MARLEY®

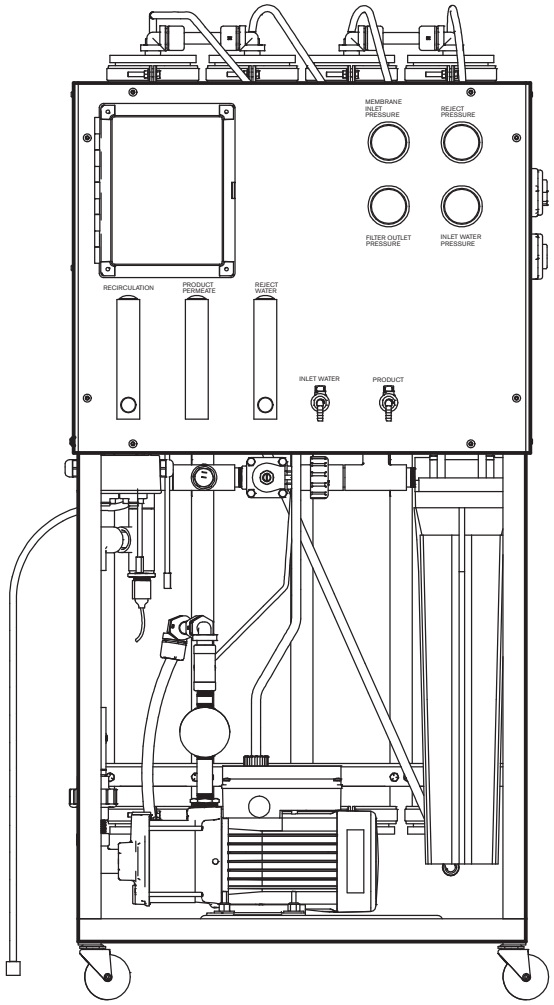
user manual

WaterGard™ model WG002-WG004

INSTALLATION - OPERATION - MAINTENANCE

10000022002 C ISSUED 11/2026

READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.



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Note

This manual contains vital information for the proper installation and operation of the Marley® WaterGard™ system. Carefully read the manual before installation or operation and follow all instructions. Save this manual for future reference.

overview

This User Manual as well as those offered separately on other components, etc., are intended to assure that the WaterGard system serves you properly for the maximum possible time. Since product warrantability may well depend upon your actions, please read this User Manual thoroughly prior to operation.

This User Manual provides information regarding general installation and operation. Any deviation from, change or modification to, the User Manual, the original design conditions or the original intended use of the equipment may result in improper installation and/or operation.

Any such deviation, change or modification shall be the responsibility of the party or parties making such deviation, change or modification. SPX Cooling Tech expressly disclaims all liability for any such deviation, change or modification. The equipment shall be warranted in accordance with the applicable SPX Cooling Tech Certification of Limited Warranty.

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product.

⚠ Warning

Indicates presence of a hazard which can cause severe personal injury, death or substantial property damage if ignored.

⚠ Caution

Indicates presence of a hazard which will or can cause personal injury or property damage if ignored.

Note

Indicates special instructions on installation, operation or maintenance which are important but not related to personal injury hazards.

overview

Technical Data

Table 1

Specifications		
Model	WG002	WG004
Performance		
Nominal Rejection	91%	
Rated Product Flow – gpm*	2.2	4.4
Recovery	85-90%	
Membranes		
Size	4" x 40"	4" x 40"
Quantity	2	4
Type	Low fouling spiral-wound composite	
Inlet Pressure Range - psig	30-80	

* Product flow rate varies with temperature. All models are rated at 60°F (15.6°C). Permeate flow for individual elements may vary -20 +25%.

Table 2

Maximum and Minimum Flow					
Model	Flow - gpm			Reject Minimum gpm	Reject Maximum gpm
	Minimum 50°F	Minimum 60°F	Maximum 50°F		
WG002	2	2.2	2.75	.22	.61
WG004	4	4.4	5	.44	1.21

Table 3

Feedwater Requirements	
Maximum Chlorine Concentration	< 0.1 ppm
Maximum Operating Temperature	110° F
Maximum Feedwater Turbidity	1.0 NTU
Maximum Feedwater SDI	5.0
Oil and Grease	Max 0.1 mg/L
Operating pH Range	2-10
Cleaning pH Range	1-12
Sediment Filtration	5 microns

overview

System Requirements

For WaterGard to function correctly these items are required:

- Two dry contacts from a generic water level controller. One signal for turning the unit on (Makeup On) and one for switching the unit into bypass operation (Low Level Alarm). SPX Cooling offers multiple WaterGard Ready options for liquid level control including the Marley LLC (liquid level control) probe style) and the Marley LLC+u (ultrasonic) water level control system.
- Municipal potable water is required, however other sources are possible please consult SPX for more information.
- Municipal potable water will have residual chlorine levels that are too high for WaterGard, therefore, a method of removal is required when any water source has a free residual chlorine level above the requirements shown in the Feedwater Requirements **Table 3**. This can either be done by purchasing a carbon tank through SPX Cooling or using liquid chemical chlorine destruct from a chemical water treater.
- A conductivity blowdown controller is required to monitor the water saving WaterGard offers. This can be purchased with the WaterGard system.

WaterGard can remove up to 91% of an individual ion. How much of an individual ion is removed depends on the ion. In some cases, the incoming water in a galvanized evaporative product may have too low of a calcium value ($<$50 ppm as $CaCO_3$) or pH may be too low ($<$6.5) making the water corrosive after WaterGard treatment. In these situations, it is recommended to initially fill the system with unfiltered feed water. If the system level is low enough, the internal bypass will automatically fill with unfiltered water. Otherwise, if the system level isn't low enough the external bypass will need to be engaged by jumping the low-level alarm. For LLC applications, once the system level is above the low-level alarm a delay timer will continue to fill the unit for 20 seconds, then WaterGard will start and operated normally. For Opti FC/LLC+u controls application, once the water level is above low-level alarm, the unit will keep bypass open until water level reaches the "makeup ON" setpoint. For additional information on soft water and its impact on tower metallurgy consult you Marley sales representative.

WaterGard operates by rejecting ions down a small, concentrated waste stream. This is typically 10-15% of the feedwater stream. Due to this, water savings are not possible when the evaporative system operates at higher cycles of concentration (COC). Any evaporative system's starting COC at 7 or higher can result in increased water usage, not water savings.

Schematics and Components

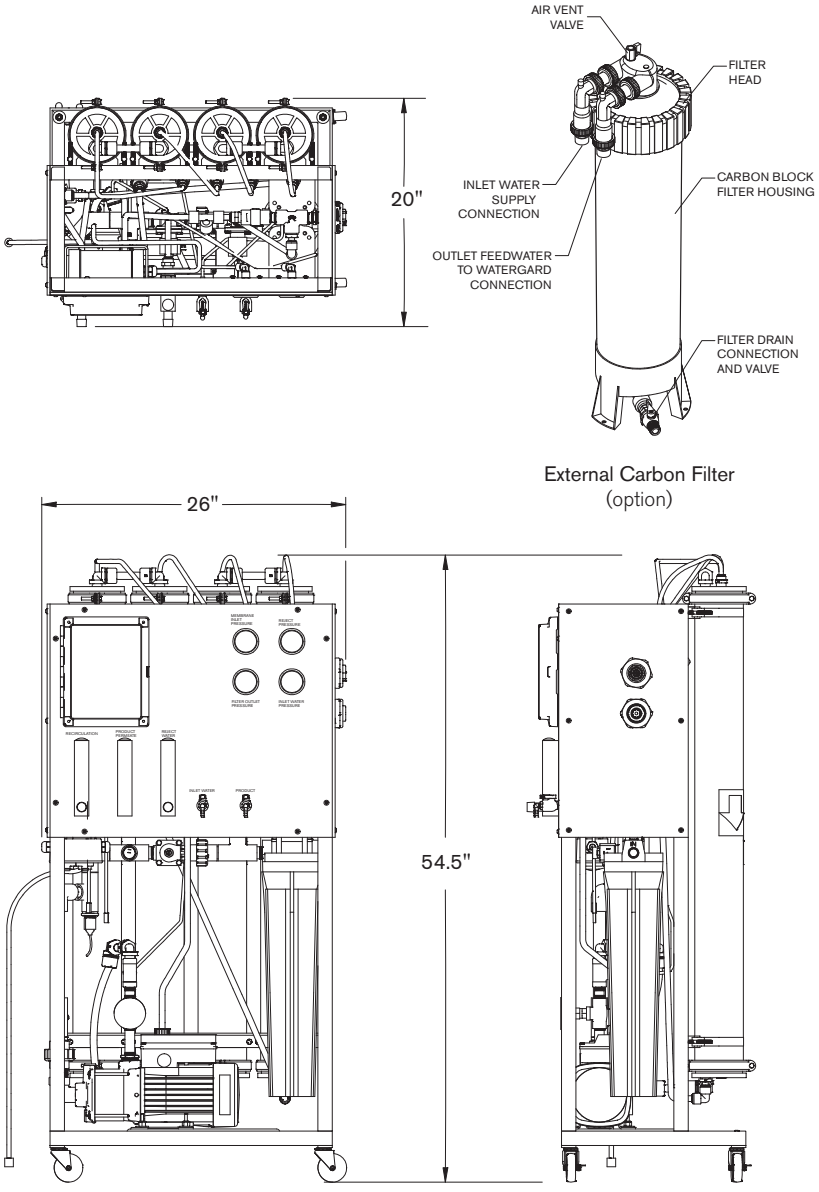


Figure 1

WG002 and WG004 Component Dimensions (WG004 shown)

installation

Rigging

The WaterGard unit should be lifted and moved by a forklift. If the WaterGard unit is lifted by a crane it should be lifted from the bottom using a platform. The unit should be secure to the platform using the anchor locations. A test lift should be done in order to determine the weight centerline.

⚠ **Caution**

Do not allow rigging straps to contact system components.

Physical System Requirements

- WaterGard is for indoor use **only**. If the end user desires the unit to be placed outdoor responsibly of the end user to protect the unit from freezing, extreme heat (above 110°F) and inclement weather conditions.
- Ideally WaterGard should be located out of direct sunlight. If this is not possible some components may experience discoloration from direct UV rays due to sunlight. This is mainly an aesthetic issue and won't adversely impact performance.
- WaterGard should be located on a level floor or housekeeping pad.
- Floor load rating must be sufficient to accept WaterGard weight.
- The location must be dry and frost-free.
- Normally, inlet water temperature should not exceed 77°F. Water temperatures from 77°F to 110°F will negatively impact the quality of the water. Anything above 110°F may impact the integrity of the membrane.
- Feedwater to the WaterGard unit must not contain chlorine or oil. For more information refer to **Table 3**.
- A floor drain close to the unit is required that can carry away the reject flow from the WaterGard system. See **Table 2** for reject flow requirements.
- The water pressure at the WaterGard inlet when in operation, must be a minimum of 30 psi, and must not exceed a maximum of 80 psi. If the pressure exceeds the maximum stated pressure, or if it fluctuates to pressures exceeding 80 psi, install a pressure-reducing valve at the inlet.
- The flow of inlet water supplied to the WaterGard unit shall be an uninterrupted flow at 30 psi minimum, and at a minimum flow rate of twice the rated product water flow of the WaterGard unit purchased. See **Table 2** for minimum flow rates. If flow rates are below this threshold, surge tanks may be required.
- WaterGard should be additionally secured in areas where necessary using seismic and wind rated anchor bolts and straps. All applicable local codes shall be followed.

installation

Electrical Requirements

⚠ **Warning**

WaterGard's provided cord serves as the ground. Conduit and water pipes are NOT an acceptable ground.

- All wiring must be properly sized, rated, and connected in accordance with local, state, and national electrical codes. The system is pre-wired and tested at the factory. See provided sales drawing for additional details.
- The WaterGard unit should be on a dedicated circuit originating at a service disconnect panel. Refer to unit nameplate for correct voltage information.
- The electrical voltage and phase must match and be verified to the WaterGard unit that was purchased.
- The WaterGard unit has a machine ground, see installation drawings for additional information.

⚠ **Caution**

Do not operate pump dry. Damage to pump seal and shaft may occur.

Piping Connections

- All piping, valves, etc. for the product permeate water outlet of the WaterGard unit must be made of PVC, PP, PEX, or corrosion resistant stainless steel. Local plumbing codes must be observed and followed.
- The carbon filter (if present) must be installed upstream from the WaterGard unit. This is designed to remove any residual chlorine present in the feedwater stream. For information on pipe sizes for each unit reference the installation and/or sales drawing
- In cases where it is not desired to fill the evaporative product's collection basin during startup, a section of piping can be added downstream of the WaterGard unit to send the product water to the drain, in order to startup WaterGard.

⚠ **Caution**

Properly secure all pipe runs. Pipe movement may cause damage to WaterGard and/or pipe. Ensure waste drain line is adequately sized and free flowing to handle the reject flow. Reject flow rates can be found in Table 2.

operation

The drain for the WaterGard unit must be designed and constructed to provide for connection to the sanitary waste system through an air gap of two pipe diameters or 1" whichever is larger.

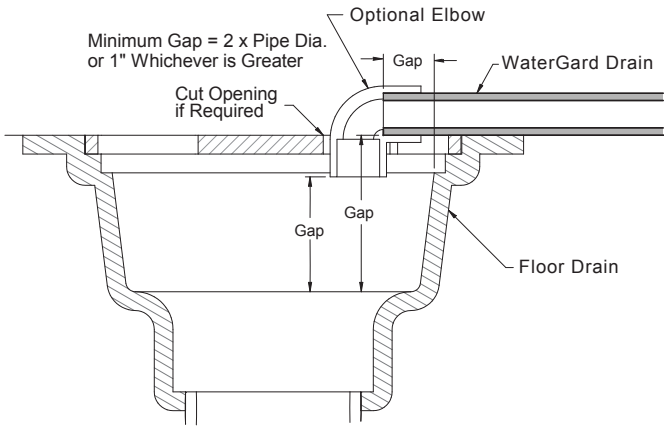


Figure 2

Startup and Operation

Note

WaterGard membranes cannot be used immediately, they must be filled with feed water and allowed to soak for a minimum of 30 minutes, see step 17.

⚠ Caution

Never completely close the waste stream, recirculating or pump discharge valve while the unit is running. Closing these valves beyond the minimum flowrates will cause irreparable damage to the membranes.

1 WaterGard and evaporative product arrangements should have been setup during the initial quoting. Refer to the Marley controls literature kit for configuration drawings and user manuals for laying out piping and electrical connections.

2 Connect the carbon filter (if present) to your potable water supply. Quarter-turn valves should be added to the inlet and outlet of the filter. Stainless steel or brass pressure gauges appropriate for water with a range from 0-160 psi should also be added.

3 Connect WaterGard to your potable water supply downstream from the carbon tank or chlorine destruct. If blending both warm and cold water to improve product flow rate, do not exceed 77°F.

4 Verify the installation of the sediment filter cartridge(s) inside its housing.

5 The reject to drain connection coming out of the WaterGard system is for reject water. The water from this will go directly to the sanitary sewer.

operation

6 Connect the WaterGard product permeate line to the evaporative product's makeup line. In the case of a single WaterGard unit to a single evaporative product/makeup supply point, no additional external makeup valve is needed. All other configurations require a makeup solenoid valve to be installed at the evaporative product and connected to a Marley control panel. See configuration drawings in the literature kit for more information.

7 Connect WaterGard to a dedicated electrical power supply. Refer to unit nameplate for voltage information.

8 Connect the WaterGard LLC controls makeup and low-level alarm into the appropriate terminal blocks. WG MU COM and WG MU NO are the terminal names for the makeup connection. WG LA COM and WG LA NO are the names of the low alarm connections.

9 If connecting a third party chemical pump for either chlorine destruct or anti-scalant connect these dry contacts to either CP1 or CP2.

10 If needed, connect the flexible hosing into the ½" FPT on the feedwater inlet of the membrane skid for each chemical pump being used.

11 Connect the unit machine ground. For the machine ground location refer to the drawings provided.

12 In cases where it is not desired to fill the evaporative unit's collection basin, a jumper will need to be added to the low-level alarm contact in either the LLC control panel or the WaterGard control panel.

13 Open the valve to the carbon tanks.

14 Partially open the vent on top of the sediment filter and carbon tanks—these can be closed once all the air has escaped.

15 Open the WaterGard feedwater inlet valve.

16 Turn on power at the disconnect on WaterGard control panel.

17 Press the WaterGard control button to the ON position. Then immediately press the "Manual Run/Flush" button twice to activate the flushing operation. Continue this until water flows stabilizes in the flow meters. Once this occurs turn the WaterGard off by pressing and holding the system On/Off button. Let the membranes soak for a minimum of 30 minutes.

18 Press the WaterGard control button to the ON position. A 10 second pump delay will occur before the pump starts and normal operation occurs.

19 Once the pump has started, membrane inlet (pump) pressure should never exceed 120 psi. Pressures over 120 psi will trigger the high pressure switch to shut down the unit. Use the valve on the discharge side of the pump to adjust the pressure to 105 psi. If pressures over 120 psi are observed it could be an indication of membrane fouling. Refer to the **Membrane Replacement** section in this manual.

20 Allow WaterGard to run for 30 minutes to allow components to fill with water, purge trapped air and to rinse the membranes of preservatives.

21 While purging, adjust the reject throttle valve and adjust to a 50:50 ratio flow through the reject flowmeter compared to the product permeate flowmeter. See **Figure 4**.

22 Once WaterGard has stabilized and all impurities and preservatives have been flushed, the water will have to stabilized. Set the product permeate water quality alarm value at the desired limit (Refer to the **Controller Adjustments** section) and adjust the reject throttle to maximize water savings. Ensure the flowrate doesn't pass the stated minimum flowrate on the WaterGard nameplate.

23 When WaterGard is running stable and within desired water quality limits, the product permeate hose or piping can be connected to the process system's piping or evaporative product's collection basin. During the initial fill of the system, the low-level alarm will be activated, this is by design. This allows for a rapid fill of the system. During this phase, unfiltered feedwater will be added to the system until the LLC signals WaterGard to turn off.

24 Record initial operating conditions on the System Log sheet in this manual and then periodically afterwards as determined by your Quality Department or Facilities Manager.

25 It is recommended using valve locks to ensure valve positions don't change.

Note

The operating conditions should be recorded at least once each day WaterGard is operated.

operation

System Shutdown

Less than 30 days. Press and hold the SYSTEM ON/OFF/POWER key (the display will show POWER OFF).

More than 30 days. Drain the system of as much water as possible by breaking unions or removing tubes. On startup, follow **Startup** procedure.

Automatic System Standby and Restart

System will automatically go into standby during the following conditions:

- Collection basin full
- Low inlet pressure (below 5 psi)
- High system pressure (above 120 psi)

Once the collection basin water level drops below its actuation point WaterGard will restart.

Bypass

System will automatically go into bypass during the following conditions:

- When WaterGard is in a shutdown condition
  - Low inlet pressure and has faulted 5 times or more
  - High system pressure has faulted 5 times or more
  - Pretreat fault has been active for more than 2 seconds
- When the LLC low level alarm has been activated
- Once the bypass conditions have been satisfied, a 20 second delay will occur before the bypass condition occurs again.

Auxiliary Chemical Ports

Included in the system there are two ½" FPT chemical ports at the feedwater (inlet) of the membrane skid. These can be used for either chlorine destruct or anti-scalant via a competent third party water treater. All components for these systems are by others.

WaterGard Controls



Figure 3

1 - Controller	7 - Membrane Inlet Pressure psi
2 - Product Permeate Flow Meter	8 - Reject Pressure psi
3 - Reject Flow Meter	9 - Sediment Filter Inlet Pressure psi
4 - Recirculation Flowmeter	10 - Sediment Filter Outlet Pressure psi
5 - Inlet Feedwater Sample Port	11 - Reject Flow Control Knob
6 - Product Permeate Water Sample Port	12 - Recirculation Flow Control Knob
Item 10 – Item 9 = Differential Pressure	

WaterGard Controllers

Two controller options are available based on the end user's requirements. The iControls ROC-5 unit is a 4-button controller with a 4-line display. This provides local control with no options for connectivity. The S150 unit is a 2-line display with multiple options for connectivity.

Figure 4



ROC-5 Controller



S150 Controller

ROC-5 Controller Operation

The unit has two modes of operation, a power OFF mode and an operating mode that are controlled by the SYSTEM ON/OFF key. In the power off mode the unit is effectively off. All outputs are turned off and the display shows POWER OFF. In the operating mode, the unit operates automatically. All inputs are monitored, and the outputs are controlled accordingly. Pressing and holding the power key will toggle the unit from the operating to power off or from power off to operating. If power is removed from the unit, when power is reapplied, the unit will restart in the mode in which the power was removed.

Operating Status Messages

The main operating status of the unit is shown on the top line of the display:

POWER OFF: The unit is off.

RO RUNNING: WaterGard unit is operating.

RO STARTING: WaterGard unit is starting up.

TANK FULL: The unit is shut down due to a collection basin full condition.

PRETREAT: The Unit is shut down due to a pretreat lockout condition.

PRESS FAULT: The unit is shut down to a low-pressure fault condition.

The secondary operating status is shown on the second line of the display.

SYSTEM FLUSHING: WaterGard flush is active. The number is the minutes remaining in the flush cycle.

PUMP DELAY: The unit is in the WaterGard start delay. The number is the seconds remaining before the WaterGard pump starts.

Temperature–The current permeate water temperature is shown on the second line. If equipped, the line will alternate with feed temperature.

Conductivity–The permeate conductivity is shown on the second line. If equipped, the third line will show feed conductivity. These values will alternate with water temperature on second line and percent rejection on third line.

WaterGard Runtime–The current operating hours are shown on the bottom line. See **Figure 5**.



Figure 5

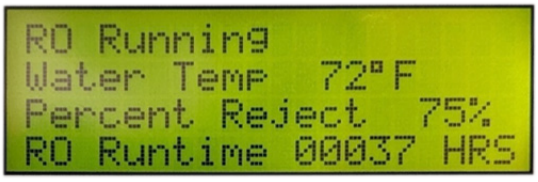


Figure 6

Warning Messages–Warning messages are also shown on the second line. If any warnings are active, the active warnings will alternate with normal displays for the bottom line.

Tank Full Operation–The unit can be operated with either the hanging probe Marley LLC or ultrasonic Marley LLC+u water level controls. Refer to the WaterGard LLC water level control User Manual for more information. When the water level sensor has been active for 5 seconds, the unit will shut down on tank full. TANK FULL will show on the display. When the tank full condition clears, the unit will come out of standby. The number is the tank full restart time and the unit will restart when this delay times out.

Pressure Fault–If the pressure fault input becomes active (opens) and stays active for the number of faults programmed (see **Standard Setpoints** on page 22 for default settings), the unit will shut down for a pressure fault with internal bypass activated. The display will show SERVICE FAULT – LOW FEED PRESSURE, and the audible alarm will sound.

Low Pressure Auto Reset–If a pressure fault shut down occurs and the Auto Reset Setpoint is programmed to 0, the unit will remain shut down until manually reset. If the Auto Reset Setpoint (see **Standard Setpoints** on page 22 for default settings) is programmed to a value greater than 0, the unit will automatically clear the pressure fault and attempt to restart after this delay times out. If the number of consecutive pressure faults that occur is more than the allowed number, full shutdown of the unit will occur, and the internal bypass will be activated.

Pretreat–If the pretreat input becomes active (closes) and stays active for 2 seconds, the unit will shut down in a pretreat lockout condition. PRETREAT will show on the display and the unit will remain shut down with the internal bypass activated as long as the pretreat input is active.

Product Water High Conductivity–If the conductivity reading exceeds the limit programmed COND limit setpoint for the delay programmed in the conductivity product water setpoint, the HI COND warning message will show on the display. This warning will clear when the conductivity drops below the setpoint. This should be set at 35% of the incoming water conductivity. Follow instructions in **Controller Adjustments** on page 19 to change the permeate alarm value if necessary.

When the High Conductivity warning message is active, the WaterGard alarm will be active until the product water conductivity goes back into the acceptance quality range.

Alarm Output–The board Divert/Alarm has been programmed to operate as **Standard Setpoints** on page 22 shows, the relay will energize whenever a shutdown condition occurs. The relay will remain energized if the shutdown condition is active. S1 should be left as a powered output for the bypass feature to function.

Cross Reference Terms on Controller Screen

Tank–Refers to the water collection basin in the evaporative equipment

Permeate–The water after having gone through the WaterGard membranes

RO–References WaterGard

Fault Condition Display

High Pressure Fault: Occurs when High Pressure Switch Closes

Line 1–Service Fault
Line 2–High System Pressure
Line 3–
Line 4–To Reset Push OFF/ON

Low Pressure Fault: System is responding to low pressure condition per system settings

Line 1–Service Fault
Line 2–Low Feed Pressure
Line 3–
Line 4–Restart in MM:S”

Pre Treat Fault: Pretreat Switch is closed indicating problem with the pretreat system

Line 1–Service Fault
Line 2–Pretreat
Line 3–
Line 4–Check Pretreat Sys

Permeate Conductivity Fault: Permeate conductivity is higher than the alarm setpoint

Line 1–Service Fault
Line 2–Permeate TDS xxx ppm or Permeate Cond xxx µS
Line 3–Alarm SP xxx ppm or Alarm SP xxx µS
Line 4–To Reset Push OFF/ON

Conductivity Probe Error messages:

Line 2 –Over-range
Measurement is out of range for the circuit, probe may also be shorted
Line 2–Probe shorted
Short circuit detected on temperature sensor in probe
Line 2–Probe not detected
Open circuit detected on temperature sensor in probe
Line 2–Probe Startup 1
Internal reference voltage too high to make valid measurement
Line 2–Probe Startup 2
Internal reference voltage too low to make valid measurement
Line 2–Probe Startup 3
Internal excitation voltage too high to make valid measurement
Line 2–Probe Startup 4
Internal excitation voltage too low to make valid measurement

Controller Adjustment

With the system ON, press and hold the UP and DOWN arrows and then press System On/Off. **Figure 7** shows the settings that can be changed at the controller.

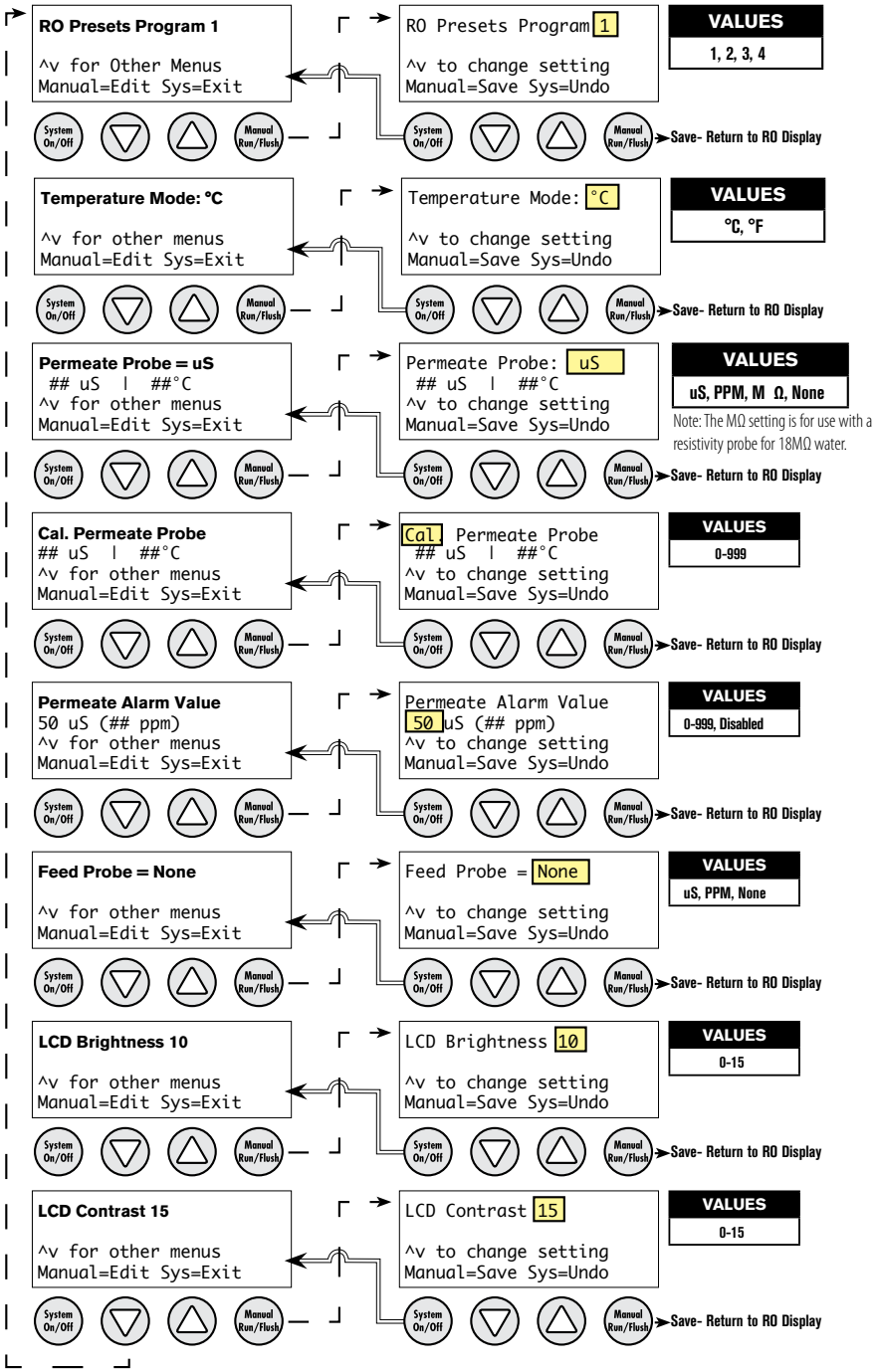


Figure 7

WaterGard Presets Program–Change program to number of program desired. Setpoints are shown in **Standard Setpoints** on page 22.

Temperature Mode–Select temperature unit desired.

Conductivity Calibration

The controller has been calibrated prior to shipment. It may be necessary to periodically calibrate the conductivity. If the controller should require calibration, follow the instruction below. Please contact your local Marley sales representative, if you have any questions regarding the procedure.

Because the conductivity measurement is affected by the physical environment in which it operates, it is best to calibrate while installed in the system and operating under normal conditions. This requires an accurate external conductivity measurement device to serve as a reference.

1 Operate WaterGard long enough for the membranes, operating temperature and product permeate conductivity reading to stabilize, ideally at least 10 minutes.

2 Take a sample of the product permeate and measure it with the reference meter.

3 With the system ON, press and hold the UP and DOWN arrows. With the UP and DOWN arrows depressed, press the System On/Off button.

4 Enter the Permeate Calibration menu using the down arrow. Once at the menu, follow the on screen directions and use the UP or Down arrow until the value on the controller matches the value obtained on the reference meter.

5 Exit and save the calibration.

6 The same procedure applies to the Feed Probe calibration.

Note

The probe calibration must be performed using solutions with conductivity of less than 900 ppm or µS. The conductivity calibration circuit will behave erratically if you attempt to calibrate using a higher value. When using a standard calibration solution, the NaCl ppm value can be used in place of the µs value if desired.

TDS to µS Conversions

Multiply	by	To Obtain
µS	1.9	TDS
TDS	.526	µS

Permeate Alarm Value–Select desired value to have permeate alarm at.

Display Adjustment–Change LCD brightness and LCD contrast to adjust for the application's best viewing experience.

ROC-5 Setpoints

Parameter	Value	Program 1	Program 2	Program 3	Program 4
Timed Manual Run	Minutes	5	5	5	5
Collection Basin Level Switch delay (actuation and de actuation)	Seconds	2	2	2	2
Pressure Switch delay (actuation and de actuation)	Seconds	2	2	2	2
Pretreat Switch delay (actuation and de actuation)	Seconds	2	2	2	2
Pump start delay	Seconds	10	10	10	10
Pump start retry interval (restart delay after LP fault)	Seconds	10	10	10	10
Inlet Solenoid stop delay	Seconds	1	1	1	1
Low pressure fault shutdown, number of faults	Faults	5	5	5	5
Low pressure fault shutdown, time to count faults	Minutes	10	10	10	10
Low pressure fault shutdown, reset after shutdown	Minutes	60	60	60	60
Low pressure timeout fault	Seconds	60	60	60	60
Flush Behavior		Low Pressure Flush	Low Pressure Flush	Low Pressure Flush	Low Pressure Flush
Startup Flush: Minutes from last flush	Minutes	0	0	0	0
Startup Flush: Duration	Seconds	0	0	0	0
Periodic Flush: Interval	Minutes	-	-	-	-
Periodic Flush: Duration	Seconds	-	-	-	-
Shutdown Flush: Time from last flush	Minutes	30	30	30	30
Shutdown Flush: Minimum operation	Minutes	0	0	0	0
Shutdown Flush: Duration	Seconds	30	30	30	30
Idle Flush: Interval	Minutes	0	0	0	0
Idle Flush: Duration	Seconds	0	0	0	0
Timed Manual Flush	Seconds	600	600	600	600
Alarm/Divert Relay*		Alarm	Alarm	Alarm	Alarm
WQ/Conductivity Shutdown Timer (0 = No Shutdown)		0	0	0	0

*Can be changed from controller. All other parameters require software changes. Contact your local Marley sales representative for assistance.

S150 Controller Operation

The S150 has two modes of operation, an offline mode and an operating mode. In the offline mode, the unit is effectively OFF. All outputs are turned off and the display shows OFFLINE. In the operating mode, the unit operates automatically. All inputs are monitored and the outputs are controlled accordingly. Pressing the POWER key will toggle the unit from offline to operate or from operate to offline. If power is removed from the unit, and power is reapplied, the unit will restart in the mode it was in when power was removed.

Operating Status Messages

The operating status of the unit is shown on the top line of the display. The following list describes the items shown for the operating status.

STANDBY: The unit is in standby mode.

DELAY 99: The WaterGard unit is in start delay. The number is the seconds remaining before the pump starts.

OPERATING: The WaterGard unit is operating.

TANK FULL: The unit is shut down due to a tank full condition.

PRETREAT: The unit is shut down due to a pretreat lockout condition.

PRESS FAULT: The unit is shut down due to a pressure fault condition.

MEMB FLUSH 99: Membrane flush is active. The number is the time remaining in the flush cycle.

TDS / Conductivity—The feed TDS/Conductivity is shown on the right half of the top line after the unit operating status. When the unit is offline because of a shutdown condition, the reading is replaced with '----' If the reading is over range (0 - 2500 µS/cm for the feed & 0 – 500 µS/cm for the product), the reading is shown as '^^^^'.

The permeate TDS/Conductivity is shown on the right half of the second line. When the unit is offline because of a shutdown condition, the reading is replaced with '----' If the reading is over range, the reading is shown as '^^^^'.

Operating Hours, Temperature and % Rejection—The operating hours, the temperature and, if enabled, the % rejection are shown on the left half of the second line. The readings will alternate on the screen.

Temperature—The current water temperature is shown on the bottom line after the operating hours. When the unit is offline because of a shutdown condition, the reading is replaced with "---".

operation

Warning Messages—Warning messages are also shown on the second line. If any warnings are active, the active warnings will alternate and be shown in place of the normal messages. The following, lists the warning messages:

HI TDS / COND: The feed TDS/Conductivity reading has exceeded the programmed limit.

TANK LOW: The tank low input is active.

TANK LOW 99: The tank low input has cleared, but the tank low restart delay is active. The number is the minutes left in the delay.

OP HOURS EXCEEDED: The current operating hours have exceeded the programmed limit.

Tank Full Operation–The unit is operated with a 1 level switch. The switch is connected to the tank full high input. When this switch has been active for 5 seconds, the unit will shut down on tank full. TANK FULL will show on the display. When the tank full condition clears, the unit will restart when the tank full restart delay times out.

Tank Full Restart–The tank full restart is the delay before the WaterGard unit starts when a tank full condition clears. This delay can be in minutes or in seconds. The TF Restart Setpoint selects seconds or minutes.

Tank Full Override—A timed tank full override can be initiated when the WaterGard unit is shut down due to a tank full condition. Pressing the Alarm Silence/Reset key for 3 seconds during a tank full condition will enable the tank full override. WaterGard will start and OVERRIDE 1 will show on the display. The number is the minutes remaining in the override timer. When the override times out, the unit will return to the tank full shut down condition.

Pressure Fault—If the pressure fault input becomes active and stays active for the delay programmed in the PF Delay Setpoint, the unit will shut down for a pressure fault. The display will show PSI FAULT, the alarm lamp will flash and the audible alarm will sound. The pressure fault can be cleared by pressing the Alarm Silence/Reset key twice.

Auto Reset—If a pressure fault shut down occurs and the Auto Reset Setpoint is programmed to 0, the unit will remain shut down until manually reset. If the Auto Reset Setpoint is programmed to a value greater than 0, the unit will automatically clear the pressure fault and attempt to restart after this delay times out.

Alarm Silence–When a shutdown occurs that causes the audible alarm to sound, the alarm can be silenced by pressing the Alarm Silence/Reset key once. The alarm will remain silenced if the Alarm Silence Setpoint is programmed to 0. If the Alarm Silence Setpoint is programmed to a value greater than 0, the alarm will resound after this delay times out. Pressing the Alarm Silence/Reset key will silence the alarm and reset this delay.

Pretreat–If the pretreat input becomes active and stays active for 2 seconds, the unit will shut down in a pretreat lockout condition. PRETREAT will show on the display and the unit will remain shut down as long as the pretreat input is active.

Membrane Flush–If the Flush Type Setpoint is programmed to 0, flush is disabled. If membrane flush is desired, several types of flush are available. When the unit enters a flush cycle, the flush relay will activate. The flush cycle will last for the time programmed in the Flush Time Setpoint. The table shows a value that must be programmed in the Flush Type Setpoint for each type of flush.

Flush Type	Description	Flush Type	Description
0	No Flush	5	Elapsed Time and Tank Full
1	Tank Full	6	Off Hours
2	Operating Hours	7	Off Hours and Tank Full
3	Operating Hours and Tank Full	8	RO Starts/Stop
4	Elapsed Time		

TANK FULL: WaterGard will flush each time a tank full condition occurs.

OPERATING HOURS: A flush will occur when the WaterGard pump has operated for the number of hours programmed in the Flush Interval Setpoint.

ELAPSED TIME: A flush will occur after the number of hours programmed in the Flush Interval Setpoint has passed.

OFF HOURS: A flush will occur when WaterGard has been shut down due to a tank full condition for the number of hours programmed in the Flush Interval Setpoint.

WaterGard START/STOP: A flush will occur each time WaterGard starts or stops.

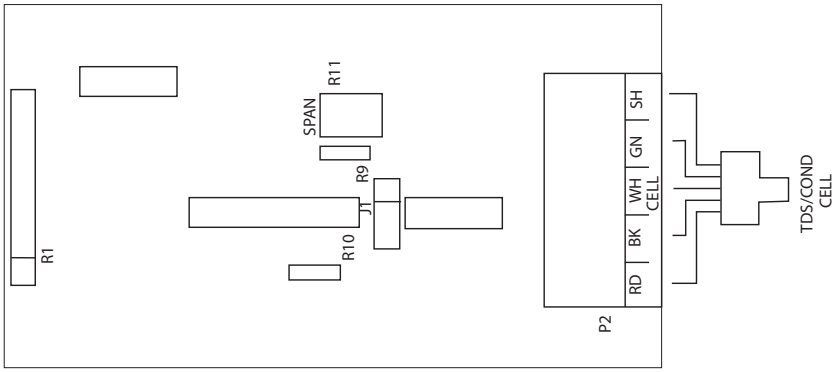
The tank full flush can be combined with any of the 3 interval flush types. A manual flush can be initiated by pressing the Alarm Silence/Reset key for 3 seconds.

Flush Mode–The Flush Mode Setpoint can be used to control the operation of the inlet valve and WaterGard pump during flush. Each can be independently programmed to operate during flush. The table shows the values to

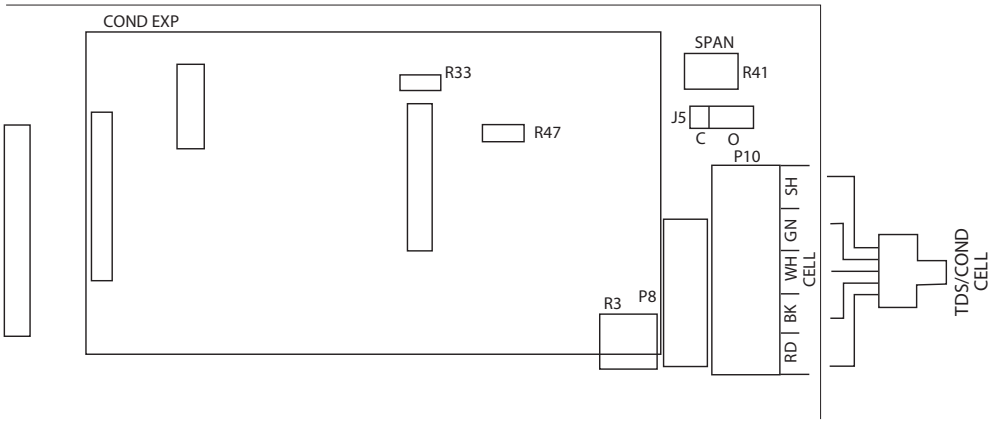
program into the Flush Mode Setpoint to control the operation of the inlet and WaterGard outputs during flush.

Flush Mode	RO Pump	Inlet Valve
0	OFF	CLOSED
1	OFF	OPEN
2	ON	CLOSED
3	ON	OPEN

S150 Conductivity Calibration–To calibrate the feed TDS / Conductivity, take a sample of the water and test it with a known, good meter. Adjust the span control on the attached expander board (R11) until the reading matches the meter.



To calibrate the product TDS / Conductivity, take a sample of the water and test it with a known, good meter. Adjust the span control (R41) located in the top right of the control board until the reading matches the meter.



Note

If the TDS/Cond. range is changed, the unit must be recalibrated and some components (both the main control board and inlet expander) may need to be changed.

S150 Setpoints Move the write protect jumper to the OFF position. Press the LEFT arrow to start with the beginning function or the RIGHT arrow for the last function.

Function	Description	Options	Factory
C2 Range	Selects range of TDS/Conductivity monitor 0-50, 1-100, 2-250, 3-500, 4-1,000, 5-2,500, 6-5,000, 7-10,000. Note: If this Setpoint is changed, the unit must be recalibrated and range components may need to be changed.	0-7	5
C2 Limit	When this value is met or exceeded, the alarm lamp will light and high TDS/ Cond µS or PPM will show on the display. To disable, set to 0.	0-9999	0
% Rej	If the second TDS/Conductivity is used to monitor feed water, programming this setpoint to 1 allows the % rejection to be displayed.	0-1	1
µS LiImit	The conductivity alarm on high conductivity.	0-999	0
Limit Delay	Alarm is delayed for seconds.	0-999	10
Limit Shutdown	Alarm shuts down WaterGard for minutes.	0-999	0
WaterGard Pump Delay	When WaterGard starts, the pump start delayed for seconds.	0-99	10
Low Inlet PSI Delay	When inlet psi is below 5, alarm delays for seconds.	0-99	10
Low PSI Auto Reset	On low PSI, attempt to restart after minutes.	0-99	20
Alarm Resound Delay	Alarm will resound after this delay for minutes.	0-99	3
Tank Full Restart Delay	Tank full restart delay for seconds or minutes.	0-99	2
TF Restart Time	0 = Seconds 1= Minutes	0-1	1
TF Overide Time	The time WaterGard can run with tank full in minutes.	0-9	1
Tank Low Restart	When a tank low condition clears, the auxiliary pump will restart after this delay (NOT USED).	0-99	0
Membrane Flush Type	Flush Type: 0-8 8 0 - No Flush 1 - Tank Full 2 - Operating Hours 3 - Operating Hours + Tank Full 4 - Elapsed Time 5 - Elapsed Time + Tank Full 6 - Off Hours 7 - Off Hours + Tank Full 8 - RO Start + Start	0-8	1
Flush Time	Flush length of time in minutes.	0-99	1
Flush Interval	The interval between off hour flush cycles. Only valid with op hour, elapsed time or off flush types.	0-99	0

Function	Description	Options	Factory
Flush Mode	Flush Mode: 0-3 1 0 - RO Pump Off, Inlet Valve Closed 1 - RO Pup Off, Inlet Valve Open 2 - RO Pump Off, Inlet Valve Closed 3 - RO Pump Off, Inlet Valve Open	0-3	1
Max Operating Hours	Warning if this number of hours is exceeded.	0-65000	0
Current Hours	Current RO Operating Hours	0-65000	0
Expander Board Mode	Mode: 0-4 2 0 - Relay 1: Aux Pump, Relay 2: Divert 1 - Relay 1: Aux Pump, Relay 2: Alarm 2 - Relay 1: Divert, Relay 2: Alarm 3 - Relay 1: Boost, Relay 2: Divert 4 - Relay 1: Boost, Relay 2: Alarm	0-4	2
Temp Offset	Adjustment of temperature reading ±5 degrees	-5 +5	0
Temp UOM	Displays temperature in °F or °C	0-1	0
Switch Select	Switch inputs are normally open or normally closed	0-32	5
TDS/Cond UOM	Selects water quality reading in µS or PPM	0-1	0
TDS/Cond Range	Selects range of quality monitor 0-50, 0-100, 2-250, 3-500, 4-1000.	0-6	3

S150 Comm Data

There are three available protocols that can be used to access the unit: Modbus TCP, BACnet IP or Ethernet/IP. These can be used alone or in combination.

The default IP address is 192.168.1.24. The network settings for the module can be changed using a web browser. In the web browser, enter the default IP address of 192.168.1.24. The browser will connect to the module and a setup screen for the module will be shown. At the bottom of the screen, a Network Settings button is shown. Click on the Network Settings button. A Network Settings window will be shown.

The network settings can be changed in this window. When the changes have been made, click on the Update IP Settings button at tab and then click the System Restart button at the bottom of the screen and click OK when prompted to restart. Wait approximately 10 seconds after the restart and enter the new IP address in the browser to reconnect with the module.

Default Username: Admin

Default Password: This label can be found on communication/ethernet board. Password can be located under “Default PW”.

S150-3 Modbus TCP

Node Name: Mb_Srv Default Node ID: 10

Modbus TCP Objects

Object Name	Description	Address	Object Type	Units
CS1	TDS/Cond Sensor 1	40001	AV	µS/PPM
TS1	Temperature Sensor 1	40003	AV	°F/°C
CS2	TDS/Cond Sensor 2	40005	AV	µS/PPM
TS2	Temperature Sensor 2	40007	AV	°F/°C
HRS	Operating Hours	40009	AV	HRS
STAT1	System Status	40011	AV	Status Table
WRN1	Warnings	40013	AV	Warning Table

The node address can be changed by changing the position of the switches on SW3, the 8-switch dipswitch. The switches have the following values.

Note

Power must be cycled to the unit for the node change to take effect.

Dipswitch Values

Switch	Value	Switch	Value
1	1	5	16
2	2	6	32
3	4	7	64
4	8	8	128

Turn on the switches whose values total the desired node address. The default value of node 10 has switch 2 and 4 on (2 + 8 = 10).

S150-3 BACnet IP

Object Types Supported: Analog Valvue–AV Objects are read only
Data Link Layer Option: BACnet IP. (Annex J)
Character Sets Supported: ANSI X3.432
Analog Value Objects Readable Fields:
object-name object-identifier object-type present-value
Node Name: BCU_12

BACnet Objects

Object Name	Description	Object ID	Object Type	Units
CS1	TDS/Cond Sensor 1	1	AV	µS/PPM
TS1	Temperature Sensor 1	2	AV	°F/°C
CS2	TDS/Cond Sensor 2	3	AV	µS/PPM
TS2	Temperature Sensor 2	4	AV	°F/°C
HRS	Operating Hours	5	AV	HRS
STAT1	System Status	6	AV	Status Table
WRN1	Warnings	7	AV	Warning Table

S150-3 Ethernet/IP

Node Name: EIP_01

Ethernet/IP Options

Tag Name	Description	Data Offset	Units*
CS1	TDS/Cond Sensor 1	1	µS/PPM
TS1	Temperature Sensor 1	2	°F/°C
CS2	TDS/Cond Sensor 2	3	µS/PPM
TS2	Temperature Sensor 2	4	°F/°C
HRS	Operating Hours	5	HRS
STAT1	System Status	6	Status Table
WRN1	Warnings	7	Warning Table

The Protocessor is setup for data table reads. The tag names can be polled to obtain the data.

Note

The S150 is configured for data read only. There is no data write functionality. Not all objects are used on all units. All values are float.

* The unit of measure for some objects is based on the programming of the span setpoint or calibration for the sensor

Status Table

Value	Description	Value	Description
0	WaterGard Off	7	
1	Operating	8	
2	Tank FulL	9	
3	Tank Full Override	10	Pressure Fault
4	Pretreat	11	High TDS/COND Shutdown
5	Flush	12	High Temp Shutdown
6		13	Tank Low Shutdown

Warning Table

Value	Description
0	None
1	High TDS/COND 1
2	High TDS/COND 2
3	Tank Low
4	High Operating Hours

troubleshooting

⚠ Caution

Only those persons who have read the complete user manual or who have received authorization from the facility director should attempt to troubleshoot and/or repair the WaterGard system.

Trouble	Cause	Remedy
WaterGard will not start	WaterGard not supplied power	Reestablish power.
	WaterGard High Pressure FAULT	System pressure should be <120 psi
	Circuit breaker tripped	Reset the breaker.
	WaterGard in a FAULT condition	Check the WaterGard controller display for FAULT condition and correct the FAULT.
System has power but no water flow	Feed source not open	Open Incoming water valve.
	Feed pressure < 5 psi	Increase pressure to ≥ 30 psi.
	Sediment filter clogged	Check the sediment filter gauges for pressure drop. Replace the sediment filter if the pressure drop is 10 psi.
	Feed solenoid is not operating	Test the solenoid. Replace the coil or valve if it is defective.
Pump making excessive noise	Low pressure or flow rate feeding WaterGard	Check the sediment filter outlet gauge psi (must be ≥ 20 psi) or carbon filter (if present) outlet gauge (must be ≥ 30 psi) and verify that the product permeate flow (flowmeter) is within range.
	Pump motor or impeller failing	Check membrane psi gauge to verify that it is within operating parameters. Replace the pump assembly if necessary.
Poor product permeate water quality	High chlorine levels	Replace membranes. Verify carbon or pretreatment is removing all chlorine.
	Fouled membrane	Replace membranes.
	Conductivity cell out of calibration	Verify the conductivity cell accuracy with a known good meter. Follow the Conductivity Calibration procedures on page 20 or replace cell if necessary.
	Reject flow rate too low	Insure reject flow rate is above the minimum requirements as shown in Table 2.
Low product permeate flow rate	Low pressure feeding membrane	Verify that the incoming tap water supply is fully open.
	Low pump psi	Pump should be operating at 70-120 psi.
	Reject gpm flow rate too high	Turn reject flow to equal product permeate flow with the throttle valve.
	Excessive PRODUCT line back pressure	Check for restrictions in the PRODUCT line.
	Low temperature incoming tap water	Consult temperature correction chart in Table 2 to determine if the product permeate flow rate is normal in relation to the feedwater temperature.
	Sediment filter clogged	Check the sediment filter gauges for pressure drop. Replace the sediment filter cartridge if the pressure drop is ≥10 PSI.
	Carbon filter clogged	Check the filter gauges for pressure drop. Replace if ≥ 20 PSI.
	Fouled membrane	Clean or replace membranes.

controls troubleshooting

⚠ Warning

Hazardous voltages are present when power is applied to the unit. Care should be taken when troubleshooting any of the input power or output circuits. When disconnecting or connecting any board or accessory, verify that power is off.

Before contacting SPX Cooling for technical help, verify the programming of all setpoints, check the display and the status of all lights and indicators. The more information available when you contact us, the easier it will be to determine the source of the problem.

Trouble	Cause	Remedy
System Inoperative	Verify power is applied to the power terminals L1 and L2.	If yes, check/replace the main fuse with Littelfuse 0234006P and check/replace CPU fuse with Littelfuse 0218.250P. If no, ensure WaterGard is plugged in.
Display Blank	Is system operational?	If no, refer to above. If yes, check ribbon cable and adjust display contrast and brightness.
Inlet Valve will not operate	Is the system in power off?	Power on system.
	Is the inlet LED lit?	If yes, verify power at inlet terminals. If no, replace board.
WaterGard pump will not operate	Is the system in power off?	If no, check power at pump. If yes, power on.
	Are any shut down conditions active?	If no, check power at pump. If yes, correct fault.
No or incorrect conductivity reading	Is sensor wired correctly?	If no, correct wiring.

Servicing

Note

If any component of the water treatment system is changed or replaced, the user should conduct appropriate tests to ensure that the revised system meets all standards to which it was initially tested.

⚠ Warning

Always remove WaterGard from the power source and turn off the water prior to any maintenance activities!

1 A daily/weekly **System Log** for the WaterGard system must be filled out completely each time the system is used. See page 38.

2 The membranes, carbon and sediment filter are non-durable components and will need to be exchanged periodically.

   a The membranes will need to be cleaned or replaced when the flow of product water decreases more than 15-20% assuming the water temperature remains constant, and no other issue is the root cause.

   b The 5-micron sediment filter will need to be replaced whenever the differential pressure on the outlet is 10 psi or greater than the pressure on the inlet of the filter housing.

   c The carbon cartridges will need to be replaced if the pressure-drop is greater than 20 psi or the residual chlorine level is above 0.1 ppm.

3 The accuracy of the conductivity display should be verified with a calibrated, hand-held meter at least annually. If the conductivity display is not within 5% of the hand-held meter readings, the controller should be calibrated in accordance with the procedures in **Controller Adjustments** on page 19.

4 The internal components of the pump are maintenance-free. It is important to keep the pump motor clean in order to ensure adequate cooling. If the pump is installed in a dusty environment, it must be cleaned and checked regularly. Take the enclosure class (IP55) of the motor into account when cleaning. The motor has maintenance-free bearings.

   – Prior to a long period of inactivity, the pump must be flushed with clean water to prevent corrosion and deposits.

System Preparation for Maintenance

1 Press the SYSTEM ON/OFF/POWER key (the display will show POWER OFF).

2 Turn off the main power switch to the system.

3 Unplug WaterGard line cord.

4 Turn off the potable feed water supply to WaterGard.

5 Relieve the pressure from the system by opening the sample port on the front of the WaterGard unit.

Typical Service Intervals

Task	Frequency	Estimated Replacement Time
Membrane replacement	Yearly or as quality degrades to be more than 35% of incoming conductivity, whichever comes first.	15 minutes per membrane
Sediment filter replacement	Quarterly or when ΔP across Sediment filter is ≥10 psi.	5 minutes
Carbon filter replacement	Yearly or as chlorine starts to pass through. Refer to feedwater requirements for acceptable level.	5 minutes

Membrane Replacement

1 Shut off feedwater supply and drain unit of water by using the product and inlet sample ports. Check to ensure 0 psi on the sediment filter gauges.

2 Remove stainless steel clamps by loosening the two bolts using 14mm wrenches or sockets.



Figure 8

3 Remove end cap. It may be tightly sealed and require some force to remove. Use a flat object and carefully pry up around the cap. For models where the cap has a crossover tube to another membrane, it is best to remove both end caps at the same time.

4 Apply plumbers silicone grease to all O-rings on end caps.

5 Lift old membrane out of housing.

6 Apply plumbers silicone grease to the brine seal O-ring on the new membrane. This is the large O-ring on the feed end.

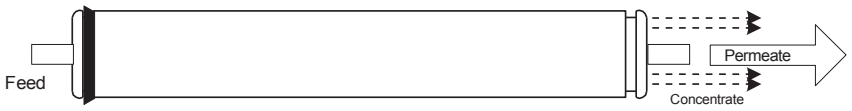


Figure 9

7 Match the flow direction arrow on the membrane with the flow direction arrow on the membrane housing and insert until seated.

8 Reattach end cap, tighten bolts, turn feedwater back on.

9 Soak the membranes for 30 minutes before use, see **Startup and Operation** on page 9 for more info.

10 Return to normal operation and ensure membrane inlet pressure is set to 105 psi.

maintenance

Sediment Filter Replacement

1 Shut off feedwater supply and relieve pressure on the sediment filter housing by opening the inlet sample port. Check to ensure 0 psi on the sediment filter gauges.

2 Using the provided wrench, twist the sediment filter housing to the left to remove.

3 Lift old filter out of the housing.

4 Insert new filter.

5 Reinstall the filter housing, taking care to ensure the filter is vertical. If it feels like you are forcing the housing into place, the filter is not vertical and seating in the top cap.

6 Turn feedwater back on, and return to normal operation.

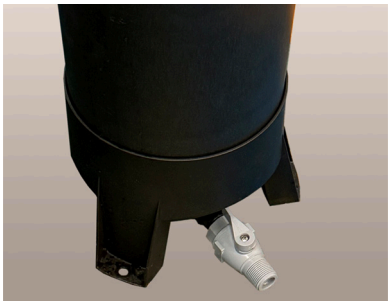
Pump Replacement

If pump replacement is necessary, use the eye-bolts on the side of the pump for lifting. Always use proper straps and lifting equipment rated for the product. Refer to the sales drawing for pump weights. Typically the center of gravity of the pump is close to the pump motor.

Carbon Filter Replacement

1 Turn off the supply water to the system by shutting off the inlet and outlet valves.

2 Open the drain valve at the bottom of the unit until all the water drains from the housing.





3 Open the inlet and outlet unions and disconnect the piping from filter head.





4 Use provided filter wrench to remove the filter head.

5 Lift out the used filter cartridge and replace.

6 Reinstall the filter head.

7 Reconnect the inlet and outlet piping.

8 Close the drain valve and slowly open the inlet and outlet valves. Open air vent until air is purged then close.

parts list

Note

Contact your Marley Sales Representative or SPX Cooling for pricing.

Part Number	Description
	WaterGard Membrane
2800054	Replacement Membrane 4" x 40"
2800055	End Cap O-Rings
2800056	Permeate Port O-Ring
2800057	Stainless Steel Clamp with 14mm bolts
2800058	Plumbers Silicone Grease
2800059	End Cap
2800064	Crossover Tubing
2800061	Permeate Fitting
2800062	Feed fitting, 0.5" MPT x 0.625" tube
2800063	Feed fitting, 0.625" tube x tube
2800065	Test Strips for Measuring Residual Chlorine
	Sediment Filter
2800066	5-micron Sediment Filter Cartridge
2800067	Sediment Filter Housing
2800068	Sediment Filter Housing Wrench
	Miscellaneous
2800076	Pump
2800077	ROC-5 Main Fuse
2800078	ROC-5 CPU Fuse
2800079	ROC-5 Terminal Board (TB-5)
2800080	ROC-5 Board with Screen (CPU-4)
2894311	S150 Main Board (0-500µS)
2894312	S150 Inlet Expander Board (0-2500µS)
2894313	S150 BACnet/MODBUS/Ethernet Board
2890522	Empty Watergard Carbon Housing (All Models)
	Replacement Kits
2800102	WG002 Membrane Replacement Kit (annual kit)
2800103	WG004 Membrane Replacement Kit (annual kit)
2882355	Carbon Replacement Kit All Models (annual kit)
2800120	Sediment Replacement Kit (6 month kit)

system log

WaterGard System Log						
Date	Chlorine ppm	Filter DP	Membrane psi	Conductivity µS	Reject gpm	Product gpm

WaterGard

USER MANUAL

SPX COOLING TECH, LLC
7401 WEST 129 STREET
OVERLAND PARK, KS 66213 USA
913 664 7400 | spxcooling@spx.com
spxcooling.com

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