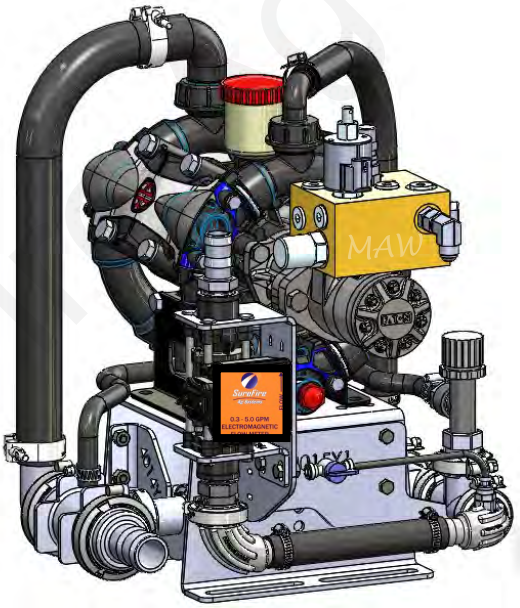
396-001070

PumpRight Fertilizer System for John Deere GreenStar Rate Controller (GRC) With PWM Control



NOTICE

Operator should read this manual before operating the system.

Maximum Pump Flow and Application Rates

	Number of Diaphragms	Max Flow GPM	Max GPA on 40' at 6 MPH	Max GPA on 60' at 6 MPH
PR17	3	17	35	23.5
PR30	3	30	62	41
PR40	4	40	82	55
D250	6	55		75

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B Components Liquid

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Safety

A

TAKE NOTE! THIS SAFETY ALERT SYMBOL FOUND THROUGHOUT THIS MANUAL IS USED TO CALL YOUR ATTENTION TO INSTRUCTIONS INVOLVING YOUR PERSONAL SAFETY AND THE SAFETY OF OTHERS. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY OR DEATH.

THIS SYMBOL MEANS ATTENTION!

BECOME ALERT!

YOUR SAFETY IS INVOLVED!

Note the use of the signal words DANGER, WARNING and CAUTION with the safety messages. The appropriate signal word for each has been selected using the following guidelines:

DANGER: Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations typically for machine components which, for functional purposes, cannot be guarded.

WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

CAUTION: Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE is used to address safety practices not related to personal safety.

Hydraulic Fluid and Equipment Safety

This system uses hydraulic equipment with hydraulic fluid under extremely high pressure.

Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin causing serious injury. Keep all hoses and connections in good serviceable condition. Failure to heed may result in serious personal injury or death. Avoid the hazard by relieving the pressure before disconnecting lines or performing work on the system.

Make sure hydraulic fluid connections are tight and all hydraulic hoses and lines are in good condition before applying pressure to the system. Use a piece of paper or cardboard, NOT BODY PARTS, to check for suspected leaks. Wear protective gloves and safety glasses or goggles when working with hydraulic systems. DO NOT DELAY!

Check hydraulic hoses and fittings frequently. Loose, broken, and missing hardware can cause equipment to not perform properly and can result in serious injury or death.
Hydraulic systems can be hot and cause burns. Before working on any system, wait until the fluid has cooled.

If an accident occurs, see a doctor familiar with this type of injury immediately. Any fluid injected into the skin or eyes must be treated within a few hours or gangrene may result.

A Word to the Operator

It is YOUR responsibility to read and understand the safety messages in this manual. YOU are the key to safety.
SAFETY IS YOUR RESPONSIBILITY.

General Description

A
Introduction

You have purchased a SureFire fertilizer system for your equipment. This system will be controlled by your John Deere GS2 or GS3 display and John Deere GreenStar Rate Controller (GRC). The Rate Controller will adjust the speed of the SureFire PumpRight hydraulic pump based on feedback from the flowmeter and vehicle speed. The system is capable of using John Deere Swath Pro to minimize overlap areas with optional section valves.

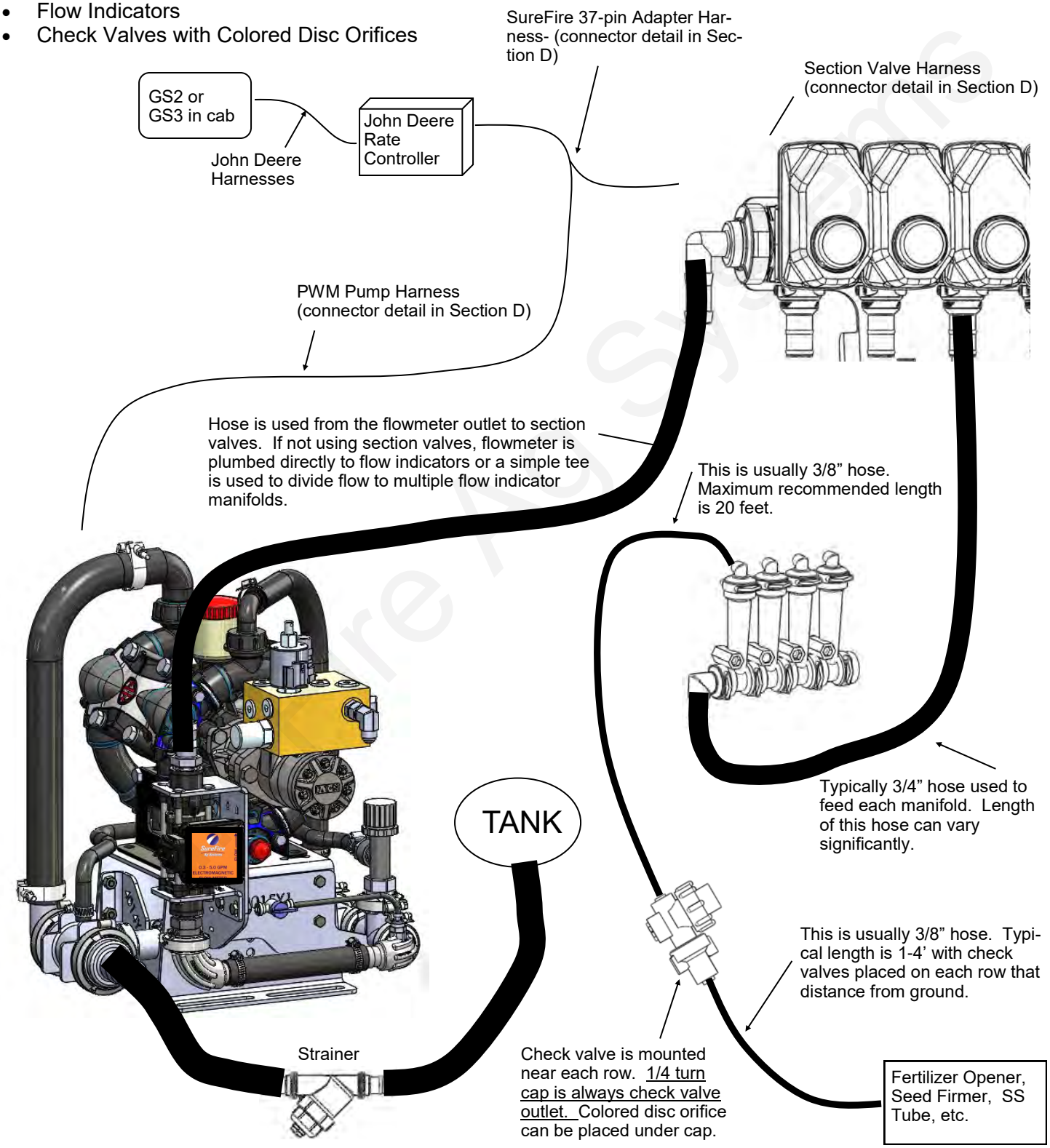
Basic Installation Steps

1. Have John Deere Rate Controller mounted and wiring harnesses connected by your John Deere Dealer.
2. Open the packages and familiarize yourself with the components. See the System Overview Example on the following page to see the big picture of how SureFire Fertilizer Systems are installed. Refer to manual sections B & D for component information.
3. Mount the PumpRight pump and make hydraulic connections. See section E for hydraulic plumbing information.
4. Plumb the tank to the PumpRight inlet. See section E for details.
5. Install the plumbing kit including section valves, flow indicator columns / manifolds, check valves, plumbing to each row unit delivery point. See section B for information on these components.
6. Attach the flowmeter outlet to section valve or manifold inlet. Attach section valve outlets to flow indicator inlets.
7. Attach harnesses as shown in Section D.
8. Set up Controller for SureFire fertilizer system as shown in Section F.
9. Fill system with water, conduct initial operation and tests per Section F.
10. Winterize system with RV Antifreeze if freezing temperatures are expected.
11. Do pre-season service each year as described on page 54.

System Overview Example

The following gives an example of a complete SureFire Fertilizer system with these components:

- John Deere GS2 or GS3
- John Deere GreenStar Rate Controller
- PumpRight PR30
- Section Valves
- Flow Indicators
- Check Valves with Colored Disc Orifices

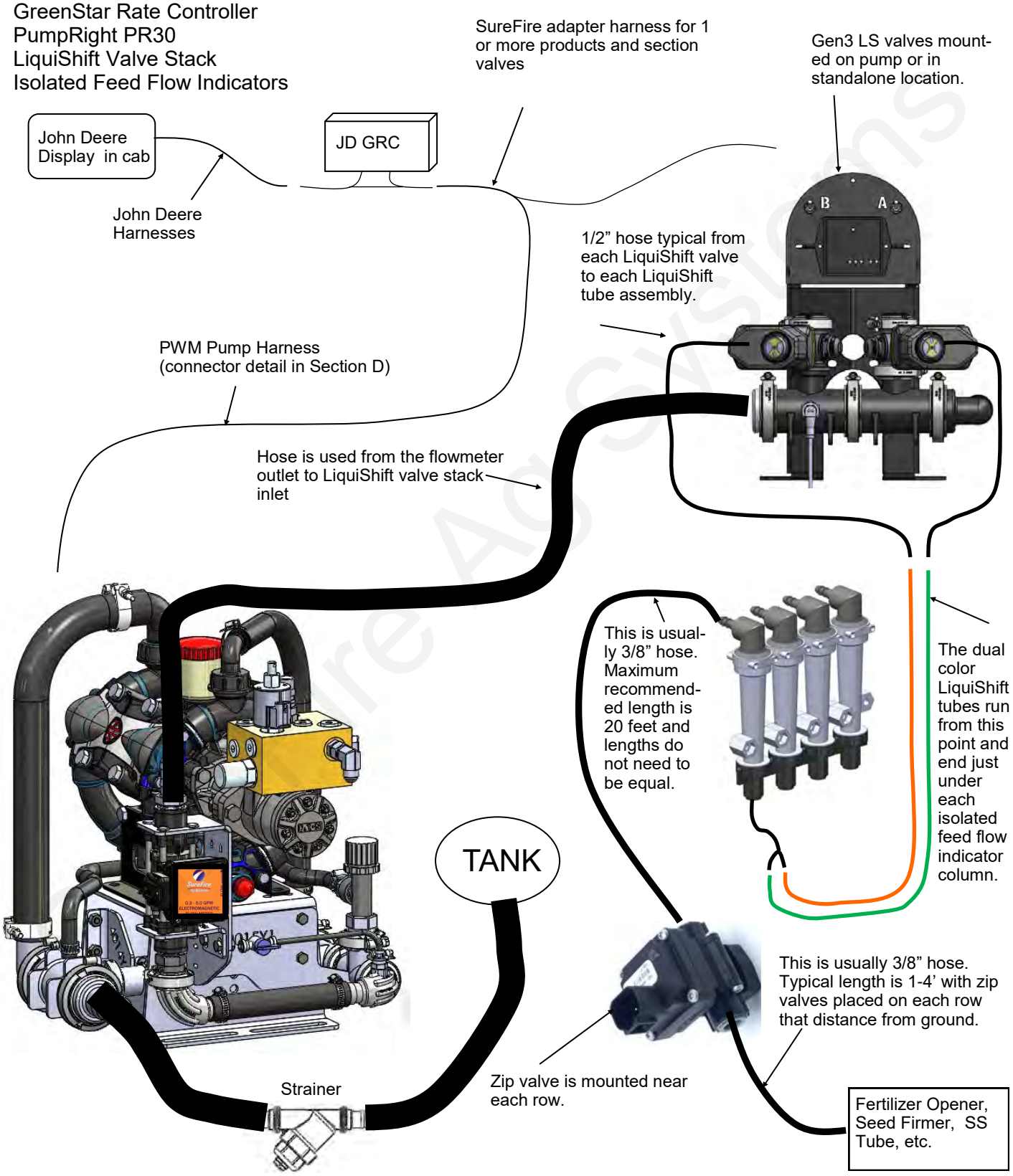


System Overview Example

The following gives an example of a complete SureFire Fertilizer system with LiquiShift and these components:

- John Deere Display
- GreenStar Rate Controller
- PumpRight PR30
- LiquiShift Valve Stack
- Isolated Feed Flow Indicators

For complete information on Gen3 LiquiShift, see the Gen3 LiquiShift manual, 396-4608Y1.



PR17 & PR30 Electromagnetic Flowmeter Kits

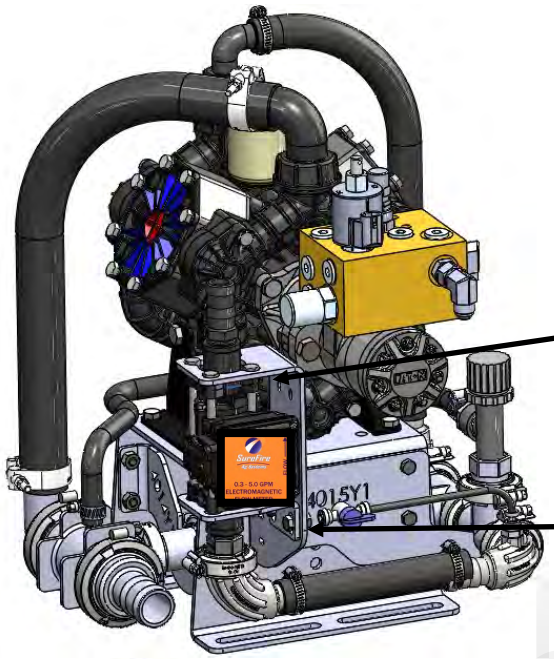
B
Components
Liquid

0.13 - 2.6 GPM Item Number 500-02-2082 (PR17)
0.3 - 5.0 GPM Item Number 500-02-2085 (PR17)
0.6 - 13 GPM Item Number 500-02-2090 (PR17 & PR30)
1.3 - 26 GPM Item Number 500-02-2095 (PR30)

Kits include flowmeter, adapter harness, mounting bracket, hose barb fittings & hose clamps.

-Before doing any arc welding on the implement, unplug the cable to the flowmeter, or damage to the flowmeter may result.

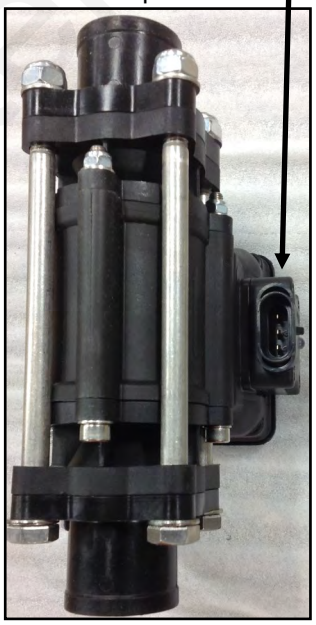
-Do not power wash the flowmeter. High pressure spray directed at the back edge of the face plate or at the wire connector may allow water into the flowmeter electronics.



Mounting Bracket, 410-4015Y1 (QTY 1) (not used for PR40 and D250 Pump)

Mounting Bracket, 400-3826Y1 (QTY 1) (not used for PR40 and D250 Pump)

Amp SuperSeal 3-pin connector
Use adapter 201-17842
to connect to 3-pin MP harness



Troubleshooting Tip:

1 2 3

Remove red guard to reach pins. Be careful so you don't break red side keepers.

3-pin MP Tower A- Signal B- 12V Power C- Ground *(See the next page for more flowmeter tips)*
3-pin AMP SuperSeal 1– Ground 2– 12V Power 3– Signal

Electromagnetic flowmeters are superior to traditional turbine flowmeters in two basic ways. First, they have no moving parts. There are no wear items or potential for contaminants to jam a spinning turbine.

Second, electromagnetic flowmeters detect the flow by electrically measuring the velocity of the liquid, which makes them independent of viscosity or density of the fluid measured. They are extremely accurate using the standard calibration number. **SureFire still recommends you perform a catch test to verify the system is properly installed and configured.**

Flowmeter Model (black meter with orange label)	JD GRC Flow Calibration	FPT Size	Hose Barb In kit
0.13 - 2.6 GPM	3000	3/4"	1"
0.3 - 5 GPM	3000	3/4"	1"
0.6 - 13 GPM	2000	3/4"	1"
1.3 - 26 GPM	2000	1"	1"

The flowmeters will accurately read higher than the rated range.

Earlier model flowmeters (meters with white labels with black text) have different calibration numbers. The flow cal number (pulses per gallon) is printed on the serial number sticker on the side of the flowmeter.

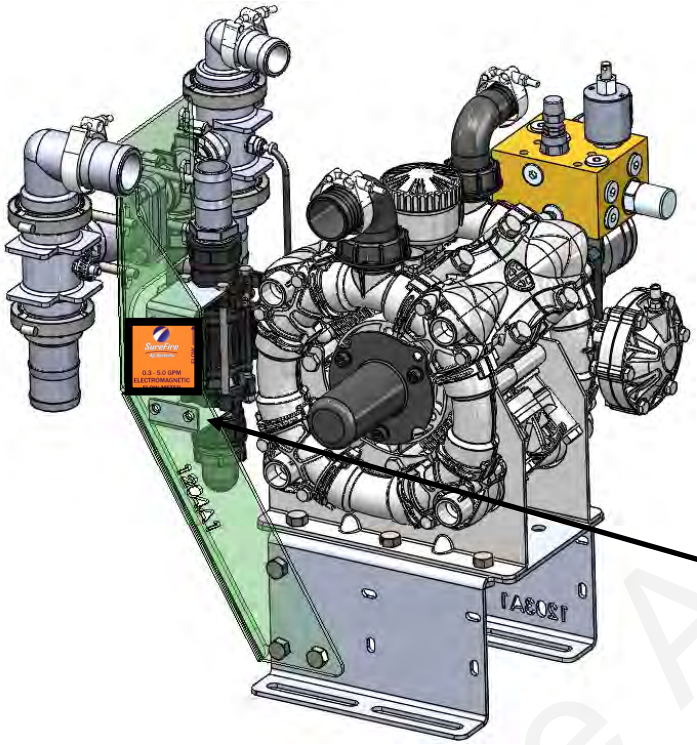
PR40 & D250 Electromagnetic Flowmeter Kit

2.6 - 53 GPM Item Number 500-02-2080

Kits include flowmeter, adapter harness, mounting bracket, hose barb fittings & hose clamps.

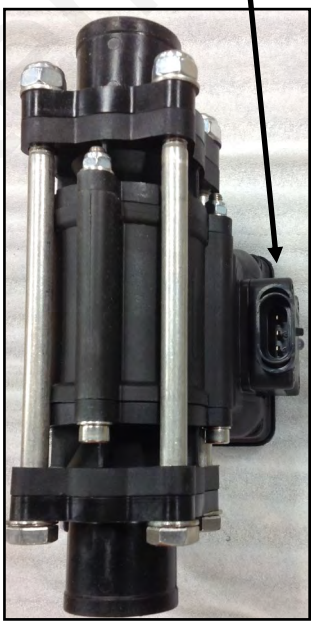
B
Components Liquid

-Before doing any arc welding on the implement, unplug the cable to the flowmeter, or damage to the flowmeter may result.
-Do not power wash the flowmeter. High pressure spray directed at the back edge of the face plate or at the wire connector may allow water into the flowmeter electronics.



Mounting Bracket, 400-3335Y1 (QTY 2) (used for PR40 and D250 Pump only)

Amp SuperSeal 3-pin connector
Use adapter 201-17842
to connect to 3-pin MP harness



1 2 3

Remove red guard to reach pins. Be careful so you don't break red side keepers.

Troubleshooting Tip:

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

Power to Ground should be 12 volts.
Signal to Ground should be 4.5 to 5 volts
Do Tap Test between Signal and Ground to test harnessing.

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

Additional Tip:

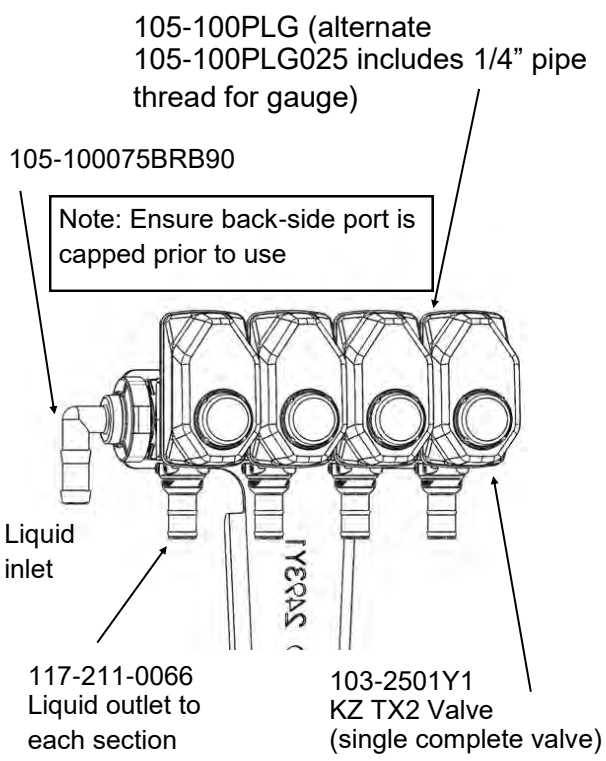
If flowmeter is not reading and the harnessing has checked out OK with voltage readings and tap test, try cleaning the inside tube of flowmeter with warm soapy water and a soft brush. Sometimes, a film builds up on the electrodes.

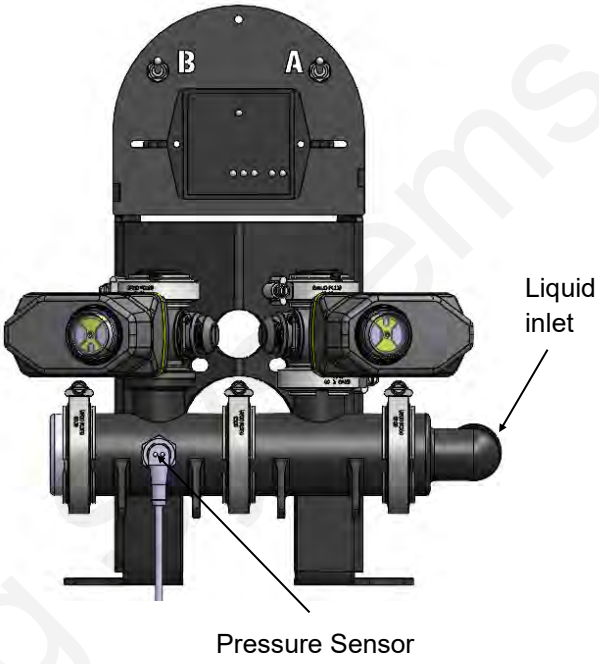
Flowmeter Model (black meter with orange label)	JDRC 2000 Flow Calibration	FPT Size	Hose Barb In kit
2.6—53 GPM	2000	1-1/4"	1-1/2"
1.3—26 GPM	2000	1"	1"

The flowmeters will accurately read higher than the rated range.

Earlier model flowmeters (meters with white labels with black text) have different calibration numbers. The flow cal number (pulses per gallon) is printed on the serial number sticker on the side of the flowmeter.

Section Valves and LiquiShift Valves





Additional Parts:

1" Gasket	105-100G-H
1" Clamp	105-FC100

How section valves work

Section valves can be assembled into groups with a common inlet to control flow to each section. Common assemblies use up to 5-6 valves, however, more can be used where practical. Many alternate fittings can be used to accommodate different hose sizes and configurations.

The valves have a 3-pin weather pack electrical connector. This has a power, ground, and switched wire. The power measured to ground should have 12 volts when the controller is on. The switched wire will have 12 volts to turn the valve on, and 0 volts to turn the valve off.

Wiring Connector:
Pin A—Red, 12 Volts +
Pin B—Black, Ground -
Pin C—White, Signal
12V=on ; 0V=off

Mounting Hardware:
2 Valve Bolt Kit
384-1100

Mounting Bracket
400-2493Y1

How LiquiShift Works

LiquiShift is a two-valve manifold specifically built and controlled to provide the operator a very wide flow range for variable rate application. It is valuable for variable rate prescription application or variable rate between different fields. LiquiShift has an A and B valve that are opened based on the system pressure.

The valves themselves are identical to a regular section valve (KZ TX2) and have a 3-pin weather pack electrical connector.

The A Valve is connected to a smaller metering tube. The B Valve is connected to a larger metering tube. The LiquiShift controller automatically turns on the A valve, or the B valve, or both valves depending on the flow required.

Gen3 LiquiShift systems on the GRC are available with up to 12 sections depending on the implement.

See also: Gen3 LiquiShift Manual (396-4608Y1)
Gen2 LiquiShift Manual (396-4063Y1)

Pressure Sensor
3 Wire Sensor with 2” Manifold x 1/4” MPT Fitting
Item Number 520-00-055100

B
Components
Liquid

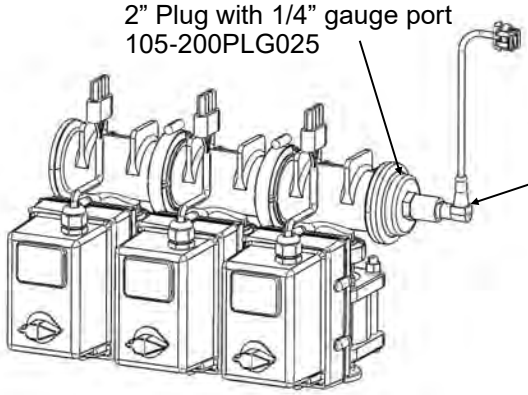
The JD GRC has the ability to show fertilizer system pressure on the display. The pressure sensor is most often mounted on electric section valves when used in PumpRight systems.
The pressure sensor is a 100 psi, 0 to 5 volt 3-wire type sensor for compatibility with the JD GRC. The sensor has a 1/4” MPT fitting.

The user can select to display the pressure on the John Deere display. ***If the pressure does not show up on the Pressure 1 display on the screen, try setting up Sensor 2, and putting PSI 2 in one of the two boxes on the bottom of the display.***

The pressure sensor is very helpful to optimize system performance and troubleshoot any issues. Pressure alarms or limits can be set on the Deere display in the cab.

2” Plug with 1/4” gauge port
105-200PLG025

See the troubleshooting section for more help.

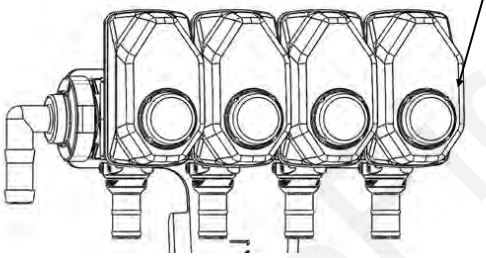


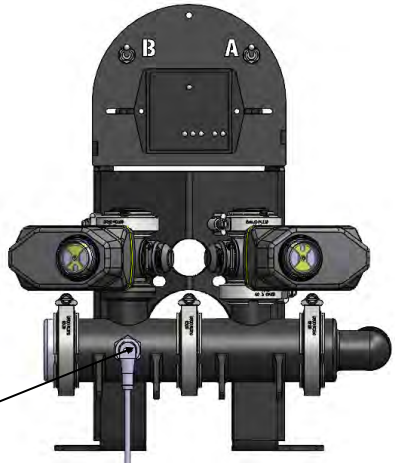
Pressure Sensor (3-wire type) with harness
521-05-050150

JD GRC:

Pressure Calibration: 50 mv/psi

1” Plug with 1/4” gauge port
105-100PLG025





Pressure Sensor for LiquiShift is mounted at the base of the valve stack. The same sensor is used for LiquiShift and displayed on the John Deere display.

Pressure Sensor Hose Tap Kits

When electric section valves or LiquiShift is **not** used in the fertilizer system, the best location to install the pressure sensor is in the hose after it leaves the flowmeter. To use these kits, order the correct kit for your hose size. Then also order the kit above that includes the 2” Manifold x 1/4” MPT fitting.

3/4” Hose Pressure Tap	520-00-055800
1” Hose Pressure Tap	520-00-055850
1 1/2” Hose Pressure Tap	520-00-055900

Pump Priming and Air Bleed Valve

An air bleed valve is included with each pump to aid in system priming. It is shipped in the pump accessories bag and must be installed during system installation.

B
Components
Liquid

Why use an air bleed valve:

Most fertilizer systems are equipped with a 4 lb or 10 lb check valve on the end of each hose delivering fertilizer to the ground. These valves do not let air escape from the system, unless it is pressurized. PumpRight liquid pumps are not good air compressors. Therefore, the pump can struggle to prime due to air trapped on the outlet side of the pump.

The air bleed valve is a small 1/4" valve that when opened lets air escape from the pump outlet at zero pressure. Open until liquid comes out and then close the valve.

Be sure the air bleed valve tube does not become plugged with dirt or it will not allow air to bleed.

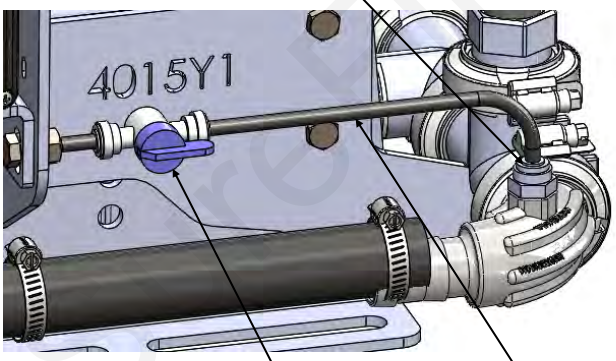
How to install the air bleed valve:

Remove the 1/4" plug from the quick connect fitting on the pump outlet side (see pictures below). Next, insert the 1/4" tubing in the quick connect fitting. Run the 1/4" tubing to an easily accessible spot on your equipment. Next, cut the tubing and push the 1/4" valve onto the tubing. Finally, run the tubing to a low location where any fertilizer that escapes will run on the ground.

Be sure the air bleed valve tube does not become plugged with dirt or it will not allow air to bleed.

PR17 & PR30

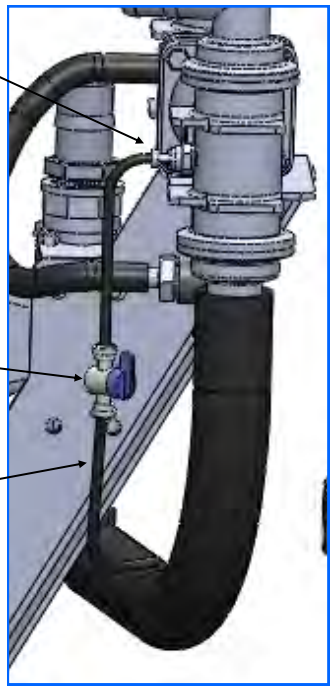
Attach 1/4" tubing to 1/4" QC on the 90 deg HB sweep gauge port



1/4" air bleed valve

PR40 & D250

Attach 1/4" tubing to 1/4" QC on back side of 1" x 2" tee on outlet side of pump



1/4" air bleed valve

1/4" Tubing

Recirculation & Agitation

A recirculation valve is standard on all 4 PumpRight models outlet plumbing assembly.

How Recirculation Works:

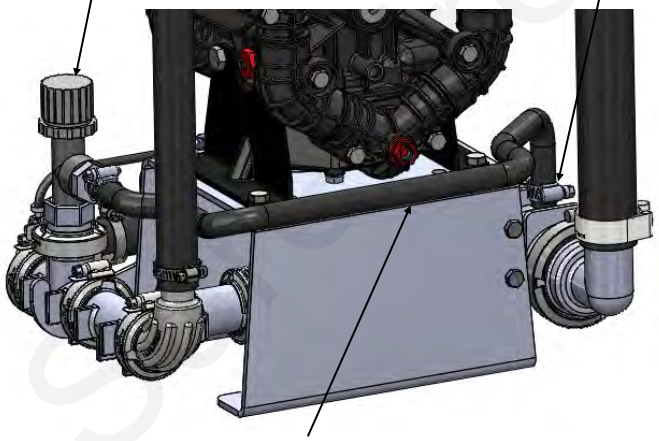
When running a PumpRight pump at less than 20% of it's maximum flow, it sometimes improves system stability to allow the pump to run faster. Opening the recirculation valve diverts some pump flow before the flowmeter, causing the pump to run faster. The application rate is still measured by the flowmeter and everything that passes through the flowmeter is applied to the ground. If the pump is surging at a low flow rate, open the recirculation regulation valve slowly until the pump runs smoothly. Start with a quarter to a half turn. OPENING THE VALVE LOWERS THE MAXIMUM RATE THAT CAN BE APPLIED TO THE GROUND. Close the valve if a higher rate is required.

How to modify for tank agitation:

If tank agitation is required, the recirculation valve can be re-plumbed to divert flow to the tank. All that is required is to remove the 1/2" recirculation hose from the pump. Then replace the 3/8" MPT x 1/2" HB on the inlet side of the pump with a 3/8" plug which is included in your PumpRight accessories bag. Finally, install a longer 1/2" hose from the recirculation valve back to the tank.

PR17 & PR30

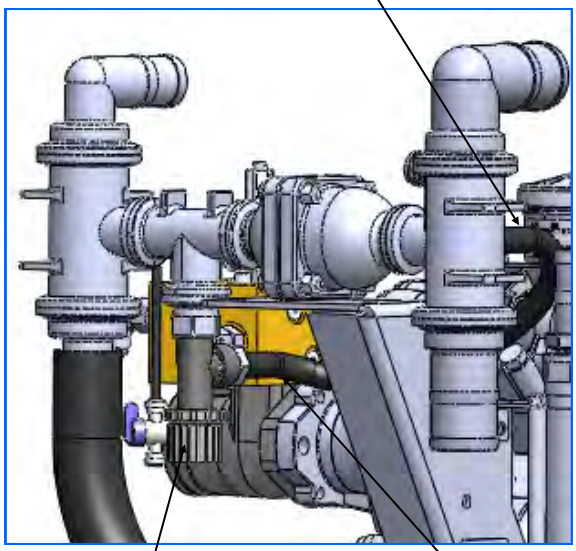
Recirculation Regulation Valve, 102-23520-3/4
Start with a quarter to a half turn open.



1/2" recirculation hose

PR40 & D250

Recirculation hose attaches to back of 2" x 1" tee on pump inlet



Recirculation Regulation Valve
102-23520-3/4
Start with a quarter to a half turn open.

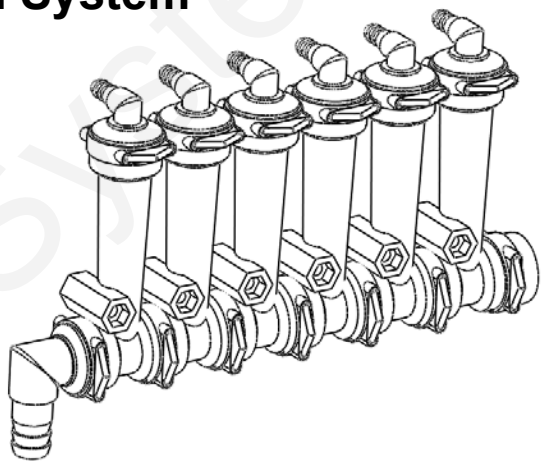
1/2" recirculation hose

Product Distribution

<u>To assure proper and even distribution to each row, the product being applied must be metered to each individual row.</u> This metering is done by one of the 3 following methods which create back pressure so an equal amount of liquid is applied to each row:

1. A metering orifice may be placed in the top cap of each floating ball flow indicator. (See photos on page 14. This is not used very often.)
2. A metering orifice may be placed in the check valve cap in the line that leads to each row. (See photo on page 16)
3. A dual metering tube kit with dual check valves may be used. (See pages 20-23)
4. A LiquiShift valve stack may be used that automatically selects which metering tube to use based on system pressure.

Floating Ball Flow Indicator & Manifold System



Flow indicators give a clear visual signal that a fertilizer system is working. These indicators use an o-ring and wire clip connection to snap together in any configuration necessary.

SureFire has simple tee brackets and U-bolts that will mount these to a variety of bar sizes.

Two main types of flow indicators are used. On 30" row spacing, the low flow column with 1/4" push to connect outlet is recommended for rates under 10 GPA. For rates over 10 GPA the full flow column with 3/8" hose barb outlet is preferred.

Parts List

Complete Columns

701-20460-950	Single Full Flow Column with 3/8" HB - 90 Degree Outlet
701-20460-940	Single Full Flow Column with 3/8" QC - 90 Degree Outlet
701-20460-960	Single Full Flow Column with 1/2" HB - 90 Degree Outlet
701-20460-935	Single Low Flow Column with 3/8" QC - 90 Degree Outlet
701-20460-920	Single Low Flow Column with 1/4" QC - 90 Degree Outlet

Fittings

701-20503-00	ORS x 3/4" HB - Straight
701-20511-00	ORS x 3/8" HB - 90 Degree
701-20512-00	ORS x 1/2" HB - 90 Degree
701-20513-00	ORS x 3/4" HB - 90 Degree
701-20516-00	ORS x 1/4" QC - 90 Degree
701-20517-00	ORS x 3/8" QC - 90 Degree
701-20518-00	ORS x 1/4" FPT - 90 Degree
701-20519-00	ORS x 1/4" FPT - Straight
701-20520-00	ORS Male x ORS Female - 90 degree
701-20521-00	Wilger End Cap
701-20523-00	ORS Male x ORS Female x 3/8" FPT - Isolator
701-20525-00	ORS Male x ORS Male x 1" FPT - Tee

Service Parts Only

701-20460-02	Wilger Flow Indicator Ball Retainer
701-20460-03	FKM O-Ring for indicator body & fittings
701-20460-04	Wilger Lock U-clip
701-20460-05	Flow Indicator Ball - 1/2" SS Ball
701-20460-06	Flow Indicator Ball - Maroon Glass
701-20460-07	Flow Indicator Ball - Red Celcon
701-20460-08	Flow Indicator Ball - Green Poly
701-20460-09	Flow Indicator Ball - Black Poly
701-20460-15	Viton O-Ring for column & fittings
701-40225-05	Viton O-Ring for Orifice

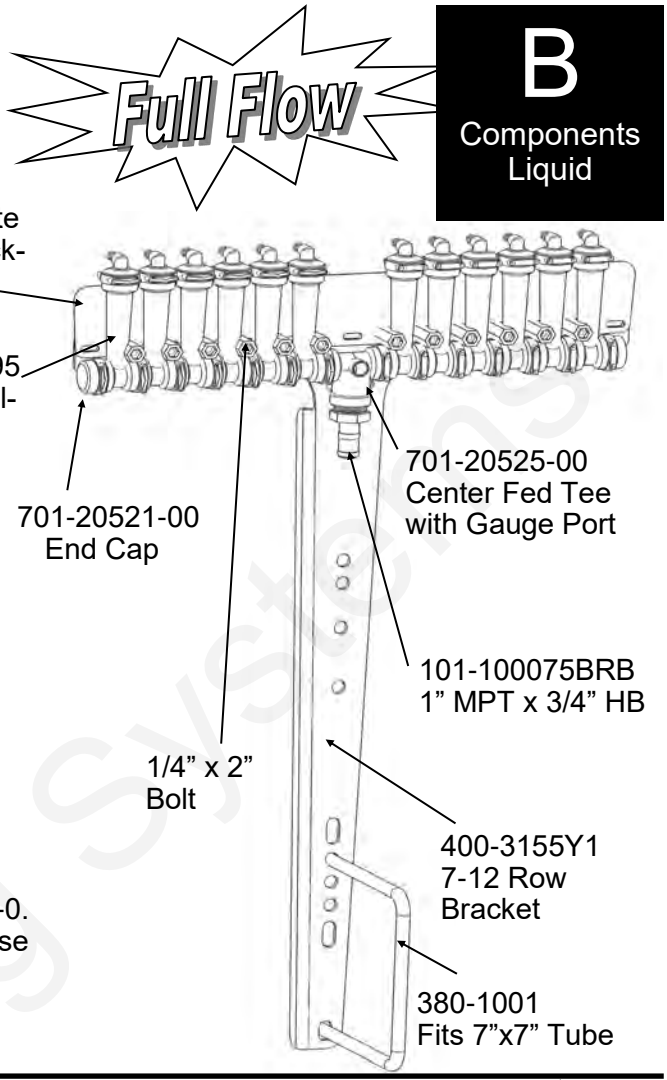
Brackets & U-Bolts

400-1037A1	3-6 Row Bracket
400-3155Y1	7-12 Row Bracket
400-2011A1	White Backer Plate for 3-6 Row Bracket
400-2010A1	White Backer Plate for 7-12 Row Bracket
400-1315A2	Flow Indicator Bracket, 6-8 in wide hitch mount

Floating Ball Flow Indicators- Full Flow Column (mostly 3/8” HB)

The full flow column is typically used with rates over 10 GPA on 30” rows. For rates less than 10 GPA SureFire recommends the low flow columns with 1/4” push to connect outlet fittings.

The full flow columns are most often assembled with 3/8” hose barb outlets. See the low flow info below for the difference between full and low flow columns.



Full Flow Indicators w/ 3/8” Hose Barb Outlet

Column Flow (GPM):	.05-2.70 GPM
Equivalent Application Rate On 30” Rows at 6 MPH:	2-70 GPA

Ball Selection for 30” Rows

GPM	GPA	Ball
.05-.18	2-6	Green Plastic*
.09-.30	3-10	Red Plastic*
.31-.72	10-20	Maroon Glass
.40-2.1	13-70	Stainless Steel (1/2”)

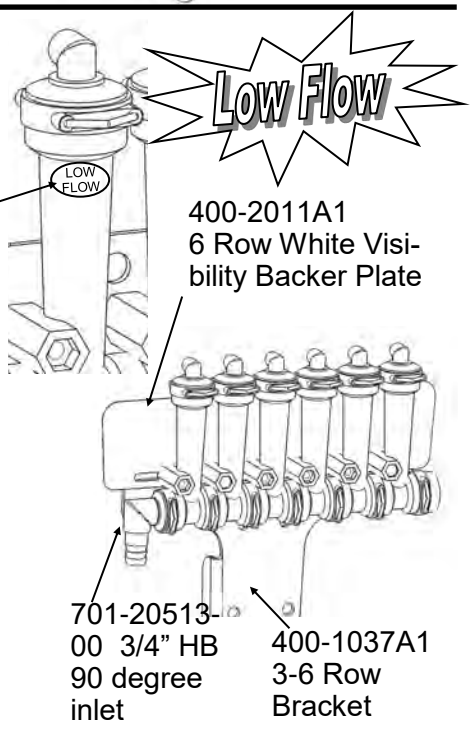
*Plastic balls may float on heavier fertilizers, such as 10-34-0. SureFire recommends using the low flow column for these flow rates.

Low Flow Column (mostly 1/4” QC or 3/8” QC)

The low flow column has a smaller internal diameter. This means a heavier ball can be used to monitor a smaller flow.

SureFire uses the low flow columns with 1/4” push to connect outlet fittings. The flow capability of 1/4” tubing and the low flow column are a great pair for rates on 30” rows under 10 GPA.

Externally, the low flow column can only be identified by “Low Flow” molded into one side of the column. All the same fittings work with low flow and full flow columns.



Low Flow Indicators w/ 1/4” Push to Connect Outlet

Column Flow (GPM):	.03-.30 GPM
*** Low Flow Column with 3/8” hose barb	.03 - .70 GPM
Equivalent Application Rate On 30” Rows at 6 MPH (1/4” QC):	1-10 GPA

Ball Selection for 30” Rows

GPM	GPA	Ball
.03-.09	1-3	Green Plastic*
.05-.14	2-4	Red Plastic*
.10-.18	3-6	Maroon Glass
.15-.70	5-10	Stainless Steel (1/2”)

*These balls may float on heavier fertilizers, such as 10-34-0. Use Maroon Glass in this case.

Floating Ball Flow Indicators– Metering Orifice Selection for 30” Rows

See www.surefireag.com for other row spacings

30” Spacing

Orifice	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
28	10	0.043	2.15	1.91	1.72	1.56	1.43	1.32	1.23
	20	0.061	3.02	2.69	2.42	2.20	2.02	1.86	1.73
	30	0.075	3.72	3.31	2.98	2.71	2.48	2.29	2.13
	40	0.087	4.29	3.82	3.43	3.12	2.86	2.64	2.45
	50	0.097	4.82	4.28	3.85	3.50	3.21	2.97	2.75
	60	0.106	5.26	4.67	4.21	3.82	3.50	3.23	3.00
35	10	0.070	3.46	3.08	2.77	2.52	2.31	2.13	1.98
	20	0.098	4.86	4.32	3.89	3.54	3.24	2.99	2.78
	30	0.120	5.96	5.30	4.77	4.33	3.97	3.67	3.40
	40	0.139	6.88	6.11	5.50	5.00	4.58	4.23	3.93
	50	0.156	7.71	6.85	6.17	5.61	5.14	4.74	4.41
	60	0.170	8.41	7.48	6.73	6.12	5.61	5.18	4.81
40	10	0.090	4.47	3.97	3.57	3.25	2.98	2.75	2.55
	20	0.127	6.31	5.61	5.05	4.59	4.21	3.88	3.60
	30	0.157	7.75	6.89	6.20	5.64	5.17	4.77	4.43
	40	0.181	8.94	7.94	7.15	6.50	5.96	5.50	5.11
	50	0.202	9.99	8.88	7.99	7.26	6.66	6.15	5.71
	60	0.221	10.95	9.73	8.76	7.96	7.30	6.74	6.26
46	10	0.119	5.91	5.26	4.73	4.30	3.94	3.64	3.38
	20	0.169	8.37	7.44	6.69	6.08	5.58	5.15	4.78
	30	0.207	10.25	9.11	8.20	7.45	6.83	6.31	5.86
	40	0.239	11.83	10.51	9.46	8.60	7.88	7.28	6.76
	50	0.267	13.23	11.76	10.58	9.62	8.82	8.14	7.56
	60	0.293	14.50	12.89	11.60	10.55	9.67	8.92	8.29
52	10	0.149	7.36	6.54	5.89	5.35	4.91	4.53	4.21
	20	0.210	10.38	9.23	8.31	7.55	6.92	6.39	5.93
	30	0.257	12.70	11.29	10.16	9.24	8.47	7.82	7.26
	40	0.296	14.67	13.04	11.74	10.67	9.78	9.03	8.39
	50	0.332	16.43	14.60	13.14	11.95	10.95	10.11	9.39
	60	0.363	17.96	15.96	14.37	13.06	11.97	11.05	10.26
63	10	0.218	10.78	9.58	8.62	7.84	7.18	6.63	6.16
	20	0.307	15.20	13.51	12.16	11.05	10.13	9.35	8.69
	30	0.376	18.62	16.55	14.89	13.54	12.41	11.46	10.64
	40	0.435	21.51	19.12	17.21	15.64	14.34	13.24	12.29
	50	0.486	24.05	21.38	19.24	17.49	16.03	14.80	13.74
	60	0.532	26.33	23.40	21.06	19.15	17.55	16.20	15.04
78	10	0.341	16.87	14.99	13.49	12.27	11.24	10.38	9.64
	20	0.481	23.83	21.18	19.06	17.33	15.89	14.66	13.62
	30	0.590	29.22	25.97	23.37	21.25	19.48	17.98	16.70
	40	0.681	33.73	29.98	26.98	24.53	22.49	20.76	19.27
	50	0.762	37.72	33.53	30.17	27.43	25.14	23.21	21.55
	60	0.835	41.31	36.72	33.05	30.04	27.54	25.42	23.60
98	10	0.553	27.38	24.34	21.90	19.91	18.25	16.85	15.64
	20	0.782	38.72	34.42	30.98	28.16	25.82	23.83	22.13
	30	0.956	47.31	42.05	37.85	34.41	31.54	29.11	27.03
	40	1.106	54.76	48.67	43.81	39.82	36.50	33.70	31.29
	50	1.239	61.33	54.51	49.06	44.60	40.88	37.74	35.04
	60	1.354	67.02	59.58	53.62	48.74	44.68	41.24	38.30
107	10	0.649	32.11	28.54	25.69	23.35	21.41	19.76	18.35
	20	0.920	45.56	40.50	36.45	33.13	30.37	28.04	26.03
	30	1.124	55.63	49.45	44.51	40.46	37.09	34.24	31.79
	40	1.301	64.39	57.24	51.52	46.83	42.93	39.63	36.80
	50	1.451	71.84	63.86	57.47	52.25	47.89	44.21	41.05
	60	1.584	78.41	69.70	62.73	57.03	52.27	48.25	44.81
130	10	0.938	46.43	41.27	37.15	33.77	30.96	28.57	26.53
	20	1.319	65.27	58.02	52.22	47.47	43.51	40.17	37.30
	30	1.619	80.16	71.26	64.13	58.30	53.44	49.33	45.81
	40	1.867	92.43	82.16	73.94	67.22	61.62	56.88	52.82
	50	2.088	103.38	91.89	82.70	75.19	68.92	63.62	59.07
	60	2.292	113.46	100.85	90.76	82.51	75.64	69.82	64.83

Pumpright Pressure Recommendations (with 10 lb check valves):

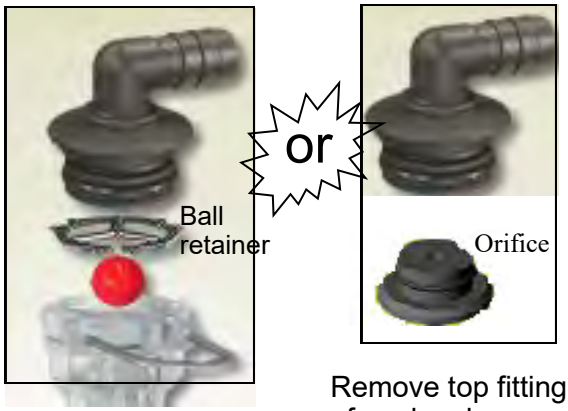
- Minimum 20 PSI
- Maximum 80 PSI

Tower Electric Pump Pressure Recommendations (with 4 lb check valves):

- Minimum 10 PSI
- Maximum 30 PSI

Chart is for 28-0-0 Fertilizer @ 70°

- Heavier fertilizers (like 10-34-0) will have 5-15% less flow than chart indicates for a certain pressure
- Cold fertilizers will cause system pressure to increase at a given application rate.
- Tower Electric Pump Systems will have reduced flow and increased electrical current draw due to cold fertilizer increasing operating pressure. **Use the largest orifice possible for cold weather operation.**



If using a metering orifice in the flow indicator, the orifice replaces the ball retainer. If not using an orifice here, the ball retainer must be in place.

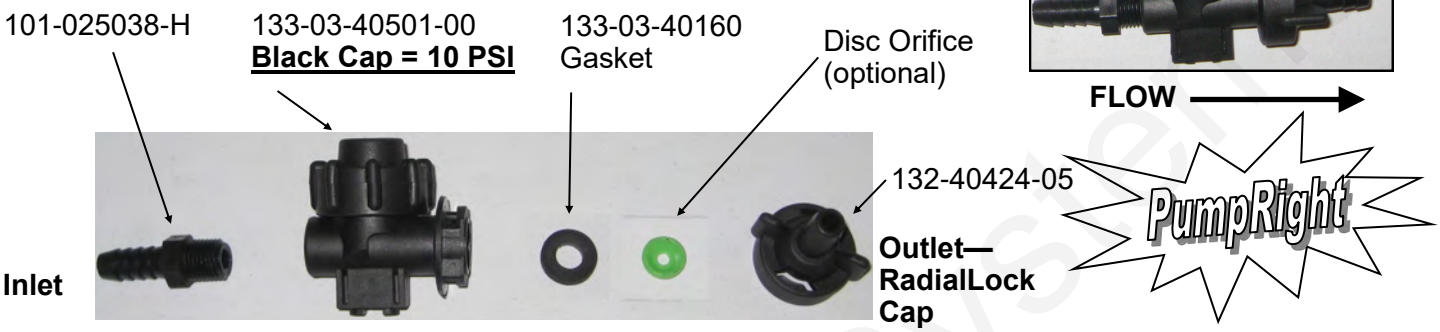
Remove top fitting of each column. Then push the metering orifice into bottom of each outlet fitting. (*This is not used very often.)*

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

Check Valves

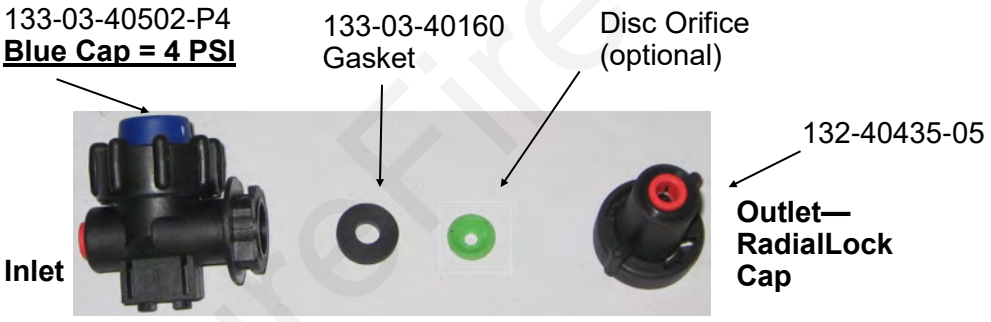
10 lb check valve with 3/8” hose barbs

The recommended check valve for most **PumpRight installations** is the 10 lb check with 3/8” hose barbs. This works with 3/8” rubber hose which SureFire recommends for most applications over 10 GPA on 30” rows. The recommended minimum system operating pressure for this check is 20 psi, to ensure all checks open fully.



4 lb check valve with 1/4” quick connect fittings

4 lb check valves are typically used with **electric pump systems**. SureFire recommends this valve for use with 1/4” tubing applying up to 10 GPA on 30” rows. The recommended minimum system operating pressure for this check is 10 psi, to ensure all checks open fully.



Special Purpose Check Valve Assemblies

Assembly Part Number	Description	Suggested Uses (30” rows)
136-10-04QC04QC	1/4" QC x 1/4" QC 10 lb	< 10 GPA with PumpRight & 1/4” Tubing
136-10-06QC06QC	3/8" QC x 3/8" QC 10 lb	With 3/8” tubing plumbing
136-04-06HB06HB	3/8" HB x 3/8" HB 4 lb	> 10 GPA with Electric Pumps
136-04-08HB08HB	1/2" HB x 1/2" HB 4 lb	> 50 GPA with PumpRight
136-10-08HB08HB	1/2" HB x 1/2" HB 10 lb	> 50 GPA with PumpRight

Colored Disc Orifice Chart for 30” rows

Download the SureFire Flow Calculator App for iPad

30” Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	1.62	1.44	1.30	1.18	1.08	1.00	0.93
	20	0.046	2.28	2.02	1.82	1.66	1.52	1.40	1.30
	30	0.057	2.80	2.49	2.24	2.04	1.87	1.73	1.60
	40	0.065	3.24	2.88	2.59	2.36	2.16	1.99	1.85
	50	0.073	3.64	3.23	2.91	2.64	2.42	2.24	2.08
	60	0.081	3.99	3.54	3.19	2.90	2.66	2.45	2.28
Gray (30)	10	0.050	2.50	2.22	2.00	1.82	1.66	1.54	1.43
	20	0.072	3.55	3.15	2.84	2.58	2.37	2.18	2.03
	30	0.088	4.34	3.85	3.47	3.15	2.89	2.67	2.48
	40	0.101	4.99	4.44	4.00	3.63	3.33	3.07	2.85
	50	0.112	5.56	4.95	4.45	4.05	3.71	3.42	3.18
	60	0.124	6.13	5.45	4.91	4.46	4.09	3.77	3.50
Black (35)	10	0.070	3.46	3.08	2.77	2.52	2.31	2.13	1.98
	20	0.098	4.86	4.32	3.89	3.54	3.24	2.99	2.78
	30	0.120	5.96	5.30	4.77	4.33	3.97	3.67	3.40
	40	0.139	6.88	6.11	5.50	5.00	4.58	4.23	3.93
	50	0.156	7.71	6.85	6.17	5.61	5.14	4.74	4.41
	60	0.170	8.41	7.48	6.73	6.12	5.61	5.18	4.81
Brown (41)	10	0.094	4.64	4.13	3.71	3.38	3.10	2.86	2.65
	20	0.132	6.53	5.80	5.22	4.75	4.35	4.02	3.73
	30	0.162	8.02	7.13	6.41	5.83	5.34	4.93	4.58
	40	0.187	9.24	8.22	7.39	6.72	6.16	5.69	5.28
	50	0.209	10.34	9.19	8.27	7.52	6.89	6.36	5.91
	60	0.228	11.30	10.05	9.04	8.22	7.53	6.95	6.46
Orange (46)	10	0.119	5.91	5.26	4.73	4.30	3.94	3.64	3.38
	20	0.169	8.37	7.44	6.69	6.08	5.58	5.15	4.78
	30	0.207	10.25	9.11	8.20	7.45	6.83	6.31	5.86
	40	0.239	11.83	10.51	9.46	8.60	7.88	7.28	6.76
	50	0.267	13.23	11.76	10.58	9.62	8.82	8.14	7.56
	60	0.293	14.50	12.89	11.60	10.55	9.67	8.92	8.29
Maroon (52)	10	0.149	7.36	6.54	5.89	5.35	4.91	4.53	4.21
	20	0.210	10.38	9.23	8.31	7.55	6.92	6.39	5.93
	30	0.257	12.70	11.29	10.16	9.24	8.47	7.82	7.26
	40	0.296	14.67	13.04	11.74	10.67	9.78	9.03	8.39
	50	0.332	16.43	14.60	13.14	11.95	10.95	10.11	9.39
	60	0.363	17.96	15.96	14.37	13.06	11.97	11.05	10.26
Red (63)	10	0.218	10.78	9.58	8.62	7.84	7.18	6.63	6.16
	20	0.307	15.20	13.51	12.16	11.05	10.13	9.35	8.69
	30	0.376	18.62	16.55	14.89	13.54	12.41	11.46	10.64
	40	0.435	21.51	19.12	17.21	15.64	14.34	13.24	12.29
	50	0.486	24.05	21.38	19.24	17.49	16.03	14.80	13.74
	60	0.532	26.33	23.40	21.06	19.15	17.55	16.20	15.04
Blue (80)	10	0.351	17.39	15.46	13.91	12.65	11.59	10.70	9.94
	20	0.496	24.57	21.84	19.66	17.87	16.38	15.12	14.04
	30	0.608	30.09	26.75	24.08	21.89	20.06	18.52	17.20
	40	0.702	34.74	30.88	27.79	25.26	23.16	21.38	19.85
	50	0.785	38.86	34.54	31.08	28.26	25.90	23.91	22.20
	60	0.859	42.53	37.81	34.03	30.93	28.36	26.18	24.31
Yellow (95)	10	0.506	25.06	22.27	20.05	18.22	16.70	15.42	14.32
	20	0.715	35.39	31.46	28.32	25.74	23.60	21.78	20.23
	30	0.876	43.37	38.55	34.69	31.54	28.91	26.69	24.78
	40	1.009	49.94	44.39	39.95	36.32	33.29	30.73	28.54
	50	1.133	56.07	49.84	44.86	40.78	37.38	34.51	32.04
	60	1.239	61.33	54.51	49.06	44.60	40.88	37.74	35.04
Green (110)	10	0.686	33.95	30.18	27.16	24.69	22.63	20.89	19.40
	20	0.973	48.19	42.83	38.55	35.04	32.12	29.65	27.53
	30	1.186	58.70	52.18	46.96	42.69	39.13	36.12	33.54
	40	1.372	67.90	60.35	54.32	49.38	45.27	41.78	38.80
	50	1.531	75.78	67.36	60.63	55.12	50.52	46.64	43.30
	60	1.681	83.23	73.98	66.58	60.53	55.49	51.22	47.56

PumpRight Pressure Recommendations (with 10 lb check valves):

- Minimum 20 PSI
- Maximum 80 PSI

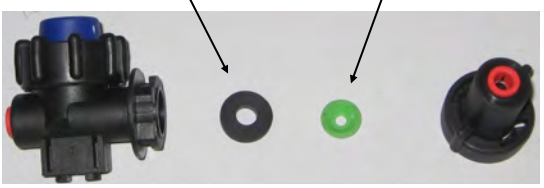
Tower Electric Pump Pressure Recommendations (with 4 lb check valves):

- Minimum 10 PSI
- Maximum 30 PSI

Chart is for 28-0-0 Fertilizer @ 70°

- Heavier fertilizers (like 10-34-0) will have 5-15% less flow than chart indicates for a certain pressure
- Cold fertilizers will cause system pressure to increase at a given application rate.
- Tower Electric Pump Systems will have reduced flow and increased electrical current draw due to cold fertilizer increasing operating pressure. **Use the largest orifice possible for cold weather operation.**

Colored Disc Orifice assembles under the check valve cap in most cases. (Drop the orifice with the hole down into the cap, then put the gasket on top of it.) The orifice can also be installed in a manifold (common on grain drills).



FLOW → 1/4 Turn Cap is Outlet

Colored Disc Orifice Chart
Common Grain Drill Row Spacings

7.5” Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	6.5	5.8	5.2	4.7	4.3	4.0	3.7
	20	0.046	9.1	8.1	7.3	6.6	6.1	5.6	5.2
	30	0.057	11.2	10.0	9.0	8.2	7.5	6.9	6.4
	40	0.065	13.0	11.5	10.4	9.4	8.6	8.0	7.4
	50	0.073	14.5	12.9	11.6	10.6	9.7	8.9	8.3
	60	0.081	15.9	14.2	12.8	11.6	10.6	9.8	9.1
Gray (30)	10	0.050	10.0	8.9	8.0	7.3	6.7	6.1	5.7
	20	0.072	14.2	12.6	11.4	10.3	9.5	8.7	8.1
	30	0.088	17.3	15.4	13.9	12.6	11.6	10.7	9.9
	40	0.101	20.0	17.8	16.0	14.5	13.3	12.3	11.4
	50	0.112	22.3	19.8	17.8	16.2	14.8	13.7	12.7
	60	0.124	24.5	21.8	19.6	17.8	16.4	15.1	14.0
Black (35)	10	0.070	13.8	12.3	11.1	10.1	9.2	8.5	7.9
	20	0.098	19.4	17.3	15.6	14.1	13.0	12.0	11.1
	30	0.120	23.8	21.2	19.1	17.3	15.9	14.7	13.6
	40	0.139	27.5	24.5	22.0	20.0	18.3	16.9	15.7
	50	0.156	30.8	27.4	24.7	22.4	20.6	19.0	17.6
	60	0.170	33.6	29.9	26.9	24.5	22.4	20.7	19.2
Brown (41)	10	0.094	19	17	15	14	12	11	11
	20	0.132	26	23	21	19	17	16	15
	30	0.162	32	29	26	23	21	20	18
	40	0.187	37	33	30	27	25	23	21
	50	0.209	41	37	33	30	28	25	24
	60	0.228	45	40	36	33	30	28	26
Orange (46)	10	0.119	24	21	19	17	16	15	14
	20	0.169	33	30	27	24	22	21	19
	30	0.207	41	36	33	30	27	25	23
	40	0.239	47	42	38	34	32	29	27
	50	0.267	53	47	42	38	35	33	30
	60	0.293	58	52	46	42	39	36	33
Maroon (52)	10	0.149	29	26	24	21	20	18	17
	20	0.210	42	37	33	30	28	26	24
	30	0.257	51	45	41	37	34	31	29
	40	0.296	59	52	47	43	39	36	34
	50	0.332	66	58	53	48	44	40	38
	60	0.363	72	64	57	52	48	44	41
Red (63)	10	0.218	43	38	34	31	29	27	25
	20	0.307	61	54	49	44	41	37	35
	30	0.376	74	66	60	54	50	46	43
	40	0.435	86	76	69	63	57	53	49
	50	0.486	96	86	77	70	64	59	55
	60	0.532	105	94	84	77	70	65	60
Blue (80)	10	0.351	70	62	56	51	46	43	40
	20	0.496	98	87	79	71	66	60	56
	30	0.608	120	107	96	88	80	74	69
	40	0.702	139	124	111	101	93	86	79
	50	0.785	155	138	124	113	104	96	89
	60	0.859	170	151	136	124	113	105	97
Yellow (95)	10	0.506	100	89	80	73	67	62	57
	20	0.715	142	126	113	103	94	87	81
	30	0.876	173	154	139	126	116	107	99
	40	1.009	200	178	160	145	133	123	114
	50	1.133	224	199	179	163	150	138	128
	60	1.239	245	218	196	178	164	151	140

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F

10” Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	4.9	4.3	3.9	3.5	3.2	3.0	2.8
	20	0.046	6.8	6.1	5.5	5.0	4.6	4.2	3.9
	30	0.057	8.4	7.5	6.7	6.1	5.6	5.2	4.8
	40	0.065	9.7	8.6	7.8	7.1	6.5	6.0	5.6
	50	0.073	10.9	9.7	8.7	7.9	7.3	6.7	6.2
	60	0.081	12.0	10.6	9.6	8.7	8.0	7.4	6.8
Gray (30)	10	0.050	7.5	6.7	6.0	5.4	5.0	4.6	4.3
	20	0.072	10.6	9.5	8.5	7.7	7.1	6.6	6.1
	30	0.088	13.0	11.6	10.4	9.5	8.7	8.0	7.4
	40	0.101	15.0	13.3	12.0	10.9	10.0	9.2	8.6
	50	0.112	16.7	14.8	13.4	12.1	11.1	10.3	9.5
	60	0.124	18.4	16.4	14.7	13.4	12.3	11.3	10.5
Black (35)	10	0.070	10.4	9.2	8.3	7.6	6.9	6.4	5.9
	20	0.098	14.6	13.0	11.7	10.6	9.7	9.0	8.3
	30	0.120	17.9	15.9	14.3	13.0	11.9	11.0	10.2
	40	0.139	20.6	18.3	16.5	15.0	13.8	12.7	11.8
	50	0.156	23.1	20.6	18.5	16.8	15.4	14.2	13.2
	60	0.170	25.2	22.4	20.2	18.4	16.8	15.5	14.4
Brown (41)	10	0.094	14	12	11	10	9	9	8
	20	0.132	20	17	16	14	13	12	11
	30	0.162	24	21	19	17	16	15	14
	40	0.187	28	25	22	20	18	17	16
	50	0.209	31	28	25	23	21	19	18
	60	0.228	34	30	27	25	23	21	19
Orange (46)	10	0.119	18	16	14	13	12	11	10
	20	0.169	25	22	20	18	17	15	14
	30	0.207	31	27	25	22	21	19	18
	40	0.239	35	32	28	26	24	22	20
	50	0.267	40	35	32	29	26	24	23
	60	0.293	43	39	35	32	29	27	25
Maroon (52)	10	0.149	22	20	18	16	15	14	13
	20	0.210	31	28	25	23	21	19	18
	30	0.257	38	34	30	28	25	23	22
	40	0.296	44	39	35	32	29	27	25
	50	0.332	49	44	39	36	33	30	28
	60	0.363	54	48	43	39	36	33	31
Red (63)	10	0.218	32	29	26	24	22	20	18
	20	0.307	46	41	36	33	30	28	26
	30	0.376	56	50	45	41	37	34	32
	40	0.435	65	57	52	47	43	40	37
	50	0.486	72	64	58	52	48	44	41
	60	0.532	79	70	63	57	53	49	45
Blue (80)	10	0.351	52	46	42	38	35	32	30
	20	0.496	74	66	59	54	49	45	42
	30	0.608	90	80	72	66	60	56	52
	40	0.702	104	93	83	76	69	64	60
	50	0.785	117	104	93	85	78	72	67
	60	0.859	128	113	102	93	85	79	73
Yellow (95)	10	0.506	75	67	60	55	50	46	43
	20	0.715	106	94	85	77	71	65	61
	30	0.876	130	116	104	95	87	80	74
	40	1.009	150	133	120	109	100	92	86
	50	1.133	168	150	135	122	112	104	96
	60	1.239	184	164	147	134	123	113	105

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F

Colored Disc Orifice Chart

15" Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	3.2	2.9	2.6	2.4	2.2	2.0	1.9
	20	0.046	4.6	4.0	3.6	3.3	3.0	2.8	2.6
	30	0.057	5.6	5.0	4.5	4.1	3.7	3.5	3.2
	40	0.065	6.5	5.8	5.2	4.7	4.3	4.0	3.7
	50	0.073	7.3	6.5	5.8	5.3	4.8	4.5	4.2
	60	0.081	8.0	7.1	6.4	5.8	5.3	4.9	4.6
Gray (30)	10	0.050	5.0	4.4	4.0	3.6	3.3	3.1	2.9
	20	0.072	7.1	6.3	5.7	5.2	4.7	4.4	4.1
	30	0.088	8.7	7.7	6.9	6.3	5.8	5.3	5.0
	40	0.101	10.0	8.9	8.0	7.3	6.7	6.1	5.7
	50	0.112	11.1	9.9	8.9	8.1	7.4	6.8	6.4
	60	0.124	12.3	10.9	9.8	8.9	8.2	7.5	7.0
Black (35)	10	0.070	6.9	6.2	5.5	5.0	4.6	4.3	4.0
	20	0.098	9.7	8.6	7.8	7.1	6.5	6.0	5.6
	30	0.120	11.9	10.6	9.5	8.7	7.9	7.3	6.8
	40	0.139	13.8	12.2	11.0	10.0	9.2	8.5	7.9
	50	0.156	15.4	13.7	12.3	11.2	10.3	9.5	8.8
	60	0.170	16.8	15.0	13.5	12.2	11.2	10.4	9.6
Brown (41)	10	0.094	9.3	8.3	7.4	6.8	6.2	5.7	5.3
	20	0.132	13.1	11.6	10.4	9.5	8.7	8.0	7.5
	30	0.162	16.0	14.3	12.8	11.7	10.7	9.9	9.2
	40	0.187	18.5	16.4	14.8	13.4	12.3	11.4	10.6
	50	0.209	20.7	18.4	16.5	15.0	13.8	12.7	11.8
	60	0.228	22.6	20.1	18.1	16.4	15.1	13.9	12.9
Orange (46)	10	0.119	11.8	10.5	9.5	8.6	7.9	7.3	6.8
	20	0.169	16.7	14.9	13.4	12.2	11.2	10.3	9.6
	30	0.207	20.5	18.2	16.4	14.9	13.7	12.6	11.7
	40	0.239	23.7	21.0	18.9	17.2	15.8	14.6	13.5
	50	0.267	26.5	23.5	21.2	19.2	17.6	16.3	15.1
	60	0.293	29.0	25.8	23.2	21.1	19.3	17.8	16.6
Maroon (52)	10	0.149	15	13	12	11	10	9	8
	20	0.210	21	18	17	15	14	13	12
	30	0.257	25	23	20	18	17	16	15
	40	0.296	29	26	23	21	20	18	17
	50	0.332	33	29	26	24	22	20	19
	60	0.363	36	32	29	26	24	22	21
Red (63)	10	0.218	22	19	17	16	14	13	12
	20	0.307	30	27	24	22	20	19	17
	30	0.376	37	33	30	27	25	23	21
	40	0.435	43	38	34	31	29	26	25
	50	0.486	48	43	38	35	32	30	27
	60	0.532	53	47	42	38	35	32	30
Blue (80)	10	0.351	35	31	28	25	23	21	20
	20	0.496	49	44	39	36	33	30	28
	30	0.608	60	54	48	44	40	37	34
	40	0.702	69	62	56	51	46	43	40
	50	0.785	78	69	62	57	52	48	44
	60	0.859	85	76	68	62	57	52	49
Yellow (95)	10	0.506	50	45	40	36	33	31	29
	20	0.715	71	63	57	51	47	44	40
	30	0.876	87	77	69	63	58	53	50
	40	1.009	100	89	80	73	67	61	57
	50	1.133	112	100	90	82	75	69	64
	60	1.239	123	109	98	89	82	75	70
Green (110)	10	0.686	68	60	54	49	45	42	39
	20	0.973	96	86	77	70	64	59	55
	30	1.186	117	104	94	85	78	72	67
	40	1.372	136	121	109	99	91	84	78
	50	1.531	152	135	121	110	101	93	87
	60	1.681	166	148	133	121	111	102	95
White (125)	10	0.867	86	76	69	62	57	53	49
	20	1.230	122	108	97	89	81	75	70
	30	1.504	149	132	119	108	99	92	85
	40	1.735	172	153	137	125	114	106	98
	50	1.938	192	171	153	140	128	118	110
	60	2.124	210	187	168	153	140	129	120
Lime Green (156)	10	1.372	136	121	109	99	91	84	78
	20	1.947	193	171	154	140	128	119	110
	30	2.381	236	209	189	171	157	145	135
	40	2.752	272	242	218	198	182	168	156
	50	3.071	304	270	243	221	203	187	174
	60	3.363	333	296	266	242	222	205	190

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

20" Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	2.4	2.2	1.9	1.8	1.6	1.5	1.4
	20	0.046	3.4	3.0	2.7	2.5	2.3	2.1	2.0
	30	0.057	4.2	3.7	3.4	3.1	2.8	2.6	2.4
	40	0.065	4.9	4.3	3.9	3.5	3.2	3.0	2.8
	50	0.073	5.5	4.8	4.4	4.0	3.6	3.4	3.1
	60	0.081	6.0	5.3	4.8	4.3	4.0	3.7	3.4
Gray (30)	10	0.050	3.7	3.3	3.0	2.7	2.5	2.3	2.1
	20	0.072	5.3	4.7	4.3	3.9	3.5	3.3	3.0
	30	0.088	6.5	5.8	5.2	4.7	4.3	4.0	3.7
	40	0.101	7.5	6.7	6.0	5.4	5.0	4.6	4.3
	50	0.112	8.3	7.4	6.7	6.1	5.6	5.1	4.8
	60	0.124	9.2	8.2	7.4	6.7	6.1	5.7	5.3
Black (35)	10	0.070	5.2	4.6	4.2	3.8	3.5	3.2	3.0
	20	0.098	7.3	6.5	5.8	5.3	4.9	4.5	4.2
	30	0.120	8.9	7.9	7.1	6.5	6.0	5.5	5.1
	40	0.139	10.3	9.2	8.3	7.5	6.9	6.3	5.9
	50	0.156	11.6	10.3	9.3	8.4	7.7	7.1	6.6
	60	0.170	12.6	11.2	10.1	9.2	8.4	7.8	7.2
Brown (41)	10	0.094	7.0	6.2	5.6	5.1	4.6	4.3	4.0
	20	0.132	9.8	8.7	7.8	7.1	6.5	6.0	5.6
	30	0.162	12.0	10.7	9.6	8.7	8.0	7.4	6.9
	40	0.187	13.9	12.3	11.1	10.1	9.2	8.5	7.9
	50	0.209	15.5	13.8	12.4	11.3	10.3	9.5	8.9
	60	0.228	17.0	15.1	13.6	12.3	11.3	10.4	9.7
Orange (46)	10	0.119	8.9	7.9	7.1	6.5	5.9	5.5	5.1
	20	0.169	12.6	11.2	10.0	9.1	8.4	7.7	7.2
	30	0.207	15.4	13.7	12.3	11.2	10.3	9.5	8.8
	40	0.239	17.7	15.8	14.2	12.9	11.8	10.9	10.1
	50	0.267	19.8	17.6	15.9	14.4	13.2	12.2	11.3
	60	0.293	21.7	19.3	17.4	15.8	14.5	13.4	12.4
Maroon (52)	10	0.149	11	10	9	8	7	7	6
	20	0.210	16	14	12	11	10	10	9
	30	0.257	19	17	15	14	13	12	11
	40	0.296	22	20	18	16	15	14	13
	50	0.332	25	22	20	18	16	15	14
	60	0.363	27	24	22	20	18	17	15
Red (63)	10	0.218	16	14	13	12	11	10	9
	20	0.307	23	20	18	17	15	14	13
	30	0.376	28	25	22	20	19	17	16
	40	0.435	32	29	26	23	22	20	18
	50	0.486	36	32	29	26	24	22	21
	60	0.532	39	35	32	29	26	24	23
Blue (80)	10	0.351	26	23	21	19	17	16	15
	20	0.496	37	33	29	27	25	23	21
	30	0.608	45	40	36	33	30	28	26
	40	0.702	52	46	42	38	35	32	30
	50	0.785	58	52	47	42	39	36	33
	60	0.859	64	57	51	46	43	39	36
Yellow (95)	10	0.506	38	33	30	27	25	23	21
	20	0.715	53	47	42	39	35	33	30
	30	0.876	65	58	52	47	43	40	37
	40	1.009	75	67	60	54	50	46	43
	50	1.133	84	75	67	61	56	52	48
	60	1.239	92	82	74	67	61	57	53
Green (110)	10	0.686	51	45	41	37	34	31	29
	20	0.973	72	64	58	53	48	44	41
	30	1.186	88	78	70	64	59	54	50
	40	1.372	102	91	81	74	68	63	58
	50	1.531	114	101	91	83	76	70	65
	60	1.681	125	111	100	91	83	77	71
White (125)	10	0.867	64	57	52	47	43	40	37
	20	1.230	91	81	73	66	61	56	52
	30	1.504	112	99	89	81	74	69	64
	40	1.735	129	114	103	94	86	79	74
	50	1.938	144	128	115	105	96	89	82
	60	2.124	158	140	126	115	105	97	90
Lime Green (156)	10	1.372	102	91	81	74	68	63	58
	20	1.947	145	128	116	105	96	89	83
	30	2.381	177	157	141	129	118	109	101
	40	2.752	204	182	163	149	136	126	117
	50	3.071	228	203	182	166	152	140	130
	60	3.363	250	222	200	182	166	154	143

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

Colored Disc Orifice Chart

22" Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	2.2	2.0	1.8	1.6	1.5	1.4	1.3
	20	0.046	3.1	2.8	2.5	2.3	2.1	1.9	1.8
	30	0.057	3.8	3.4	3.1	2.8	2.5	2.4	2.2
	40	0.065	4.4	3.9	3.5	3.2	2.9	2.7	2.5
	50	0.073	5.0	4.4	4.0	3.6	3.3	3.1	2.8
	60	0.081	5.4	4.8	4.3	4.0	3.6	3.3	3.1
Gray (30)	10	0.050	3.4	3.0	2.7	2.5	2.3	2.1	1.9
	20	0.072	4.8	4.3	3.9	3.5	3.2	3.0	2.8
	30	0.088	5.9	5.3	4.7	4.3	3.9	3.6	3.4
	40	0.101	6.8	6.1	5.4	5.0	4.5	4.2	3.9
	50	0.112	7.6	6.7	6.1	5.5	5.1	4.7	4.3
	60	0.124	8.4	7.4	6.7	6.1	5.6	5.1	4.8
Black (35)	10	0.070	4.7	4.2	3.8	3.4	3.1	2.9	2.7
	20	0.098	6.6	5.9	5.3	4.8	4.4	4.1	3.8
	30	0.120	8.1	7.2	6.5	5.9	5.4	5.0	4.6
	40	0.139	9.4	8.3	7.5	6.8	6.3	5.8	5.4
	50	0.156	10.5	9.3	8.4	7.6	7.0	6.5	6.0
	60	0.170	11.5	10.2	9.2	8.3	7.6	7.1	6.6
Brown (41)	10	0.094	6.3	5.6	5.1	4.6	4.2	3.9	3.6
	20	0.132	8.9	7.9	7.1	6.5	5.9	5.5	5.1
	30	0.162	10.9	9.7	8.7	8.0	7.3	6.7	6.2
	40	0.187	12.6	11.2	10.1	9.2	8.4	7.8	7.2
	50	0.209	14.1	12.5	11.3	10.3	9.4	8.7	8.1
	60	0.228	15.4	13.7	12.3	11.2	10.3	9.5	8.8
Orange (46)	10	0.119	8.1	7.2	6.5	5.9	5.4	5.0	4.6
	20	0.169	11.4	10.1	9.1	8.3	7.6	7.0	6.5
	30	0.207	14.0	12.4	11.2	10.2	9.3	8.6	8.0
	40	0.239	16.1	14.3	12.9	11.7	10.8	9.9	9.2
	50	0.267	18.0	16.0	14.4	13.1	12.0	11.1	10.3
	60	0.293	19.8	17.6	15.8	14.4	13.2	12.2	11.3
Maroon (52)	10	0.149	10	9	8	7	7	6	6
	20	0.210	14	13	11	10	9	9	8
	30	0.257	17	15	14	13	12	11	10
	40	0.296	20	18	16	15	13	12	11
	50	0.332	22	20	18	16	15	14	13
	60	0.363	24	22	20	18	16	15	14
Red (63)	10	0.218	15	13	12	11	10	9	8
	20	0.307	21	18	17	15	14	13	12
	30	0.376	25	23	20	18	17	16	15
	40	0.435	29	26	23	21	20	18	17
	50	0.486	33	29	26	24	22	20	19
	60	0.532	36	32	29	26	24	22	21
Blue (80)	10	0.351	24	21	19	17	16	15	14
	20	0.496	34	30	27	24	22	21	19
	30	0.608	41	36	33	30	27	25	23
	40	0.702	47	42	38	34	32	29	27
	50	0.785	53	47	42	39	35	33	30
	60	0.859	58	52	46	42	39	36	33
Yellow (95)	10	0.506	34	30	27	25	23	21	20
	20	0.715	48	43	39	35	32	30	28
	30	0.876	59	53	47	43	39	36	34
	40	1.009	68	61	54	50	45	42	39
	50	1.133	76	68	61	56	51	47	44
	60	1.239	84	74	67	61	56	51	48
Green (110)	10	0.686	46	41	37	34	31	28	26
	20	0.973	66	58	53	48	44	40	38
	30	1.186	80	71	64	58	53	49	46
	40	1.372	93	82	74	67	62	57	53
	50	1.531	103	92	83	75	69	64	59
	60	1.681	113	101	91	83	76	70	65
White (125)	10	0.867	59	52	47	43	39	36	33
	20	1.230	83	74	66	60	55	51	47
	30	1.504	102	90	81	74	68	62	58
	40	1.735	117	104	94	85	78	72	67
	50	1.938	131	116	105	95	87	81	75
	60	2.124	143	127	115	104	96	88	82
Lime Green (156)	10	1.372	93	82	74	67	62	57	53
	20	1.947	131	117	105	96	88	81	75
	30	2.381	161	143	129	117	107	99	92
	40	2.752	186	165	149	135	124	114	106
	50	3.071	207	184	166	151	138	128	118
	60	3.363	227	202	182	165	151	140	130

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

36" Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	1.4	1.2	1.1	1.0	0.9	0.8	0.8
	20	0.046	1.9	1.7	1.5	1.4	1.3	1.2	1.1
	30	0.057	2.3	2.1	1.9	1.7	1.6	1.4	1.3
	40	0.065	2.7	2.4	2.2	2.0	1.8	1.7	1.5
	50	0.073	3.0	2.7	2.4	2.2	2.0	1.9	1.7
	60	0.081	3.3	3.0	2.7	2.4	2.2	2.0	1.9
Gray (30)	10	0.050	2.1	1.8	1.7	1.5	1.4	1.3	1.2
	20	0.072	3.0	2.6	2.4	2.2	2.0	1.8	1.7
	30	0.088	3.6	3.2	2.9	2.6	2.4	2.2	2.1
	40	0.101	4.2	3.7	3.3	3.0	2.8	2.6	2.4
	50	0.112	4.6	4.1	3.7	3.4	3.1	2.9	2.6
	60	0.124	5.1	4.5	4.1	3.7	3.4	3.1	2.9
Black (35)	10	0.070	2.9	2.6	2.3	2.1	1.9	1.8	1.6
	20	0.098	4.1	3.6	3.2	2.9	2.7	2.5	2.3
	30	0.120	5.0	4.4	4.0	3.6	3.3	3.1	2.8
	40	0.139	5.7	5.1	4.6	4.2	3.8	3.5	3.3
	50	0.156	6.4	5.7	5.1	4.7	4.3	4.0	3.7
	60	0.170	7.0	6.2	5.6	5.1	4.7	4.3	4.0
Brown (41)	10	0.094	3.9	3.4	3.1	2.8	2.6	2.4	2.2
	20	0.132	5.4	4.8	4.4	4.0	3.6	3.3	3.1
	30	0.162	6.7	5.9	5.3	4.9	4.5	4.1	3.8
	40	0.187	7.7	6.8	6.2	5.6	5.1	4.7	4.4
	50	0.209	8.6	7.7	6.9	6.3	5.7	5.3	4.9
	60	0.228	9.4	8.4	7.5	6.8	6.3	5.8	5.4
Orange (46)	10	0.119	4.9	4.4	3.9	3.6	3.3	3.0	2.8
	20	0.169	7.0	6.2	5.6	5.1	4.6	4.3	4.0
	30	0.207	8.5	7.6	6.8	6.2	5.7	5.3	4.9
	40	0.239	9.9	8.8	7.9	7.2	6.6	6.1	5.6
	50	0.267	11.0	9.8	8.8	8.0	7.3	6.8	6.3
	60	0.293	12.1	10.7	9.7	8.8	8.1	7.4	6.9
Maroon (52)	10	0.149	6	5	5	4	4	4	4
	20	0.210	9	8	7	6	6	5	5
	30	0.257	11	9	8	8	7	7	6
	40	0.296	12	11	10	9	8	8	7
	50	0.332	14	12	11	10	9	8	8
	60	0.363	15	13	12	11	10	9	9
Red (63)	10	0.218	9	8	7	7	6	6	5
	20	0.307	13	11	10	9	8	8	7
	30	0.376	16	14	12	11	10	10	9
	40	0.435	18	16	14	13	12	11	10
	50	0.486	20	18	16	15	13	12	11
	60	0.532	22	20	18	16	15	14	13
Blue (80)	10	0.351	14	13	12	11	10	9	8
	20	0.496	20	18	16	15	14	13	12
	30	0.608	25	22	20	18	17	15	14
	40	0.702	29	26	23	21	19	18	17
	50	0.785	32	29	26	24	22	20	19
	60	0.859	35	32	28	26	24	22	20
Yellow (95)	10	0.506	21	19	17	15	14	13	12
	20	0.715	29	26	24	21	20	18	17
	30	0.876	36	32	29	26	24	22	21
	40	1.009	42	37	33	30	28	26	24
	50	1.133	47	42	37	34	31	29	27
	60	1.239	51	45	41	37	34	31	29
Green (110)	10	0.686	28	25	23	21	19	17	16
	20	0.973	40	36	32	29	27	25	23
	30	1.186	49	43	39	36	33	30	28
	40	1.372	57	50	45	41	38	35	32
	50	1.531	63	56	51	46	42	39	36
	60	1.681	69	62	55	50	46	43	40
White (125)	10	0.867	36	32	29	26	24	22	20
	20	1.230	51	45	41	37	34	31	29
	30	1.504	62	55	50	45	41	38	35
	40	1.735	72	64	57	52	48	44	41
	50	1.938	80	71	64	58	53	49	46
	60	2.124	88	78	70	64	58	54	50
Lime Green (156)	10	1.372	57	50	45	41	38	35	32
	20	1.947	80	71	64	58	54	49	46
	30	2.381	98	87	79	71	65	60	56
	40	2.752	114	101	91	83	76	70	65
	50	3.071	127	113	101	92	84	78	72
	60	3.363	139	123	111	101	92	85	79

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

Dual Metering Tube Plumbing Kits with Dual Check Valve

For more information, read Navigating the Metering Tube Maze or Metering Tube / LiquiShiftTube Charts.

B
Components

SCAN
for "What is Metering Tube?" video

SureFire dual metering tube plumbing kits are a great way to apply fertilizer.

These plumbing kits will contain everything you need to distribute fertilizer from the flowmeter outlet down to the ground application device of your choice (not included).

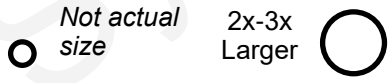
These instructions will show you where all the pieces go. It will provide guidance on how much metering tube to use. There are some optional fittings included in each plumbing kit. These instructions will show you where and why you'd want to use the optional pieces.

The dual check valve assembly is a key piece in the dual metering tube design. In addition to a check valve to stop fertilizer from draining when the system is shut off, **each check valve has an on/off valve on top of it. These on / off valves allow the operator to turn on only tube 1, only tube 2, or both tube 1 and 2**. This provides for three different application ranges, which is especially helpful when using a fertilizer which has a highly variable viscosity based on temperature changes or when changing rates from field to field.

Dual Advantage of Dual Metering Tube

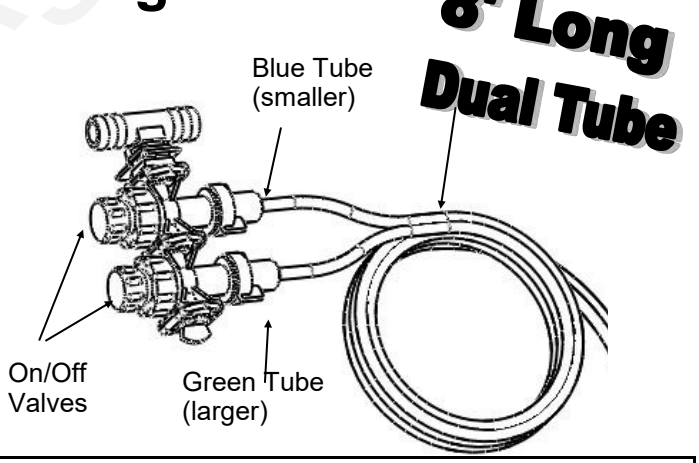
Metering tube provides a larger passage way diameter than a comparable orifice. For a 5 GPA rate on 30" rows, a size 0.046" orifice would be used. For the same rate a 0.110" meter tube that is 8' long would be used. This 8' tube with more than twice the diameter creates a fertilizer system resistant to plugging while providing excellent row to row distribution.

By using two metering tubes, the fertilizer system can handle a wider range of rates and provide the proper system pressure as the fertilizer properties change due to temperature, mixtures and other factors.



Standard Orifice Metering Tube

Field Operation of Dual Metering Tube - Dual Check Valve System



The dual metering tube allows for three application rate ranges. Some fertilizers have a widely variable viscosity. Therefore, based on temperature, tank mixing and fertilizer batch, the best tube to use will change.

SureFire recommends you start with the larger tube ON only. This is the middle size and is a good starting point. Conduct a test using the Nozzle Flow Check with fertilizer to determine your system pressure. If pressure is below 15 psi, some check valves may not open and row to row distribution will be uneven.

Start with larger tube ON, smaller tube OFF:

- **• Pressure below 15 PSI: Turn larger tube OFF and smaller tube ON.**
- **• Pressure over 50 PSI: Turn BOTH tubes ON.**

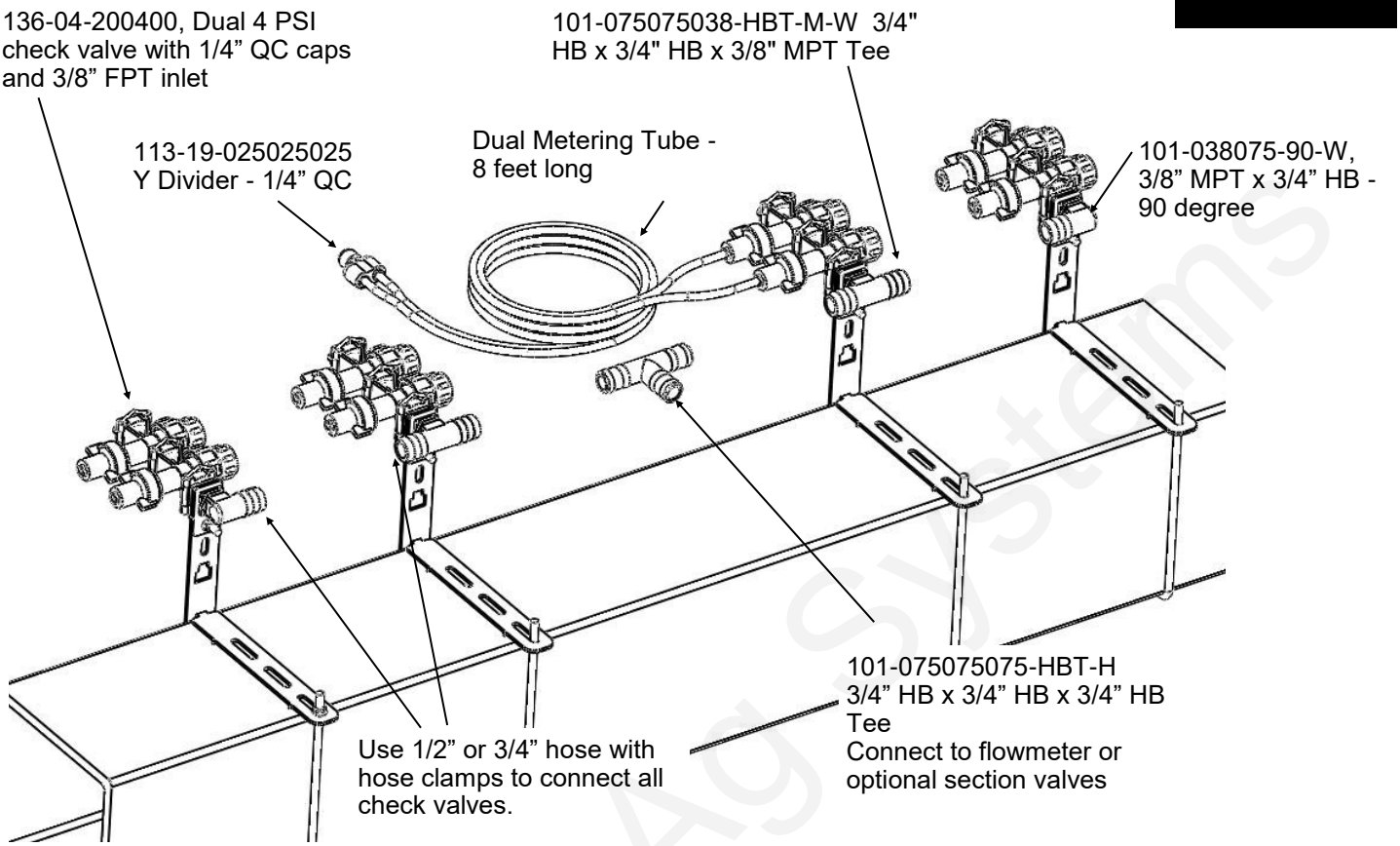
	GPA on 30" rows (approx, will vary)
Blue Tube	1.5 - 3
Green Tube	3 - 6
Blue & Green Tube	6 - 10
Minimum Recommended flow for Blue Tube (8 ft)	4 - 5 oz/min

Other tubes are available if needed for different application rates.

** Ultra Low Rate Application –For rates from 2-5 oz/min/row use a 12 foot length of metering tube.
To calculate oz/min/row: Oz/min/row = (GPA x MPH x spacing (inches)) ÷ 46.4

Dual Check Valve Plumbing Diagram

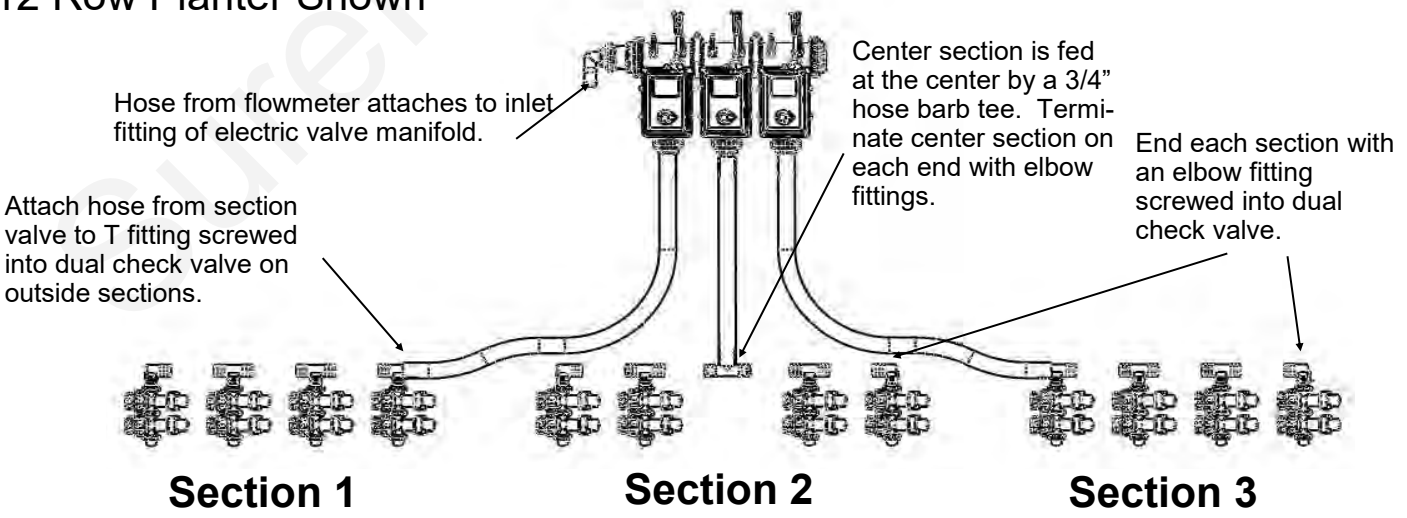
4 Row Planter Shown, add rows as necessary



This is a general diagram showing the dual check valve assembly mounted on a planter toolbar. The check valve and bracket are very flexible in their mounting. The check valve can mount behind, directly over, or in front of the toolbar. The check valve can be put in the bracket facing up & down or sideways (shown). In addition the steel bracket could be rotated 90 degrees and clamp around the bar. The multiple slots in the bracket are used to mount to any tube 7x7 inches or smaller.

Sectional Plumbing Diagram with Dual Check Valves

12 Row Planter Shown

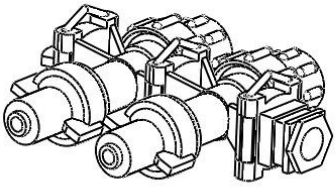


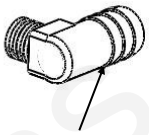
For a **2 section plumbing system**, omit the center section and plumb similar to the outside 2 sections.

Dual Check Valve Assembly Steps

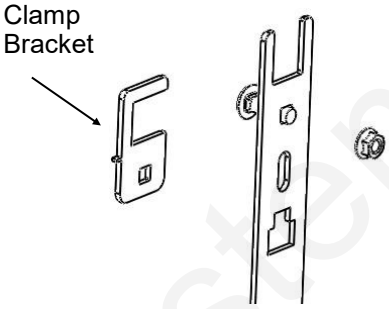
Follow these steps to mount each check valve to the steel bracket.

1. Screw the 3/8” MPT x 3/4” HB tee or elbow into the check valve using blue thread sealer. Orient the hose barb to run the 3/4” hose down the planter toolbar.
2. Insert the check valve into the “C” notch in the end of the bracket, according to how you want the check valve to be mounted on your planter. Orient the wire clips up or to the side for easiest access.
3. Slide the small “C” clamp bracket around the check valve to lock it in place.
4. Install the 1/4” carriage bolt and flange nut to secure the “C” clamp plate around the check valve.
5. Now, mount the check valve on the bar. Hold the check valve and long bracket assembly on the toolbar. Slide the tab on the front of the short bracket into the upper or lower notch on the long bracket.
6. Slide the L bolt into the appropriate slots on the brackets for your tube size. Tighten the 1/4” flange nuts to hold the bracket in place.

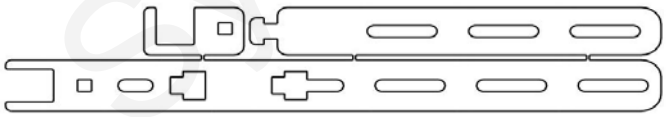




Elbow at end of section, Tee in mid-locations.



400-1966A1 Dual Check Valve Mount Bracket

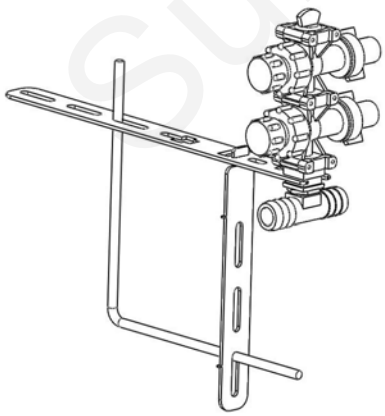


The long, short & clamp bracket come as one part connected by break-off tabs.

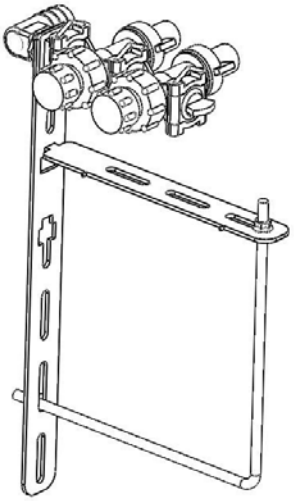
Check Valve Mounting Options

The dual check valve mounting bracket is very flexible to fit many different planter configurations. Three options are shown here to illustrate some of the possibilities.

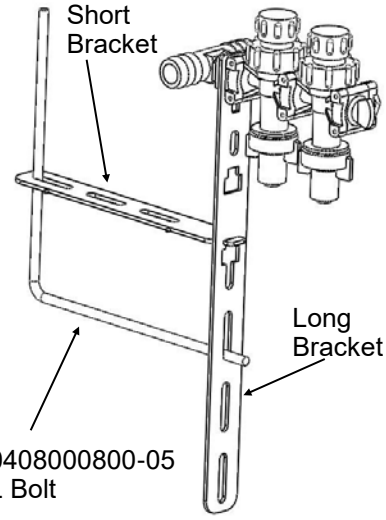
Example 1. Use the long bracket on the top of a bar. The check valve is mounted vertically. The liquid supply hose is ran directly on the front side of the bar. The U-bolt is placed in slots to clamp on a 4x6 inch tube.



Example 2. Use the long bracket on the rear of a bar. The check valve is mounted over the top of the bar. The supply line would run above and behind the bar. The short bracket is placed in the notch to mount the check valve closer to the bar.



Example 3. Use the long bracket on the front of a 3x7 bar (vacuum tube on some planters). Mount the check valve hanging forward of the bar. The supply line will run directly over the bar. The excess bolt and bracket length can be cut off.



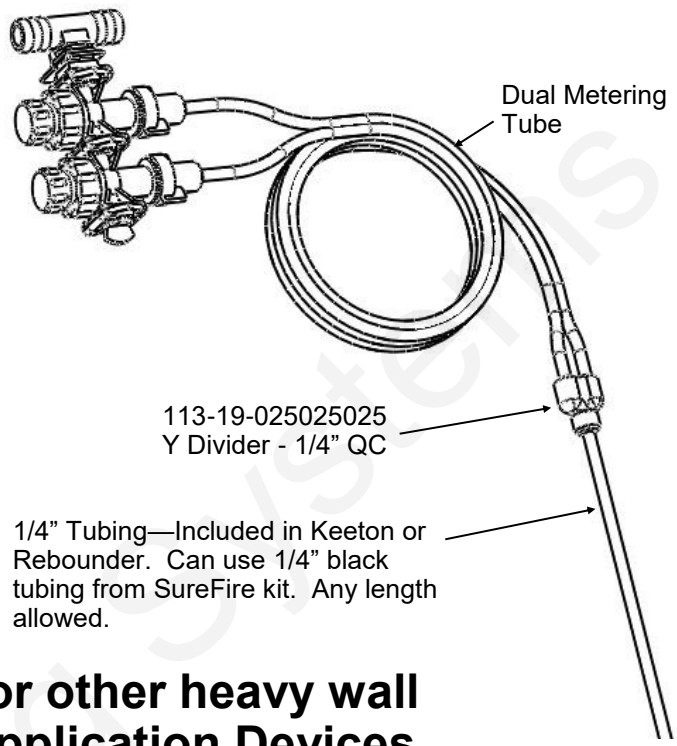
Connection to Keeton Seed Firmer, Rebounder Seed Covers or through thin wall stainless steel tubes

1. Mount the Keeton Seed Firmer or Rebounder Seed Cover.
2. Route the tube included in the above kit as instructed.
3. Attach the 1/4” tube to the 1/4” QC Y divider fitting.
4. Zip all tubing to the planter and row unit in as many locations as possible.

For thin wall stainless steel tubes, you can push the 1/4” black tubing all the way through the stainless steel tube so fertilizer will run directly from the tubing onto the ground.

For more information on metering tube, go to

http://www.surefireag.com/cms/images/Metering-Tube-Maze_Reduced.pdf (underscore before Reduced)

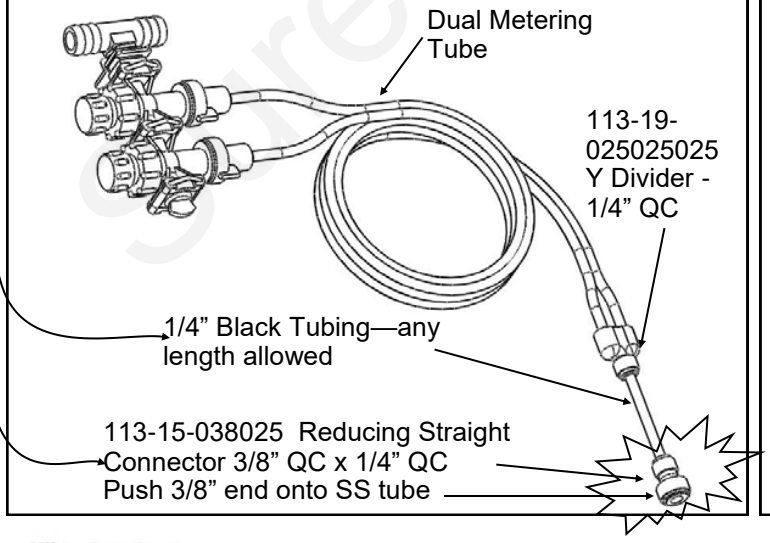


Connection to Totally Tubular or other heavy wall Stainless Steel Tube Ground Application Devices

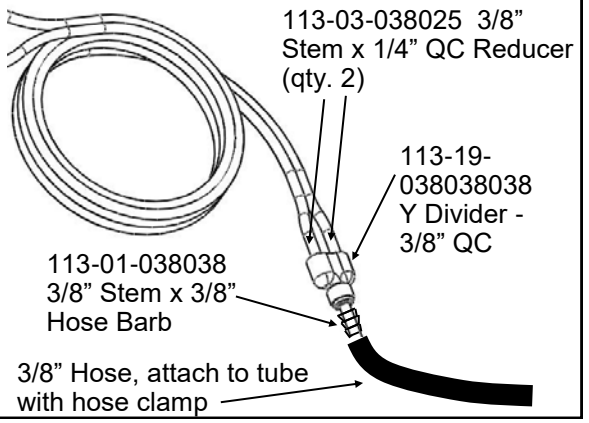
When using a 3/8” OD stainless steel tube to apply fertilizer to the ground, there are two options for the delivery tube plumbing. If the tube ID is less than 1/4” (tubing will not fit inside tube) this attachment method must be used. The description following is for Option 1. See bottom right picture for Option 2.

1. Use the 1/4” x 3/8” QC fitting shown. Push the 3/8” end onto the stainless steel tube. (Hint: if the fitting slips off the stainless steel tube, use sandpaper or a file to roughen the end of the tube slightly)
2. Use a short piece of 1/4” black tubing to connect the Y fitting to the reducer fitting on the stainless steel tube.
3. Zip all tubing to the planter and row unit in as many locations as possible.

Option 1: QC Fitting attaches to SS Tube



Option 2: 3/8” Hose attaches to SS Tube



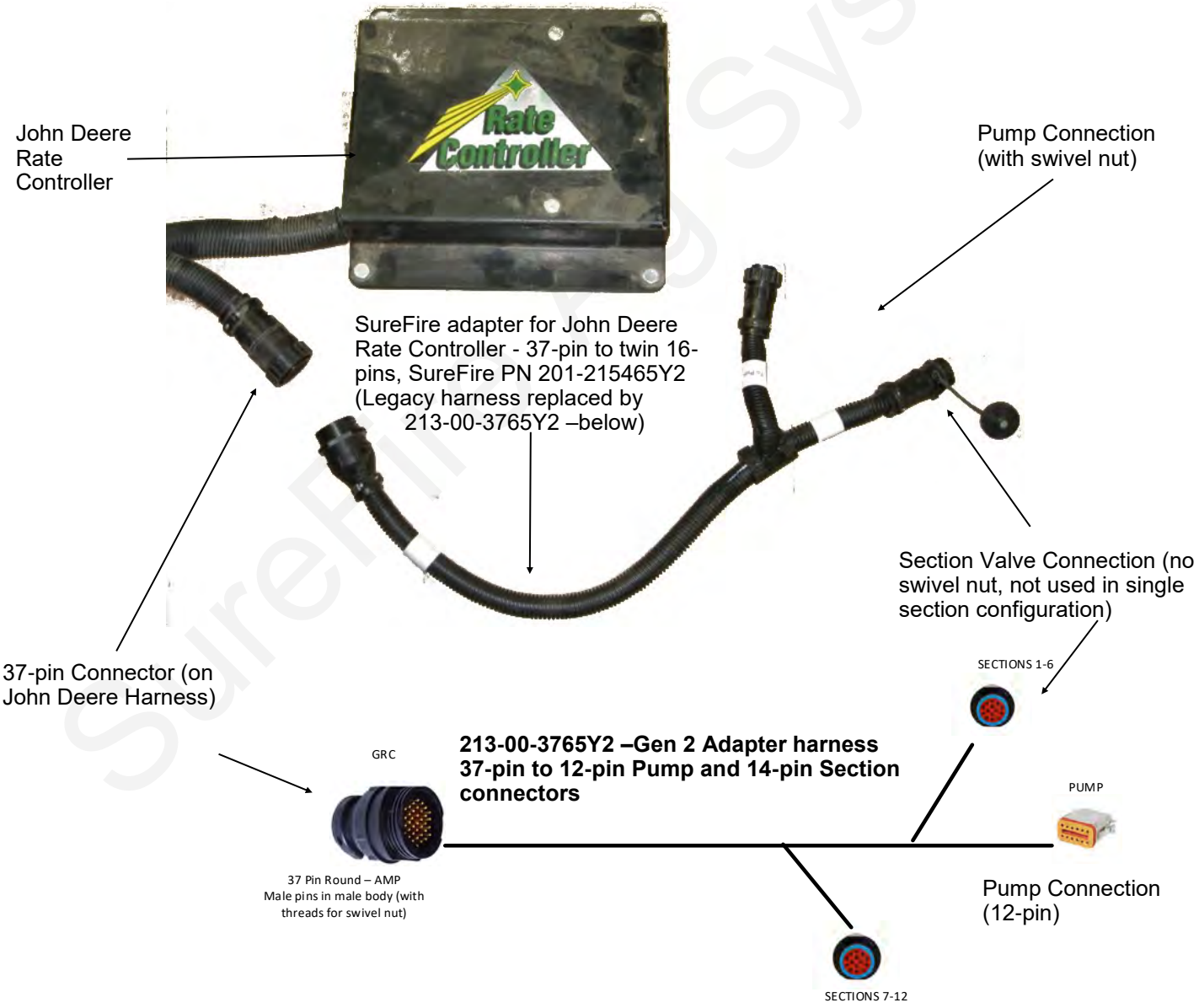
John Deere Rate Controller for GS2 & GS3

SureFire Fertilizer Systems begin at the John Deere Rate Controller, which you will need to purchase from your John Deere dealer. The picture below shows the John Deere Rate Controller. A John Deere Rate Controller can control one product. Therefore, if you were applying two liquid fertilizers on your planter, you will need three rate controllers, one for seed and two for liquid fertilizer. The John Deere Rate Controller communicates with the John Deere display in the cab.

The harness coming from the rate controller is a 37-pin Amp connector. SureFire Fertilizer System harnesses begin at this 37-pin connector. The following page shows a system layout to illustrate how the harnessing is connected to all components. Detailed harness drawings follow for information and troubleshooting.

Instructions for setting up the GS2 or GS3 display are in Section F. Detailed screen shots of the display are included showing exactly what settings are required and recommended for SureFire Fertilizer Systems.

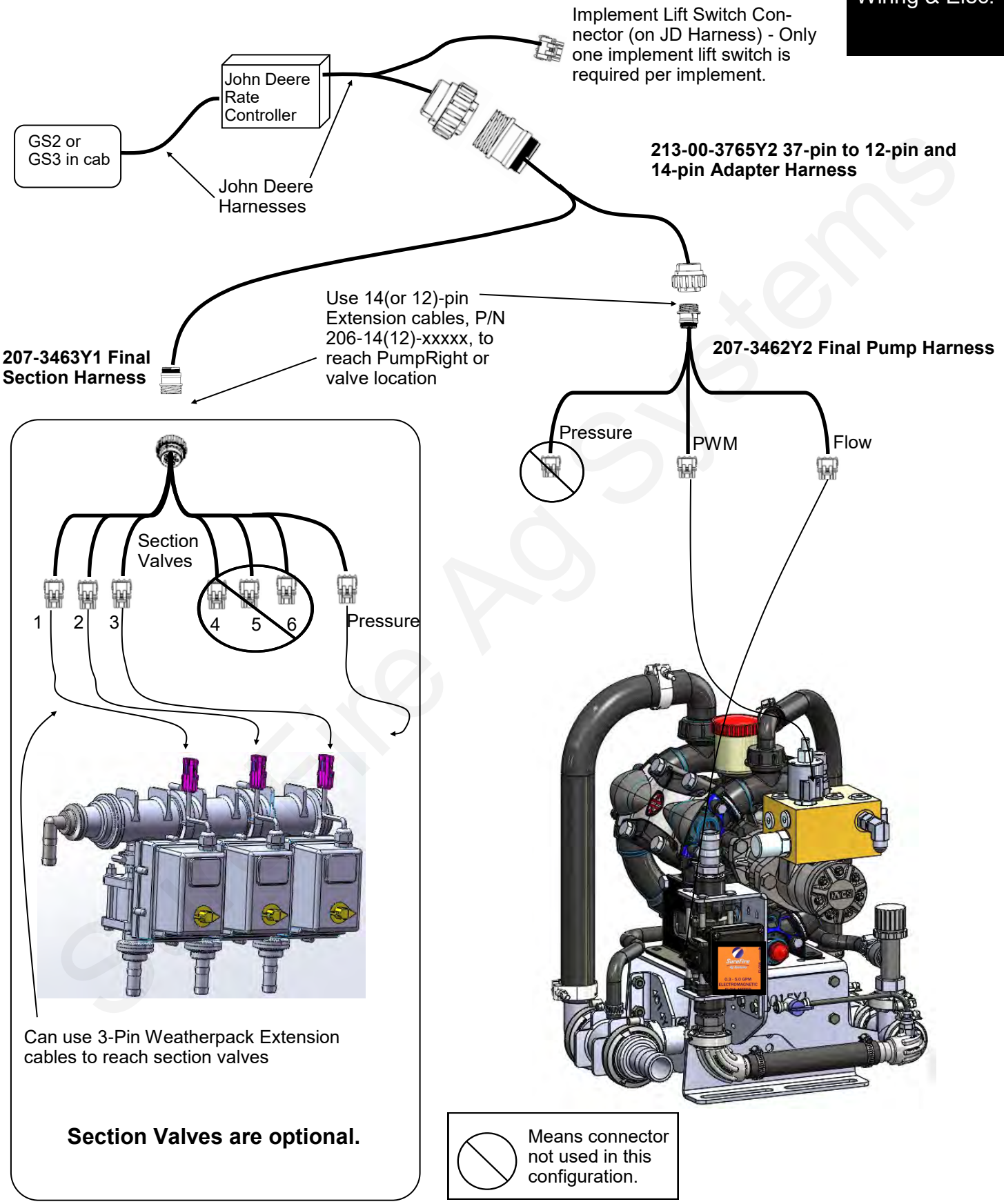
See your John Deere Rate Controller Operator's Manual for more setup and operating instructions.



PumpRight & John Deere Rate Controller Layout

Control: PWM Hydraulic Valve
Sections: 3

D
Wiring & Elec.



John Deere GreenStar Rate Controller Wiring Schematics

Your John Deere system may have one of the following two sets of harnesses. The first set is being introduced during the 2018 season. The second set is the legacy set that has been used for several years.

New JD GreenStar Rate Controller harnesses for the 2018 season:
(with improved 12-pin Deutsch and 14-pin Deutsch connectors)

Adapter Harness

213-00-3765Y3 **JD Rate Controller Adapter harness with 12-pin Product and 14-pin Section connectors**

Pump Harness

207-3462Y2 **12-pin Final Cable for SureFire Liquid System (PWM, Flow, Pressure, Pump RPM)**
Or
207-3461Y2 12-pin Final Cable for Tower with 1 or 2 Section Valves (PWM, Flow, Pressure, Sections 1 and 2)

Section Harness (if needed)

207-3463Y1 **14-pin 6-section Final Cable**

John Deere GreenStar Rate Controller Legacy Harnesses

Adapter Harness

201-215465Y3 JD Rate Controller to twin 16-pin AMP connectors

Pump Harness

207-215223Y2 PWM Pump Cable

Section Harness

207-215466Y2 16-pin 6-Section Harness

X-026
GRC 37-pin

Cav.	Wire	Colour	Gauge	Signal
1	WIRE001	BK	14	GND
2	WIRE002	BK	14	GND
3	WIRE008	RD	14	HC PWR
4	WIRE015	OR	18	Section 1
5	WIRE018	BR	18	Section 2
6	WIRE022	BL	18	Section 3
7	WIRE023	BK WH	18	Section 4
8	WIRE024	BR WH	18	Section 5
9	WIRE025	BL WH	18	Section 6
10	WIRE026	WH BK	18	Section 7
11	WIRE027	WH BR	18	Section 8
12	WIRE028	WH BL	18	Section 9
13	WIRE029	PK	18	Section 10
14				
15	WIRE034	GN	18	PWM (-)
16	WIRE037	YE	18	PWM (+)
17				
18				
19	WIRE031	GN	18	Section 12
20	WIRE030	WH YE	18	Section 11

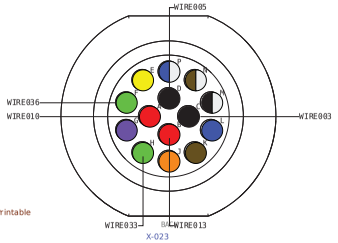
Cav.	Wire	Colour	Gauge	Signal
21				
22				
23				
24				
25				
26				
27				
28	WIRE021	BL	18	Flow Signal 1
29				
30				
31	WIRE040	VT	18	Pressure 1
32				
33				
34				
35	WIRE043	VT WH	18	Pressure 2
36	WIRE009	RD	14	HC PWR
37				

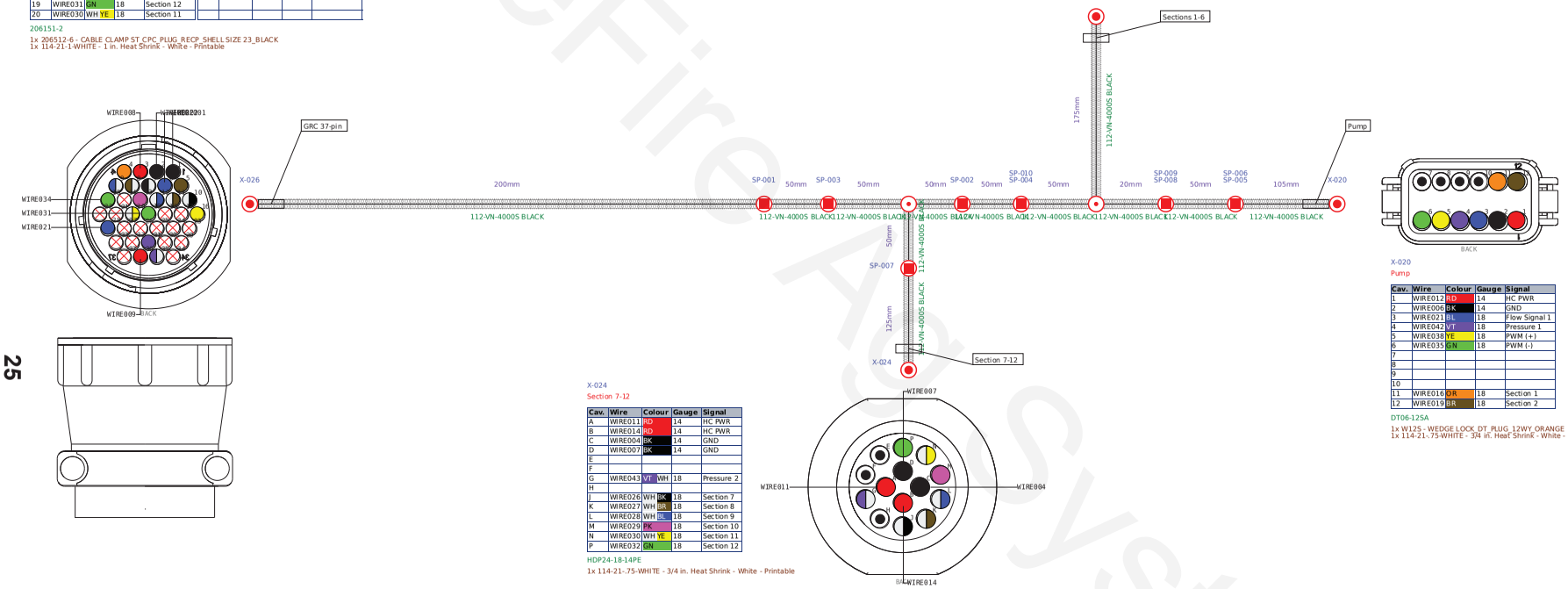
206151-2
1x 206512-6 - CABLE CLAMP ST_CPC_PLUG_RECP_SHELL SIZE 23_BLACK
1x 114-21-1-WHITE - 1 in. Heat Shrink - White - Printable

X-023
Sections 1-6

Cav.	Wire	Colour	Gauge	Signal
A	WIRE010	RD	14	HC PWR
B	WIRE013	RD	14	HC PWR
C	WIRE003	BK	14	GND
D	WIRE005	BK	14	GND
E	WIRE039	YE	18	PWM (+)
F	WIRE036	GN	18	PWM (-)
G	WIRE041	VT	18	Pressure 1
H	WIRE033	GN	18	Section 12
J	WIRE017	OR	18	Section 1
K	WIRE020	BR	18	Section 2
L	WIRE022	BL	18	Section 3
M	WIRE023	BK WH	18	Section 4
N	WIRE024	BR WH	18	Section 5
P	WIRE025	BL WH	18	Section 6

HDP24-18-14PE
1x 114-21-1-WHITE - 1 in. Heat Shrink - White - Printable





X-020
Pump

Cav.	Wire	Colour	Gauge	Signal
1	WIRE012	RD	14	HC PWR
2	WIRE006	BK	14	GND
3	WIRE021	BL	18	Flow Signal 1
4	WIRE042	VT	18	Pressure 1
5	WIRE038	YE	18	PWM (+)
6	WIRE035	GN	18	PWM (-)
7				
8				
9				
10				
11	WIRE016	OR	18	Section 1
12	WIRE019	BR	18	Section 2

DT06-12SA
1x W12S - WEDGE LOCK_DT_PLUG_12WY_ORANGE
1x 114-21-.75-WHITE - 3/4 in. Heat Shrink - White - Printable

X-024
Section 7-12

Cav.	Wire	Colour	Gauge	Signal
A	WIRE011	RD	14	HC PWR
B	WIRE014	RD	14	HC PWR
C	WIRE004	BK	14	GND
D	WIRE007	BK	14	GND
E				
F				
G	WIRE043	VT WH	18	Pressure 2
H				
J	WIRE026	WH BK	18	Section 7
K	WIRE027	WH BR	18	Section 8
L	WIRE028	WH BL	18	Section 9
M	WIRE029	PK	18	Section 10
N	WIRE030	WH YE	18	Section 11
P	WIRE032	GN	18	Section 12

HDP24-18-14PE
1x 114-21-.75-WHITE - 3/4 in. Heat Shrink - White - Printable

25

SureFire Ag Systems

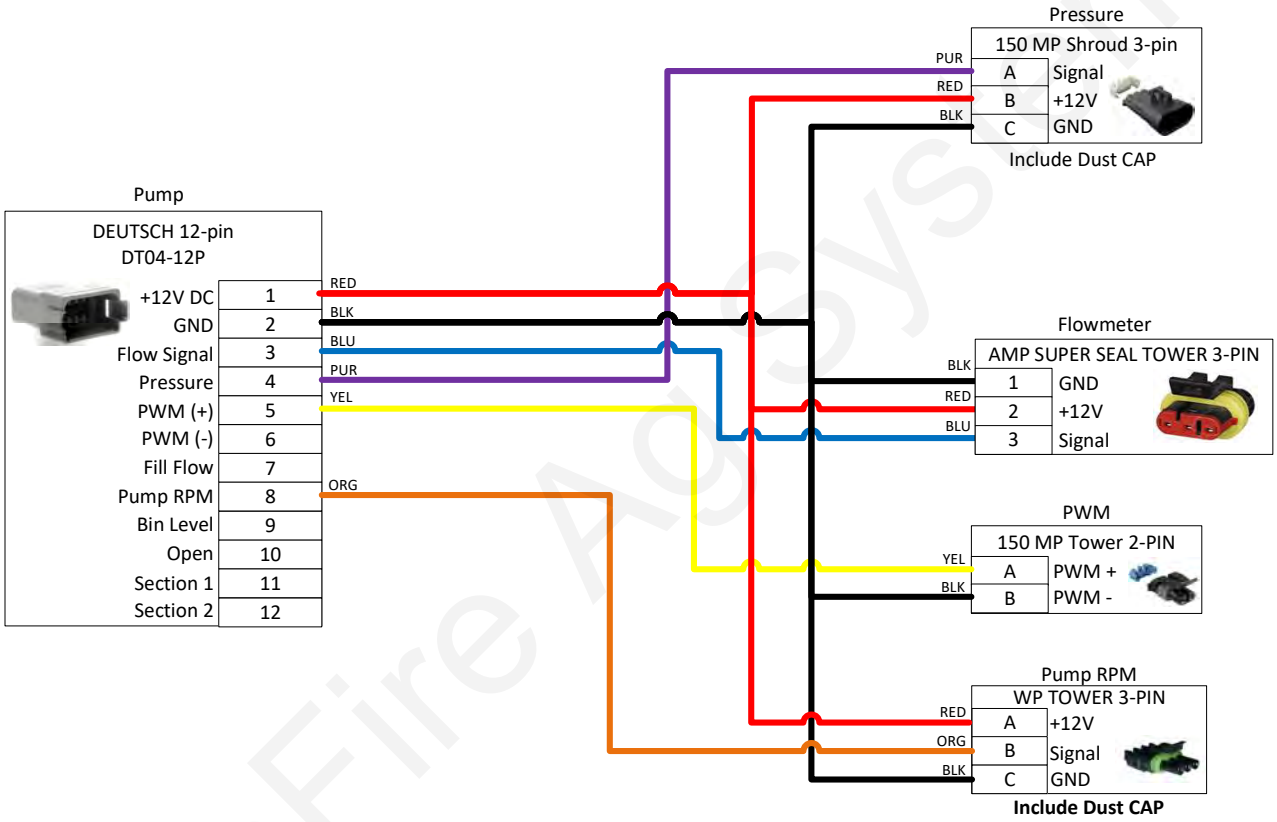
DESCRIPTION
GreenStar Rate Controller 37-pin to 12-pin Product and 14-pin Sections

PART NUMBER	REV	DRAWN BY	DRAWN DATE	UNITS
213-00-3765Y3	A-04	Matthew Fritz	2021-02-01	mm
MODIFIED BY	MODIFIED DATE	SHEET		SIZE
nketzner	2021-06-04	1 OF 3		B

207-3462Y2

Final Cable for SureFire Liquid Pump System (pwm, flow, pres., pump rpm)

Wire 18AWG unless otherwise specified

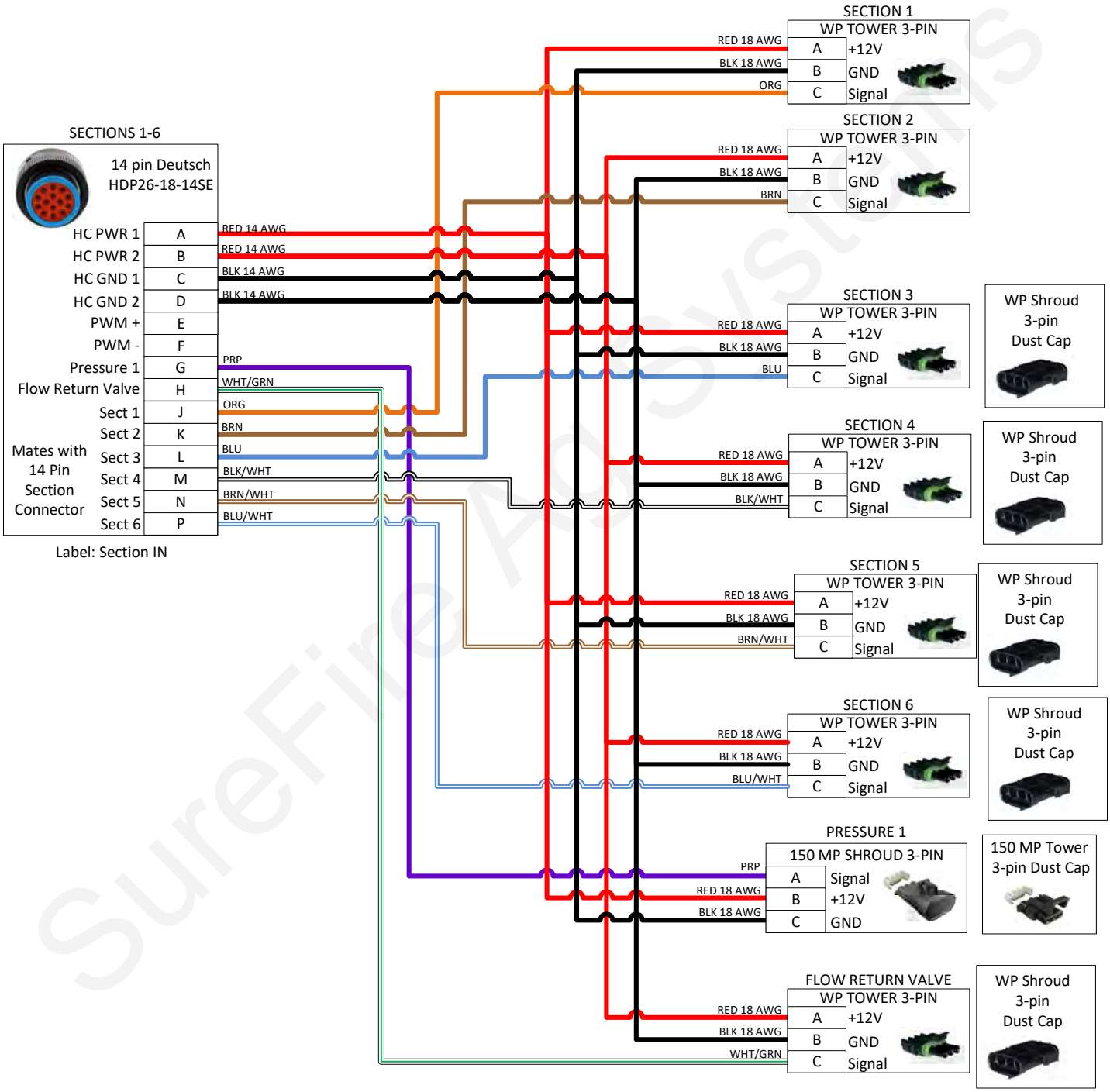


SureFire Ag Systems	Part No:	207-3462Y2	Drawn By:	Brandon Cavenee	
	Description:	Final Cable for SureFire Liquid Pump System (pwm, flow, pres., pump rpm)	Last Edit Date:	6/4/2021	Revision A-03
			26		

207-3463Y1

14-Pin 6 Section Final Cable (6 sections, flow return, pressure)

Wire 18AWG unless otherwise specified



SureFire Ag Systems	Part No:	207-3463Y1	Drawn By:	Brandon Cavenee	
	Description:	14-Pin 6 Section Final Cable (6 sections, flow return, pressure)	Last Edit Date:	6/4/2021	Revision A-02
			27		1 of 2

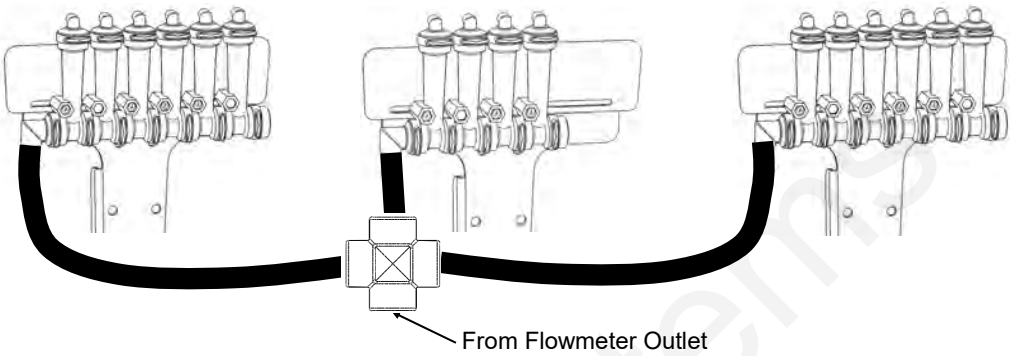
Floating Ball Flow Indicators

E
Installation Overview

Flow Indicators are extremely flexible and can be mounted in hundreds of different configurations on various types of liquid application equipment. This page is to give you some ideas and let you customize the installation for what works best on your equipment.

16 Row
Split 6 - 4 - 6

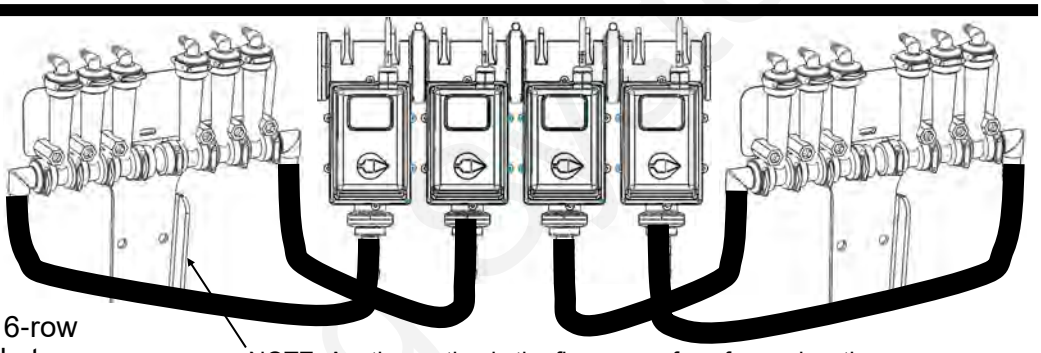
This configuration works well on a 16-row front fold planter. Each flow indicator manifold is shown fed by a cross in a single section installation. Each manifold could be fed by a section valve if desired.



12 Row
Split 3 - 3 - 3 - 3

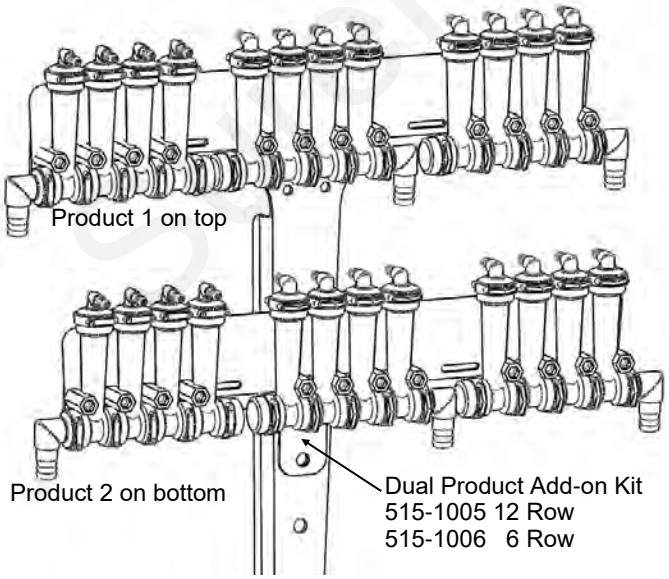
Shown here is a 12 row with four 3-row sections controlled by four section valves. Note each 6-row T-Bracket can hold two separate 3-row manifolds.

A 4-section 24-row could be similar with four 6-row manifolds on two large T-Brackets.

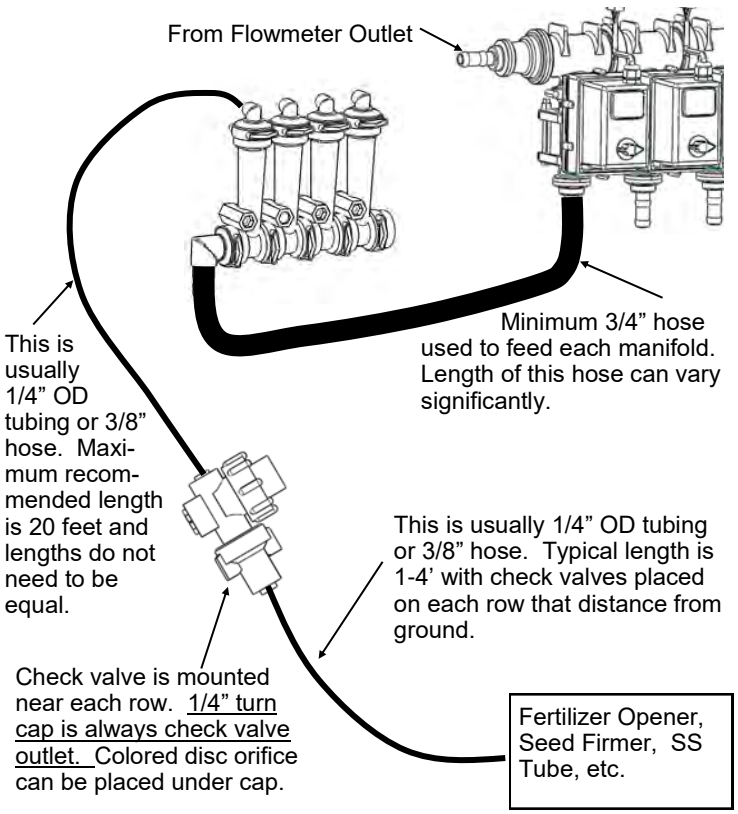


12 Row Dual Product
Product 1 Split 4 - 4 - 4 / Product 2 Split 4 - 4 - 4

In this case each manifold would be fed by a section valve. There would be 6 total section valves (3 sections X 2 products). Most often one set (top) of flow indicators would be Full Flow for high rate fertilizer and 2nd set (bottom) would be Low Flow for starter.



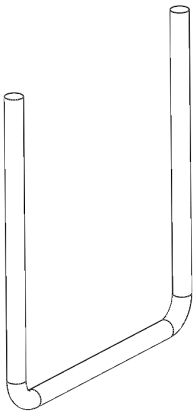
General Plumbing Guidelines



PumpRight Pump Installation

Mounting

1. Mount pump in your preferred location. The PumpRight pump has excellent suction and priming ability, so it can be mounted away from or above fertilizer tanks.
2. SureFire has U-Bolts available to mount the pump directly to multiple bar sizes shown below. Each U-bolt kit includes 1 bolt and 2 flange nuts.
3. If the U-Bolts will not work, order the universal backer plate kit, number 515-203000 which will clamp to any size tube from 4” - 8” wide.



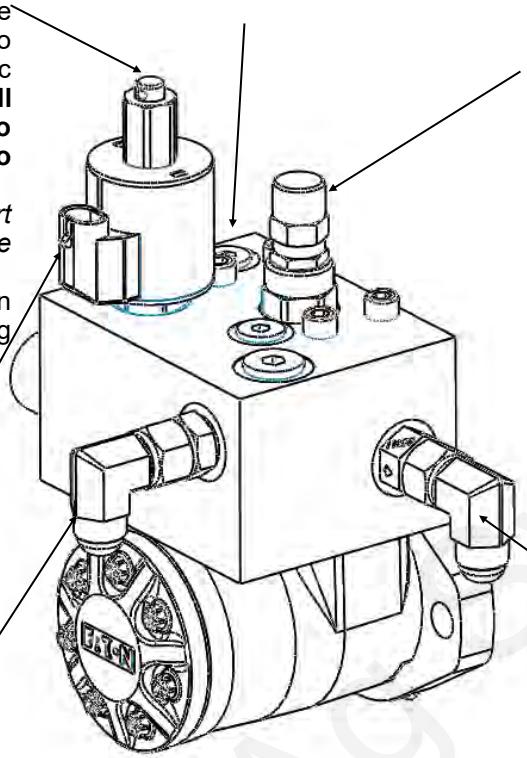
Mounting Bar Size	Item Number	Item Description
3” x 3”	380-1022	1/2" U-bolt Kit - 1/2", fits 3" x 3" tube - (3" opening)
4" x 4"	380-1023	1/2" U-bolt Kit - 1/2", fits 4" x 4" tube - (4" opening)
4" x 6"	380-1015	1/2" U-bolt Kit - 1/2", fits 4" x 6" tube - (4" opening)
	380-1017	1/2" U-bolt Kit - 1/2", fits 6" x 4" tube - (6" opening)
5" x 7"	380-1014	1/2" U-bolt Kit - 1/2", fits 5" x 7" tube - (5" opening)
	380-1016	1/2" U-bolt Kit - 1/2", fits 7" x 5" tube - (7" opening)
6” x 7”	380-1018	1/2" U-bolt Kit - 1/2", fits 7" x 6" tube - (7" opening)
7" x 7"	380-1001	1/2" U-bolt Kit - 1/2", fits 7" x 7" tube - (7" opening)
6” x 10”	380-1021	1/2" U-bolt Kit - 1/2", fits 6" x 10" tube - (6" opening)
8" x 12"	380-1019	1/2" U-bolt Kit - 1/2", fits 8" x 12" tube - (8" opening)
8" x 16"	380-1020	1/2" U-bolt Kit - 1/2", fits 8" x 16" tube - (8" opening)

PUMPRIGHT
HYDRAULIC DRIVE DIAPHRAGM PUMPS

PumpRight Hydraulic Connections
PWM Valve

Load Sense Port—For power beyond hydraulic use only.

Manual Override - Push down and turn 1/2 turn CCW to lift the valve for manual override to check for proper hydraulic operation. **Override will completely open valve, so limit tractor hydraulic flow to valve.**
(May need to clean packed dirt to allow movement of override knob.)
Push down and turn 1/2 turn CW to return to operating position.



Bypass Valve—Remove the cap to access a bypass needle valve. This valve is shipped from the factory closed. **The only case when valve should be open is when running in series with other hydraulic motors.**

Depending on your tractor and exact hydraulic plumbing scenario your pump may turn very slowly when it should stop. To stop the pump completely, open the bypass valve slightly.

To adjust the Bypass Needle Valve, first loosen the lock nut. Do not overtighten the needle valve.

PWM Valve Connector -2 Pin MP Shroud
Troubleshooting Tip:
To check coil, an ohmmeter placed on the two pins should show 7-9 ohms.

Return oil to Tank - Check valve included on return port

Pressure line from Tractor

⚠ DANGER

Hydraulic oil under extremely high pressure. Do not use hand or any other skin to check for or to stop hydraulic leaks. Be sure pressure is relieved before loosening hydraulic fittings. Replace worn hoses immediately. Seek medical care immediately if hydraulic oil is shot into the eye or the skin.

Pump Rotation Check Valve

A check valve is included on the outlet port of the hydraulic valve. This prevents the pump from running in the wrong direction. If ran in the wrong direction, liquid will be pumped, however the hydraulic valve will not be able to control the flow. The check valve can be identified by the Part Number 1108R stamped on it and a flow direction arrow.

How it Works with Power Beyond Hydraulics

This valve is designed to work with power beyond hydraulics. This configuration will not require a standard tractor remote hydraulic valve. The load sense port and hose described next will typically not be needed if other hydraulic ports are in use. If the load sense is needed, do this: First, remove the load sense plug and install a #6 male boss x #6 JIC adapter fitting, SureFire PN 161-01-6MB-6MJ. Then run a 3/8” or 1/4” hydraulic hose back to the tractor. This hose will connect to the load sense port on the tractor. The load sense line will signal the tractor hydraulic system to supply the flow needed by the pump to meet your application rate. The SureFire valve has an internal load sense check valve, which is required for power beyond hydraulics.. The bypass valve (see above) must be closed to use power beyond hydraulics or else an unlimited amount of oil will be continuously circulated.

PumpRight Hydraulic Connections

E
Installation Overview

Hydraulic Hose

SureFire recommends 1/2” hydraulic hose for both pump inlet and outlet. The hoses will need #8 JIC female swivel fittings.

Where do I get hydraulic flow for my PumpRight?

This question is often asked as many implements use up all the hydraulic connections on a tractor. SureFire has some recommendations as to what works best.

Best Option - Dedicated PumpRight Circuit

Preferred

If you have a tractor remote available, attach the tractor remote valve directly to the PumpRight pressure and return ports. DO NOT try to avoid this method simply to save another set of hydraulic hoses running to the tractor. Operating the PumpRight on it’s own circuit is the simplest for installation and operation. It guarantees the PumpRight won’t negatively affect any other hydraulic components on your equipment.

SCAN for video on plumbing behind CCS fan

Alternate Option - In Series with John Deere CCS Fan or Bulk Fill Seed Fan

If you do not have a tractor remote valve available, this may be your best method. You can plumb the PumpRight after the seed distribution fan. If using this method, the SureFire PWM bypass valve must be open (see previous page for instruction & picture). If bypass is left closed, the SureFire valve will limit the speed of the seed distribution fan.

For example, the John Deere CCS fan uses around 7 GPM of oil. This will limit the PumpRight maximum flow (approximately 8.5-9 GPM oil necessary for maximum flow). See the charts on the next page for adjusted maximum pump flow. See section G for flow charts to determine your necessary flow rate. If you absolutely need the maximum flow in this case, SureFire has an alternate motor (smaller displacement) to increase pump speed at 7 GPM oil flow.

DO NOT plumb the PumpRight in series with a vacuum fan. The vacuum fan uses just a few GPM of oil. Also, problems will be caused by excessive pressure at the vacuum fan motor

Two PumpRights

The preferred method is to plumb the two pumps in series. DO NOT plumb two pumps after the CCS fan. Excessive pressures may damage the CCS fan motor. Run the pressure line from tractor to first pump inlet. Plumb from the outlet of Pump 1 to the Inlet of Pump 2, then from Pump 2 outlet back to the tractor. Open the bypass needle valve on both pumps so each valve controls motor speed independently. Run the flow setting procedure on the next page to minimize the hydraulic flow based on the pump that requires more hydraulic motor flow.

Hydraulic oil under extremely high pressure. Do not use hand or any other skin to check for or to stop hydraulic leaks. Be sure pressure is relieved before loosening hydraulic fittings. Replace worn hoses immediately. Seek medical care immediately if hydraulic oil is shot into the eye or the skin.

PumpRight Hydraulic Oil Flow Requirements

(Requirements for 4.0 CID Motor—standard SureFire motor beginning in 2016—Earlier motor was 4.9 CID which uses 20% more oil)

Setting Tractor Hydraulic Remote Speed

PumpRight pumps require a constant hydraulic oil flow from the tractor. The amount of oil needed varies with pump size and speed. The chart at right shows the necessary oil flow for each pump model at varying fertilizer flows.

Use this procedure to determine the correct setting on your tractor hydraulic flow.

1. Run the fertilizer system in the field at the maximum rate and ground speed.
2. Turn down the hydraulic flow slowly while watching the pump flow (Volume / Minute).
3. Observe when the Volume / Minute begins to drop.
4. Turn the hydraulic flow back up slightly.

This setting will provide the Pump Right pump just enough oil for your application rate.

If running with the bypass open (only recommended when 2 motors are operated in series) this process will minimize the oil circulated in the bypass loop, leaving more oil flow for other hydraulic functions.

NOTICE

The pump is rated at a maximum of 550 RPM. Spinning the pump over 550 RPM may cause pump failure.

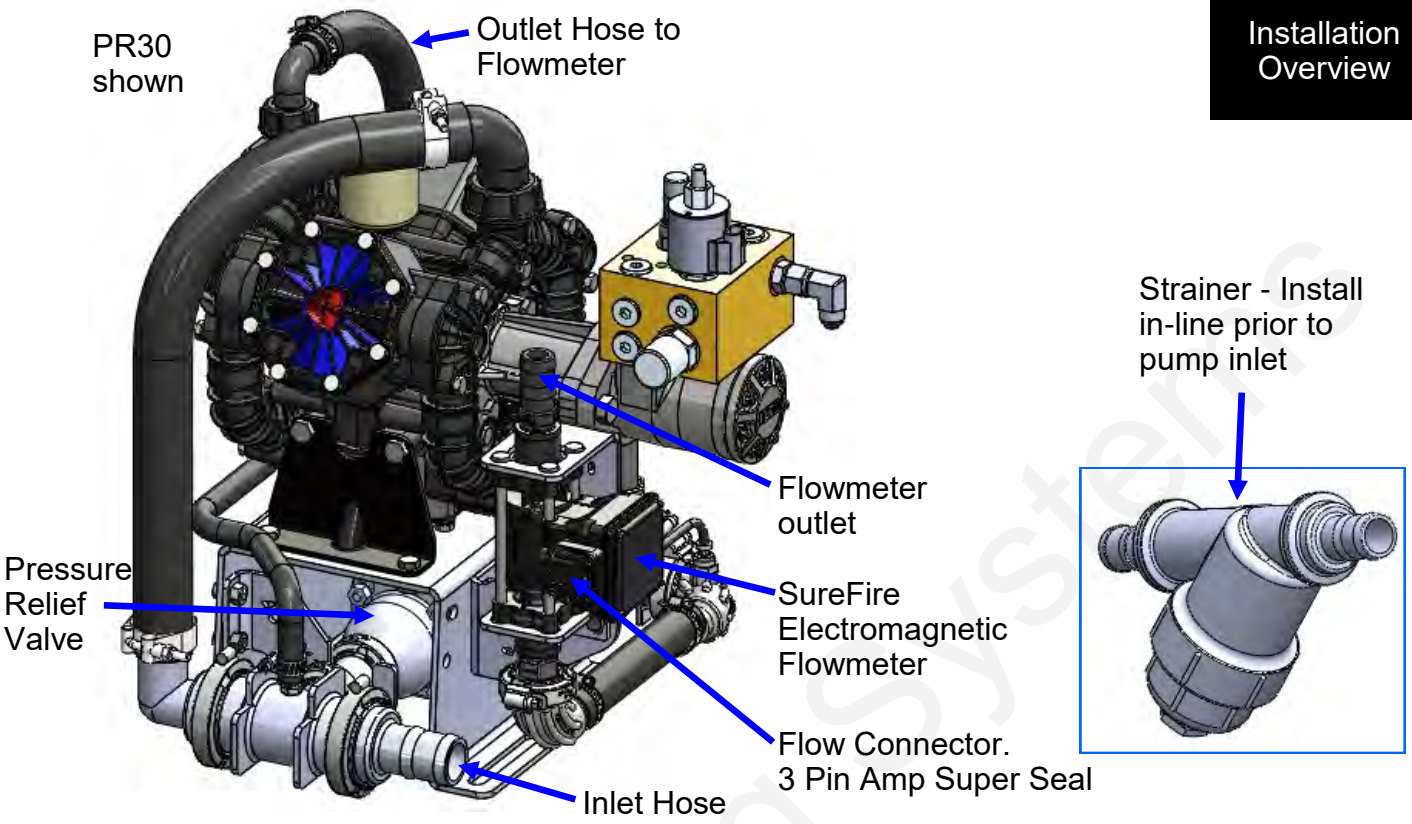
The system will spin the pump faster than that if precautions are not taken to limit the speed. This could happen if the strainer becomes plugged or blocked and the controller attempts to speed the pump up to achieve the desired Rate. It could also happen if a high pressure situation occurs that opens the Pressure Relief Valve (PRV) and the pump speeds up to try to achieve the Rate.

A way to limit the maximum pump speed is to set the High PWM Limit just above what is needed for regular operation. If the pump tries to speed up above that, check for blocked strainer or other issue.

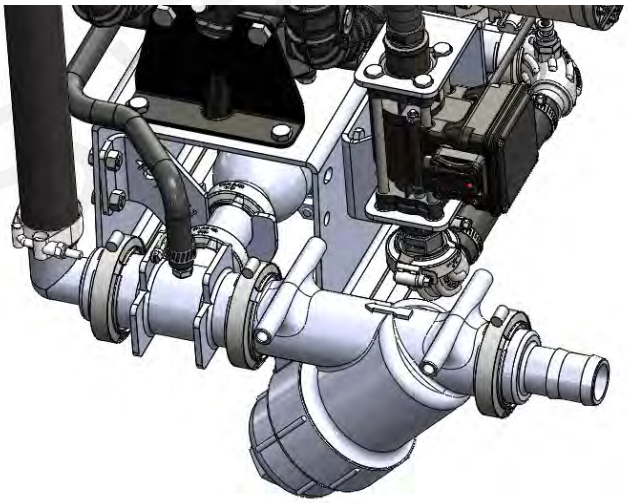
Model PR17 - 3 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
5	137	2.4
10	275	4.8
15	412	7.1
17	467	8.1
Model PR30 - 3 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
5	85	1.5
10	170	2.9
15	255	4.4
20	340	5.9
25	425	7.4
30	510	8.8
Model PR40 - 4 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
10	115	2.0
20	229	4.0
30	344	6.0
40	458	7.9
Model D250 - 6 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
10	86	1.6
20	172	3.2
30	258	4.8
40	343	6.4
50	429	8.0
55	472	8.6

PUMPRIGHT HYDRAULIC DRIVE DIAPHRAGM PUMPS

PR17 & PR30 Liquid Plumbing Connections



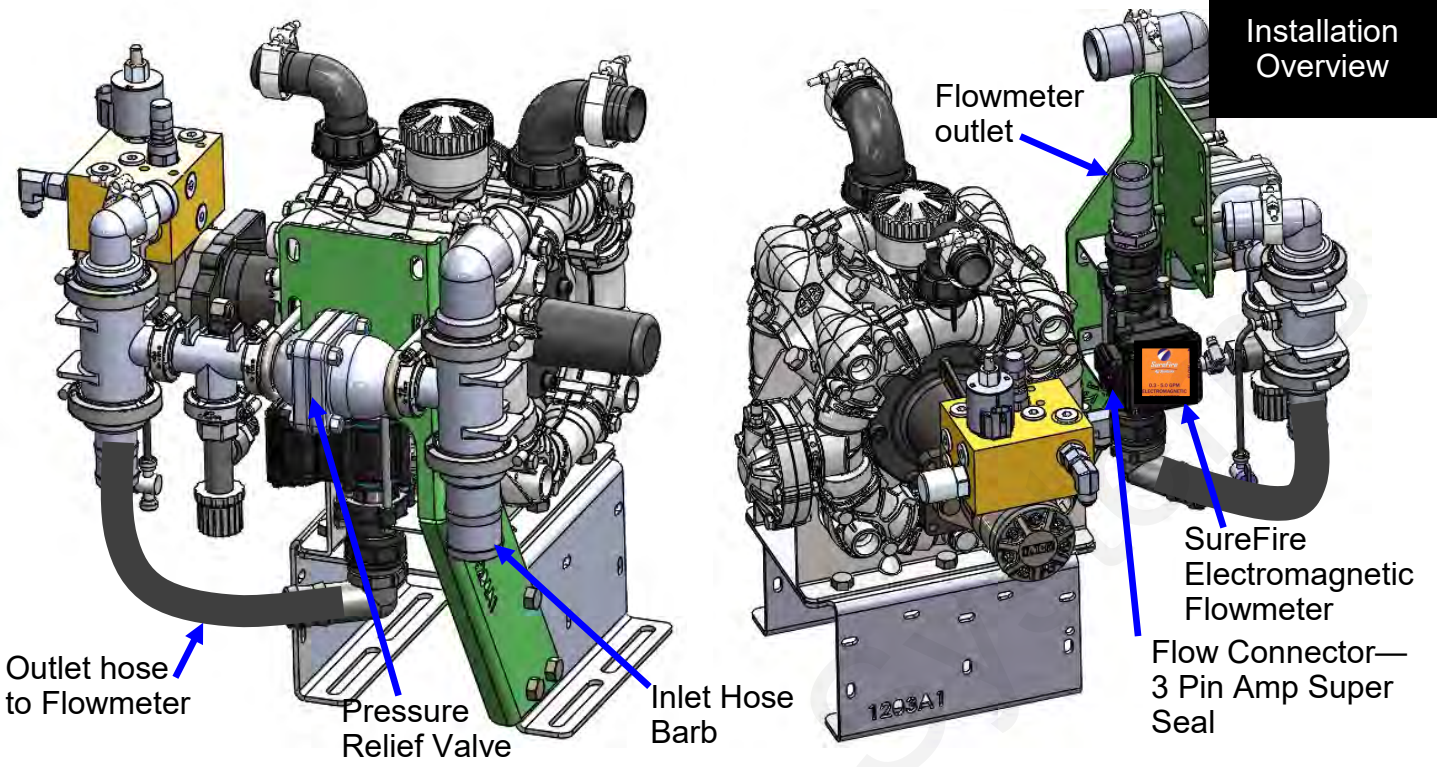
Inlet: The PR17 and PR30 PumpRight are shipped with a 1 1/2" inlet hose barb. Attach this to the hose from your supply tank and strainer . A 1 1/2" 90 degree hose barb is included and can be substituted.
Inlet Strainer: A 20 mesh strainer is included in the pump kit. The manifold strainer includes two hose barbs so it can be mounted anywhere in the inlet line. If space allows, the strainer can be mounted directly to the inlet plumbing assembly as shown below.
Outlet: The outlet is plumbed directly to the flowmeter with 1" hose. As shown above, the flowmeter may be mounted directly to the PumpRight pump. The flowmeter outlet is a 1" hose barb. The outlet hose should be a minimum of 24" long with a gentle curve prior to any fittings for optimum flowmeter performance. The flowmeter outlet will attach to your manifold(s) or section valves. A 3/4" hose barb is included in the bag of parts and can be substituted on the flowmeter outlet.
Pressure Relief Valve (PRV): The PRV is a 100 psi relief. If there is a restriction that creates over 100 psi in the system, the PRV will open allowing the excess flow to pass back to the inlet side of the pump. This protects the pump and fertilizer system from damage.

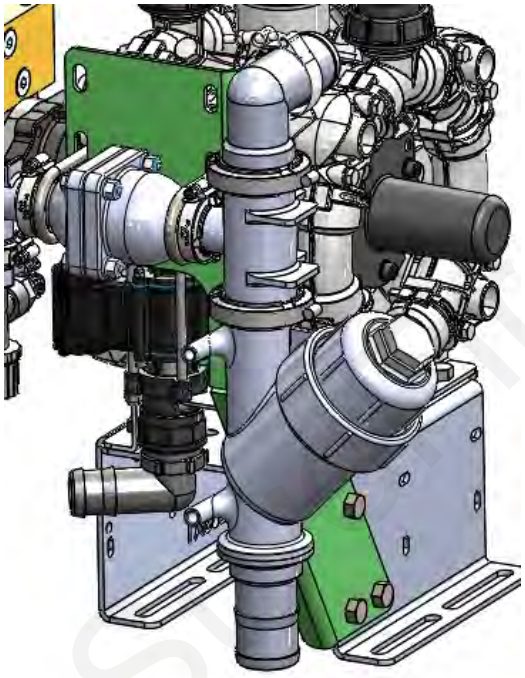


CAUTION

These pumps can deliver liquid at high pressure (290 PSI). Be sure the 100 PSI Pressure Relief Valve (PRV) is installed and functioning so system pressure will be kept under 100 PSI. Check hoses, hose clamps, and liquid fittings regularly and repair or replace loose connections.

PR40 & D250 Liquid Plumbing Connections





Inlet: The PR40 and D250 PumpRight are shipped with a 2" inlet hose barb. Attach this to the hose from your supply tank and strainer . A 2" 90 degree hose barb is included and can be substituted.

Inlet Strainer: A 20 mesh strainer is included in the pump kit. The manifold strainer includes two hose barbs so it can be mounted anywhere in the inlet line. If space allows, the strainer can be mounted directly to the inlet plumbing assembly as shown in image to the left.

Outlet: The outlet is plumbed directly to the flowmeter with 1 1/2" hose. As shown above, the flowmeter may be mounted directly to the PumpRight pump. The flowmeter outlet is a 1 1/2" hose barb. The outlet hose should be a minimum of 24" long with a gentle curve prior to any fittings for optimum flowmeter performance. The flowmeter outlet will attach to your manifold(s) or section valves.

Pressure Relief Valve (PRV): The PRV is a 100 psi relief. If there is a restriction that creates over 100 psi in the system, the PRV will open allowing the excess flow to pass back to the inlet side of the pump. This protects the pump and fertilizer system from damage.

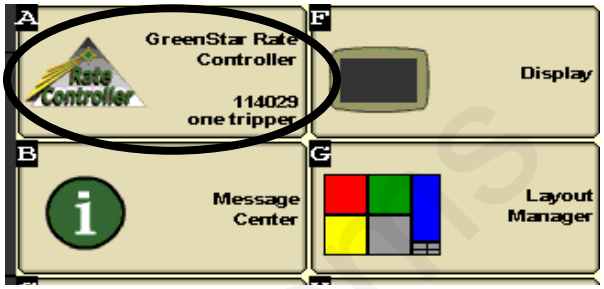
⚠ CAUTION

These pumps can deliver liquid at high pressure (290 PSI). Be sure the 100 PSI Pressure Relief Valve (PRV) is installed and functioning so system pressure will be kept under 100 PSI. Check hoses, hose clamps, and liquid fittings regularly and repair or replace loose connections.

Rate Controller Setup

F
Setup & Operation

To access the Greenstar Rate Controller (GRC) Functions, push this button. If this button is not present the Rate Controller is not communicating with the GS2/GS3 display. See your John Deere operators manual or your John Deere dealer for assistance.
If more than one GreenStar Rate Controller is installed, check the Serial number to be certain they are configured for the correct system.



Main Rate Controller Screen

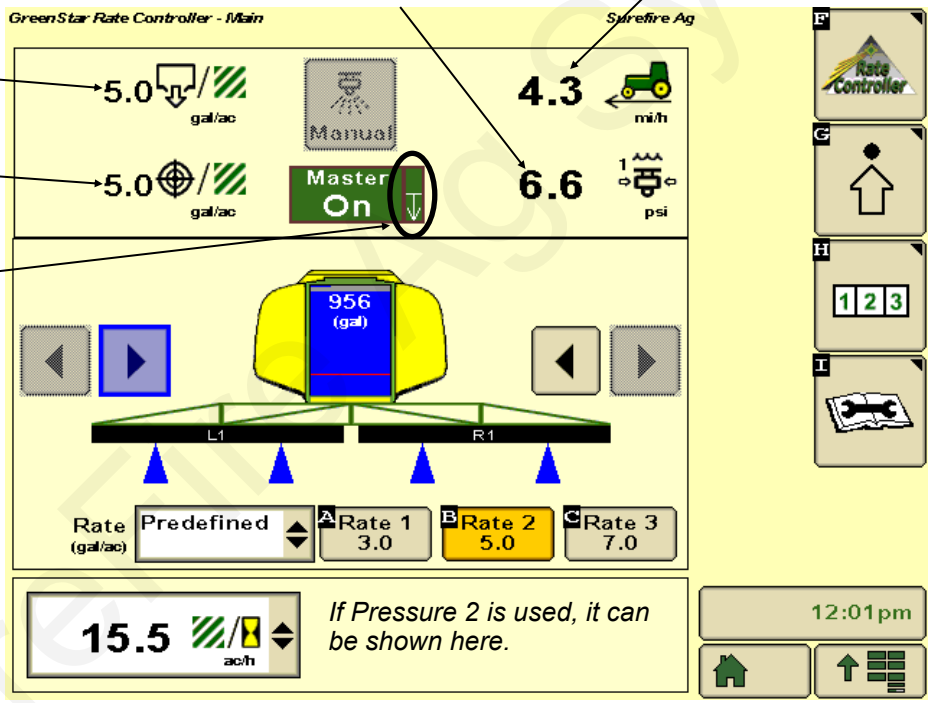
Pressure (if Pressure Sensor 1 is installed) OR Flow in GPM (without pressure sensor) (*If pressure does not show up on Pressure 1, try setting up Sensor 2, and adding it to a box on the bottom of the screen.)*

Tractor Speed

Actual Rate

Target Rate

Implement Height Switch Indicator, Arrow will point up or down to indicate implement position if height switch is used.



Navigation Buttons
- Main Rate Controller Screen
- Setup
- Totals
- Diagnostics

Menu Structure

Setup
- Implement
- System
- Alarms
- Rates

Totals
- Current
- Job Summaries
- Lifetime Totals

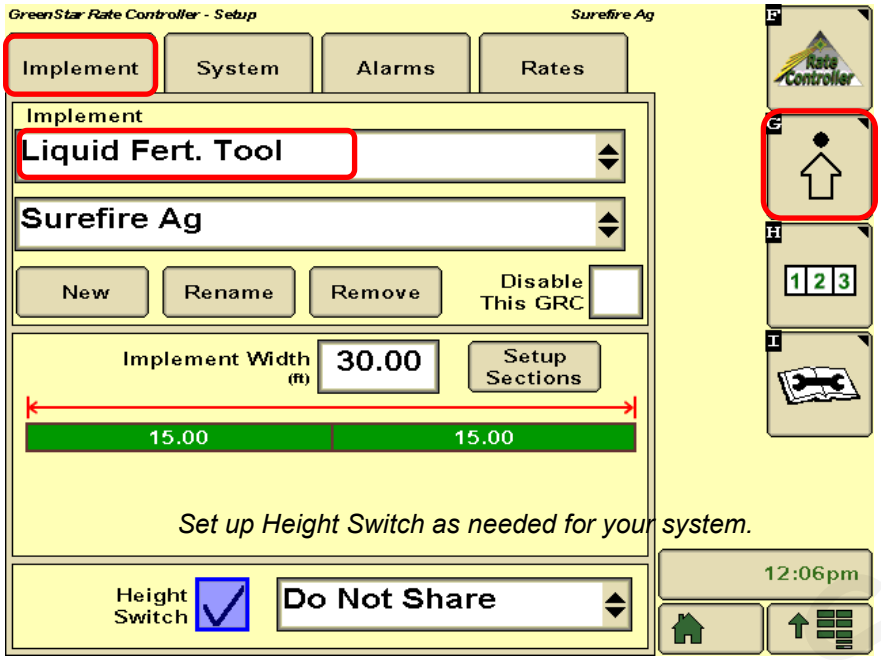
Diagnostics
- Readings
- Tests

SCAN for video on **Diagnostics > Readings**

SCAN for video on **Diagnostics > Tests**

Setup - Implement

Here you will enter the **type, name, total width and section width** for the implement you will be using for this operation.



Rate Controller Setup: Use the QuickStart Setup card for your system.

396-3100 Tower Electric

396-3101 PumpRight Hydraulic

396-4760 Gen3 LiquiShift

Available at http://www.surefireag.com/support

Implement Type, Name & Width

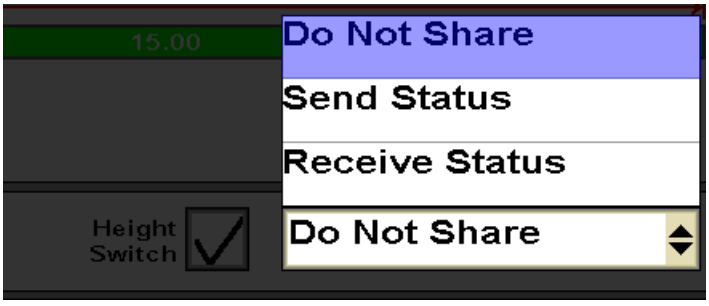
1. Choose implement type "**Liquid Fert Tool**"
2. Enter a **Name** for the Implement where "SureFire Ag" is shown above.
3. Enter your **Implement Width** in feet.
4. Push **Setup Sections** button if dividing the implement into sections.
5. Setup the width of each section on the new screen that pops up.

Height Switch

If using a height switch on your implement, check the box at the bottom of this screen. You must then choose one of the choices at right. *Some Seed Controller/Rate Controller combinations may not allow sharing of the Height Switch between Seed and Liquid Application. If you have 2 Liquid systems, plug the Height Switch into one system, set that system to Send Status, and set the other Liquid system to Receive Status.*

On a single product fertilizer applicator with it's own Height Switch you would set to "Do Not Share".

On previous versions of GS2/GS3 software, a height switch was required for a Liquid Fertilizer Tool. However, on this version you can leave the Height Switch box unchecked and no height switch is required.

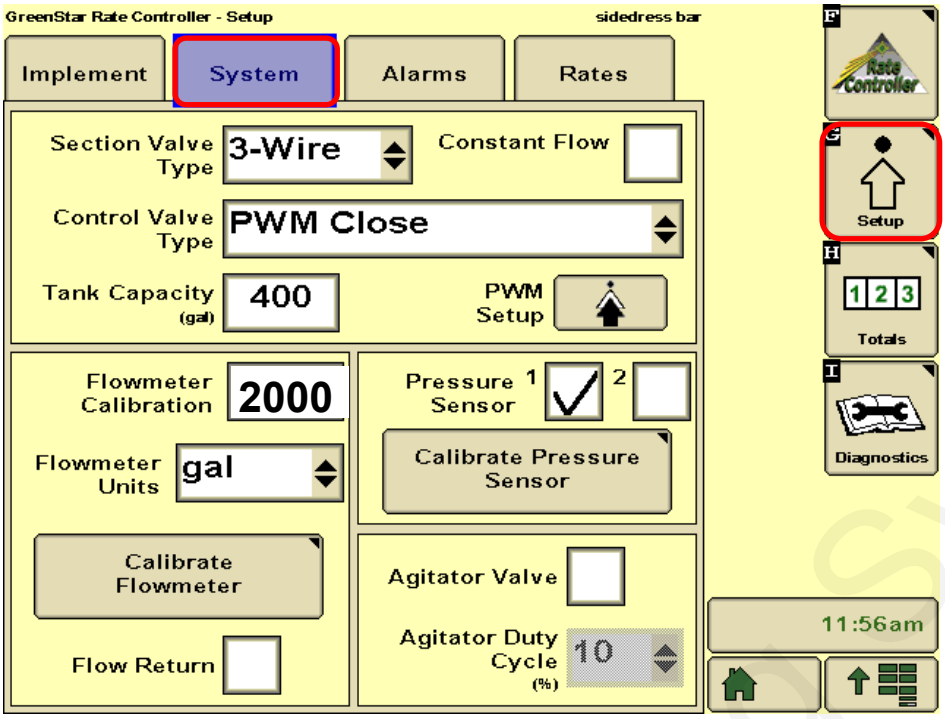


This is a sample setup. Set your height switch as needed for your system.

Setup - System

System Setup is where you will set the John Deere Rate Controller to be compatible with the SureFire fertilizer system components.

F
Setup & Operation



Rate Controller Setup: Use the QuickStart Setup card for your system.

396-3100 Tower Electric

396-3101 PumpRight Hydraulic

396-4760 Gen3 LiquiShift

Available at http://www.surefireag.com/support

1. **Section Valve Type**: 3-Wire **Constant Flow:** Do NOT check this box.
2. **Control Valve Type**: PWM Close ("Close" means when the rate is zero or all sections are off, the controller will stop the pump)
3. **Flowmeter Calibration**:
   - Electromagnetic Flowmeter: see chart
4. **Flowmeter Units**: gal
5. **Flow Return**: Optional Flow Return Valve connector is on Section Harness. Normally, this box is not checked.

Flowmeter Model (GPM)	GS2 & GS3 Flowmeter Calibration
0.3—5.0	3000
0.6—13	2000
1.3—26	2000
2.6—53	2000

6. **Pressure Sensor**: Check #1 if using optional electronic Pressure Sensor 1. Check #2 if using Pressure Sensor 2. See next page for instructions to calibrate pressure sensor. (If Sensor 1 does not read pressure, try setting up Sensor 2. If you have harness 213-00-3765Y**1**, Pressure 2 is on the Section 1-6 connector. On harness 213-00-3765Y**2 and Y3**, Pressure 1 is on the Section 1-6 connector.)
7. **Agitator Valve:** NOT Checked
8. See next page for instructions on "PWM Setup" & "Calibrate Pressure Sensor"

** Earlier model flowmeters (meters with white labels with black text) have different calibration numbers. See the documentation with that flowmeter or find calibration number on Serial Number sticker on the side of the flowmeter.*

Setup - System (continued)

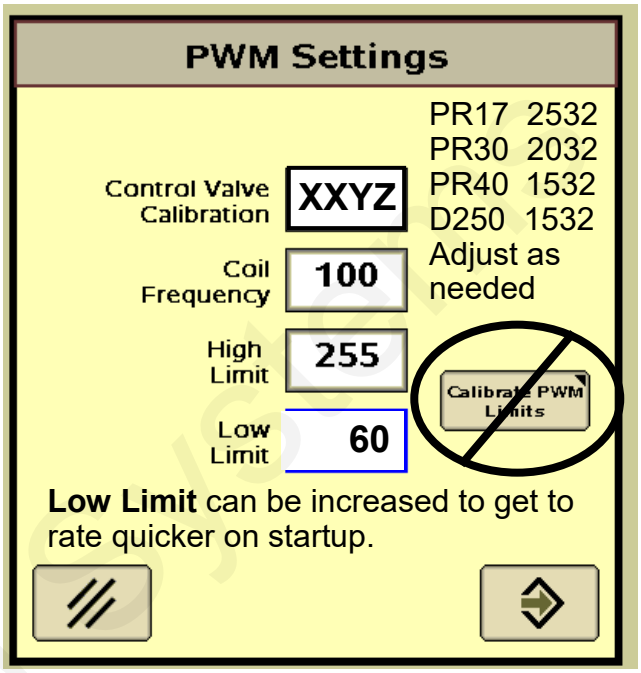
PWM Setup

From System Setup screen, push "**PWM Setup**" to open this screen.

1. **Control Valve Calibration**: 2532, 2032, 1532

   The John Deere Rate Controller Control Valve Calibration can be changed to optimize performance on your specific equipment. The 4 digit number is formatted XXYZ. Increase XX to make the system respond quicker. If set too high, the actual rate will oscillate around the target. Y is the output deadband and Z is the control deadband. Generally leave these two digits low. Read your JD Rate Controller Operators Manual for more information. For example, to slow your response speed, move the number from 2532 to 2032 or 1532. To speed up the valve go to 3032 or 3532.

2. **Coil Frequency**: 100
3. **High Limit**: 255 (maximum value allowed) *This can be set lower to limit the speed of the pump.*
4. **Low Limit**: 60 (setting where SureFire hydraulic valve cracks open). *This can be set higher to get the system to Target Rate faster on startup. If set too high, the system may not be able to go slow enough when needed.*



The "Calibrate PWM Limits" button is not necessary after you enter the numbers above. However, the Calibrate PWM Limits Test can be used to test the system in a manual mode.

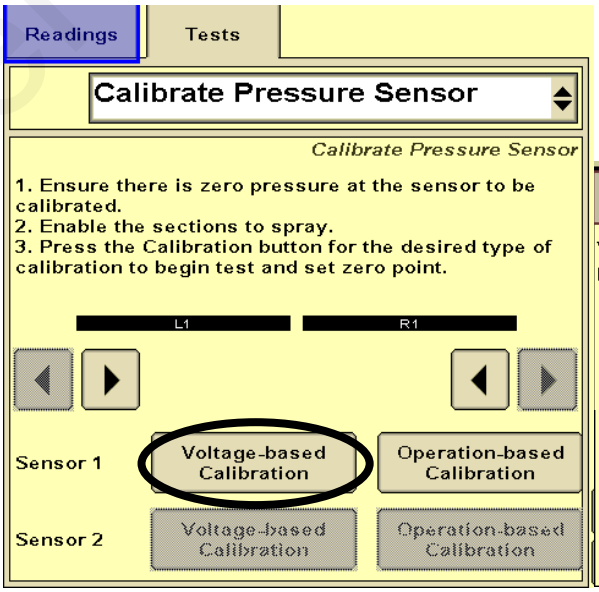
5. Push the lower right button to return to the System Setup screen.

Calibrate Pressure Sensor

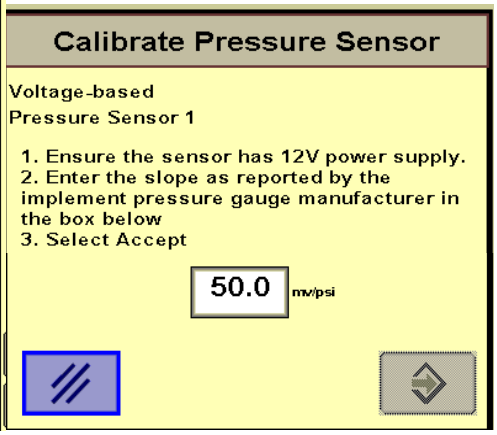
From System Setup screen, push "**Calibrate Pressure Sensor**" to open this screen.

1. Select **Voltage-based Calibration**
2. On the screen that opens up, enter **50.0** mv/psi.
3. Push the lower right button to return to the System Setup screen.

The Rate Controller will accommodate 2 pressure sensors. This requires a SureFire harness with Pressure 1 and Pressure 2 connectors. ***If the pressure does not read on Sensor 1, try Sensor 2.***



Tip: If the system has been running, there may be pressure in the system due to the check valves. In that case, simply unplug the sensor while this setup is being done so it will calibrate the zero point correctly.

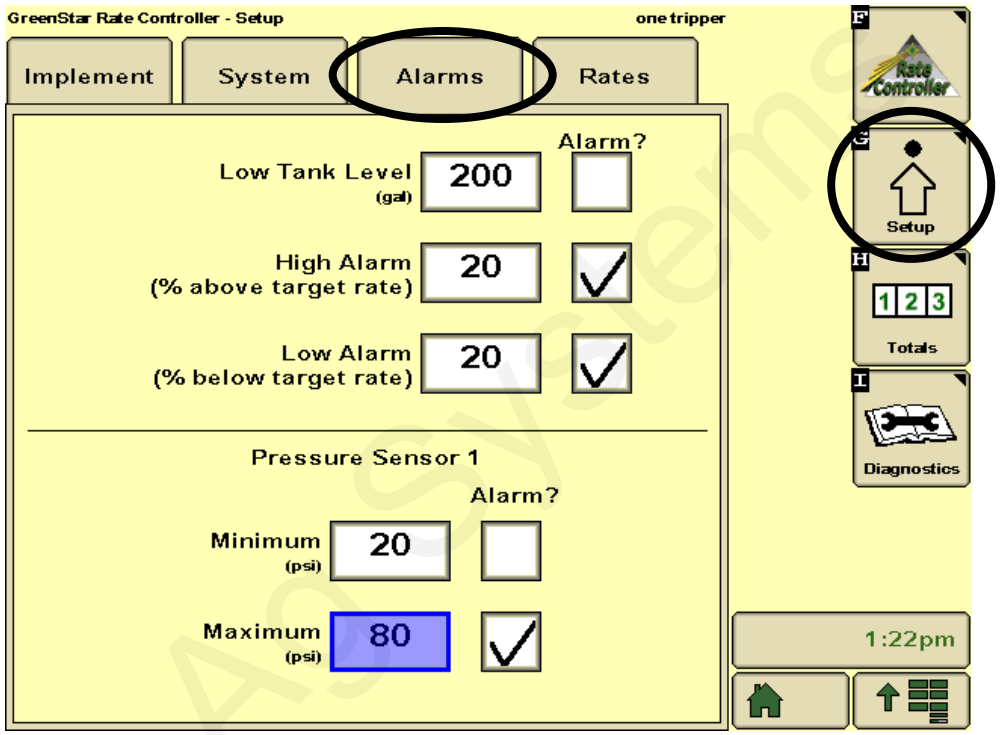


Setup - Alarms

F
Setup & Operation

Customize your alarms and settings on this page.

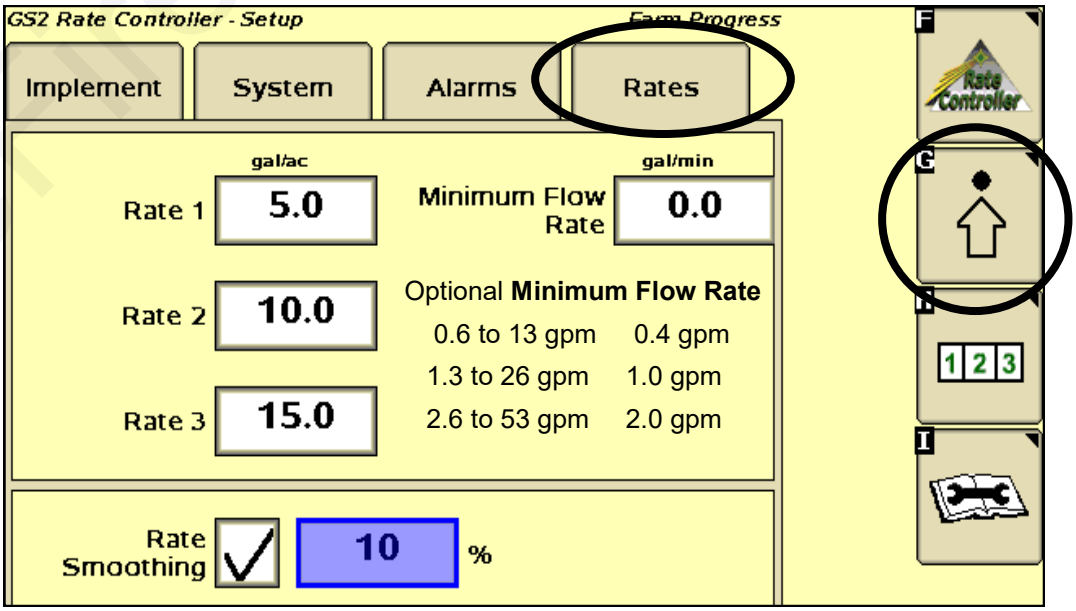
1. **Low Tank Level** can be used by the customer if they desire, but is not required.
2. **High and Low Alarm**: 20% is the John Deere default and SureFire recommended setting. SureFire recommends these alarms be enabled (checkmark in the box).
3. **Minimum pressure**: 20 psi is a safe minimum pressure to ensure all check valves (10 psi setting) are fully opening and equal flow will go to every row. SureFire recommends turning this alarm off as each time the system turns on & off it will activate, being a nuisance.
4. **Maximum Pressure**: 80 psi is the recommended setting. SureFire pumps have a 100 psi pressure relief valve. Continually activating that relief valve causes vibrations that will damage components. SureFire recommends turning this alarm on to provide an early warning before high pressure causes other problems. (The system can run at 80-90 PSI without hurting anything if needed.)



Setup - Rates

Enter your desired application rate(s) here.

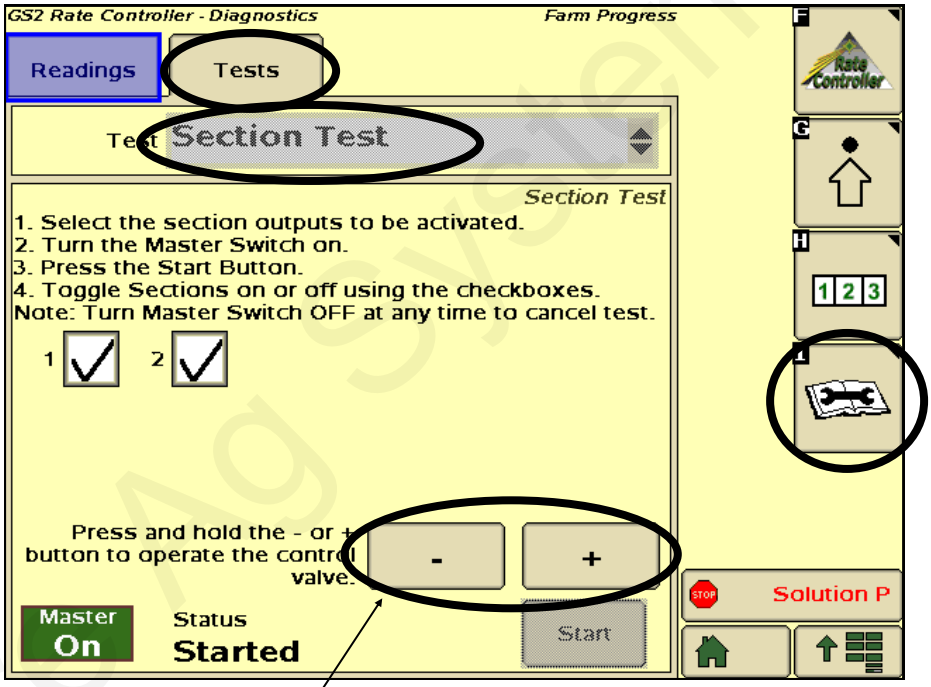
1. Enter up to 3 rates. Rates entered here will be available on the home page.
2. SureFire recommends checking the **Rate Smoothing** box and entering 10%.
3. SureFire recommends leaving **minimum flow rate** at 0.0. If greater than zero, this is the minimum flow in *gallons per minute* that the system will NEVER go lower than. Optionally, it could be set to the minimum flow limit of your flowmeter as shown above.



Initial Operation Instructions - Step 1

SureFire highly recommends you perform these exact steps with water to verify the system is correctly installed and ready for field use.

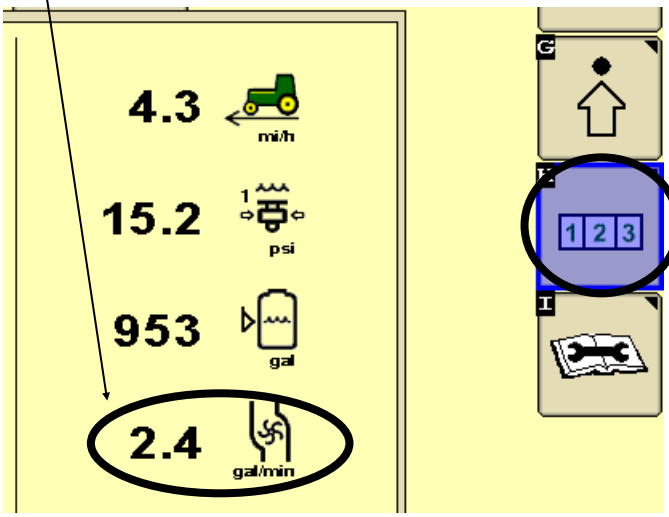
1. Go to the **Section Test** (Diagnostics > Tests > Section Test). **Section Test** essentially functions like a MANUAL mode where you have direct control of pump and valves.
2. Turn the Master switch on.
3. Test section valves by checking and unchecking boxes. Check boxes to open all valves.
4. Activate tractor hydraulic remote.
5. Push the "+" button and **hold it**. This should open PWM hydraulic valve. Pump should begin running. (It takes lots of individual taps of this button to cause a visible effect).
6. Is water being pumped? If system is not primed, open the priming air bleed valve and close the recirculation knob. This will allow air to be expelled and the pump to prime.
7. With pump running and water flowing, push "1,2,3" button. Look at flow in GPM. Is there a reading there? If not, is the system primed with water flowing to every row? If water is flowing, but no reading, check flowmeter calibration and wiring harness connections.
8. Push wrench button, now push the "-" button. Go back to the "1,2,3" screen. Did the flow in GPM decrease?
9. **Make sure the GS2 or GS3 flow readout in GPM can be increased and decreased with the plus & minus buttons.**



Go to Step 2 on the next page when you can increase and decrease the GPM reading using the + and - buttons.

NOTICE

Running these tests will dispense liquid. Be sure it is safe to dispense the liquid in your tank in this location.



You can also observe system performance at Diagnostics > Readings > Delivery System.

This is a good screen to see flowmeter operation and PWM Duty Cycle.

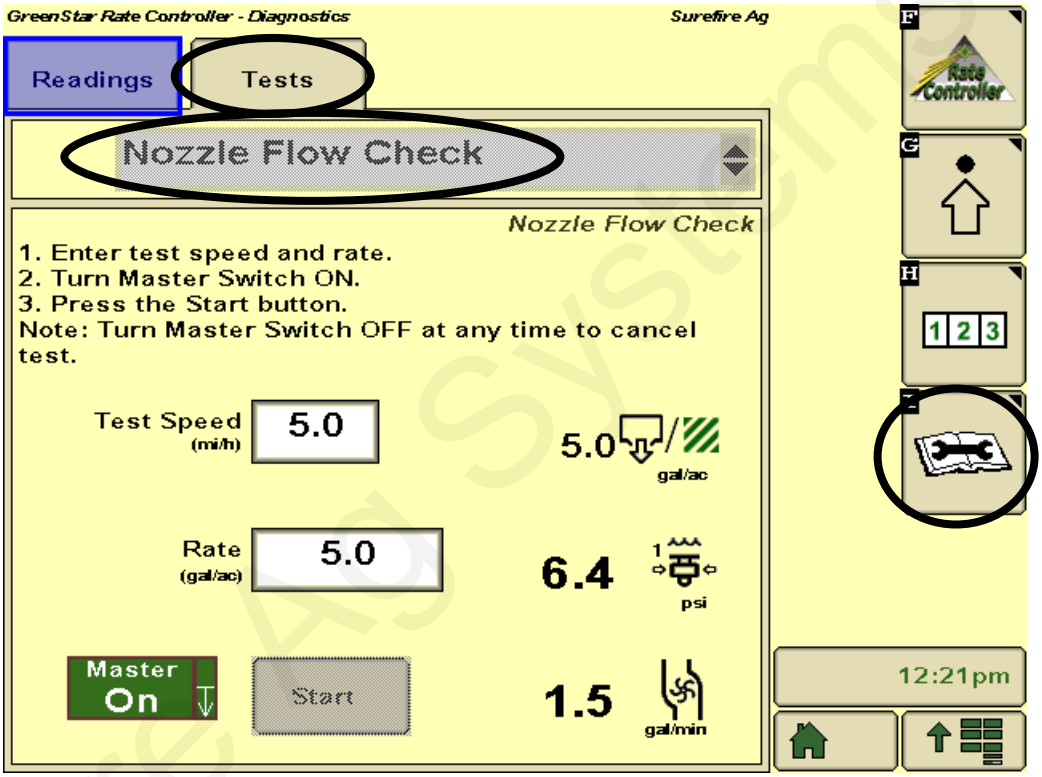
The system can also be operated manually by running the Calibrate PWM Limits Test.

Initial Operation Instructions - Step 2

NOTICE

Running these tests will dispense liquid. Be sure it is safe to dispense the liquid in your tank in this location.

1. Go to the **Nozzle Flow Check** (Diagnostics > Tests > Nozzle Flow Check). This test will operate the system as if it were running in the field at a speed and application rate you enter.
2. **Test Speed**: Enter your typical field operating speed.
3. **Rate**: Enter your typical application rate.
4. Turn the Master switch on.
5. Pump will turn on and begin applying the entered rate.
6. Observe the system. Are the flow and pressure on the screen stable and reasonable? Is the flow reasonable and equal from each application point?
7. **Repeat this test at minimum and maximum values for both Test Speed and Rate**. Remember heavier fertilizers, such as 10-34-0, will have higher pressures at a given flow than water.
8. You can use this procedure with fertilizer (instead of water) to verify your minimum pressure is at least 20 psi (to ensure all check valves open). Also, check the maximum speed and rate to make sure the pressure is under 80 psi. ***When testing with water, the pressure will be much less than it will be when using fertilizer and not all of the check valves may open, so there may not be flow from every row.***



Helpful Tip

*The **Calibrate PWM Limits Test** is the first and most basic test to make sure that the system is set up and hooked up correctly. This test verifies that you can run the pump and control the speed of the pump.*

If there is a problem with the operation of the system, start with the Calibrate PWM Limits Test or Section Test to run the system manually.

Helpful Tip

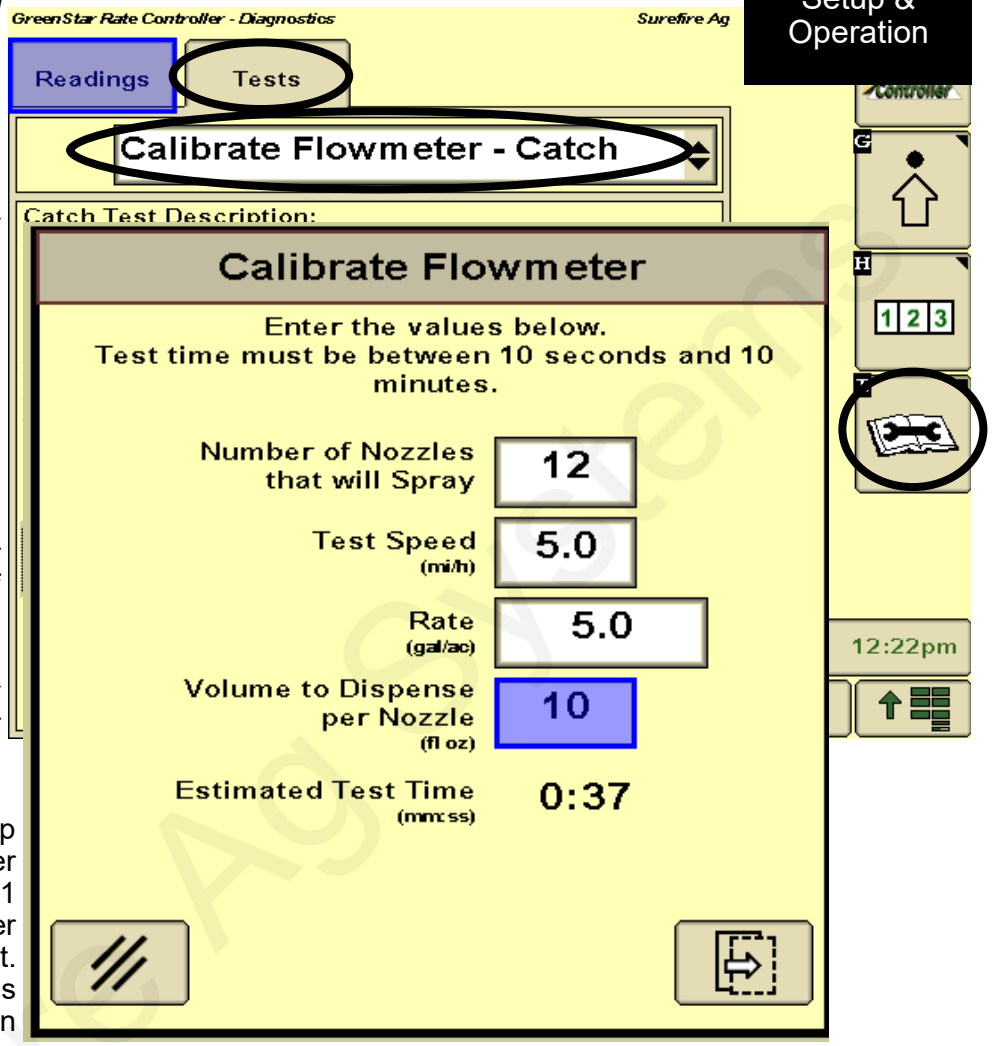
*Diagnostics > Readings > **Delivery System***

Check this screen while system is running a test or while it is running in the field.

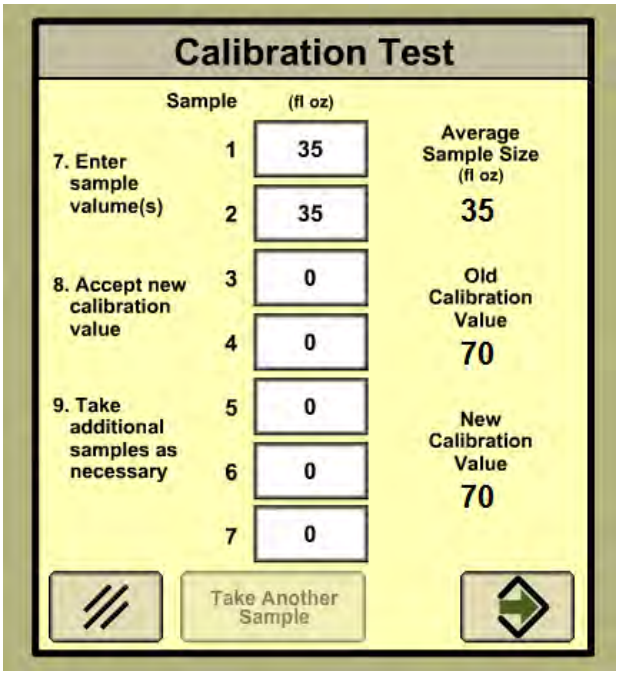
This shows the flowmeter operation and PWM Duty Cycle (a very important system parameter).

Initial Operation Instructions - Step 3-Optional

This test can be used to check the flowmeter calibration or a manual catch test can be done.



1. Go to **Calibrate Flowmeter - Catch** (Diagnostics, Tests, Calibrate Flowmeter - Catch). The Calibrate Flowmeter screen will pop up.
2. **Number of Nozzles** that will spray: Enter total rows on equipment.
3. **Test Speed:** Enter typical operating speed.
4. **Rate**: Enter typical application rate.
5. **Volume to dispense**: Enter volume that you are capable of catching and measuring from a single nozzle (in ounces).
6. Push continue button in lower right corner. Turn master switch and hydraulic remote on and begin test.
7. The screen to the right will pop up after test is complete. Enter the sample size collected from 1 or more rows. You need enter only 1 sample measurement. The GS2/GS3 then calculates the new flowmeter calibration value based on the average sample size.



With SureFire Electromagnetic flowmeters, most times the sample volume is correct. In that case, just enter the same sample size you did in #5 above to leave the calibration value unchanged. If the sample volume differs from what is expected, recheck the calibration settings. ***Do not change the calibration value if there is a small difference in the sample volume.***

SureFire recommends that you do not change the Flowmeter Calibration value unless repeated catch tests or field use shows that the amount indicated by the flowmeter is not correct. The flowmeter is very accurate and the flow cal should not be changed without a very accurate test.

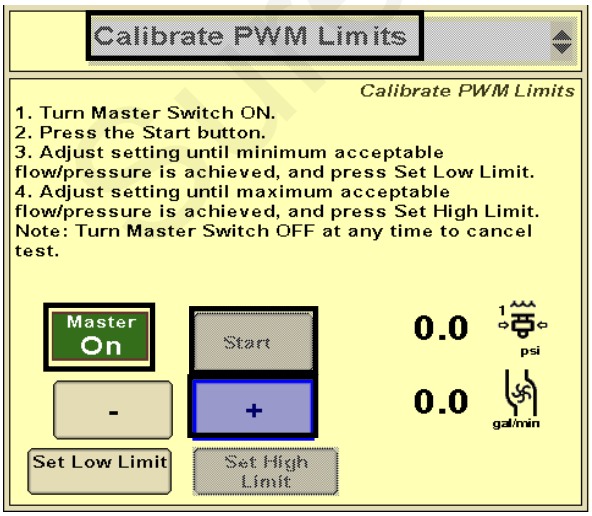
NOTE: DO NOT ADJUST THE FLOWMETER CALIBRATION VALUE BASED ON A CATCH OF 1 ROW ON AN IMPLEMENT. AT A MINIMUM CATCH 3-4 ROWS.

Hydraulic Pump Will Not Turn

Turn hydraulics off, go to the **SureFire 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

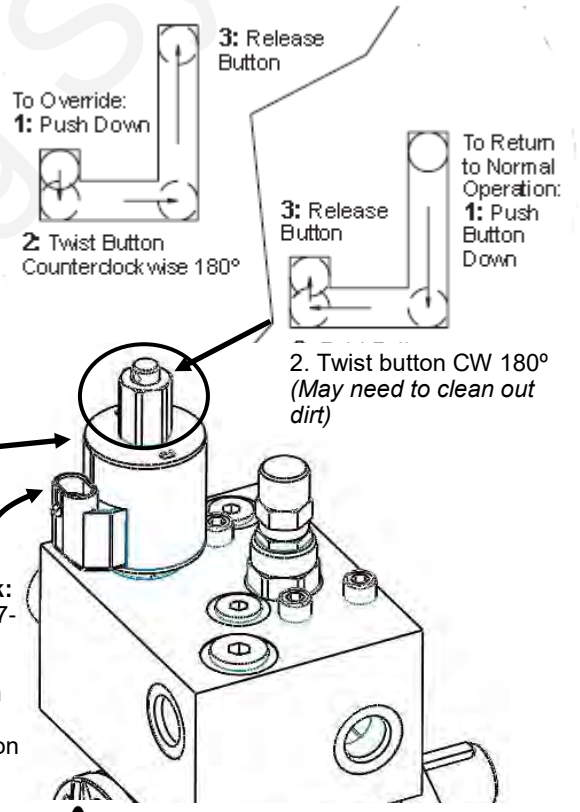
1. Close manual override (lock down)
2. Go to **Diagnostics >Tests > Calibrate PWM Limits** to investigate this issue.
3. Verify hydraulics are on.
4. In Calibrate PWM Limits, hold down "+" button for 8-10 seconds. A single tap of this button produces a very small change in signal to the valve, so you 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. There should be 12 v if the PWM Duty Cycle is at 255.
7. If 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 12 volts while in Calibrate PWM Limits after holding "+" button to take the PWM Duty Cycle to 255.
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 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



DANGER

Hydraulic Fluid and Equipment Safety

This system uses hydraulic equipment with hydraulic fluid under extremely high pressure. Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin causing serious injury. Use a piece of paper or cardboard, NOT BODY PARTS, to check for suspected leaks. Wear protective gloves and safety glasses or goggles.

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.

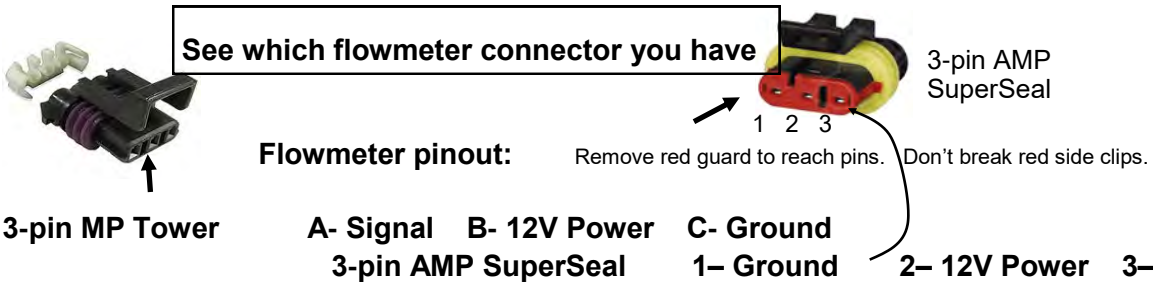
1. Go to **Setup - System - PWM Setup**.
2. If Valve Cal is 2532, try 2032. If system is still surging, go to 1532, and lower if needed. If the first two digits get too low, the system will be slow to respond to speed or rate changes. If the system is stable, but slow to adjust and slow to get to rate, increase the first 2 digits (from 2532 to 3032, 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 SureFire 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



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.
2. If 12 volts is present, then conduct a **tap test.** Have a second person watch Flow 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) of Flowmeter (Hz) should show up indicating the wiring is not damaged.
3. If the display 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. SureFire 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.)*

Do not power wash the flowmeter.

Unplug the flowmeter before doing any welding on the implement.

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 SureFire adapter harness connected to the GreenStar Rate Controller is 213-00-3765***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 1 (power) and 2 (ground) if you have a 12-pin pump connector. (Check pins 11 (ground) & 16 (power) on the 16-pin connector labeled PUMP on the legacy harnessing.)
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 go less than 11."

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 SureFire 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 SureFire 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 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	2532—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 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 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 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.

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 SureFire publication "396-3269Y1 Navigating the Metering Tube Maze" or "396-4116Y1 Metering Tube Charts" 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.

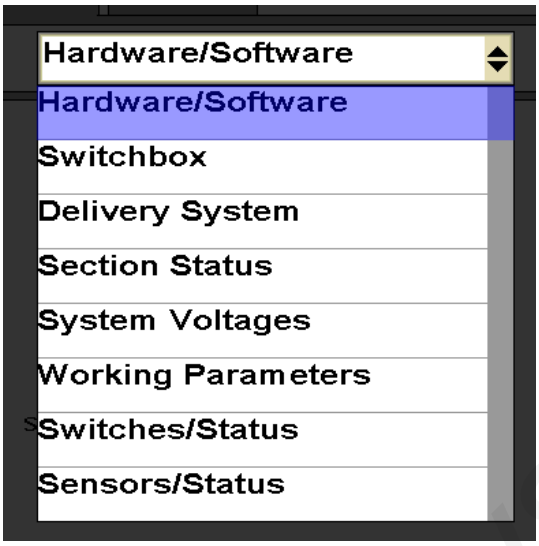
See the system manual for your system for more complete information. Manuals and publications are available for download at www.surefireag.com.

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.

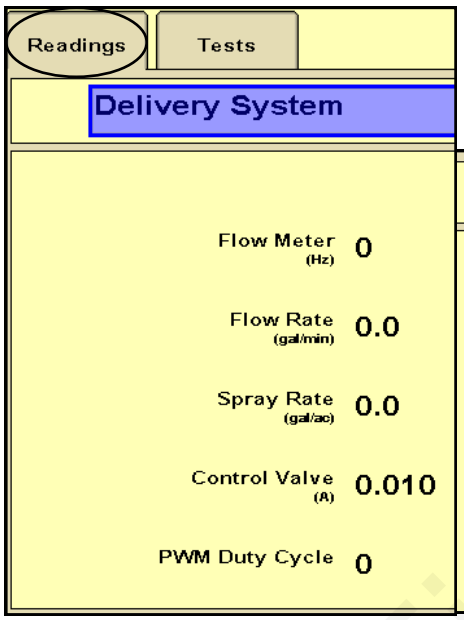
Troubleshooting Tip

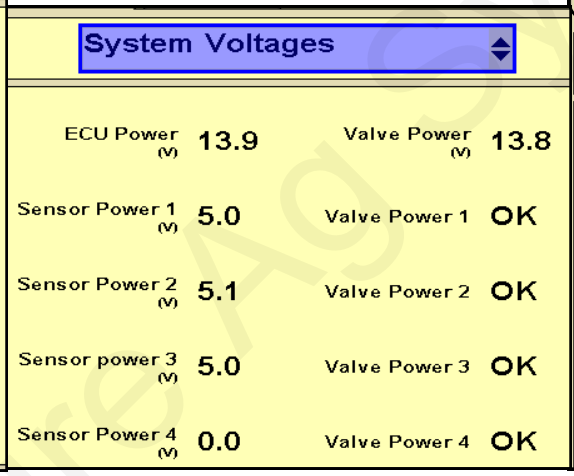
1. Useful information is available at **Diagnostics—Readings**.
2. Below are examples of some of the screens available:

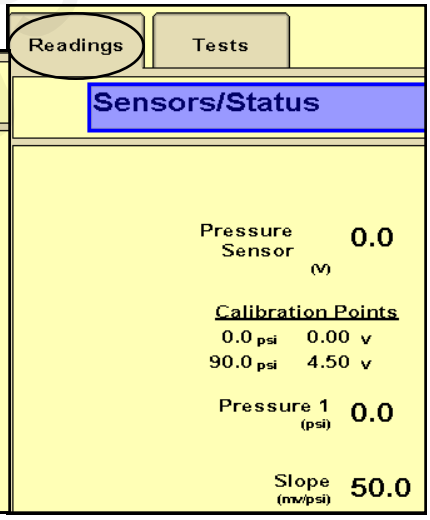
SCAN for video on **Diagnostics > Readings**



SCAN for video on **Diagnostics > Tests**







Delivery System
Check the operation of the **flowmeter** here.
The **PWM Duty Cycle** tells how fast the pump is being told to run. The range is from 0 to 255.

NOTICE Most systems generally should not need to run much more than 150 on the PWM Duty Cycle. If the Duty Cycle is running 200 to 255, it may be overspeeding the pump. The pump is rated at 550 RPM. Continuous overspeeding may cause premature pump failure. If the system needs to run high Duty Cycles all the time, check to see that the expected pump output is within the pump capacity. Be sure the recirculation knob is closed. Be sure that high pressure is not opening the PRV. Be sure that the strainer is not plugged or that there are no other inlet restrictions. Be sure the pump has adequate hydraulic oil flow. If the pump will not reach it's rated capacity, check for a torn diaphragm or a malfunctioning valve.

System Voltages should be similar to those shown here.

Sensors/Status—Check the operation of the **pressure sensor** here. The top number (V) will be between 0 and 5.0.

The **Calibration Points** should indicate that 0.0 psi is 0.00 volts and that 90 PSI is 4.5 volts.
The **Slope** should be 50.0 mv/psi. *If pressure does not show on Pressure 1, try setting up Sensor 2.*
You can test the harnessing for the pressure sensor by using a AA or AAA battery. Connect the (+) end of the battery to pin A of the pressure sensor connector. Connect the (-) end of the battery to pin C. The Pressure Sensor (V) should be approximately 1.5 volts. The Pressure should read about 30 PSI.

Recommended Care and Maintenance

H
Maintenance & Parts

Air Bladder

Legacy D-series PumpRight pumps and the PR40 have an air bladder to smooth the pump output flow. It is recommended to run this bladder at 20% of working pressure. So, if your system operates at 50 psi, charge the air bladder to 10 psi. Due to the small size of the air bladder, **very little air is needed**. SureFire recommends charging a portable air tank to the correct pressure, then attach to the bladder valve to charge the air bladder to the same pressure as your air tank.
The PR17 and PR30 pumps do not have an air bladder.

Winterization

SureFire recommends flushing your fertilizer pump and complete system with adequate amounts of water first. Next, use RV antifreeze to winterize your system by pumping an adequate amount through all components. At the beginning of the next season, begin with water to verify the system is in working order with no leaks.

Change Pump Oil Annually

PumpRight pumps use an internal oil lubricated crankshaft and connecting rod design. The oil is held in an external reservoir with level indicators. Hypro oil is recommended for the pump. This is a non-detergent SAE30 weight oil. If not available, hydraulic jack oils are a similar non-detergent formulation. Annual oil changes are recommended.

To fill or drain the pump completely, the pump shaft must be turned slowly by hand. The hydraulic motor will have to be removed to do this.

On some pump models, the pump will have to be removed from the mounting bracket and lifted slightly to allow access to the oil plug.

When refilling the pump with oil, the shaft will again have to be rotated to fill the pump to its required oil volume.

CRANKCASE OIL CAPACITIES				
Model	Capacity		Model	Capacity
PR17	13 oz		PR40	56 oz
PR30	28 0z		D250	98 oz

Diaphragm & Valve Replacement

PumpRight pumps are designed to allow very simple replacement of the two main pumping components; the diaphragms and the inlet & outlet valves. It is a good practice to replace these every 3 or 4 years (or every 1000 hours). It is a small job that helps ensure reliable operation during the busy season.

Pre-season Service

(A little time spent here may prevent some downtime when you want to be rolling.)

1. Visually check entire system (hoses, fittings, harnesses, etc.) for any signs of wear or trouble.
2. On the display, recheck all setup screens (see Section F) to verify correct setup.
3. Fill system with water and run in Manual mode (Section Test or Calibrate PWM Limits) to verify components and system are in working order. (May need to open air bleed valve to prime pump the first time. Be sure air bleed tube is not plugged.)
4. ***Clean out the dirt that may be packed in to the manual override knob on the hydraulic valve block.***
5. If necessary run pump in manual override mode to check hydraulic setup (see page 39).
6. Tighten all clamps. Loose clamps may be evident by leaks on the output side of the system. Loose clamps from the tank to the pump are not always apparent, but can be sources of air getting into the system which can create issues.
7. Push in tubes at all Quick-Connect fittings so they are seated tightly. Tubes that are not fully seated are not always obvious, but may allow air in, which can cause check valves to leak.
8. Remove the black cap from the top of each check valve. Check the diaphragm to be sure it is intact and not gummed up with residue. Look under the diaphragm for debris. Compress the spring in the cap to be sure it moves freely. Carefully replace diaphragm and tighten cap.
9. Remove and clean the strainer. Be sure strainer is tightened securely so it will not suck air.
10. Be sure all rows are flowing and that all metering tubes/orifices are open. (Note: It will take a higher flow rate with water to create enough pressure to open all the check valves.)
11. Run the Nozzle Flow Check to verify that system will lock on to a Target Rate.
12. Check, and if necessary, tighten the tank straps.

Hydraulic oil under extremely high pressure. Do not use hand or any other skin to check for or to stop hydraulic leaks. Be sure pressure is relieved before loosening hydraulic fittings. Replace worn hoses immediately. Seek medical care immediately if hydraulic oil is shot into the eye or the skin.

These pumps can deliver liquid at high pressure (290 PSI). Be sure the 100 PSI Pressure Relief Valve (PRV) is installed and functioning so system pressure will be kept under 100 PSI. Check hoses, hose clamps, and liquid fittings regularly and repair or replace loose connections.

PumpRight Valves & Diaphragms for D pumps

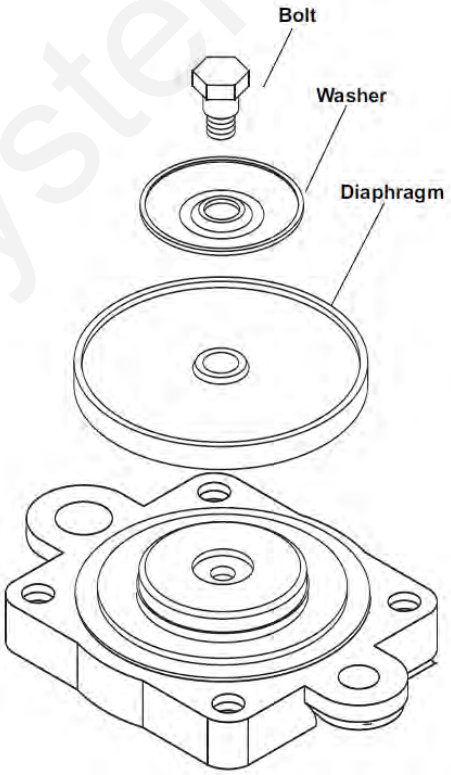
All PumpRight models use the same diaphragm and valve parts.

Diaphragm Pump Service Kit Item Number 291-02-100500

1 Kit contains 1 diaphragm and 2 valves to service a single pumping diaphragm. Order multiple kits to service all the diaphragms in your pump per chart at right.

Qty in Kit	Part Number (all begin 291-02-9910-xxxxxx)	Description
1	550081	Diaphragm (BlueFlex)
2	320030	O-Ring
2	759051	Valve Assembly

	Number of Diaphragms
D70	2
D115	3
D160	4
D250	6

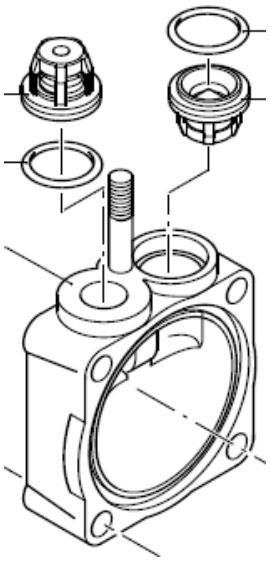


Diaphragm & Valve Service Steps:

1. Remove inlet and outlet plumbing connections by unscrewing ring nut on inlet and outlet fitting.
2. Use extreme caution when removing and replacing drain plug, so that threads are not stripped and o-ring is not damaged. Remove drain plug from bottom of pump to drain oil from pump. Rotate pump shaft to remove all oil. Replace drain plug making sure o-ring is in place. Tighten plug to 171.4 In.Lbs.
3. Remove pump manifold(s) using a 17mm or 13 mm wrench.

D70	1 manifold	2 x 17 mm nuts (on top)
D115	1 manifold	3 x 17 mm nuts (on side)
D160	2 manifolds	Each manifold has 4 sets of 2 x 13 mm nuts
D 250	2 manifolds	Each manifold has 6 sets of 2 x 13 mm nuts

4. Remove and replace complete valve assembly.
5. Remove the pump head.
6. Remove the diaphragm bolt, support washer and diaphragm. Turn the pump shaft to up stroke to replace diaphragm.
7. Install new diaphragm (LIQUID side up), then replace washer and bolt.
8. Turn pump to downstroke to seat new diaphragm into the sleeve groove.
9. Replace pump head and manifold(s).
10. Refill crankcase with SAE30 non detergent oil (PumpRight Oil or hydraulic jack oil). Turn pump shaft and top off sight glass with oil.



D70 - D115 Valves are on same side of head. Valves should pop out with slight screwdriver pressure.

D160 - D250 Valves (not shown) are arranged on opposite sides of head.

Other Service Parts D70, D115, D160, D250

Part Number (all begin 291-02-9910-xxxxxx)	Description
550080	Diaphragm (Buna, Optional)
550190	Accumulator Diaphragm

PumpRight Valves & Diaphragms

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Maintenance & Parts

Diaphragm Pump Service Kits

1 Kit contains 1 diaphragm and 2 valves to service a single pumping diaphragm.

Order multiple kits to service all the diaphragms in your specific pump per chart below...

Visit http://www.surefireag.com or www.support.surefireag.com for PumpRight Diaphragm Pump Repair and Maintenance Video

QTY in Kit	Part Number	Description
PR17 Pump Service Kit - 3 Diaphragm		
KIT #: 291-13-100100 (pump requires 3 kits)		
1	291-13-1040083	BlueFlex Diaphragm (PR17)
2	291-13-2429051	Valve
2	291-13-3460380	Gasket/O-ring

PR30 Pump Service Kit - 3 Diaphragm		
KIT #: 291-13-100150 (pump requires 3 kits)		
1	291-13-550081	BlueFlex Diaphragm
2	291-13-2429051	Valve
2	291-13-3460380	Gasket/O-ring

PR40 Pump Service Kit - 4 Diaphragm		
KIT #: 291-13-100150 (pump requires 4 kits)		
1	291-13-550081	BlueFlex Diaphragm
2	291-13-2429051	Valve
2	291-13-3460380	Gasket/O-ring

D250 Pump Service Kit - 6 Diaphragm		
KIT #: 291-13-100200 (pump requires 6 kits)		
1	291-13-550081	BlueFlex Diaphragm
2	291-02-9910-759051	Valve
2	291-02-680070	Gasket/O-ring

For other service parts, see individual Pump Part Breakout Diagrams in 396-4034Y1, the PumpRight manual that came with your pump.

Also see the manual and individual pump parts breakouts online here. (store.surefireag.com)

PumpRight Valves & Diaphragms

Diaphragm Pump Service Kit Replacement Instructions for PR Pumps

Visit www.surefireag.com or www.support.surefireag.com for PumpRight Diaphragm Pump Repair and Maintenance Video

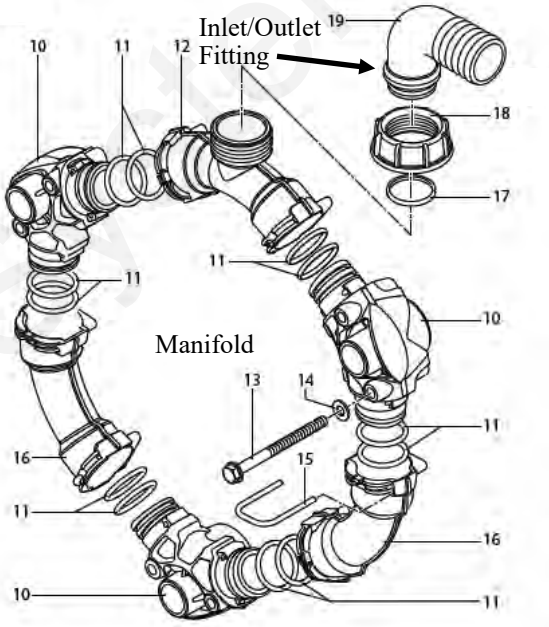
	Number of Diaphragms
PR17	3
PR30	3
PR40	4
D250	6

Diaphragm & Valve Service Steps:

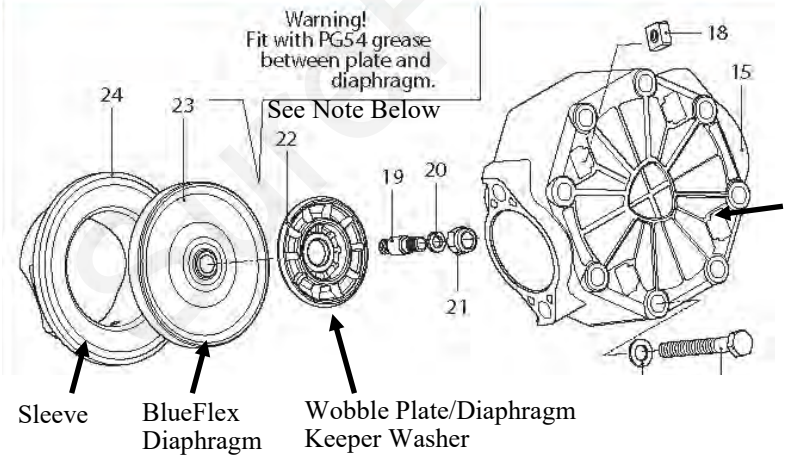
1. Remove inlet and outlet plumbing connections by unscrewing ring nut on inlet and outlet fitting.
2. Use extreme caution when removing and replacing drain plug, so that threads are not stripped and o-ring is not damaged. Remove drain plug from bottom of pump to drain oil from pump. Rotate pump shaft to remove all oil. Replace drain plug making sure o-ring is in place. Tighten plug to 180 In.Lbs.
3. Remove pump manifold(s) using a 13 mm wrench.
4. Remove and replace complete valve assembly.
5. Remove the pump head.
6. Remove the diaphragm bolt, support washer and diaphragm. Turn the pump shaft to up stroke to replace diaphragm.
7. Install new diaphragm (LIQUID side up), then replace washer and bolt.
8. Turn pump to downstroke to seat new diaphragm into the sleeve groove.
9. Replace pump head and manifold(s).
10. Refill crankcase with SAE30 non detergent oil (PumpRight Oil or hydraulic jack oil). Turn the pump shaft and top off sight glass.

NOTE: See individual Part Breakout Charts for Bolt/Nut Torque Specs.

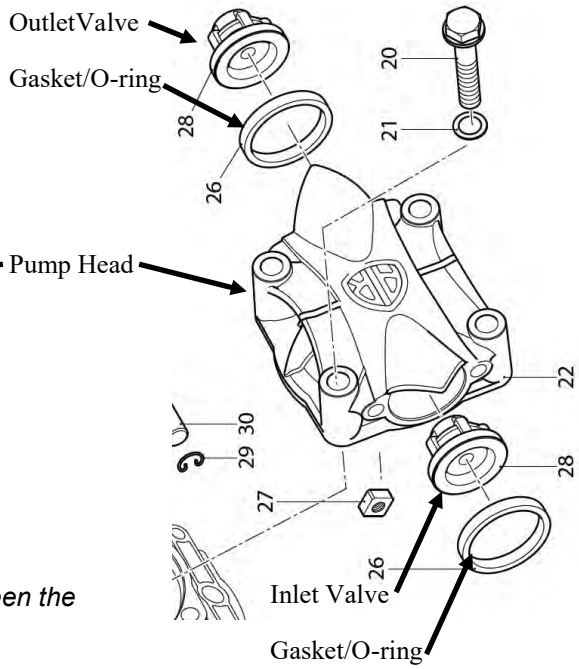
Typical Manifold—2 per pump—inlet and outlet



Typical Diaphragm Assembly



Typical Valve Assembly



NOTE: A multipurpose grease is fine to use for applying in between the Diaphragm and Wobble Plate/Washer

For other pump service parts, see individual Pump Part Breakout Diagrams in 396-4034Y1, the PumpRight manual that came with your pump.

Also see the manual and individual pump parts breakouts online here. (store.surefireag.com)

Go to support.surefireag.com for pump information and parts breakdowns.

PWM Valve and Motor Parts

164-FTA0994	4.0 CID motor (this is the standard motor beginning in 2016)
164-FTA1609	Same as 164-FTA0994, but with RPM Speed Sensor-- GRC does not support a Pump RPM sensor.