

Reverse Osmosis Process Controller

User Manual

Model S – 150



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INTRODUCTION

The S – 150 Series controller is a state of the art control system for commercial and industrial reverse osmosis systems. The S – 150 Series controller combines features that have not previously been available in one compact unit.

The S – 150 Series controller is a microprocessor controlled system that can monitor pressure and level switches. A TDS / Conductivity monitor / controller with programmable Setpoints is an integral part of the S – 150 Series controller. The S – 150 Series controller displays system status and sensor and switch input status on an easy to read backlit display. User programmable Setpoints are provided that allow fast and easy adjustment of system parameters.

SPECIFICATIONS

Power:	85 – 265VAC 50/60Hz, 25Watts	
Environment:	–22°F to 140°F, 0 – 95% RH, noncondensing	
Enclosure:	8" x 6" x 4" (203mm x 152mm x 102mm) NEMA 4X	
Display:	2 line x 20 character, alphanumeric backlit LCD	
Front Panel:	Overlay with LCD window, alarm lamp, 7 key membrane switch	
Switch Inputs, Dry Contact:	Pressure fault Pretreat lockout Tank full high Tank full low	
Relay Outputs:	RO pump relay	120/240VAC, 1HP
	Inlet valve relay	120/240VAC, 5A
	Flush valve relay	120/240VAC, 5A
	Relays supply same output voltage as board power (120 or 240 VAC)	
Cell:	TDS / Conductivity cell with digital display, permeate standard range, 0 – 250 PPM or uS. Other ranges available: Permeate: 50, 100, 500, 1,000, 2,500, 5,000. Optional Feed: 50, 100, 500, 1,000, 2,500, 5,000, 10,000. Wetted parts ABS and 316SS, 3/4" NPT, maximum 300 psi	
Optional I/O expander:	Auxiliary/divert/boost relay	120/240VAC, 1HP
	Divert/alarm relay	120/240VAC, 5A
	Tank low switch input, dry contact	

FRONT PANEL CONTROLS AND INDICATORS

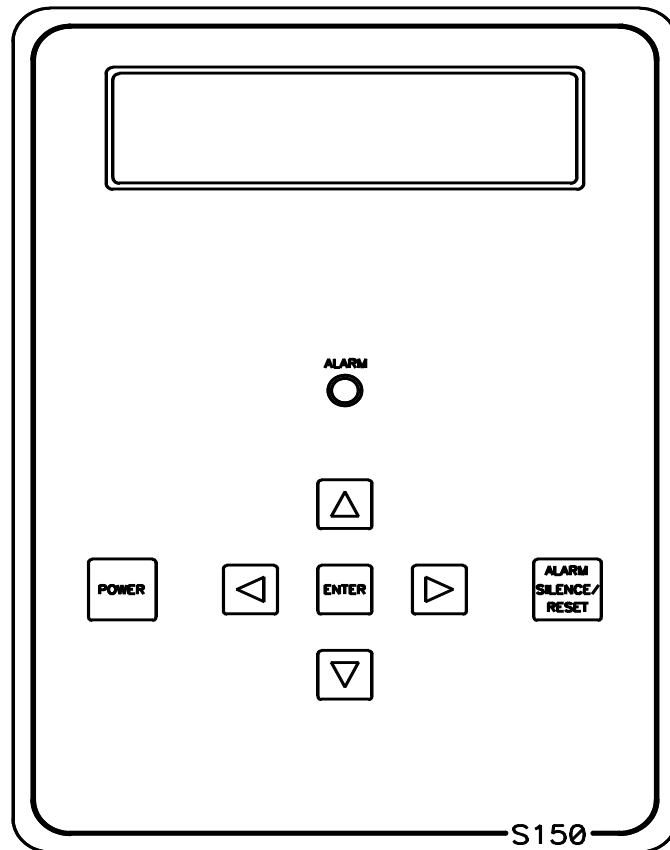


Figure 1

DISPLAY:	Shows status of system.
ALARM LAMP:	Flashes when fault causes the RO system to shut down. On steady when a Setpoint is exceeded that does not cause the RO system to shut down.
POWER KEY:	Places controller in operating or standby mode.
LEFT ARROW KEY:	Scrolls through Setpoints starting with first Setpoint.
RIGHT ARROW KEY:	Scrolls through Setpoints starting with last Setpoint.
UP ARROW KEY:	Increases value of Setpoint.
DOWN ARROW KEY:	Decreases value of Setpoint
ENTER KEY:	Confirms entry of new Setpoint value
ALARM SILENCE/RESET KEY:	Push once for alarm silence and twice to reset system after a shutdown has occurred.

INSTALLATION

Physical Installation

Mount the S – 150 Series controller in a convenient location on the RO equipment using the four mounting ears provided with the unit or the optional panel mounting bracket.

NOTE: All terminals on the board are labeled.

Terminal Strip, Jumper and Adjustment Locations

Refer to Figure 2 for the location of all terminal strips and connectors. Figure 2 also shows all jumper and adjustment locations. Figure 3 shows a sample wiring diagram.

Power Wiring

Refer to Figure 2 and Figure 3 for the terminal strip locations. AC power for the unit is connected to terminal strip P1. Connect the ground wire of the AC power to the terminal labeled GND. For AC power with a neutral and hot wire, the hot wire connects to L1 and the neutral wire connects to L2. For AC power with two hot wires, either wire can connect to L1 and L2. On AC power with two hot wires, the wire jumper between P6 and P7 should be removed and a fuse (GMA 1/4A) installed in F2.

Pump and Valve Relay Outputs

The S – 150 Series controller supplies relay outputs to control the RO pump and solenoid valves.

NOTE: The relays output the same voltage as the AC power to the board. If the pump and solenoids operate on different voltages, a contactor will need to be supplied to operate the pump.

RO Pump Wiring

The RO pump connects to the L1 and L2 RO pump terminals of P1. This output can operate 120/240VAC motors up to 1HP directly. For motors larger than 1HP or 3 phase motors, this output can be used to operate a contactor.

Inlet and Flush Valve Wiring

The inlet and flush valves must operate at the same voltage as supplied to the board. These outputs can supply 5A maximum and are not designed to operate pump motors directly. If these outputs are to be used to operate a boost or flush pump, the output should be used to operate a contactor. The inlet valve connects to the L1 and L2 inlet terminals of P1. The flush valve connects to the L1 and L2 flush terminals of P1.

TDS / Conductivity Cell Wiring

For accurate TDS / Conductivity readings, the cell should be installed in a tee fitting where a continuous flow of water passes over the cell and no air can be trapped around the cell. Refer to Figure 5 for example installation. The cell is connected with five wires to terminal strip P10. Connect each colored wire to the terminal labeled with the same color.

Switch Inputs

Switch inputs are connected to P9. The connections for these inputs are not polarity sensitive and can be connected to either terminal. The switch inputs should be dry contact closures only.

NOTE: Applying voltage to these terminals will damage the controller. The switches can be either normally open or normally closed in any combination. The switch connected to an input that is configured as normally open must be open for the unit to run. The switch connected to an input that is configured as normally closed must be closed for the unit to run. The Switch Select Setpoint allows each input to be configured as normally open or normally closed. The Switch Select Setpoint is defaulted to zero, which programs all inputs as normally open. This means that all switch inputs must be open for the unit to run. Table 1 lists the values used to program the Setpoint to configure the inputs.

SWITCH	N.O.	N.C.	VALUE
PRESSURE FAULT	0	1	
PRETREAT	0	2	
TANK FULL HIGH	0	4	
TANK FULL LOW	0	8	
TANK LOW	0	16	
		TOTAL	

TABLE 1. Switch Select Programming

Select the type of switch used for each input and put that number in the value column. Add the values and program the total in the Switch Select Setpoint. For example, if the pressure fault and tank low inputs were normally closed and all others normally open, the value programmed in the Switch Select Setpoint would be 17(1 + 16).

Pressure Fault Switch

On systems where a low feed pressure shutdown is required, a feed pressure switch can be connected to the pressure fault input of P9. If a high pump pressure shutdown is required, a high pressure switch can be connected to this input. If both low feed pressure and high pump pressure shutdown are required, both switches can be connected to this input. Both switches must be either normally open or normally closed to operate properly.

Pretreat Switch

In systems with pretreatment, a pretreat lockout switch can be connected to the pretreat input of P9. This switch should operate when the pretreatment device is out of service.

NOTE: The output from the pretreatment device must be a dry contact and must not supply voltage.

Tank Full Switch

In systems with a single tank level switch for controlling the RO pump, the level switch connects to the tank full high input of P9. If dual level switches are used for controlling the RO pump, the upper level switch connects to the tank full high input of P9 and the lower level switch connects to the tank full low input of P9.

I/O Expander Board

If the optional I/O expander board is installed, two additional relay outputs and one additional switch input are provided. Refer to Figure 4 for the location of terminal strips, jumpers and wiring for this board. AC power for the relays is connected to the L1 and L2 power terminals of P1. Relay 1 is connected to this power input and will supply the same voltage. This relay is rated for 120/240VAC at 1HP maximum. Relay 1 can be configured to supply a dry contact by connecting a jumper wire between the L1 and L2 power terminals of P1.

NOTE: If Relay 1 is configured as a dry contact, Relay 2 must be configured as a dry contact also. If Relay 1 is configured to supply voltage, Relay 2 can be selected to supply voltage, 120/240, 5A maximum, or as a dry contact output. Jumpers J1–J4 are used to select the Relay 2 output type. To output voltage, a wire jumper is installed between J1 and J4 and a second wire jumper is installed between J2 and J3. For a contact closure output, a single wire jumper is installed between J3 and J4. Relay 2 outputs can be selected to operate as an auxiliary pump output, a divert output or an alarm output by programming the Expander Mode Setpoint. Table 2 shows the values used to program the relay outputs.

EXPANDER MODE	RELAY 1	RELAY 2
0	AUXILIARY PUMP	DIVERT
1	AUXILIARY PUMP	ALARM
2	DIVERT	ALARM
3	BOOST	DIVERT
4	BOOST	ALARM

TABLE 2. Expander Mode Programming

Auxiliary Pump

If the Expander Mode Setpoint is programmed to zero or one, Relay 1 operates as an auxiliary pump output. This output is energized when the tank low input is not active. This output will supply power or a contact closure determined by the connections L1 and L2 of the terminal strip P1.

Boost Pump

If the Expander Mode Setpoint is programmed to three or four, Relay 1 operates as a boost pump output. This output is energized when the inlet solenoid output is active. This output will supply power or a contact closure determined by the connections L1 and L2 of the terminal strip P1.

Divert Output

If the Expander Mode Setpoint is programmed to zero or three, Relay 2 operates as a divert relay and will operate whenever the unit is in the divert mode. This output will supply voltage or provide a contact closure based on the configuration of Relay 1 and on the position of jumpers J1–J4. If the Expander Mode Setpoint is programmed to two, Relay 1 operates as a divert relay and will operate whenever the unit is in the divert mode. This output will supply power or a contact closure determined by the connections L1 and L2 of the terminal strip P1.

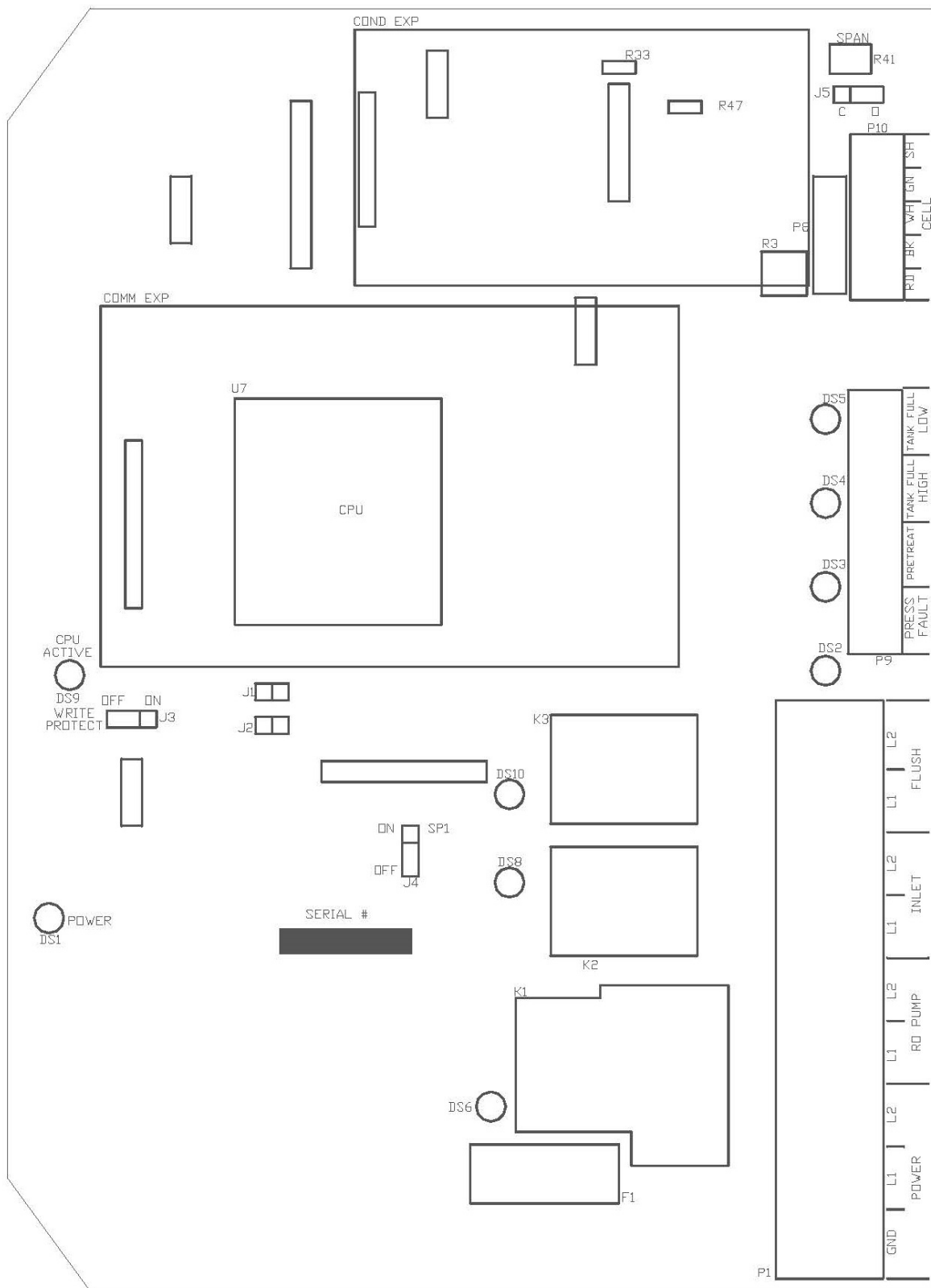
Alarm Output

If the Expander Mode Setpoint is programmed to one, two or four, Relay 2 operates as an alarm relay. When an alarm or warning is active, this relay will supply voltage or provide a contact closure based on the configuration of Relay 1 and the position of jumpers J1–J4.

Tank Low Switch

A tank low switch input can be connected to the tank low input of P2 on the expander board. This input will provide a tank low warning on the unit and if the expander is programmed to provide an auxiliary pump output, will provide low tank level protection for this pump.

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Sample Wiring

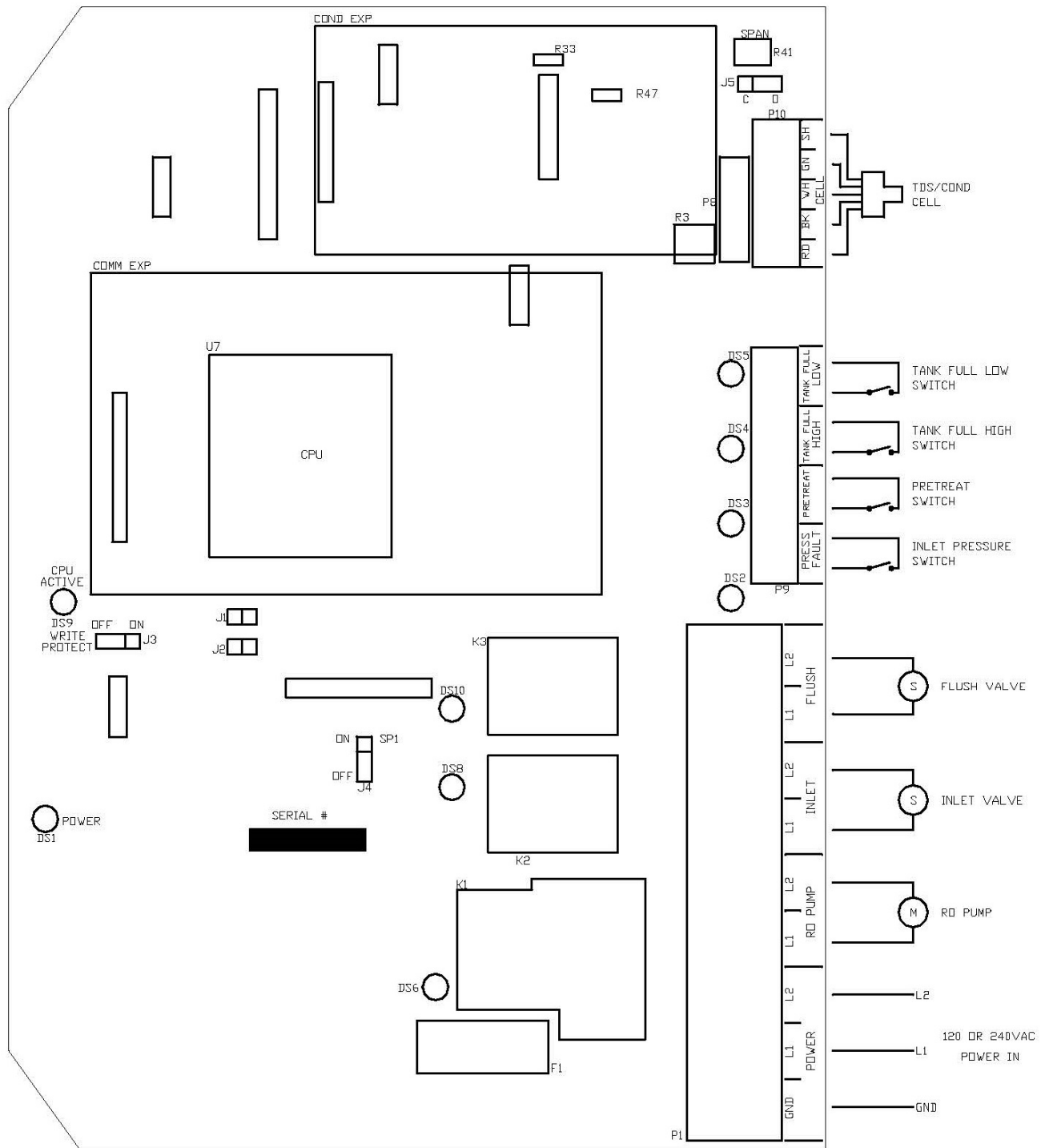


Figure 3

Expander Board Terminal Strip, Jumper Locations

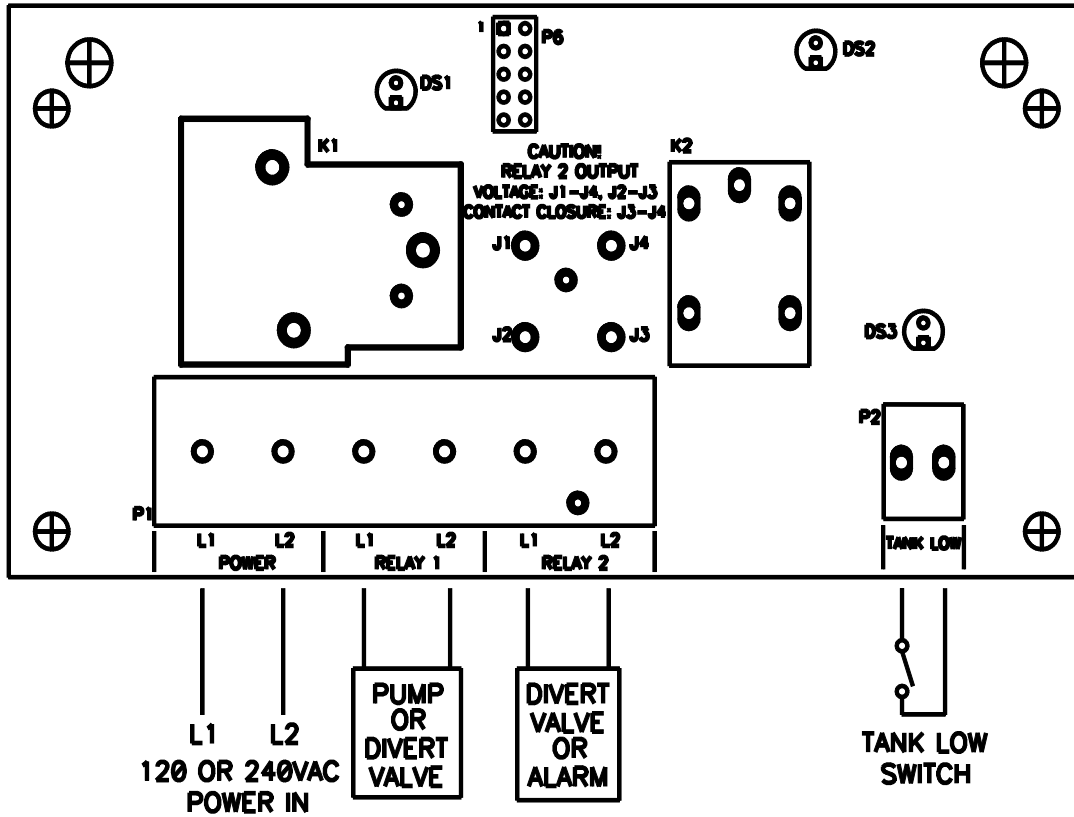


Figure 4

TDS / Conductivity Cell Installation

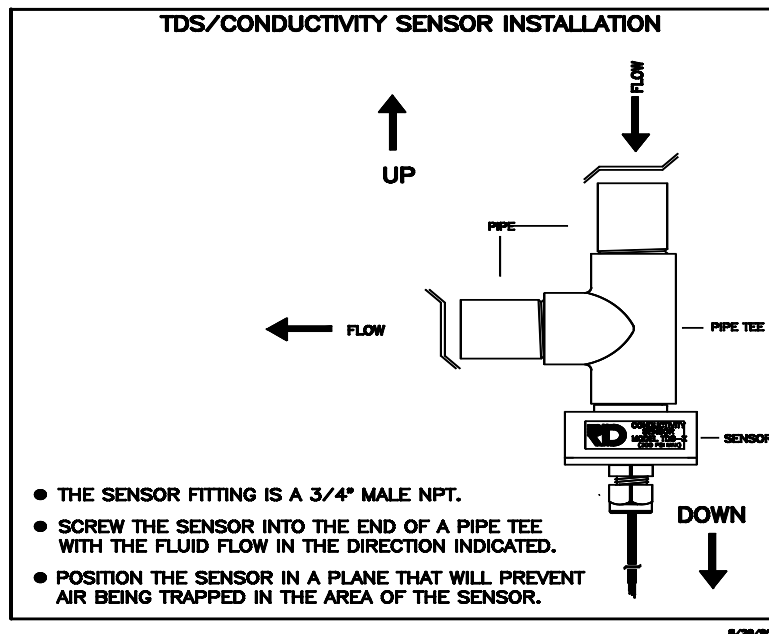


Figure 5

STANDARD SETPOINTS			
SETPOINT	DESCRIPTION	RANGE	DEFAULT
TDS / Conductivity Limit	When this value is met or exceeded, the alarm lamp will light and high TDS / Conductivity will show on the display. To disable, set to zero.	0 – 999 uS or ppm	100
TDS / Conductivity Delay	When the limit Setpoint is exceeded, no alarm will be given until this time has expired.	0 – 999 seconds	30
TDS / Conductivity Shutdown	Once a TDS / Conductivity alarm is active, if the time in this exceeded, a TDS / Conductivity shutdown will occur. To disable, set to zero.	0 – 99 minutes	0
RO Start Delay	The amount of time between the inlet valve opening and the RO pump start.	0 – 99 seconds	5
Press Fault Delay	The time a pressure fault must be active before a pressure fault shutdown occurs.	0 – 99 seconds	5
Auto Reset	When a pressure fault shutdown is active, the system will attempt to restart after this delay. If set to zero, system must be manually reset.	0 – 99 minutes	60
Alarm Silence	If the audible alarm is silenced after this delay, the alarm will resound. If set to zero minutes the alarm will remain silenced.	0 – 99 minutes	0
TF Restart Delay	When a tank full condition clears, the system will restart after this delay.	0 – 99 seconds/minute	5
TF Restart	Selects whether the tank full restart delay is in seconds or minutes. 0 = seconds, 1 = minutes.	0 – 1	0
TFO Time	The amount of time that a tank full override lasts.	0 – 9 minutes	5
Tank Lo Restart	When a tank low condition clears, the auxiliary pump will restart after this delay.	0 – 99 minutes	15
Flush Type	Selects the type of flush. Set to zero to disable flush.	0 – 8	0
Flush Time	The length of time a membrane flush cycle will last when flush is active.	0 – 99 minutes	5
Flush Interval	The interval between flush cycles. Only valid with op hour, elapsed time or off flush types.	0 – 99 hours	24
Flush Mode	Selects if the inlet and RO pump relays operate during flush.	0 – 3	0
Maximum Hours	If the current operating hours exceed this limit, the operating hours warning will occur. To disable, set to zero.	0 – 65000 hours	0
Current Hours	Current number of hours of RO system operation.	0 – 65000	0
Expander Mode	Selects how the relays on the I/O expander board operate.	0 – 4	0
Temp Offset	Allows adjustment of temperature reading by +–5 degrees.	–5 – +5	0
Temp UOM	Selects display of temperature in °F or °C.	0 – 1	0
Switch Select	Selects if switch inputs are normally open or normally closed.	0 – 32	0
TDS / Conductivity UOM	Selects display of water quality in uS or PPM. NOTE: If this Setpoint is changed, the unit must be recalibrated.	0 – 1	0
TDS / Conductivity Range	Selects range of TDS / Conductivity monitor 0–50, 1–100, 2–250, 3–500, 4–1000, 5–2500, 6–5000 NOTE: If this Setpoint is changed, the unit must be recalibrated and may require some components be changed.	0 – 6	2
TF Delay	Selects delay time for Tank Full	0 – 5 seconds	5

TO DISPLAY OR CHANGE SETPOINTS

1. Refer to Figure 1 for the location of the keys used to display or change the Setpoints and Figure 2 for the location of the write protect jumper, J3. For the unit to be able to accept a change in a Setpoint, the shorting jumper must be in the off position (center and left pins).

NOTE: Setpoints cannot be changed if the write protect jumper is in the ON position.

2. Use the Left and Right arrow keys to display the Setpoints. Each press of an arrow key will advance the display to the next Setpoint. The Left arrow key starts with the beginning Setpoint and the Right arrow key starts with the last Setpoint.
3. The Up and Down arrow keys are used to increment or decrement the Setpoint value. The value will change by one count each time a key is pressed. If the key is pressed and held for less than one second, the Setpoint value will change at a fast rate. When the key is released, the fast rate will be reset. Pressing both the Up and Down arrow keys together will reset the Setpoint value to zero.
4. Pressing the Alarm Silence / Reset key at any time will cancel the operation and return the display to the main screen.
5. To accept the new Setpoint value, press the Enter key.
6. The unit will beep twice if the change is accepted. If the write protect jumper is on, the unit will show WRITE PROTECTED on the display and one long beep will sound.
7. When finished changing Setpoints, the write protect jumper should be placed in the on position (center and right pins).

SYSTEM OPERATION

General Operation

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

Display

The display is a 2 line x 20-character backlit liquid crystal display. System operating status and sensor readings are shown on this display. Setpoint information is also shown on this display.

Operating Status Messages

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

STANDBY:	The unit is in the standby mode.
DELAY 99:	The unit is in the RO start delay. The number is the seconds remaining before the RO pump starts.
OPERATING:	The RO unit is operating.
TANK FULL:	The unit is shut down due to a tank full condition.
TANK FULL 99:	The unit is shut down due to a tank full condition. If the number is blinking, the tank full high switch has cleared, but the tank full low switch is still active. If the number is on steady, both tank level switches have cleared and the delay is counting down.
PRETREAT:	The unit is shut down due to a pretreat lockout condition.
PRESS FAULT:	The unit is shut down due to a pressure fault condition.
MEMB FLUSH 99:	Membrane flush is active. The number is the minutes remaining in the flush cycle.

TDS / Conductivity

The TDS / Conductivity is shown on the top line after the unit operating status. When the unit is offline because of a shutdown condition, the reading is replaced with '——'. If the reading is over range, the reading is shown as '^^^'.

Operating Hours

The current operating hours are shown on the bottom line.

Temperature

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

Warning Messages

Warning messages are also shown on the second line. If any warnings are active, the active warnings will alternate with the normal displays for the bottom line. The following lists the warning messages.

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

TANK LOW: The tank low input is active.

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

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

Tank Full Operation

The unit can be operated with 1 or 2 level switches. With 1 level switch, the switch is connected to the tank full high input. When this switch has been active for five seconds, the unit will shut down on tank full. TANK FULL will show on the display. When the tank full condition clears, the display will show TANK FULL 99. The number is the tank full restart time and the unit will restart when this delay times out.

For 2 level switch operation, the upper switch is connected to the tank full high input and the lower switch is connected to the tank full low input. When both switches are clear, the RO unit will run. The RO unit will continue to run when the water level rises and the lower switch becomes active. When the upper switch becomes active, after the five second delay, the RO unit will shut down. TANK FULL will show on the display. When the tank level drops and the upper level switch clears, the display will show TANK FULL 99 and the RO unit will remain off. The number is the tank full restart time and the number will blink until the lower level switch clears. When the lower level switch clears, the number will remain steady and the RO will restart when the delay times out.

Tank Full Restart

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

Tank Full Override

A timed tank full override can be initiated when the RO unit is shut down due to a tank full condition. Pressing the Alarm Silence/Reset key for three seconds during a tank full condition will enable the tank full override. The RO will start and TF OVERRIDE 9 will show on the display. The number is the minutes remaining in the override timer. When the override times out, the unit will return to the tank full shutdown condition.

Pressure Fault

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

Auto Reset

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

Alarm Silence

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

Pretreat

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

Membrane Flush

If the Flush Type Setpoint is programmed to zero, flush is disabled. If membrane flush is desired, several types of flush are available. When the unit enters a flush cycle, the flush relay will activate. The flush cycle will last for the time programmed in the Flush Time Setpoint. Table 3 shows the value that must be programmed in the Flush Type Setpoint for each type of flush.

FLUSH TYPE	DESCRIPTION
0	NO FLUSH
1	TANK FULL
2	OPERATING HOURS
3	OPERATING HOURS AND TANK FULL
4	ELAPSED TIME
5	ELAPSED TIME AND TANK FULL
6	OFF HOURS
7	OFF HOURS AND TANK FULL
8	RO START/STOP

TABLE 3. Flush Type

TANK FULL:	The RO unit will flush each time a tank full condition occurs.
OPERATING HOURS:	A flush will occur when the RO pump has operated for the number of hours programmed in the Flush Interval Setpoint.
ELAPSED TIME:	A flush will occur after the number of hours programmed in the Flush Interval Setpoint has passed.
OFF HOURS:	A flush will occur when the RO has been shut down due to a tank full condition for the number of hours programmed in the Flush Interval Setpoint.
RO START/STOP:	A flush will occur each time the RO starts or stops. The tank full flush can be combined with any of the three interval flush types. A manual flush can be initiated by pressing the Alarm Silence/Reset key for three seconds.

Flush Mode

The Flush Mode Setpoint can be used to control the operation of the inlet valve and RO pump during flush. Each can be independently programmed to operate during flush. Table 4 shows the values to program into the Flush Mode Setpoint to control the operation of the inlet and RO outputs during flush.

FLUSH MODE	RO PUMP	INLET VALVE
0	OFF	CLOSED
1	OFF	OPEN
2	ON	CLOSED
3	ON	OPEN

TABLE 4. Flush Mode

High TDS / Conductivity Warning / Alarm

If the TDS / Conductivity reading exceeds the limit programmed the TDS / Conductivity Limit Setpoint for the delay programmed in the TDS / Conductivity Delay Setpoint, the alarm lamp will light and the HI TDS / Conductivity warning message will show on the display. This warning will clear when the TDS / Conductivity drops below the Setpoint. If the TDS / Conductivity Shutdown Setpoint is programmed to zero, the unit will continue to operate. Otherwise, once a high TDS / Conductivity warning occurs, after the time programmed in this Setpoint, the RO unit will shut down and the alarm will sound. **The alarm can be cleared by pressing the Alarm Silence/Reset key twice.**

NOTE: The auto reset function is not active for this shut down.

Operating Hours Exceeded

If the current hours exceed the limit programmed in the Maximum Hours Setpoint, the alarm lamp will light and the OP HOURS EXCEEDED warning message will be shown. This warning can be cleared by programming the current hours to zero or by increasing the maximum hours limit.

I/O Expander

The I/O Expander board adds 2 relays and 1 switch input. The operation and programming of the 2 relays is described in the installation section.

Auxiliary Output

Relay 1 can be used to control a repressurization pump when Relay 1 of the expander board is configured to operate an aux relay. In this mode, this relay will be energized as long as the tank low input is not active. When energized, the relay supplies power to the repressurization pump.

Tank Low

When the tank low input has been active for five seconds, the auxiliary output will turn off. The alarm lamp will light and the TANK LOW warning message will show on the display. When the tank low condition clears, the TANK LOW 99 warning message is displayed. The number is the delay in minutes before the auxiliary relay will energize.

For boost pump operation, when the tank low input has been active for five seconds, the boost pump output will turn off, the RO unit will shut down, the alarm lamp will flash and the audible alarm will sound. TANK LOW shutdown message will show on the display. When the tank low condition clears, the TANK LOW 99 shutdown message is displayed. The number is the delay before the RO unit will restart. The shutdown can be manually reset by pressing the Alarm Silence/Reset button twice.

Boost Pump Output

Relay 1 can be used to control a boost pump when the expander board is configured to operate Relay 1 as a boost pump relay. This relay will operate the same as the inlet solenoid relay. This option is used to directly operate a boost pump up to 1HP.

Divert Output

When Relay 1 or Relay 2 has been programmed to operate as a divert relay, the relay will energize when the TDS / Conductivity exceeds the TDS / Conductivity Limit Setpoint. This will occur as soon as the reading exceeds the limit, there is no delay. When the reading drops below the limit and stays below the limit continuously for five seconds, the divert relay will turn off.

Alarm Output

When Relay 2 has been programmed to operate as an alarm relay, the relay will energize whenever a warning or alarm condition occurs. The relay will remain energized as long as the warning / alarm condition is active.

ADJUSTMENTS

TDS / Conductivity Calibration

Refer to Figure 2 for adjustment location. To calibrate the TDS / Conductivity, place the cell in a known standard solution. Adjust the span adjustment for the correct reading. If the cell is installed, the unit can be calibrated by taking a sample of the permeate water and testing it with a known, good meter. Adjust the span control until the reading matches the meter.

NOTE: If the TDS / Conductivity range is changed, the unit must be recalibrated and some components may need to be changed.

Display Adjustment

The display contrast can be adjusted for best viewing by adjusting control R3. This control is located toward the upper right corner of the board, just to the left of the cell connector.

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.

Verify the programming of all Setpoints, Check the display and check the status of all lights and indicators. The more information available, the easier it will be to determine the source of the problem.

System Inoperative

Is the yellow CPU active LED blinking? If no, is the green power LED, DS1 Lit? If no, is the fuse OK? If no, replace the fuse. If yes, with a voltmeter, verify power is applied to the power terminals L1 and L2. If power is applied to the power terminals and the above checks are OK, the board is probably defective and should be replaced. If no power is applied to the board, check the power wiring to the system.

Display Blank

Is the green power LED, DS1 lit? If no, refer to the system inoperative section. If yes, is the CPU active LED, DS9 blinking? If no, replace the board. If yes, adjust the display contrast adjustment, R3. Is the display still blank? If yes, replace the board.

Inlet Valve Will Not Operate

Is the system in standby? If no, are any shutdown conditions active? If no, is the inlet LED, DS8 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.

RO Pump Will Not Operate

Is the system in standby? If no, are any shutdown conditions active? If no, is the RO LED, DS6 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.

Unit Not Flushing or Not Flushing Correctly

Verify that flush is enabled and what type of flush is selected. Is flush enabled? If no, enable flush. If yes, press the Alarm Silence /Reset key for 3 seconds. Does the unit show flush on the display? If no, replace the board. If yes, is the flush LED, DS10 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.

No or Incorrect TDS / Conductivity Reading

Is sensor wired correctly? If no, correct wiring. If yes, is sensor installed as described in the installation section? If no, install correctly. If yes, verify correct TDS / Conductivity range. Range correct? If no, correct range. If yes, calibrate unit. Does unit calibrate OK? If no, disconnect green and white wires of sensor. Does reading show 0? If no, replace board. If yes, reconnect wires and remove sensor from piping and dry. Does reading show 0? If no, replace cell. If yes, short pins of cell together. Does reading show '^^'? If no, replace board.

TDS / CONDUCTIVITY EXPANDER

Installation / Wiring

The TDS / Conductivity expander board allows a 2nd TDS / Conductivity to be monitored and displayed by the S – 150 Series controller. The expander board is mounted on the main board to the left of the connector for the first cell. Figure 6 shows the wiring and adjustment information for the expander.

TDS / Conductivity Expander

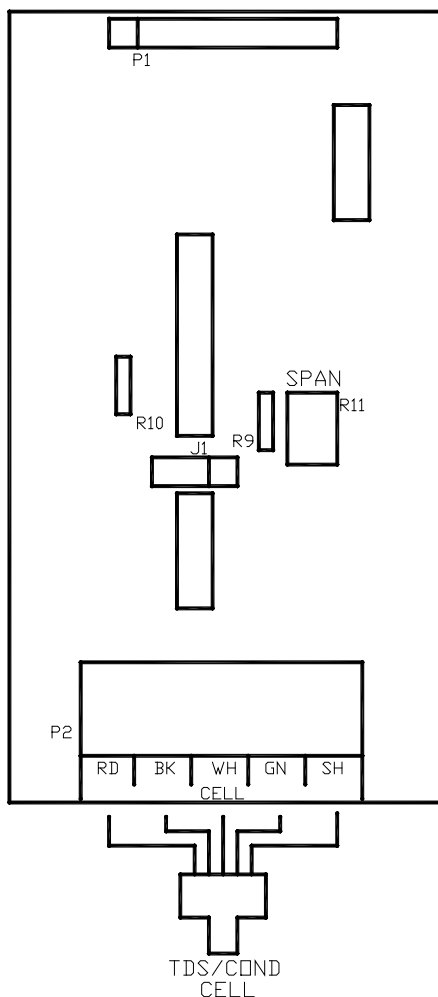


Figure 6

Setpoints

When the expander is installed, 3 additional Setpoints are provided to allow features of the expander to be changed. Refer to the Displaying or Changing Setpoints section of the manual on page 14 for information on changing the Setpoints. The additional Setpoints are listed below.

SETPOINT	DESCRIPTION	RANGE	DEFAULT
C2 Range	Selects range of TDS / Conductivity monitor 0 – 50, 1 – 100, 2 – 250, 3 – 500, 4 – 1,000, 5 – 2,500, 6 – 5,000, 7 – 10,000 NOTE: If this Setpoint is changed, the unit must be recalibrated and range components may need to be changed.	0 – 7	2
C2 Limit	When this value is met or exceeded, the alarm lamp will light and high TDS / Conductivity will show on the display. To disable, set to zero.	0 – 9999 uS or ppm	0
% Rejection	If the second TDS / Conductivity is used to monitor feedwater, programming this Setpoint to one allows the percentage of rejection to be displayed.	0 – 1	0

Operation

When the TDS / Conductivity expander is installed, the reading will be shown on line two and will alternate every three to four seconds with the hours and temperature. If the percentage of rejection display is enabled, it will be shown on line two with the second TDS / Conductivity reading.

If the C2 limit is enabled, and the second TDS / Conductivity reading exceeds the limit programmed the C2 Limit Setpoint for the delay programmed in the TDS / Conductivity Delay Setpoint, the alarm lamp will light and the HI TDS / Conductivity 2 warning message will show on the display. This warning will clear when the second TDS / Conductivity drops below the Setpoint.

Calibration

Refer to Figure 6 for adjustment location. To calibrate the second TDS / Conductivity, place the cell in a known standard solution. Adjust the span adjustment for the correct reading. If the cell is installed, the unit can be calibrated by taking a sample of the water and testing it with a known, good meter. Adjust the span control until the reading matches the meter.

General Warranty

One-Year Limited Warranty

The manufacturer (hereinafter “manufacturer”) provides a twelve (12) month limited warranty on the materials, workmanship, and performance of its own manufactured components, when installed and operated in accordance with the manufacturer’s recommended design and operating specifications. This warranty only applies to the original purchaser (the “Customer”) of each component (each “Product”) and commences from the date of purchase as stated on manufacturer’s original invoice.

Exclusions from Warranty

This Warranty does not extend to equipment or Products manufactured by others and distributed by manufacturer, nor to equipment or Products manufactured by others into which a manufacturer product has been incorporated. If allowable, manufacturer hereby assigns, without warranty, to the Customer its interest, if any, under any warranty made by the manufacturer of such equipment or Product.

This Warranty shall be void if the Product is subject to any accident, damage, damage to the sealing surfaces, faulty installation, problems with sealing caused by foreign debris or mishandling, misapplication, chemical exposure, or other abuse or misuse; any modifications, additions or alterations not approved by manufacturer in writing; any use of the Product after discovery of a defect without manufacturer’s prior written consent; or the Customer’s or user’s refusal to permit manufacturer or its authorized representative to examine the Product in a timely manner in order to determine the nature and extent of a claimed defect. Normal wear of replaceable components, including without limitation o-ring seals, are specifically excluded from this Warranty.

DISCLAIMERS

No agent, employee, or representative of the manufacturer has any authority to bind the manufacturer to any affirmation, representation, or warranty concerning the goods sold under this contract, and unless an affirmation, representation or warranty made by an agent, employee, or representative is specifically included within this Warranty, it will not be enforceable by the Customer.

REMEDY

The manufacturer’s sole obligation under this warranty, and the Customer’s sole remedy for any breach of this Warranty, is limited to, and shall be fully discharged by, the manufacturer’s repair of any defective Product or, at the manufacturer’s sole option, its replacement of such Product with an identical or substantially similar Product. The manufacturer’s repair or replacement of such Product shall take place at the manufacturer’s plant and the Customer shall be solely responsible for all charges incurred in shipping the Product to the manufacturer’s plant and for any and all insurance in connection therewith. Any replacement Product will be warranted against defects in material and workmanship for the unexpired portion of the warranty period applicable to the Product as to which such repair and replacement has been made.

WARRANTY EVALUATION

THE MANUFACTURER’S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO THE REPAIR OR REPLACEMENT (AT THE MANUFACTURER’S SOLE DISCRETION) OF ANY PRODUCT, OR COMPONENT THEREOF, PROVED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP WITHIN THE COVERED WARRANTY PERIOD.

The Customer, at the Customer's risk and expense, shall be responsible for returning such Product or component, only after obtaining a Return Goods Authorization (RGA) number from the manufacturer, arranging for freight prepaid, and in conformance with any special packaging and shipping instructions set forth on the operation documentation or RGA instructions, or as otherwise reasonably required, to the manufacturer's address set forth below, together with (1) RGA number issued by the manufacturer at Customer's request; (2) proof of purchase and, if necessary, proof of installation date; (3) a Return Good Authorization Form; (4) a description of the suspected defects; (5) the serial number of the manufacturer Product alleged to be defective; and (6) a description of the type of water and pretreatment equipment which has been utilized in connection with the Product, if any. The manufacturer shall, in the manufacturer's reasonable discretion, be the sole judge of whether a returned Product or component is defective in material or workmanship. Required or replaced Products or components shall be returned surface freight. In genuine emergency situations, the manufacturer will (at the manufacturer's sole discretion) forward replacement parts to Customer without waiting for authorized return of the questionable part(s). In such cases, Customer will issue a purchase order or other payment guarantee prior to shipment. If the returned part is found to have been misused or abused, or the defective part is not received by the manufacturer within thirty (30) days; the Customer will be invoiced for the replacement part(s) provided. This Warranty does not cover or include labor and/or travel to the Customer's premise or location or any other location. Charges of \$1000 per day plus associated travel expenses will be incurred by the Customer in providing the Warranty Service at any location other than the manufacturer's main headquarters; that is if the manufacturer deems that the Product is not covered by said Warranty. The manufacturer reserves the right to precondition such travel to Customer's premises upon prepayment of the manufacturer's anticipated costs of attending such premises.

LIMITATIONS OF WARRANTY

OTHER THAN AS SPECIFICALLY SET FORTH IN THIS WARRANTY, THE MANUFACTURER MAKES NO WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT, AND THE MANUFACTURER DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE. THE MANUFACTURER'S LIABILITY UNDER THIS WARRANTY SHALL IN NO EVENT EXCEED THE PURCHASE PRICE FOR THE PRODUCTS. THE MANUFACTURER SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, LOSS OF USE, COST OF REMOVING OR INSTALLING THE PRODUCT OR COMPONENTS, DOWNTIME, OR THE CLAIMS OF THIRD PARTIES, AND INJURIES OR DAMAGES TO PERSONS OR PROPERTY.

INSTALLATION AND USE

The specifications and operational requirements for a Product are readily available from the manufacturer and may be requested in writing via fax or email. Failure to request this information shall not void or invalidate this Warranty or the limitations contained herein.

EXCLUSIVE WARRANTY

It is the intent of the parties to this contract to fully and completely state the rights and obligations of the parties in this Warranty and the manufacturer has specifically set forth in this Warranty the extent and nature of the warranty on the Product(s) to be sold. There are no warranties which extend beyond the description in this Warranty.