396-001240

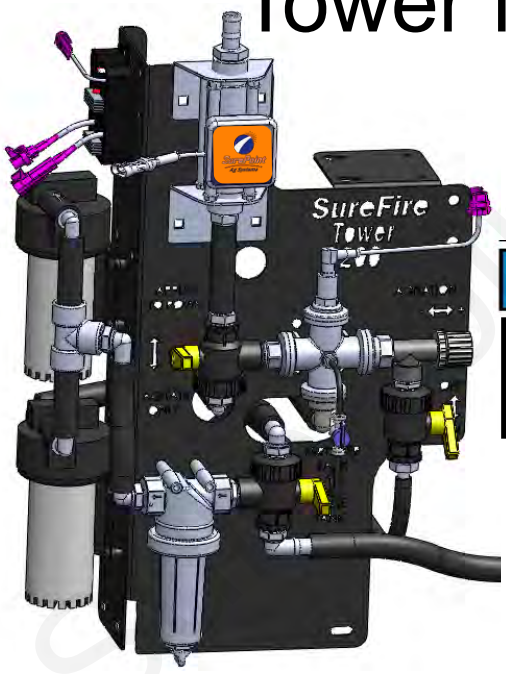
Tower Fertilizer System for Trimble® Field IQ™

(FmX® & FM-1000™ & TMX-2050™ displays)

Trimble Field-IQ™

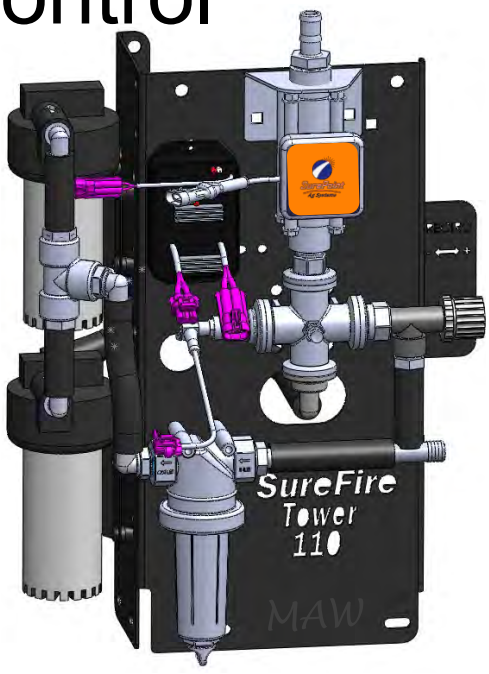
&

Tower for PWM Control



NOTICE

Operator should read this manual before operating the system.



Maximum Application Rates with 2 Electric Pumps

Maximum Application Rates in GPA on 30" Rows at 6 MPH (no agitation)				
Rows	8	12	16	24
Max GPA	20	12	9	5

Table Of Contents

Safety

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.

A Word to the Operator

SAFETY IS YOUR RESPONSIBILITY.

YOU are the key to safety.

It is YOUR responsibility to read and understand the safety messages in this manual.

This system may be used to apply many different kinds of agricultural liquid products. Read and follow all label information and instructions related to the handling, storage, and application of the product you are using.

All electrical harnessing should be checked regularly and should be routed and secured so it will not be pinched, cut, or stretched.

General Description

A
Introduction

You have purchased a SurePoint fertilizer system for your equipment. This system will be controlled by your FM-1000™, FmX®, CFX-750™, FM-750, or TMX-2050 display and Field-IQ™ Rate and Section Control Module. The rate controller will adjust the speed of the SurePoint electric pump(s) based on feedback from the flowmeter and vehicle speed. The system is capable of section control to minimize overlap areas with optional section valves.

Note for TMX-2050 Users

The setup screens shown in this manual are from the FmX or FmX Plus app on the TMX-2050 display. Most of the setup for the TMX-2050 with the FmX Plus application and FmX or FM-1000 look the same.

A big difference from prior software versions is in the Drive Calibration. The TMX-2050 and most recent FmX software uses Proportional Gain instead of Integral Gain. Run the Auto-Tuning process to get the Drive Calibration. Set the Upper PWM Limit to 100 after running the Auto-Tuning. Auto-Tuning may set the Upper PWM Limit at a lower number which limits the top end of your system.

Basic Installation Steps

1. Install Trimble® display, harnesses, and Field IQ™ Rate & Section Control Module. Check with your Trimble dealer for the latest software/firmware for the display and module.
2. Open the packages and familiarize yourself with the components. Refer to manual sections B, C & D for component information.
3. Mount the Tower on your equipment.
4. Plumb the tank to the Tower 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 flow meter outlet to section valve or manifold inlet. Attach section valve outlets to flow indicator inlets.
7. Attach harnesses as shown in Section D.
8. Setup Controller for SurePoint 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.

NOTICE

Operator must read this manual before operating the system.

Consult your Trimble Display User Guide for more information on the setup and operation of your Trimble system.

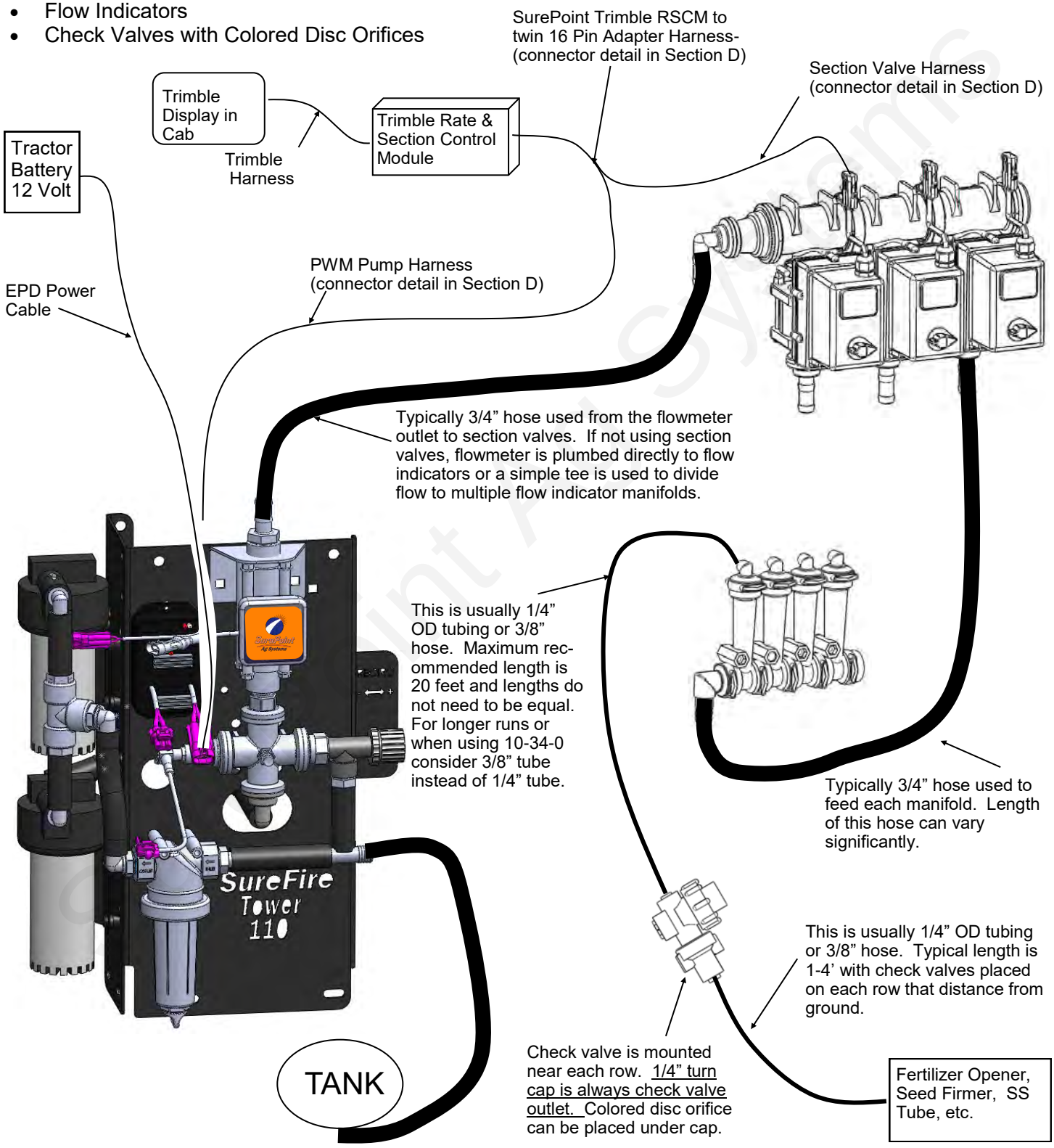
think SAFETY act SAFELY

System Overview - Example 1

A
Introduction

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

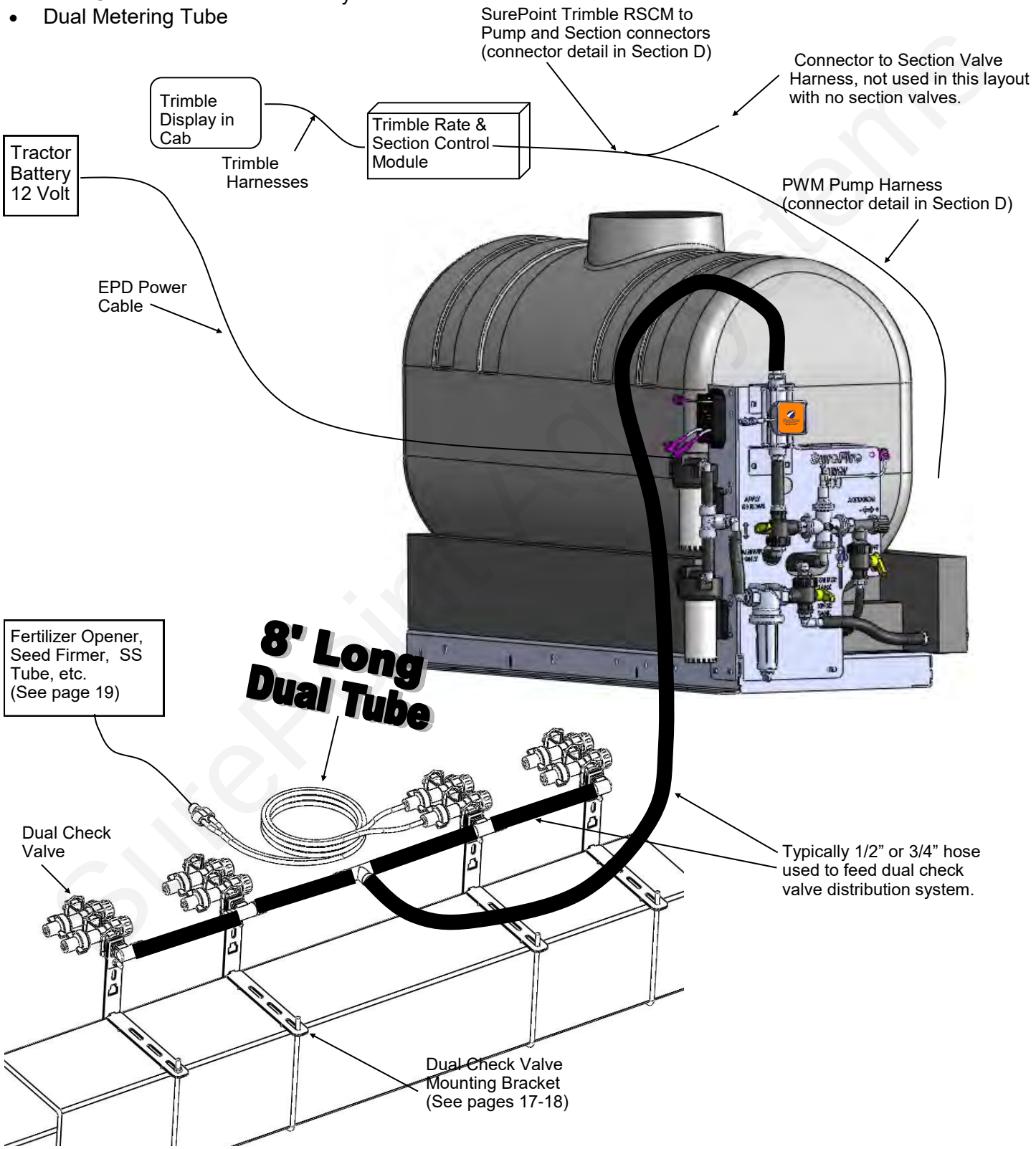
- Trimble® Display
- Trimble® Rate & Section Control Module
- Tower 110
- Section Valves
- Flow Indicators
- Check Valves with Colored Disc Orifices



System Overview - Example 2

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

- Trimble® Display
- Trimble® Field-IQ Rate & Section Control Module
- Accelerator with Tower 200
- Dual Check Valve Distribution System
- Dual Metering Tube



Electromagnetic Flowmeter Kits

		Flowmeter Only
0.13 - 2.6 GPM	**Item Number 500-02-2040**	**204-01-46211CUF00**
0.3 - 5.0 GPM	**Item Number 500-02-2050**	**204-01-46211CUF01**
0.08 - 1.6 GPM	**—-**	**204-01-46211CUF05**

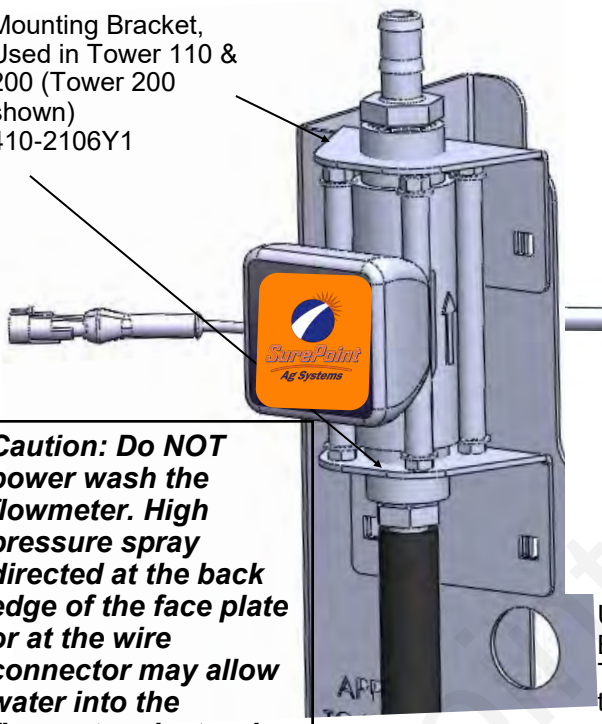
Kits include flowmeter, mounting bracket, hose barb fittings & hose clamps.

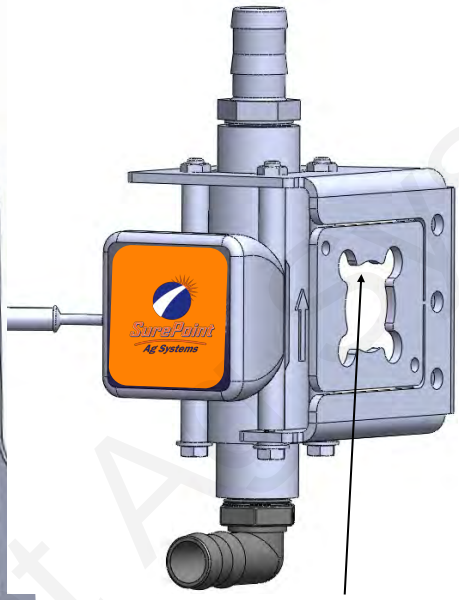
B
Components
Liquid

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

New Look in 2017—Black body with orange label. Same accurate, reliable electromagnetic technology.
3-pin Amp SuperSeal connector is sealed to flowmeter body for tighter, cleaner connection.

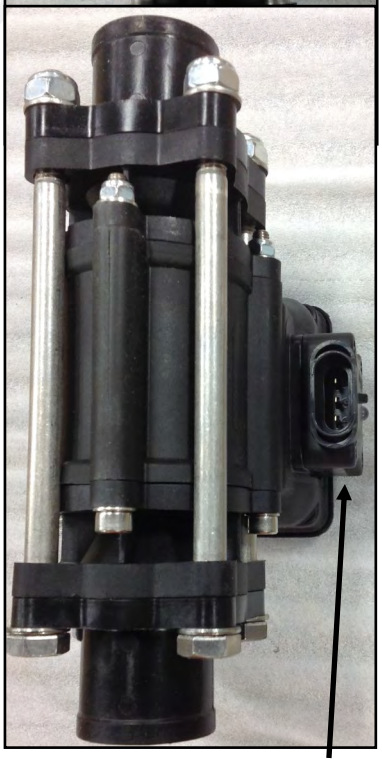
Mounting Bracket,
Used in Tower 110 & 200 (Tower 200 shown)
410-2106Y1





Universal Twist Tab Mounting Bracket 400-1208A1
Twist tab to detach. Plate mounts to bottom of bracket (with two 1/4”x1” carriage bolts) to capture flowmeter.

Caution: 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.



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

Electromagnetic flowmeters are superior to traditional turbine flowmeters in two basic ways. First, they have no moving parts. This translates into 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. **SurePoint still recommends you perform a catch test to verify the system is properly installed and configured.**
Always verify flowmeter calibration in the field by comparing acres worked with gallons applied.

Flowmeter Model (orange label or blue label)	Pulses/Gal	FPT Size	Hose Barb In kit
0.13 - 2.6 GPM	3000	3/4”	3/4”
0.3 - 5.0 GPM	3000	3/4”	3/4”
0.08-1.6 GPM	22700	3/4”	3/4”

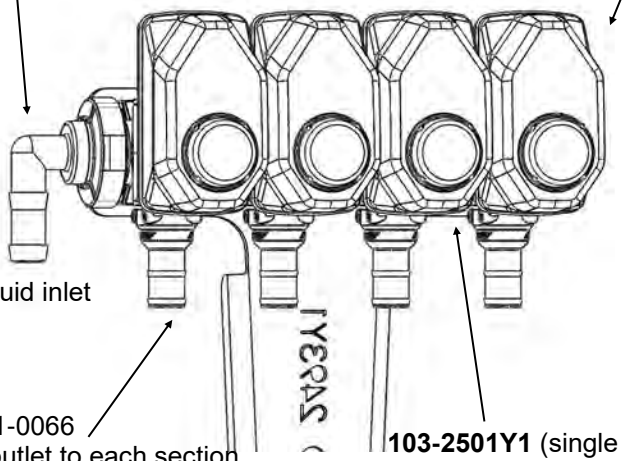
Serial number label on side also shows pulses per gallon.

Section Valves

105-100075BRB90

105-100PLG (alternate
105-100PLG025 includes 1/4" pipe thread for gauge)

Note: Ensure back-side port is capped prior to use



Liquid inlet

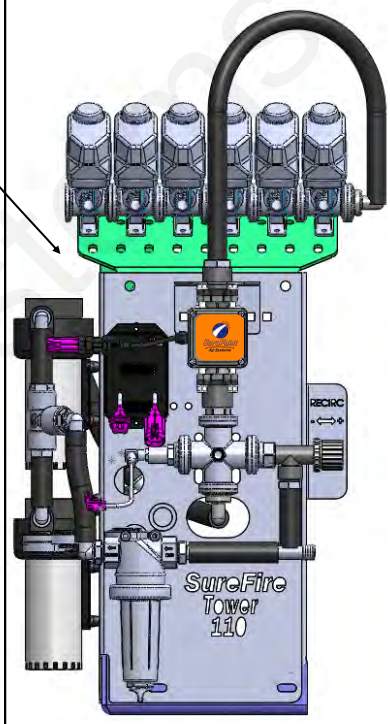
117-211-0066
Liquid outlet to each section

103-2501Y1 (single complete valve)
KZ Electric TX2 Series, 1 ball valve

Additional Parts:

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

Tower 110 Section Valve Bracket
Item Number 410-2110Y2



The Tower 110 can have up to 6 section valves mounted directly to the top of it with this bracket.

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.

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.

How it Works

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 signal wire. The power measured to ground should have 12 volts when the controller is on. The switched signal 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

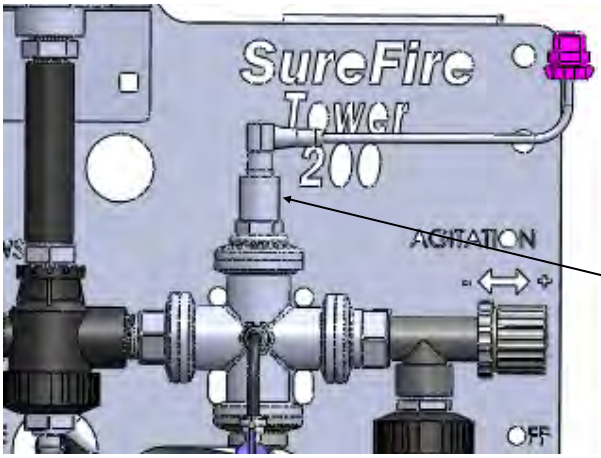
Mounting Hardware:

2 Valve Bolt Kit	384-1100
Mounting Bracket	400-2493Y1

Pressure Sensor

The Tower 110 and 200 come equipped with a 100 psi (0 to 5 volt) pressure sensor to work with Trimble. This sensor is a 3 wire type sensor for compatibility with Trimble. The sensor has a 1/4" MPT fitting.

The Trimble display will show the system pressure on the in cab screen. The pressure reading is only for informational purposes and is NOT used in the flow control process. Flow control uses the flowmeter feedback only.



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

The pressure sensor is very helpful to optimize system performance and troubleshoot any issues.

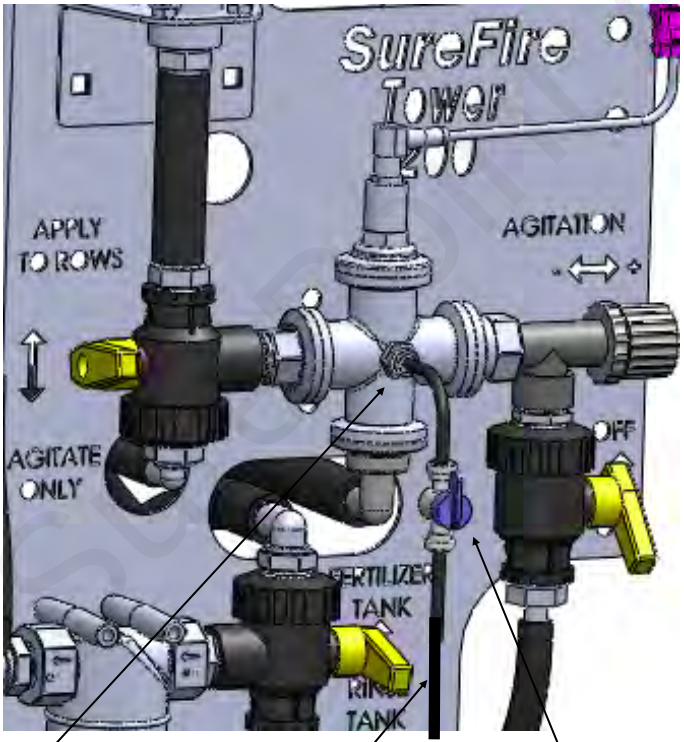
There is a Main Pressure connector on both the final pump harness (207-4189Y1) and on the section harness (207-3463Y1).

The pressure transducer is factory calibrated and will display a very accurate pressure reading on the Trimble display. No manual gauge is required.

Trimble Pressure Calibration:
50 mv/psi

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.



Shipped from factory with plug installed.

1/4" Tubing

1/4" air bleed valve

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. 12-volt 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.

How to install the air bleed valve:

Remove the 1/4" plug from the quick connect fitting on the center cross on the Tower (see picture). 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 the air to bleed.

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.

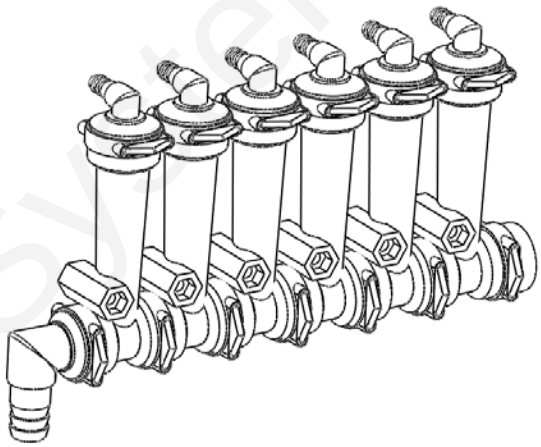
1. A metering orifice may be placed in the top cap of each floating ball flow indicator. (See photos on page 10—this is not used very often)
2. A metering orifice may be placed in the check valve cap in the line that leads to each row. (See photo on page 12)
3. A dual metering tube kit with dual check valves may be used. (See pages 16-19)

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.

SurePoint 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

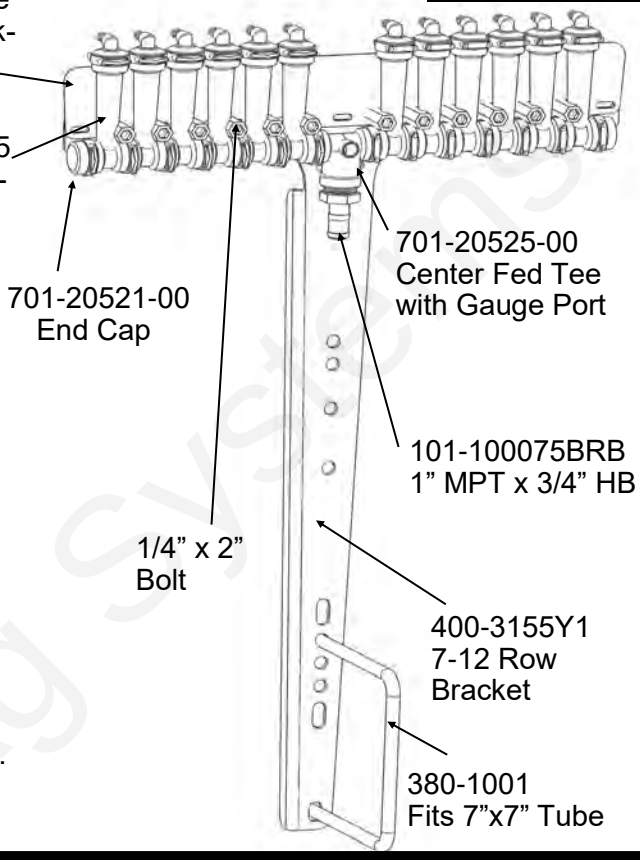
400-1037A1	3-6 Row Bracket
400-3155Y1	7-12 Row Bracket
400-2011A1	White Backer Plate for 3-6 Row Bracket
400-2010A1	White Backer Plate for 7-12 Row Bracket
400-1315A2	Flow Indicator Bracket, 6-8 in wide hitch mount

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

B
Components
Liquid

The full flow column is typically used with rates over 10 GPA on 30" rows. For rates less than 10 GPA SurePoint 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")

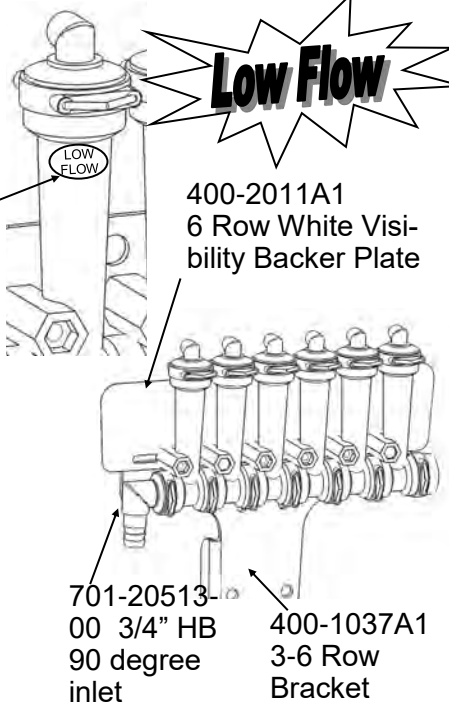
*Surepoint recommends using the low flow column for these flow rates.
Plastic balls may float on heavier fertilizers, such as 10-34-0.

Low Flow Column (mostly 1/4" QC)

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

SurePoint 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.surepointag.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

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

Tower Electric Pump

Pressure Recommendations

(with 4 lb check valves):

- Minimum 10 PSI
- Maximum 30 PSI

PumpRight

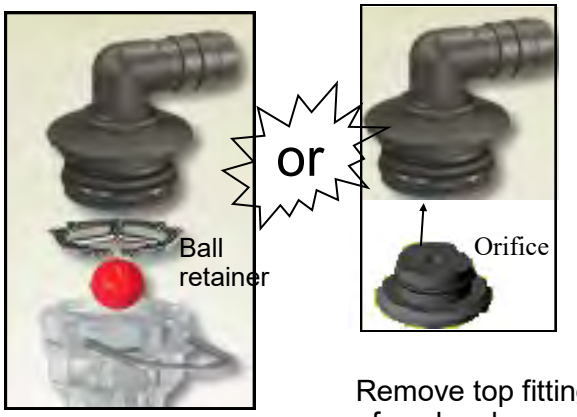
Pressure Recommendations

(with 10 lb check valves):

- Minimum 20 PSI
- Maximum 80 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.**



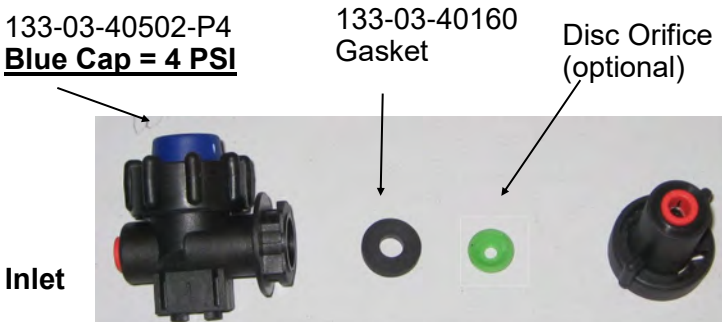
If using a metering orifice in the flow indicator, the orifice replaces the ball retainer. If not using an orifice here, the ball retainer must be in place.

Remove top fitting of each column. Then push the metering orifice into bottom of each outlet fitting.

Check Valves

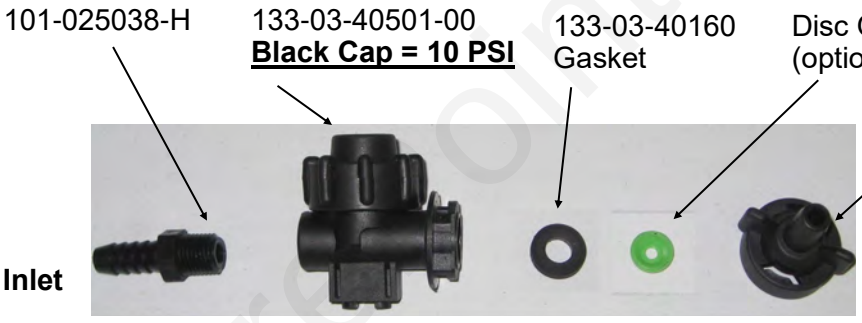
4 lb check valve with 1/4” quick connect fittings

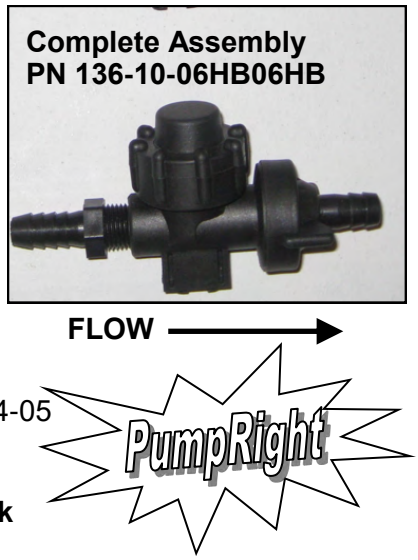
4 lb check valves are typically used with **electric pump systems**. SurePoint recommends this valve for use with 1/4” tubing applying up to 10 GPA on 30” rows. (3/8” tube may be better for 10-34-0 or with long runs) The recommended minimum system operating pressure for this check is 10 psi, to ensure all checks open fully.



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 SurePoint 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.





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

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

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

- Minimum 10 PSI
- Maximum 30 PSI *(pump can do 50 PSI or more if total output is not too great)*

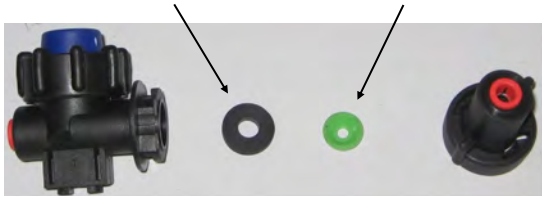
PumpRight Pressure Recommendations (with 10 lb check valves):

- Minimum 20 PSI
- Maximum 80 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. This is absolutely essential for 24-row systems using electric pumps.**

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, watch this video or see the metering tube chart.

B
Components
Liquid

SurePoint dual metering tube plumbing kits are a great way to plumb a planter to apply starter fertilizer. They'll also work on other implements when applying low rates or high rates of 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).

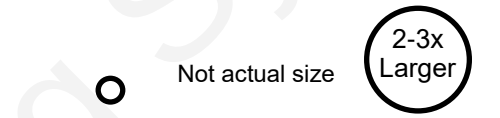
These instructions will show you where all the pieces go. It will provide guidance on how much metering tube to use. There are some optional fittings included in each plumbing kit. These instructions will show you where and why you'd want to use the optional pieces.

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 Black Label Zn fertilizer (or any other liquid) which has a highly variable viscosity based on temperature changes.

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 Black Label ZN (or most other liquid solutions) and provide the proper system pressure as the fertilizer properties change due to temperature, mixtures and other factors.



Field Operation of Dual Metering Tube - Dual Check Valve System

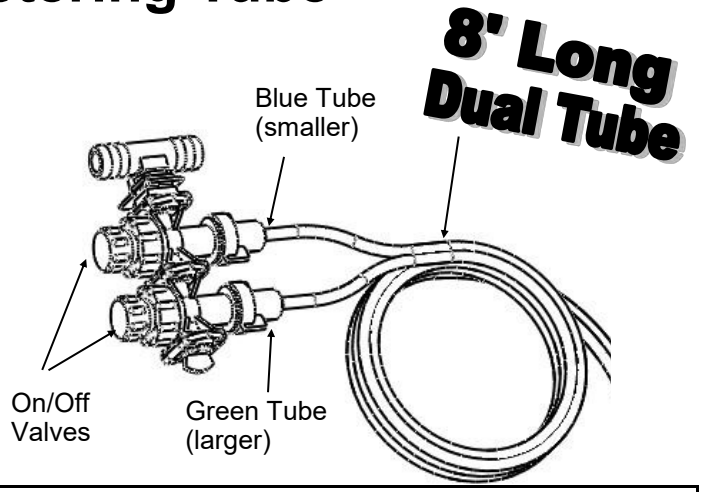
The dual metering tube allows for three application rate ranges. Some fertilizers can have a widely variable viscosity range. Therefore, based on temperature, tank mixing and fertilizer batch, the best tube to use will change.

SurePoint recommends you start with the Green (or larger) tube ON only. This is the middle application range and is a good starting point. Conduct a test using the test speed mode to determine your system pressure. Recommended pressure is between 8 - 30 PSI. If pressure is below 8 psi, some check valves may not open and row to row distribution will be uneven. If pressure is too high , pump output will decrease and you may not reach the target rate.

Start with green (or larger) tube ON, blue tube OFF:

- **Pressure below 10 PSI: Turn green tube OFF and blue tube ON.**

Pressure over 30 PSI: Turn BOTH tubes ON.
(Other color tubes are available for different application rates.)

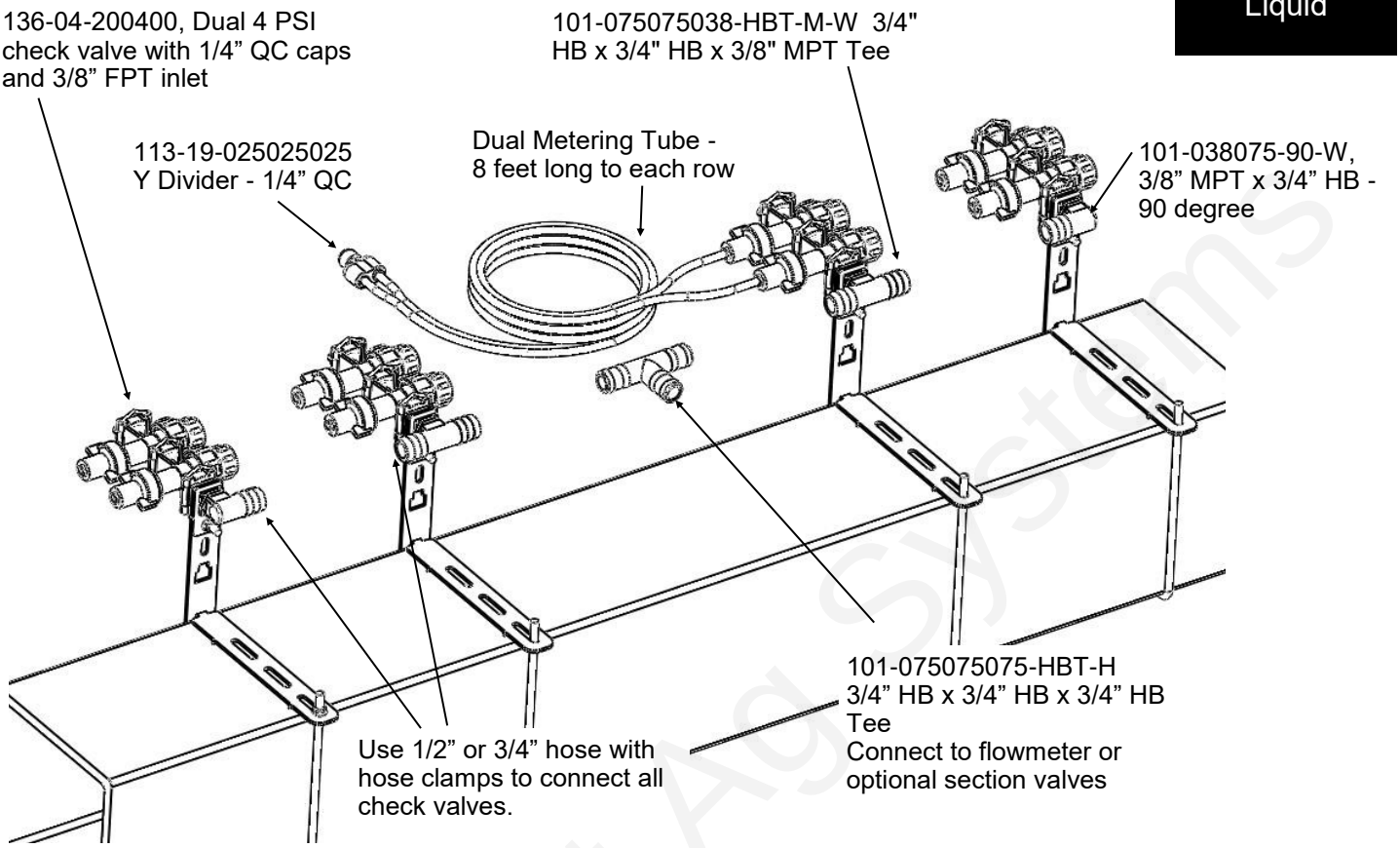


	GPA on 30" rows (approx, will vary)
Blue Tube	1.5 - 3
Green Tube	3 - 6
Blue & Green Tube	6 - 10
Minimum Recommended flow for Blue Tube (8 ft)	4 - 5 oz/min

** 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

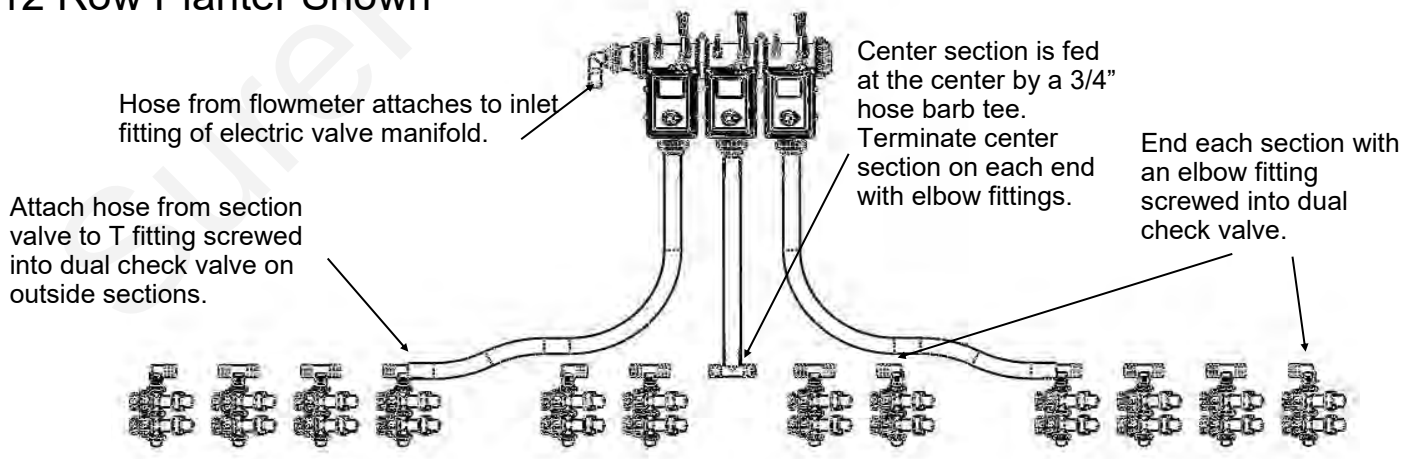
4 Row Planter Shown, add rows as necessary



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

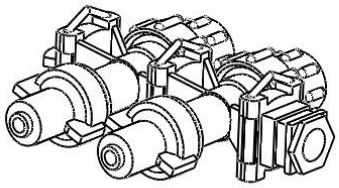


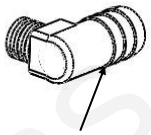
For a **2 section plumbing system**, omit the center section and plumb similar to the outside 2 sections.

Dual Check Valve Assembly Steps

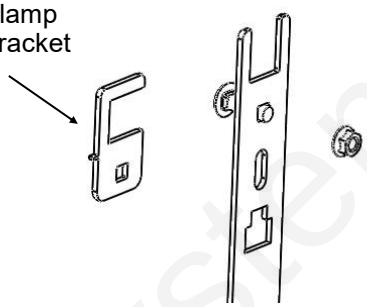
Follow these steps to mount each check valve to the steel bracket.

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.



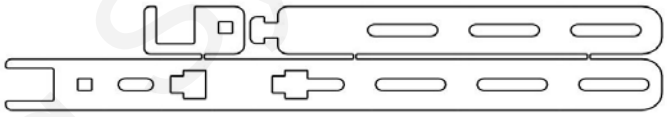


Clamp Bracket



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

400-1966A1 Dual Check Valve Mount Bracket

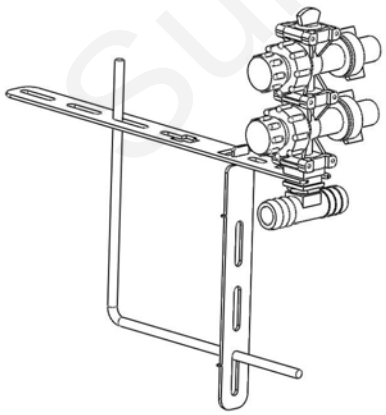


The long, short & clamp bracket come as one part connected by break-off tabs.

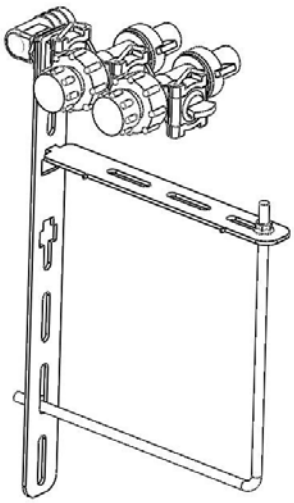
Check Valve Mounting Options

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.

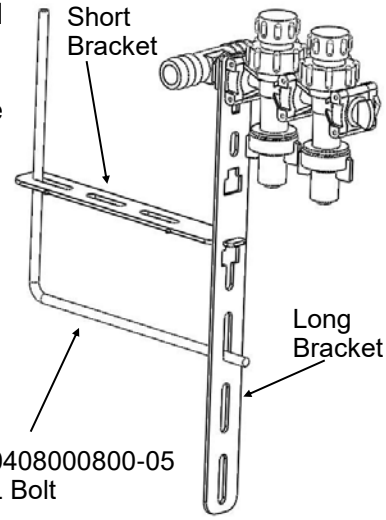
Example 1. Use the long bracket on the top of a bar. The check valve is mounted vertically. The liquid supply hose is ran directly on the front side of the bar. The U-bolt is placed in slots to clamp on a 4x6 inch tube.



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.



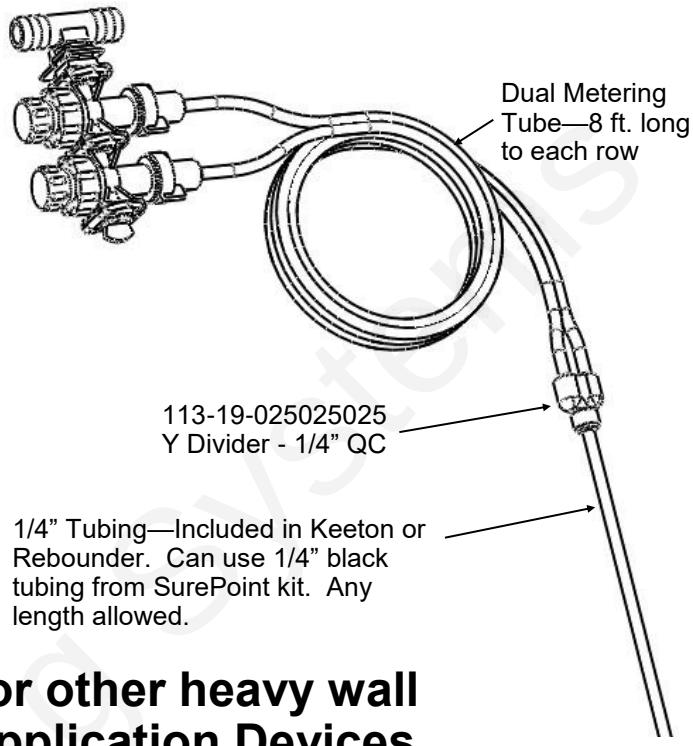
Example 3. Use the long bracket on the front of a 3x7 bar (vacuum tube on some planters). Mount the check valve hanging forward of the bar. The supply line will run directly over the bar. The excess bolt and bracket length can be cut off.



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.

<u>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.</u>

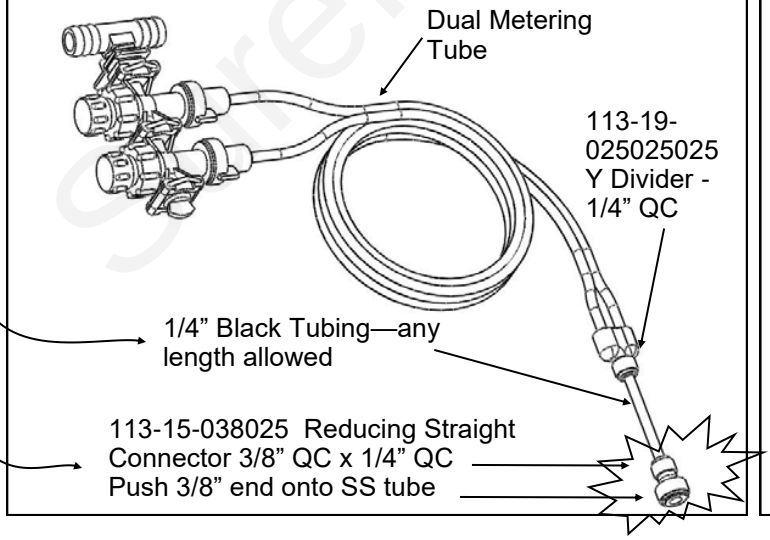


Connection to Totally Tubular or other heavy wall Stainless Steel Tube Ground Application Devices

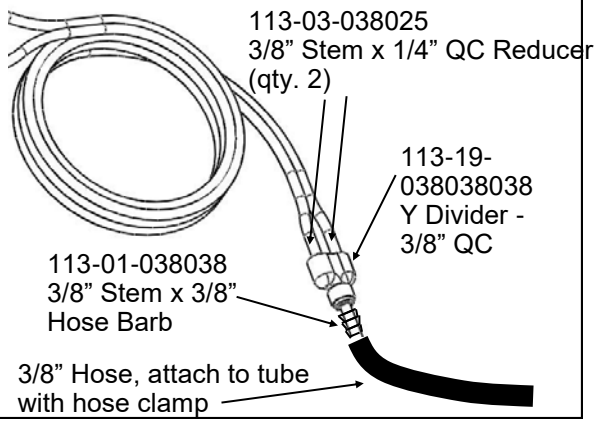
When using a 3/8” OD stainless steel tube to apply fertilizer to the ground, there are two options for the delivery tube plumbing. If the tube ID is less than 1/4” (tubing will not fit inside tube) this attachment method must be used. The description following is for Option 1. See bottom right picture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



Electric Pump (Tower) Systems--10-40 PSI *(Tubes 8' unless noted)*

Low Viscosity (28-0-0 approx 10.7 lb/gal)				Medium-Low Viscosity (32-0-0 approx 11.0 lb/gal)			
	oz/min	mL/min	gal/min		oz/min	mL/min	gal/min
Tube Color	**Flow Range**	**Flow Range**	**Flow Range**	**Tube Color**	**Flow Range**	**Flow Range**	**Flow Range**
Gray	3.5-7.4	105-220	0.03 - 0.06	Gray	2.5-5.5	74-163	0.02-0.04
Purple	6-14.4	175-415	0.05 - 0.11	Purple	4.1-11.1	121-328	0.03-0.09
Brown	8-18.2	235-540	0.06 - 0.14	Brown	5.7-14.3	170-425	0.04-0.11
Blue	10-22.6	295-670	0.08 - 0.18	Blue	7.5-18	220-530	0.06-0.14
Green	18-40.2	530-1190	0.14 - 0.31	Green	14-33.2	415-980	0.11-0.26
Tan	25-55	740-1625	0.19 - 0.43	Tan	20-46.4	590-1370	0.16-0.36
Orange	44-93.6	1300-2770	0.34 - 0.73	Orange	36-83	1065-2455	0.28-0.65
Yellow	55-114.4	1625-3380	0.43 - 0.89	Yellow	44-100	1300-2955	0.34-0.78
Black	72-152	2130-4495	0.56 - 1.19	Black	60-129	1775-3815	0.47-1.01
5' Tan	33-73	975-2160	0.26 - 0.57	5' Tan	27-63	*800-1865*	0.21-0.49
5'Orange	57-121	1685-3580	0.45 - 0.95	5'Orange	49-113	1450-3340	0.38-0.88
5' Yellow	70-145	2070-4290	0.55 - 1.13	5' Yellow	59-134	1745-3965	0.46-1.05
5' Black	95-200	2810-5915	0.74 - 1.56	5' Black	80-172	2365-5085	0.63-1.34

10-40 PSI 60°F

Medium Viscosity (Starter, N-P Blend, approx 11.2 lb/gal)				High Viscosity (10-34-0 approx 11.6 lb/gal)			
	oz/min	mL/min	gal/min		oz/min	mL/min	gal/min
Tube Color	**Flow Range**	**Flow Range**	**Flow Range**	**Tube Color**	**Flow Range**	**Flow Range**	**Flow Range**
Gray	1.5-3.7	45-110	0.01-0.03	Gray			
Purple	2.2-7.8	65-230	0.02-0.06	Purple	1.0-2.8	30-83	0.008-0.02
Brown	3.5-10.4	105-310	0.03-0.08	Brown	1.4-4.2	41-124	0.011-0.03
Blue	5-13.7	150-405	0.04-0.11	Blue	1.8-5.5	53-163	0.014-0.04
Green	9.5-26	280-770	0.07-0.20	Green	2.6-9.4	77-280	0.02-0.07
Tan	14-37.4	415-1105	0.11-0.29	Tan	4-14.8	120-440	0.03-0.12
Orange	27-72	800-2130	0.21-0.56	Orange	9-30	265-885	0.07-0.23
Yellow	33-85	975-2515	0.26-0.66	Yellow	13-42	385-1240	0.10-0.33
Black	48-106	1420-3135	0.38-0.83	Black	18-55	530-1625	0.14-0.43
5' Tan	20-53	590-1565	0.16-0.41	5' Tan	6-22.2	165-655	0.04-0.17
5'Orange	38-101	1125-2985	0.30-0.79	5'Orange	13-43	380-1270	0.10-0.34
5' Yellow	46-118	1360-3490	0.36-0.92	5' Yellow	18-58	540-1715	0.14-0.45
5' Black	67-148	1980-4375	0.52-1.16	5' Black	25-76	740-2250	0.20-0.59

10-40 PSI 60°F--For 10-34-0 select a tube with additional capacity for cold weather.

Water (8.34 lb/gal)			
	oz/min	mL/min	gal/min
Tube Color	**Flow Range**	**Flow Range**	**Flow Range**
White	2.5-5.5	75-165	0.02-0.04
Gray	5.8-11.6	170-340	0.045-0.09
Purple	10-20	295-590	0.08-0.16
Brown	12.5-25	370-740	0.10-0.20
Blue	17.5-35	520-1040	0.14-0.28
Green	26-52	770-1540	0.20-0.40
Tan	34-68	1005-2010	0.27-0.54
Orange	60-120	1775-3550	0.47-0.94
Yellow	75-150	2220-44400	0.59-1.18

These charts are typical flow rates from 10 to 40 PSI.

The capacity of electric pumps declines as the pressure increases. If total pump output is low enough, they can operate at 50 psi or more.

These charts are designed for typical N-P fertilizers. Suspension, granular, and/or clay/based products may not follow these charts.

These charts are for product at 60° F. Products will be thicker and pressure will be higher at lower temperatures (esp 10-34-0). MAW

Trimble® Field-IQ™
Rate and Section Control Module

SurePoint Fertilizer Systems begin at the Trimble Field-IQ Rate and Section Control Module. The picture below shows this control module. You will need to purchase this module from your Trimble dealer. You will also need to purchase an unlock code for your Trimble display to enable rate control functions.

The rate controller has two harness connections. The first is the connection to the Trimble wiring harness (18-pin) that connects to the in-cab display. The second (30-pin) is where the SurePoint Fertilizer System harnesses begin. The following pages show system diagrams for single section, 2-6 section and 7-12 section configurations. Detailed harness drawings follow for information and troubleshooting.

Instructions for setting up the Field-IQ on the in cab display are in Section F. Detailed screen shots of the TMX-2050, FmX & FM-1000 and displays are included showing exactly what settings are required and recommended for SurePoint Fertilizer Systems.

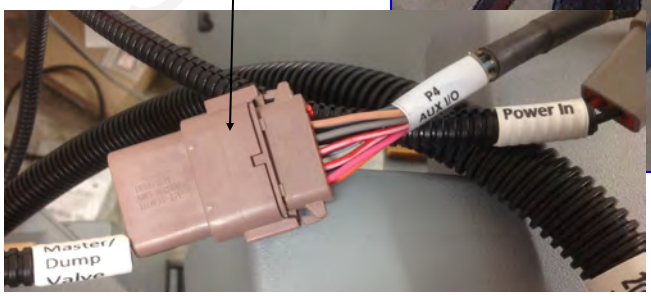
Trimble Rate and Section Control Module

18 Pin Connector- Connect to Trimble Harness back to in-cab display

30 Pin Connector- Connect SurePoint Harness here

SurePoint Harness 213-02-3764Y2

Aux Master/Dump Valve (12-pin Deutsch connector) on 213-02-3764Y2 plugs into Aux I/O (12-pin Deutsch connector) that comes from 18-pin Trimble connector harness. (Only needed if using Aux Master/ Dump Valve.)



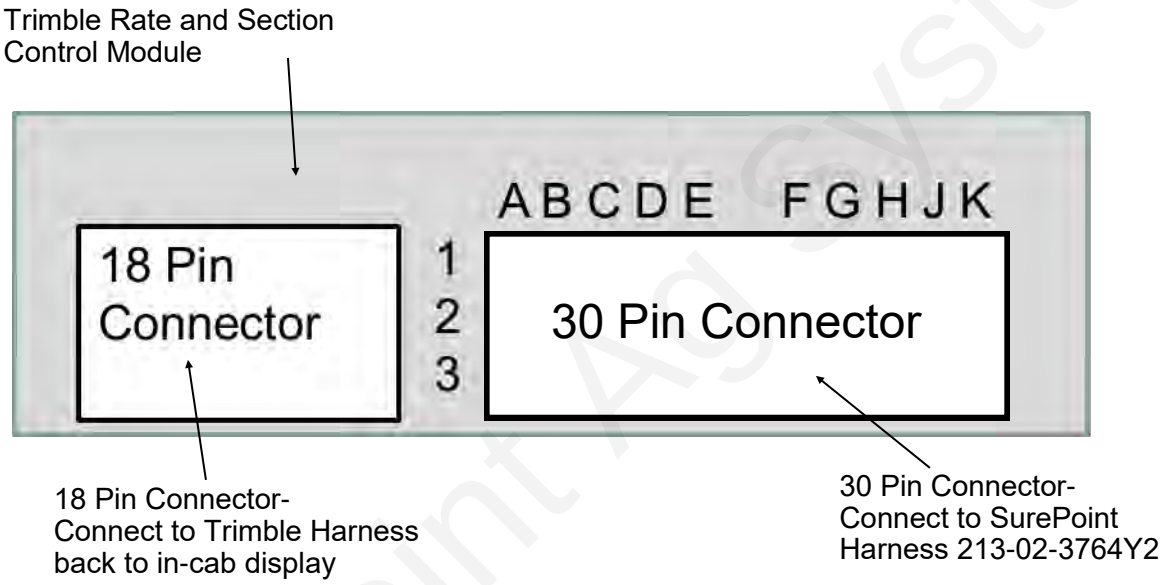
2-Pin Power Connector (P5)
-Connect to SurePoint Harness
(Be sure red and black wires match up when plugged in.)

Trimble® Field-IQ™
Rate and Section Control Module

D
Wiring & Elec

This chart shows you the output functions by pin location on the Trimble Rate and Section Control Module. Use this information to verify if the Trimble system is providing the correct output. If the module is not providing the correct output, contact your Trimble dealer to repair the problem. Also review any applicable settings on the display to verify the system is properly set up.

Check with your Trimble dealer or online for the current software and firmware for your display and Field -IQ module.



Common Troubleshooting:

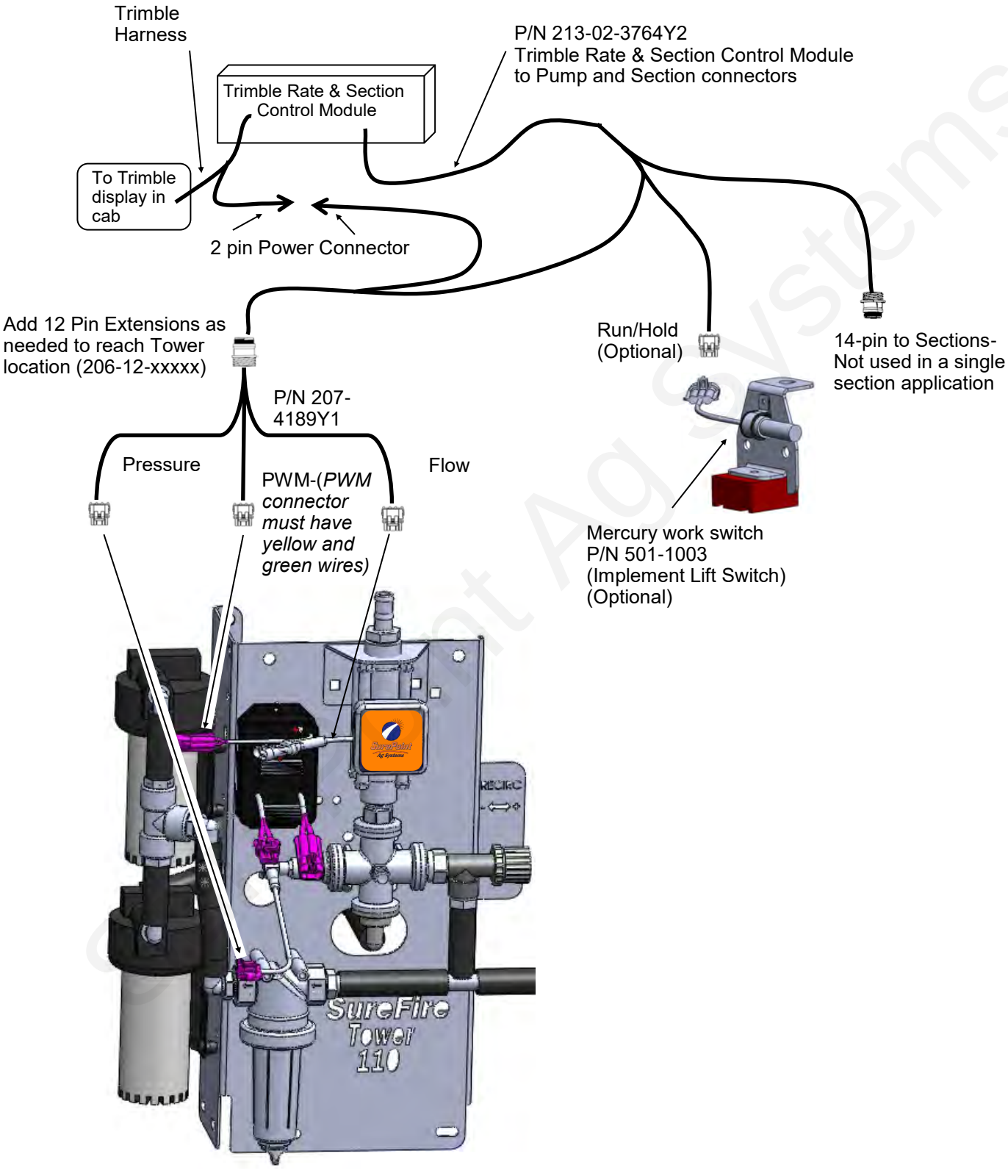
PWM Signal to Pump: Pins E1 to E2 on the 30-pin connector should have 3-12 volts to turn pump on. Use manual mode to increase signal. Should get up to 12 volts after holding increase button.

Flowmeter Tap Test: Pins C2 and C3 on the 30-pin connector are Flow Signal and Ground. If no flow is registering on the display, you can tap between these two pins with a short wire. This produces a pulse. The display should indicate a flow when this is done rapidly. *(Note: To help register flow for the tap test, change the flowmeter calibration to 1, so it will show a flow with fewer taps. Be sure to reset the flow cal to the proper number after the test.)*

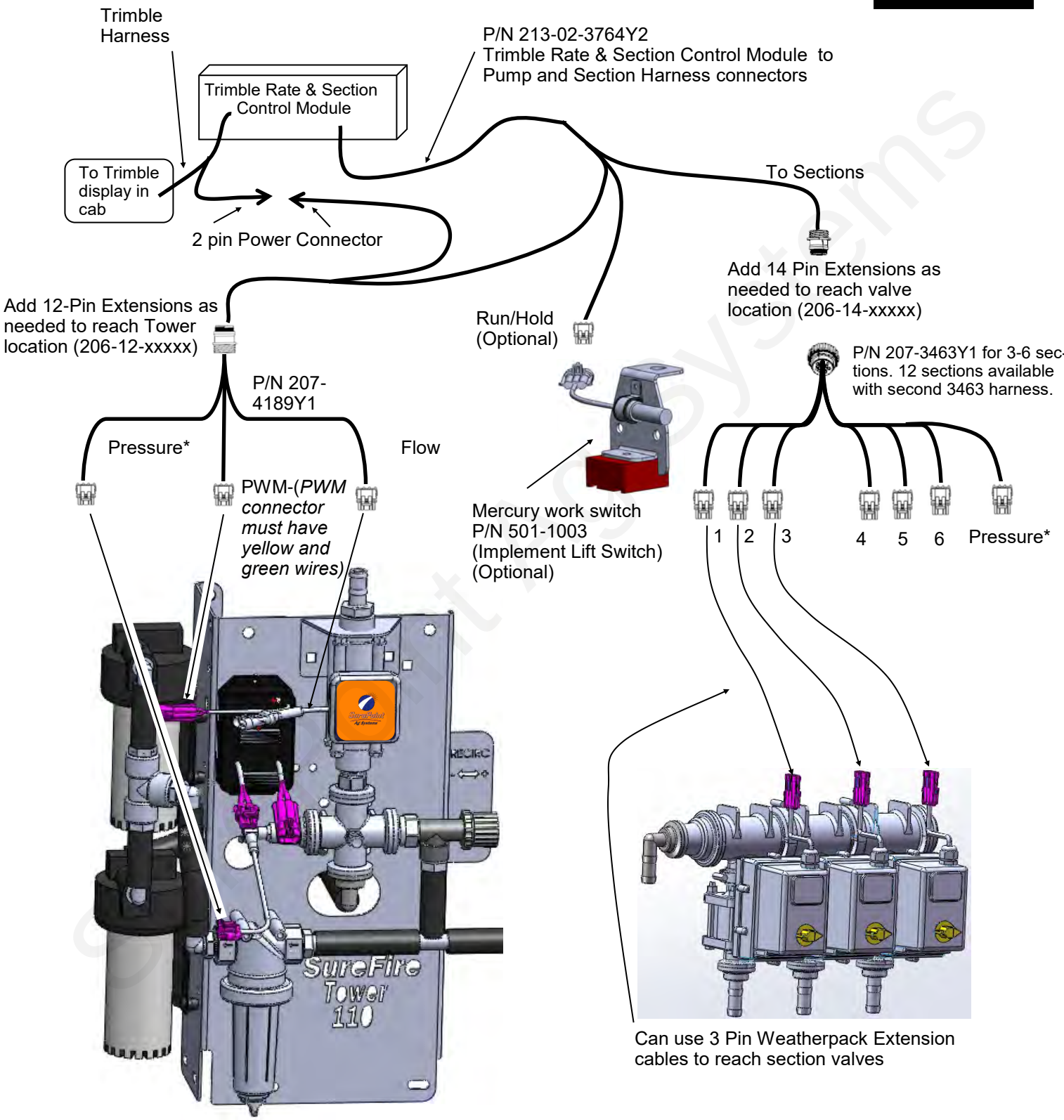
See the drawing of harness 213-02-3764Y2 on page 28 for all pin locations on the 30-pin connector.

*The final pump harness **PWM connector must have yellow and green wires** for the Trimble Field-IQ Rate & Section Control module. A yellow and black wire PWM connector WILL NOT work.*

Trimble® Field-IQ™ PWM Wiring Schematic Single Section for Tower Electric Pump Liquid Application



Trimble® Field-IQ™ PWM Wiring Schematic Up to 12 Sections for Tower Electric Pump Liquid Application



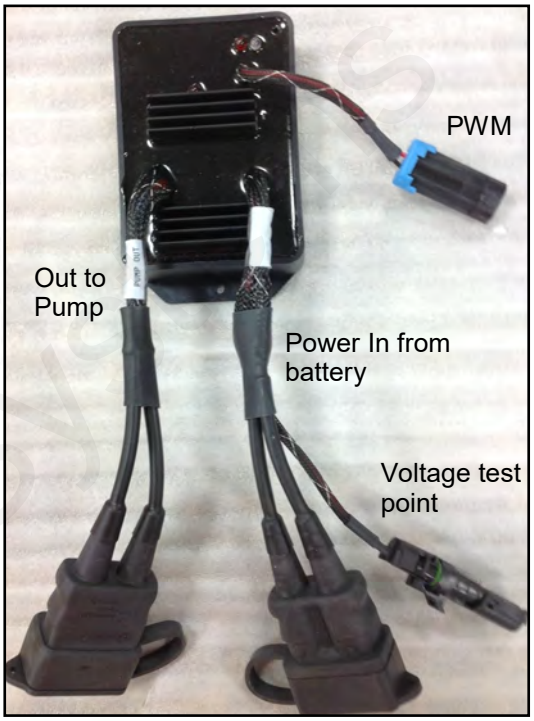
* It is possible to connect 2 pressure sensors to the Trimble display using the Surepoint xxxxxx**Y2** harnesses with Pressure 1 and Pressure 2 connections.

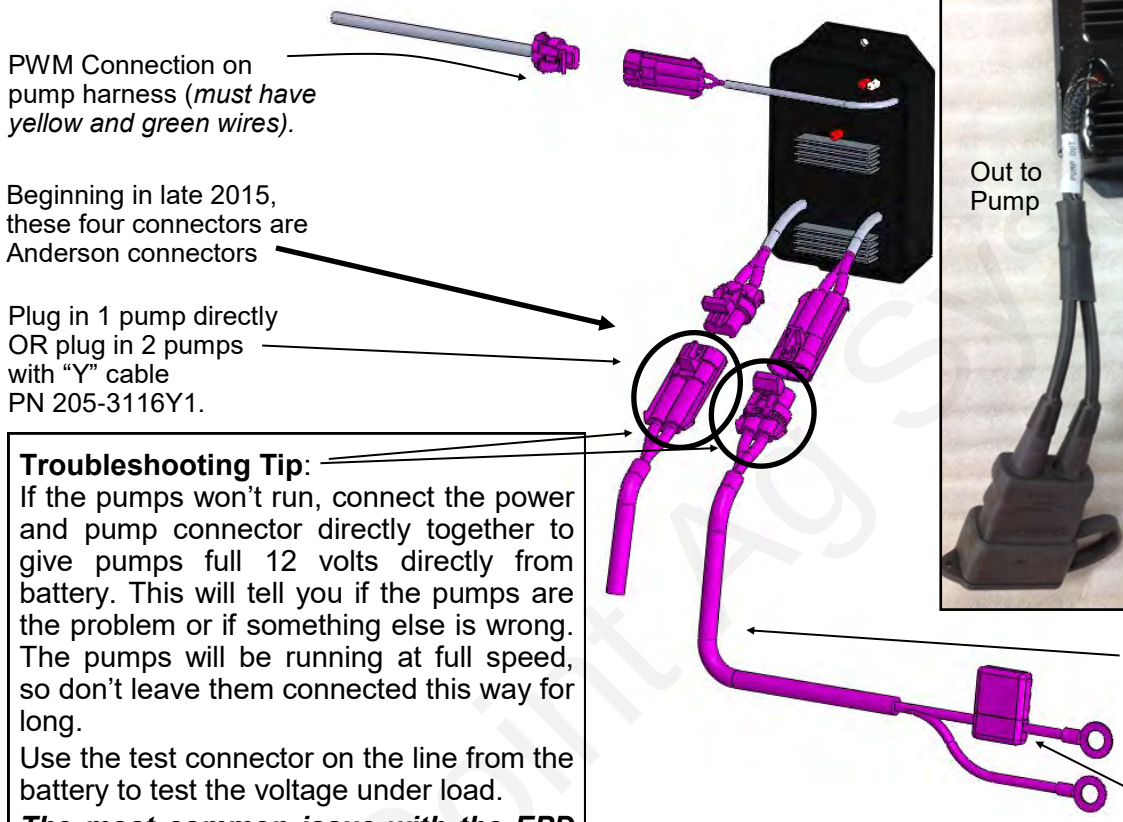
40 Amp PWM EPD
(Pulse Width Modulated Electric Pump Driver)
Item Number: 205-19024 with Anderson connectors
(replaces 205-18385 with 480 MP connectors)

D
Wiring & Elec.

The Electric Pump Driver powers 1 or 2 electric pumps by providing a pulse width modulated signal to control pump speed. It needs to have a power connection and wiring capable of carrying up to 40 amps of current. **It must be connected directly to the tractor battery.** SurePoint recommends 8 gauge wire (or heavier) if extending harnesses in the field.

205-19024





Troubleshooting Tip:
If the pumps won't run, connect the power and pump connector directly together to give pumps full 12 volts directly from battery. This will tell you if the pumps are the problem or if something else is wrong. The pumps will be running at full speed, so don't leave them connected this way for long.

Use the test connector on the line from the battery to test the voltage under load.

***The most common issue with the EPD** will be a low voltage condition (under load) delivered to the EPD from the battery. Voltage drop occurs anytime current is moved through a wire. A low-voltage (12 v) system with long runs (60-80 feet) may have unacceptable voltage drops if any part of the system is weak or the load is high. This could be bad (corroded, weak, loose or burnt) connectors (at the battery, at the hitch, and at the EPD), too small of wire used (smaller wire equals more voltage drop), low source voltage, and heavy load. Any or all of these may contribute to a low voltage condition under load that may shut down the processor in the EPD module. This will be indicated by 4 quick flashes of the red light, followed by a short pause. Unplug the power-in connector to reset the EPD.*

Use EPD **Power Harness Extensions** as needed

(These have Anderson Connedtors)		Wire Size
206-02-3120Y1	1' Extension	10 gauge
206-02-3121Y1	5' Extension	10 gauge
206-02-3122Y1	10' Extension	8 gauge
206-02-3123Y1	20' Extension	8 gauge
206-02-3124Y1	30' Extension	30' and longer—6 gauge
206-02-3125Y1	40' Extension	
206-02-3126Y1	50' Extension	
206-02-3127Y1	60' Extension	
206-02-3128Y1	2' Anderson Ext w/ Power Switch-8 AWG	

SurePoint recommends a single long extension harness as multiple connectors will reduce voltage, increase current and hurt performance of your electric pump system.

Implement Lift Switch for Field-IQ™ (Mercury Run/Hold Switch)

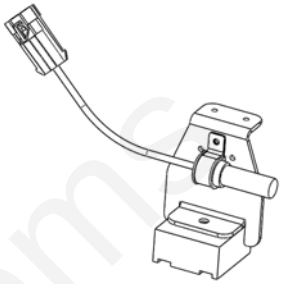
The Mercury Run/Hold Switch turns liquid application on and off automatically when the implement is raised or lowered. The switch is mounted on a component that rotates when the implement is raised and lowered. The switch is attached to a magnetic base for easy mounting to any metal part of your tractor hitch or implement.

For mounted 3-point equipment:

- Mount the switch on the tractor 3 point arms.
- See the pictures below for switch orientation in run and hold positions.
- Connect the switch to the Run/Hold Switch connector on Harness 213-03-3764Y2.

For hitch drawn implements:

- Mount the switch on a wheel frame that rotates as it lifts the wheels up and down to raise and lower the implement.
- See the pictures below for switch orientation in run and hold positions.
- Connect the switch to the Run/Hold Switch connector on Harness 213-02-3764Y2.



See page 52 of this manual or the User Guide for your Fm X Display to set up the Implement Lift Switch. →

Calibrating the implement lift switch **Fm X or FM-1000**
1. From the **Field-IQ Calibration screen,** select the **Implement Lift option**.
2. Raise the implement and then tap Next.
3. Lower the implement and then tap Next.
4. Tap OK to return to the Field-IQ Calibration screen.

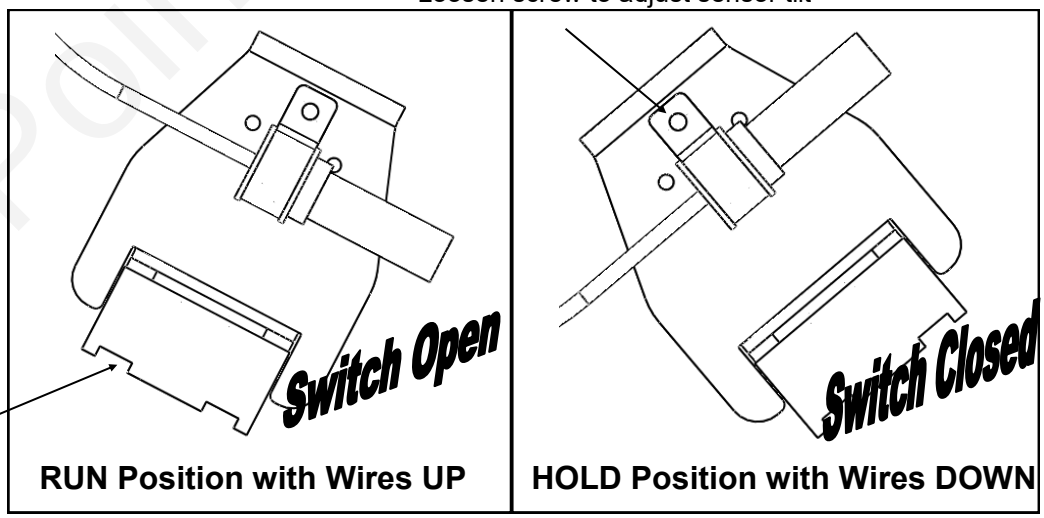
Run/Hold Switch Logic

How to Adjust:

If your controller is turning off product application before or after you want, tilt the switch. If it turns off after you want when lifting the implement, tip more to the HOLD position. If product application should begin sooner when you lower the implement, tip more to the RUN position.
You can adjust the switch by moving the magnet or by loosening the screw and rotating the mercury switch.

Loosen screw to adjust sensor tilt

Magnet to attach to metal surface.



How to Test:

To test the run / hold mercury switch you will need a volt meter. Set the meter to test continuity (or ohms). With the wires down, you should have continuity between the two pins in the connector. With the wires up, the switch should be open (no continuity).

Trimble Field-IQ Wiring Schematics

Your Field-IQ 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 Trimble Field-IQ harnesses for the 2018 season:

Adapter Harness

213-02-3764Y2 Field-IQ Adapter harness with 12-pin Product and 14-pin Section connectors

Pump Harness

207-4189Y1 12-pin Final Cable for Tower with 1 or 2 Section Valves (PWM, Flow, Pressure, Sect 1 and 2)

Or

207-4190Y1 12-pin Final Cable for SurePoint PumpRight Liquid System (PWM, Flow, Pressure)

(Note: 207-3461Y2 and 207-3462Y2 will NOT work on the Trimble system. 207-3461Y2 and 207-3462Y2 have Yellow and Black on the PWM connector. 207-4190Y1 and 207-4189Y1 have Yellow and Green.)

Section Harness (if needed)

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

Trimble Field-IQ Legacy Harnesses

Adapter Harness

201-215464Y4 Trimble Field-IQ Rate & Section Control Module to twin 16-pin AMP connectors

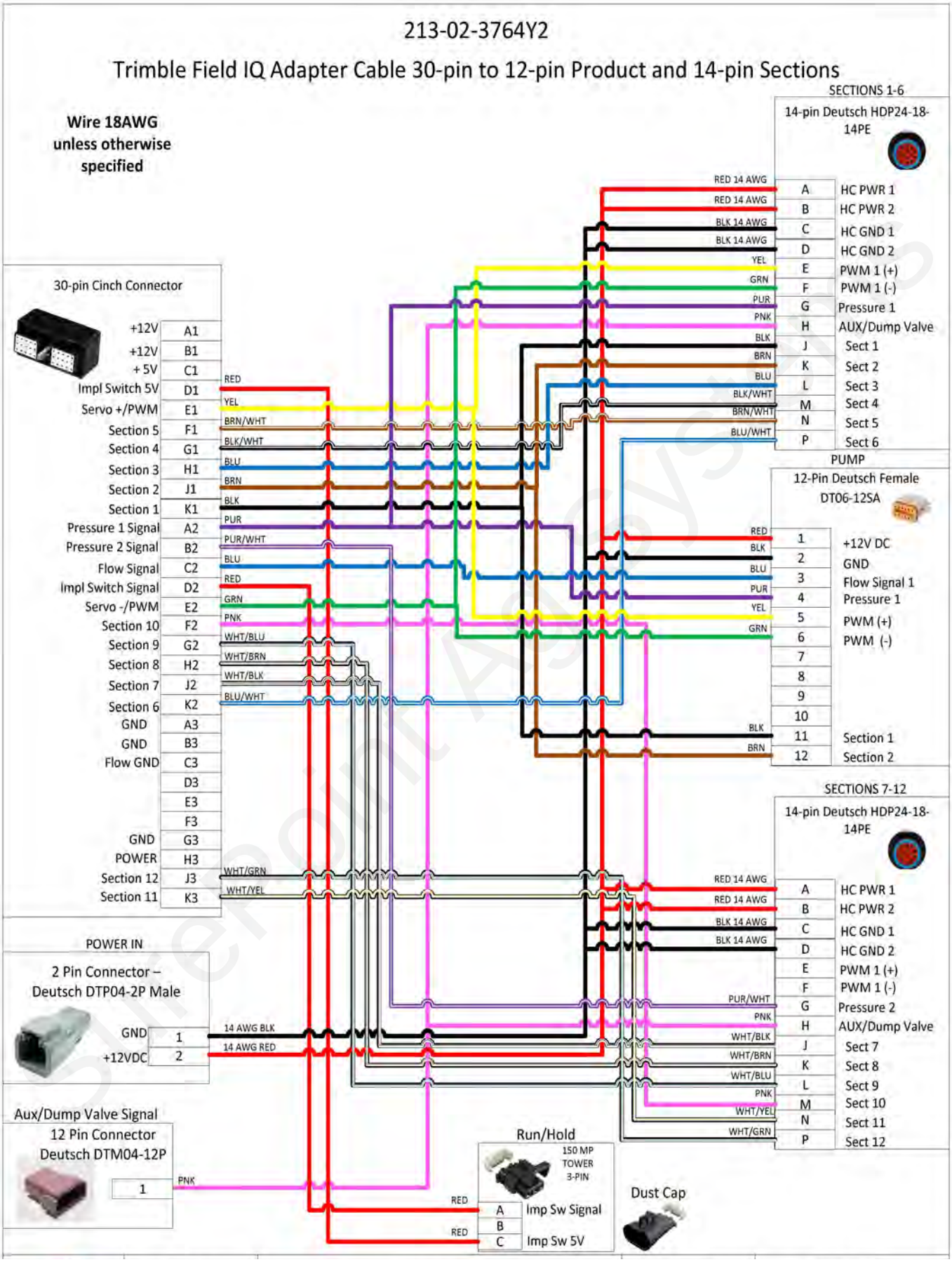
Pump Harness

207-215223Y2 PWM Pump Cable

Section Harness

207-215466Y2 16-pin 6-Section Harness

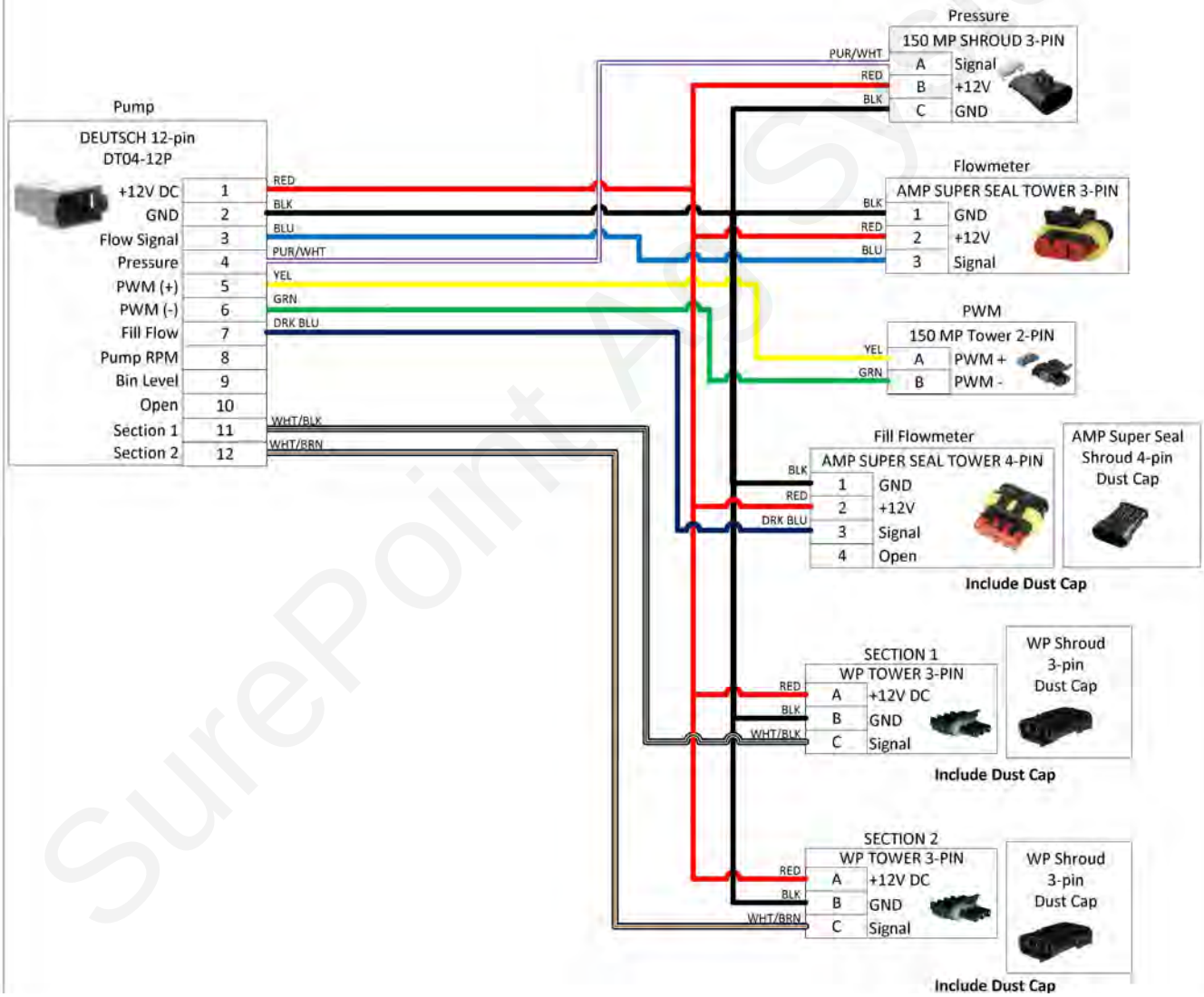
207-215467Y2 16-pin 12-Section Harness



207-4189Y1

Final Cable for Tower With 1-2 Section Valves (pwm, flow, pres., sec 1, sec 2, fill flow)

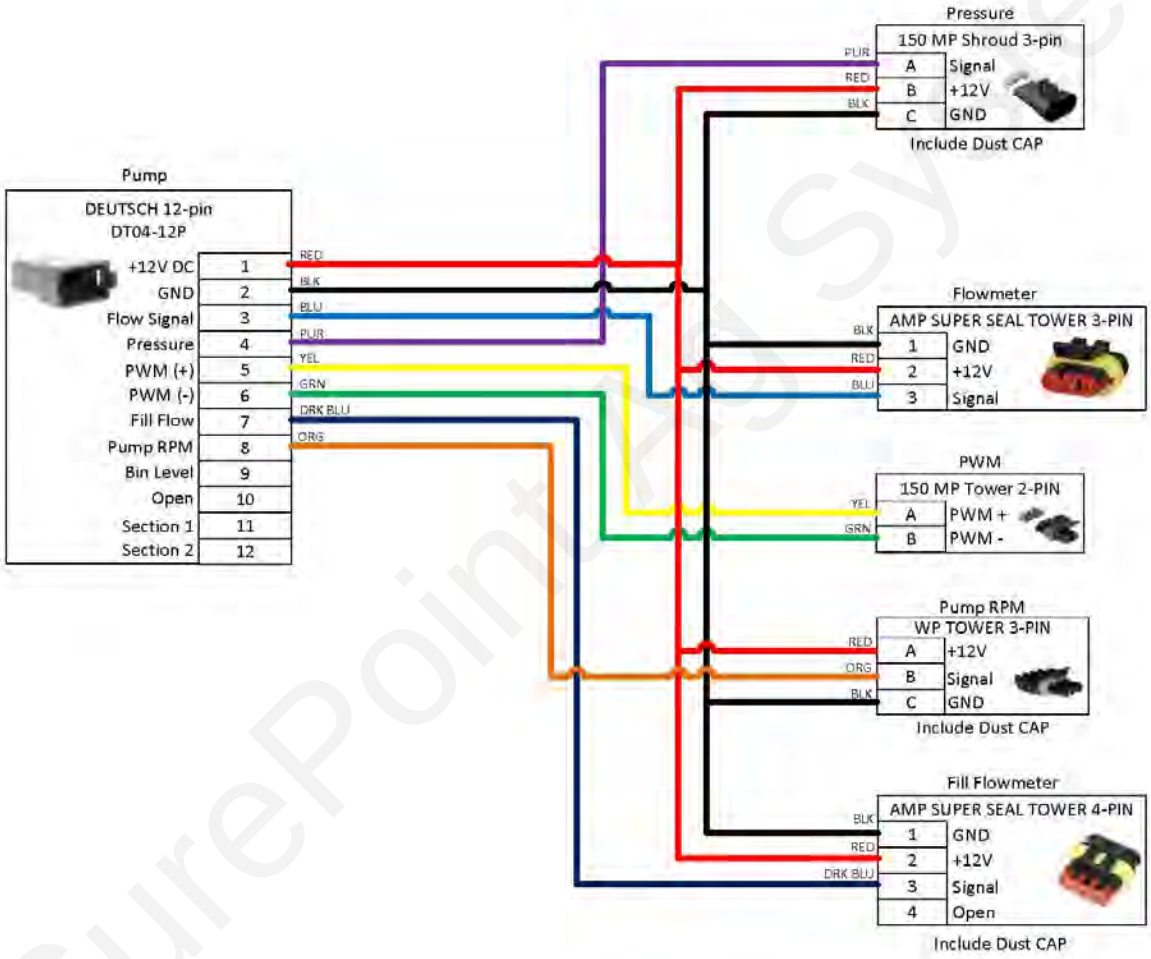
Wire 18AWG unless otherwise specified



207-4190Y1

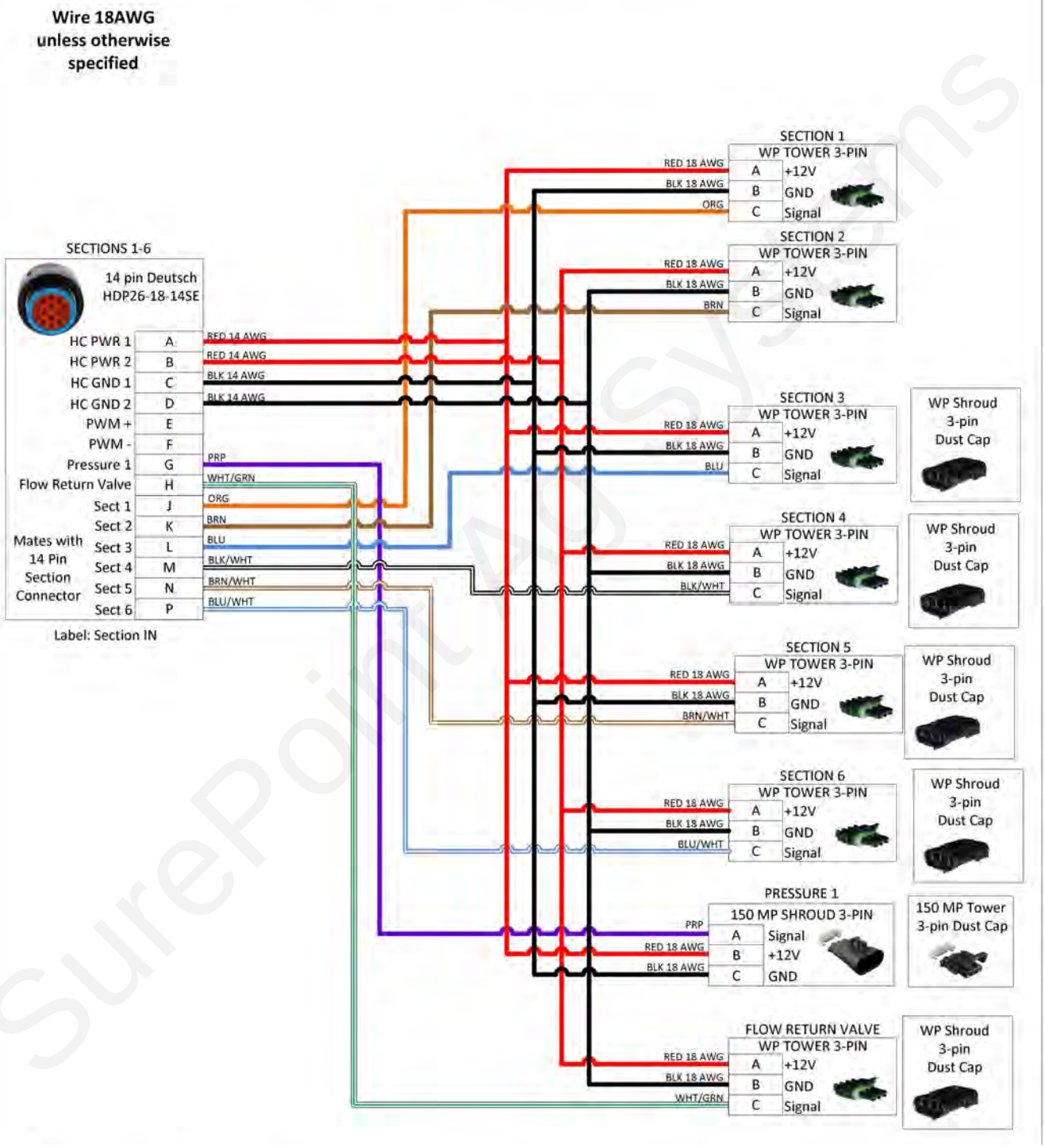
12-pin Deutsch Final Cable-same as 3462Y1

Wire 18AWG unless otherwise specified



207-3463Y1

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

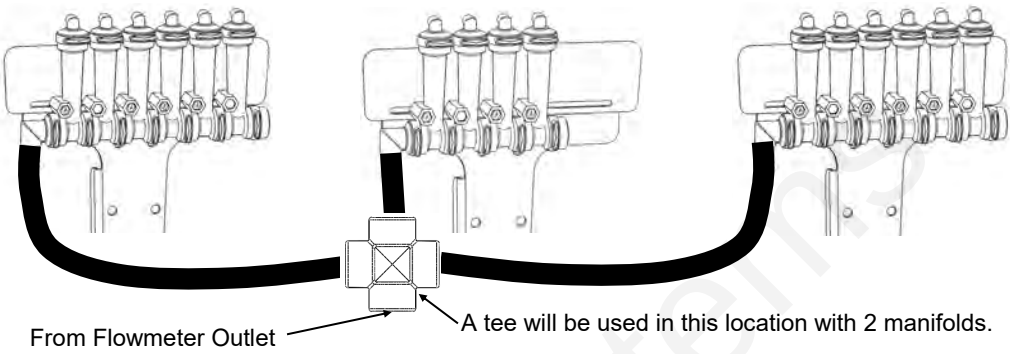


Floating Ball Flow Indicators

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

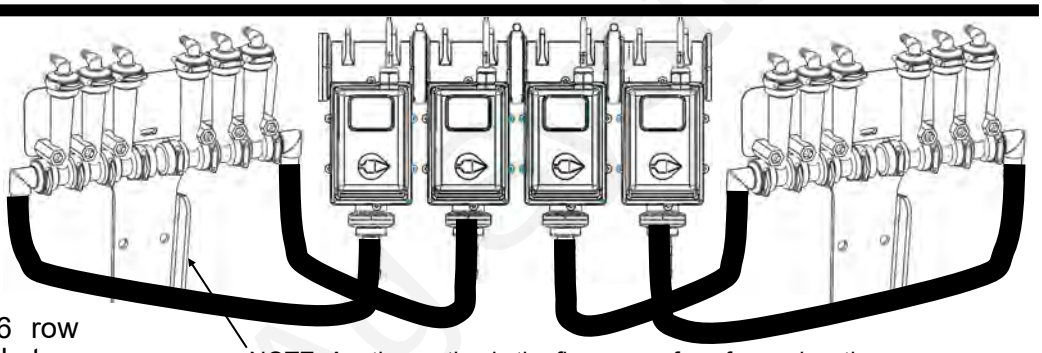
This configuration works well on a 16 row front fold planter. Each flow indicator manifold is shown fed by a cross in a single section installation. Each manifold could be fed by a section valve if desired.



12 Row
Split 3 - 3 - 3 - 3

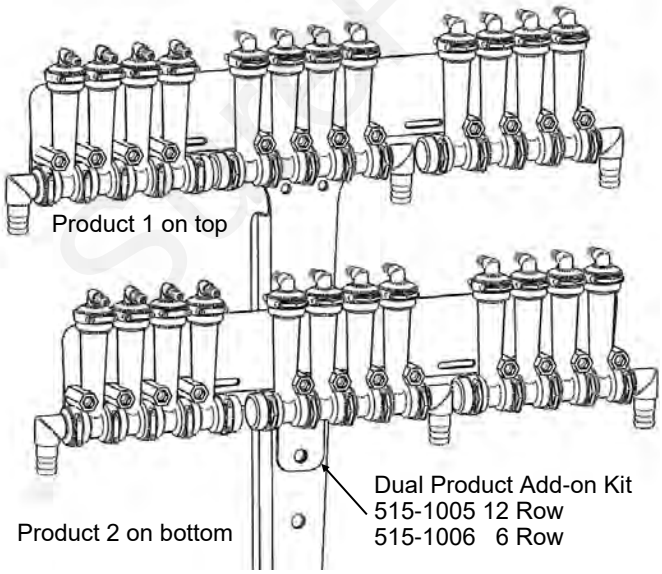
Shown here is a 12 row with four 3 row sections controlled by four section valves. Note each 6 row T-Bracket can hold two separate 3 row manifolds.

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

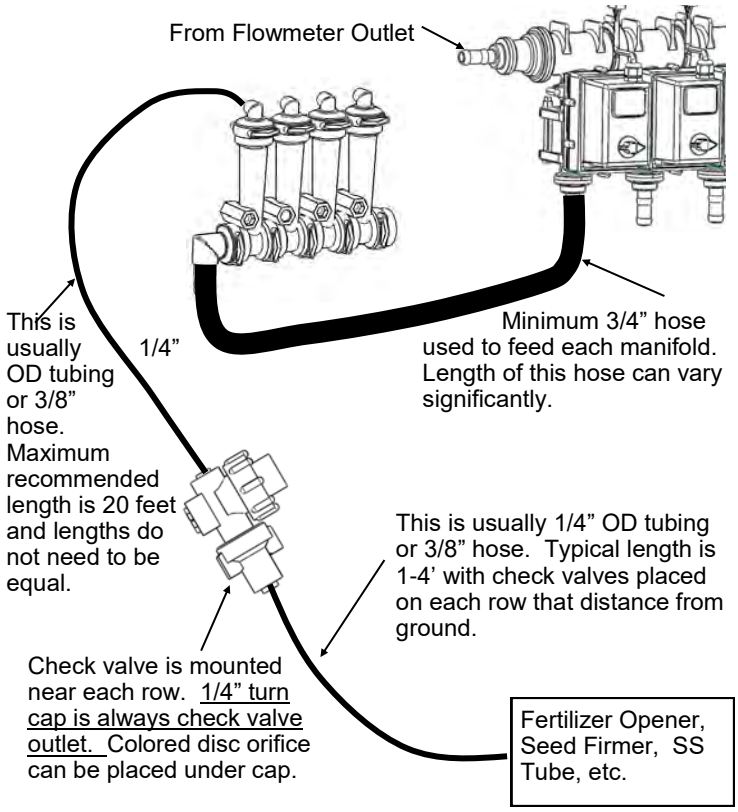


12 Row Dual Product
Product 1 Split 4 - 4 - 4 / Product 2 Split 4 - 4 - 4

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.

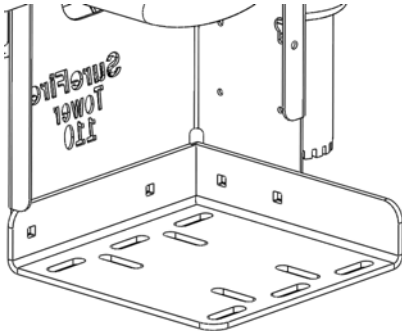


General Plumbing Guidelines

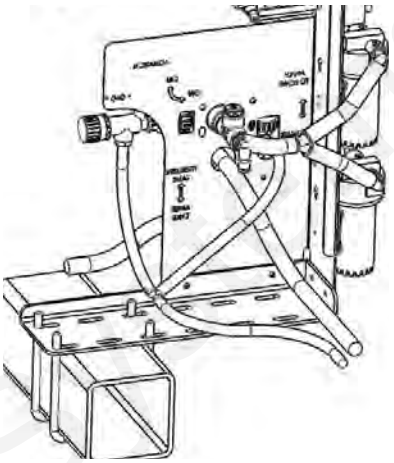


Tower 110 & 200 Mounting Options

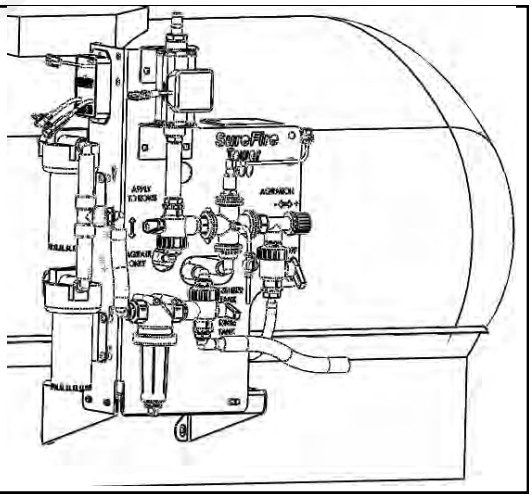
Tower Basic Mounting Bracket
Item Number:
511-1007 (8x16 hitch)
511-1008 (8x12 hitch)
This kit includes a bracket to mount to the top side of a bar or hitch and mount the tower directly over that bar. It is often used on front fold planter hitches. U-bolts to mount to two common hitch sizes are included in the kits as labeled above.

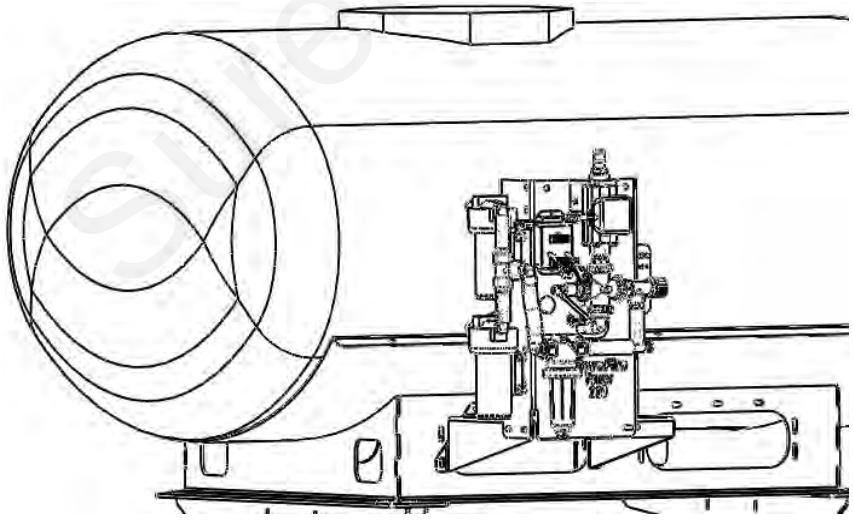


Tower Offset Mounting Bracket
Item Number 511-1010
The Tower is available as a stand alone item. This kit includes a bracket to mount to the top side of a bar and hold the Tower . U-bolts are NOT INCLUDED. They must be ordered separately based on mounting bar size. Multiple slots allow the Tower to be mounted away from or directly over the bar.



Tractor Front Mount Elliptical Cradle Tower Mounting Bracket
Item Number 511-1009
Mounts a Tower directly to the front of tractor front mount 200 & 300 gallon elliptical tank cradles. This bracket will mount the back of the tower just over 4 1/2" forward of the flat bracket mounting face. When using a tractor mounted tank, SurePoint recommends mounting the Tower near the tank, not back on the implement. Electric pumps work better to push the liquid than to suck the liquid a long distance into the pump inlet.



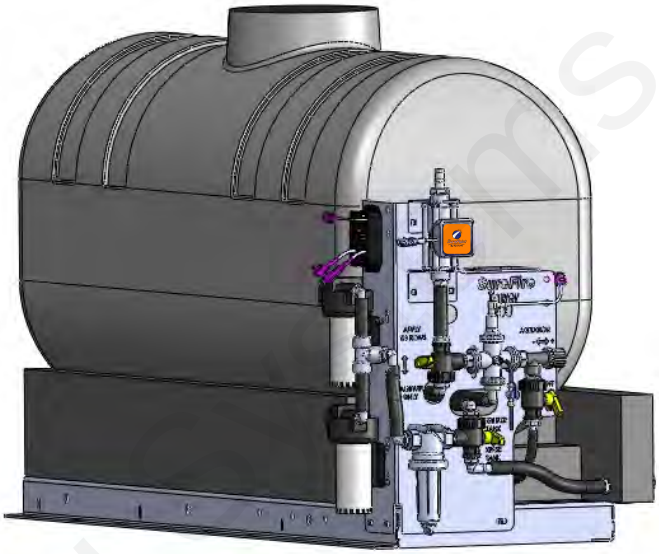


500 Gallon Elliptical Cradle Tower Mounting Bracket
Item Number 526-10-200500
Mounts a Tower directly to the side of the SurePoint 500 gallon elliptical tank cradle. This bracket will mount the back of the tower just over 9" forward of the flat bracket mounting face.

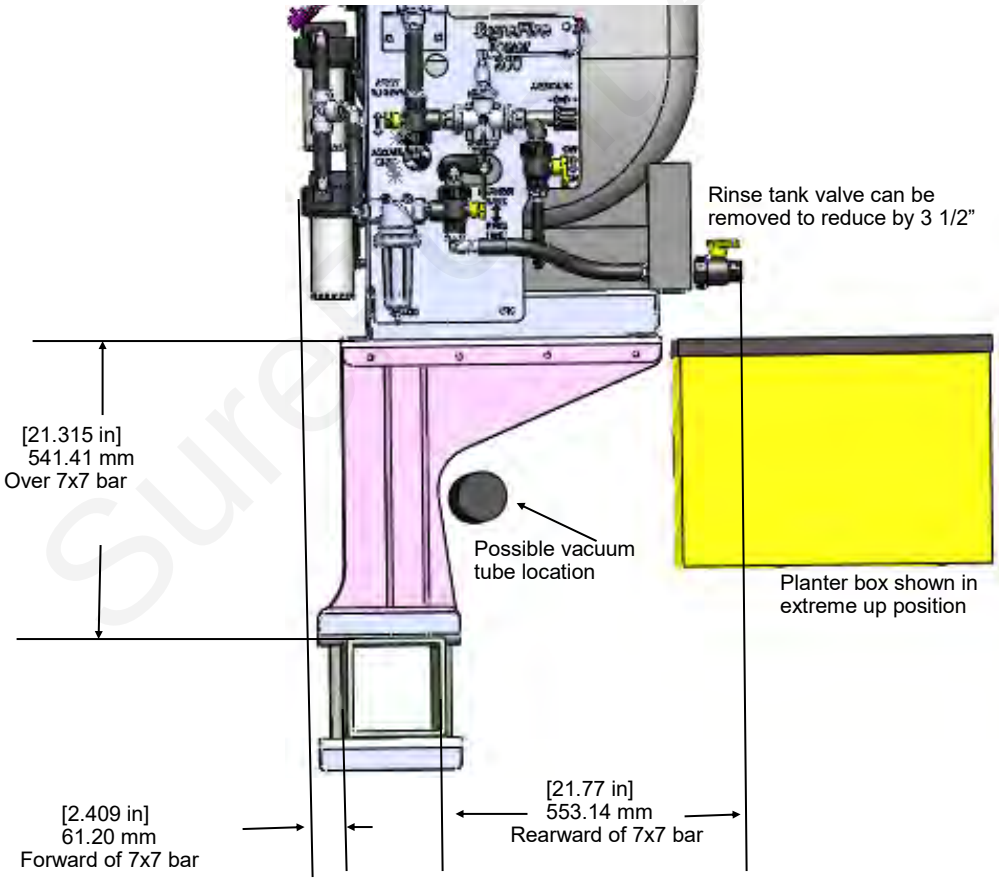
Accelerator with Tower 200 Pump Panel

The Accelerator is a completely assembled and tested fertilizer system. It has a 55, 110, or 155 gallon tank resting in a custom molded tank base that doubles as a rinse water tank. This bolts to a steel frame with eighteen 5/8” mounting slots for flexible mounting to fit many situations. The Tower 200 is often used with the accelerator to work with the rinse tank base.

Dimensions:
55 Gallon: 27” W x 54” L x 36” T
110 Gallon: 28” W x 72” L x 36” T
155 Gallon: 28” W x 72” L x 46” T

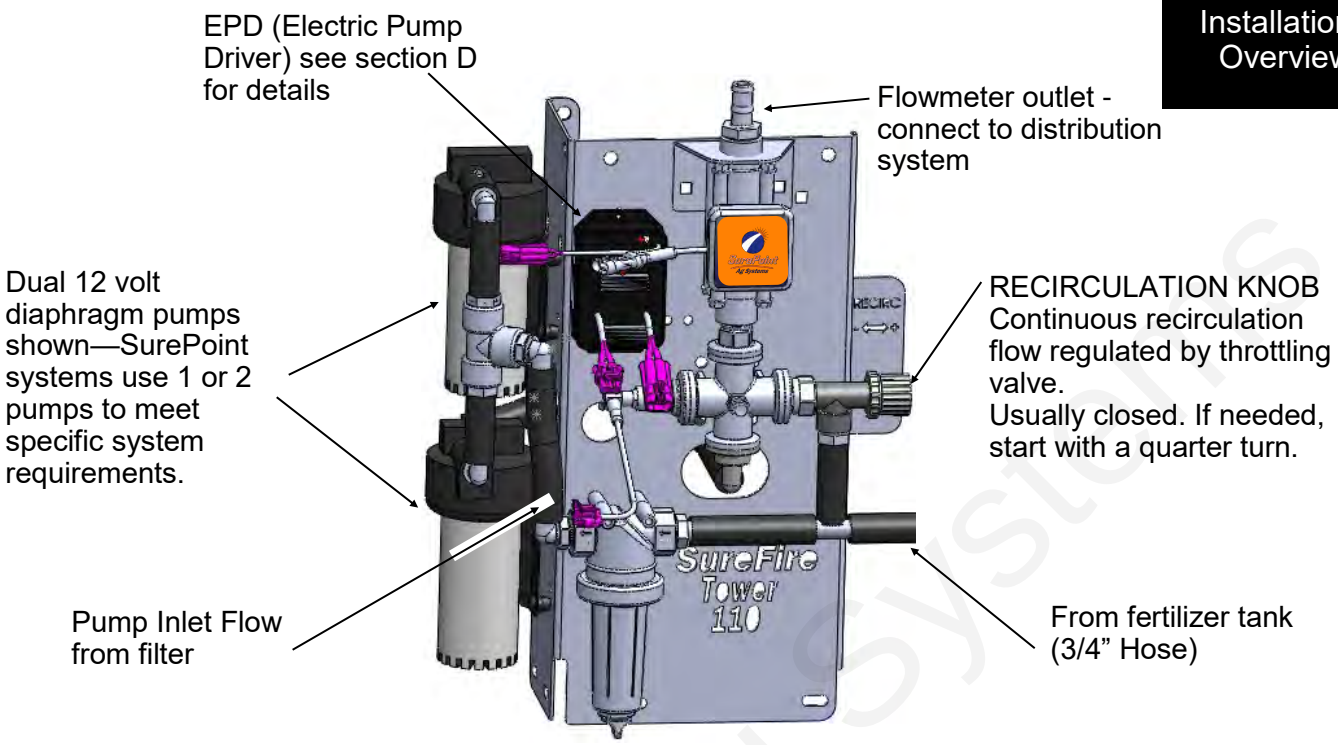


Accelerator Z Mount Kit (fits 5" to 7" wide bars, included bolts fit 7" tall bar)
Item Number 526-01-100300



This mount kit includes two welded brackets to mount any of the 3 sizes of accelerator tanks above and offset from the 7x7 planter toolbar as shown.

Tower 110 Plumbing Overview & Valve Operation



Do I need recirculation flow?

Recirculation flow allows the pump(s) to run faster than if the total pump flow was applied to the ground. This is helpful when operating at very low flow rates. On a Tower 110 equipped with two 5.3 GPM pumps, you likely will NOT open the recirculation valve if applying over 1.5 GPM to the ground.

How to use the Recirculation Adjust Valve:

Follow these steps to set the agitation adjust valve after your system is primed and tested:

1.On the Trimble display set a manual speed in speed input settings. Enter your field operating speed and rate. Turn your master switch on. The system will now operate at your Target Rate and Test Speed.

2.Start with the recirculation adjust valve completely closed and note the slow pump speed (by pump noise).

3.Open the agitate adjust valve slowly and note the increased pump speed and noise. The system is applying the same amount to the ground, the pumps are now running faster due to more recirculation flow.

4.Set the valve to somewhere in the middle based on visual observation of agitation flow needed.

5.On your Trimble display, verify the system has locked on to application rate at your agitation valve setting.

Troubleshooting:

•If the system can not reach your Target rate, you need to close the agitation adjust valve some.

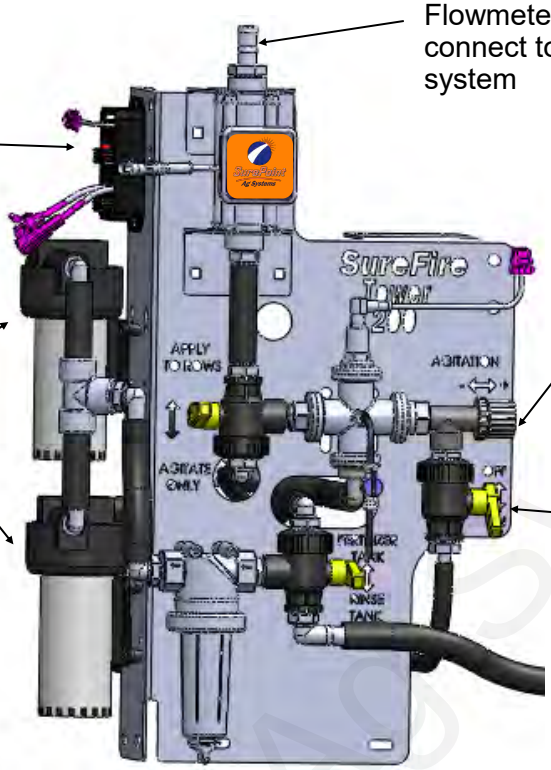
•If the system is applying a rate higher than you want and will not lock on rate, you need to open the agitation adjust valve some. Also check for a Minimum Flow setting or PWM Low Limit that may not let pump go slow.

•If the rate is still fluctuating around your target and you have a two pump system, unplug one pump. At low flows, one pump may deliver the needed rate and produce a more stable flow.

What if my product needs agitation?

- Tower Electric Pump systems can provide minimal agitation. On the Tower 110, simply remove the tee located below the recirculation valve. Connect the main hose from product tank to the filter and connect the tank agitation hose to the recirculation valve. Agitation will reduce the amount available to the rows.

Tower 200 Plumbing Overview



Flowmeter outlet - connect to distribution system

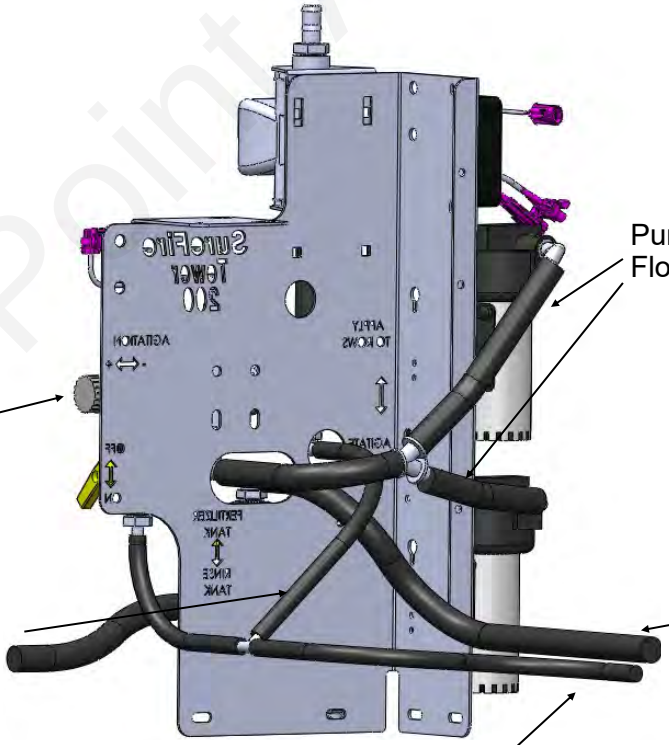
EPD (Electric Pump Driver) see section D for details

Dual 12 volt diaphragm pumps shown—SurePoint systems use 1 or 2 pumps to meet specific system requirements.

RECIRCULATION KNOB Continuous recirculation flow regulated by throttling valve. Usually closed. If needed, start with a quarter turn.

Agitation ON/OFF valve

From rinse tank base



Pump Outlet Flow

Continuous Agitation flow regulated by agitation adjust valve

Agitation flow when using agitate only mode to mix prior to application

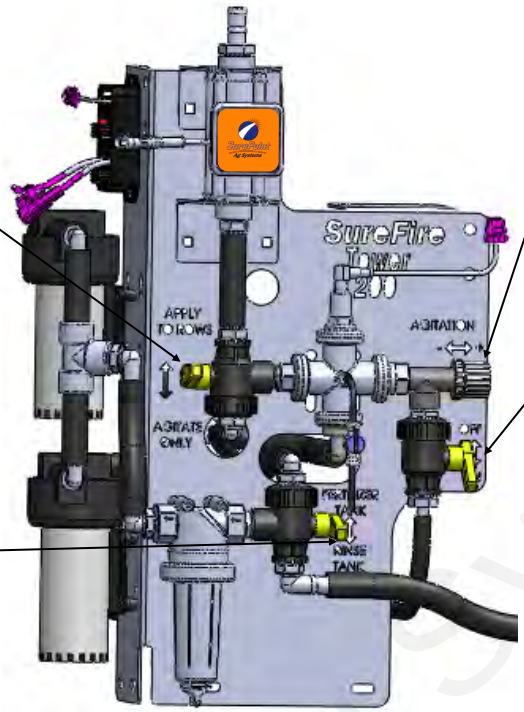
From fertilizer tank (3/4” Hose)

Agitation return to tank (1/2” hose)

Tower 200 Valve Operation

System Mode Valve: This valve selects if you will apply to the rows. **Valve must be in the up position for field operation**. Move down to Agitate Only for tank mixing prior to field operations.

Tank Selection Valve: This valve selects if product is pulled from the fertilizer tank or rinse tank. **For field operation the valve must be up**. Move down to Rinse Tank to flush fertilizer system.



Agitation Adjust Valve: RECIRCULATION KNOB
This valve adjusts how much flow returns to the tank while working in the field. Normally closed. If needed, start with a quarter turn.

Agitation On/Off Valve: This valve will shut off agitation flow without the need to move the agitation adjust valve**. <u>This valve must be closed when rinsing the system with product still in the fertilizer tank. If not closed, the rinse water will be injected into the fertilizer tank through the agitation line.</u>**

How to use the Agitation Adjust Valve:

Agitation or recirculation flow serves two purposes. First, it mixes products that will separate. Second, it allows the pump(s) to run faster than if the total pump flow was applied to the ground. The pump(s) will become difficult to control if they are operated at the slowest speed possible. By circulating product back to tank, the pump(s) will run faster, producing a more stable flow.

Follow these steps to set the agitation adjust valve after your system is primed and tested:

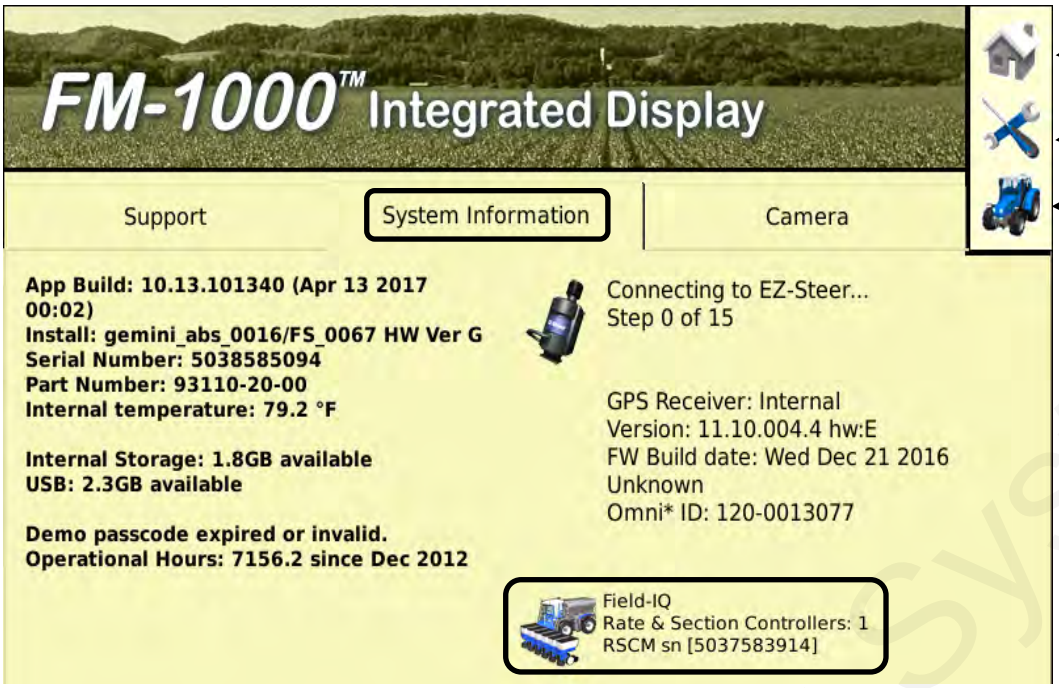
1. On the Trimble display set a manual speed in speed input settings. Enter your field operating speed and rate. Turn your master switch on. The system will now operate at your Target Rate and Test Speed.
2. Open the Agitation On/Off valve.
3. Start with the recirculation adjust valve completely closed and note the slow pump speed (by pump noise).
4. Open the agitate adjust valve (Recirculation Knob) slowly (start with a quarter turn) and note the increased pump speed and noise. The system is applying the same amount to the ground, the pumps are now running faster due to more recirculation flow.
5. Set the valve to somewhere in the middle based on visual observation of agitation flow needed. (A quarter to a half turn is often sufficient recirculation to speed the pump up slightly.)
6. On your Trimble display, verify the system has locked on to application rate at your agitation valve setting.

Troubleshooting:

- If the system cannot reach your target, you need to close the agitation adjust valve some.
- If the system is applying a rate higher than you want and will not lock on rate, you need to open the agitation adjust valve some. Be sure there is not a Minimum Flow Setting or Low PWM Limit.
- If the rate is still fluctuating around your target and you have a two pump system, unplug one pump. **At low flows, one pump may deliver the needed rate and produce a more stable flow.**

Trimble® Field-IQ™ Setup for TMX-2050, FmX® or FM-1000™

Home Screen > System Information



Home

Configuration Setup - Diagnostics

Run Screen

Check with your Trimble dealer for the latest software/firmware updates.

System Information

From the HOME screen, you can select 3 tabs; Support, System Information or Camera. The **System Information** tab is shown above. This will show what Trimble components are properly connected to your display. **If your fertilizer system quits functioning, first check that the Field-IQ Rate & Section Control Module is still recognized on the display.** If not, inspect the Trimble wiring harness connections or consult your Trimble dealer.

CFX-750 and FM750 Users

The SurePoint Tower system will also work with Field-IQ on the 750 displays. All the information in this manual is applicable to the 750 except for screen shots shown in Section F, Setup & Operation. The calibration and setup values in section F DO apply to the 750. However, the 750 has a completely different screen layout and menu structure that is not shown in this manual. Use your Trimble manual to navigate, then enter the appropriate numbers from the SurePoint manual.

Use your Trimble FmX® Integrated Display USER GUIDE (Chapter 10 Field-IQ Plugin) or CFX-750™ Display USER GUIDE (Chapter 5– Field IQ System) for further configuration instructions.

TMX-2050 Users

The SurePoint system works well with the TMX-2050 running the FMX Plus Application. Some screens look a little different, but setup is similar to the Field-IQ setup for the regular FmX.

The TMX-2050 and latest versions of the FmX software use the Proportional Gain setting instead of the Integral Gain. Using the AutoTuning procedure should give values that work. The screenshots on the following pages show what a typical setup might look like. Your setup may vary from what is shown.

The *TMX-2050 User Guide* has complete information on the setup and operation of this display.
Chapter 6 > Implements > see *Application control*
Chapter 10 > Operations > Field-IQ system operations *Chapter 11 > Diagnostics / Troubleshooting*

FmX & FM-1000 Home Screen > Support

FM-1000™ Integrated Display

Support | System Information | Camera

To upgrade (or change) the software version on the Field-IQ Rate and Section Control, go to Home Screen > Support > Upgrade > Field-IQ and select the FIQ_Rate_Section_Module version that you want to use.

3.20 has been a good version.

There have been issues with 4.09 or 4.11.

4.13 and above should be OK. 3.20 has worked almost all the time.

To identify which version is being used, Field-IQ > Diagnostics > Hardware (see below).

Data Files

Upgrade

Unlocks

Firmware Upgrade

Hardware

Display

Field-IQ

Firmware

FIQ_Rate_Section_Module_3_20

~~FIQ_Rate_Section_Module_4_09~~

~~FIQ_Rate_Section_Module_4_11~~

FIQ_Rate_Section_Module_4_13

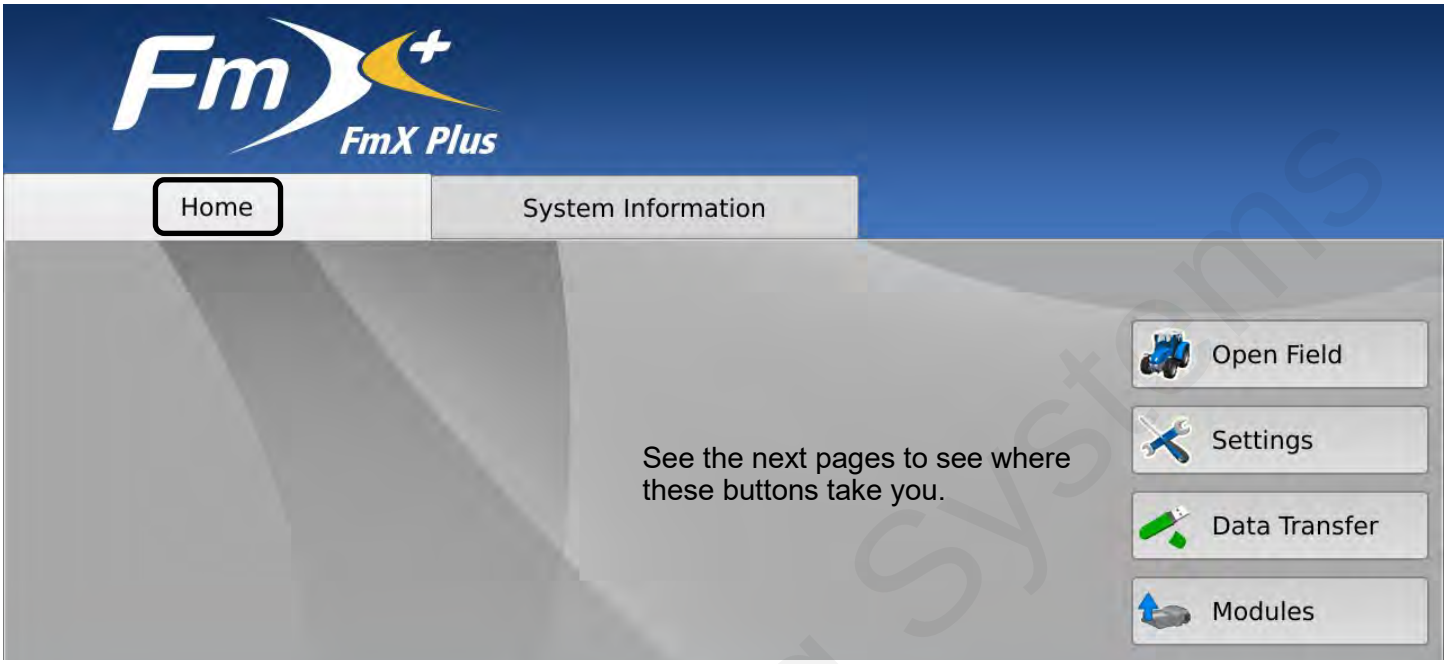
Field-IQ Diagnostics

Operations | Hardware | Sensor | Row Monitor

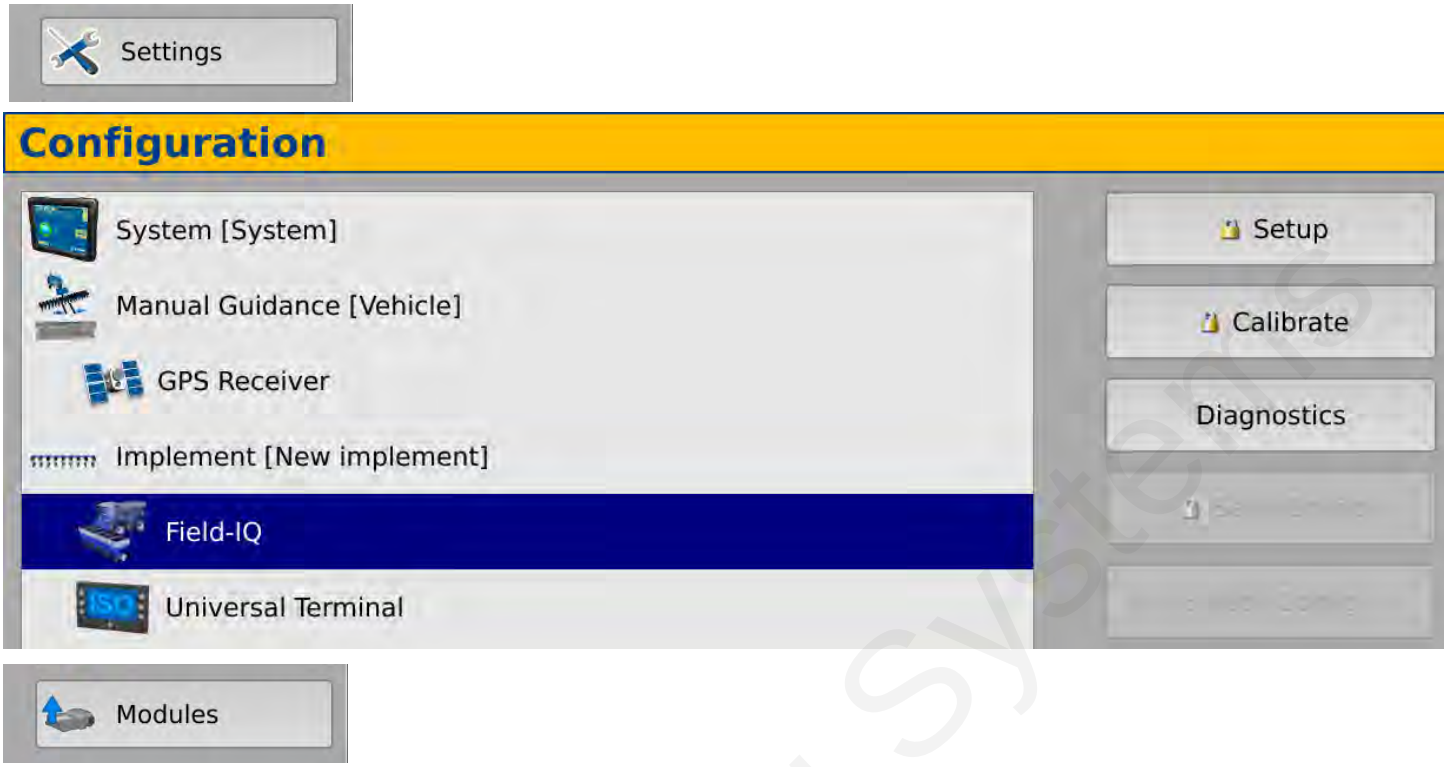
Controller	S/N	Position	Version	Status	Details	Auth	Tx/Rx	Errors (C
Rate and Section Control Module	5607501428	n/a	4.13	Master is off		Yes	98 / 99	
Rate and Section Control Module	5315512570	n/a		Not detected		No	0 / 0	
Master Switch Box	5537500244	n/a	3.06	Connected		Yes	98 / 99	

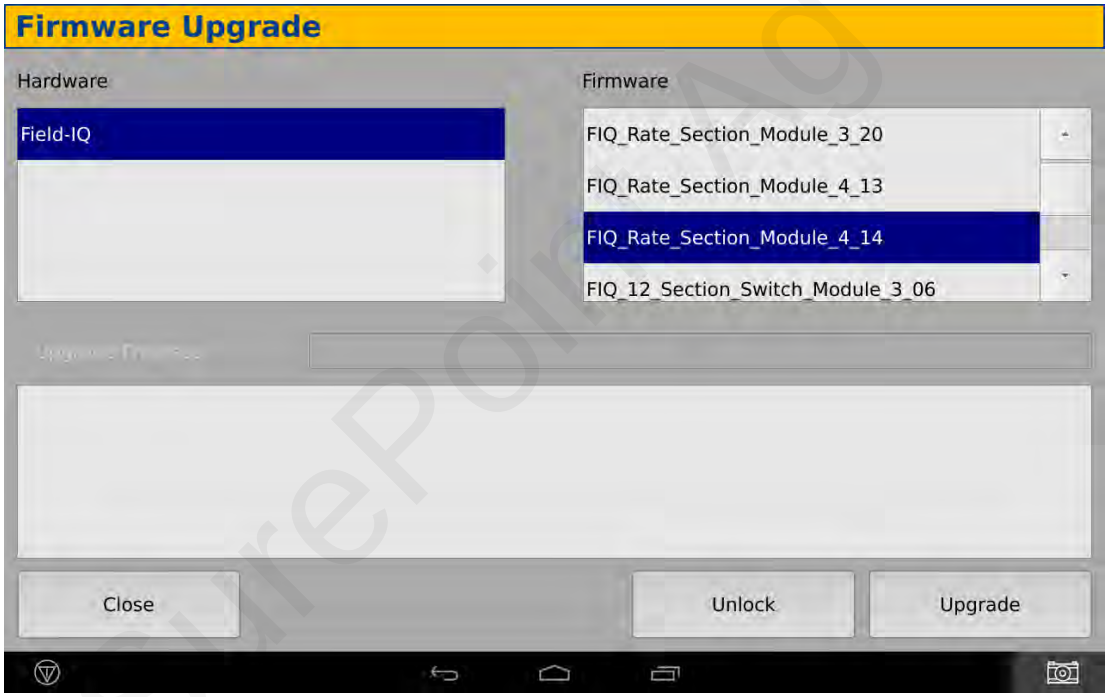
TMX-2050 with FmX Plus > Home Screen > System Information

On the TMX-2050 Startup screen, press the FmX Plus icon to start the FmX Plus app.



TMX-2050 with FmX Plus > Home Screen >





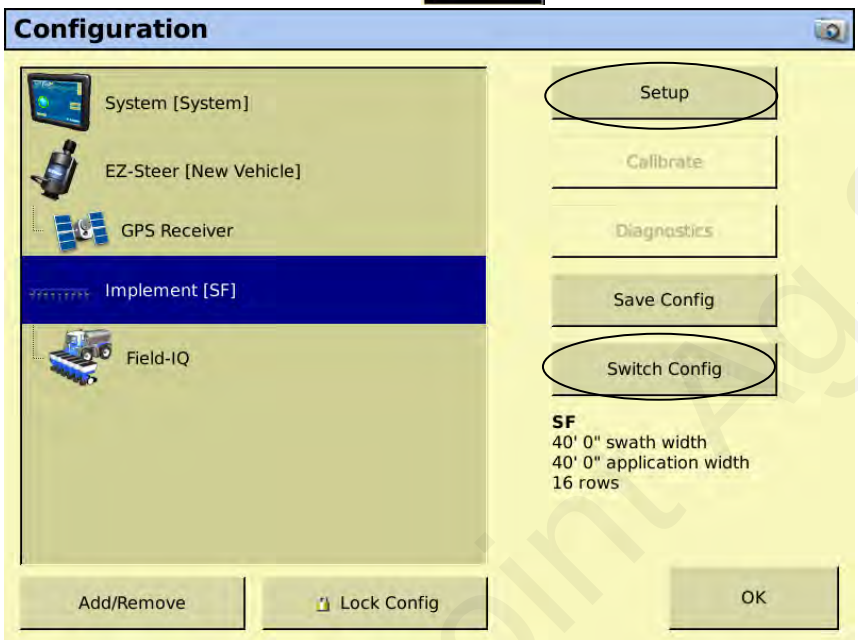
3.20 has been a good version. If you have problems with another version, try 3.20.

⚠ WARNING

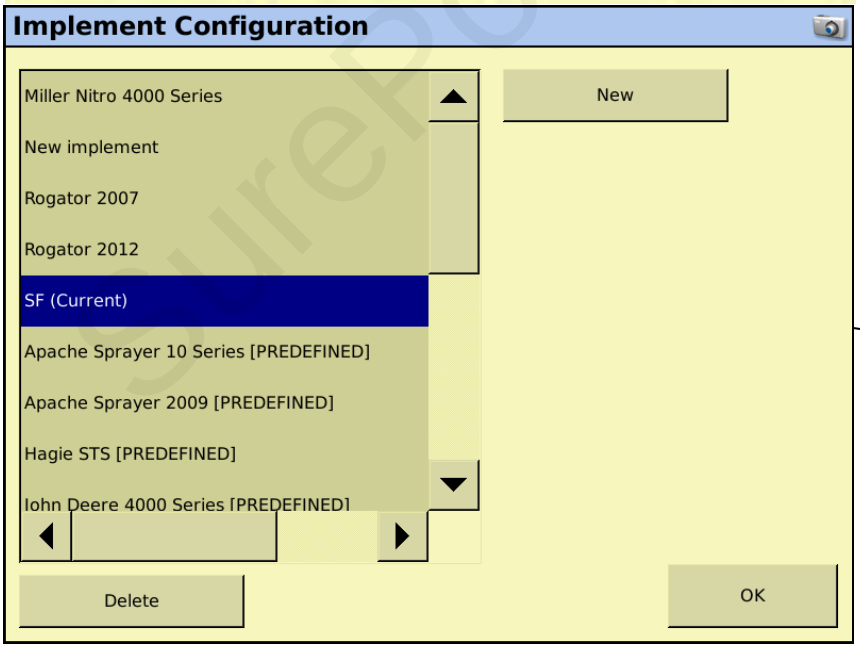
The operator is responsible for knowing and understanding the safe operation of this equipment. Systems with hydraulic equipment require additional safety precautions to prevent serious injury and/or death.

Implement Setup

Implement Setup is where you set the information for the implement you are using. Some of these settings affect the guidance control. However, if using auto section shutoff, these settings will determine when each section valve shuts off.
Measure your implement carefully and consult your Trimble dealer or the Trimble FmX Integrated Display User Guide (Chapter 10) for additional assistance with the Implement Setup section.

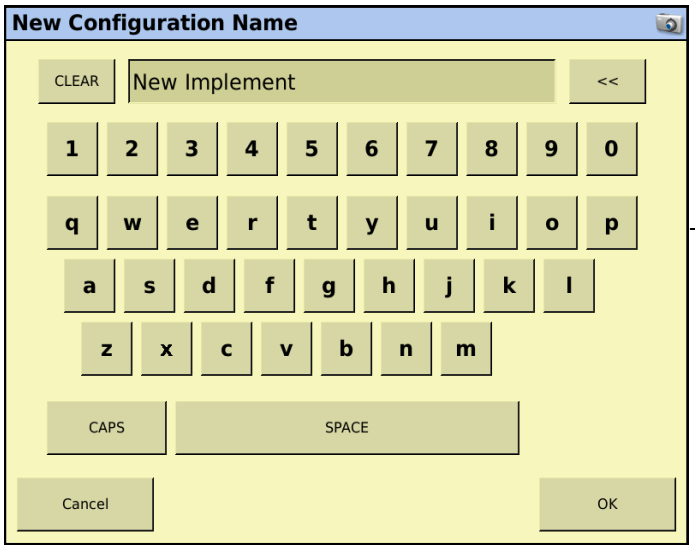


1. From the Home Screen select the wrenches to go the Configuration screen.
2. The Configuration screen below will appear. Choose **Implement**. If the Setup button is locked, shown by a padlock next to it, Push **Setup** (to edit the Implement that is shown) or **Switch Configuration** (to set up a new Implement or to switch to an Implement previously entered), then enter "**2009**".
3. You will be ready to edit the Implement Setup or to enter a New Implement Setup.

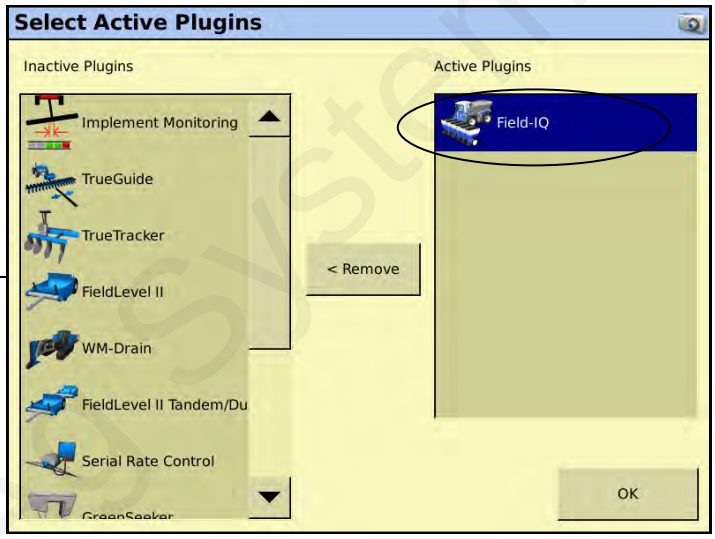


From this screen, either select a previously entered Implement or select **New** to set up a new implement.

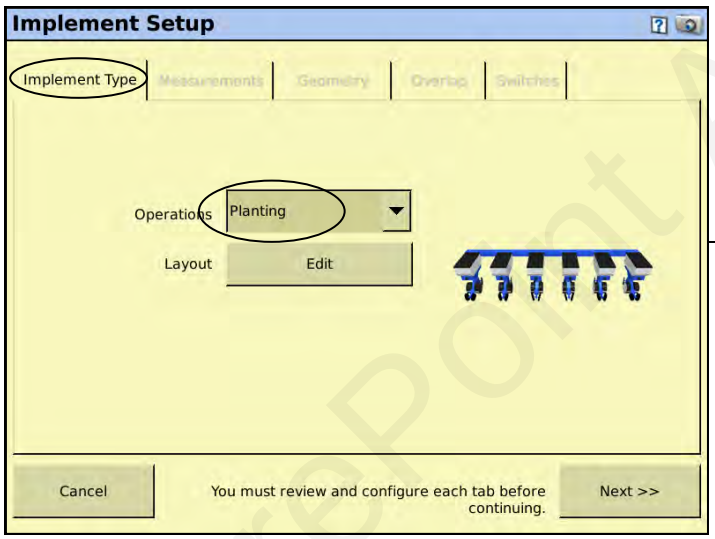
Implement Setup (continued)



If entering a New Implement, type in a name for the Implement, and then press OK.

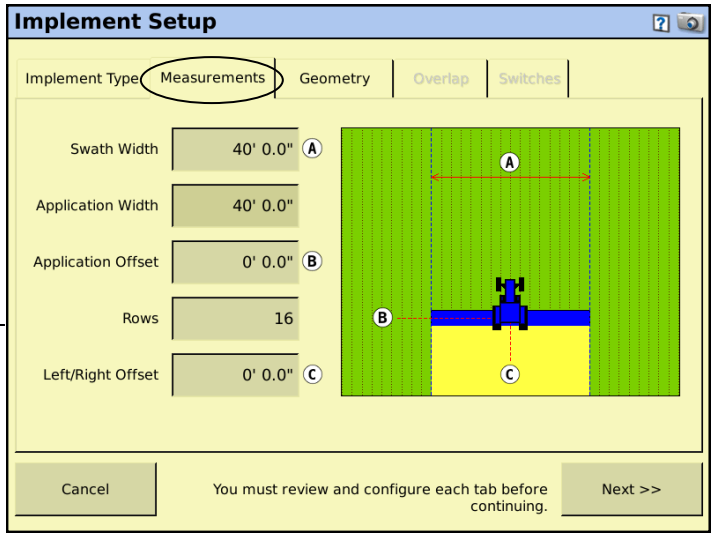


Select **Field-IQ** as the Active Plugin.



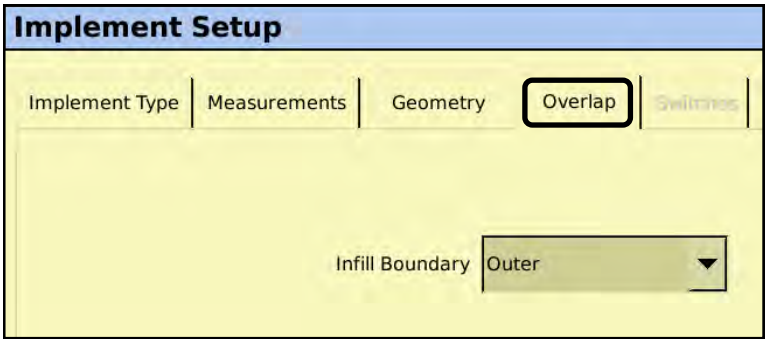
For Implement Type, select **Planting** (if setting up a planter to apply fertilizer) or the appropriate Implement Type.

Edit the Layout of the Planter (or other Implement) as needed.



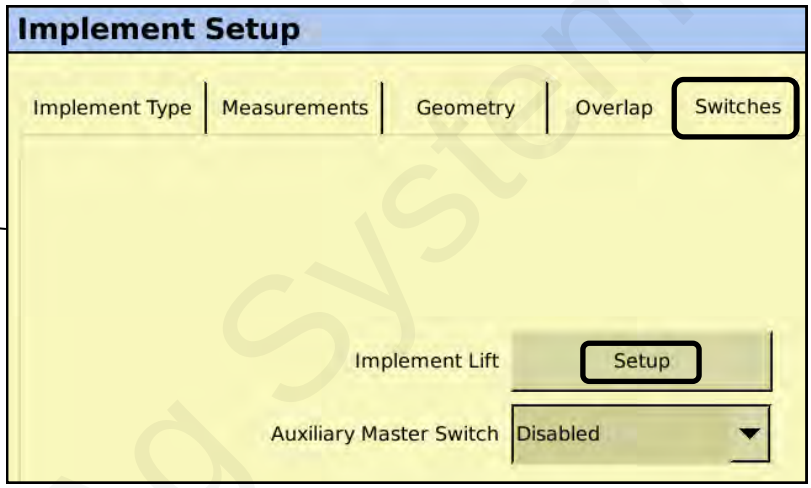
Enter the appropriate measurements for the Implement.
On the **Next** screen, enter the **Geometry** measurements requested.

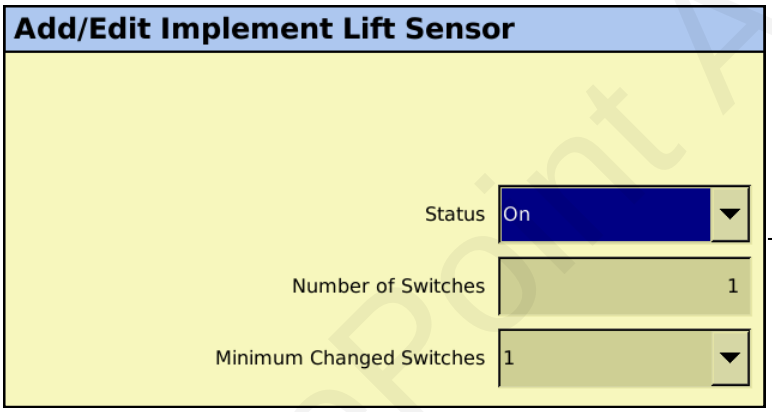
Implement Setup (continued)



Select either "**Outer**" or "**Inner**" for the Infill Boundary on the Overlap Tab.
Outer uses the field boundary as the infill boundary. **Inner**: When running a Headland setting, this moves the boundary to the inside of the last headland pass.

If you are not using an Implement Lift Switch (also known as a Mercury Run/Hold Switch), just press **OK.**
If you will be using an Implement Lift Switch, press **Setup.**

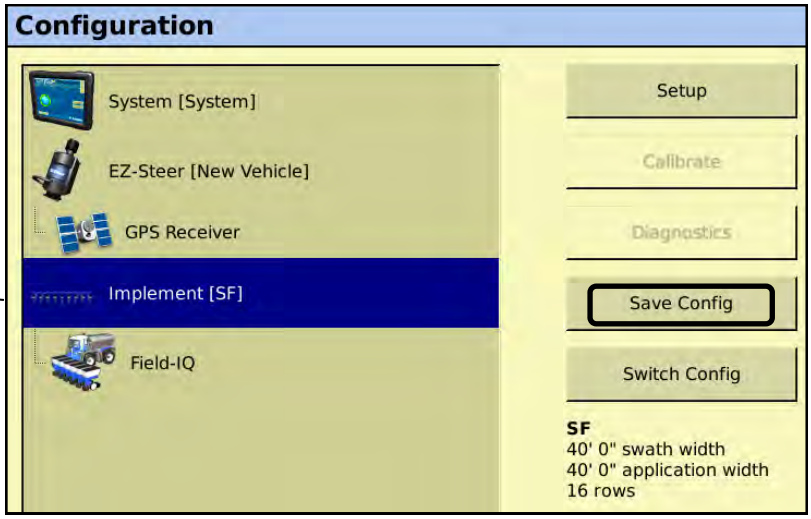




If using an Implement Lift Switch, change the Status to **On**. Enter the number of switches and the minimum number of switches that need to change.
You will need to Calibrate the Implement Lift Switch later on by going to Field IQ - Configuration - Implement Lift Switch (see page 25 and page 50.)

When you return to the beginning screen, select **Save Configuration**.

The Implement should be set up.

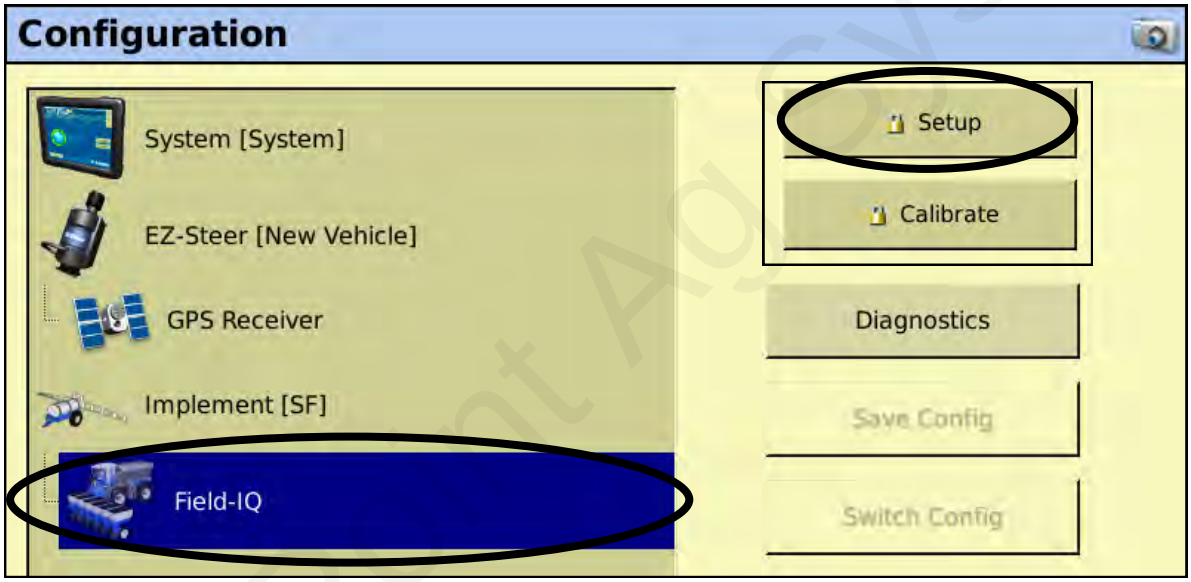


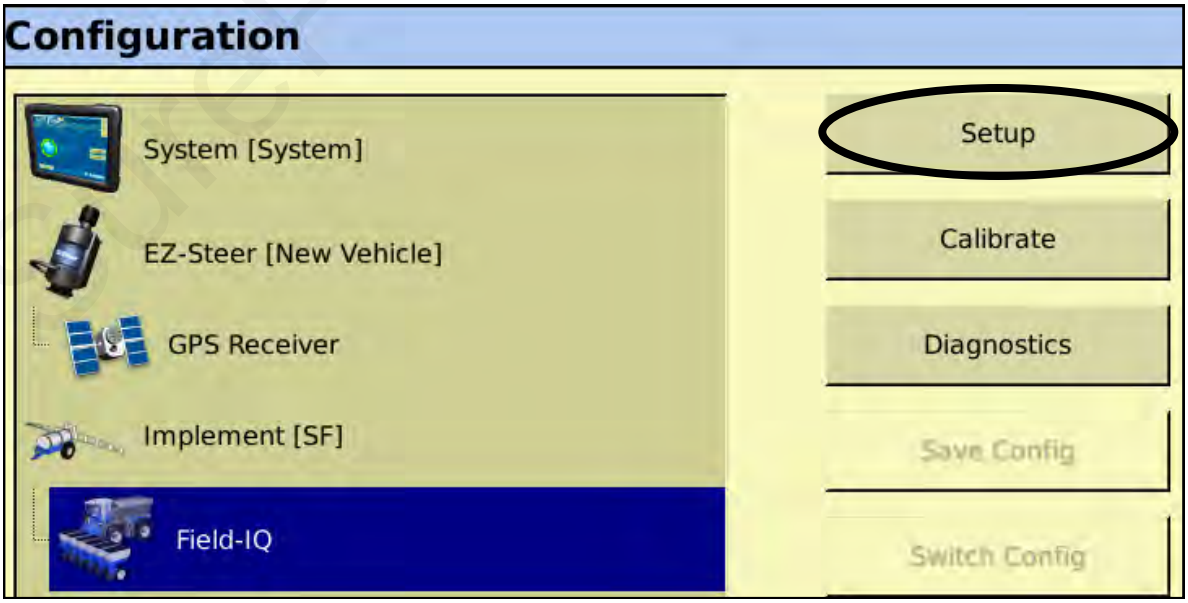
Configuration - Field-IQ™ Setup

In the Setup & Calibrate menus you will set the Trimble Field-IQ to work properly with the SurePoint Fertilizer System. Carefully follow these steps to first make the proper settings. Then, run the tests shown to verify your fertilizer system is ready to go to the field.

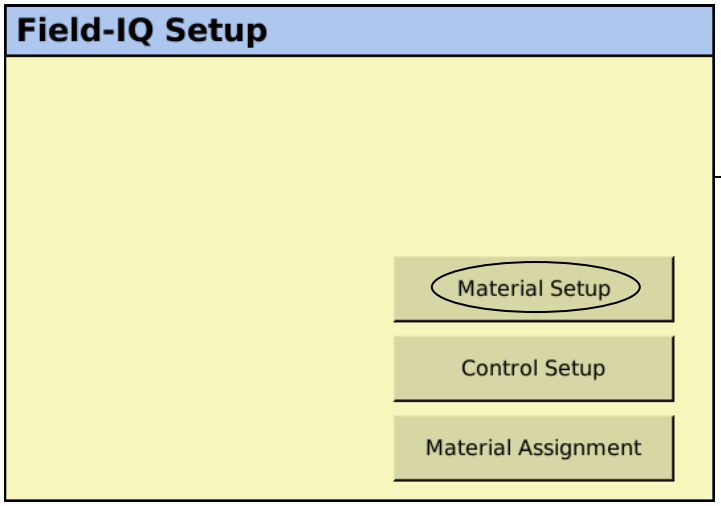
1. From the Home Screen access the Configuration screen (wrenches).
2. The Configuration screen below will appear. Choose **Field-IQ**. If the Setup & Calibrate buttons are locked, shown by a padlock next to them, Push **Setup**, then enter "**2009**".
3. After entering the code, the locks will disappear. Push Setup to proceed to the next steps.

(If the Calibrate and Diagnostics buttons are grayed out, you probably need to close a Field.)

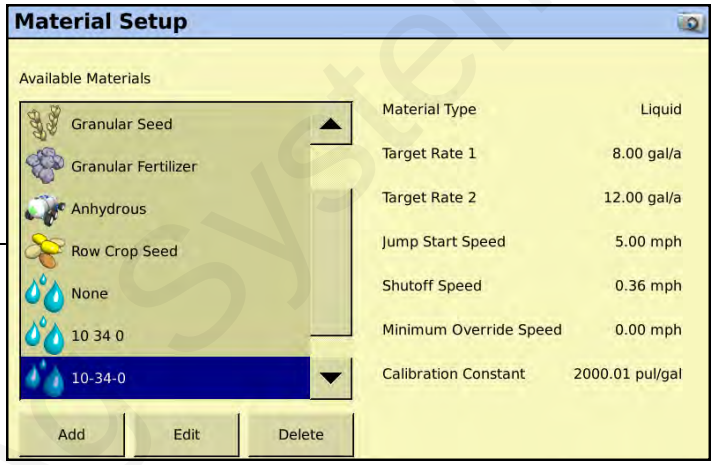




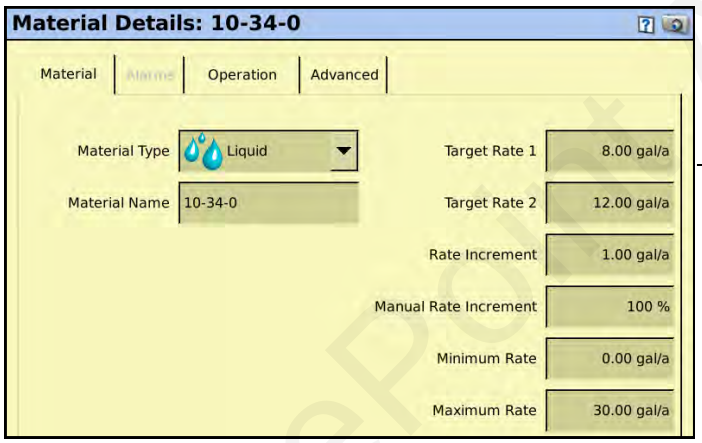
Material Setup



To set up the Material, press **Material Setup**.



Select one of the Available Materials or press **Add** to add a new material.
Press **Edit** to change any of the parameters of the Material.



Set **Target Rate 1 & Target Rate 2** as desired.

Rate Increment increases or decreases Rate 1 or Rate 2 by this amount each time you press the Rate Adjustment Switch on the Master Switch Box.

Manual Rate Increment works when the Rate Switch is in the Manual Position. This number controls the speed at which the valve increases or decreases when you press the Rate Adjustment Switch on the Master Switch Box.

Minimum Rate is typically set at 0.

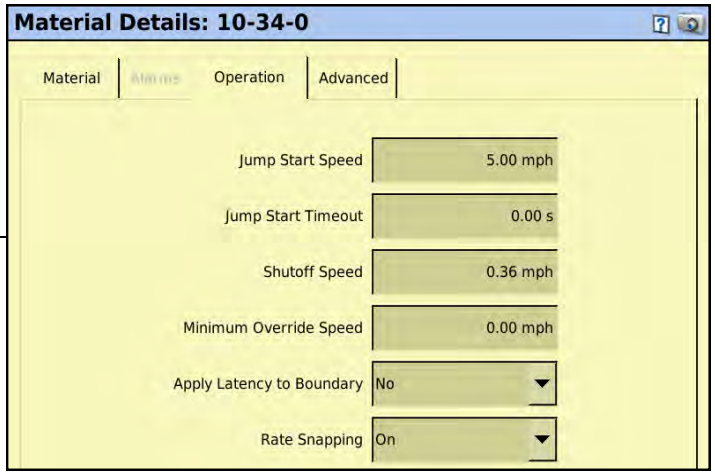
Maximum Rate is set at something higher than the maximum rate that will be applied.

These parameters may be adjusted as desired.

Jump Start Speed is the speed the system will ramp up to when the operator pushes the Jump Start button on the Master Switch Box. 3.0-5.0 mph is a good setting for this. **Jump Start Timeout** allows the Jump Start Speed to run for a specified amount of time.

Apply Latency to Boundary: Set as needed so the system begins applying when needed.

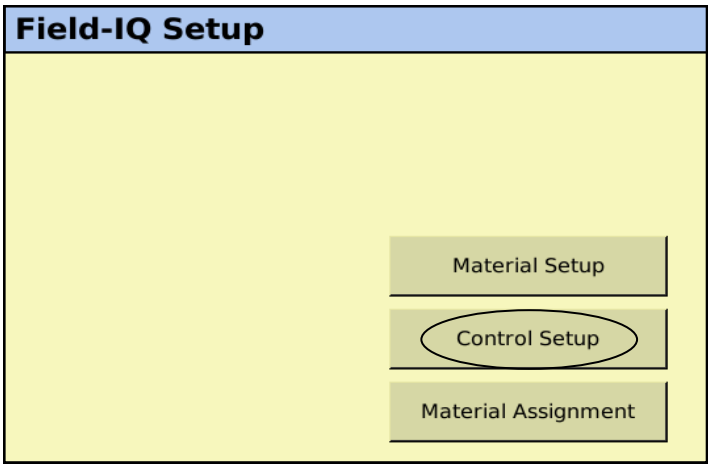
SurePoint recommends setting the **Rate Snapping** to **On.** This will smooth out the rate fluctuation seen on the screen. If you are within the rate smoothing range, the applied rate will just show your target rate, and not small deviations from the target rate.

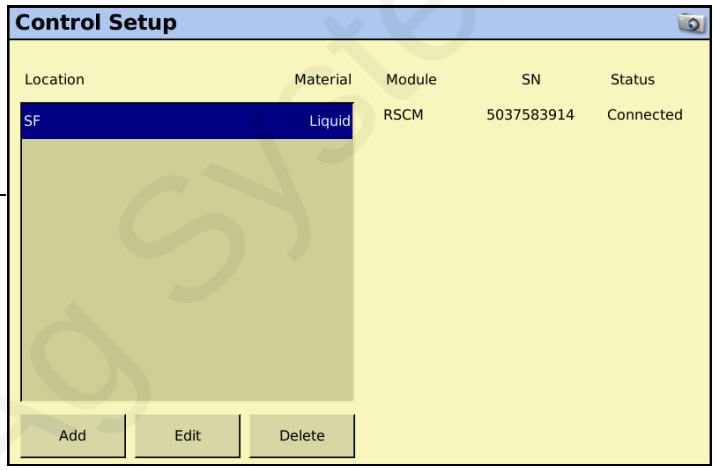


Trimble® Field-IQ™ Setup for FmX® or FM-1000™ (continued)

Control Setup

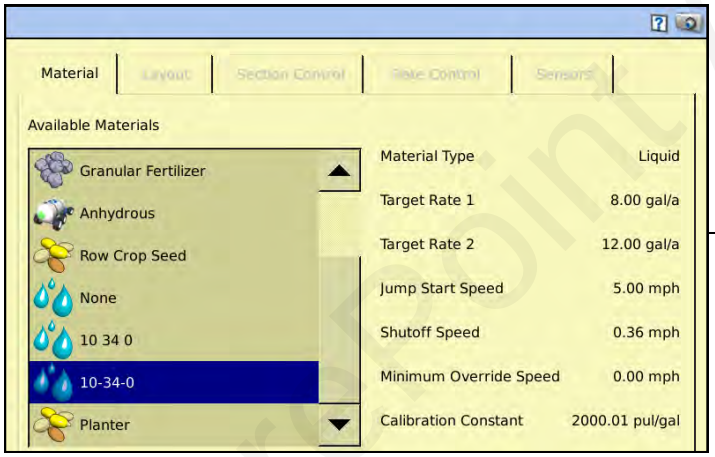
See the FmX Integrated Display User Guide, beginning on page 10-22, for more information.



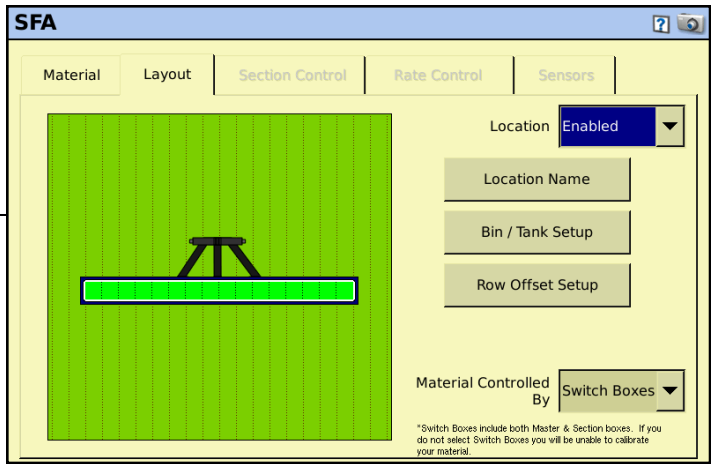


If this is the first time to do Control Setup, there will be no Locations entered. In that case, press **Add** and enter the information for a location.

If there is a location and material set up, you can select and/or edit it.

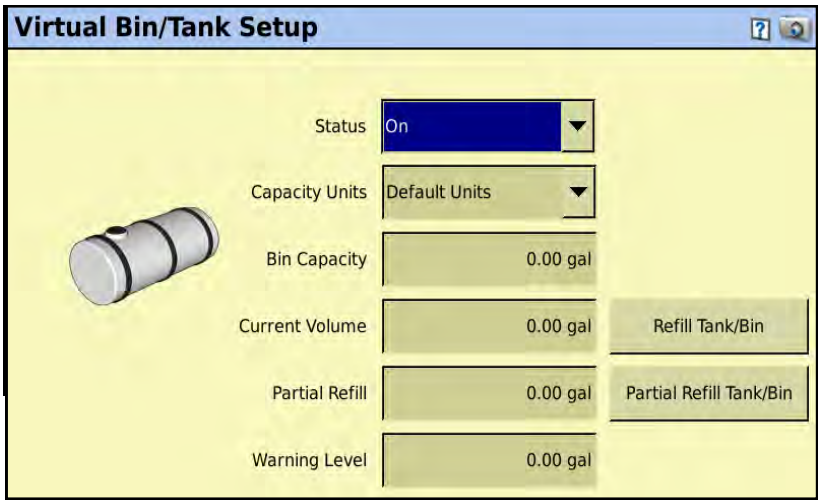


Select an Available Material.



From this screen, you can add a **Location Name** such as Front Tank, Rear Tank, etc..

If desired, you can set up the **Bin/Tank Setup** to allow the system to track how much material is left in the tank. (See screenshot on next page)

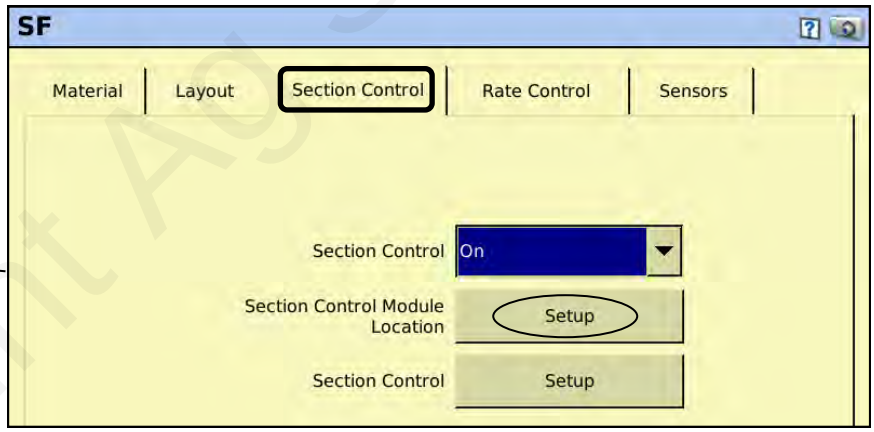


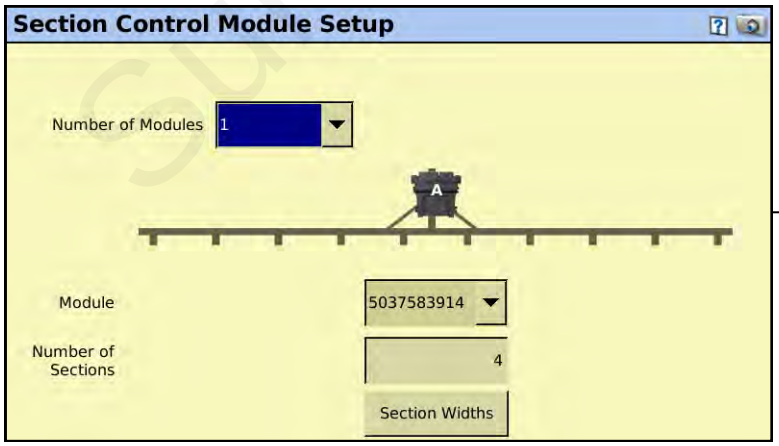
Optional. If desired, enter the information here to let the controller monitor how much material is left.

Section Control

See the FmX Integrated Display User Guide, beginning on page 10-25, for more information.

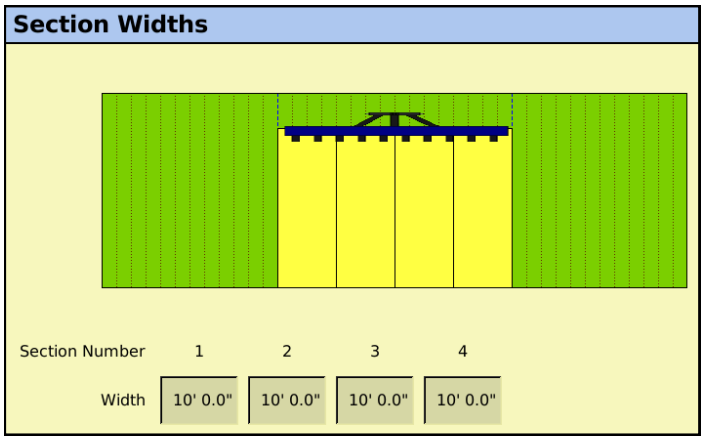
Press **Setup** next to **Section Control Module Location**.





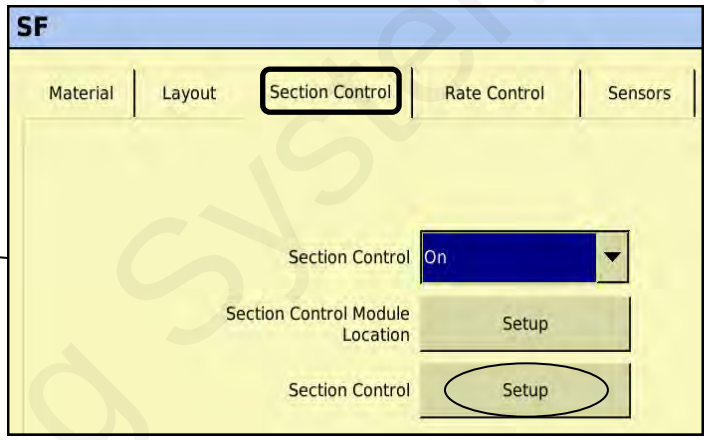
1. Set the Number of Modules in your system.
2. Select the Module Serial Number.
3. Set the number of Sections for your system.
4. Press **Section Widths.**

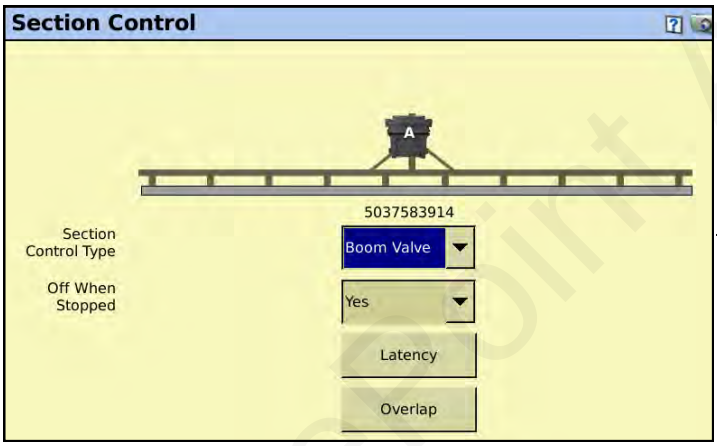
Section Control Setup (cont.)



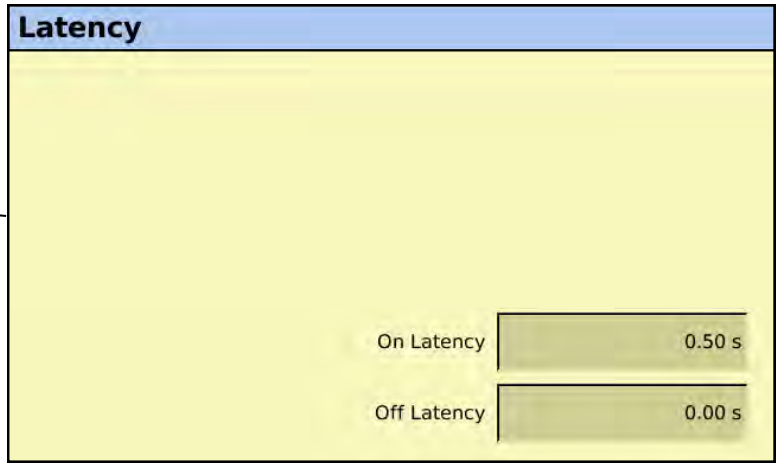
→ Set the width of your sections.

Press **Setup** next to **Section Control**.





1. Set **Section Control Type** to **Boom Valve.**
2. Set **Off When Stopped** to **Yes**.
3. Press **Latency.**

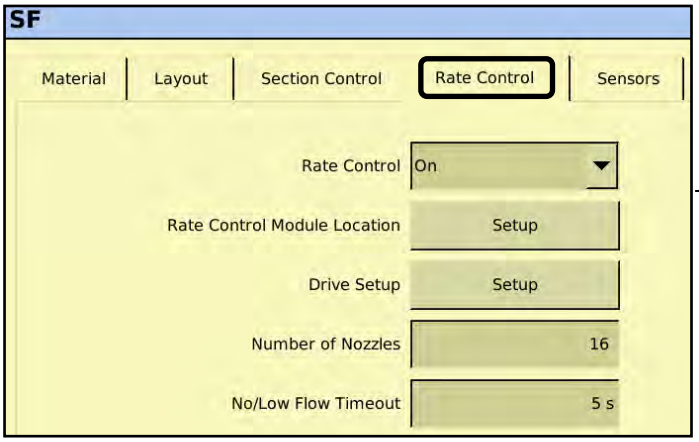


1. Set **On Latency** to 0.50 seconds.
2. Set **Off Latency** to 0.

These numbers pertain to how long it takes for your system to actually begin applying or stop applying after the controller sends the signal to start or stop when controlling automatically. To start the system sooner, increase the On Latency number.
Adjust as necessary in the field.

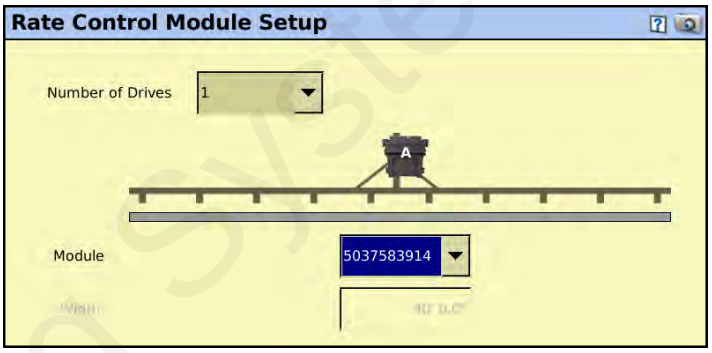
Trimble® Field-IQ™ Setup for FmX® or FM-1000™

Rate Control Setup

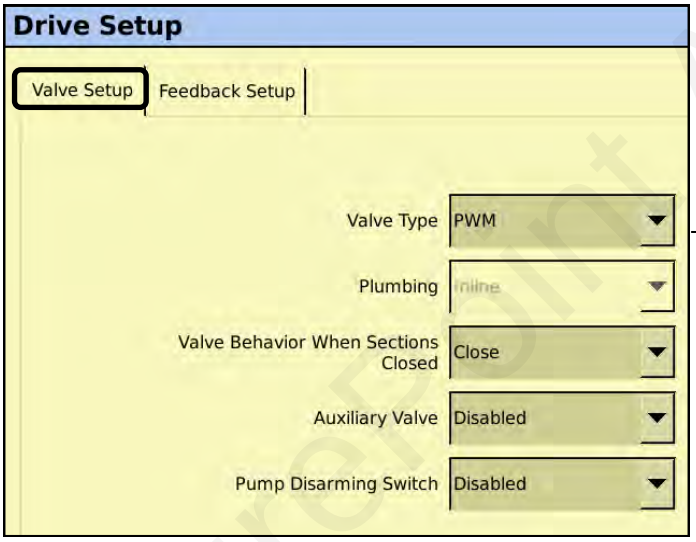


See the FmX Integrated Display User Guide, beginning on page 10 -32, for more information.

1. Select the **Rate Control** tab at the top.
2. Set **Rate** Control to **On.**
3. Set **Number of Nozzles** number or rows).
4. Set **No/Low Flow Timeout** to 45 s for troubleshooting so the system does not shut off too quickly.
5. Press **Setup** next to **Rate Control Module Location.**



1. Set the correct information on this screen.
2. Press **OK.**
3. The next screen should look like the screen above. On **Drive Setup**, press **Setup**.

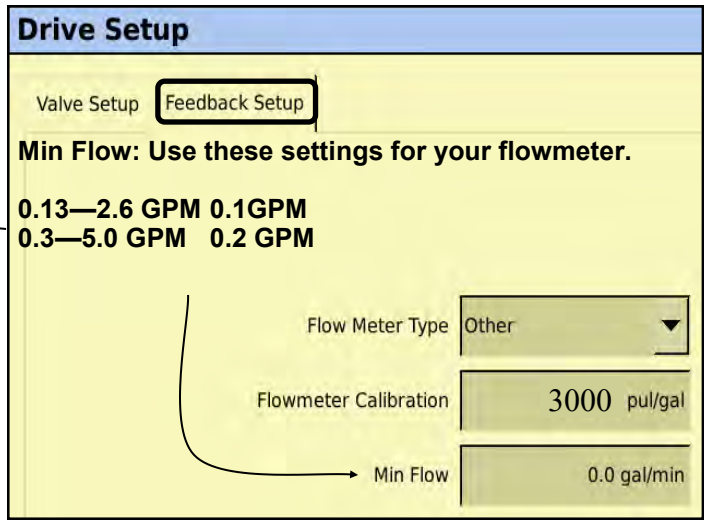


Set the Valve Setup as shown.
ValveType: PWM
Valve Behavior When Sections Closed: Close
Auxiliary Valve: Disabled
Pump Disarming Switch: Disabled

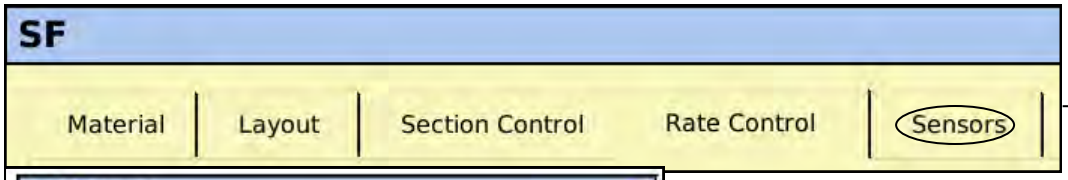
*(Optional: If using an **Aux/Dump valve** to keep the pump running when application stops so the system will resume applying at the Target Rate immediately upon restart, set **Auxiliary Valve** to **Dump**, then set **Valve Behavior When Sections Closed** to either **Lock in Last Position** or **Lock at Minimum**. This setup requires section valves with an additional dump valve plumbed to return flow to the tank when application stops.)*

Set the Feedback Setup screen as shown.
Flowmeter Calibration = 3000.

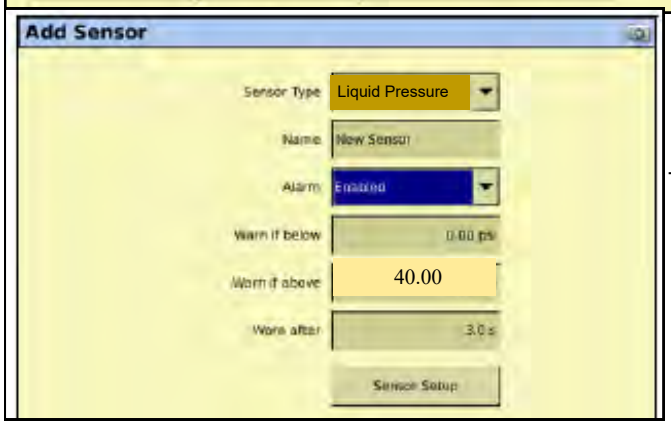
This flowmeter calibration will work with the flowmeter that has the blue label or orange label on the PumpRight System.
Earlier flowmeters have a white label with black text and have different calibration numbers.
Always verify flowmeter calibration in the field by comparing acres worked with gallons applied.



Pressure Sensor Setup



→ Select the **Sensor** tab.



→ **Sensor Type : Liquid Pressure**

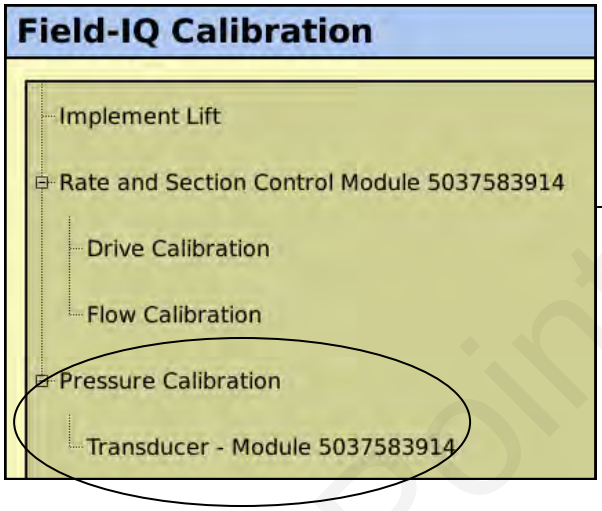
Name: Transducer (or other name)

Alarm: As desired. You may want to leave Warn if Below set to 0, and Warn if Above to 40 PSI for electric pump systems.

Sensor Setup will take you to a screen where you can select the Field-IQ Module that is controlling this sensor.

Two pressure sensors can be connected when using SurePoint harnesses with Pressure 1 and Pressure 2 connectors.

Reminder: The pressure sensor is for informational purposes only and does not control the system in any way. The SurePoint system can have up to two pressure sensors.



→ To finish the Pressure Sensor setup, it will be necessary to go to Field-IQ Calibration and select Pressure Calibration and the name of the Pressure sensor you set up.

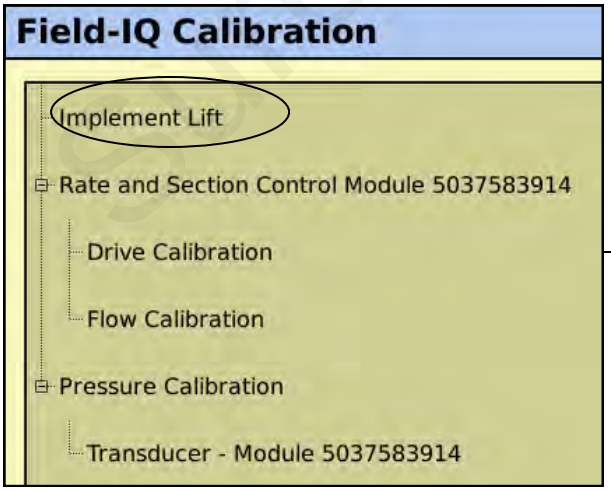
Calibrate Type: Point/Slope

The calibration setting (slope) is **50 mv/PSI.**

Be sure there is no pressure on the sensor when you calibrate. You can unplug the sensor to be sure.

You do not need to “Run Calibration”. You *do not* need to hook up a manual gauge to calibrate the sensor.

Implement Lift Switch Calibration

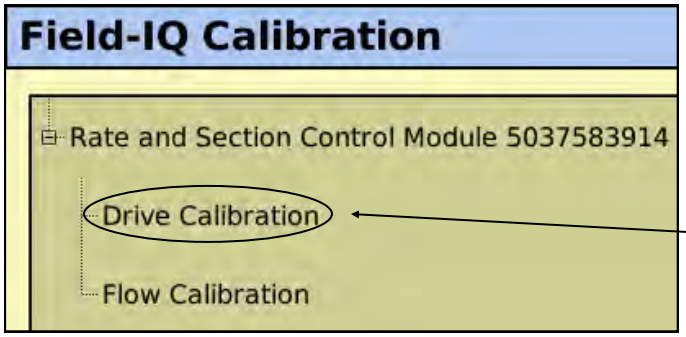


→

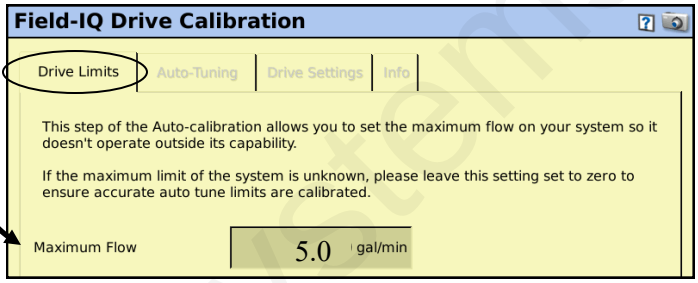
1. From the **Field-IQ Calibration screen,** select the **Implement Lift option**.
2. Raise the implement and then tap Next.
3. Lower the implement and then tap Next.
4. Tap OK to return to the Field-IQ Calibration screen.

Trimble® Field-IQ™ Setup for FmX® or FM-1000™

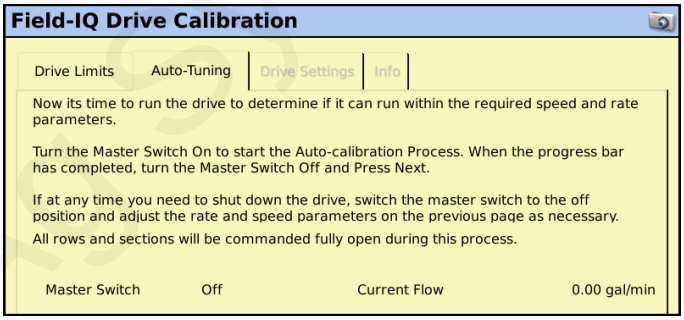
Field-IQ Calibration

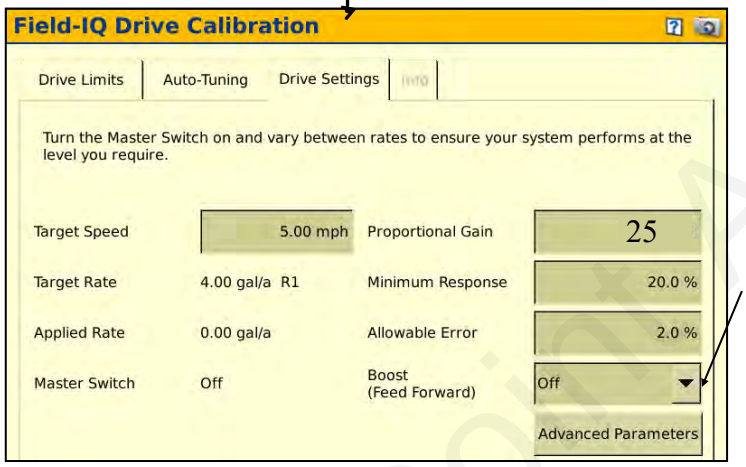


Select **Field-IQ - Calibrate** on the Calibration screen.
This brings up the screen on the left.
Select **Drive Calibration.**



Set the **Maximum Flow** rate at 5 gal/min.
Select **Next.**
Follow the screen instructions to run the Auto Tuning Procedure.
After the Auto Tuning Procedure you can press **Next** at the bottom of the Auto-Tuning screen to go to the **Drive Settings** screen.





Select the **Advanced Parameters** button to bring up the **Advanced Tuning** screen (shown below). Here you will enter the numbers for the system.
Target Speed: Enter a typical operating speed.
Upper PWM Limit: ***Make sure this is set to 100****. If Auto-Tuning has been used, the Trimble control will set it at a lower number that will limit the upper range of your pump.*
Lower PWM Limit: 0

Recommended Settings for Tower Electric Pump for FmX:

Proportional Gain: 25 (20-30). If the gain is set too high, the system will surge above and below the desired flow. Lower the gain to achieve steady pump operation. Raise the gain if the system is slow to adjust to speed and rate changes.

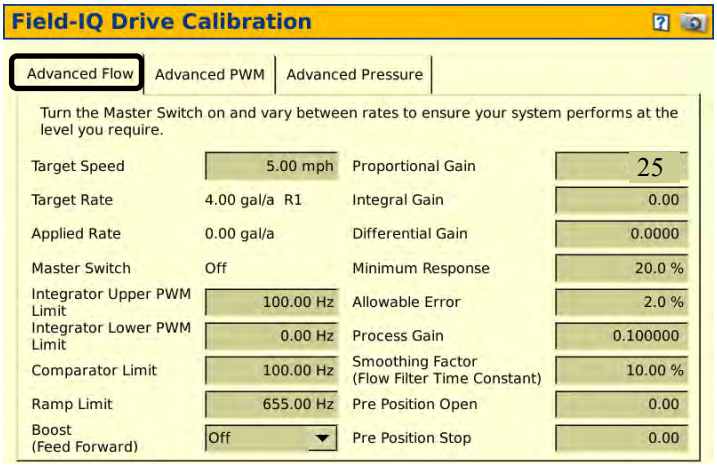
Minimum Response: 10-20% This helps the pump start faster as well as react quicker to changes.. Raise it to get to Target Rate faster when starting. Lower it if system overshoots Target Rate when starting or when going across the field.

Allowable Error: From 1% to 2%

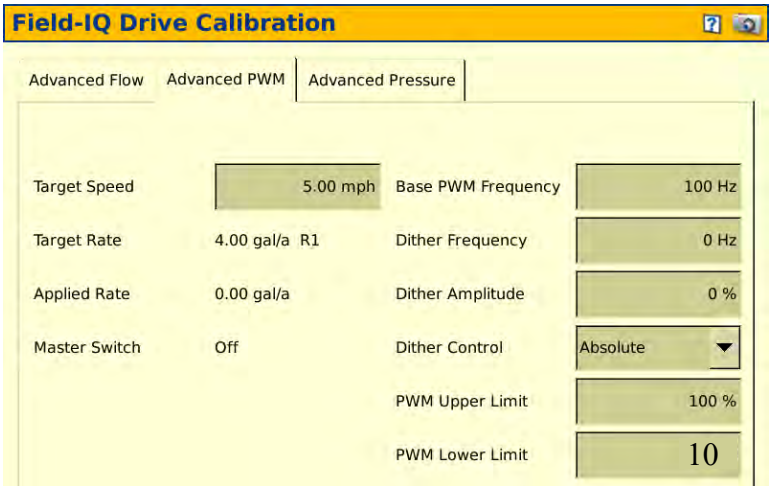
Process Gain: 0.10

Smoothing Factor: 5

Older software versions use Integral Gain instead of Proportional Gain. In that case, use the Proportional Gain numbers shown above for the Integral Gain.

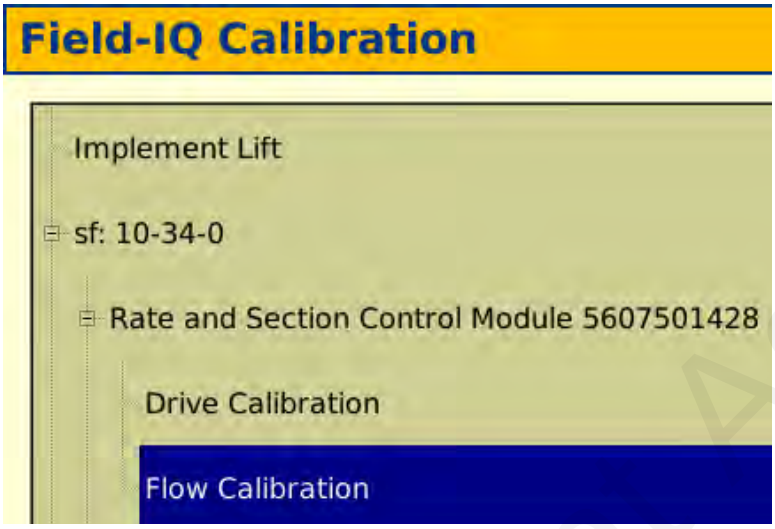


Field-IQ Drive Calibration: Advanced PWM



Advanced PWM Tab

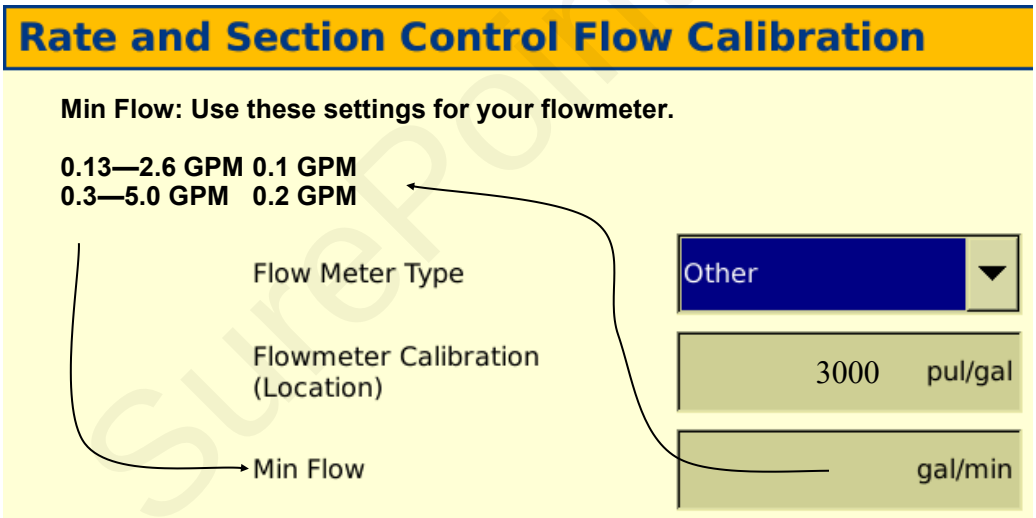
Base PWM Frequency: 100
Dither Frequency: 0
Dither Amplitude: 0
→ **Dither Control: Absolute**
PWM Upper Limit: 100%
PWM Lower Limit: 10%



Flow Calibration

Select **Field-IQ - Calibrate** on the Calibration screen.
This brings up the screen on the left.
Select **Flow Calibration.**

The Flow Calibration numbers may have already been set in the Drive Setup. You can verify or update the settings here.



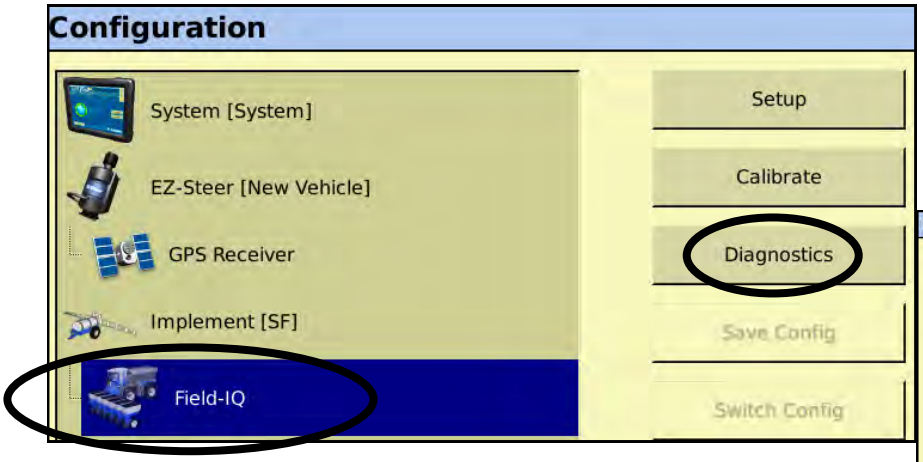
Always verify flowmeter calibration in the field by comparing acres worked with gallons applied.

Flowmeter Model (blue label or orange label)	Pulses/Gal	FPT Size	Hose Barb In kit
0.13 - 2.6 GPM	3000	3/4”	3/4”
0.3 - 5.0 GPM	3000	3/4”	3/4”
0.08 - 1.6 GPM	**22700**	3/4”	3/4”

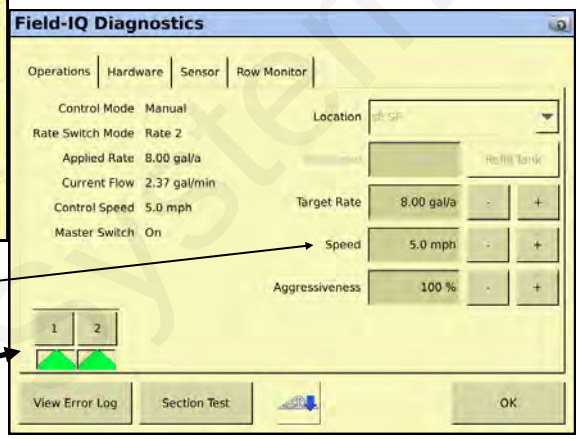
The flowmeter calibration number (pulses/gal) is printed on the serial number sticker on the side of the flowmeter.
Earlier model flowmeters (meters with white labels with black text) have different calibration numbers. See the documentation for those meters to find the calibration numbers or check on the serial number sticker.

Initial Operation Instructions

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



From the Configuration Screen, select **Field-IQ**, then **Diagnostics**. *(If the Diagnostics tab is grayed out, you probably need to close a Field.)*



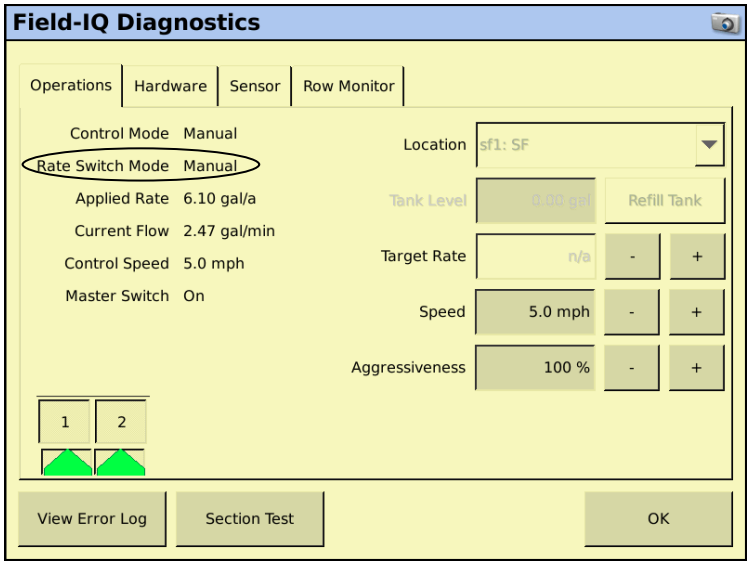
1. Press the + next to Speed to simulate a Speed signal.
2. Turn the Field-IQ master switch (#5) on (see picture below).
3. Push each section valve button and verify each valve is working.
4. Turn Switch #2 to Manual and open the section valves. Use switch #1 to increase flow. Does "Current Flow" display a flow rate? Is it stable after the system is primed? Do increase & decrease buttons increase & decrease flow?
5. Move switch #2 to Rate 1 and set speed to your typical field speed.
6. The system should begin to pump liquid now in automatic control mode. Is the flow in GPM stable? Is it applying at the correct rate? (applied rate = target rate?)
7. Change rate using screen buttons or switch #1 to increase/decrease rate or switch #2 to go to Rate 2. Does applied rate change to equal target? (**Aggressiveness** can be set anywhere from 100% to 150% to make quicker adjustments to rate changes.)

8. Close 1 section valve, does flow decrease? Does applied rate still equal target rate?
9. Change speed and target rate to minimum and maximum values. Does system perform at these values? Does the system pressure seem reasonable (remember fertilizer will increase pressure over water)? Use "Sensor" tab at the top of page to read the pressure sensor value (if equipped).
10. Press the **Sensor** tab to see **PWM PERCENT** while the system is running. Typical operating ranges will be between 10% and 60%, possibly higher on high-rate outputs. With the control switch in Manual mode, pressing switch #1 towards (+) on the switch box should increase PWM Percent.

Running the system with water will create much lower pressure than what will occur with fertilizer. If the pressure is too low, all the check valves will not open, and some of the rows will have no flow. Increase the flow to build enough pressure to open all the check valves.

Field-IQ Diagnostics

From the **Configuration Screen,** select **Field-IQ** and then **Diagnostics.** You can test-run the system from this screen. (*If the Diagnostics tab is grayed out, you probably need to close a Field.)*

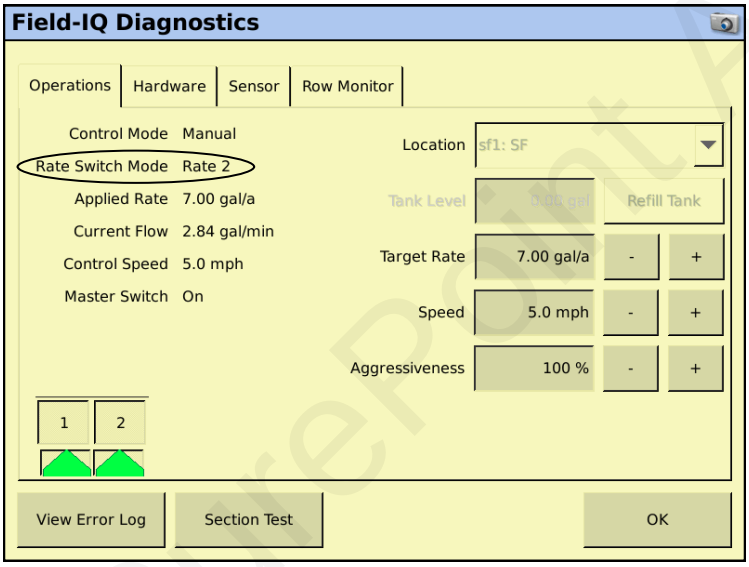


To enable the sections, tap the numbered section tabs above each of the section icons.

The **Operations** tab displays the current status of:
Control Mode (Auto or Manual)
Rate Switch Mode (Manual, Rate 1, or Rate 2)
Master Switch (Off, On, or Jump Start)

This screen also allows you to manually enter values for *Tank Level, Target Rate,* and/or *Speed.*

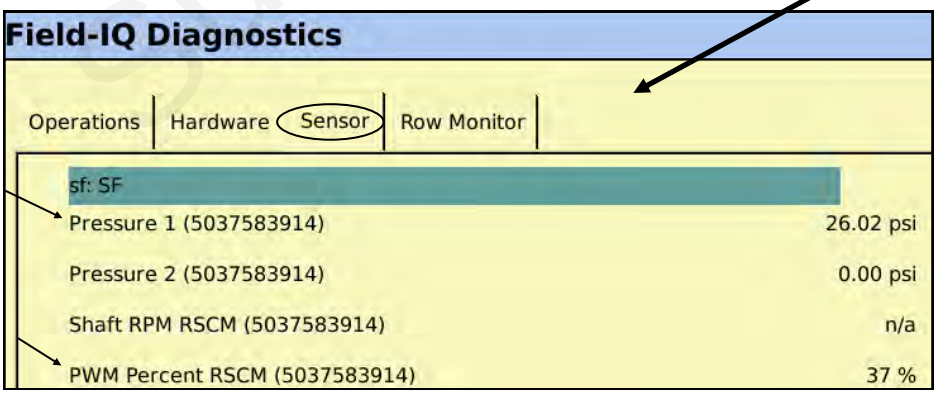
Operate the system, and check the value shown for *Applied Rate* at various *Speeds* and *Target or Manual Rates.*



In **Manual** mode, press the + or - button beside Target Rate to increase or decrease the rate.

You can change the Rate and/or Speed while the system is running by pressing the corresponding + or - buttons.

Sensor tab: Go here while the system is running to see the PWM Percent. In manual mode, the PWM Percent should increase and decrease while the (+) and (-) button is held down on the switch box.
In AUTO Mode, the PWM Percent should hold steady while the system is locked on to a rate.

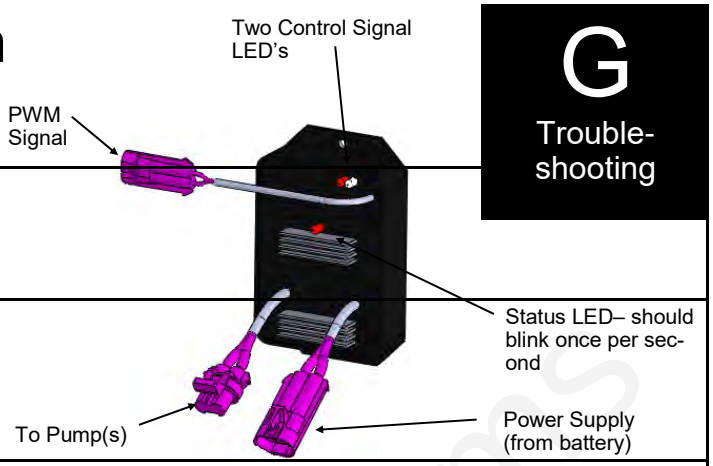


The **Sensor** tab provides information on the Pressure Sensor(s) and Pump Speed (PWM Percent).

*To enable the pump to get to the Target Rate faster when starting, the **Minimum Response** (see Drive Calibration on Pages 51-52) can be increased.*

Electric Pumps Won't Run

EPD Status Lights



Status LED	Status Description	Troubleshooting Steps
On Steady	Power input is good and PWM input Signal is detected	**No Problem, Typical operating condition.**
Steady Blink (1 hz— 1 blink/sec)	Power input is good and PWM signal is not detected.	**Typical 'Off' Condition.** If pumps should be on: 1. Inspect wiring and connectors 2. Check voltage at PWM connector to EPD, should be 1-12 volts to turn on. 3. Check voltage on PWM wires at 37 pin connector, pins 15&16.
Blink once, pause, blink once, pause	Open circuit between motor output and motor.	Check harness and connectors to motor. If using two motors, plug each in separately directly to EPD (bypassing Y-harness)
Blink twice, pause, blink twice, pause	Output short circuit detected.	• Check motor wiring
Three blinks, pause, three blinks, pause	Overcurrent condition	• Check total load • Clean cooling fins on EPD
Four blinks, pause, four blinks, pause	***Input power fault. Low voltage condition in power to EPD.***	***Unplug battery power from EPD to reset. Check power cables and connections for quality.*** ***Be certain that power cable connects directly to battery and has a solid, clean connection.*** • Test the voltage under load coming into the EPD. (See picture on page 24 for voltage test point.) Voltage may appear adequate when system is not on, but bad connectors or wiring may not carry the current needed under load.) • You may be able to reduce power draw by lowering the system pressure. Typically, though, this is an indication of a cable or connector issue.
Five blinks, pause	Input frequency out of range.	Check PWM Settings on Rate Controller.
Control Signal LEDs (top corner)		
Light intensity varies	Off - No PWM Signal 100% brightness - Maximum PWM input signal	Red light in top corner should be on when PWM signal is received (system is applying product)

The most common issue with the EPD *will be a low voltage condition (under load) delivered to the EPD from the battery. Voltage drop occurs anytime current is moved through a wire. A low-voltage (12 v) system with long runs (60-80 feet) may have unacceptable voltage drops if any part of the system is weak or the load is high. This could be bad (corroded, weak, loose or burnt) connectors (at the battery, at the hitch, and at the EPD), too small of wire used (smaller wire equals more voltage drop), low source voltage, and heavy load. Any or all of these may contribute to a low voltage condition under load that may shut down the processor in the EPD module. This will be indicated by 4 quick flashes of the red light, followed by a short pause. Unplug the power-in connector to reset the EPD. Check and correct any wiring deficiencies.*

Troubleshooting / Service Tips

Always verify the controller settings. See the screenshots in Section F of the system manual and on the QuickStart setup sheet.

The pump won't run.

Electric Pump System

EPD flashing 4 times

1. 1. Find the EPD module (electric pump driver—black module on Tower). Should have a steady blinking light (one blink per second) in the middle when pumps should be off. In Run mode, the center light should be steady red, the upper right should be steady red (indicates it is receiving a PWM signal). If Status LED (center light) is *flashing 4 times, then pausing*, EPD has tripped due to low voltage condition. Unplug the Power Supply to the EPD to reset. If condition persists, check Power Supply cables from battery to EPD to insure solid connections and good electrical path. Check connections at battery. Check connectors at the hitch and at the EPD. (*There should be 11.5-13 volts at the point where the EPD connects to the battery power harness, when **tested under load**. This voltage may show up when there is no load, but the harnessing may not be good enough to deliver 11.5-13 volts under load.)*

No Lights on EPD

1. There should be a steady blinking light in the middle of the EPD. If no light is ON, check the 40-amp fuse in the EPD harness near the battery. Use a voltmeter to verify that there is 12-13 volts at the Power Supply connector that plugs into the EPD. *If there is good voltage here, but no light on the EPD, replace the EPD module.*

Will pumps run?

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

Pumps run, but won't pump anything—

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

Electric pumps only run with 12 volts direct from battery

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

1. Connect pumps and power harness back to EPD.
2. Go to **Diagnostics** to investigate this issue.
3. Start Diagnostics test in manual mode, 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. *(Look at PWM Percent on Sensor tab)*
4. Remove PWM valve connector at EPD and check voltage. You will need 6-12 volts to turn pumps on. (PWM Duty Cycle at 100 should be 12+ volts on PWM signal)
5. If 6-12 volts is not present, check harnesses and review control valve type setup (should be PWM).
6. Go back to the 12-pin Deutsch pump connector, check PWM voltage between Pins 5 & 6.
7. If necessary, go back to the 30-pin outlet on the Field-IQ module. There should be PWM voltage between pins E1 and E2.

Pump starts up running full speed and won't control.

Verify that the PWM connector on the harness to the EPD has a green and yellow wire. Black and yellow will not work.

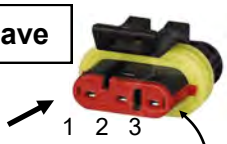
Check Firmware version on Field-IQ module. Should be 4.13 or newer.

Pump runs for a while when I push the (+) button on switch box, then stops.

Verify that controller is set to PWM and not to Servo.

No Flow shown on display, but liquid is being pumped
Flowmeter Tap Test

See which flowmeter connector you have



Remove red guard to reach pins. Don't break red side clips.

Flowmeter pinout:

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

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

1. Unplug the flowmeter. With voltmeter, check for **12 volts between Power & Ground** of flowmeter connector. Should have **4-5 volts between signal and ground**. If voltage is not present, inspect wiring harness and check for voltage at harness connection(s) nearer the Rate Controller (at 12-pin Deutsch connector, Power is 1, Ground is 2, Flow Signal is 3).
2. If 12 volts is present, then conduct a **tap test**. Go to **Setup** and change the flow cal to 1. Have a second person watch GPM on the screen while other person taps repeatedly (use a short piece of wire or a paper clip) between signal and ground pins of flowmeter connector. A flow value (gpm) should show up indicating the wiring is not damaged. (If alone, note or reset a volume counter to 0. Check for increased volume after tapping.)
3. If the flow showed on the display during the tap test, your wiring to that point is good. If tap test did not work, go back to the next harness connection and do a tap test there between signal and ground.
4. If the tap test registers flow on the display, replace flowmeter. (*Sometimes, cleaning the inside tube of the flowmeter with soapy water and a soft brush will remove a film covering the electrodes.)*
5. Change Flow Cal back to appropriate Flow Cal when finished with Tap Test.
6. SurePoint has a Speed/Flow Simulator (PN 219-01462) or a Tap Tester (212-03-3912Y1) that can be used to confirm if the wiring is good between the flowmeter and controller.

Field Verification of Flowmeter Calibration

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

In general:

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

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

Formula to Adjust Flow Cal Number

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

Example: Display shows 727 gallons was applied. Weigh ticket shows 750 gallons was actually applied. Flow cal number in display was 3000. *(We applied too much, so we will decrease the flow cal.)*

727 / 750 X 3000 = 2908 (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 welding on the implement.

Section Valve(s) will not move

1. Go to **Diagnostics** to investigate this issue.
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)
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.

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

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-pin connector, then the 30-pin on the Field-IQ module 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.

This is a 3-way valve. If product will not flow when valve is ON, either move the outlet hose to the other outlet port, or remove actuator and rotate valve ball 180º, and replace actuator. Product should flow through the port closest to the Indicator light when the valve is open (green).

Pressure Sensor is not reading

1. Be sure the Pressure Sensor that is displayed on your screen is the same sensor that is plugged into your harness for that product.
2. Make sure the pins where the harness screws on to the end of the sensor have not been bent.
3. Be sure Pressure Sensor is set up and calibrated in the display. Unplug the pressure harness before doing this.

   The calibration is **50 mv/PSI.**
4. There should be a green LED light on the end of the pressure sensor. (may be difficult to see in daylight). The sensor needs 12 v. Check between pins B&C on the Pressure connector on the harness that connects to the pressure sensor. If there is no voltage here, check the voltage between pins 1 & 2 on the 12-pin connector labeled PUMP.
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* > *Sensors*.

Application Rate & Flow Troubleshooting

Application Rate Fluctuates

First, you need to determine if the fluctuation is caused by the controller sending fluctuating signals to the valve.

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 screen.
2. Turn the system on and watch the flow in GPM. Check PWM Percent on Sensors tab.
3. Is the flow steady within a very small range? For example a fluctuation from 2.3 to 2.5 GPM would be considered normal. A fluctuation from 2-3 GPM is a problem. If only a small normal fluctuation is seen, 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 for flowmeter information.
6. If visually the flow is unsteady, the flowmeter is working correctly reporting a flow problem. Is the pump turning steady or surging? If the pump is surging, reduce the gain (or aggressiveness) setting.
7. 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.

Application Rate fluctuates in field, but flow in manual mode is stable.

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

1. Go to Field-IQ, Calibration, Drive Calibration
2. Change the settings by reducing the Proportional Gain.
3. Run the system from the Diagnostics screen. Set up a Target speed with Auto Rate. Go to the Sensors tab and look at the PWM Percent. This should increase until the system locks onto the Target rate, and then hold steady.
4. Check the firmware version on the Field-IQ module. It should be 4.13 or newer. (Version 3.20 worked well in the past. This may not work with the current display software.) Display software should be current as well.

Application Rate is slow to get to the Target Rate

1. You may need to increase the valve calibration. Go to Field-IQ, Calibration, Drive Calibration.
2. Change the settings by increasing the Proportional Gain.
3. At Field-IQ, Diagnostics, make sure the Aggressiveness is at 100% to 150%.
4. If system is slow getting to Target Rate on startup after doing the steps above, set the **Minimum Response** to a higher number (see page 46). Another option to get to Target Rate quicker on startup on a system with section valves is to add an additional Aux Dump valve that is plumbed to return flow to the tank and setting the PWM valve to Lock in Last Postion (see Drive Setup on page 45).

Other issues

1. **"My rate won't go low enough. I want 8 gpa, but it won't go less than 11."**

   A. Check ***Field-IQ > Calibrate > Flow Calibration > Min Flow.*** This can be set at 0.0 or at the low range of your flowmeter. This is ***gal / min*** not ***gal / acre***.

   B. Check ***Field-IQ > Calibrate > Drive Calibration > Next > Next > Drive Settings > Advanced Parameters > Advanced PWM > PWM Lower Limit<*** If this is too high, pump will not be able to slow down. Typically, 10 is low enough, but on very low applications may need to go to 5 or less.

   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? Normally, the recirculation valve should be closed. If it needs to be open, start with a quarter turn.

   B. On a dual electric pump system, check each pump individually to see that each one is working at capacity.

   C. **Is the strainer plugged?** If too small of a mesh strainer is being used, the fluid can gel up around the screen as the fluid is pulled through. Most SurePoint systems with metering tube and electromagnetic flowmeter can use a 20– or 30-mesh strainer.

   D. Does the pump have enough hydraulic oil to hit the desired rate? If the pump is in series behind another pump or motor, the hydraulic oil to this pump may be limited. Run pump in Manual Override to see output.

   E. Check ***Field-IQ > Calibrate > Drive Calibration > Next > Next > Drive Settings > Advanced Parameters > Advanced PWM > PWM*** **Upper Limit.** This should be from 80 to 100.

   F. Go to **Diagnostics >** Run a test. What is PWM Percent (Sensors Tab) while the pump is running (in the field or on a manual or auto test)? 100 means the pump is being told to run at full speed.

   G. Run a manual test and hold the (+) button to speed up the pump. Check GPM and PSI at different levels. Check the PWM Percent at the Sensors tab.

   H. Run a test in AUTO mode with auto rate. See gal/ac, PSI, gal/min, and PWM Percent.

   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 > Material Setup > Rate Smoothing. Rate Smoothing** should be ON.

   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. **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.

5. "My pressure is too high / too low."

The pressure will be what it is depending on how hard it has to push to get the amount of liquid you are moving from the pressure sensor to where it leaves the system. This pressure will depend on the product itself, the volume (gal/min) you are moving and how much restriction there is to that flow. The orifice or metering tube will be the primary restriction, but it is possible that other parts of the system may add to the total pressure. 1/4" tubing can build a lot of pressure with 10-34-0. The pressure a system develops will be less (possibly much less) with water than it will be with a fertilizer product.

What pressure is "too low"?

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

What pressure is "too high"?

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

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

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

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

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

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

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

See SurePoint video "What is Metering Tube...?" or "396-4116Y1 Metering Tube Charts" for more information on how metering tube works.

See the system manual for your system for more complete information. Manuals and publications are available for download at https://support.surepointag.com.

Recommended Care and Maintenance

H
Maintenance & Parts

Winterization

SurePoint 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.

Inspect Electric Pumps

The electric pump and motor is a completely sealed component. Over time the electric motor will lose efficiency. The entire pump and motor will need replaced when it won't efficiently produce the flow required.

Each individual pump should be able to produce more than 4 gpm of water flow with an open outlet (zero pressure). If pump falls short of this specification, replace to ensure a trouble-free fertilizing operation.

You can test the operation of each pump individually by unplugging one pump and running one pump at a time. Compare the output of each pump to each other and to the standard above.

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. Be sure pins are clean, not corroded, and are making good contact.
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 to verify components and system are in working order. (May need to open air bleed valve to prime pump the first time. Be sure recirculation knob is closed.)
4. If pump runs but won't pump, tap on pump with a rubber mallet. If fertilizer was left in the system, you may need to pour hot water in the pump inlet to loosen the material.
5. Unplug one pump at a time to verify that each pump is operating as it should. Check GPM output of each pump.
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 all QuickConnect (QC) fittings to be sure the tubes are tightly seated. QC fittings that are not sealed 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.

9. 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 so that each row will flow.)

10. Run system in Diagnostics > AUTO with speed and rate to be used in the field.