396-3249Y1

Troubleshooting / Service Guide for SurePoint PWM Liquid Application Systems

John Deere GS2 2600 & GS3 2630 with GreenStar Rate Controller (GRC)

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

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For more complete system information see the manual for your system. Manuals can be seen and downloaded at www.SurePointag.com/support. The manuals also contain wiring harness diagrams.

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The pump won't run.

Electric Pump System

EPD flashing 4 times

1. Find the EPD module (electric pump driver—black module on Tower). Should have a steady blinking light (one blink per second) in the middle when pumps should be off. In Run mode, the center light should be steady red, the upper right should be steady red (indicates it is receiving a PWM signal). If Status LED (center light) 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. Check connections at battery. Check connectors at the hitch and at the EPD. (*There should be 11.5-13 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 11.5-13 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 individually. If pump won't run, connect it to pickup battery with jumper cables.

Pumps run, but won't pump anything—

1. Are valves from tank to pump open? Is strainer clean? Close recirculation. Open air bleed valve.
2. Tap on pump with rubber mallet. Pour water (hot, if available) in inlet of pump. Remove outlet hose from pump.

Electric pumps only run with 12 volts direct from battery

Check to see if PWM signal is getting to the EPD:

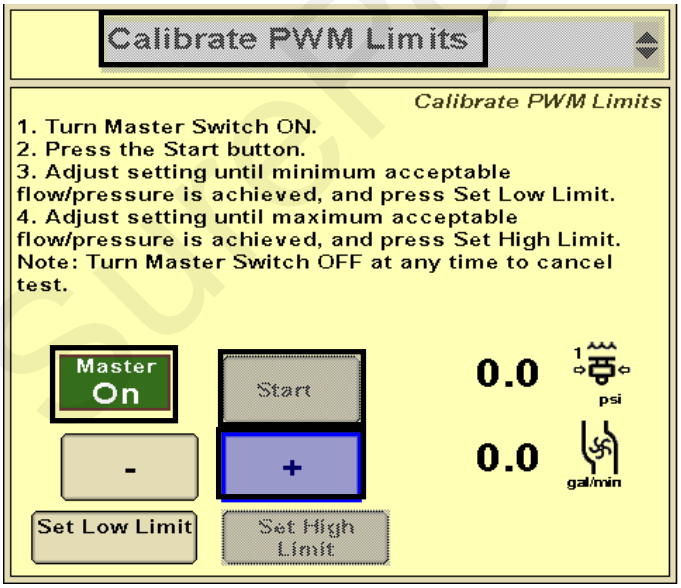
1. Connect pumps and power harness back to EPD.
2. Go to **Diagnostics > Tests > Calibrate PWM Limits** to investigate this issue.
3. In Calibrate PWM Limits, hold down "+" button for a 8-10 seconds. A single tap of this button produces a very small change in signal to the valve, so you must hold it. *(Look at Readings > Delivery System > PWM Duty Cycle)*
4. Remove PWM valve connector at EPD and check voltage. You will need 6-12 volts to turn pumps on. (PWM Duty Cycle at 255 should be 12+ volts on PWM signal)
5. If 6-12 volts is not present, check harnesses and review control valve type setup.
6. If you have a 16-pin connector that plugs into the Pump harness. Check voltage between pins 3 & 4.
7. If you have a 12-pin connector, check PWM voltage between Pins 5 & 6 and between pins 5 & 2.
8. Go back to the 37 pin connector at the John Deere Rate Controller. Check voltage between pins 15 & 16 and between pins 16 and 2. Should be between 6-12 volts while in Calibrate PWM Limits test after holding "+" button.
9. If you cannot get voltage at pins 15 & 16, contact your John Deere dealer for further assistance.

Hydraulic Pump Will Not Turn

Turn hydraulics off, go to the **SurePoint Hydraulic 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. Start the **Calibrate PWM Limits Test** to open the section valves. Turn hydraulics on **at a low flow only** as the valve is 100% open. Gradually increase the hydraulic flow from the cab. If pump does not turn, try hydraulic lever in opposite direction. Try switching to a different remote. 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** >**Tests > Calibrate PWM Limits** to investigate this issue.
3. Verify hydraulics are on.
4. In Calibrate PWM Limits, hold down "+" button for 8-10 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 and pins 5 & 2. If yours is a 16-pin connector, check between pins 3 & 4.
9. Go back to the 37-pin connector at the John Deere Rate Controller. Check voltage between pins 15 & 16 (and 16 & 2), should be between 6-12 volts while in Calibrate PWM Limits after holding "+" button.
10. If you cannot get voltage at pins 15 & 16, 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. Look closely, it's a small movement.



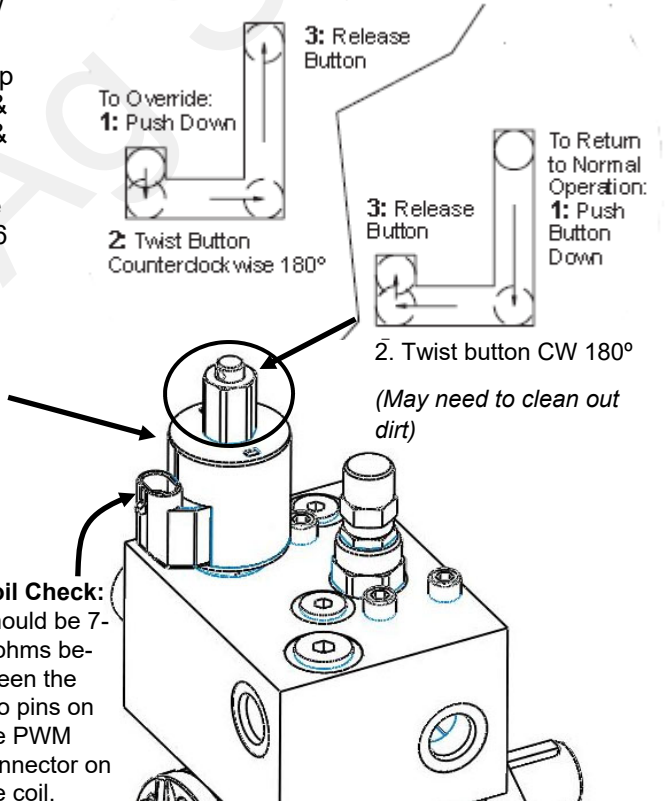
Hydraulics Problem

1. Leave the manual override open on the SurePoint valve.
2. Check the hose routings. The "P" port on the SurePoint 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



Coil Check: Should be 7-9 ohms between the two pins on the PWM connector on the coil.

The **Calibrate PWM Limits Test** is a very useful diagnostic tool in servicing the John Deere system. It is a good way to prime the pump initially. It can be helpful to go the ***Readings > Delivery System*** to see information on the flowmeter operation and the ***PWM Duty Cycle***.

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.*

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. Go to **Diagnostics > Tests > Calibrate PWM Limits Test,** to run the system in ***Manual Mode***.
2. Turn the system on. Watch the flow in GPM and PSI. ***Does the system run steady in Manual Mode?***
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 11-14 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. Sometimes, the inside of the flowmeter may need to be cleaned with a soft brush and soapy water.
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 when running in Manual mode, there is a hydraulic problem.

Application Rate fluctuates in field, but flow in Calibrate PWM Limits 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.

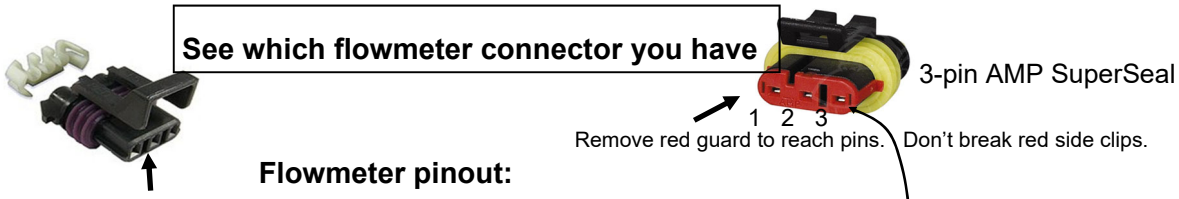
1. Go to **Setup - System - PWM Setup**.
2. If Valve Cal is 4012, try 2522. If system is still surging, go to 2022, and then to 1522 if needed. If the first two digits get too low, the system will be slow to respond to speed or rate changes. If the system is stable, but slow to adjust and slow to get to rate, increase the first 2 digits (from 2522 to 3022, etc.).

Application Rate is slow to get to the Target Rate

1. You may need to increase the valve calibration. Go to **Setup - System - PWM Setup**.
2. Change the **Valve Calibration** by increasing the valve speed (first two digits of the valve calibration number). For example, increase the number from 2522 to 3022, which changes valve speed from 25 to 30. If this number is set too high, the rate will oscillate as you are going across the field.
3. If system is too slow to get to the Target Rate when starting, go to **Setup—System - PWM Setup.** Raise the **Low Limit (from 60 to 80, possibly higher).** This will start the pump at a faster speed when it initially turns on. *(This number sets the low limit of your pump, so if it is set too high your pump may not be able to slow down enough at low speed/low rate settings or with some sections turned off.)*
4. ***Optional Method 1*** *to get to Target Rate faster: (Caution: You can only use this method if you have Electric Section Valves.) Go to* ***Setup - System.*** *Set* ***Control Valve Type*** *to* ***PWM.*** *This leaves the pump running at the last speed when product application is stopped. Under* ***PWM Settings*** *check the* ***Pump Enable Checkbox****. With the section valves closed and the pump running, this can build up too much pressure in the system at times. To reduce this pressure, open the Recirculation Regulation Valve slightly. Since this will cause continuous recirculation, it will reduce the maximum output to the rows that is attainable and the pump will run at a higher speed all the time.*
5. ***Optional Method 2*** *to get to Target Rate faster: Use the John Deere Rate Controller* ***Flow Return*** *feature. This will involve adding an additional electric valve and plumbing to return flow to the tank when product application is stopped. It also requires a SurePoint harness with Flow Return connection. On the* ***Setup - System*** *screen, check the* ***Flow Return*** *box. In* ***Setup - System****, the* ***Control Valve Type*** *is set to* ***PWM.*** *Under* ***PWM Settings*** *check the* ***Pump Enable Checkbox****. With the Control Valve Type set to PWM, the pump continues to run at the last speed it was running when product application was stopped. Flow at this time is returned to the tank. When product application is resumed, flow is diverted from the tank back to the rows.*

No Flow shown on display, but liquid is being pumped

Flowmeter Tap Test



Flowmeter pinout:

3-pin MP Tower **A- Signal** **B- 12V Power** **C- Ground**

3-pin AMP SuperSeal **1– Ground** **2– 12V Power** **3– Signal**

1. Unplug the flowmeter. With voltmeter, check for **12 volts between Power & Ground** of flowmeter connector. Should have **4-5 volts between signal and ground**. If voltage is not present, inspect wiring harness and check for voltage at harness connection(s) nearer the Rate Controller. (16-pin: Power is Pin 16, Ground is 11, Signal is 13) 37-pin: Power is Pin 36, Ground is 21, Signal is 28)
2. If 12 volts is present, then conduct a **tap test**. Go to setup and change the Flow Cal to 1. Have a second person watch Flowmeter (Hz) and Flow (GPM) on the Diagnostics > Readings > Delivery System screen while other person taps repeatedly (use a short piece of wire or a paper clip) between signal and ground pins of flowmeter connector. A flow value (gpm) should show up indicating the wiring is not damaged.
3. If GS2/GS3 responded to the tap test, your wiring to that point is good. If tap test did not work, go back to the next harness connection and do a tap test there between signal and ground.
4. If the tap test registers flow on the display, replace flowmeter. (*Sometimes, cleaning the inside tube of the flowmeter with soapy water and a soft brush will remove a film covering the electrodes.)*
5. Change Flow Cal back to appropriate Flow Cal when finished with Tap Test.
6. SurePoint has a Speed/Flow Simulator (PN 219-01462) or a Tap Tester (212-03-3912Y1) that can be used to confirm if the wiring is good between the flowmeter and controller.

Field Verification of Flowmeter Calibration

Always verify the flow cal setting by comparing the amount actually applied in the field (from weigh tickets) with the amount shown on the display. Adjust the flow cal as needed to get less than 1% difference between the actual amount applied and the amount shown on the display.

In general:

Increase the Flow Cal number if not enough product is actually being applied. *(If you want more, increase the number)*

Decrease the Flow Cal number if too much product is being applied. *(If you want less, decrease the number)*

Formula to Adjust Flow Cal Number

(Volume shown on display) / (Volume actually applied) X flow cal number in display = new flow cal

Example: Display shows 727 gallons was applied. Weigh ticket shows 749 gallons was actually applied. Flow cal number in display was 3000. *(We applied too much, so we will decrease the flow cal.)*

727 / 749 X 3000 = 2912 (new flow cal number to set in display)

(*Any adjustments to the flow cal number will only be as accurate as the measurements used in figuring it.)*

Section Valve(s) will not move

1. Go to **Diagnostics > Tests > Section Test** to investigate this issue. If system shuts off with Solution Pump Dry warning, use the Calibrate PWM Limits Test.
2. Start 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. If none of the valves are working, or if half of the valves are working, it may be a Power (or Ground) issue. The odd-numbered sections have one power source, the even-numbered sections have another power source. (See harness diagrams)

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

4. If a valve does not open, switch the connector that is plugged into that valve with a connector that is plugged into a working valve. Also, plug in the connector to the non-working valve to a valve that is working.
5. Check the harness connection to the non-working valve. It is a 3-Pin Weather Pack connector. Check voltage pin A to Pin B. Must be 12 volts, if not, go back to the next harness connection and check the voltage there. (See harness diagrams for pins)
6. 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.
7. If signal voltage is not present to open valve, use diagrams to check at the 14- (or 16-) pin connector, then the 37-pin for voltage on the proper pin for that section.
8. If harnesses and voltages are good, but valve still will not open, remove the actuator from the valve and see if the actuator will work when it is not connected to the valve. Use a wrench to turn the valve to be sure it is moving freely. Be sure actuator and valve are oriented correctly when you put them back together.
9. If constant voltage (Pins A&B) and switched voltage (Pins C&B) are present, inspect, repair or replace the valve.

If valve indicator stays GREEN all the time or if valve indicator is not in full ON or full OFF position, replace actuator. Pull gray pin to remove actuator from valve.

Replacement Valve Actuator **104-KZ1169**—KZ Electric TX2 Series Actuator

This is a 3-way valve. If product will not flow when valve is ON, either move the outlet hose to the other port, or remove actuator and rotate valve ball 180º, and replace actuator.

Pressure Sensor is not reading

1. Monitor pressure sensor at *Diagnostics > Readings > Sensors/Status.* Calibration points should be 0 PSI—0.0v; 90 PSI—4.5v).
2. Be sure Pressure Sensor is plugged into Pressure Sensor 1 connector. If the SurePoint adapter harness connected to the GreenStar Rate Controller is 231-00-3765***Y1,*** *the pressure connector on the Section harness is for* ***Sensor 2.*** *In that case, on the display do the Calibration for Sensor 2, and put PSI 2 in one of the two bottom boxes on the Run Screen.*
3. Make sure the pins where the harness screws on to the end of the sensor have not been bent.
4. Be sure Pressure Sensor is set up and calibrated in the display. Unplug the pressure harness before doing this.

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

4. 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 the harness. If there is no voltage here, check the voltage between pins 11 & 16 on the 16-pin connector labeled PUMP (if you have a 12-pin pump connector, check pins 1 and 2).
5. **Testing Pressure Sensor Harnessing:** If the pressure sensor is not reading, you can use a AA or AAA battery to test the harnessing. Connect the (-) end of the battery to pin C and the (+) end to pin A of the pressure connector. The 1.5 v should show up as 30 psi on the screen. You can check this at Diagnostics > Readings > Sensors/Status.

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 15 for electric pumps and 60 for hydraulic pumps. These may be set higher to get the pump to start faster to get to Target Rate sooner, but 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 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. Most SurePoint systems with metering tube and electromagnetic flowmeter can use a 20– or 30-mesh strainer.

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. Run pump in Manual Override to see output.

E. Check **Setup > System > PWM Setup > PWM Settings > High Limit.** This should be 255.

F. Go to **Diagnostics > Readings > Delivery System.** What is PWM Duty Cycle while the pump is running (in the field or on a Section Test or Nozzle Flow Check)? 255 means the pump is being told to run at full speed.

G. Run the **Calibrate PWM Limits Test** and hold the (+) button to speed up the pump. Check GPM and PSI at different levels. Check the PWM Duty Cycle at Diagnostics > Readings > Delivery System.

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? Is speed reading 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 SurePoint diaphragm pumps. This message may be stopped by going to **Setup > System > PWM Setup > PWM Settings > Low Limit.** ***Increase the Low Limit so the pump will start faster.***

Be sure the recirculation knob is closed, so the flow goes to the row and not to recirculation. If you must recirculate, start with a quarter turn of the knob.

5. "What settings do I use for the SurePoint 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	2522—100—255--60
Alarms—Pressure Sensor	10—40	15—80
Rates—Minimum Flow	0.0 or low end of flowmeter (***Note: This is Gal/min NOT Gal/acre.***	
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. 1/4" tubing can build a lot of pressure with 10-34-0. 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"?

A pressure is too high if it keeps the system from being able to hit the rate you want or if it opens the PRV (Pressure Relief Valve) on a hydraulic pump.

The plumbing components of a SurePoint system are rated at 100 PSI or above. On an electric pump system, the pump capacity decreases as the pressure increases. Our standard Tower electric 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. High pressure requires more current, which causes more voltage drop, which causes EPD problems.

The SurePoint PumpRight hydraulic pump has the ability to pump up to 290 PSI. SurePoint 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.

7. How do I set the Recirculation knob?

Generally, the recirculation knob is closed. If tank agitation is necessary while applying, the recirculation hose can be plumbed back to the tank. Electric pumps do not have the capacity to do much agitation. A small amount of recirculation may be desired if the pump needs to run slowly and the output is not smooth. Start with a quarter turn of the knob (less on an electric pump). A half turn of the knob will recirculate a lot. If too much is recirculated, the pump may not be able to hit the rate to the rows. Opening recirculation will not lower the pressure required to push the desired product to the rows.

See SurePoint publication "396-3269Y1 Navigating the Metering Tube Maze" or "396-4116Y1 Metering Tube Charts" for more information on how metering tube works.

See SurePoint 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.SurePointag.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.

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