

396-3613Y1



# Troubleshooting / Service Guide for SureFire PWM Liquid Application Systems

**JDRC 2000**

*Always verify the controller settings. See the screenshots in Section F of the system manual.*

## The pump won't run.

### Electric Pump System

#### EPD flashing 4 times

1. Find the EPD (electric pump driver) shown above. Should have a steady blinking light in the middle when pumps should be off. If Status LED is flashing 4 times, then pausing, EPD has tripped due to low voltage condition. Unplug the Power Supply to the EPD to reset. If condition persists, check Power Supply cables from battery to EPD to insure solid connections and good electrical path. (*There should be 11-12 volts at the point where the EPD connects to the battery power harness, when tested under load. This voltage may show up when there is no load, but the harnessing may not be good enough to deliver 11-12 volts under load.*)

#### No Lights on EPD

1. There should be a steady blinking light in the middle of the EPD. If no light is ON, check the 40-amp fuse in the EPD harness near the battery. Use a voltmeter to verify that there is 12-13 volts at the Power Supply connector that plugs into the EPD. Check this under load. It may show adequate voltage with nothing on, but bad wiring or connectors may not support the current needed with a load.

#### Will pumps run?

1. Connect the two large connectors that are plugged into the bottom of the EPD to each other (bypass the module and supply 12 volts directly to pumps).
2. Do the pumps run? If not, check the 40 amp fuse in the EPD harness near the tractor battery. Inspect harnesses and connections. If 2 pump system, plug pumps in by themselves to check both.

### Electric pumps only run with 12 volts direct from battery

1. Connect pumps and power harness back to EPD.
2. Go to **Diagnostics, Calibrate PWM Limits Test** to investigate this issue (this is a place where you can run the pump).
3. Start the test. Hold down "+" button for a few seconds. A single tap of this button produces a very small change in signal to the valve, so you must hold it.
4. Remove PWM valve connector at EPD and check voltage. You will need 4-12 volts to turn pumps on.
5. If 4-12 volts is not present, check harnesses and review control valve type setup.
6. Go back to the 12-pin connector that plugs into the Pump harness. Check voltage between pins 5 & 6.
7. Go back to the 47-pin connector (if using a harness with this). Check voltage between pins 23 & 24 for Product 1, or pins 25 & 26 for Product 2. This should be between 6-12 volts after holding "+" button.
8. On 35-pin connector on JDRC 200 ECU, PR 1 PWM is pins 23 & 35. PR 2 PWM is pins 13 & 24 when set up in a Generic profile for 2 liquids. Contact your John Deere dealer for further assistance.

**For more complete system information see the manual for your system. Manuals can be seen and downloaded at [www.surefireag.com/support](http://www.surefireag.com/support). The manuals also contain wiring harness diagrams.**



# Hydraulic Pump Will Not Turn

Turn hydraulics off, go to the **SureFire PWM valve** and use the manual override (red knob) on top of the electric coil to **manually open the valve** (Manual Override UP = valve fully open). There may be dirt in here that needs to be cleaned out before you can turn and raise the override. Turn hydraulics on **at a low flow only** as the valve is 100% open. If pump does not turn, try hydraulic lever in opposite direction. Does the pump turn? If it turns, your problem is electric / electronic. If the pump still does not turn, you have a hydraulic problem.

## Electric / Electronic Problem

1. Close manual override (lock down)
2. Go to **Diagnostics, Calibrate PWM Limits Test** to investigate this issue (this is a place where you can turn the pump on).
3. Verify hydraulics are on.
4. Start test. Hold down “+” button for a few seconds. A single tap of this button produces a very small change in signal to the valve, so you must hold it.
5. Take a metal object and hold it next to the coil. If the coil is working, you will feel the magnetic pull.
6. If no magnetic force is felt, disconnect the PWM valve connector and check voltage. You will need 6-12 volts to get hydraulic valve to open.
7. If 6-12 volts is not present, check harnesses and review control valve type setup.
8. Go back to the 12-pin connector that plugs into the Pump harness. Check voltage between pins 5 & 6.
9. Go back to the 47-pin connector (if present). Check voltage between pins 23 & 24 for Product 1 PWM; pins 25 & 26 for Product 2 PWM). This should be between 6-12 volts after holding “+” button.
10. At 35-pin connector on ECU, PR 1 PWM—pins 23 & 35; PR 2 PWM—pins 13 & 24). Contact your John Deere dealer for further assistance.
11. You can remove the electromagnetic solenoid with proportional valve to see if the valve moves when a PWM signal is sent to it.

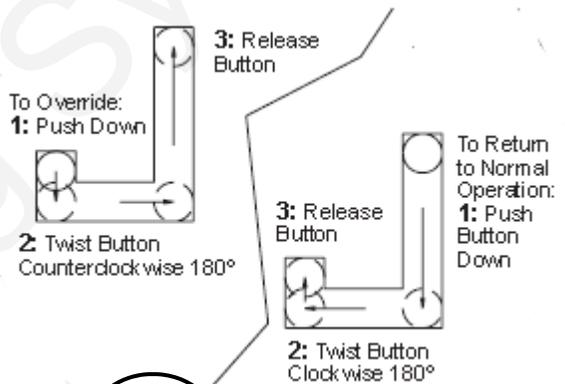
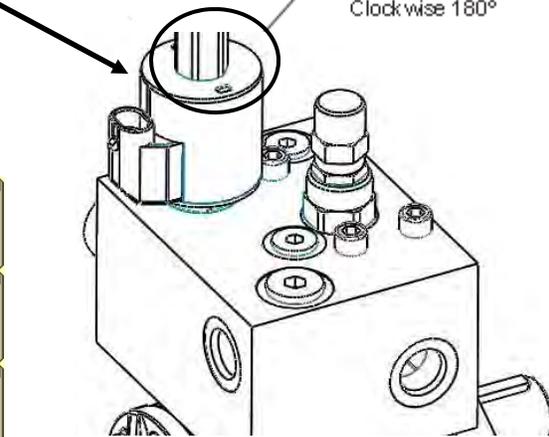
## Hydraulics Problem

1. Leave the manual override open on the SureFire valve.
2. Check the hose routings. The “P” port on the SureFire valve should hook to pressure. The “T” port is the return that should flow back to the tractor.
3. Try hoses in a different hydraulic remote. Inspect hydraulic connectors for damage or restrictions.

## Hydraulic Manual Override

**Down - Normal Operation**

**Up - Override, valve 100% open**

The **Section Test** is another place to run the system. Or, enter a Test Speed and run the system in Manual Mode from the Run Screen.

**Tests > Nozzle Flow Check** is a good screen to try a Speed and Target Rate to see if it will lock on to a rate. When testing with water, the pressure will be a lot less than it will be when using a fertilizer product.

You can also enter a Test Speed and run the system in Auto Mode from the Run Screen.

## Application Rate Fluctuates

First, you need to determine if the fluctuation is caused by the controller sending fluctuating signals to the valve or because of something else.

1. **Inspect & clean pump inlet strainer.** Strange flow rate fluctuations are very often due to an obstruction to the pump inlet. Inspect plumbing from tank to pump.

OR

1. Run the system in Manual Mode with a Test Speed.
2. Turn the system on. Watch the flow in GPM.
3. Is the flow steady within a very small range? For example, a fluctuation from 12.3 to 12.6 GPM would be considered normal. A fluctuation from 10-14 GPM is a problem. If only a small normal fluctuation is seen in section test, skip steps 4-8 and proceed to "Application Rate Fluctuates in Field ..... " below.
4. If there is a large fluctuation, observe the system flow. Is the discharge a steady stream; are the flow indicator balls floating steady?
5. If visually the flow is steady, but the display reports a fluctuation in GPM, inspect the flowmeter. See section B of manual for flowmeter information. Check connections between tank and pump. A loose connection may not show up as a leak, but it can be a place where air can be sucked in. Air in the system will cause erratic flowmeter operation.
6. If visually the flow is unsteady, the flowmeter is working correctly reporting a flow problem. Is the pump turning steady or surging?
7. If the pump is turning steady, the hydraulic circuit is functioning correctly. Look for any type of obstruction in the pump inlet. Clean the strainer. If continually plugging the strainer investigate fertilizer quality and necessary strainer size.
8. If the pump speed is surging, there is a hydraulic problem.

## Application Rate fluctuates in field, but flow in Section Test mode is stable.

This problem indicates the valve calibration needs changed. The system is surging because the Rate Controller is moving the hydraulic valve too much.

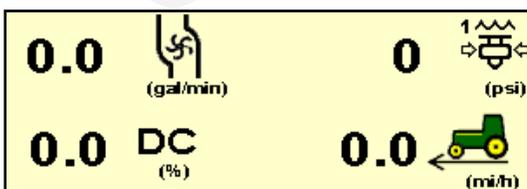
1. Go to **Setup - System Settings - Control Valve Setup**.
2. Lower the Valve Response Rate by 5 or 10. You can do this on the go and see how the change affects the rate.
3. In extreme cases, it may be necessary to go to Advanced Tuning and adjust some other parameters.

## Application Rate is slow to get to the Target Rate

1. To get system to Target Rate faster on startup, go to **Setup - System Settings - Control Valve Setup > PWM Setup > PWM Startup**. Set PWM Startup (%) so that pump starts up at or slightly above the normal PWM Duty Cycle.
2. If system is slow responding to rate or speed changes, you may need to increase the Valve Response Rate. Go to **Setup - System Settings - Control Valve Setup**. Increase Valve Response Rate 10 at a time. You can do this while going across the field and observe the effects of each change. If Valve Response Rate is at 100 and system is still slow getting to Target, go to Advanced Tuning and increase P and S.

## Helpful Operating and Troubleshooting Information on the JDRC 2000

1. **Flow (gal/min), Pressure (PSI), PWM Duty Cycle (DC%), and Pump RPM** (if equipped on your hydraulic pump) are important indicators of system performance. It is good to know what these values are in normal field operation. They provide good troubleshooting information if there is a problem.



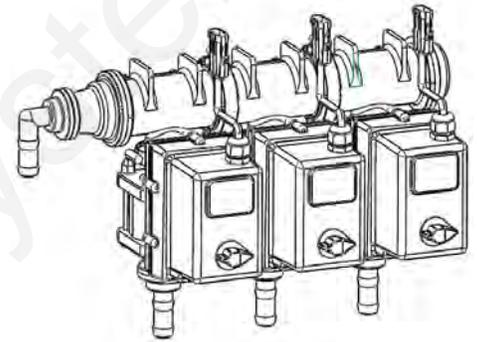
2. These items can be placed on the Run Screen with Display Settings or can be placed in the bottom two windows on the Run Screen.



# No Flow shown on display but liquid is being pumped

## Flowmeter Tap Test

1. Unplug the flowmeter. With voltmeter, check for 12 volts between power and ground of flowmeter connector. If 12 volts not present, inspect wiring harness and troubleshoot all connections per schematic. There should be 5 volts between the ground and signal pin.
2. If 12 volts is present, then conduct a **tap test**. Go to setup and change the flow cal to 10. Have a second person watch GPM on the display while other person taps (use a short piece of wire or a paper clip) between the signal and ground pins (pins 1 & 3 of flowmeter connector. A flow value should show up indicating the wiring is not damaged. (If alone, note or reset a volume counter to 0 and check for increased volume after tapping.)
3. If flow shows up during the tap test, your wiring to that point is good. If still not fixed, inspect adapter harness and test continuity per schematic (see Section D).
4. Replace flowmeter.
5. Change Flow Cal back to appropriate Flow Cal when finished with Tap Test.
6. SureFire has a Speed/Flow Simulator (PN 219-01462) that can be used to confirm if the wiring is good between the flowmeter and controller.

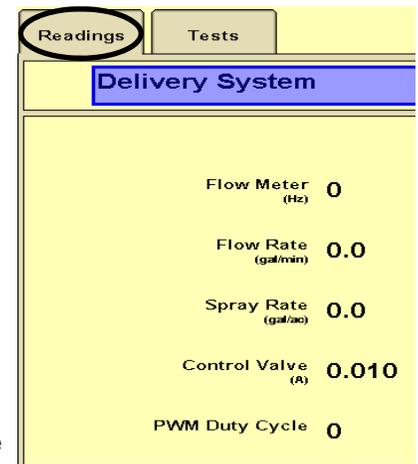


## Section Valve(s) will not move

1. Go to **Diagnostics, Section Test** to investigate this issue.
2. In Section Test, check and uncheck the boxes. With the box checked the valve should turn on. The valve should be off with the box not checked.
3. Check the harness connection to that valve. It is a 3-Pin Weather Pack connector. See Section D for wiring diagrams
4. Check voltage pin A to Pin B. Must be 12 volts, if not, go back to 14-pin and check voltage (pins 1 & 2 are +12V, pins 3 & 4 are ground).
5. If voltage is present on pins A&B of 3 pin connection to valve, then check Pin C to Pin B. This should be 12 volts when the valve is commanded on or open, this should be zero volts when valve is off or closed.

Pin	Function
A	+ 12 V Constant
B	Ground
C	+ 12 V Signal

6. If signal voltage is not present to open valve, use diagrams to check at the 14-pin, then the 47-pin for voltage on the proper pin for that section.
7. If constant voltage (Pins A&B) and switched voltage (Pins C&B) are present, inspect, repair or replace the valve.



## Troubleshooting Tip

1. Useful information is available at **Diagnostics—Readings—Delivery System**.
2. Check flowmeter operation here.
3. See PWM Duty Cycle (an indication of how fast the pump is running (0-100%)). You can also place PWM DC% on the Run Screen.

## Pressure Sensor is not reading

1. Be sure Pressure Sensor is plugged into Pressure Sensor 1 connector. Make sure the pins where the harness screws on to the end of the sensor have not been bent.
2. Be sure Pressure Sensor is set up and calibrated in the display.

**Setup > System > Check the box for Pressure Sensor 1 > Calibrate Pressure Sensor > Voltage-based Calibration > 50 mv/PSI.**

3. There should be a green LED light on the end of the pressure sensor. This may be difficult to see in daylight. The sensor needs 12 v. Check between pins B&C on the Pressure 1 connector on harness that connects to the pressure sensor. If there is no voltage here, check the voltage between pins 1 & 2 on the 12-pin connector labeled PUMP.

## Other issues

### 1. “My rate won’t go low enough. I want 8 gpa, but it won’t put down less than 11 gpa.”

- A. Check **Setup > Rates > Minimum Flow Rate**. This can be set at 0.0 or at the low range of your flowmeter. This is **gal / min** not **gal / acre**.
- B. Check **Setup > System > PWM Setup > PWM Settings > Low Limit**. Default setting for JD is 10 for electric pumps and 25-30 for hydraulic pumps. If set too high, the pump cannot slow down enough when your speed drops or when sections close.
- C. On a hydraulic pump, be sure the red manual override knob is down and locked on the hydraulic valve.

### 2. “I can’t get up to my rate. I want 12 gpa, and I can’t get more than 10 gpa.”

- A. How many GPM are required to hit your rate? Is this within the pump’s specifications? On an electric pump, the output of the pump decreases as the pressure increases. Keep the pressure under 40 PSI (or lower) on an electric system. Is a recirculation valve open, allowing too much liquid to recirculate?
- B. On a dual electric pump system, check each pump individually to see that each one is working at capacity.
- C. Is the strainer plugged? If too small of a mesh strainer is being used, the fluid can gel up around the screen as the fluid is pulled through.
- D. Does the pump have enough hydraulic oil to hit the desired rate? If the pump is in series behind another pump or motor, the hydraulic oil to this pump may be limited.
- E. Check **Setup > System > PWM Setup > PWM Settings > High Limit**. This should be 100.
- F. Check the PWM DC % (Duty Cycle). This can be placed on the Run Screen.
- G. Run the pump with a Test Speed in Manual Mode. Press the + button to increase flow. Observe flow (GPM), PWM DC%, PSI, and Pump RPM (if equipped).
- H. Run a Nozzle Flow Check. See gal/ac, PSI, gal/min, and PWM Duty Cycle.
- I. Is the flow cal correct? Is the width of the implement set correctly?

### 3. “It’s pretty close to the rate, but it won’t ever lock in to the rate.”

Go to **Setup > Rates > Rate Smoothing**. Check the box for Rate Smoothing. Put **10** in the box.

Without Rate Smoothing it is normal for the system to show the rate constantly changing small amounts as you go across the field. With Rate Smoothing, if the Applied Rate is close to the Target Rate, the display does not show all the small changes.

### 4. “When I start up, I get a screen that says “Solution Pump Dry”.

This is not unusual on the Deere display. If the flowmeter does not show flow immediately when you start, this screen pops up. It is made to protect centrifugal pumps that can be harmed quickly if they are dry. This is not a problem for SureFire diaphragm pumps. To get to Target Rate quicker on startup, set the PWM Startup % so the pump starts at or near where it will be running.

### 5. “What settings do I use for the SureFire system on the original JD Rate Controller?”

The full screenshots of these are in Section F of the manual that came with the system.

Here is a summary of the typical settings: Not everything is shown in this table. Some systems may need to be adjusted for better operation.

Setup Arrow	Tower Electric	PumpRight Hydraulic
Implement	Liq Fert Tool—Set up width, sections, and height switch as needed	
System—Section Valve—Control Valve	3-Wire—PWM Close	
Flowmeter Calibration	3000—gal	2000—gal
PWM Setup	9911—100—255—20	4012—100—255--60
Alarms—Pressure Sensor	10—40	15—80
Rates—Minimum Flow	0.0 or low end of flowmeter ( <i>Note: This is Gal/ min NOT Gal/acre.</i> )	
Rates—Rate Smoothing	Check the box—10	

## 6. “My pressure is too high / too low.”

The pressure will be what it is depending on how hard it has to push to get the amount of liquid you are moving from the pressure sensor to where it leaves the system. This pressure will depend on the product itself, the volume (gal/min) you are moving and how much restriction there is to that flow. The orifice or metering tube will be the primary restriction, but it is possible that other parts of the system may add to the total pressure. The pressure a system develops will be less (possibly much less) with water than it will be with a fertilizer product.

### ***What pressure is “too low”?***

You need enough pressure to open the check valves. If the pressure is too low, some check valves will open before others, so that some rows may be flowing while others are not. **With 4 lb check valves, we like at least 8 PSI. With 10 lb check valves, we like 15-20 PSI.**

### ***What pressure is “too high”?***

There are a few products that may have flow characteristics that are better at lower rather than higher pressures. With most products that is not a concern.

The plumbing components of a SureFire system are rated at 100 PSI or above. On an electric pump system, the pump capacity decreases as the pressure increases. Our standard Tower pump has an internal 70 PSI bypass. **With an electric pump, we like to see pressures from 10 to 30 PSI.** If the pump has the capacity to hit the rate at higher pressures, there is not a problem with doing that, but for long-term operation it would be best to switch to a larger orifice or metering tube.

The SureFire PumpRight hydraulic pump has the ability to pump up to 290 PSI. SureFire plumbs these with a 100 PSI pressure relief valve (PRV) so that plumbing components will not be damaged if high pressure develops. **Typical operating pressures with hydraulic pumps will be 20-60 PSI**, but the pump will work fine at 80-90 PSI if that is needed. If continually running in that high range, consider a larger orifice or metering tube.

Lower pressure will not necessarily reduce the **velocity of the output stream** at the row. Conversely, higher pressure will not necessarily increase the velocity of the output stream at the row. The velocity of the output stream is determined by the volume of the flow and the size of the opening at the output. Changing the pressure by changing an orifice or metering tube upstream from the outlet will not affect the velocity of the output stream if the flow volume remains the same.

**Options if pressure is too high with orifices:** Use a bigger orifice. Slow down. If pressure is too low, use a smaller orifice.

**With metering tube: Options if pressure is too high:** Use a larger diameter tube. Shorten the tubes that are on now. Slow down. (*The pressure in a metering tube is related to the viscosity of the product. Many products change viscosity as the temperature changes. A product will have a higher viscosity (and therefore higher pressure) on a cold morning than it will on a hot afternoon.*)

**With metering tube: Options if pressure is too low:** Switch to a smaller diameter tube. Use a longer tube.

**See SureFire publication “396-3269Y1 Navigating the Metering Tube Maze” for more information on how metering tube works.**

**See SureFire publication “396-3229Y1 Liquid System Components Overview” for a description of all the system components and additional troubleshooting/service information.**

**See the system manual for your system for more complete information. Manuals and publications are available for download at [www.surefireag.com](http://www.surefireag.com).**

Also see the John Deere manuals for the GS3 Display and the John Deere Rate Controller for more information on the setup and operation of those components.