# REVERSE OSMOSIS SYSTEM

Wall Mount (Hinged) Design



# INSTALLATION, OPERATION, AND MAINTENANCE MAUAL

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# REVERSE OSMOSIS SYSTEM

## 1.  INTRODUCTION

The Diamond $H_2O$ Reverse Osmosis System produces high quality Permeate Water.  Permeate Water has a low Total Dissolved Solids (TDS) content.

The Diamond $H_2O$ 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:

Data manufactured:      _____

Model number:          _____          Pump Model Number:_____

Serial number:          _____          Pump Serial Number: _____

**Factory Performance:**

| | | |
|---|---|---|
| Feed water | _____ ppm TDS   @ | _____ $^oF$ |
| Product (permeate) TDS | _____ ppm | |
| %TDS rejection | _____ | |
| Product (permeate) rate | _____ gpm | |
| Drain (concentrate) rate | _____ gpm | |
| Operating pressure pre-membrane | _____ psi | |
| Post membrane | _____ psi | |
| Membrane array | _____ | |
| Flush time | _____ min. | |

### 2.2.   INSTALLATION DATA:

**Fill in after installation**

| | | |
|---|---|---|
| Feed water TDS | _____ ppm TDS   @ | _____ $^oF$ |
| Hardness | _____ | |
| Iron | _____ | |
| Misc. | _____ | |
| Product TDS | _____ ppm | |
| %TDS rejection | _____ | |
| Product rate | _____ gpm | |
| Drain rate | _____ gpm | |
| Operating pressure pre-membrane | _____ psi | |
| Post membrane | _____ 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 to the left side and allow at least 25 inches to the front for the removal of the entire membrane housing.

## 3.2.    MOUNTING

Secure Mounting Bracket to wall.  Take care to keeping the bracket level.  Use appropriate hardware to support 150 pounds.  After the Mounting Bracket is fully secure, lift the RO unit on to Bracket as shown is the drawing below.  After the R.O. unit is hung, install appropriate hardware into the bottom mounting hole.

Top Mounting Holes

Mounting Bracket

Side RO Frame into Slot on Bracket as Shown

Bottom Mounting Hole
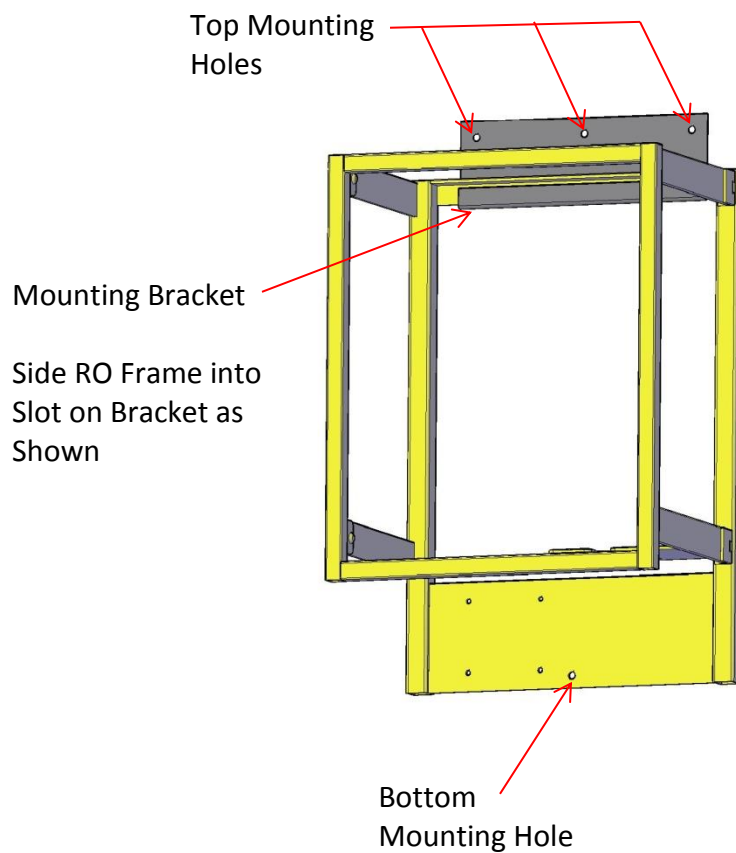
# 3. INSTALLATION continued

## 3.3.   PLUMBING

The feed water source must be able to provide adequate water quantity (see page 7 for Feed Water Specifications) and maintain an operating water pressure of 25 to 80 psi, which does not exceed 105$^{o}$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 7.

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 or PVC pipe, or stainless steel pipe or tubing.  The storage tank inlet should be as high as possible.

Permeate
Water Outlet

Concentrate
Water Outlet

Feed Water
Inlet

Back of Panel
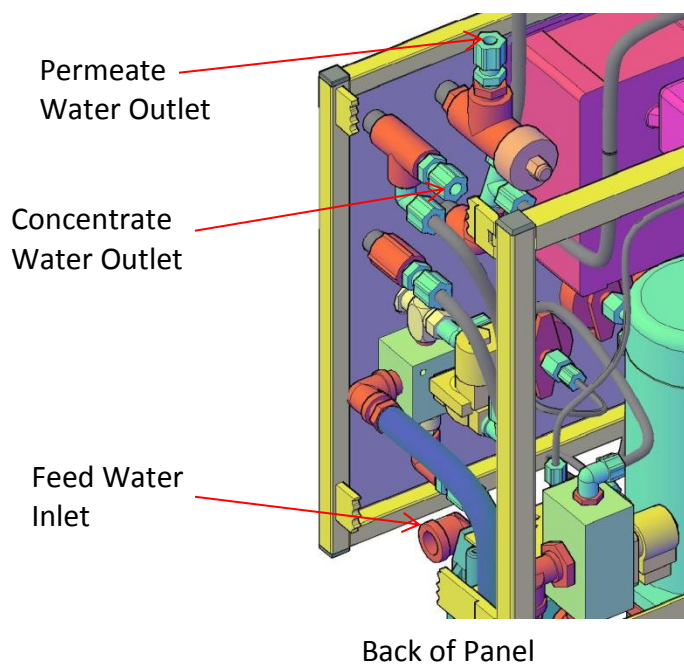
**CAUTION:**  Permeate water is corrosive.  Brass, bronze or carbon steel pipe should **never** be used.

**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.

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# 3.  INSTALLATION continued

## 3.3.    ELECTRICAL

The R.O. system use requires single-phase 120V/220 volt at 60 hertz, and is equipped with a 10 foot electrical cord.

The motors used are available in single-phase 120/220 volt at 60 hertz or three-phase 220 volt at 50/60 hertz at an additional charge.

**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) between the Carbon Filter Control Valve and 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 18 to prevent rewiring problems.

## 4.  FEED WATER SPECIFICATIONS

| | | | |
|---|---|---|---|
| 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 |
| Feed SDI | < 3.0 | pH | 3 – 10 |
| Free Chlorine | 0.1 ppm | Temperature | $40 - 95^{o}F$ |
| 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 | $113^{o}F$ |

## 6.  SYSTEM SPECIFICATIONS

| MODEL # | DFS 2400 | DFS 4800 |
|---|---|---|
| RO Membrane | 4" x 40" TFM | 4" x 40" TFM |
| Element No. | 1 | 2 |
| Array | 1 | 1/1 |
| Pump | 1 HP | 1 HP |
| Inlet Size | 3/4" NPT | 3/4" NPT |
| Permeate Size | 3/8" | 1/2" |
| Drain Size | 3/8" | 3/8" |
| Permeate | 1.7 GPM | 3.3 GPM |
| Concentrate | 1.2 to 0.6 GPM | 2.4 to 1.2 GPM |
| Power Options* (Voltage, Phase, Max Load Amps) | 120 V, 1 PH, 19.2 A<br>220 V, 1 PH, 9.6 A<br>230 V, 3 PH, 4.7 A<br>460 V, 3 PH, 2.35 A | 120 V, 1 PH, 19.2 A<br>220 V, 1 PH, 9.6 A<br>230 V, 3 PH, 4.7 A<br>460 V, 3 PH, 2.35 A |

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

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## 7.  FEED WATER PRETREATMENT

Diamond $H_2O$ 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.

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## 9. REVERSE OSMOSIS TERMS

**R.O.:** Reverse Osmosis, this is the process of passing 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.

% Recovery = (Permeate Water / Feed Water) x 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.

% Rejection = (Feed TDS – Permeate TDS / Feed TDS) x 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.

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# 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**.**

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## 11.    REVERSE OSMOSIS SYSTEM FLOW DIAGRAM
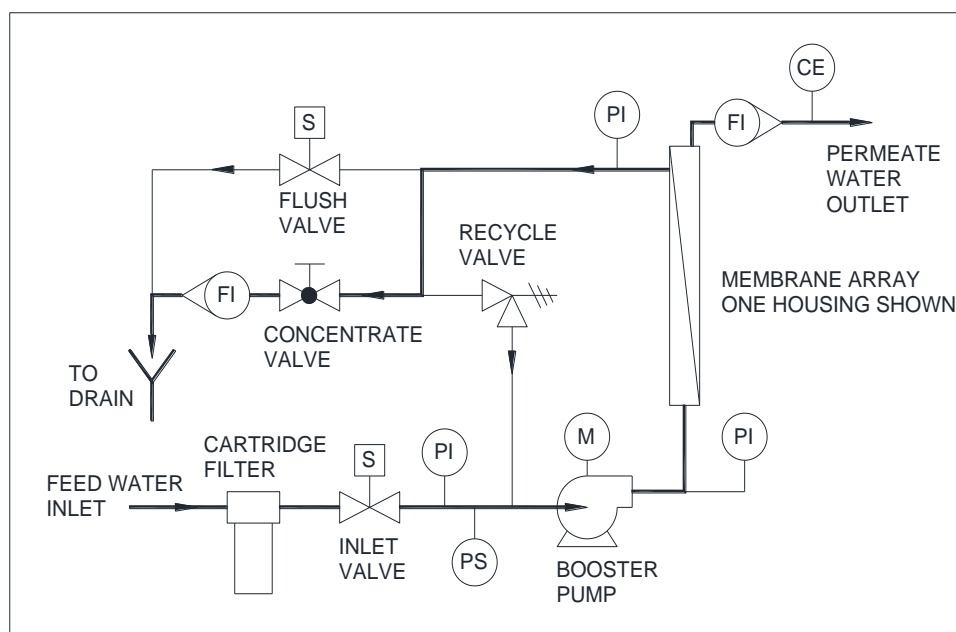


Figure 1

**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.

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## 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 and the RO Pump will turn on.

**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.

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# 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


# 14.    RO SYSTEM MAINTENANCE GUIDE

As part of a routine preventative maintenance program, it is suggested that performance data or your Diamond H$_2$O 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.  There is a performance data log included in this manual on page 35.

## 14.1.    REPLACE PRE-FILTER CARTRIDGES:

The standard 'Rule of Thumb' is that once a month the 5 Micron pre-filter should be replace.  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.

**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.

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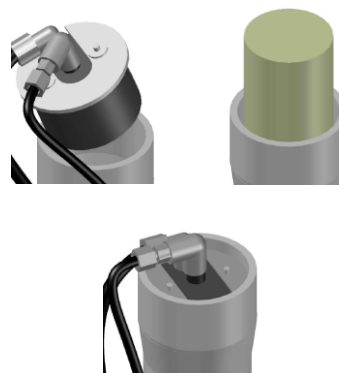
## 14.4.  MEMBRANE ELEMENT REPLACEMENT Continued

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 <span style="color:red">non-petroleum</span> based lubricate (ie. 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 <span style="color:red">non-petroleum</span> 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.

Membrane Seal

Flow Direction

Membrane Seal

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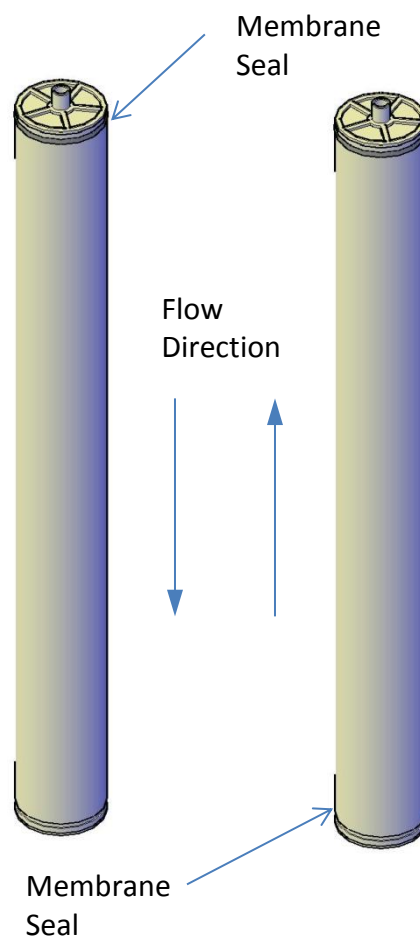
# 15. SYSTEM CONTROLLER

## 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 µs |
| | (Resistivity to 20M ohm available with Resistivity Cell) |
| Feed Conductivity (opt): | 0-3000* PPM, 0-6000 µs |
| | *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

## CIRCUIT PROTECTION

**Main Power Fuse (110V):**

| | | | | |
|---|---|---|---|---|
| F1 | 3AG | 20 Amp | LittleFuse 314.020(P) | (For 1HP motor) |
| F1 | 3AG | 12 Amp | LittleFuse 314.012(P) | (For .5 – .75 HP motor) |
| F1 | 3AG | 4 Amp | LittleFuse 312.004(P) | (Motor contactor coil) |

**Main Power Fuse (208/240V):**

| | | | | |
|---|---|---|---|---|
| F1 | 3AG | 12 Amp | LittleFuse 314.012(P) | (For 2HP) |
| F1 | 3AG | 6 Amp | LittleFuse 314.006(P) | (For 1 HP) |

**Relay Fuse:**

| | | | |
|---|---|---|---|
| F2 | 3AG | 2 Amp | LittleFuse 312.002(P) |

**Transformer Fuse:**

| | | | |
|---|---|---|---|
| F3 | 3AG | 1/8 Amp | LittleFuse 312.125(P) |

## OTHER:

| | |
|---|---|
| Dimensions: | 13.5" tall, 11.4" wide, and 6.7" deep. Nema 4X non-metallic. |
| Weight: | 6 lb. (Basic Configuration, not including optional motor contactors, etc.) |
| Environment: | 0-50°C, 10-90%RH (non-condensing) |

# FIGURE 1.  SIMPLIFIED SCHEMATIC

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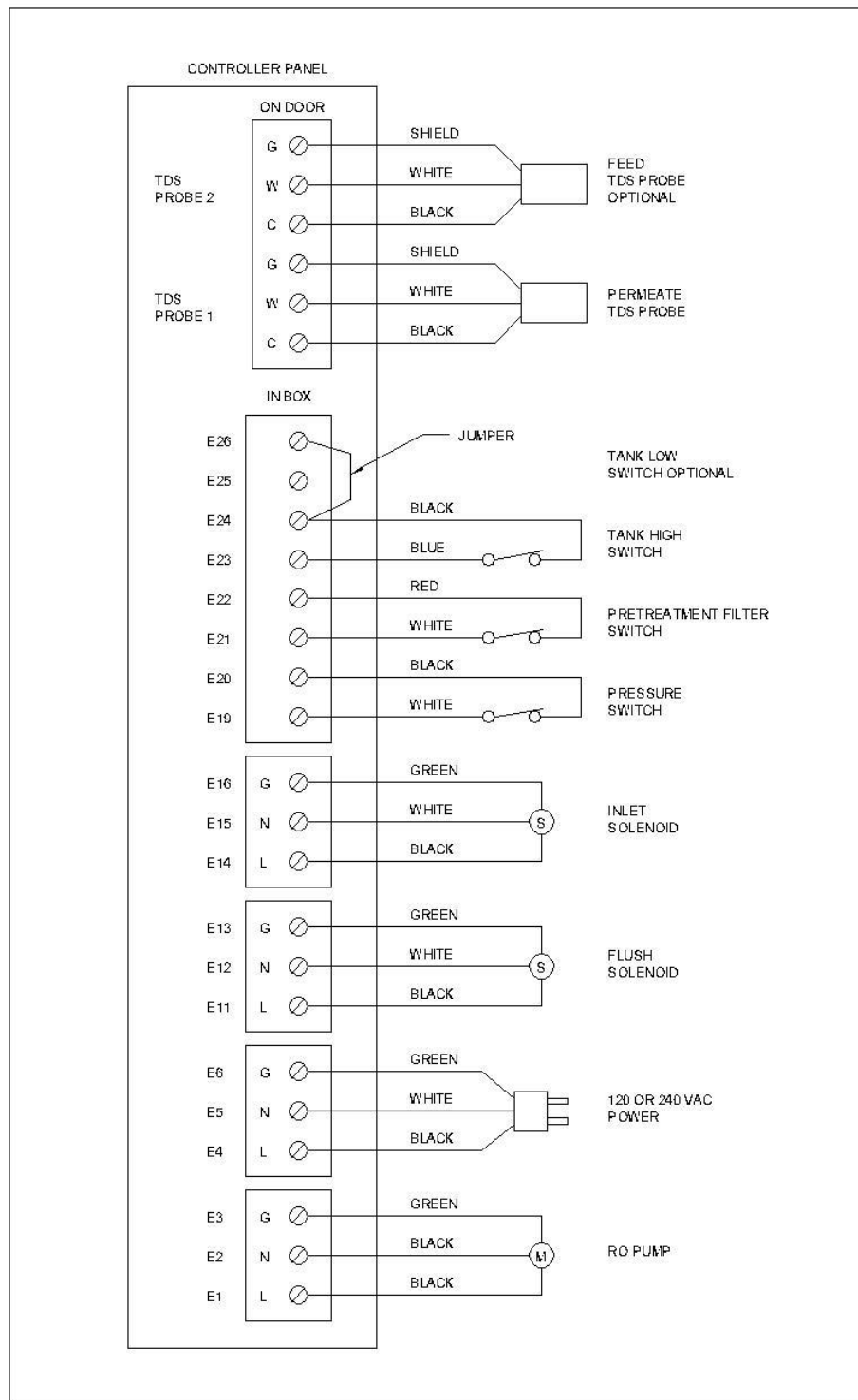
## FIGURE 2. CONTROLLER OVERVIEW

**Display.**

System ON/OFF,

Up Arrow

Down Arrow

Manual Run,
Manual Flush
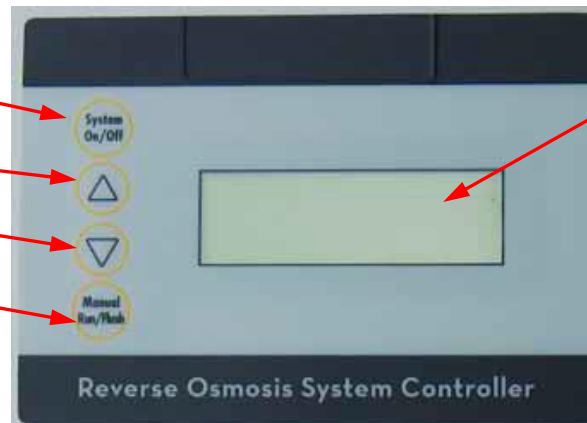


**Display.** (4 line, 20 character) Clear, concise feedback on the RO's status

**Alarm.** Display backlight flashes along with audible beeper to indicate alarm condition.



CPU Board (CPU-3)

Conductivity Probe Connections

Terminal Board (TB-1)

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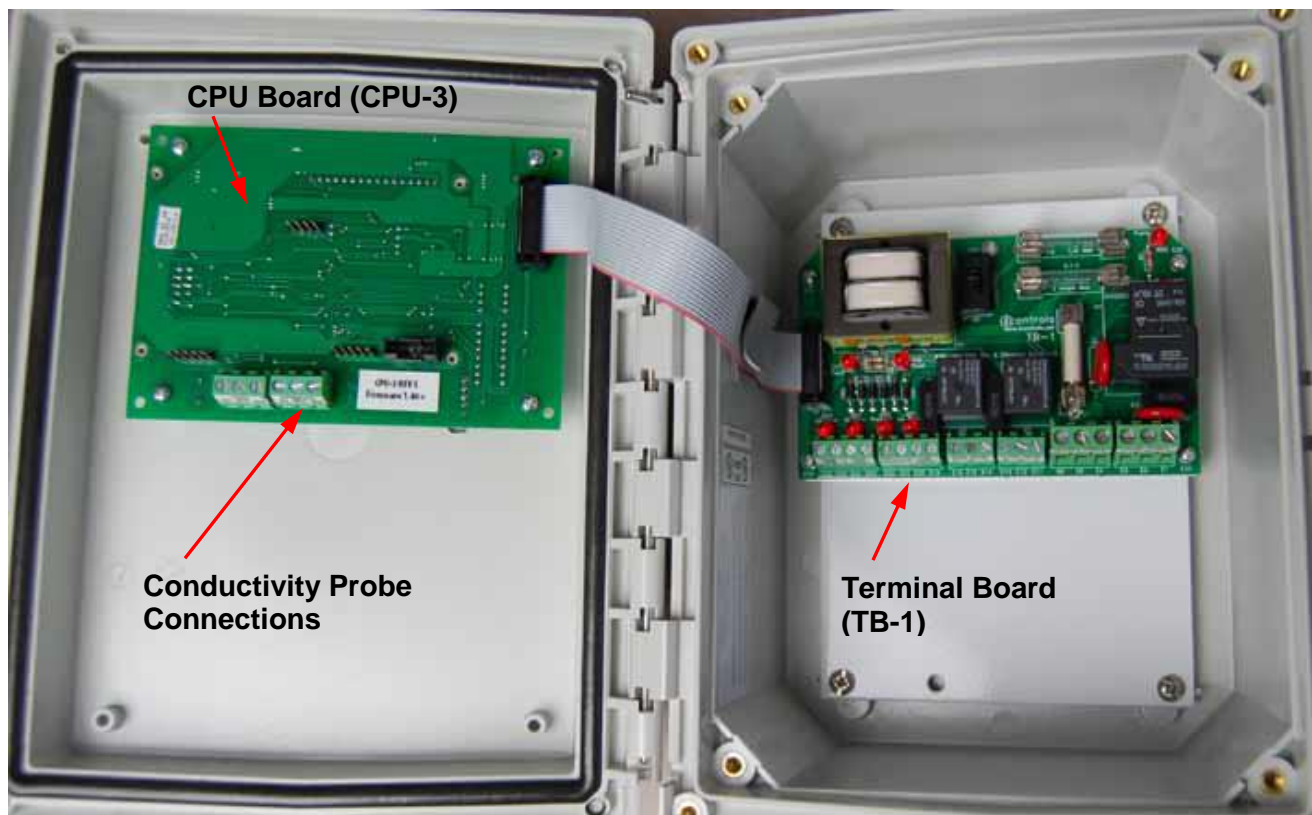
# FIGURE 3. CONTROLLER DETAIL: CPU-3

Typical Configuration
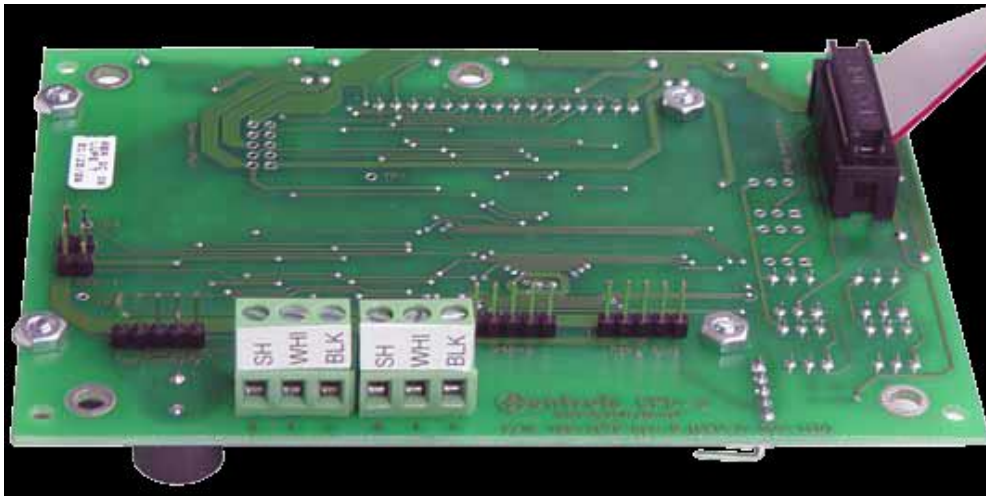


**Cable to Terminal Board**

**Shield White Black**

**Permeate Conductivity Probe**

Detailed View
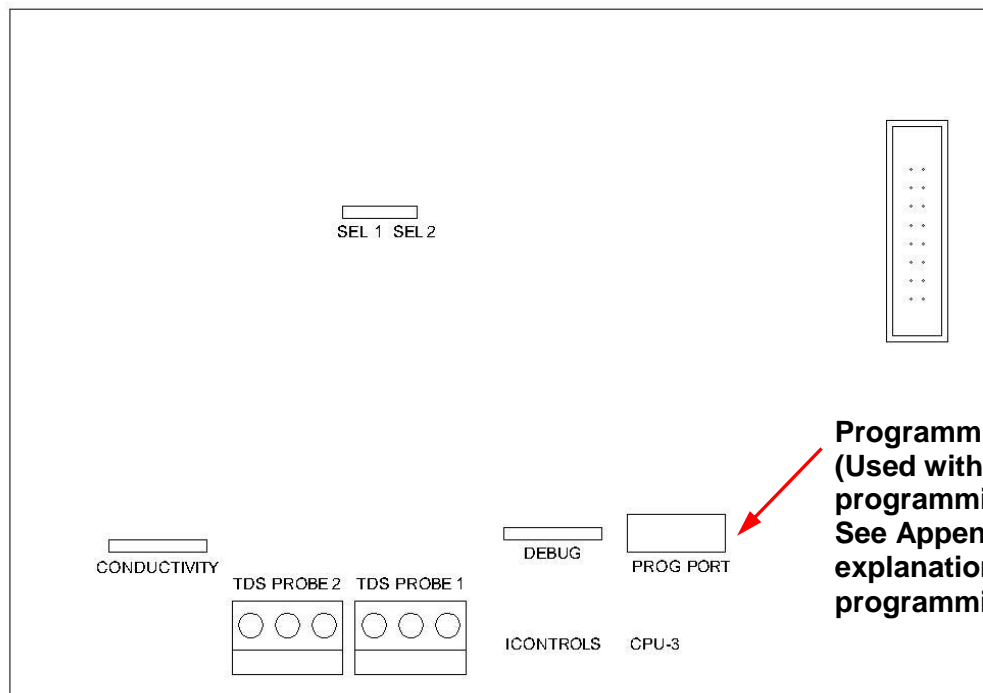


**Main interface port connects via ribbon to Terminal Board.**

**Programming Port. (Used with optional programming interface) See Appendix B for explanation of the programming interface**

**Optional Feed Conductivity Probe**

**Shield White Black**

**Shield White Black**

**Permeate Conductivity Probe**

# FIGURE 4.  CONTROLLER DETAIL:  TB-1 (See Fig. 1 for schematic)

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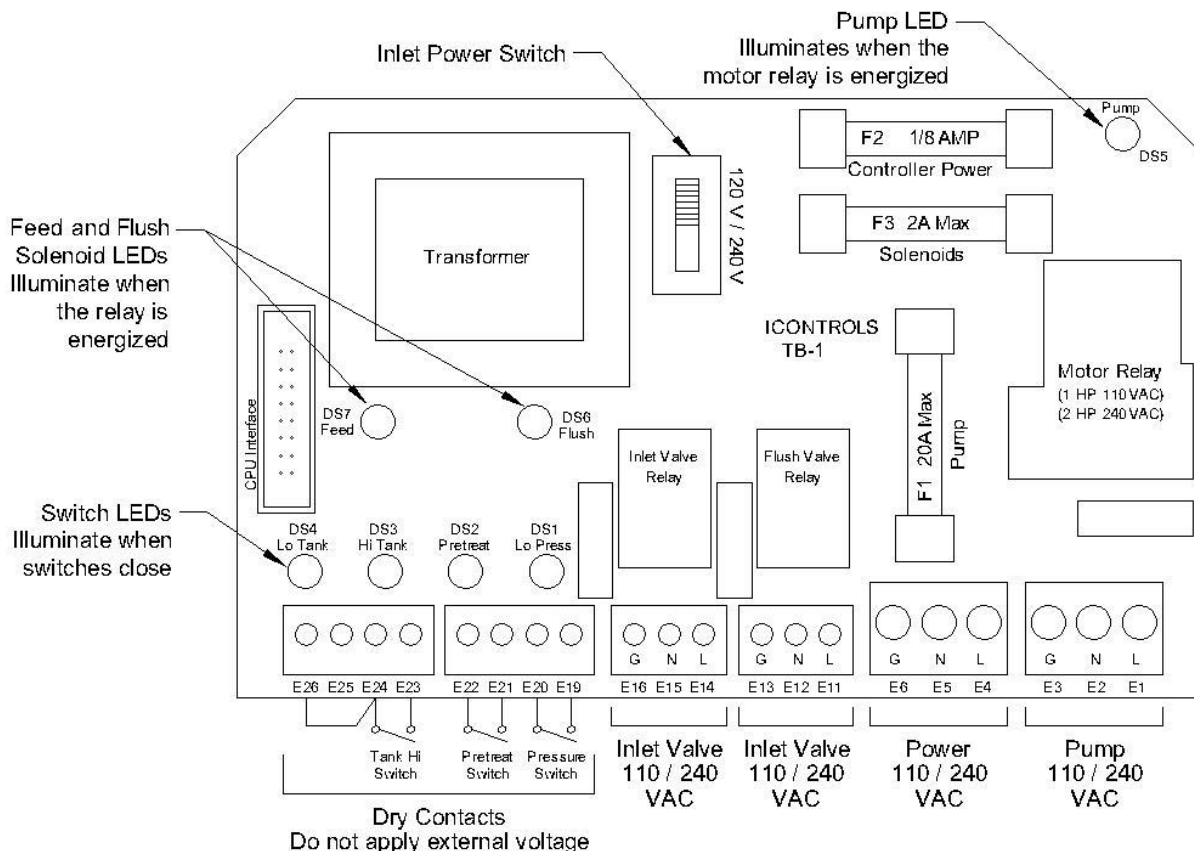
## FIGURE 5. CONDUCTIVITY PROBE INSTALLATION

**Flow**

**Install the Conductivity Probe in the "Run" of a Tee.  Orient the probe so air cannot become trapped in the area near the probe.**

**Conductivity Probe**

**Flow**
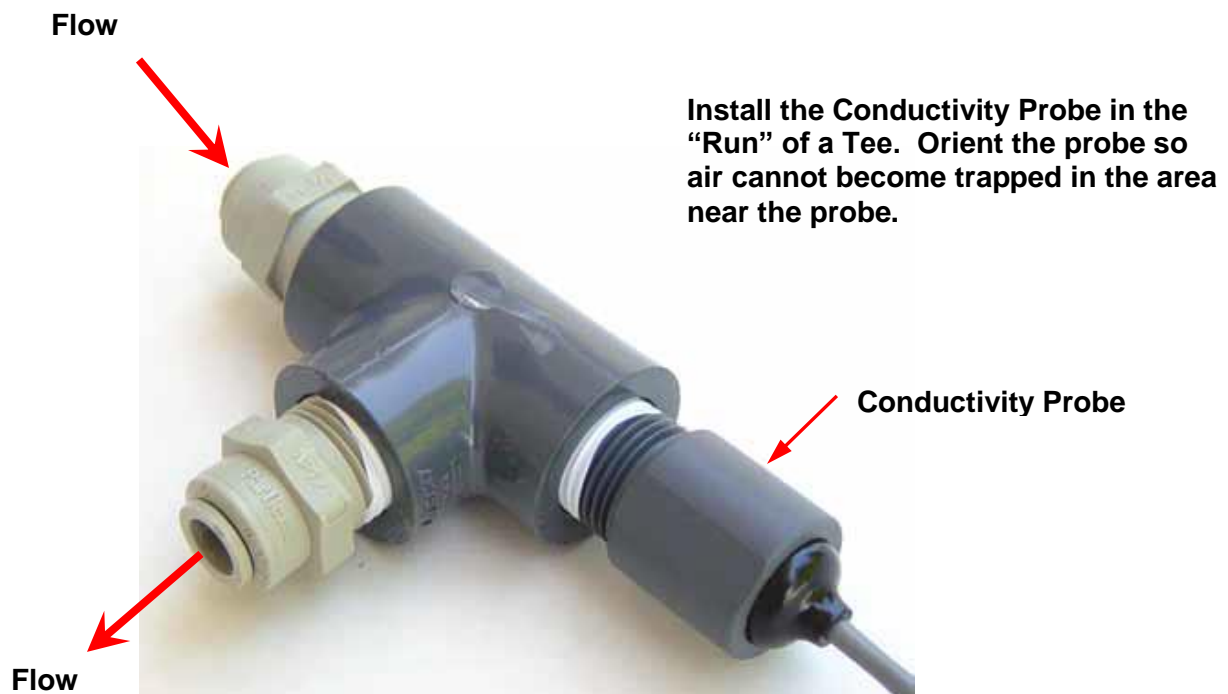
## CONTROLLER POWER FUSE VALUES

|         | 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 |

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# FIGURE 6. CONTROLLER PROGRAMMING. ACCESSING THE HIDDEN MENUS.

1. With the System ON, Press and Hold the UP and Down Arrows.

2. With the UP and Down Arrows depressed, press the System On/Off Switch. The menu will switch to the RO Presets menu shown in Figure 7.
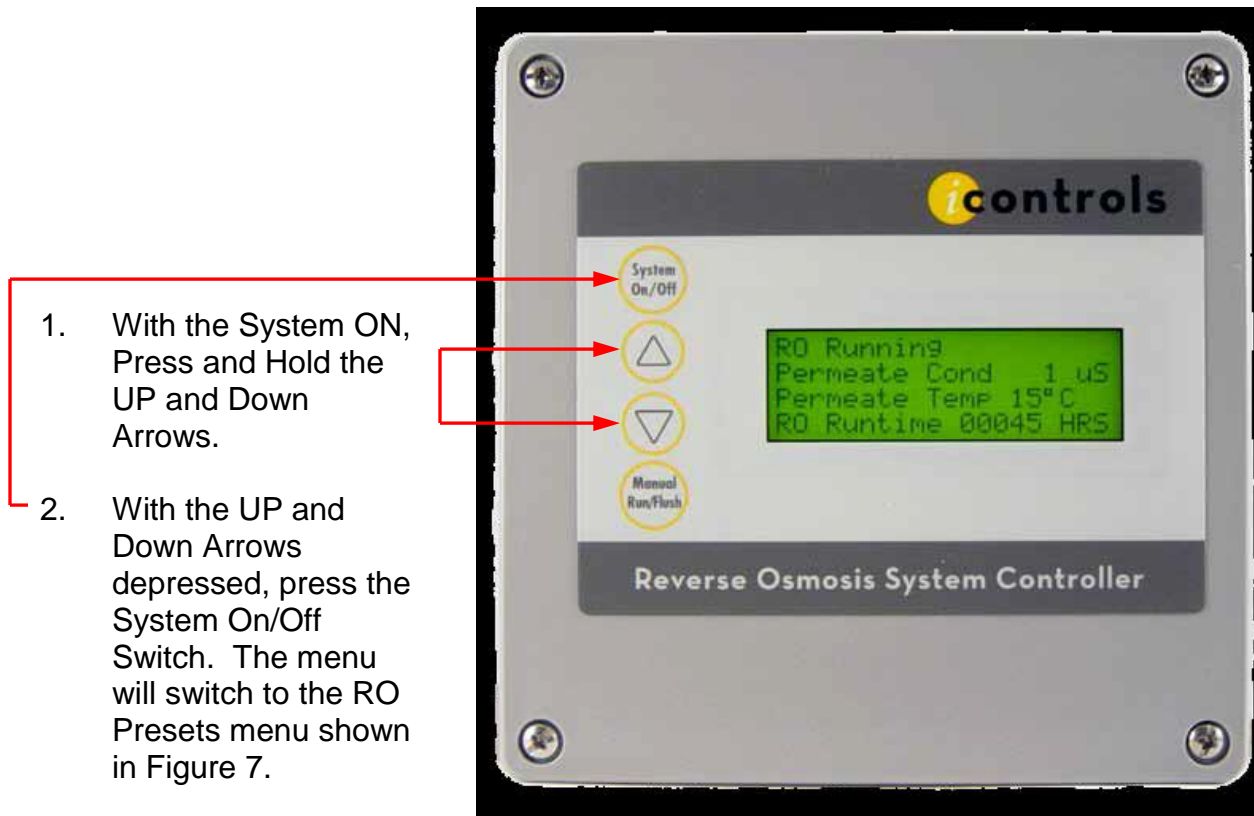
## TABLE 2. CONTROLLER PROGRAMMING: PROGRAM SELECTIONS

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.

- For high feed TDS and two minute flushes use Program 1.
- For low feed TDS and two minute flushes use Program 2.
- For high feed TDS and four minute flushes use Program 3.
- For low feed TDS and four minute flushes use Program 4.
- See the following 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 effect on the RO's operation.

| Parameter | Value | Program 1 | Program 2 | Program 3 | Program 4 |
|---|---|---|---|---|---|
| Tank Level Switch delay (actuation and de-actuation) | Seconds | 5 | 5 | 5 | 5 |
| Pressure Switch delay (actuation and de-actuation) | Seconds | 5 | 5 | 5 | 5 |
| Pretreat Switch delay (actuation and de-actuation) | Seconds | 2 | 2 | 2 | 2 |
| Pump start delay | Seconds | 15 | 15 | 15 | 15 |
| Inlet Solenoid stop delay | Seconds | 2 | 2 | 2 | 2 |
| Pump start retry interval | Seconds | 60 | 60 | 60 | 60 |
| # of Low pressure fault till shutdown, | Faults | 9 | 9 | 9 | 9 |
| Time period to count faults till shutdown | Minutes | 30 | 30 | 30 | 30 |
| Reset after low pressure fault shutdown | Minutes | 30 | 30 | 30 | 30 |
| Low pressure restart timeout fault | Seconds | 120 | 120 | 120 | 120 |
| **Flush Behavior** | | | | | |
| Time from last flush before Flush on Shutdown | Minutes | 0 | 0 | 0 | 0 |
| Minimum operation before Flush on Shutdown | Minutes | 30 | 60 | 30 | 60 |
| Flush duration on Shutdown | Seconds | 120 | 120 | 240 | 240 |
| Periodic Flush interval | Minutes | 0 | 0 | 0 | 0 |
| Periodic Flush duration | Seconds | 0 | 0 | 0 | 0 |
| Unit Idle Flush interval | Hours | 0 | 0 | 0 | 0 |
| Unit Idle Flush duration | Seconds | 0 | 0 | 0 | 0 |
| Timed Manual Run | Minutes | 5 | 5 | 5 | 5 |
| Timed Manual Flush | Minutes | 2 | 2 | 5 | 9 |
| Conductivity Probe Sample Rate | Seconds | 2 | 2 | 2 | 2 |
| Conductivity Shutdown | Minutes | 0 | 0 | 0 | 0 |

RO Pump will run on flush.

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# FIGURE 7. CONTROLLER PROGRAMMING: MENU NAVIGATION

| | | |
|---|---|---|
| **RO Preset Program 1**<br><br>▼ ▲ for Other Menus<br>Manual = Edit  Svs = Save | RO Preset Program  1<br><br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | **VALUES**<br>**1, 2, 3, 4** |
| System On/Off  ▽  ▽  Manual Run/Flush | System On/Off  ▽  ▽  Manual Run/Flush | → Save – Return to RO Display |
| **Permeate Probe = uS**<br>## uS \| ##°C<br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | Permeate Probe = uS<br>## uS \| ##°C<br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | **VALUES**<br>**uS, PPM, None** |
| System On/Off  ▽  ▽  Manual Run/Flush | System On/Off  ▽  ▽  Manual Run/Flush | → Save – Return to RO Display |
| **Cal. Permeate Probe**<br>## uS \| ##°C<br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | Cal. Permeate Probe<br>## uS \| ##°C<br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | **VALUES**<br>**0 - 999** |
| System On/Off  ▽  ▽  Manual Run/Flush | System On/Off  ▽  ▽  Manual Run/Flush | → Save – Return to RO Display |
| **Permeate Alarm Value**<br>50 uS  (## ppm)<br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | Permeate Alarm Value<br>50 uS  (## ppm)<br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | **VALUES**<br>**0 – 999, Disabled** |
| System On/Off  ▽  ▽  Manual Run/Flush | System On/Off  ▽  ▽  Manual Run/Flush | → Save – Return to RO Display |
| **Feed Probe = None**<br><br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | Feed Probe = None<br><br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | **VALUES**<br>**uS, PPM, None** |
| System On/Off  ▽  ▽  Manual Run/Flush | System On/Off  ▽  ▽  Manual Run/Flush | → Save – Return to RO Display |
| **LCD Brightness  10**<br><br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | LCD Brightness  10<br><br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | **VALUES**<br>**0 - 15** |
| System On/Off  ▽  ▽  Manual Run/Flush | System On/Off  ▽  ▽  Manual Run/Flush | → Save – Return to RO Display |
| **LCD Contrast  15**<br><br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | LCD Contrast  15<br><br>▼ ▲ for Other Menus<br>Manual = Edit  Sys = Save | **VALUES**<br>**0 - 15** |
| System On/Off  ▽  ▽  Manual Run/Flush | System On/Off  ▽  ▽  Manual Run/Flush | → Save – Return to RO Display |

## APPENDIX A. CONTROLLER PROGRAMMING: PARAMETERS EXPLAINED

| Parameter | Value | Range | Example |
|---|---|---|---|
| **Input Switch Behaviors** | | | |
| Tank Level Switch delay (actuation and de-actuation) | Seconds | | 5 |
| *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.* | | | |
| Pressure Switch delay (actuation and de-actuation) | Seconds | | 5 |
| *This specifies the time that the pressure switch must be closed or open before the controller accepts it as a valid condition. Since pressure switches usually have built-in hysteresis this value is set at 0.* | | | |
| Pretreat Switch delay (actuation and de-actuation) | Seconds | | 2 |
| *This is the time that the pretreat switch must be OPEN before the controller accepts it as a valid condition.* | | | |
| | | | |
| **Pump/Inlet Solenoid Behaviors** | | | |
| Pump start delay | Seconds | | 15 |
| *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.* | | | |
| Inlet Solenoid stop delay | Seconds | | 2 |
| *This value sets the delay for the inlet solenoid valve to be de-energized following the de-energizing 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.* | | | |
| | | | |
| **Low Inlet Pressure Behaviors** | | | |
| Pump start retry interval (restart delay after LP fault) | Seconds | | 60 |
| *When the inlet pressure switch opens, the controller de-energizes 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.* | | | |
| Low pressure fault shutdown, # of faults | Faults | | 9 |
| Low pressure fault shutdown, time period to count faults | Minutes | | 30 |
| Low pressure fault shutdown, reset after shutdown | Minutes | | 30 |
| *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.* | | | |
| Low pressure timeout fault | Seconds | | 120 |
| *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.* | | | |

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## APPENDIX A. CONTROLLER PROGRAMMING: PARAMETERS EXPLAINED

| Flush Behavior | Value | Range | Example |
|---|---|---|---|
| Time from last flush before Flush on Shutdown | Minutes | | 0 |
| Minimum operation before Flush on Shutdown | Minutes | | 60 |
| Flush duration on Shutdown | Seconds | | 120 |
| Periodic Flush interval | Minutes | | 0 |
| Periodic Flush duration | Seconds | | 0 |
| Unit Idle Flush interval * | Minutes | | 0 |
| *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.* | | | |
| Unit Idle Flush duration * | Seconds | | 0 |
| *Sets the duration of the Idle Flush. (0)=disabled* | | | |
| | | | |
| Timed Manual Run - Duration of Manual Run | Minutes | | 5 |
| Timed Manual Flush - Duration of Manual Flush | Minutes | | 2 |
| Conductivity Probe Sample Rate | Seconds | | 2 |
| Conductivity Shutdown *  *(0)=disabled* | Minutes | | 0 |

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## 16. TROUBLESHOOTING

| SYMPTOM | SOLUTION |
|---|---|
| **Low R.O. Water Production** | **Check water pretreatment equipment**<br>Improperly pretreated water can cause membrane to foul prematurely.<br><br>**Check pre-membrane pressure**<br>if pre-membrane pressure is not maintained between 120-200 psi loss in production will occur |
| **Unable to Keep Pre-membrane Pressure between 120-200 psi** | **Check reject control valve**<br>With the R.O. running, completely shut off the reject control valve. Pressure should climb well above the minimum pressure.<br>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.<br>If the pressure increases, the reject control valve needs to be replaced.<br><br>**Check feed water rates**<br>The R.O. Systems requires 50 psi feed water pressure. With low feed water pressure it may be difficult to maintain proper premembrane pressure. |
| **Spot Free Water is Spotting** ( TDS is above 40) | **Check raw water TDS**<br>If the raw water TDS is above 1000 the R.O. System may have to be recalibrated to a different recovery rate.<br><br>**Check product water TDS**<br>Test the product water as it is being made. Sample the water as it goes to the storage tank.<br>If the TDS is high it could mean that the membrane has fouled.<br><br>**Check storage tank TDS**<br>The storage tank is an atmospheric storage container which can make it prone to contamination. Routine cleaning of the tank will eliminate this problem. |

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# 16.   TROUBLESHOOTING continued

| SYMPTOM | SOLUTION |
|---|---|
| **Production Pump Won't Start** | **No power to R.O. System**<br>Check R.O. controller's display is working.  If not, check the source power and make sure it is turned on.<br><br>**Blown fuse in control box**<br>Check if either of the fuses in the control box looks blown.<br>If yes, then replace fuse.<br><br>**R.O Fault condition exists**<br>Check the R.O. controller display for messages.  The Production Pump will not start for the displays of TANK FULL, HIGH TDS, PRESS FAULT, MEMBRANE FLUSH, PRETREAT. |
| **R.O display shows PRESS FAULT** | **Low water pressure to R.O**<br>Check to see if prefilter needs to be changed.<br>Check to see if incoming water pressure to the R.O. system is at least 18 psi.<br><br>**Low water pressure switch**<br>Jump the pressure switch terminals on the control board.<br>If pump operates replace low water pressure switch |
| **R.O display shows TANK FULL when the storage tank is not** | **High level float switch is not working**<br>Using a jumper wire, jump the tank full high terminals on the control board.<br>If the R.O. display does not change to TANK FULL 99, check wires from control box to float switch.<br>If wire is ok, replace high level float switch. |

## 16.   TROUBLESHOOTING continued

| SYMPTOM | SOLUTION |
|---|---|
| **R.O display shows HIGH TDS** | **Check raw water TDS**<br>If the raw water TDS is above 1000 the R.O. System may have to be recalibrated to a different recovery rate.<br><br>**Check product water TDS**<br>Test the product water as it is being made.  Sample the water as it goes to the storage tank.<br>If the TDS is high it could mean that the membrane has fouled.<br><br>**Check storage tank TDS**<br>The storage tank is an atmospheric storage container which can make it prone to contamination.  Routine cleaning of the tank will eliminate this problem. |
| **Production Pump Won't Stop** | **High level float switch is not working**<br>Remove the wire to the tank full high terminals on the control board.<br>If the R.O. pump does not stop, replace the board in the R.O. controller.<br>If the R.O. pump stops, replace high level float switch. |
| **R.O System Flushes Continuously** | **Check the flush time setting on R.O Controller**<br>The flush time should be set for 1.5 minutes per membrane.<br><br>**Replace the control board** |

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## 17.    SPARE PARTS LIST

| Part Number | Description |
|---|---|
| | **Circuit Board, 240V** |
| 32-0016-XX | Terminal Block Board (Back) |
| 32-0017-XX | Computer Board (Front) |
| | |
| 65-0024-XX | Tank Level Switch |
| 65-0028-XX | Inlet Pressure Switch (Low Limit Shutoff) |
| 12-0108-XX | Inlet Solenoid |
| 51-0021-XX | Flush Solenoid |
| 126-0001-XX | Solenoid Coil, 220 VAC |
| 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 DWM |
| 64-0001-CP | Flush Block |
| 152-0028-XX | Flush Block Assembly DWM |
| 30-0115-XX | Membranes 4X40 |
| 69-0001-BR | Pressure Regulator |
| 51-0005-BR | Concentrate Valve |
| 86-0001-FG | Membrane Housing With Caps |
| 53-0005-XX | 1/2" OD Poly Hose |
| 53-0093-XX | 5/8" Black Push Lock Hose |
| 53-0017-XX | 3/8" Poly Hose |
| 75-0021-XX | 3/4" Clamps |
| | |
| | |
| | **DWM-2400 & 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) |

# INLET BLOCK ASSEMBLY
**Assembly # 152-0027-XX**

|     | Part #      | Description                                        |
|-----|-------------|----------------------------------------------------|
| 1   | 64-0006-CP  | Inlet Block, Clear Flo                             |
| 2   | 12-0108-XX  | Solenoid, 3/4, 220V                                |
| 3   | 10-0010-BR  | St. Elbow, 3/4" Brass                              |
| 4   | 37-0052-PV  | Bushing, 1" x 3/4" TxT PVC                         |
| 5   | 37-0015-PV  | Bushing, 1/2" x 3/8" TxT PVC                       |
| 6   | 10-0101-PP  | Elbow, 1/4" Male x Compression                     |
| 7   | 10-0129-PP  | Elbow, 3/8" Male x Compression                     |
| 8   | 17-0159-BR  | Barbed Adapter, 3/4" MPT x 5/8" Barb, Brass        |
| 9   | 26-0016-PV  | Nipple 3/4" Close PVC                              |
| *10 | 65-0028-XX  | Pressure Switch, W/DIN Connector                   |
|     |             | ***Pressure Switch Not Included in Assembly***     |
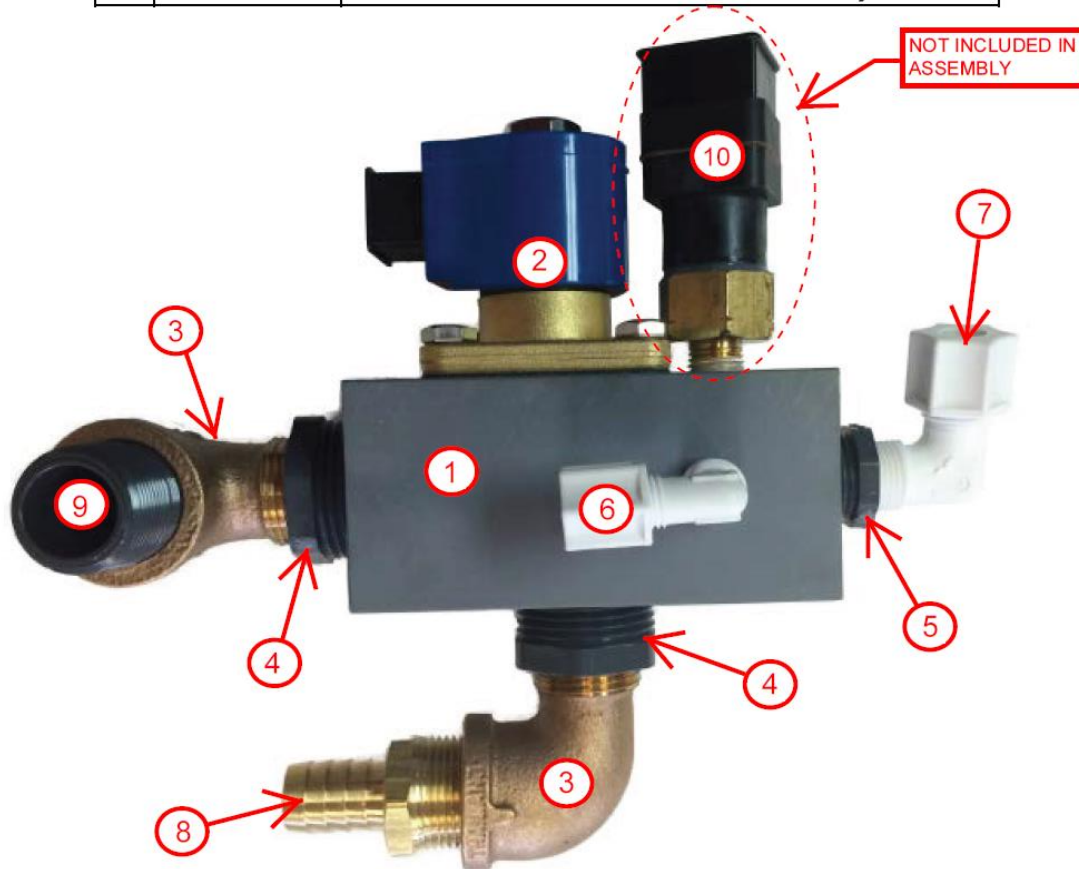


NOT INCLUDED IN ASSEMBLY

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## FLUSH BLOCK ASSEMBLY
### Assembly # 152-0028-XX

| | Part # | Description |
|---|---|---|
| 1 | 64-0001-PV | Flush Block |
| 2 | 51-0021-XX | Solenoid Valve, 2 way, NC, 1/2" 220V |
| 3 | 51-0005-BR | Concentrate Valve, 3/8" Male Brass |
| 4 | 69-0001-BR | Recycle Valve, 3/8" Inlet/Outlet 10gpm |
| 5 | 10-0070-XX | 1/2"x1/2" Male x Compression Elbow |
| 6 | 42-0024-PP | 3/8" x 1/2" Male x Compression |
| 7 | 10-0101-PP | 1/4" x 1/4" Male x Compression Elbow |
| 8 | 17-0160-BR | Barbed Adapter, 1/2" MPT x 5/8" Barb |
| 9 | 26-0024-BR | 1/2" x Close Nipple (Qty 2) |
| 10 | 10-0021-BR | 1/2" 90 Brass Threaded |
| 11 | 26-0015-BR | 3/8" x Close Nipple Brass |
| 12 | 10-0063-PV | 3/8" 90 PVC Threaded |
| 13 | 10-0129-PP | 3/8" x 3/8" Male x Compression Elbow |
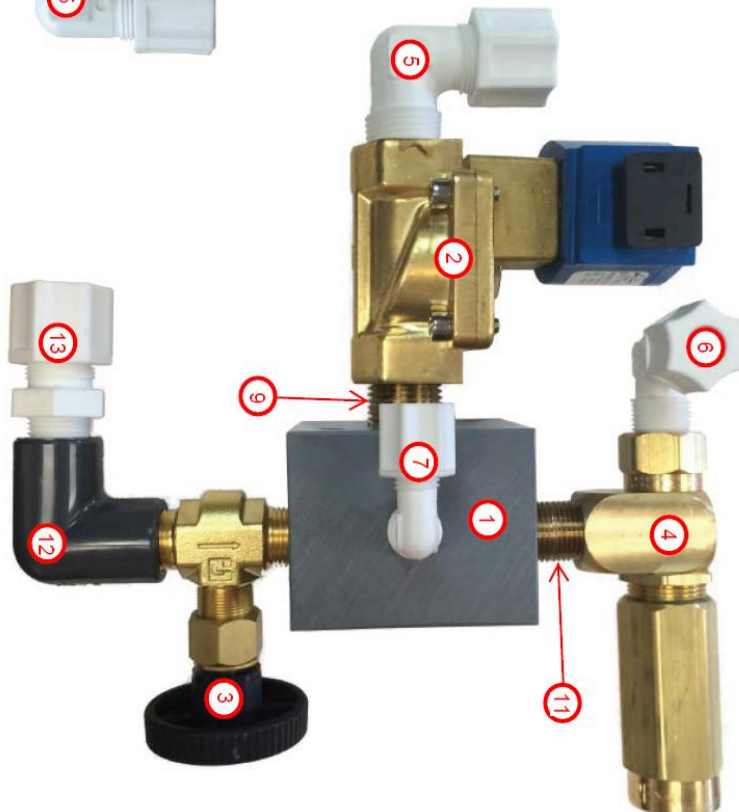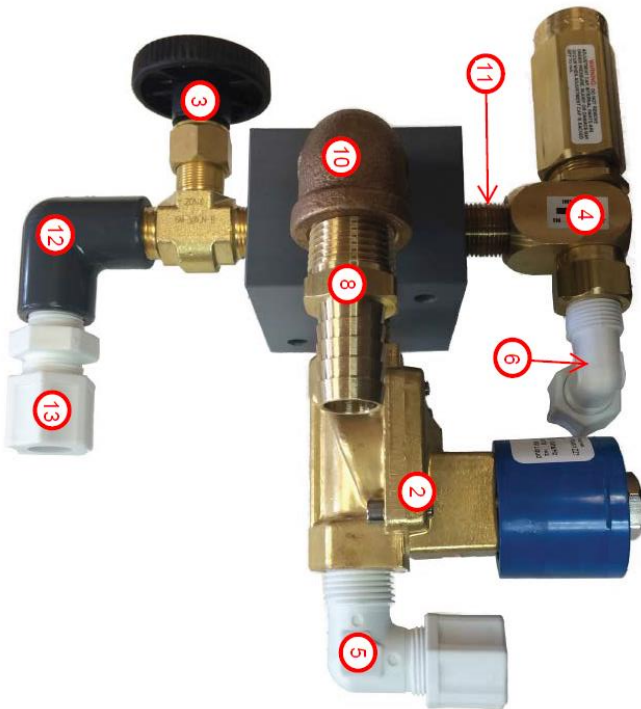
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## 18. CONTROLLER FAULT CONDITION DISPLAYS

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.

**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

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## 18.  LOG SHEET

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

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# 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 NEGLECT.
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