
Manual

Reverse Osmosis System Control Board With Delivery Pump Control

ESDI Model 503

(120 VAC & 230 VAC)
ESDI Part No. 030503-120
ESDI Part No. 030503-230

Revised: July 30, 2008

By: M. A. Stern

Electronic Systems Design, Inc.

1010 North Maclay Ave., San Fernando, California 91340 USA
Phone: (818) 365-0864 Fax: (818) 365-1308 Web Site: www.esdi.net

Manual

Reverse Osmosis System Controller ESDI Model 503

1.0 General:

The ESDI Model 503 is a full-featured electronic controller that performs all of the tasks necessary to control a reverse osmosis water purification system. It maintains a storage tank level, performs periodic membrane flushes, and has a float level input that controls an auxiliary relay for use in a delivery system.

This R.O. Controller is available separately in two operating voltages, 120VAC and 230VAC. The pump and all valves operate from that same voltage. The controller comes with an hour meter and is mounted in a NEMA 4 polycarbonate enclosure. The controller is also available as a single circuit board assembly for those wishing to use their own enclosure.

The ESDI R.O. Controller's description, features, and specifications are presented in this manual.

2.0. Features:

2.1. RO Membrane Flush Cycles:

To help increase the life of the RO membrane, this controller features several RO membrane flush cycles. These flush cycles can be enabled or disabled by the program option switch S1, FLUSH STATUS.

2.1.1. Flush Time:

Switches S2 and S3 set the Flush Time. The selectable flush times are 1, 2, 3, and 4 minutes. During this time, the Flush and Feed Valves are opened and feed water is allowed to pass over the membrane and out the Flush Valve to the drain. This will remove any built up brine that has collected in the membrane enclosure and will help rinse off some of the contaminants from the membrane itself. At the completion of the flush cycle, the Flush Valve will close, and the controller will go back to the process it was performing prior to the beginning of the flush cycle. This flush duration will be the same for all flush cycles that are initiated by the controller.

2.1.2. Flush Period, During Processing (RUN):

When the system has been processing water for an extended period of time, it is important that the system periodically stops and flushes the RO membrane. This helps clean the membrane and improve its efficiency. This "RUN" flush cycle time can be set by switch S4 to run every 2 hours, or every 4 hours. The flush duration will be the same as that set by switches S3 and S2.

2.1.3. Flush Period, Tank Full:

When the tank is full, the system is idle in a standby mode. During this time no water passes through the membrane. The Model 500 includes a flush cycle that periodically runs during this standby mode. During this flush, the feed and flush valves are opened, and the flush duration will be the same as that set by switches S2 and S3. The "FULL" flush cycle time can be set by switch S5 to run every 8 hours, or every 12 hours.

2.1.4. Additional Flush Cycles:

The system is programmed to perform flush cycles in the following instances. A flush cycle will occur each time the system starts up and begins to process water. A flush cycle will occur each time the tank is filled and prior to the system shutting down and going into standby. A flush cycle will occur each time the system returns from a lockout or "Low Pressure" condition. (Note: 1-minute timeout after lockout) The flush duration will be the same as that set by switches S2 and S3.

3.0. Inputs:

3.1. Tank Level Hi Input:

The Tank Level Hi input connects to a float located at the top of the water storage tank. This float is used as feedback to the controller so it can maintain a full tank. The Tank Level Hi input requires an isolated contact closure when the tank is not full, and an open circuit when the tank is full. To prevent rapid on/off pump cycles, a float with built-in hysteresis must be used here. That is, the float must travel some distance before the switch status can change.

3.2. Tank Level Lo Input:

The Tank Level Lo input connects to a float located at the bottom level of the water storage tank. This float is used as feedback to the controller so it can control the operation of the auxiliary relay. The Tank Level Lo input requires an isolated contact closure to turn on the auxiliary relay, and an open circuit to turn it off. To prevent rapid on/off pump cycles, a float with built-in hysteresis must be used here. That is, the float must travel some distance before the switch status can change.

3.3. Lockout Input:

The Lockout input allows an external device to disable the controller. It can be connected to a pre-conditioner (water softener) to disable it while the unit is reconditioning and inlet water is unavailable. If the tank is full, the controller will ignore any Lockout condition. The Lockout only affects the system while the system is processing water.

An isolated contact closure will enable the system while an open circuit will disable it and place it into Lockout. If this input is not used, place a jumper across the Lockout terminals.

Upon returning from Lockout, the system will time out for one minute, and then execute a flush cycle (if selected). It will then return to its previous status prior to Lockout.

3.4. Pressure Input:

The Pressure input is connected to a low pressure switch that monitors the water inlet to let the system know that there is enough water pressure to operate the pump.

An isolated contact closure will enable the system while an open circuit will disable it and place it into PSI LOW mode. If this input is not used, place a jumper across the Pressure input terminals.

The Pressure input only affects the system while the pump is on, and the system is processing water. Upon receiving a "Low Pressure" signal, the system will shut down and time out before trying to start back up. The time out sequence is as follows:

Low Pressure detected first time, Restart time out is:	5 minutes
Low Pressure detected second time, Restart time out is:	5 minutes
Low Pressure detected third time, Restart time out is:	5 minutes
Low Pressure detected fourth time, Restart time out is:	30 minutes
Low Pressure detected fifth time, Restart time out is:	60 minutes
Low Pressure detected thereafter, Restart time out is:	60 minutes

The Low Pressure time out sequence will reset back to 5 minutes after the completion of the next flush cycle. The "Check System" indicator will come on after the fourth restart.

3.5. EXT/TDS Input:

The EXT/TDS input can be connected to a TDS monitor, or any other external device for monitoring the water quality. If bad TDS is detected, the unit will illuminate the "Check System" LED. If the "Option 1" switch is selected, the system will shut down, and not make any more water, until a technician comes and services the system.

An isolated contact closure will enable the system while an open circuit will place it into a BAD TDS mode. If this input is not used, place a jumper across the TDS and Common terminals. Do not connect any wires to the +5VDC terminal. This +5VDC is available to power a low current TDS monitor.

4.0. Outputs:

4.1 Pump Output:

The Pump output controls an electric pump. See specifications for 120VAC and 230VAC operation. This output can also be used to control an external relay or contactor. To help insure that the pump will not run dry, the system is programmed to open the Feed Valve three seconds prior to turning on the pump. Upon shutting off the pump, the Feed valve will remain open, and then close one second after the pump is turned off.

4.2. Flush Valve:

This output connects to the Flush Valve. This valve, when open, should allow water to pass by the RO membrane and route the brine water into the drain.

4.3. Feed (Inlet) Valve:

The Feed (or Inlet) Valve is connected to this output. This valve, when open, should allow water to pass into the system from the municipal water line.

4.4. Auxiliary Relay: CAUTION HIGH VOLTAGE

The Auxiliary relay turns ON any time the Tank Level Lo input has a contact closure. This can be routed to control a delivery pump or other auxiliary device. Output voltage is same as board power, 120/240VAC.

4.5. Hour Counter:

The Hour Counter monitors the time that the pump is operating. The least significant digit of the counter is 1/10th of an hour. The processor software keeps track of the time that the pump is running, and every 6 minutes of run time, it sends a pulse to the Hour Counter. The counter increment by .1 Hour and displays the total time.

5.0 Specifications:

- | | |
|-------------------------------|--|
| 5.1. Tank HI Level Input: | Isolated contact closure.
Close = Run Open = Stop. |
| 5.2. Tank LO Level Input: | Isolated contact closure.
Close = Run Open = Stop. |
| 5.3. Lock Out Input: | Isolated contact closure.
Close = Run Open = Stop. |
| 5.4. Pressure Input: | Isolated contact closure.
Close = Run Open = Stop. |
| 5.5. EXT/TDS Input: | Isolated contact closure.
Close = Run Open = Stop. |
| 5.6. Auxiliary Relay Output:* | 120/240VAC, 3 Amp max. |
| 5.7. Hour Counter Output: | 12VDC pulses to counter
200 millisec pulse every 6 minutes |
| 5.8. Pump Relay Output:* | 120VAC, 3/4 HP, 12 Amp Max.
240VAC, 1 HP, 12 Amp Max. |
| 5.9. Flush Valve Output:* | 120/240VAC, 3 Amp max. |
| 5.10. Feed Valve Output:* | 120/240VAC, 3 Amp max. |
| 5.11. Circuit board Size: | 4.125" X 4.875" X 1.25". |
| 5.12. Power Requirements:* | 120VAC, 50/60 Hz, 12 Amp (nominal).
230VAC, 50/60 Hz, 12 Amp (nominal).
Voltage tolerance: ± 10 % Minimum. |

*Specifications shown for both board versions:

Model 030503-120VAC

Model 030503-230VAC

7.0. Switches & Indicators:

7.1. Option Settings DIP Switch:

Switches are read at every power up and every reset.

7.1.1. Flush Status:	<u>S1</u>	<u>Active:</u>
	On	Flush Active
	Off	Flush Not Active

7.1.2. Flush Time:	<u>S2</u>	<u>S3</u>	<u>Time:</u>
	On	On	1 minute
	On	Off	2 minutes
	Off	On	3 minutes
	Off	Off	4 minutes

7.1.3. Flush Period (RUN):	<u>S4</u>	<u>Time:</u>
	On	2 Hrs.
	Off	4 Hrs.

7.1.4. Flush Period (Full):	<u>S5</u>	<u>Time:</u>
	On	8 Hrs.
	Off	12 Hrs.

7.1.5. Option 1:	<u>S6</u>	<u>Option:</u>
	On	TDS Shutdown
	Off	No TDS Shutdown

7.1.6. Option 2:	<u>Spare</u>
------------------	--------------

7.2. Reset Switch: Resets and initializes the system. Same as a power up condition.

7.3. Power LED (GRN): Indicates that there is power to the board.

7.4. Tank Full LED (GRN): Indicates that the water storage tank is full.

7.5. Run LED (GRN): Indicates that the system is processing water.

7.6. Flush LED (YEL): Indicates that the system is in a flush cycle.

7.7. Lock Out LED (RED): Indicates that the system is locked out.

7.8. PSI Low LED (RED): Indicates that the system has Low Inlet water pressure.

7.9. Check System (RED): Indicates that the system requires attention due to either a Lockout, Bad TDS, or Low Pressure after 4 restarts.

7.10. Auxiliary LED (GRN): Indicates that the Auxiliary relay is on.

8.0. Connectors:

The terminal block is pluggable and can be removed without removing the individual wires from the terminal block. The pluggable terminal blocks can be oriented either vertically or at right angles to the circuit board headers. It is recommended that all interconnect wiring be with UL type 1015, 20 AWG minimum, with the power input and pump output being 16 AWG.

8.1. Inputs:

All inputs are either open, or closed. **DO NOT APPLY ANY EXTERNAL VOLTAGES TO INPUTS, OR BOARD MAY BE DAMAGED.**

TB1-1	Tank Level Hi Input
TB1-2	Tank Level Hi Input Common
TB1-3	Tank Level Lo Input
TB1-4	Tank Level Lo Input Common
TB1-5	Pressure Input
TB1-6	Pressure Input Common
TB1-7	Lockout Input
TB1-8	Lockout Input Common
TB1-9	+5VDC Output
TB1-10	EXT/TDS Input
TB1-11	EXT/TDS Input Common

8.2. Outputs:

Outputs are either 120VAC or 12VDC. These outputs are not fused, or current limited. Therefore, CARE MUST BE TAKEN TO PREVENT SHORTING OF THESE OUTPUTS TOGETHER, TO COMMON, OR TO ANY OTHER VOLTAGE SOURCE, OR CIRCUIT BOARD MAY BE DAMAGED.

TB2-1	Hour Counter +12VDC
TB2-2	Hour Counter -12VDC
TB3-1	Auxiliary Relay, 120/240VAC, 3 Amp max.
TB3-2	Auxiliary Relay, 120/240VAC, 3 Amp max.
TB3-3	Flush Valve, 120/240VAC, 3 Amp max.
TB3-4	Flush Valve, 120/240VAC, 3 Amp max.
TB3-5	Feed Valve, 120/240VAC, 3 Amp max.
TB3-6	Feed Valve, 120/240VAC, 3 Amp max.
TB3-7	Pump, 120/230VAC, 12Amps maximum
TB3-8	Pump, 120/230VAC, 12Amps maximum
TB3-9	Power Input, 120/230VAC, Neutral
TB3-10	Power Input, 120/230VAC, Ground
TB3-11	Power Input, 120/230VAC, Hot

Caution: Input voltage is not selectable. There are two different models. One that is for 120VAC ONLY, and one that is for 230VAC ONLY.