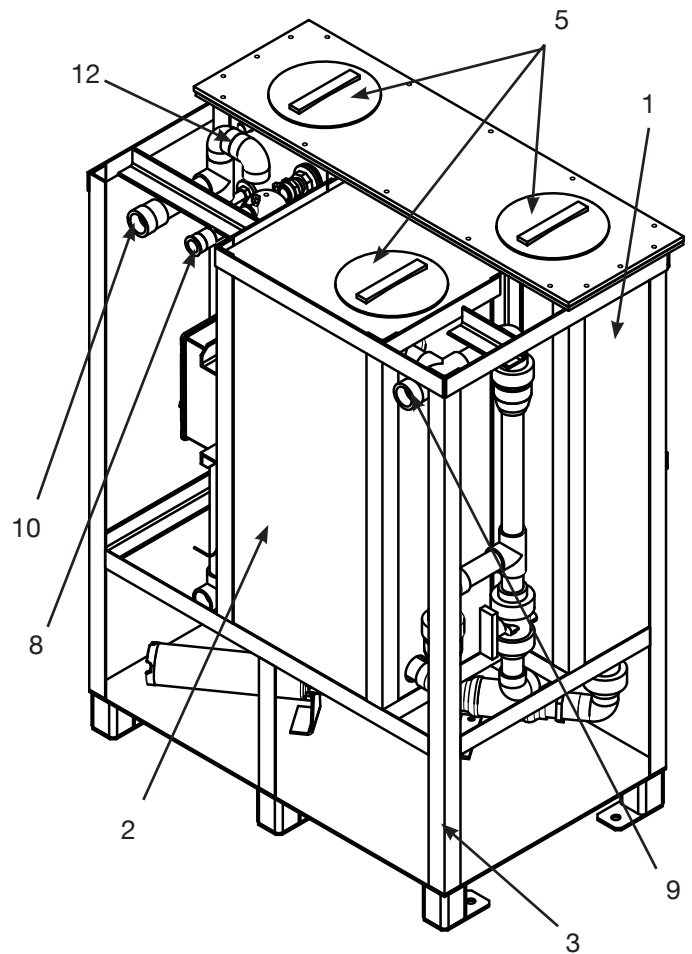


The system will need scheduled monitoring for correct operation and integrity. This monitoring type and schedule is the responsibility of the customer.

Specifications

System Specification

ITEM	DESCRIPTION
1	Membrane Tank
2	Backwashing Tank
3	Frame
4	Pump
5	Inspection Ports
6	Controller
7	Inlet Filter
8	Inlet Port
9	Discharge Port
10	Backwash Outlet
11	Manual Drain
12	Breather
13	Drain Pipe work
14	Pump Inlet Pipe work
15	Backwashing/Pump Discharge Pipe work
16	Membrane



Specifications

System Specification

Inlet:	1" BSP Thread
Outlet:	1½" BSP Thread
Overflow:	1½" BSP Thread
Drain:	1½" BSP Thread
Weight:	350kg
Membrane Tank Capacity	230L
Backwash Tank Capacity	100L

Materials

Tank & Tank Components:	Polyethylene
Frame:	Galvanised steel
Pipework:	ABS
Pump:	316 stainless steel
Stator:	Natural rubber
Fasteners:	304 stainless steel

Environmental

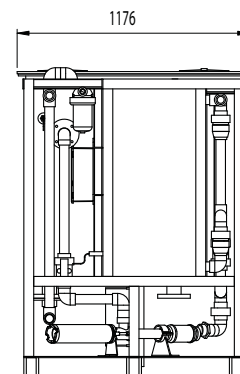
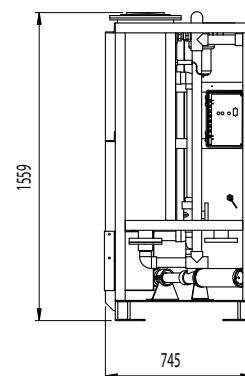
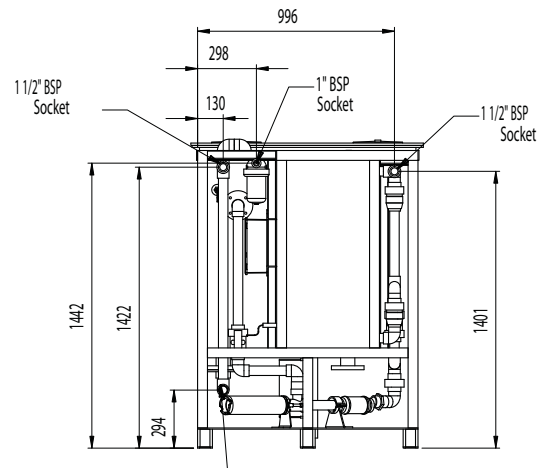
Storage Temperature:	-10 to 60 deg C
Operating Temperature:	0 to 40 deg C
Environmental Temperature:	-5 to 40 deg C
IP Rating:	IP55
Humidity:	95% Max

System Characteristics

Power Requirement:	350 Watts
Max. Flow Rate:	40 L/min
Max. Discharge Pressure:	40 metres

Com Connector RS232
 9600 baud
 rts/cts

Dimensions:



Specifications

Solar Filtration Controller Specification

Input (Solar Array)

Controller Input Voltage:	30 to 100 VDC
Max Current:	6.0 Amps
Solar Array:	350W Max.

Outputs

Motor:	Voltage: 0 to 180V 3 Phase switched DC
	Frequency: 0 to 100 Hz
	Current: 0 to 3 Amps

Com Connector

- RS232
- 9600 baud
- rts/cts

Environmental

Storage Temperature	-10 to 60°C
Operating Temperature	-10 to 50°C
IP Rating	IP66
Humidity	95% Max.

Dimensions & Weight

Dimensions (in carton)	270 x 390 x 310mm
Weight (in carton)	2.7 kg

Lightning Protection

In a solar water pumping system it is necessary to avoid having two earth points (e.g. The motor itself and the earth rod attached to the solar array frame.)

The most vulnerable point is at the motor cable entry to the electronics where it is possible to receive an extreme earth potential rise after a lightning strike nearby.

Metal oxide varistors are fitted on the array input and Transorbs on the motor output.

Specifications

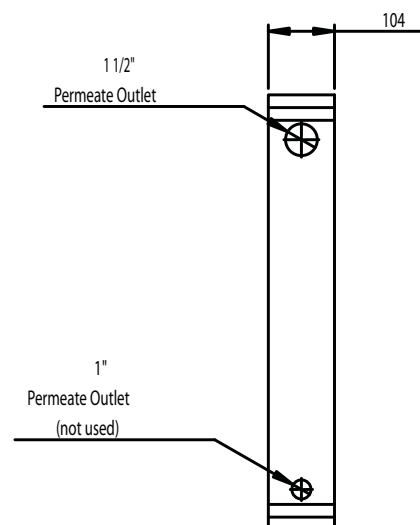
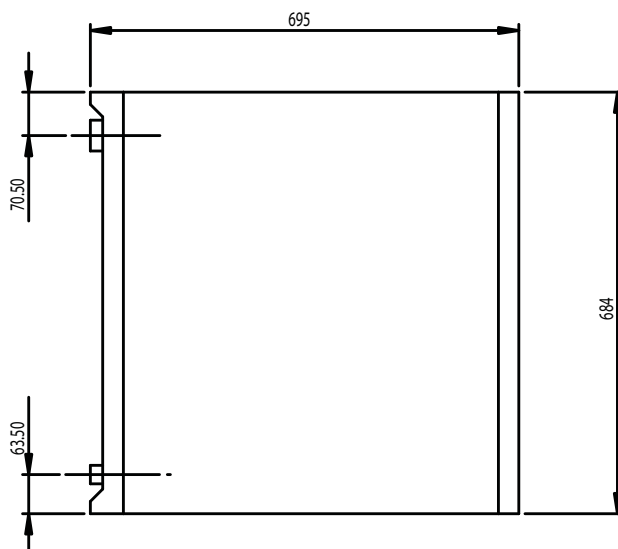
Membrane Specification

Membrane Chemistry	Polyvinylidene Fluoride
Membrane Type	Ultra filtration
Flow Path	Outside In
Nominal Pore Size	0.02 microns
Nominal Membrane Area	46.5 m ²
Shipping Weight	16 kg
Wet Module Weight	20 - 25 kg

Operating Specifications

Maximum Operating Temperature	40 deg C
Maximum Cleaning Chlorine Exposure	1000 ppm (<30 deg C) as Cl ₂ 500 ppm (>30 deg C) as Cl ₂
Total Chlorine Exposure Limit, ppm - hours	1,000,000 ppm
Operating pH Range	5 - 9.5
Cleaning pH Range	2 - 10.5

Dimensions



Water Analysis

Pre Purchase Water Analysis

Before Mono Pumps will supply a solar filtration system as a form of treatment for providing filtered water to a small community, a water analysis will need to be conducted on the feed water and presented to Mono Pumps. The water analysis must have the following water quality characteristics tested for:

- Turbidity
- Apparent Colour
- True Colour
- Alkalinity
- pH
- Hardness
- Suspended Solids
- Total Organic Carbon
- Escherichia Coli (E. Coli)
- Thermotolerant Coliforms

The water analysis will need to be conducted via an accredited laboratory.

Collection and presentation of the sample will need to be as per the instructions of the accredited laboratory.

Once the above water analysis has been conducted, the results should be presented to Mono Pumps. Mono Pumps will then verify that the solar filtration system can be used in the application to provide filtered water.

A maintained systems removes a very high percentage of bacteria, viruses, pathogens and suspended solids from the feedwater depending on the water type and analysis. The suitability of the system can be confirmed through the water analysis. The solar filtration membrane will not remove dissolved metals, minerals and salts.

Periodic Water Analysis

It is highly recommended that a water analysis be performed on a regular basis when the system is in operation, to ensure that the solar filtration system is providing filtered water. The water analysis needs only to be conducted on the filtered water. The water analysis should have the following water quality characteristics tested for:

- Turbidity
- Apparent Colour
- True Colour
- Alkalinity
- pH
- Hardness
- Suspended Solids
- Total Organic Carbon
- Escherichia Coli (E. Coli)
- Thermotolerant Coliforms

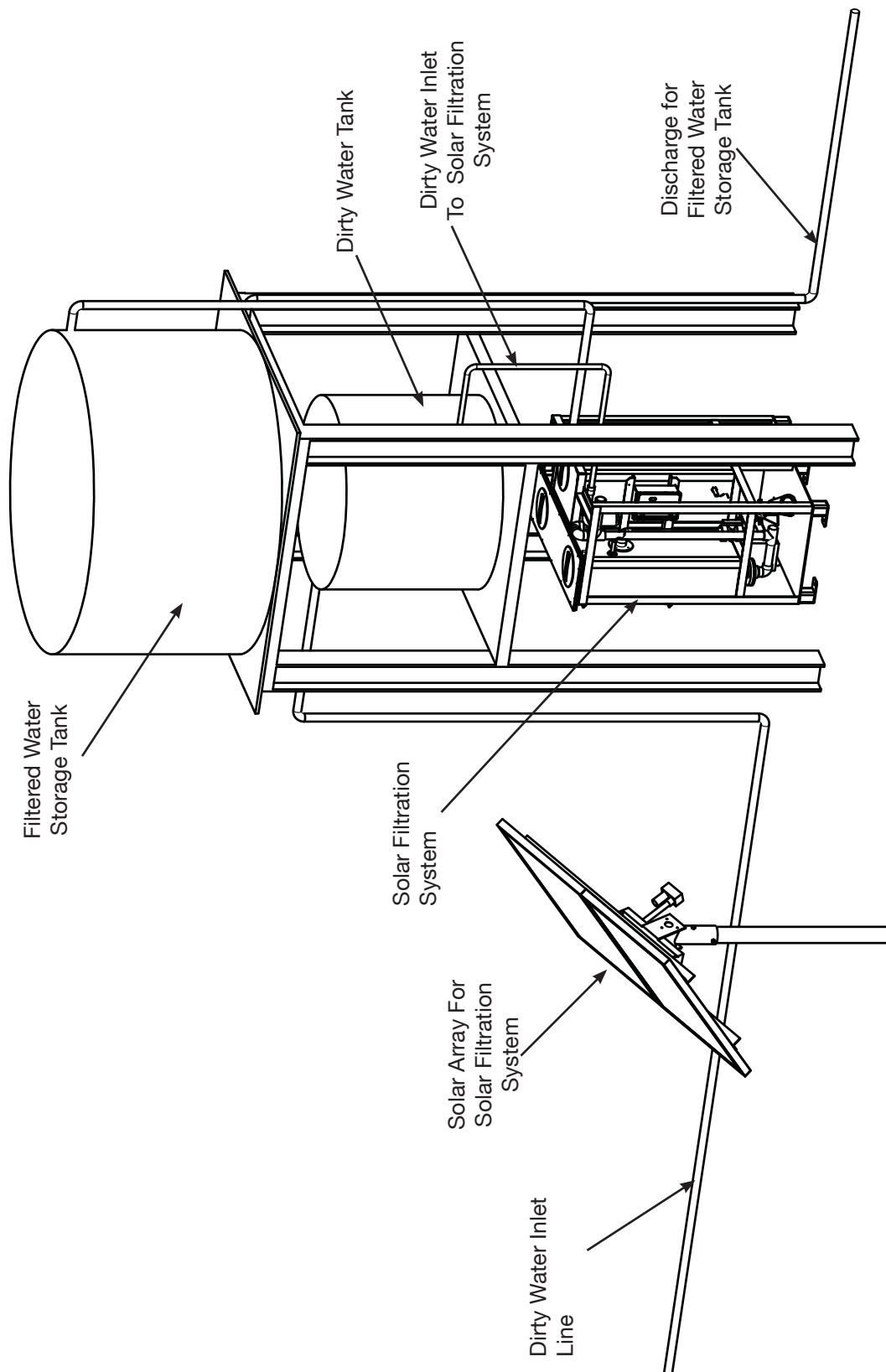
The water analysis will need to be conducted via an accredited laboratory.

The frequency and type of water test needs to be determined by a water specialist taking into account local conditions and needs.

Collection and presentation of the sample will need to be as per the instructions of the accredited laboratory.

Installation

Typical Installation



Installation

Installation Checklist

	Action	Check
1	The ground is flat where the solar filtration system will be installed.	
2	Filtered water storage tank is clean.	
3	The solar filtration system is been installed under cover.	
4	The solar array has been installed as per MPA593 Solar Array Instructions	
5	A ball valve has been installed at the outlet for the dirty supply water tank.	
6	A ball valve has been installed at the outlet for the filtered water storage tank.	
7	The inlet pipe has 2m pressure in line and has a maximum 5m elevation.	
8	The discharge pipe has a minimum of 1m to maximum 350m pressure inline.	
9	The backwash outlet pipe work has been installed so that the outlet is away from the solar filtration system and populated areas.	
10	The manual drain pipe work has been installed so that the outlet is away from the solar filtration system and populated areas.	
11	Solar filtration system and solar array has been earthed.	
12	Membrane has been installed in membrane tank and brackets have been screwed in place.	

Installation

Installation of the System



Before heading out to site, ensure that you have included the following items:

- 40L minimum of known clean water.
- A bucket.
- A watering can.

Step 1. Site Requirements

- Solar filtration system needs to be installed onto a flat ground surface. A level concrete slab would be ideal.
- The solar filtration system should be covered.
- Install the solar array as per MPA593 Solar Array Installation, Operation and Maintenance Instructions.
- The filtered water storage tank should be as small as possible and should be new. This is to avoid contamination of the filtered water supply.
- This installation guide assumes that the dirty source water storage tank and the filtered water storage tank have been installed.

Step 2. Solar Filtration System Pipe work

- It is recommended that a ball valve be installed at the outlet for the dirty source water storage tank and at the inlet of the filtered water storage tank. This will allow these tanks to be isolated so that maintenance work can be conducted on the solar filtration system.
- Ensure that the dirty source water and the filtered water supply storage tanks are isolated before any connection to the solar filtration system commences.
- The inlet pipe work from the dirty source water storage tank to the solar filtration system, needs to be installed with a minimum 2m to maximum 5m elevation. If there is too much pressure in the inlet pipe work, the valves on the solar filtration system will not close.
- The discharge pipe from the solar filtration system to the filtered water storage tank needs to be a minimum 10 kPa to 320 kPa pressure in the line. This discharge pipe work must not be installed downhill as this will not allow the valves on the solar filtration system to close.

- The outlet for the backwash outlet pipe work needs to be installed away from the solar filtration system and not into populated areas.
- The outlet for the manual drain pipe work needs to be installed away from the solar filtration system and not into populated areas.

Step 3. Earthing the Solar Filtration System

The solar filtration system and the solar array will need to be earthed to provide lightening protection and to prevent either structure from becoming “live” in the case of a fault with the array or controller.

- The post or one of the support legs of the solar array must be earthed.
- The frame of the solar filtration system must be earthed.

Step 4. Installation of the Controller



Warning: Incorrectly connecting the positive and negative wires between array and the controller will result in damage to the electronics inside the controller.



Warning: Removing the motor plug from the controller or shorting the wires together when the controller is operating could result in damage to the electronics in the controller.

1. Ensure that the on/off switch on the side of the controller is in the off position before connection.



2. Switch the isolation switch on the array to the off position (if fitted).
3. The solar filtration controller utilise 2 x “MC” style leads to connect the controller to the solar array.

Installation

4. Connect the MC cables into the ports on the controller and on solar array switch located on the back of the solar array.



5. Ensure that the motor plug is in the motor socket on the controller.

Step 5. Installation of the Pump

1. The pump will require priming before the system is activated.
2. Remove the lid of the membrane tank.
3. Locate the pump inlet pipe work.
4. Loosen the barrel union on the pump inlet pipe work.
5. Turn the pump inlet pipe so that it is facing upwards.
6. Pour known clean water into this pipe work until water overflows out the pipe. Stop once this has occurred.
7. Return the pump inlet pipe work back to original position.

Step 6. Installation of the Membrane



It is important that great care is taken when handling the membrane. Do not touch fibres. Fibres can not be knocked or damaged. Plastic cover around the membranes can receive general knocks during installation.

1. Unscrew the bolts holding the top cover of the membrane tank. Remove this cover and gasket.



2. Remove top bracket and lift up the float valve.



3. Remove the new membrane from the packaging. Do not place the membrane onto dirt. Use the packaging as a mat under the membrane.
4. Ensure that the membrane discharge port is always facing upwards away from the ground and dirt. There is only one discharge port to the membrane.
5. Ensure that the two o-rings are in place on the membrane discharge port.
6. Make sure that the membrane discharge port is facing the internal inlet pipe work. Lift the membrane up and onto the tank. From this point, lift the membrane into the membrane tank.



This lift will require a two man lift as membrane is heavy and the lift is awkward.

7. Push the pump inlet pipe work inside the membrane tank, onto the membrane discharge port past the o-rings.
8. Ensure that the membrane is sitting in between the locating lugs at the bottom of the tank.
9. Hand tighten the inlet onto the membrane discharge, do not use pipe wrench.
10. Replace top bracket to secure membrane.

Installation

11. Swing ball valve back into place.



12. The membrane will need the majority of the glycerine cleared. The membrane does not need to be totally cleared of the glycerine. This can be done either two ways:
 - a. Attach a 1" screw fitting with hose to the float valve outlet. Face the hose to the opening of the membrane and open up the solar filtration system inlet. Move the hose across the membrane opening while the water is flowing.
 - b. Using a bucket, pour dirty or clean water over the opening of membrane.
13. With either way, ensure that the manual drain valve is open to dump the water containing the glycerine.
14. Once the glycerine has been removed from the membrane, close the manual drain valve.

Step 7. Check Flow rate into Membrane Tank

1. Open the float valve for the dirty source water and clean water storage tanks.
2. Open the inlet valve on the solar filtration system.
3. Check that the float valve in the membrane tank is working by:
 - a. Dirty source water is pouring into the membrane tank.
 - b. Lift up float valve and dirty water should stop pouring into the membrane tank.
4. Check the flow into the membrane tank for air locks. The flow should be a continuous stream of water into the tank. Air locks will cause the flow to surge. If air locks are present, check the inlet line from the dirty storage tank to the solar filtration system.

Step 8. Before Leaving Site

- Ensure that the membrane tank is full with dirty water.
- Ensure that the float valve at the dirty source water storage tank is in the open position.
- Ensure that the inlet valve to the solar filtration system is in the open position.
- Ensure that the controller on/off switch is in the off position.
- Ensure that the cover for the membrane tank has been screwed down.

Commissioning

Commissioning of the Solar Filtration System

Starting the System

1. Unscrew the bolts holding the top cover of the membrane tank. Remove the cover and ensure that the membrane tank is full.



2. Ensure that the discharge valve is in the open position.
3. Turn the array isolation switch to the on position (if fitted).
4. Turn the on/off switch on the side of the controller to the on position. The solar filtration controller should light up indicating that power is available from the array.



5. The "Run" status light should flash indicating that the pump is starting (providing that power is available from the array). When the pump has started the "Power" status light will turn off and the "Run" status light will flash or turn on continuously.
6. Listen to the operation of the pump. If air can be heard bubbling up into the backwash tank, the pump may be running backwards. Immediately turn off the solar filtration controller and check the motor plug wiring at the controller before restarting. If the pump is run backwards for more than 20 seconds the stator may be damaged.

7. Check the back pulse function:
 1. Make sure that there is plenty of sun.
 2. Push back pulse button.



3. Start back pulse.
 4. Blower will be activated.
 5. Backwash will continue for 240 sec (4 mins).
 6. Water coming out of waste discharge.
8. Replace cover for the membrane tank and screw back in place.

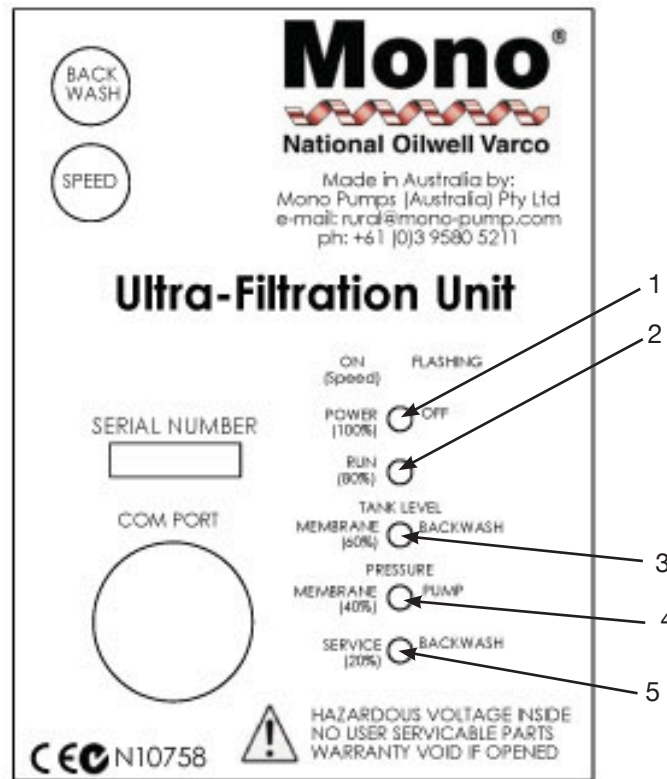


Step 9. Prior to use of system

- After the set up of the system and operation tests, it is recommended that both pre and post water samples be taken to ensure the system is working correctly. The scope of these tests depend on the water type.

Operation

Operation of the Controller



Solar Filtration Controller's Diagnostic Indicators

The solar filtration controller features five multi-function system status lights (LED's).

- The first function of each light is indicated by continuous illumination of the LED.
- The second function of each light is indicated by a flashing LED.

The functions of the LED's are as follows:

1. Solar Power/Low Power
 - *Continuous Illumination:* When solar power is available.
 - *Flashing:* When the unit is turned off via the On/Off switch or via the com port.
 - The indicator turns off if insufficient power is available to the solar filtration controller.
2. Max. Speed / Motor Run
 - *Continuous Illumination:* When the motor is running at maximum speed.
 - *Flashing:* Flashes proportional to the speed of the motor at lower speeds.
3. Tank Level
 - *Continuous Illumination:* Water level in membrane tank is low.
 - *Flashing:* When the backwash tank water level is low.
4. Pressure
 - *Continuous Illumination:* The membrane pressure exceeds the preset limit
 - *Flashing:* The pump pressure exceeds the preset limit.
5. Service/Backwash
 - *Continuous Illumination:* Solar filtration system requires a service. Contact your local service provider.
 - *Flashing:* Solar filtration system is performing a backwash.

Operation

Explanations of the Operations

Membrane/Backwash Tank Levels

Membrane Tank

The level switch for the membrane tank is situated just above the top of the membrane. This level switch is to ensure:

- a) The membrane is always submersed.
- b) No air enters into the system. Air in the system can cause dry running of the pump.

Backwash Tank

The level switch for the backwash tank is situated just above the bottom of the tank. This level switch is to ensure that the pump is always under flooded suction. This ensures that the pump will not be run dry.

Pump Speed Control

The pump speed feature on the solar filtration controller can be used to limit the maximum speed of pump, therefore reducing the peak flow of the pump. This is useful when the peak flow needs to be reduced because of a low yielding water source.

There are two methods of reducing the maximum motor speed. First method is by pushing the front panel speed switch, the second method is by using the Solar Display unit.

1. **Front Panel Speed Button**
Pushing the speed button will increase the maximum speed by 20% each push. The initial push will illuminate the number of indicators corresponding to the current maximum speed setting. If the switch is pushed again the maximum speed will be increased by 20%. Once the absolute maximum setting of 100% has been attained the next push will revert back to the 20% setting.
2. **Backwash Speed via the Solar Display Unit (SDU)**

To reduce the maximum pump speed using the SDU, plug the SDU into the front of the controller and follow these steps:

- i. Press enter (#) on the SDU to clear any previous operation.
- ii. Press * 6 # , the display should read "Max Motor Volt ?"

- iii. Enter the desired maximum motor voltage between 36 and 180V, for 100V press 100#, the display should now read "Max Motor V=100V".

Note: The SDU setting will override the maximum available speed button setting. Therefore the front panel switch can only increment the speed up to the SDU setting.

Solar Filtration Totaliser Operation

The solar ultra filtration controller has an inbuilt totaliser function. This function counts every revolution the pump has done since installation. This reading can be used as a method to calculate the total amount of water that has been pumped from installation date.

1. To recall number of Pump Revolutions from the controller enter *8# on the Solar display unit.
2. Pump conversion factors
SM041 75
3. To calculate litres pumped:
Total Litres = Revolutions/Pump Factor
e.g. 1340000 Revs SM041 Pump
 $1340000/75 = 17,867$ litres

Backwashing

Backwashing can be forced by pressing the backwashing button on the controller.

Maintenance

General Maintenance

Manual Dump

Depending on the quality of the water will depend on how often the Solar Filtration System will require a manual dump.

The manual dump is to regularly remove the sludge that may build up at the bottom of the tank.

It is important to remove the sludge from the tank to help prevent the membranes from fouling.

1. Turn off the controller.



2. Close the inlet port.
3. Unbolt and remove the membrane tank lid.



4. Open the manual drain and dump the water from the membrane tank.



5. Attach a 1" screw fitting with hose to the ball valve outlet.
6. Clean the walls and base of tank.
7. Open up the inlet port.

8. Use the hose to hose down the sides and bottom of the tank, removing as much sludge as possible.
9. Face the hose to the opening of the membrane and move the hose across the membrane opening to try and move any sludge from within the membrane.
10. Close the manual drain.



11. Open the inlet and refill the tank.
12. Turn on controller.



13. Replace membrane tank lid and bolt into place.



Maintenance

Inlet Filter

1. Turn off the controller.



2. Close the inlet port.
3. Using valve union tool (supplied with unit) unscrew the inlet filter from the solar filtration system.



4. Remove the disk cartridge from the filter cover.



5. Using a small brush, scrub the plastic disks on the outside and in between the disks.
6. Remove most of the film/sludge etc.. from the disks.
7. Clean the inside of the filter cover.
8. Flush both the cover and the disk cartridge with clean water.
9. Install the disk cartridge back into the cover.
10. Screw the filter cover back into the solar filtration system.
11. Hand tighten the thread.
12. Open the inlet port.

Cleaning the Ball Valves

1. Close the inlet port.
2. Unbolt and remove the membrane tank lid.



3. Open the manual drain and dump approximately a quarter of the water from the membrane tank.



4. Open the inlet port.
5. Check the flow coming into the membrane tank.
6. If the flow is constricted, then the valve could be partially or fully blocked.
7. Clear the valve.
8. Replace membrane tank lid and bolt into place.

Maintenance

Cleaning The Solar Filtration System

There are three types of cleaning method for the Solar Filtration System:

1. Self cleaning mechanism (backwash).
2. Clean in place.
3. New Membrane.

Solar Filtration System Self Cleaning

The solar filtration system has its own ability to self clean the membrane through backwashing. The self activated backwashing is triggered by time and/or pressure.

Backwash - Time

Provided that there is enough power in the system, the controller will perform a backwash cycle every two hours. The time triggered backwash helps increase the time before the membrane requires a chemical treatment.

Backwash - Pressure

When the pores of the membrane become blocked, the suction that is required to pull water into the membrane fibres is increased. When the pressure becomes too high, this triggers a backwash to occur.

Clean In Place

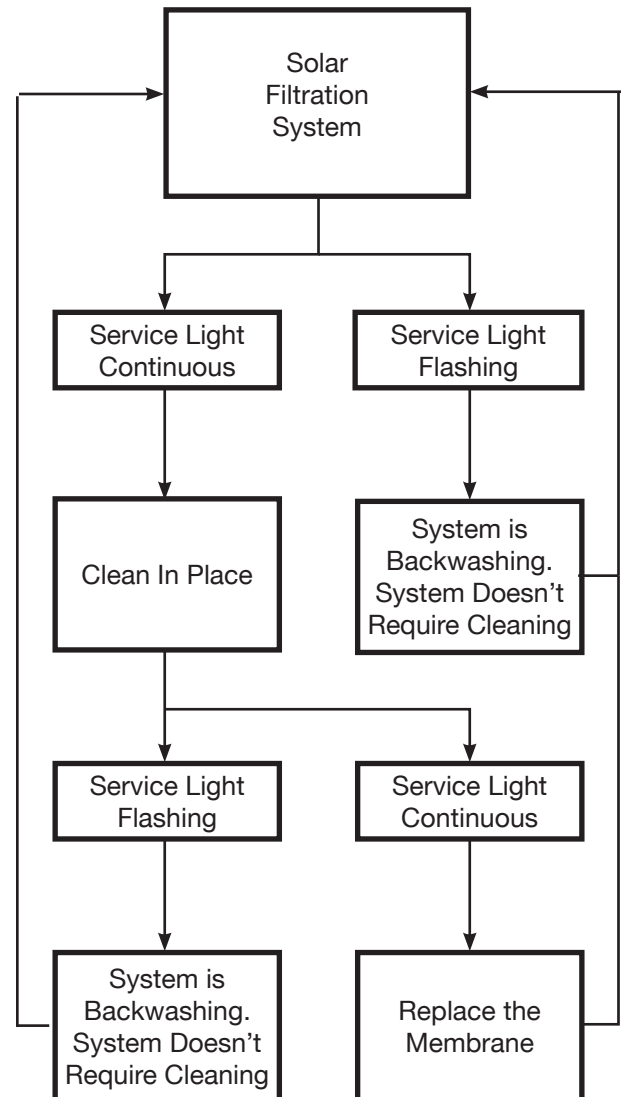
When the system has been forced to perform a backwash due to pressure two consecutive times, the service light on the controller will be illuminated. This indicates that it is time for the membrane to be chemically cleaned. There are two types of cleaning process to remove fouling from the membranes. The first process is to remove organic fouling and the second process is to remove inorganic fouling. After a clean in place has been conducted, the system should go back to its normal backwashing cycle.

New Membrane

After a clean in place has occurred, if the service light has been reactivated within a week then the membrane will need to be replaced. This is because too many of the pores in the membrane are still blocked. The membrane will need to be removed for a major chemical clean to try and revitalise the membrane.

Cleaning Flowchart

Use the flowchart to assess what type of clean will need to occur.



Maintenance

Clean in Place



You will need:

- Hose with 1" screw fitting.
- Chlorine (commonly called pool chlorine).
- Measuring cylinder.
- Cl_2 indicator papers
- Citric acid.
- pH probe.
- Battery for the blower (if required).
- Enough sunlight to be able to run the backwash.



Always ensure that the clean storage water tank contains enough water to cover the water requirements of the site for at least a couple of days.

There is two types of fouling that effect the performance of the membranes. Organic and inorganic fouling.

The organic clean uses chlorine (chemical name is sodium hypochloride approx.. 13%). The inorganic clean uses citric acid.

The water quality of the application will determine how quickly the membrane will foul. Usually an organic and inorganic clean should be conducted (but not at the same time) during a chemical clean. If the water is "soft" (i.e. less than 75 mg/L of CaCO_3), then an inorganic clean may not need to be conducted.



The two types of cleaning processes (inorganic and organic) should never be performed at the same time, as highly toxic chlorine gas could be produced. Chlorine gas can be harmful to humans. Chlorine gas is considered to be very corrosive towards most metals.

Organic Clean



It is important that the blower is not activated during the organic clean, as the air could convert the chlorine to chlorine gas.

Step 1.

1. Turn off the controller.



2. Close the inlet port.
3. Unbolt and remove the membrane tank lid.



4. Open the manual drain and dump the water from the membrane tank.



5. Attach a 1" screw fitting with hose to the ball valve outlet.
6. Clean the walls and base of tank.
7. Open up the inlet port.
8. Use the hose to hose down the sides and bottom of the tank removing as much sludge as possible.

Maintenance

9. Face the hose to the opening of the membrane and move the hose across the membrane opening to try and move any sludge from within the membrane.
10. Close the manual drain and refill the tank with dirty water (clean water would be preferred).



11. Fill the tank so that the water covers the membrane, but is under the brass fittings on the ball valve.
12. Close the inlet valve.
13. You will need to add enough chlorine so that the residual concentration of chlorine is a maximum of 500 ppm (mg/L). Check the chlorine as per the instructions provided with the Cl₂ indicator papers.
14. Replace the cover back on the membrane and backwash tank.



16. Activate the blower for one minute. (A battery may be required for this operation).
17. Either allow the water to sit overnight or for a minimum of 6 hours.

Step 2.

1. Remove the membrane tank lid.



2. Check the chlorine concentration in the tank using the Cl₂ indicator papers. Ensure that there is residual chlorine. If there is no chlorine detected in the tank, then the cleaning may not have been effective. Repeat the organic cleaning cycle.
3. Attach the blower to the battery and activate for 1 minute.
4. Perform a backwash by:
 - a) Turn on controller
 - b) Make sure that there is plenty of sun.
 - c) Push the back pulse button on the front of the controller. The blower will be activated.



- d) Backwash occurs for approx.. 4 mins.
5. As the backwash is occurring, dump the water from the membrane tank.
6. Use the hose to hose down the sides and bottom of the tank, removing any sludge.
7. Face the hose to the opening of the membrane and move the hose across the membrane opening to flush any sludge from within the membrane.
8. Close the inlet port.
9. Close the manual drain.



10. Remove the hose and open the inlet.
11. Refill the membrane tank.
12. Ensure that the membrane tank lid is bolted back into place and that the backwash inspection port is screwed back into place.

Maintenance



13. Ensure that the controller is in the “on” position.



14. System has completed the organic clean and is now either ready for the inorganic clean or to be used again.

Inorganic Clean Step 1.

1. If the inorganic clean is following straight after the organic clean, go to Step 13.
2. Turn off the controller.



3. Close the inlet port.
4. Unbolt and remove the membrane tank lid.



5. Open the manual drain and dump the water from the membrane tank.



6. Attach a 1” screw fitting with hose to the ball valve outlet.
7. Clean the walls and base of tank.
8. Open up the inlet port.
9. Use the hose to hose down the sides and bottom of the tank, removing as much sludge as possible.
10. Face the hose to the opening of the membrane and move the hose across the membrane opening to try and move any sludge from within the membrane.
11. Close the manual drain and refill the tank with dirty water (clean water would be preferred).



12. Fill the tank so that the water covers the membrane, but is under the brass fittings on the ball valve.
13. Close the inlet valve.
14. You will need enough citric acid in the membrane tanks so that the pH of the water is 2.2. Check the citric acid concentration using a pH probe.
15. Replace the cover back on the membrane tank and the backwash tank.



Maintenance

16. Allow the water to sit for 6 hours.
17. It is recommended that every 1/2 hour for five minutes the blower is activated. This is to help remove the sludge from the membranes.

Step 2.

1. Check the pH of the water in the membrane tank to ensure that it is approximately pH = 2.2. If the pH is above 3.0, then the cleaning may not have been effective. Repeat the inorganic cleaning cycle.
2. Remove the membrane tank lid.



3. Perform a backwash by:
 - a) Turn on controller
 - b) Make sure that there is plenty of sun.
 - c) Push the back-pulse button on the front of the controller. The blower will be activated.



- d) Backwash occurs for approx.. 4 mins.
4. As the back wash is occurring, dump the water from the membrane tank.
5. Use the hose to hose down the sides and bottom of the tank, removing any sludge.
6. Face the hose to the opening of the membrane and move the hose across the membrane opening to flush any sludge from within the membrane.
7. Close the inlet port.
8. Close the manual drain.



9. Remove the hose and open the inlet.
10. Refill the membrane tank.
11. Ensure that the membrane tank lid is bolted back into place and that the backwash inspection port is screwed back into place.



12. Ensure that the controller is in the "on" position.



13. System has completed the inorganic clean and is ready to be used again.

If the service light goes back into continuous illumination within one to two weeks of the chemical clean, it is recommended that the membrane be replaced.

Maintenance

New Membrane



Always ensure that no dirty water transfers to the back wash water tank during this process.

You will need:

- Hose with 1" screw fitting.
- Enough sunlight to be able to run the backwash.

Steps Required To Replace the Membrane

1. Turn off the controller.
2. Close the inlet port.
3. Unbolt and remove the membrane tank lid.
4. Open the manual drain and dump the water from the membrane tank.



5. Undo the outlet union that connects the membrane inside the membrane tank.
6. Remove brackets that hold the membrane down.
7. Lift up the float valve in the membrane tank.



The membrane weighs 25 kg. An assisted lift or multi-person lift must be used when removing the membrane. Remove membrane by lifting straight up and out of the tank.

8. Attach a 1" screw fitting with hose to the ball valve outlet.
9. Clean the walls of tank.
10. Open up the inlet port and the manual drain.
11. Use the hose to hose down the walls and base of the tank. Remove as much sludge as possible. Be careful not to get any of the dirty water in the membrane outlet pipe work in tank.
12. Once the walls and base of the tank are totally clean, close the inlet port and the manual drain.
13. Ensure that walls are totally clean.



It is important that great care is taken when handling the membrane. Do not touch fibres. Fibres can not be knocked or damaged. Plastic cover around the membranes can receive general knocks during installation.

14. Remove the new membrane from the packaging. Do not place the membrane onto dirt. Use the packaging as a mat under the membrane.
15. Ensure that the two o-rings are in place on the membrane discharge port.
16. Make sure that the membrane discharge port is facing the internal inlet pipework. Lift the membrane up and onto the tank. From this point, lift the membrane into the membrane tank.



This lift will require a two man lift as membrane is heavy and the lift is awkward.

17. Push the pump inlet pipe work inside the membrane tank, onto the membrane discharge port past the o-rings.
18. Ensure that the membrane is sitting in between the locating lugs at the bottom of the tank.
19. Hand tighten the inlet onto the membrane discharge, do not use a pipe wrench.
20. Replace top bracket to secure membrane.
21. Swing the float valve back into place.
22. Open the manual drain.

Maintenance



23. The membrane will need to be cleared of the majority of the glycerine. The membrane does not need to be totally cleared of the glycerine. This can be done either two ways:
 - a) Attach a 1" screw fitting with hose to the ball valve outlet. Face the hose to the opening of the membrane and open up the solar filtration system inlet. Move the hose across the membrane opening while the water is flowing.
 - b) Using a bucket, pour dirty or clean water over the opening of membrane.
24. Once most of the glycerine has been removed from the membrane, close the manual drain valve.
25. Fill up the membrane tank.
26. While the membrane tank is filling, check that float valve is working by:



1. Check that the float valve in the membrane tank is working by:
 - a) Dirty source water is pouring into the membrane tank.
 - b) Lift up ball valve and dirty water should stop pouring into the membrane tank.
 2. Check the flow into the membrane tank for air locks. The flow should be a continuous stream of water into the tank. Air locks will cause the flow to surge. If air locks are present, check the inlet line from the dirty storage tank to the solar filtration system.
27. Turn controller on. A back pulse will need to be performed to remove the glycerine from the

pores.



28. Make sure that there is plenty of sun.
29. Push the back pulse button on the front of the controller. Provided that there is enough sun the back pulsing will begin.



30. When the back pulse starts the blower will be activated and the pump as well. The bubbles will force the membrane strands apart, allowing any glycerine to be removed. Back pulse will continue for 240 secs/4 mins.
31. Once the back-pulse has finished its cycle, the system will start to filter the water. Turn the controller off and close the inlet port.
32. Open up the manual drain and dump the water from the membrane tank. Discharge water will be frothy due to the glycerine.



33. When the tank has emptied, close the manual drain and open the inlet port. Fill the membrane tank.

Maintenance

34. Once the membrane tank is full, turn on the controller.



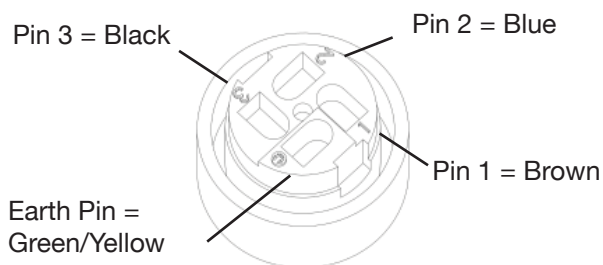
35. Using the hand held, check the membrane pressures.
36. Provided that there is enough sunlight, allow the system to fill up the backwashing tank (there can be foam in the backwashing tank due to the glycerine. Glycerine is not harmful to the system or to people's health)
37. Wait until the tank is filled to ensure that the system is working well.
38. If the service light is still on when leaving the site, this indicates that the system may not have done a back-pulse cycle. Once the system has conducted a back-pulse via time, the service light will turn off.

Maintenance

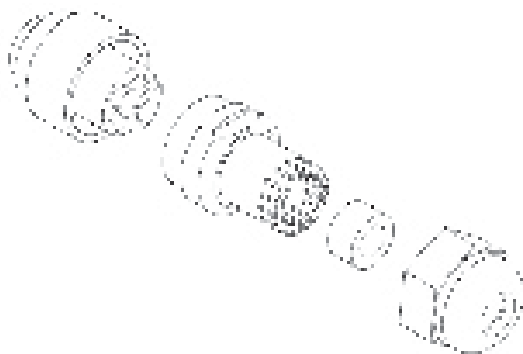
Electrical Connections - Motor Plug

Controller End

The connection plug for the motor cable to the filtration controller is to be wired as below. It is important that the wires are reconnected correctly to ensure that the pump runs in the correct direction.

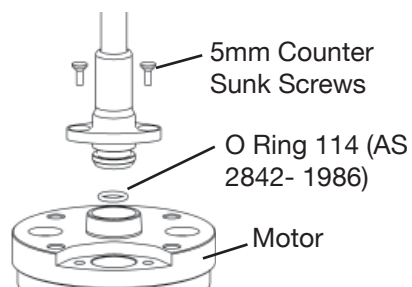


Assemble the remainder of the plug as shown below.



Motor End

If the motor plug needs to be removed from the motor, it must be replaced with a new o-ring and sealant grease.



For disconnection or connection of the plug, the pump barrel must be removed.

Fault Finding

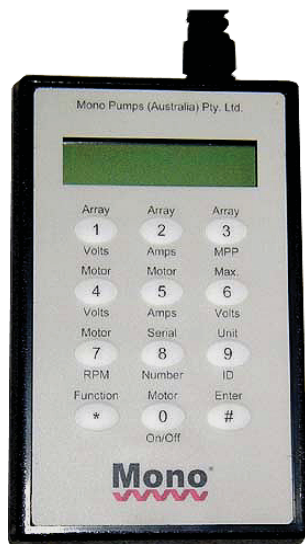
Fault Finding

Status Light	State	Possible Problem	Solution
Solar Power	Off	Loose array connection.	Test array & rectify problem.
		Faulty array.	Test array & rectify problem.
		Faulty controller.	Return to Mono for assessment.
		Not enough solar power.	Check array position or wait for more sun light.
	Flashing	On/Off switch set to off.	Push On/Off switch.
		Remote control set to off.	Push On/Off switch.
Max Speed/ Motor Run	On but no flow from pump.	Motor disconnected from pump.	Reconnect motor to pump. Check direction of rotation.
		Broken Flexishaft/Coupling.	Replace Flexishaft/Coupling.
	Flashing/slow	Array partially faulty.	Test array & rectify problem.
		Pump load increased.	Check for obstruction in the pump non-return valve or increased head due to pipe blockage.
	Off	System is waiting for enough power.	Need more solar power.
		Stuck pump.	Clear or prime pump.
		Faulty motor.	Return to Mono for assessment.
Tank Level	On	Water level in membrane tank is low.	Check that the inlet pipe is not blocked.
			Check that the inlet course filter is not blocked.
			Check along the inlet line from the solar filtration system back to the dirty water source for leaks or failed equipment.
			Check that the dirty water source is still producing water.
	Flashing		
Pressure	On	Membrane is blocked.	Clean membrane.
	Flashing	Pump over pressured.	Release pressure in system.
Service/ Backwash	On	Membrane is blocked.	Clean membrane.

Optional Accessories

Solar Hand Held Display Unit

Part No.: SUN DISP UNIT



The Solar Hand held Display Unit is an optional accessory that allows the operator to extract data and change software settings within the solar filtration controller.

The solar hand held display unit is powered either from the solar filtration controller or a 9 volt battery. If the solar filtration controller is running the display unit takes power from the controller. If the solar filtration controller is not connected to power, the solar hand held display unit will run off the internal battery, provided that the battery is not flat. Provided that there is battery power, the solar hand held display unit will also power up the microprocessor on the solar filtration controller so that settings can be changed without the controller being connected to mains power.

The solar hand held display unit has two sets of functions, primary and secondary. The primary functions will give actual information on the solar filtration system. The secondary functions allows the operator to change certain functions of the solar filtration controller software.

Primary Functions

To access the primary functions, press the number key then enter.

Number Key	Primary Function
0	Motor On/Off (turns the pump on/off)
1	Array Volts
2	Array Amps
3	Array Maximum Power Point (Normally auto, but if the voltage has been fixed, set voltage will be displayed)
4	Motor Volts
5	Motor Amps
6	Maximum Motor Volts (Default = 180 volts. By setting a lower maximum motor voltage the maximum speed of the pump can be controlled.)
7	Motor RPM
8	Serial Number and Date of Manufacture of Controller
9	Unit ID of the Solar Display Unit

Secondary Functions



Caution: Secondary functions should only be changed by an experienced operator, as changing the settings from the factory defaults could cause damage to the solar filtration system.

To access the secondary functions, press:

- * key
- Number key for the function to be changed.
- Enter
- New Value (that function is to be changed too)
- Enter

Number Key	Secondary Function
1	Array Power
2	Pressure Limit (0 reads current setting)
3	Array Maximum Power Point (Turns off the maximum power point tracking and sets the voltage to a fixed value. 0 returns to auto mode.
5	Pump Pressure
6	Maximum Motor Voltage
7	Pump Model (0 reads current setting)
8	Revolution Counter.
9	Set Defaults (1=Return back to factory settings)

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NOV Mono®

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