



REVERSE OSMOSIS SYSTEM

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL



Table of Contents

REVERSE OSMOSIS SYSTEM	1
1. INTRODUCTION	1
2. SYSTEM INFORMATION	1
3. INSTALLATION	2
4. FEED WATER SPECIFICATIONS	3
5. MEMBRANE OPERATING PARAMETERS	3
6. SYSTEM SPECIFICATIONS	4
7. FEED WATER PRETREATMENT	5
8. R.O. PUMP.....	5
9. REVERSE OSMOSIS TERMS.....	6
10. CONTROL COMPONENTS	7
11. REVERSE OSMOSIS SYSTEM FLOW DIAGRAM.....	8
12. MACHINE START-UP.....	9
13. MACHINE OPERATION.....	10
14. RO SYSTEM MAINTENANCE GUIDE	10
15. SYSTEM CONTROLLER	13
15.1. INTRODUCTION	13
16. TROUBLESHOOTING	28
17. SPARE PARTS LIST	31
18. LOG SHEET	32
19. LIMITED WARRANTY	36

REVERSE OSMOSIS SYSTEM

1. INTRODUCTION

The Diamond H₂O Reverse Osmosis System produces high quality Permeate Water. Permeate Water has a low Total Dissolved Solids (TDS) content.

The Diamond H₂O RO System utilizes a state of the art electronic controller to control the RO System operation. The controller monitors water quality, system inlet pressure and tank level to operate the system with safety and reliability as the main goal.

2. SYSTEM INFORMATION

2.1. FACTORY DATA:

Date manufactured:	<input type="text"/>		
RO Model number:	<input type="text"/>	Pump Model number	<input type="text"/>
RO Serial number:	<input type="text"/>	Pump Serial number	<input type="text"/>

Factory Performance:

Feed water	<input type="text"/>	ppm TDS	@	<input type="text"/>	°F
Product (permeate) TDS	<input type="text"/>	ppm			
%TDS rejection	<input type="text"/>				
Product (permeate) rate	<input type="text"/>	gpm			
Drain (concentrate) rate	<input type="text"/>	gpm			
Inlet pressure	<input type="text"/>	psi			
Pump pressure	<input type="text"/>	psi			
Post membrane	<input type="text"/>	psi			
Membrane array	<input type="text"/>				
Flush time	<input type="text"/>	min			

2.2. INSTALLATION DATA:

Fill in after installation

Feed water TDS	<input type="text"/>	ppm TDS	@	<input type="text"/>	°F
Hardness	<input type="text"/>				
Iron	<input type="text"/>				
Misc.	<input type="text"/>				
Product TDS	<input type="text"/>	ppm			
%TDS rejection	<input type="text"/>				
Product rate	<input type="text"/>	gpm			
Drain rate	<input type="text"/>	gpm			
Operating pressure pre-membrane	<input type="text"/>	psi			
Post membrane	<input type="text"/>	psi			

3. INSTALLATION

3.1. LOCATION

When installing the RO Unit, allow at least 45 inches above the unit for membrane removal and loading. If the height is not available, install the unit 6 inches from the wall and allow at least 25 inches to the side for the removal of the entire membrane housing.

3.2. PLUMBING

The feed water source must be able to provide adequate water quantity (see page 4 for Feed Water Specifications), maintain an operating water pressure of 15 to 80 psi, and not exceed 105°F.

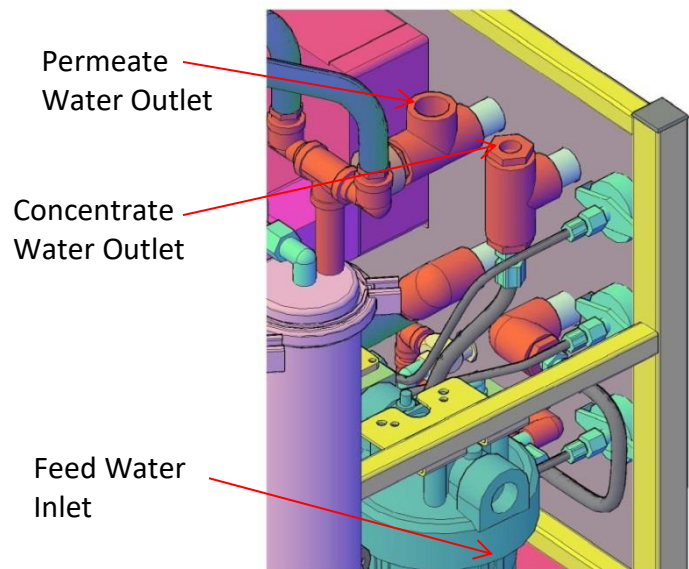
The tube or pipe used to connect to the R.O. system must be equal to or larger than the sizes listed in the System Specifications table found on page 5.

Connect the water supply to the Feed Water Inlet.

Connect the Concentrate Water Outlet to an adequate drain plumbed to accepted practices in accordance to local plumbing codes.

CAUTION: Take care to not have any restrictions in the drain line. This can result in damage to the system components.

Connect the Permeate Water Outlet to the R.O holding tank with a high quality nylon tubing, PVC pipe, or stainless steel pipe or tubing. The storage tank inlet should be as high as possible entering the tank.



Back of Panel

CAUTION: Permeate water is quite corrosive. Brass, bronze or carbon steel pipe should never be used.

WARNING: Machine Damage May Occur If Permeate Back Pressure Exceeds 60 Psig During Operation.

NOTE: During R.O. Start-Up and Clean-In-Place (CIP) membrane operations, it is necessary to divert the Permeate lines to drain to prevent contamination of the R.O Water Storage tank. Plan the piping runs according to your needs.

3. INSTALLATION continued

3.3. ELECTRICAL

The R.O. controller requires either a single-phase 120 V or single-phase 220 V power supply, and is equipped with a 10 foot electrical cord.

The motors require a separate power supply and are available in single-phase or 120 V @ 60 Hz, single-phase 220 V @ 60 Hz, three-phase 220 V @ 50/60 Hz, or three-phase 460 V @ 50/60 Hz.

NOTE: We recommend that a licensed electrician install your system in accordance with local and national electrical codes.

WARNING: To reduce the risk of electrical shock, the incoming power supply must include a protective earth ground.

Connect the wire (red and white with connector end) from the Carbon Filter Control Valve to the R.O. Controller.

Disconnect the Float Switch wires from the R.O. Controller. Install the Float Switch into the storage tank. Feed the wires through a bulk head fitting and back to the R.O. Controller. Reconnect the Float Switch wires to the R.O. Controller. Reference the Electrical diagram on the page 16 to prevent rewiring problems.

4. FEED WATER OPTIMAL LEVELS

Total Dissolved Solids	< 2000 ppm	Hardness	< 17 ppm
Iron	< 0.1 ppm	Manganese	< 0.1 ppm
Silica	< 10 ppm	Hydrogen Sulfide	< 0.0 ppm
Organics	< 2 ppm TOC	Turbidity	< 0.1 NTU
Silt Density Index	< 3.0	pH	3 – 10
Free Chlorine	0.1 ppm	Temperature	40 – 95°F
Inlet Pressure	20 – 80 psi		

5. MEMBRANE OPERATING PARAMETERS

Membrane:	Thin Film Composite		
Typical Operating Pressure:	150 psig	Maximum Pressure:	400 psig
pH Range, Continuous:	3 – 10	pH Range, Cleaning:	1 – 12
Maximum Pressure Drop:	10 psig per element	Max. Calcium Hardness:	< 0.0 LSI
Nominal Rejection:	98%	Max. Temperature	113°F

6. STANDARD SYSTEM SPECIFICATIONS

MODEL #	DFS 2400	DFS 4800	DFS 7200
RO Membrane	4" x 40" TFM	4" x 40" TFM	4" X 40" TFM
Element No.	1	2	3
Array	1	1/1	1/1/1
Pump	1 HP	1 HP	1 ½ HP
Inlet Size	3/4" NPT	3/4" NPT	3/4" NPT
Permeate Size	1/2"	1/2"	1/2"
Drain Size	1/2"	1/2"	1/2"
Permeate	1.7 GPM	3.3 GPM	5.0 GPM
Concentrate	1.2 to 0.6 GPM	2.4 to 1.2 GPM	3.5 to 1.8 GPM
Power *	220 V, 1 PH	220 V, 1 PH	220 V, 1 PH

MODEL #	DFS 9600	DFS 12000	DFS 14400	DFS 18000
RO Membrane	4" X 40" TFM	4" X 40" TFM	4" X 40" TFM	4" X 40" TFM
Element No.	4	5	6	8
Array	2/1/1	2/2/1	2/2/1/1	2/2/2/1/1
Pump	1 ½ HP	2 HP	2 HP	3 HP
Inlet Size	1" NPT	1" NPT	1" NPT	1" NPT
Permeate Size	5/8" NPT	5/8" NPT	1" NPT	1" NPT
Drain Size	1/2"	5/8"	5/8"	1" NPT
Permeate	6.7 GPM	8.3 GPM	10.0 GPM	12.5 GPM
Concentrate	4.7 to 2.4 GPM	5.9 to 3.0 GPM	7.1 to 3.5 GPM	9.4 to 4.7 GPM
Power *	220 V, 1 PH	220 V, 1 PH	220 V, 1 PH	220 V, 1 PH

* Three phase 230/460 VAC single drop power option available on all models at an additional charge.

*** 4" x 40" TFM Membrane Part # 30-0130-XX**

7. FEED WATER PRETREATMENT

Diamond H₂O R.O. systems are supplied with a Activated Carbon Filter that removes chlorine, and a Cartridge Filter that filters out most particles over 5 micron. Change the cartridge at least every month.

NOTE: The system must be operated on filtered water only. Do not attempt to clean used filter cartridges.

CAUTION: If the pre-filter becomes clogged and the water flow to the pump is reduced or interrupted, cavitation will occur. This will damage the pump.

NOTE: If the feed water contains excessive water hardness or Iron, a water softener should be installed.

NOTE: If the feed water contains a slightly soluble material such as calcium sulfate, silica, or colloidal clay, a continuous injection of membrane anti-scalant should be used.

8. R.O. PUMP

Follow these guidelines to ensure proper operation of the pump:

The pump must NEVER be run dry. Operating the pump without sufficient feed water will damage the pump.

ALWAYS feed the pump with filtered water. The pump is susceptible to damage from sediment and debris.

9. REVERSE OSMOSIS TERMS

R.O.: Reverse Osmosis, this is the process of forcing water through a semi-permeable membrane that allows the water molecule but not the impurities in water to pass through. This is accomplished by utilizing pressure from a pump to force the water molecules through the membrane.

Feedwater: The water that is supplying the RO system.

Concentrate: The water that does not go through the membrane and contains the concentrated ions in the feed water. This water is normally discarded.

Permeate: The “good” water. This portion is the water that has passed through the membranes and has been separated from the majority of the ionic species in the feedwater.

Recovery: The efficiency of the machine. This efficiency is determined by the ratio of permeate to the feed water.

$$\% \text{ Recovery} = (\text{Permeate Water} / \text{Feed Water}) \times 100$$

Rejection: The percentage of dissolved material that does not go through the membrane. This rejection is different for each ionic species in the water that is being treated.

$$\% \text{ Rejection} = (\text{Feed TDS} - \text{Permeate TDS} / \text{Feed TDS}) \times 100$$

TDS: Total Dissolved Solids, this is a measurement usually made by measuring the electrical conductivity of the water. It is a good measure for the amount of ions in a water sample.

Element: The membrane element is located in the membrane housing. This is the main part of the system that produces the high quality water. It will over time foul and will need to be replaced and/or cleaned. The frequency of which will depend on the quality of feedwater that is being sent to the system.

Housing: The part of the system that holds the membrane. The housing is designed to hold the membrane without allowing concentrate to leak into the permeate side of the membrane.

10. CONTROL COMPONENTS



- INLET PRESSURE GAUGE:** Indicates pressure of the supply water after the inlet solenoid valve has opened.
- PUMP PRESSURE GAUGE:** Indicates the water pressure the booster pump is supplying to the membranes.
- MEMBRANE PRESSURE GAUGE:** Indicates the pressure of the concentrate water after passing through the membrane housing.
- PERMEATE FLOW METER:** Indicates the flow rate of permeate water the system is producing.
- CONCENTRATE FLOW METER:** Indicates the amount of concentrate flow that is being sent to the drain.
- CONCENTRATE VALVE:** The valve that is used to adjust the concentrate flow rate. Adjustments in this valve also affect the amount and quality of permeate water that is produced.
- RECYCLE VALVE:** The valve opens on high pressure to prevent damage to R.O. membranes.
- RO CONTROLLER:** Microprocessor that controls the operation of the system. It also monitors permeate water quality and will shut down the system on low inlet pressure.

11. REVERSE OSMOSIS SYSTEM FLOW DIAGRAM

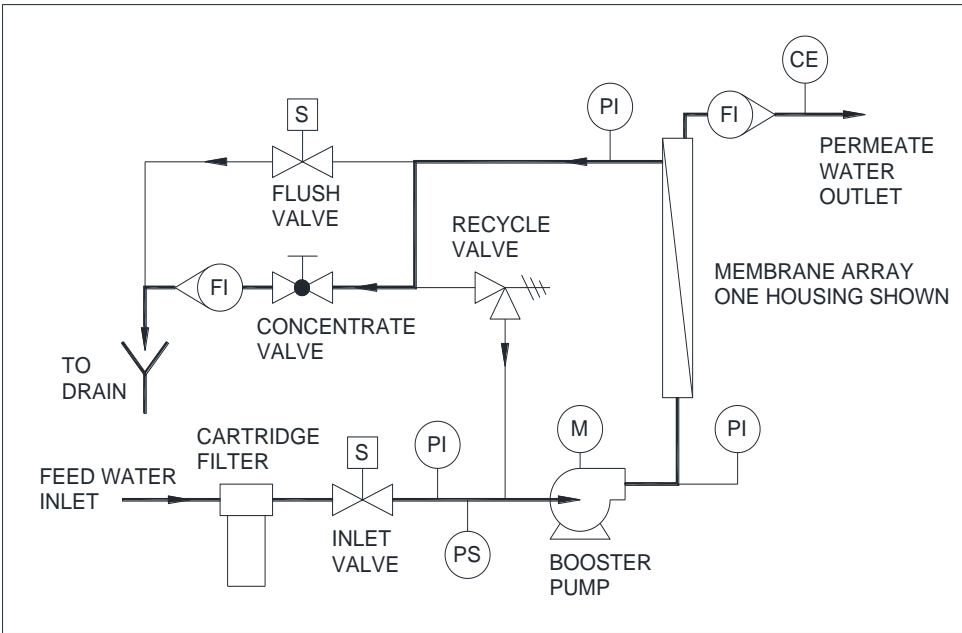


Figure 1

Feed Water is supplied to the **Inlet Solenoid Valve**. When the RO System is activated to produce **Permeate Water**, the **Inlet Solenoid Valve** is opened and the **Booster Pump** is activated. The **Booster Pump** pressurizes the **Feed Water** and forces it through the membranes located inside the **Membrane Housings**. The membranes are designed to remove **TDS** from the feed water providing highly purified water. The **Concentrate Valve** allows the operator to adjust the volume and pressure of water through the membranes. Throttling the **Concentrate Valve** increases the water pressure causes more water to pass through the membrane. This increases the permeate flow but it also decreases the permeate water quality. Throttling the **Concentrate Valve** will lower the amount of concentrate water going to drain. When the RO water storage tank is full, the **Flush Solenoid Valve** will automatically open causing a high flow rate of water across the membranes to clean them.

12. MACHINE START-UP

12.1. MACHINE START-UP PREPARATION

Check the function and integrity of your pretreatment equipment. Ensure that your water softener and activated carbon filters have been leaked checked and properly flushed, before starting up your RO machine.

CAUTION: Improperly flushed pretreatment may cause serious RO machine problems at start-up.

12.2. START-UP

STEPS

1. Refer to the Installation section of the manual; inspect the piping and wiring to insure proper assembly.
2. Check to ensure power is supplied to the Controller and the unit is turned OFF.
3. Slowly turn on the feed water supply, while checking for leaks in the pretreatment and inlet feed water lines.
4. For initial start-up, redirect the permeate line to the drain.
5. Locate the Concentrate Valve on the panel and turn the handle counter clockwise to open.
6. Press the Power button on the controller. System will enter a Membrane Flush operation; the Inlet and Flush solenoid will open allowing water flush out the food-grade antifreeze. This provides a wet start-up of the pump and removes any air in the system.
7. After the Membrane Flush is complete. The Flush solenoid will close.

WARNING: With systems with the 3-phase pump option; if the RO pump is started with incorrect rotation (i.e., backwards), a noticeable drop in flows and pressures will result. If pump motor operates backwards for any length of time, pump damage may result. If rotation is wrong, de-energize the pump voltage from the source and switch any two of the three-phase wires coming in on top of the three-phase starter.

8. Adjust the Concentrate Valve by slowly closing and watch the Concentrate Flow Indicator to set the concentrate flow. Refer to the System Specification Table for the proper amount of flow.
9. Allow the machine to run for 15 to 20 minutes to thoroughly flush out the system.
10. When the TDS display is in the proper range, press the Power button to turn off the machine. Redirect the permeate line back to the permeate water storage tank.
11. Press the Power button on the controller. The R.O. unit is now in operation.

NOTE: Adjusting the concentrate flow below the minimum flow rate listed in the System Specifications will void warranty.

13. MACHINE OPERATION

The operation and maintenance of an RO machine requires regular data recording and routine preventative maintenance. It cannot be emphasized enough the importance of filling out the Daily Log Sheet during each operating shift. A Start-Up Data Sheet should have been completed at startup containing pertinent facts on the operation of your machine. These two records are invaluable in diagnosing the performance of the equipment, and must be kept for reference. If you have questions concerning the operation of your machine or the method of data recording, contact the manufacturer.

NOTE: Optimum recovery will vary according to water quality

NOTE: A daily log sheet is included with this manual (Page 36)

14. RO SYSTEM MAINTENANCE GUIDE

As part of a routine preventative maintenance program, it is suggested that performance data or your Diamond H₂O RO System is recorded on a regular basis. By recording the performance data, diagnosing any performance problems at a later date will be much easier. (Please see the attached RO System Performance Data/Records).

There are four primary preventative maintenance procedures to ensure the highest level of performance and extended system life, these procedures must be done on a regular basis.

14.1. REPLACE PRE-FILTER CARTRIDGES:

The standard 'Rule of Thumb' is that once a month the 5 Micron pre-filter should be replaced. The frequency can vary depending on the production demands of the RO System. This filter protects the membrane elements from particles, which may be in the feed water. Note: A pressure drop of 8 psi or more during operation indicates that the pre-filter cartridge needs replacing. Use filters rated at 5 micron or less. Replacement filters are available from your local distributor.

14. RO SYSTEM MAINTENANCE GUIDE Continued

14.2. MEMBRANE FLUSHING:

To prevent premature replacement of your RO System membranes, Your RO System needs to perform a periodic membrane flush to ensure the highest level of performance and membrane life. The Diamond RO System is programmed to perform a membrane flush before every production cycle begins, and after the completion of every production cycle.

Note: To manually activate a membrane flush, press and hold the Alarm Silence/Reset Key for 3 seconds

Note: Diamond H2O's standard RO System uses an advanced control that allows for adjustments in the membrane flushing sequence. It is recommended that the unit is flushed at a minimum of every 24 hours.

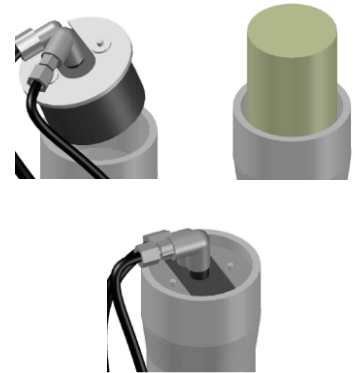
14.3. MEMBRANE ELEMENT REPLACEMENT

Even with a preventative care and maintenance, eventually RO Membranes will need to be replaced. Your local Diamond H2O distributor will be able to provide you with the correct replacement membranes.

Note: Diamond H2O cannot guarantee that our RO System will perform to our stated performance specifications if the replacement RO membranes are not approved membrane models.

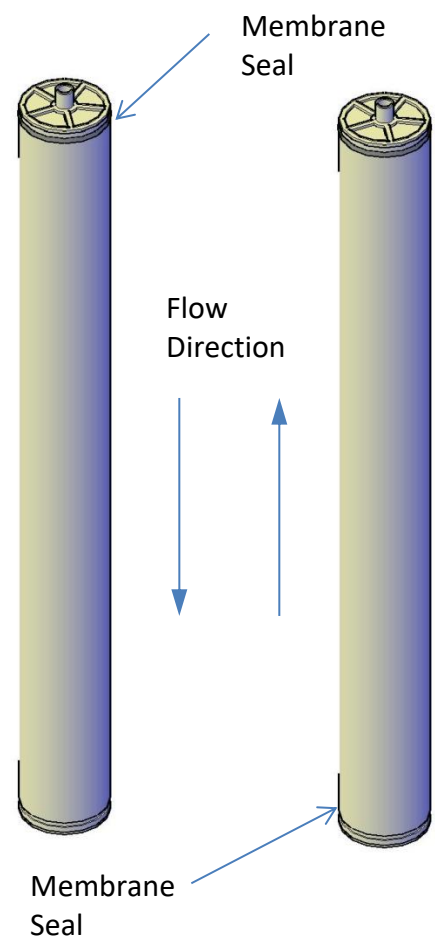
14.4. MEMBRANE ELEMENT REPLACEMENT Continued

Caution: Replacement membranes are shipped from the factory in plastic bags. The bags are sealed, and filled with a small amount of bactericide solution to prevent any biological growth. When installing membranes, always provide adequate ventilation and wear gloves while handling the membrane elements. The membrane elements must be kept moist at all times to prevent any possible damage to the membrane element materials.



STEPS:

1. Remove the top end caps and clamps from the membrane element housings. Lubricate all the O-Rings, Brine Seals, and Membrane Element Stems with **non-petroleum** based lubricate (i.e. glycerin or poly water).
2. Load the 'Down' flow membrane elements first by inserting the membrane elements housing with the brine seal end of the membrane element 'Up'. Slowly turn the element as you lower it into the membrane housing. As you reach the bottom of the housing, slowly guide the Stem on the end of the membrane into the Head of the End Cap. As the membrane element slides into the housing, the brine seal will be on the top.
3. Next, load the 'Up' flow membrane elements, by lubricating all the O-Rings, Brine Seals, and Membrane Element Stems with the 'Up' flow membrane element and brine seal on the bottom of the membrane element. Turn the element slowly as you lower it down in to the housing. As with the down flow membrane element, slowly guide the Stem on the membrane element into the end cap.
4. Before re-installing the end caps, lubricate the O-Rings located inside the end cap (again using a **non-petroleum** based lubricant). Re-install the end cap on the membrane element first by aligning the Stem into the hole in the end cap. Then, slowly turn the End Cap clockwise as you push the end cap down into the membrane element housing.
5. Re-attach the housing clamp and tighten.
6. Re-attach the feed line and flush the permeate and concentrate lines to the drain for 20-30 minutes.
7. Re-connect the permeate line to the point-of-use.
8. The RO System is now ready for operation.



15. SYSTEM CONTROLLER

15.1. INTRODUCTION

The microprocessor controlled system can monitor the TDS sensor, pressure switch, and level switches. The controller displays system status and sensor and switch input status on an easy to read backlit display.

TABLE 1. SPECIFICATIONS

Inputs

Tank level switches:	Normally-Closed.
Inlet pressure switch:	Normally-Closed.
Pretreat lockout switch:	Normally-Open.
Controller Power:	120/240 VAC, 60/50Hz (Range: 90-145 VAC at 120VAC setting, 180-290 VAC at 240 VAC setting)
Permeate Conductivity:	0-1500* PPM, 0-3000 μ s (Resistivity to 20M ohm available with Resistivity Cell)
Feed Conductivity (opt):	0-3000* PPM, 0-6000 μ s *These ranges are provided with the standard conductivity cell constant of 1.0. Higher ranges can be obtained by using a cell with a different constant.

Output Relay Ratings

Feed Solenoid:	12A Resistive, 6A (Inductive). Voltage is the same as motor/supply voltage.
Flush Solenoid:	12A Resistive, 6A (Inductive). Voltage is the same as motor/supply voltage.
Pump Motor:	30A Resistive, .75 HP/110V, 1.5 HP/220V.

TABLE 1. SPECIFICATIONS**Inputs**

Tank level switches	(2) Normally-Closed. <i>Can be used with a single level switch.</i>
Inlet pressure switch	Normally-Open.
Pretreat lockout switch	Normally-Open.
High pressure switch	Normally-Open.
Controller Power	110/240 VAC, 60/50Hz
Permeate Conductivity	0-3000 PPM, 0-6000 μ s (standard sensor, CP-1, K=.75)
Feed Conductivity (<i>opt</i>)	0-3000 PPM, 0-6000 μ s (standard sensor, CP-1, K=.75)

Output Relay Ratings (*relays are fused with a 6A fuse*)

Feed Solenoid	0.5A. <i>Voltage is the same as motor/supply voltage.</i>
Flush Solenoid	0.5A. <i>Voltage is the same as motor/supply voltage.</i>
Feed Pump Terminals	0.5A. <i>Voltage is the same as motor/supply voltage.</i>
Divert	0.5A. <i>Voltage is the same as motor/supply voltage or can be dry contact selectable via SI.</i>
Motor Contactor Coil	0.5A. <i>Voltage is the same as motor/supply voltage.</i>

Circuit Protection

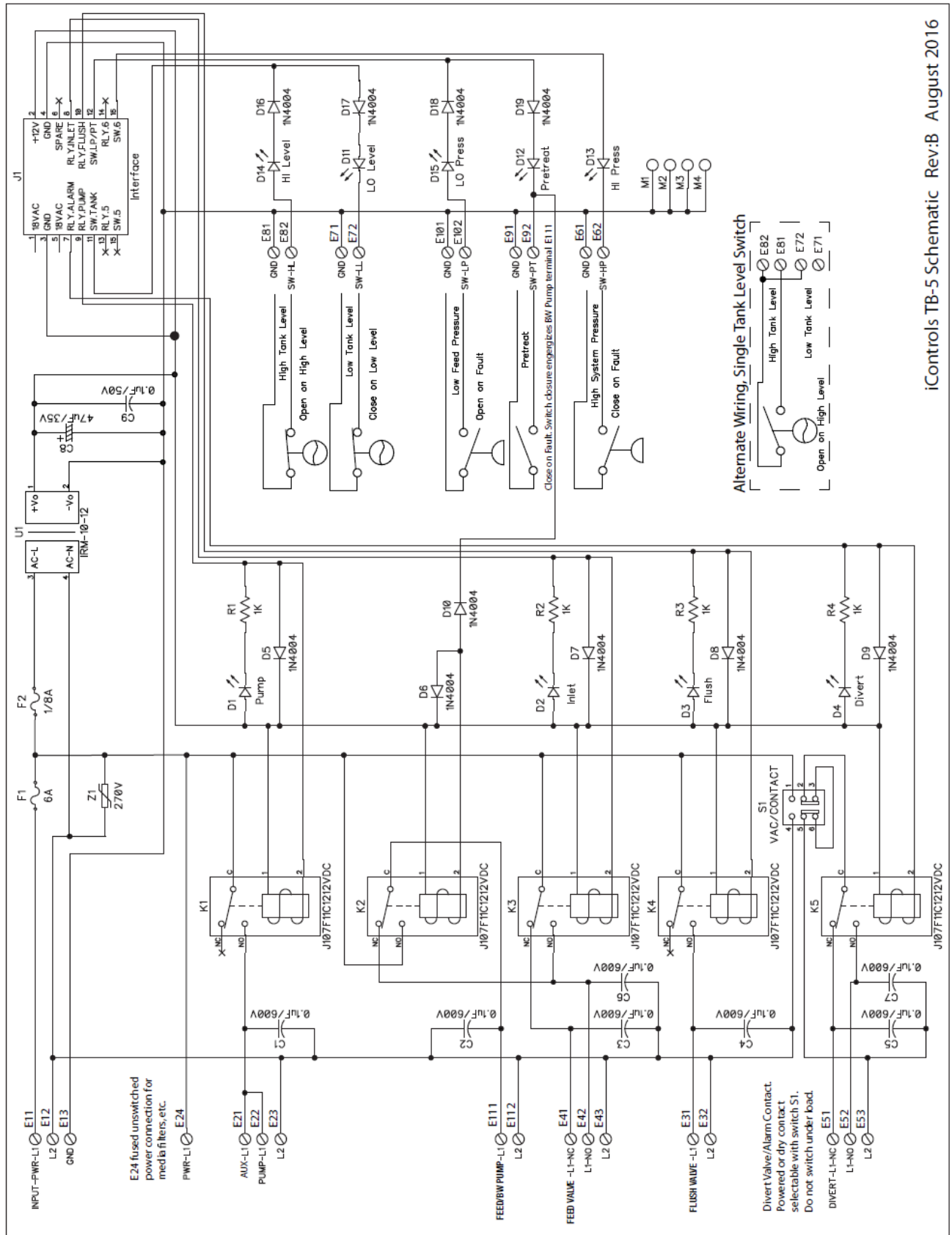
Main/Relay Power Fuse	F1	5x20mm	6 Amp	Littelfuse O234006P
Power Supply/CPU Fuse	F2	5x20mm	0.125 Amp	Littelfuse O218.125P

Other

Dimensions	11.5" tall, 9.3" wide, 6.7" deep. Nema Type 1 non-metallic (10x8x6)* 13.5" tall, 11.4" wide, 6.7" deep. Nema Type 1 non-metallic (12x10x6)* 15.5" tall, 13.3" wide, 7.7" deep. Nema Type 1 non-metallic (14x12x7)*
Weight	4.2 lb. (10x8x6) (<i>Enclosure, CPU-4 and TB-5 only.</i>) 6.0 lb. (12x10x6) (<i>Enclosure, CPU-4 and TB-5 only.</i>) 10.6 lb. (14x12x7) (<i>Enclosure, CPU-4 and TB-5 only.</i>)
Environment	0-50°C, 10-90%RH (non-condensing)

*The enclosures are Nema Type 4X, glass reinforced polycarbonate before our modifications. They are reduced to Type 1 because the enclosure has not been tested following the modifications needed to install our components.

SIMPLIFIED SCHEMATIC

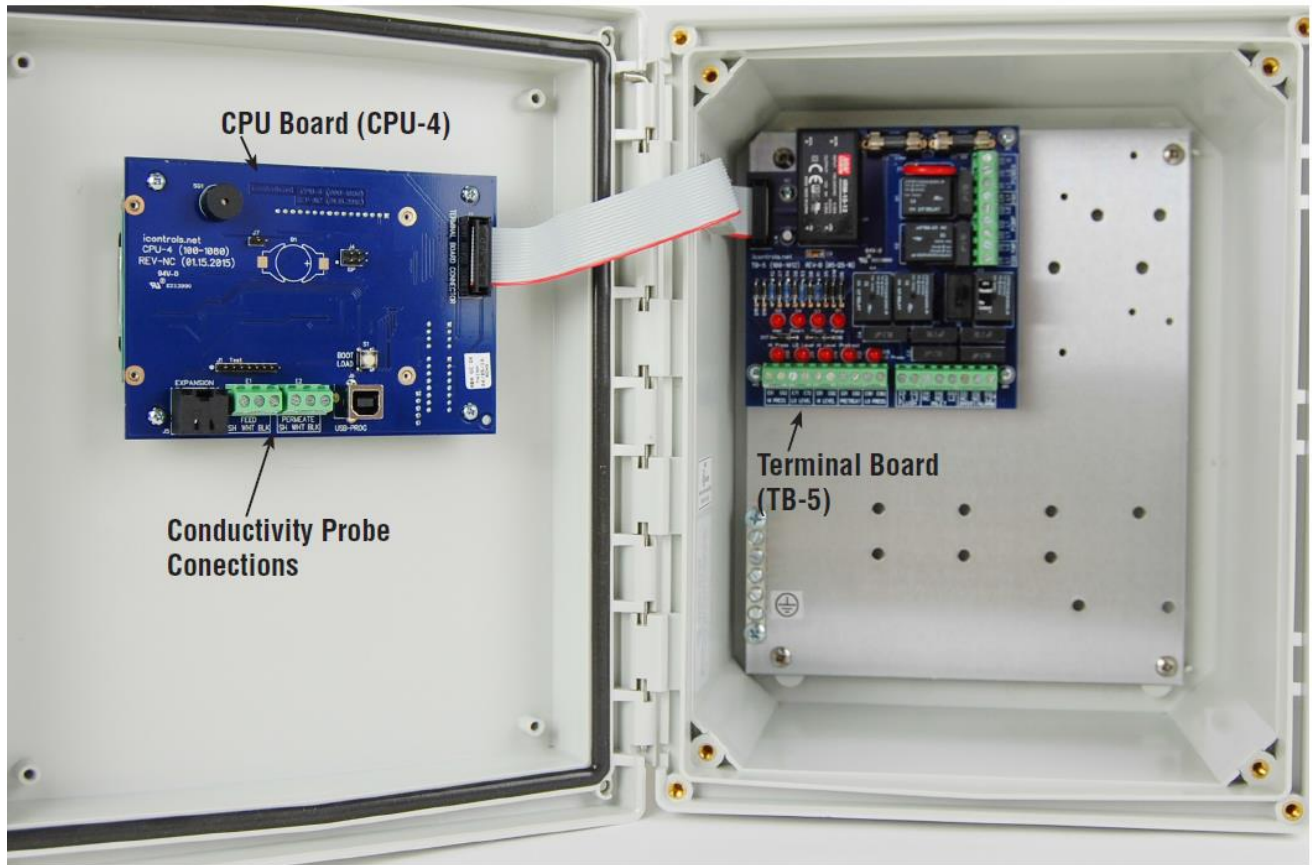
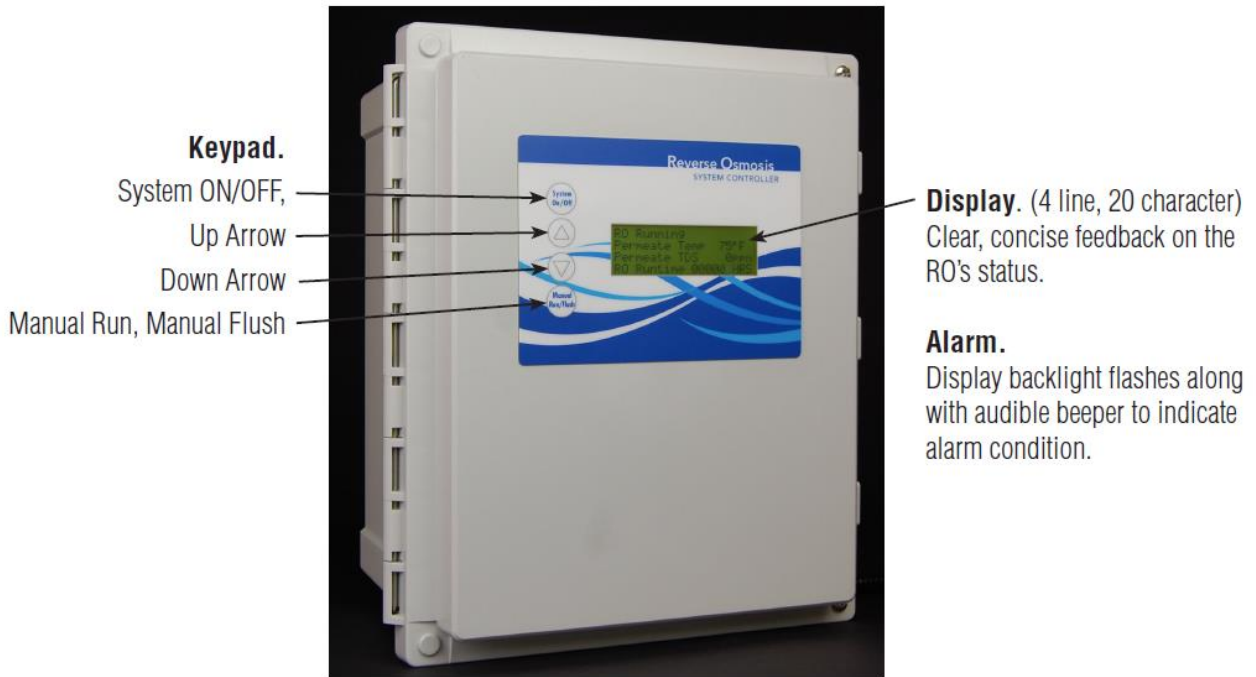


iControls TB-5 Schematic Rev:B August 2016

Diamond H2O

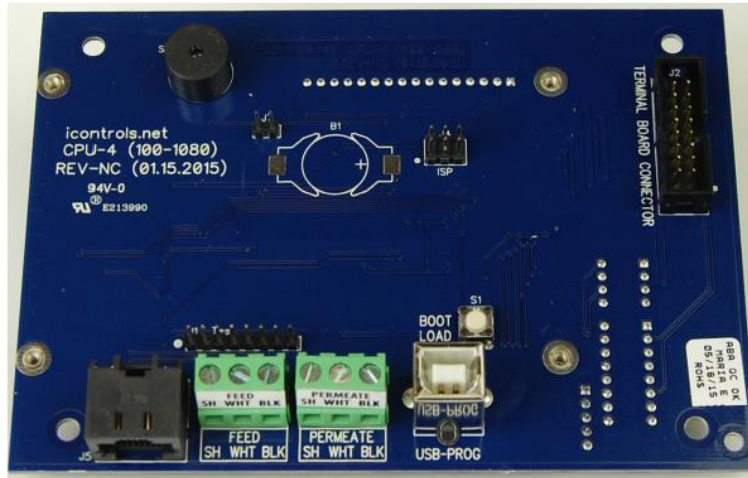
N1022 Quality Drive / PO Box 170 / Greenville, WI 54942
 Ph: (920) 757-5440 / (866) 757-9287 / Fax: (920) 757-5819

CONTROLLER OVERVIEW

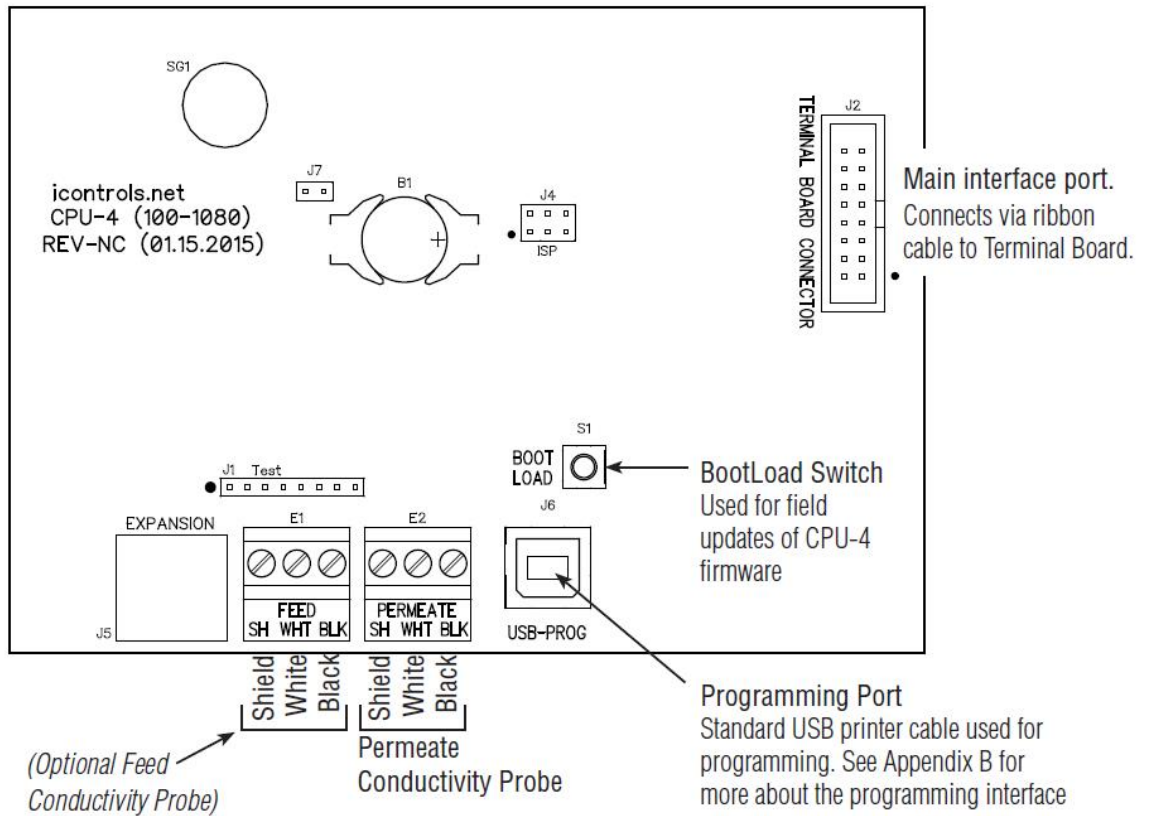


CONTROLLER DETAIL:

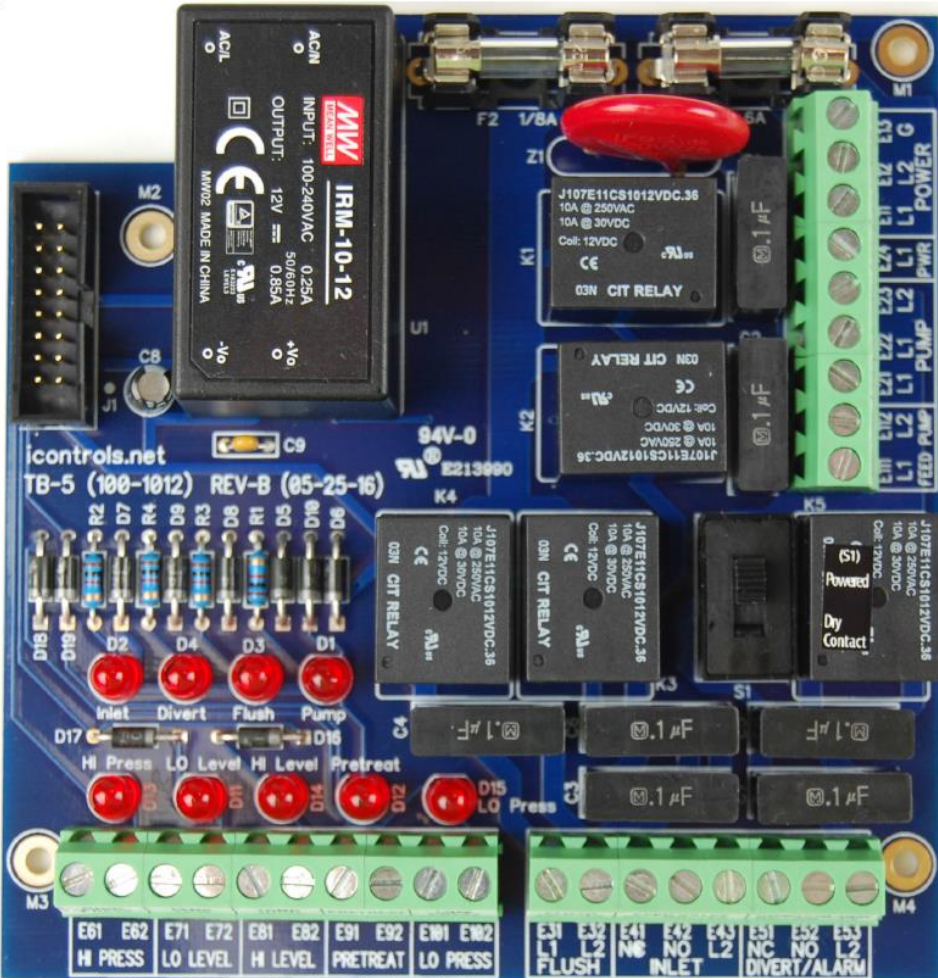
Typical Configuration



Detailed View

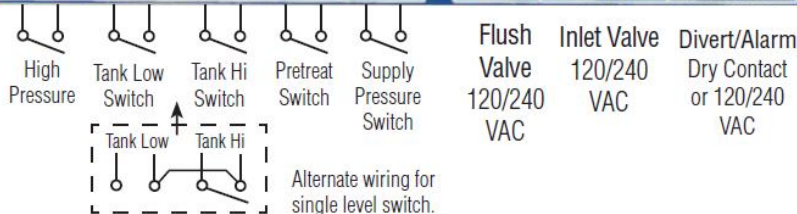


CONTROLLER DETAIL:



- Supply Power
120/240 VAC
- Aux Output, unswitched
- RO Pump Contactor Coil
120/240 VAC
- Aux Output, Switched with pump
- Feed/BW Pump Contactor
Coil - 120/240 VAC

S1
Divert/Alarm relay,
Powered or Dry contact
selector
NOTE: Switch only when
not under load.



Diamond H2O

N1022 Quality Drive / PO Box 170 / Greenville, WI 54942
Ph: (920) 757-5440 / (866) 757-9287 / Fax: (920) 757-5819

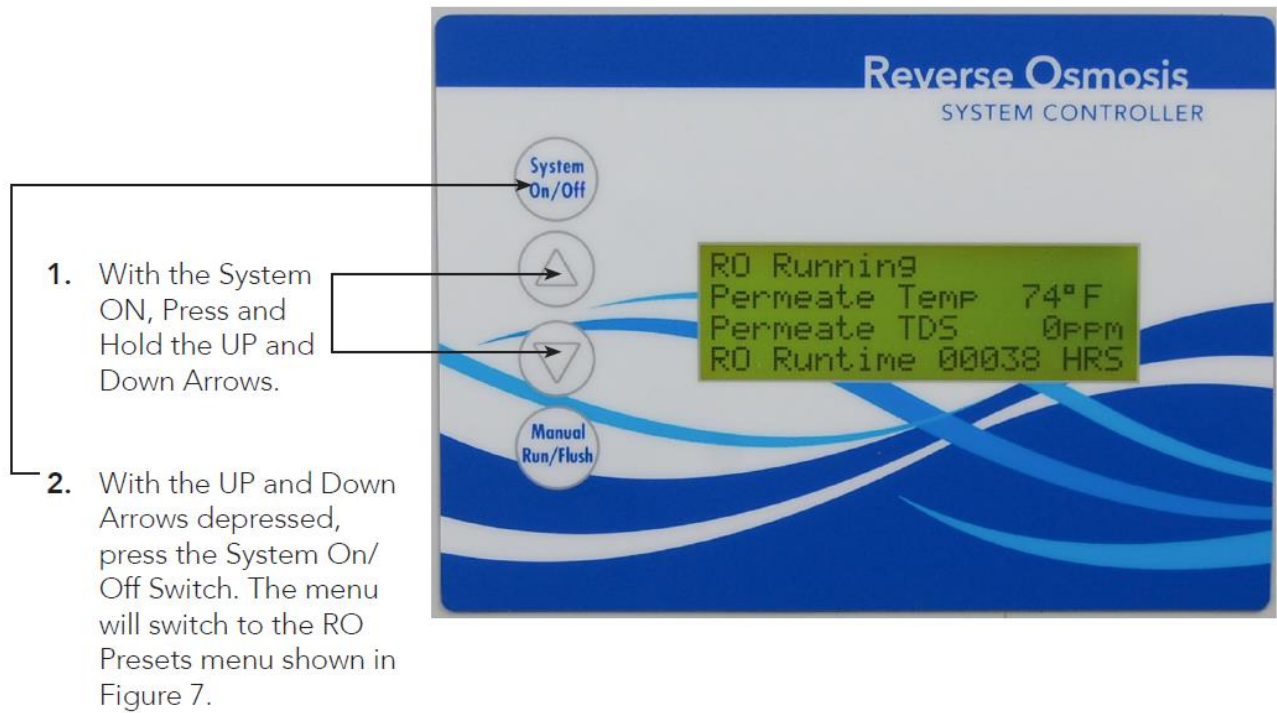
CONDUCTIVITY PROBE INSTALLATION



CONTROLLER POWER FUSE VALUES

	½ HP	¾ HP	1 HP	1 ½ HP	2 HP
120 VAC	12 A	20 A	N/A	N/A	N/A
240 VAC		-	5 A	12 A	12 A

CONTROLLER PROGRAMMING. ACCESSING THE HIDDEN MENU.



CONTROLLER PROGRAMMING: PROGRAM SELECTIONS

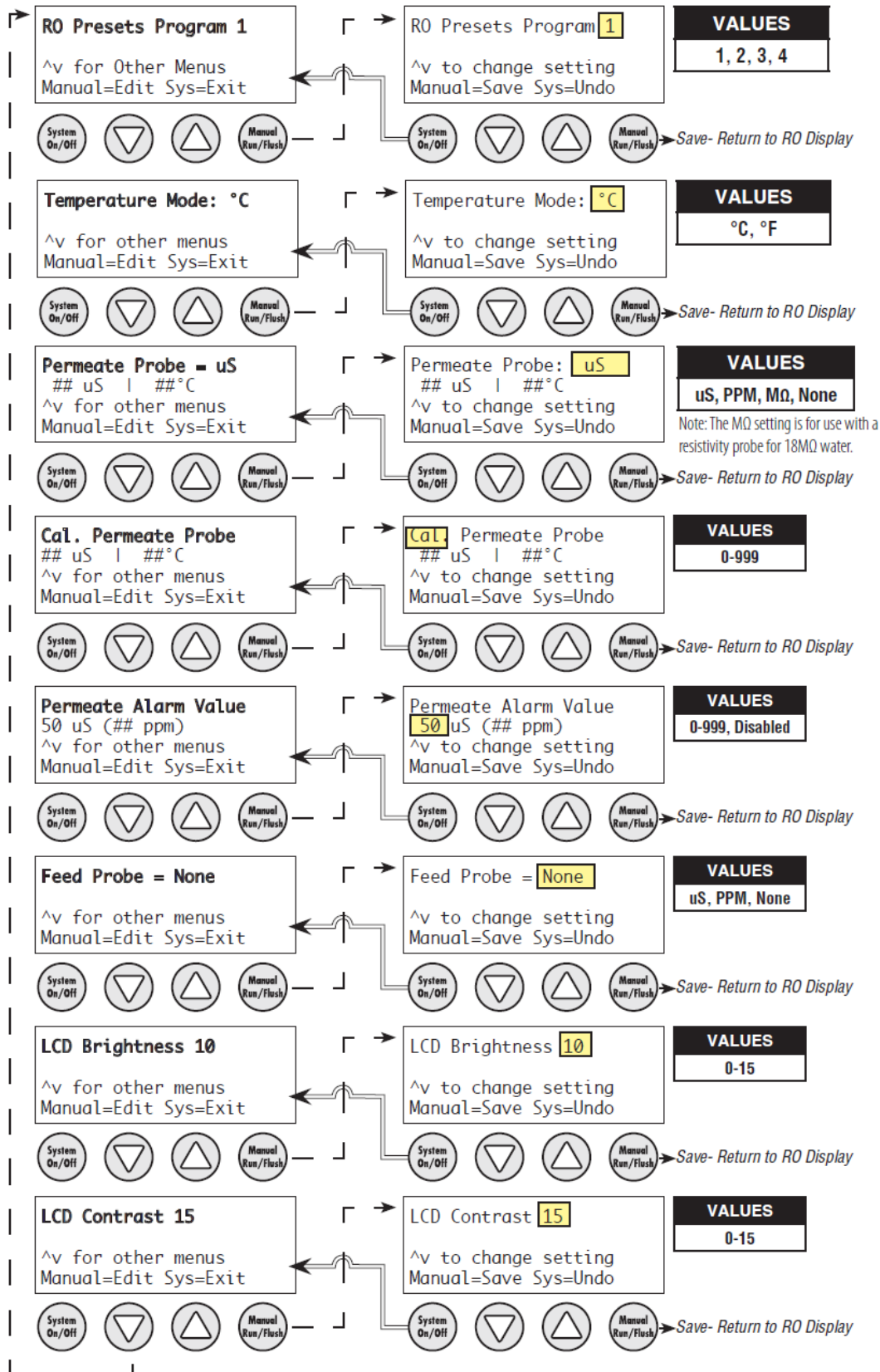
The controller has 4 separate, field-selectable sets of settings for configuring the RO. The factory default settings are shown below. The settings are identical except for variations in the flush behavior.

- Program 1, High Pressure flush.
- Program 2, No Flush
- Program 3, Permeate Flush, (low pressure, inlet valve closed)
- Program 4, Low Pressure, feed water flush
- See the previous page for instructions on how to access the menu for selecting these programs.
- See Appendix A for a detailed explanation of the Parameters and their affect on the RO's operation.

Parameter	Value	Program 1	Program 2	Program 3	Program 4
Tank 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
Inlet Solenoid stop delay	Seconds	1	1	1	1
Pump start retry interval (restart delay after LP fault)	Seconds	60	60	60	60
Low pressure fault shutdown, # of faults	Faults	5	5	5	5
Low pressure fault shutdown, time period 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		High Pressure	No Flush	Permeate Flush	Low Pressure Flush
Startup Flush: Minutes from last flush	Minutes	0	0	0	0
Startup Flush: Duration	Seconds	0	0	0	30
Periodic Flush: Interval	Minutes	60	0	0	0
Periodic Flush: Duration	Seconds	30	0	0	0
Shutdown Flush: Time from last flush	Minutes	10	0	0	0
Shutdown Flush: Minimum operation	Minutes	30	0	0	0
Shutdown Flush: Duration	Seconds	60	0	60	60
Idle Flush: Interval *	Minutes	0	0	0	0
Idle Flush: Duration *	Seconds	0	0	0	0
Timed Manual Run	Minutes	5	5	5	5
Timed Manual Flush	Minutes	5	0	5	5

* These features are disabled by default due to the potential for confusion on the part of end-users in the field. They can be enabled when needed via the OEM PC programming interface which allows changes to all of the values shown above.

CONTROLLER PROGRAMMING: MENU NAVIGATION



APPENDIX A. CONTROLLER PROGRAMMING: PARAMETERS EXPLAINED

Parameter	Value	Range	Example
Input Switch Behaviors			
Tank Level Switch de-Bounce	Seconds		2.0
<i>This specifies the time that the tank switch must be closed or open before the controller accepts it as a valid condition. The function is to prevent nuisance tripping of the RO especially in small tanks or turbulent tanks</i>			
Pressure Switch de-Bounce	Seconds		2
Pump/Inlet Solenoid Behaviors			
Pump start delay	Seconds		10
<i>On RO start-up, after the tank switch opens, the inlet solenoid valve is energized. When the inlet pressure switch closes this begins the "Pump start delay". If the pressure switch remains closed, the pump will start after 10 seconds.</i>			
Inlet Solenoid stop delay	Seconds		1
<i>This value sets the delay for the inlet solenoid valve to be deenergized following the deenergizing of the motor on RO shut down. The purpose is to prevent the pump from operating against a closed suction as the pump spins down.</i>			
Low Inlet Pressure Behaviors			
Pump start retry interval (restart delay after LP fault)	Seconds		60
<i>When the inlet pressure switch opens, the controller deenergizes the motor and the inlet solenoid valve remains open. The controller will continue to monitor the inlet pressure switch. After the switch is closed for the duration of the "Pump start retry interval" the motor is reenergized.</i>			
Low pressure fault shutdown, # of faults	Faults		5
Low pressure fault shutdown, time period to count faults	Minutes		10
Low pressure fault shutdown, reset after shutdown (0 value = no restart)	Minutes		60
<i>These three values work together to determine how the RO handles Low Pressure conditions. The first two values, "# of faults" and "time period to count faults", sets the limit for the number of low fault conditions over time that are required to place the RO in "Low Pressure Fault Shutdown". The third value sets the duration of the "Low Pressure Fault Shutdown" which is the period that the RO will remain idle before trying to restart. The purpose of the Low Pressure Fault Shutdown is to prevent an RO from turning OFF/ON repeatedly without any limit.</i>			
Low pressure timeout fault	Seconds		60
<i>If the inlet valve is open, but the pressure isn't sufficient to close the inlet pressure switch, the RO would run indefinitely on line pressure. This value sets the time limit for the RO to operate with the inlet valve open with Low Pressure as indicated by an Open inlet pressure switch before a Low Pressure Fault is added to the counter above</i>			

APPENDIX A. Continued

Flush Behavior			
Time from last flush before Flush on Shutdown	Minutes		15
Minimum operation before Flush on Shutdown	Minutes		60
Flush duration on Shutdown	Seconds		60
Periodic Flush interval	Minutes		60
Periodic Flush duration	Seconds		30
Unit Idle Flush interval *	Minutes		0
<i>The Unit Idle Flush Interval sets a time after which the RO will start-up and run in the flush mode. This is disabled by default because of the danger of over-flowing a tank if not properly implemented. It is intended for environments where leaving the RO idle for long periods would invite bio-fouling. (0)=disabled</i>			
Unit Idle Flush duration *	Seconds		0
<i>Sets the duration of the Idle Flush. (0)=disabled</i>			
Timed Manual Run - Duration of Manual Run	Minutes		5
Timed Manual Flush - Duration of Manual Flush	Minutes		5
Conductivity Probe Sample Rate	Seconds		2
Conductivity Shutdown * (0)=disabled	Minutes		0

CONTROLLER FAULT CONDITION DISPLAYS

Below are examples and explanations of the displays which accompany the fault conditions possible in the ROC-3. Fault conditions always indicated a problem of some sort which requires corrective action. the displays provide sufficient information to recognize the source of the fault and the required corrective action.

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:SS"

Pre Treat Fault: *(Pretreat Switch is closed indicating problem with 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 uS"
Line 3 "Alarm SP xxx ppm" or "Alarm SP xxx uS"
Line 4 "To Reset Push OFF/ON"

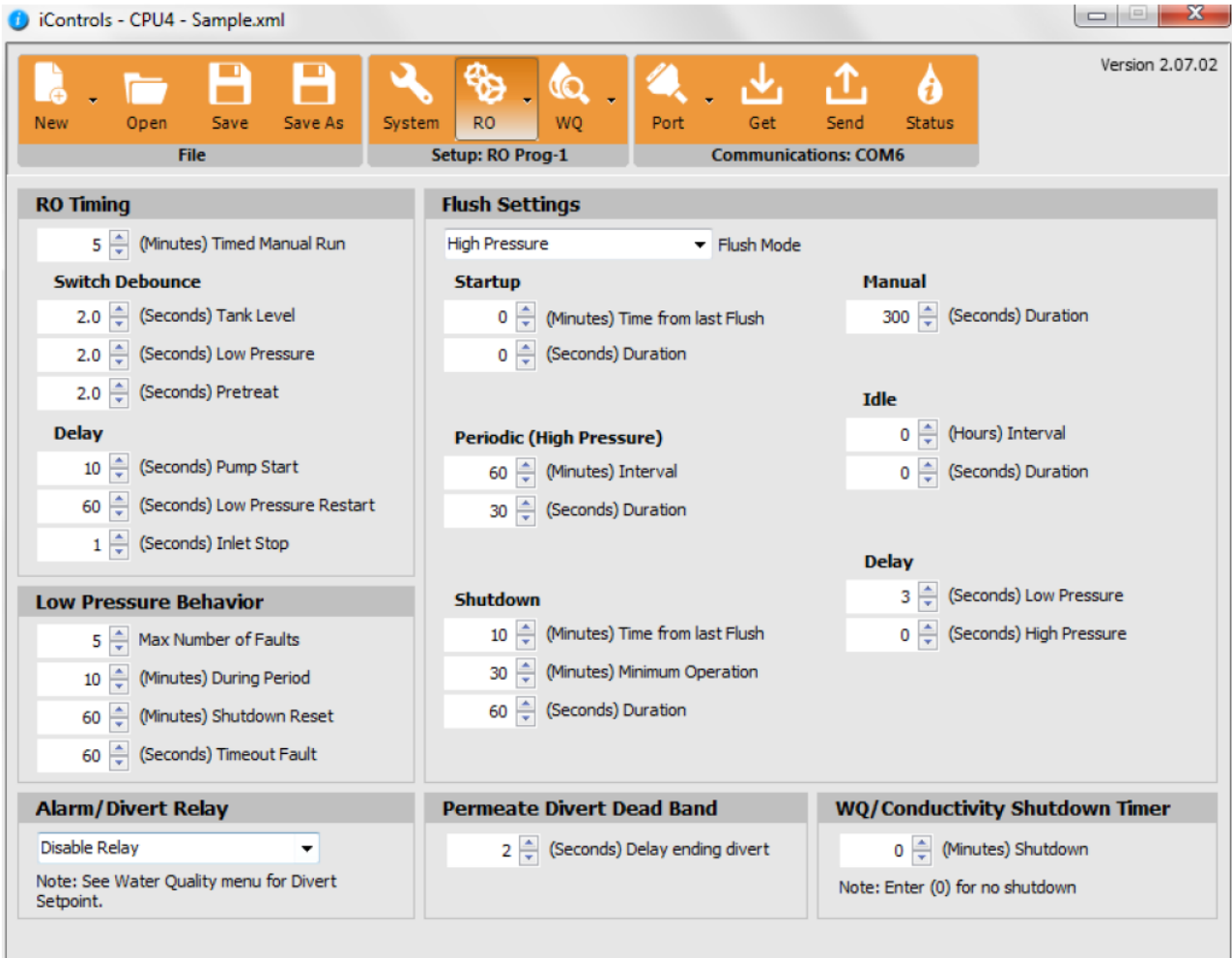
Feed Conductivity Fault: *(Feed conductivity is higher than the alarm setpoint.)*

Line 1 "Service Fault"
Line 2 "Feed TDS xxx ppm" or "Feed Cond xxx uS"
Line 3 "Alarm SP xxx ppm" or "Alarm SP xxx uS"
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

Programming



The Programming interface is a Windows-based tool for making changes to the ROC software. This screen shows the RO settings available. There are 4 different sets of settings stored in the CPU-4

15.2. TROUBLESHOOTING

CAUTION: 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, be sure power is turned off at the disconnect.

Before contacting Diamond H₂O for technical help, verify the programming of all setpoints, check the display and check 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.

15.2.1. INLET VALVE WILL NOT OPERATE

Is the system in standby? If no, are any shut down conditions active? If no, is the Feed LED, DS7 lit? If no, replace the board. If yes, with a voltmeter, verify if there is power on the inlet terminals. Is there power? If no, replace the board. If yes, check the valve and wiring.

15.2.2. RO PUMP WILL NOT OPERATE

Is the system in standby? If no, are any shut down conditions active? If no, is the Pump LED, DS5 lit? If no, replace the board. If yes, with a voltmeter, verify if there is power on the RO pump terminals. Is there power? If no, replace the board. If yes, check the pump and wiring.

15.2.3. UNIT NOT FLUSHING OR NOT FLUSHING CORRECTLY

Press the Manual Run/Flush key for 3 seconds. Does the unit show flush on the display? If no, replace the board. If yes, is the Flush LED, DS6 lit. If no, replace the board. If yes, with a voltmeter, verify if there is power on the flush terminals. Is there power? If no, replace the board. If yes, check the valve and wiring.

16. TROUBLESHOOTING

SYMPTOM	SOLUTION
<p>Low R.O. Water Production</p>	<p>Check water pretreatment equipment Improperly pretreated water can cause membrane to foul prematurely.</p> <p>Check pre-membrane pressure if pre-membrane pressure is not maintained between 120-200 psi loss in production will occur</p>
<p>Unable to Keep Pre-membrane Pressure between 120-200 psi</p>	<p>Check reject control valve With the R.O. running, completely shut off the reject control valve. Pressure should climb well above the minimum pressure. If pressure does not increase, pinch off R.O. drain hose. If pressure does not increase, the production pump needs to be repaired or replaced. If the pressure increases, the reject control valve needs to be replaced.</p> <p>Check feed water rates The R.O. Systems requires 15 psi feed water pressure. With low feed water pressure it may be difficult to maintain proper pre-membrane pressure.</p>
<p>Spot Free Water is Spotting (TDS is above 50)</p>	<p>Check raw water TDS If the raw water TDS is above 1000 the R.O. System may have to be recalibrated to a different recovery rate.</p> <p>Check product water TDS Test the product water as it is being made. Sample the water as it goes to the storage tank. If the TDS is high, it could mean that the membrane has been compromised.</p> <p>Check storage tank TDS The storage tank is an atmospheric storage container which can make it prone to contamination. Routine cleaning of the tank will eliminate this problem.</p>

16. TROUBLESHOOTING continued

SYMPTOM	SOLUTION
<p>Production Pump Won't Start</p>	<p>No power to R.O. System Check R.O. controller's display is working. If not, check the source power and make sure it is turned on.</p> <p>Blown fuse in control box Check if either of the fuses in the control box looks blown. If yes, then replace fuse.</p> <p>R.O Fault condition exists Check the R.O. controller display for messages. The Production Pump will not start for the displays of TANK FULL, LOW FEED PRESSURE, PRETREAT.</p>
<p>R.O display shows PRESS FAULT</p>	<p>Low water pressure to R.O Check to see if prefilter needs to be changed. Check to see if incoming water pressure to the R.O. system is at least 18 psi.</p> <p>Low water pressure switch Jump the pressure switch terminals on the control board. If pump operates replace low water pressure switch</p>
<p>R.O display shows TANK FULL when the storage tank is not</p>	<p>High level float switch is not working Using a jumper wire, jump the tank full high terminals on the control board. If the R.O. display does change to RO Running, check wires from control box to float switch. If wire is ok, replace high level float switch.</p>

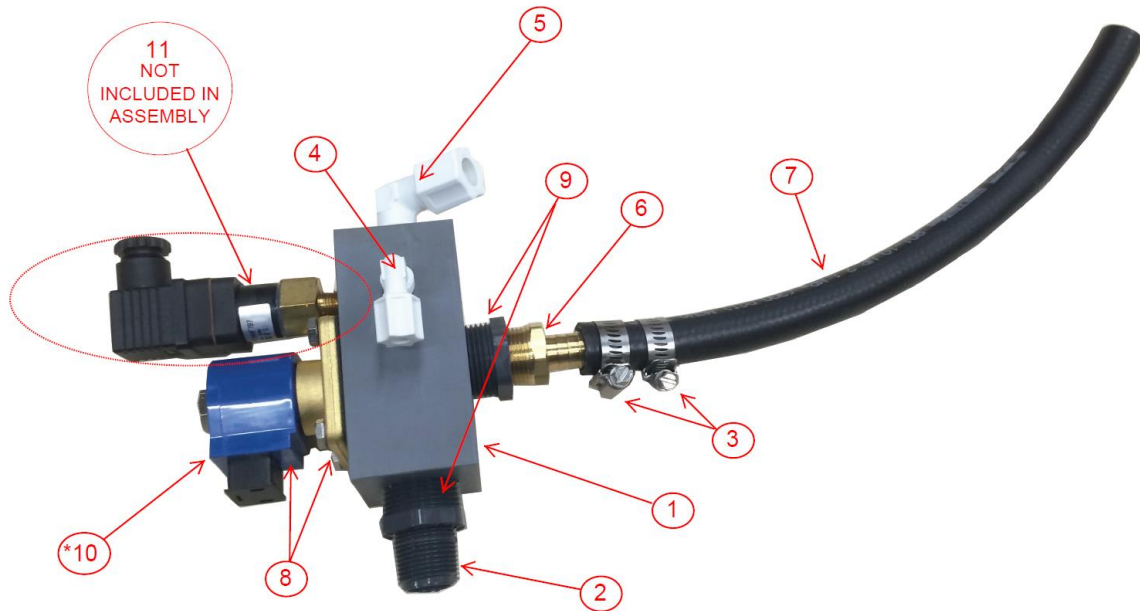
16. TROUBLESHOOTING continued

SYMPTOM	SOLUTION
<p>R.O display shows HIGH TDS</p>	<p>Check raw water TDS If the raw water TDS is above 1000 the R.O. System may have to be recalibrated to a different recovery rate.</p> <p>Check product water TDS Test the product water as it is being made. Sample the water as it goes to the storage tank. If the TDS is high it could mean that the membrane has fouled.</p> <p>Check storage tank TDS The storage tank is an atmospheric storage container which can make it prone to contamination. Routine cleaning of the tank will eliminate this problem.</p>
<p>Production Pump Won't Stop</p>	<p>High level float switch is not working Add a jumper wire the tank full high switch terminals on the control board. If the R.O. pump does not stop, replace the board in the R.O. controller. If the R.O. pump stops, replace high level float switch.</p>
<p>R.O System Flushes Continuously</p>	<p>Check the flush time setting on R.O Controller The flush time should be set for 2 or 4 minutes.</p> <p>Replace the control board</p>

17. SPARE PARTS LIST

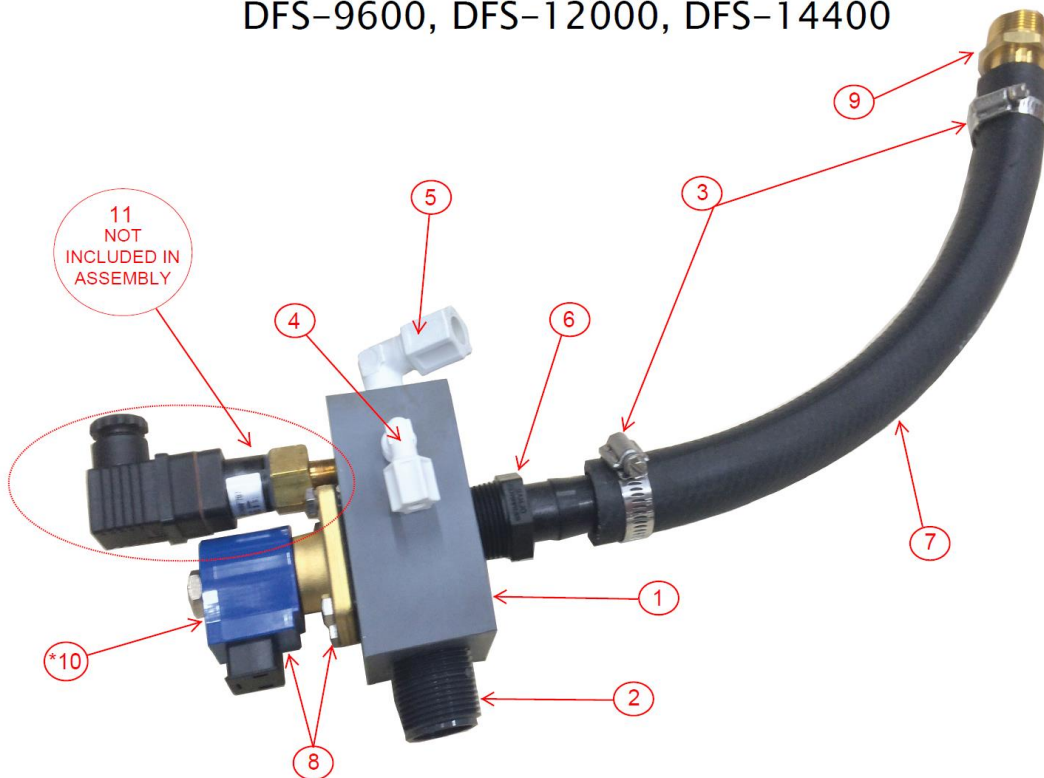
INLET BLOCK ASSEMBLY

DFS-2400, DFS-4800, DFS-7200



INLET BLOCK ASSEMBLY

DFS-9600, DFS-12000, DFS-14400



Diamond H2O

**N1022 Quality Drive / PO Box 170 / Greenville, WI 54942
Ph: (920) 757-5440 / (866) 757-9287 / Fax: (920) 757-5819**

Inlet Block Assembly

<u>DFS-2400, DFS-4800, DFS-7200</u>		
Assembly # 152-0024-XX		
	Part #	Description
1	64-0006-CP	Inlet Block
2	26-0016-PV	Nipple, 3/4 x Close, SCH80 PVC
3	75-0035-SS	Hose Clamp, Worm Gear, Size 1 (QTY 2)
4	10-0101-PP	Elbow, Male x Comp., 1/4, W/ Plastic Nut Gripper Nut
5	10-0070-XX	Elbow, Male x Comp., 1/2 x 1/2, W/ Plastic Gripper Nut
6	17-0159-BR	Barbed Adapter, 3/4 MPT x 5/8, Brass (QTY 2)
7	53-0093-XX	Hose, Push Lock, 5/8, Black (1 ft)
8	12-0108-XX	Kit, Solenoid, S211, 3/4, 220V AC Coil and Brass Bonnet
9	37-0052-PV	Bushing, 1 x 3/4, T x T, SCH80 PVC
*10	126-0002-XX	120V Coil (Used with 3ph Pumps)
11	65-0028-XX	Pressure Switch, W/DIN Connector *NOTE: PRESSURE SWITCH NOT INCLUDED IN ASSEMBLY

<u>DFS-9600, DFS-12000, DFS-14400</u>		
Assembly # 152-0025-XX		
	Part #	Description
1	64-0006-CP	Inlet Block
2	26-0021-PV	Nipple, 1 x Close, SCH80 PVC
3	75-0023-SS	Clamp, Hose, Worm Gear, Size 16, 1-1/2 (QTY 2)
4	10-0101-PP	Elbow, Male x Comp., 1/4, W/ Plastic Nut Gripper Nut
5	10-0070-XX	Elbow, Male x Comp., 1/2 x 1/2, W/ Plastic Gripper Nut
6	14-0060-PV	Barbed Adapter, 1 Male NPT x 1, Plastic
7	53-0086-XX	Hose, 1 ID, Goodyear Horizon (1 ft)
8	12-0108-XX	Kit, Solenoid, S211, 3/4, 220V AC Coil and Brass Bonnet
9	17-0159-BR	Barbed Adapter, 3/4 MPT x 5/8, Brass
*10	126-0002-XX	120V Coil (Used with 3ph Pumps)
11	65-0028-XX	Pressure Switch, W/DIN Connector *NOTE: PRESSURE SWITCH NOT INCLUDED IN ASSEMBLY

Parts List

Part Number	Description
65-0024-XX	Tank Level Switch
65-0025-XX	Inlet Pressure Switch (Low Limit Shutoff)
12-0108-XX	Feed Solenoid
	Flush Solenoid
	Main Power Fuse (110V)
	F1 3AG 20 Amp Little Fuse 314.020(P) (For 1HP motor)
	F1 3AG 20 Amp Little Fuse 312.004(P) (Motor contactor coil)
	Main Power Fuse (208/240V)
	F1 3AG 12 Amp Little Fuse 314.012(P) (For 2HP)
	F1 3AG 6 Amp Little Fuse 314.006(P) (For 1HP)
	Relay Fuse
	F2 3AG 2 Amp Little Fuse 312.002(P)
	Transformer Fuse
	F3 3AG 1/8Amp Little Fuse 312.125(P)
	Circuit Board, 240V
32-0016-XX	Terminal Block Board (Back)
32-0017-XX	Computer Board (Front)
	Fuse, 25mA, 250V
51-0021-XX	Solenoid Valve, 220 VAC
126-0001-XX	Solenoid Coil, 220 VAC
65-0004-XX	Pressure Switch, 220V
61-0007-XX	Pressure Gauge 0-300 psi (QTY 2)
61-0002-XX	Pressure Gauge 0-100 psi
75-0035-SS	Hose Clamp, Size 1
64-0006-CP	Inlet Block
152-0024-XX	Inlet Block Assembly DFS-2400, DFS-4800, DFS-7200
152-0025-XX	Inlet Block Assembly DFS-9600, DFS-12000, DFS-14400
64-0001-CP	Concentrate Block
30-0115-XX	Membranes 4X40
69-0001-BR	Pressure Regulator
51-0005-BR	Concentrate Valve
86-0001-FG	Membrane Housing

	DFS-2400
30-0021-XX	Prefilter 5 MIC 20"
54-0002-XX	Flow Meter, .5 - 5.0 GPM (QTY 2)
15-0066-XX	Pump, 1HP, 1 phase (STANDARD)
15-0060-XX	Pump, 1HP, 3 phase (NON-STANDARD)

	DFS-4800
--	-----------------

30-0021-XX	Prefilter 5 MIC 20"
54-0002-XX	Flow Meter, .5 - 5.0 GPM (QTY 2)
15-0066-XX	Pump, 1HP, 1 phase (STANDARD)
15-0060-XX	Pump, 1HP, 3 phase (NON-STANDARD)

	DFS-7200
30-0021-XX	Prefilter 5 MIC 20"
54-0002-XX	Flow Meter, .5 - 5.0 GPM
54-0013-XX	Flow Meter, 1 - 10 GPM
15-0059-XX	Pump, 1-1/2HP 1 phase (STANDARD)
15-0075-XX	Pump, 1-1/2HP 3 phase (NON-STANDARD)

	DFS-9600
30-0096-XX	Prefilter 25/5 MIC Dual Gradient 4.5" x 9.8"
54-0002-XX	Flow Meter, .5 - 5.0 GPM
54-0013-XX	Flow Meter, 1 - 10 GPM
15-0059-XX	Pump, 1-1/2HP 1 phase (STANDARD)
15-0075-XX	Pump, 1-1/2HP 3 phase (NON-STANDARD)

	DFS-12000
30-0096-XX	Prefilter 25/5 MIC Dual Gradient 4.5" x 9.8"
54-0013-XX	Flow Meter, 1 - 10 GPM (QTY 2)
15-0063-XX	Pump, 2HP, 1 phase (STANDARD)
15-0076-XX	Pump, 2HP, 3 phase (NON STANDARD)

	DFS-14400
30-0096-XX	Prefilter 25/5 MIC Dual Gradient 4.5" x 9.8"
54-0013-XX	Flow Meter, 1 - 10 GPM
54-0004-XX	Flow Meter, 2 - 20 GPM
15-0063-XX	Pump, 2HP, 1 phase (STANDARD)
15-0076-XX	Pump, 2HP, 3 phase (NON-STANDARD)

	DFS-18000
30-0096-XX	Prefilter 25/5 MIC Dual Gradient 4.5" x 9.8"
54-0013-XX	Flow Meter, 1 - 10 GPM
54-0004-XX	Flow Meter, 2 - 20 GPM
15-0063-XX	Pump, 3HP, 1 phase (STANDARD)
15-0080-XX	Pump, 3HP, 3 phase (NON-STANDARD)


18. LOG SHEET

Date	Permeate Flow	Concentrate Flow	Inlet Pressure	Pump Pressure	Membrane Pressure	Temp.	Permeate TDS	Feed TDS	Feed Hardness
	gpm	gpm	psi	psi	psi	F	ppm	ppm	


It is recommended that the log sheet is filled in everyday to help monitor the R.O. systems performance and to aid in troubleshooting.

Pre-filter cartridge should be changed each month.

Handheld TDS Monitor:
P/N: 36-0008-XX



Hardness Test Kit: (presence/absence)
P/N: 06-0006-XX



Hardness Test Kit: (drop, 1-30gpg):
P/N: 06-0007-XX





19. LIMITED WARRANTY

Diamond Commercial Reverse Osmosis System
(DARO, DWM, DFS Series)

Diamond Water Conditioning warrants to the original consumer / purchaser against defects in material and/or workmanship from the date of original Manufacture as follows:

Limited Warranty, covering materials and workmanship for 1 year from date of installation, subject to user's to compliance with manufacturers operating and maintenance instructions. Filter and Membranes are excluded by Warranty, and Diamond Waters responsibility is limited to any warranty provided by the filter or membranes manufacturer. Diamond Water shall not be liable for any special, incidental or consequential damages, and will, at its option, repair or replace any defective components.

Any parts used for replacement are warranted for the remainder of the original warranty period. THIS WARRANTY DOES NOT COVER DEFECTS CAUSED BY ACCIDENT, FIRE, FLOOD, ACTS OF GOD, MISUSE, MISAPPLICATION, OR NEGLIGENCE.

Shipping expenses to Diamond Water Conditioning at N1022 Quality Dr., Greenville, WI 54942 are the responsibility of the consumer. Diamond Water Conditioning will ship the repaired or new component at the consumer's expense and will not be responsible for any labor charges or other costs resulting from the removal or installation of the repaired or replaced part.

DIA/LIT/WAR

6/08/01