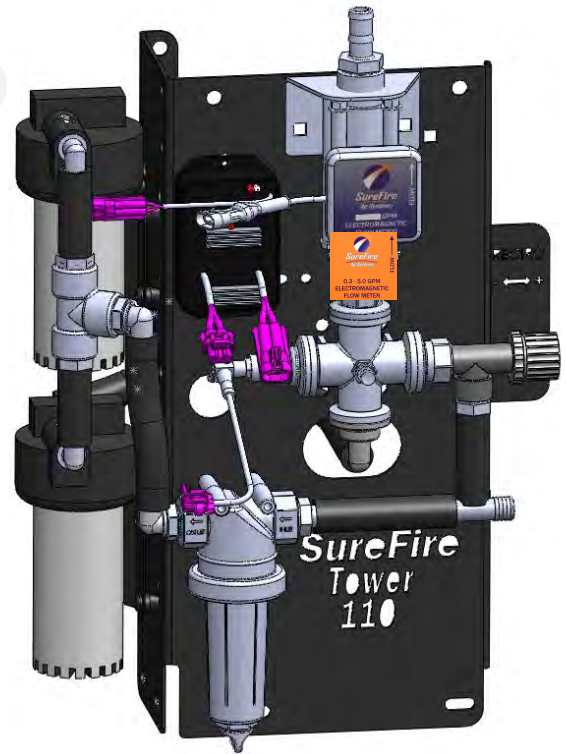
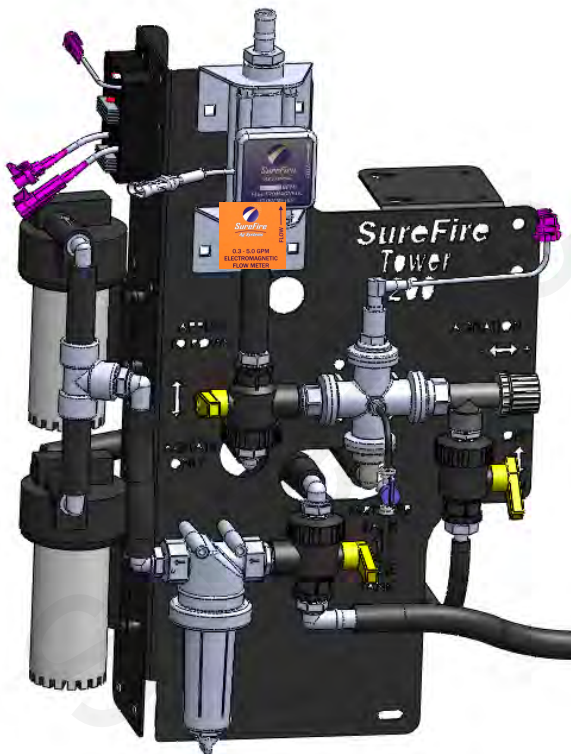


396-001260



**Tower Electric Pump
Fertilizer System
for
Ag Leader
Liquid Product Control
Module
And
Liquid ISO Module
with PWM Control**

Ag Leader



Maximum Application Rates with Two 5.3 GPM 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

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General Description

A

Introduction

You have purchased a SureFire fertilizer system for your equipment. This system will be controlled by your Ag Leader display and Ag Leader Liquid Product Control Module or ISO Liquid Module, which you will need to purchase from your Ag Leader dealer. The rate controller will adjust the speed of the SureFire electric pumps based on feedback from the flowmeter and vehicle speed. The system is capable of section control to minimize overlap areas with optional section valves. The system will also use the Ag Leader Aux Input Module and DirectCommand.

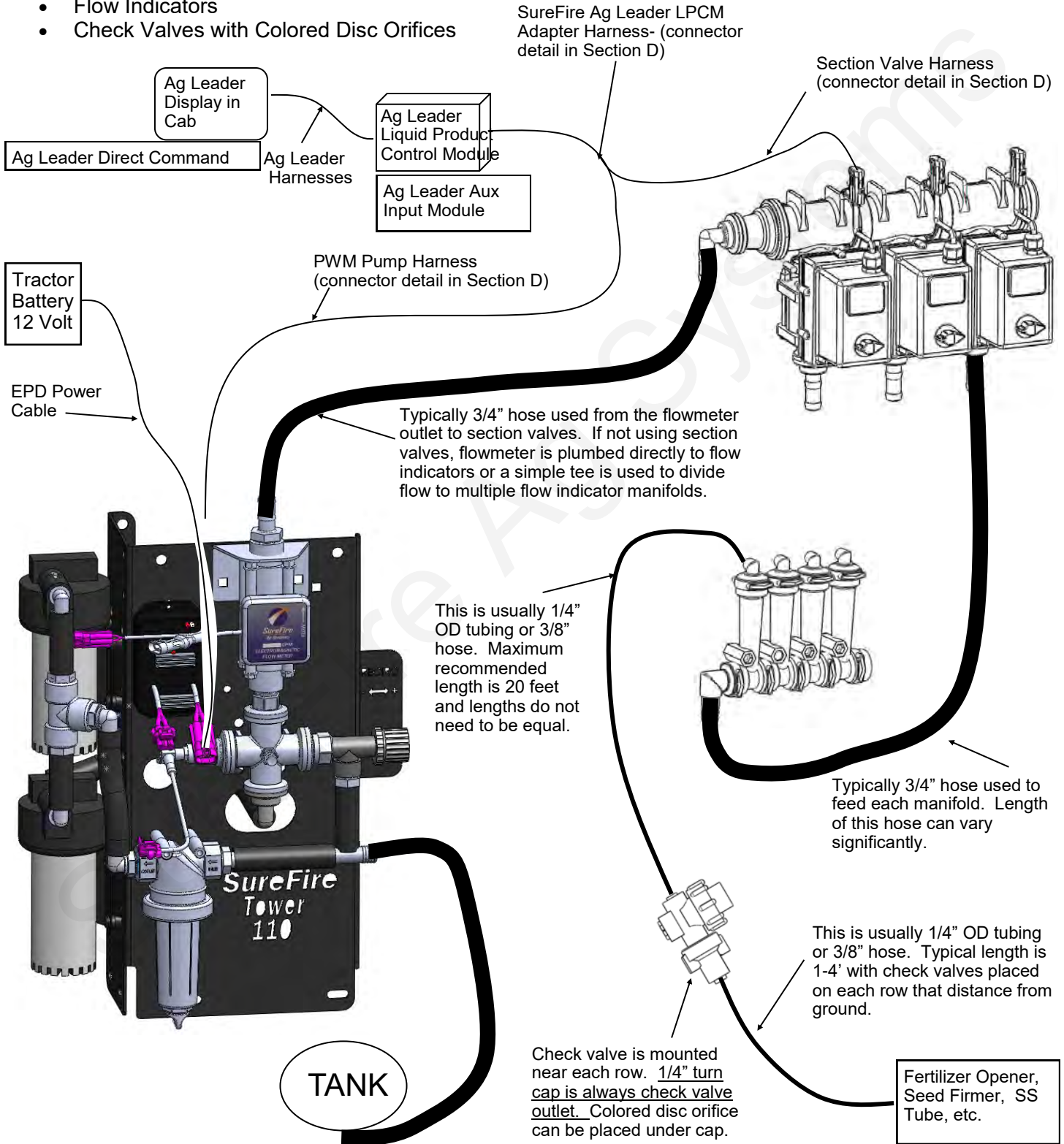
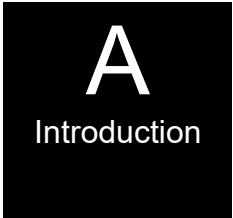
Basic Installation Steps

1. Install Ag Leader display, Liquid Product Control Module, Aux Input Module, and DirectCommand per Ag Leader instructions.
2. Open the packages and familiarize yourself with the components. Refer to manual sections B & 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 flowmeter outlet to section valve or manifold inlet. Attach section valve outlets to flow indicator inlets.
7. Attach harnesses as shown in Section D. Be sure to plug in the 2-pin Duetsch power connector.
8. Setup Controller for SureFire fertilizer system as shown in Section F.
9. Fill system with water, conduct initial operation and tests per Section F.
10. Winterize system with RV Antifreeze if freezing temperatures are expected.

System Overview - Example 1

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

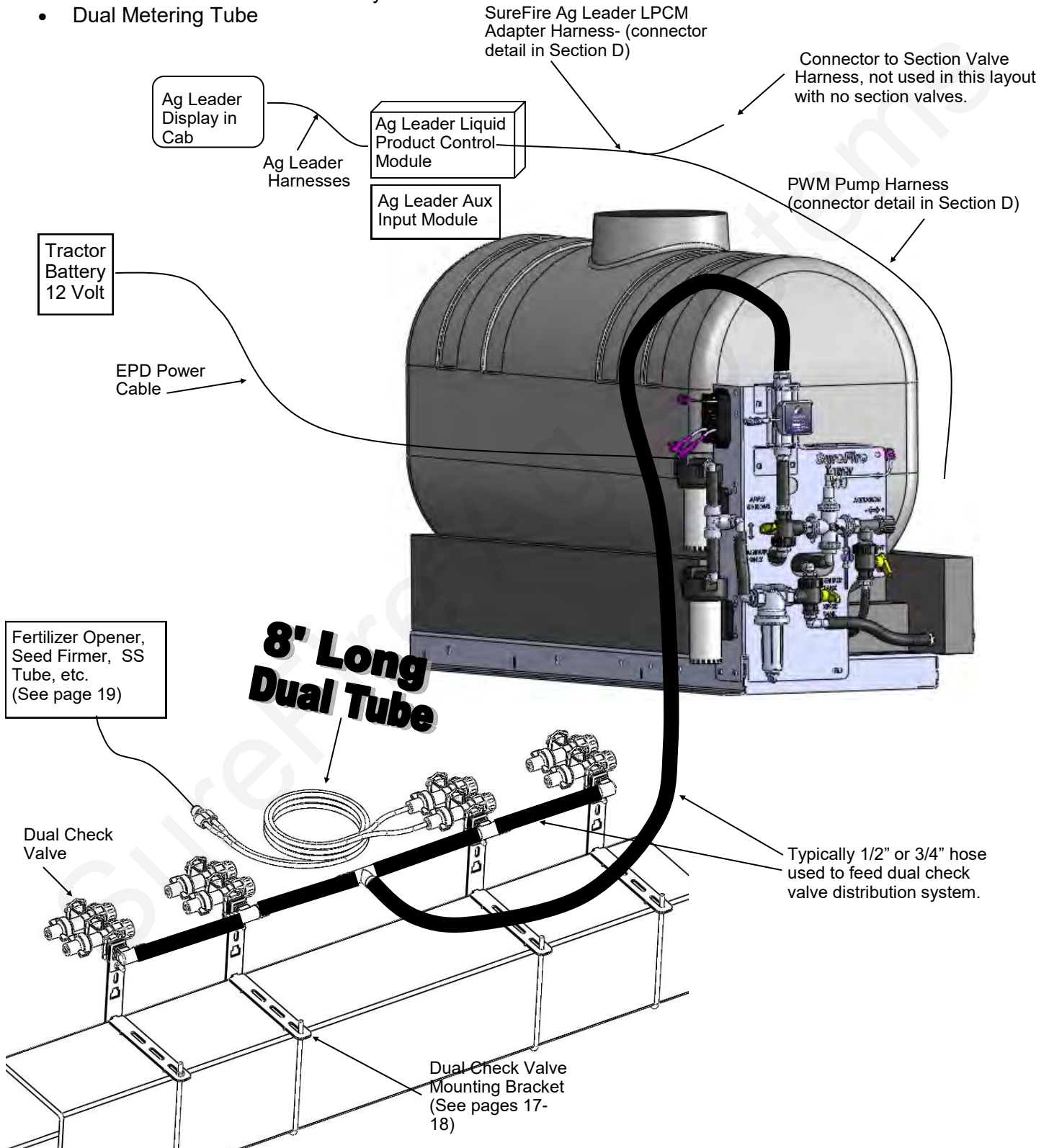
- Ag Leader Display
- Ag Leader Liquid Product Control Module, Aux Input Module, and DirectCommand
- Tower 110
- Section Valves
- Flow Indicators
- Check Valves with Colored Disc Orifices



System Overview - Example 2

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

- Ag Leader Display
- Ag Leader Liquid Product Control Module, Aux Input Module, and DirectCommand
- Accelerator with Tower 200
- Dual Check Valve Distribution System
- Dual Metering Tube



Electromagnetic Flowmeter Kits

0.13 - 2.6 GPM

Item Number 500-02-2040

0.3 - 5.0 GPM

Item Number 500-02-2050

0.08 - 1.6 GPM 204-01-46211CUF05 (FM only)

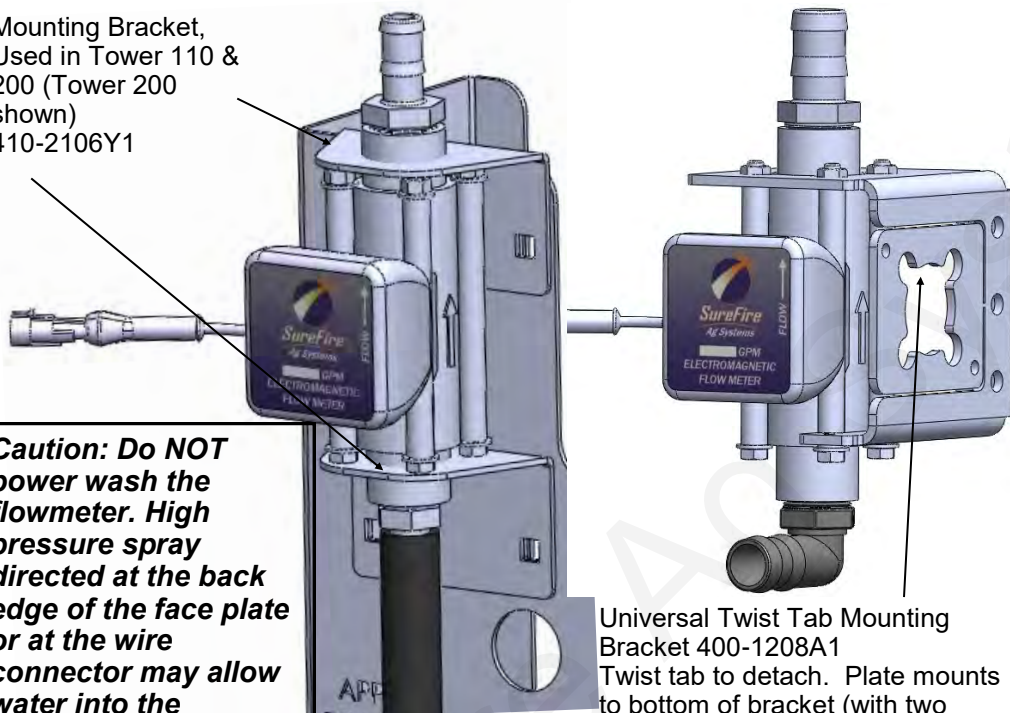
Kits include flowmeter, mounting bracket, hose barb fittings & hose clamps.



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

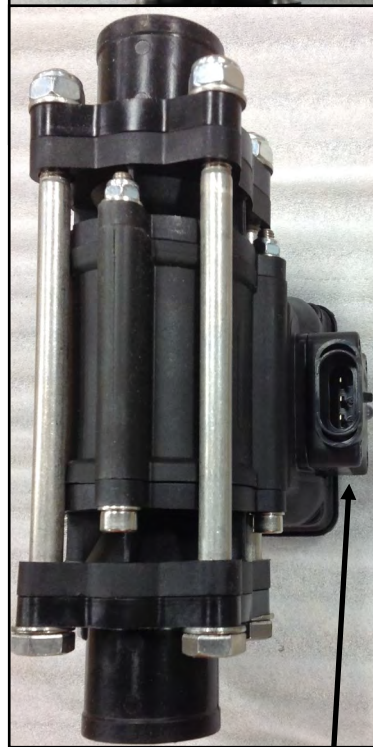
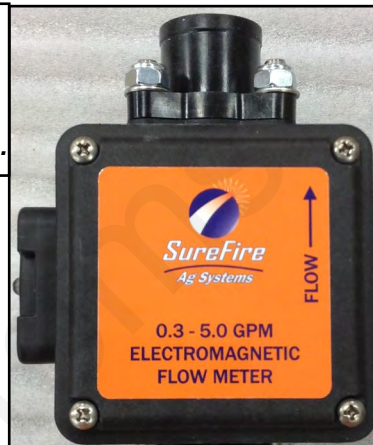
New Look in 2017—Black body with orange label. Same accurate, reliable electromagnetic technology. 3-pin Amp SuperSeal connector is sealed to flowmeter body for tighter, cleaner connection.

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



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.

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.



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. **SureFire still recommends you perform a catch test to verify the system is properly installed and configured.**

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	22710	3/4"	3/4"



Serial number label on side also shows pulses per gallon.

Each flowmeter has a different diameter sensing element. Although the calibration numbers may be the same, the proper sized flowmeter must be used.

*** Earlier model flowmeters (meters with white labels with black text) have different calibration numbers. See the documentation for those meters to find calibration numbers.)**



Section Valves

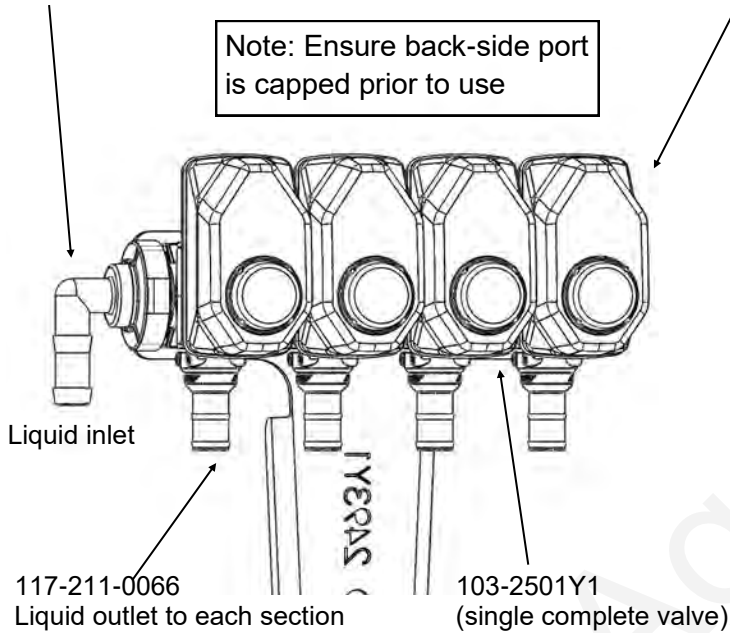
B

Components
Liquid

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

105-100075BRB90

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



Additional Parts:

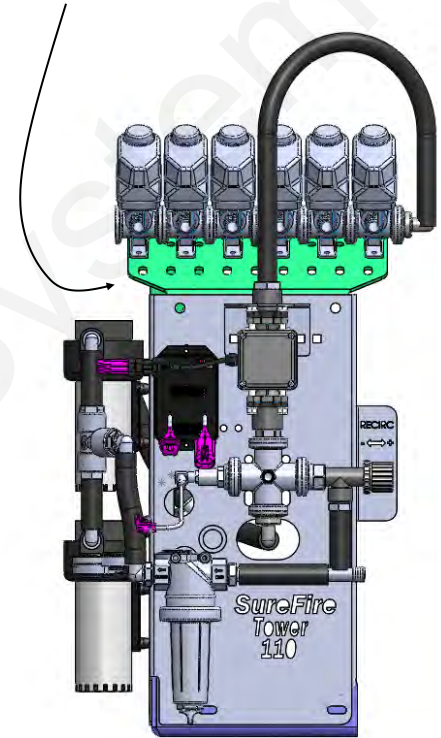
- | | |
|-----------|------------|
| 1" Gasket | 105-100G-H |
| 1" Clamp | 105-FC100 |

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 wire. The power measured to ground should have 12 volts when the controller is on. The switched wire will have 12 volts to turn the valve on, and 0 volts to turn the valve off.

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.

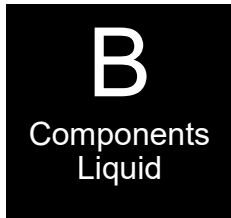
Wiring Connector:

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

Mounting Hardware:

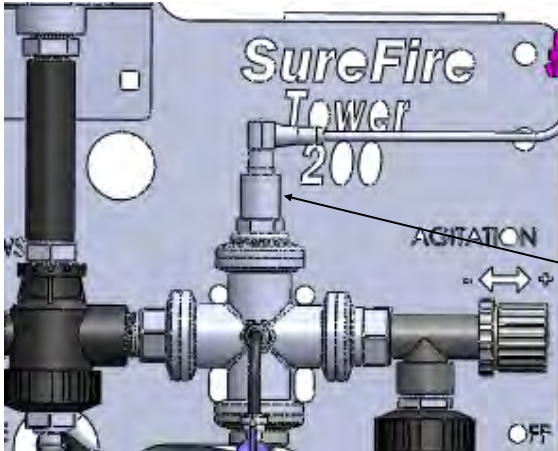
- | | |
|------------------|------------|
| 2 Valve Bolt Kit | 384-1100 |
| Mounting Bracket | 400-2493Y1 |

Pressure Sensor



The Tower 110 and 200 come equipped with a 100 psi pressure sensor to work with Ag Leader. This sensor is a 3 wire type sensor for compatibility with Ag Leader. The sensor has a 1/4" MPT fitting. The Ag Leader display has the ability to show pressure from 2 sensors on the display.

The Ag Leader 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.



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

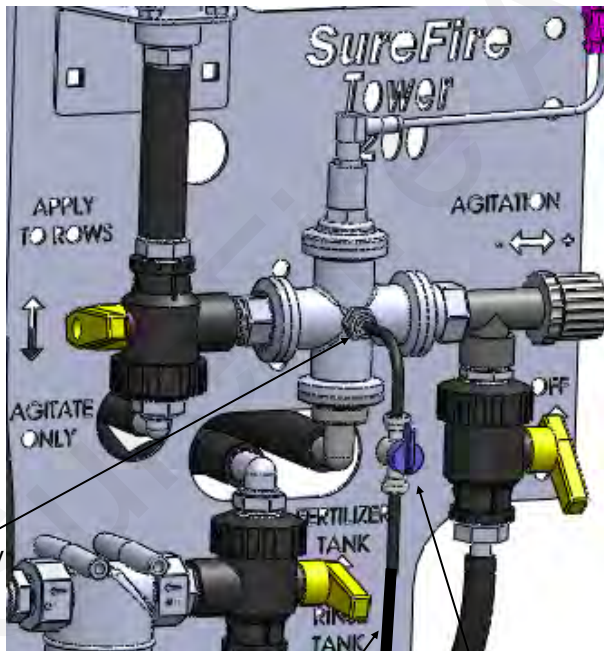
The pressure transducer is factory calibrated and will display a very accurate pressure reading on the Ag Leader display. No manual gauge is required.

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

Ag Leader 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.



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.

Shipped from factory with plug installed.

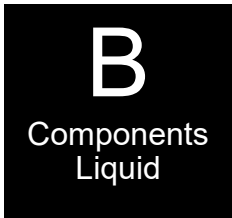
1/4" Tubing

1/4" air bleed valve

Product Distribution

To assure proper and even distribution to each row, the product being applied must be metered to each individual row. 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)

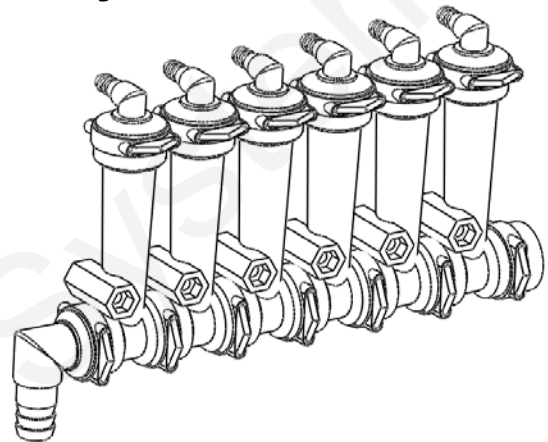


Floating Ball Flow Indicator & Manifold System

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.

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

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



Parts List

Complete Columns

- 701-20460-95 Single Full Flow Column with 3/8" HB - 90 Degree Outlet
- 701-20460-96 Single Full Flow Column with 1/4" FPT - 90 Degree Outlet
- 701-20460-97 Single Low Flow Column with 1/4" QC - 90 Degree Outlet
- 701-20460-98 Single Full Flow Column with 3/8" QC - 90 Degree Outlet
- 701-20460-99 Single Full Flow Column with 1/2" HB - 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

- 701-20460-00 Full Flow Column
- 701-20470-00 Low Flow Column
- 701-20460-04 Wilger Lock U-clip
- 701-20460-05 Flow Indicator Ball - 1/2" SS Ball
- Flow Indicator Ball - Maroon Glass
- 701-20460-06
- 701-20460-07 Flow Indicator Ball - Red Celcon
- 701-20460-08 Flow Indicator Ball - Green Poly
- 701-20460-09 Flow Indicator Ball - Black Poly
- Viton O-Ring for column & fittings
- 701-20460-15
- 701-40225-05 Viton O-Ring for Orifice

Brackets & U-Bolts

- 400-1037A1 3-6 Row Bracket
- 400-1036A2 7-12 Row Bracket
- 400-2011A1 White Backer Plate for 3-6 Row Bracket
- 400-2010A1 White Backer Plate for 7-12 Row Bracket
- 400-1315A2 Flow Indicator Bracket, 6-8 in wide hitch mount

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

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

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

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

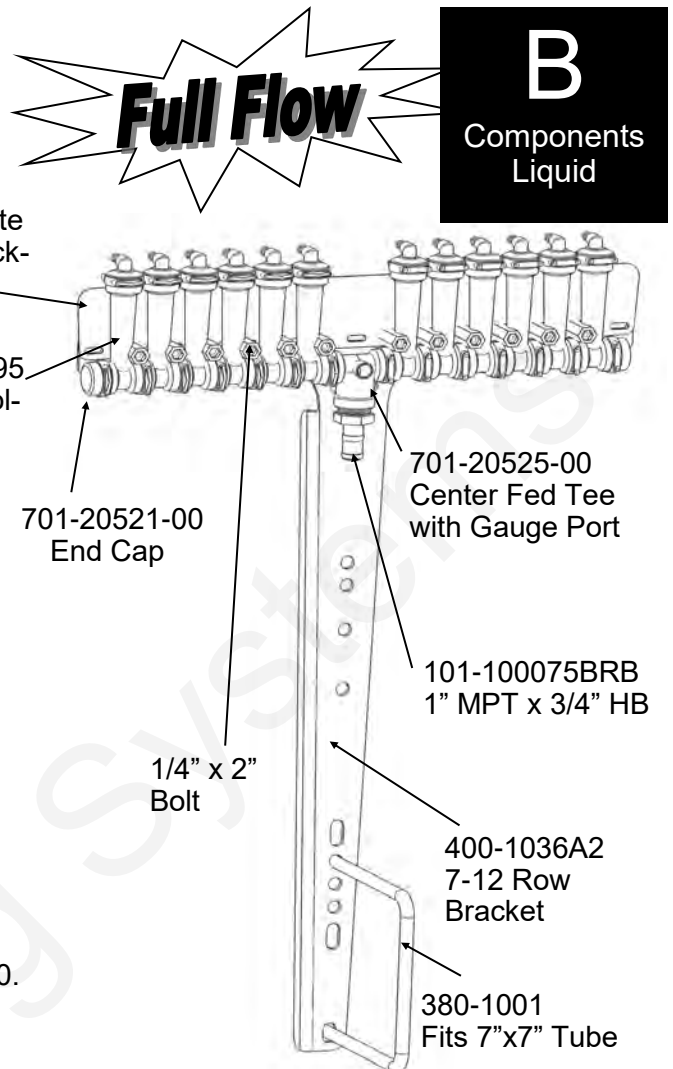
Column Flow (GPM):	.05-2.70 GPM
Equivalent Application Rate On 30" Rows at 6 MPH:	2-70 GPA

Ball Selection for 30" Rows

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

*SureFire 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.

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

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

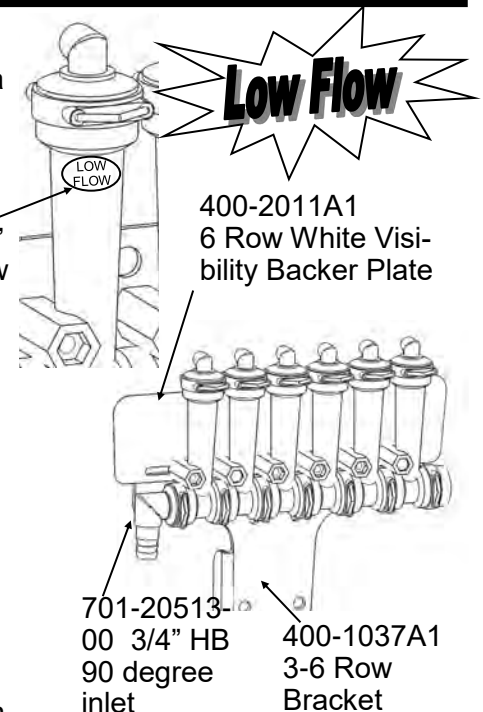
Low Flow Indicators w/ 1/4" Push to Connect Outlet

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

Ball Selection for 30" Rows

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

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



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

See www.surefireag.com for other row spacings



30” Spacing

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

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

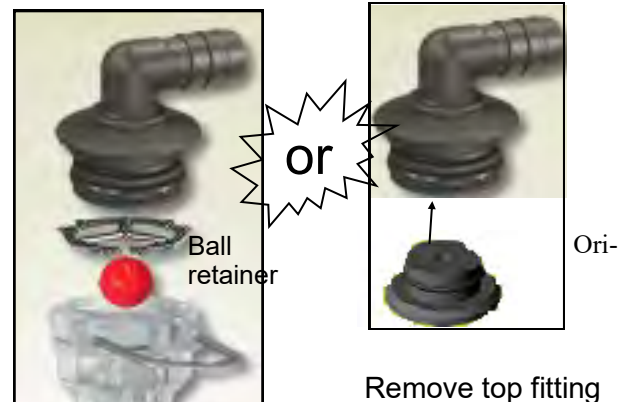
- Minimum 10 PSI
- Maximum 30 PSI (*The pumps will operate up to 60 PSI, but the pump output decreases greatly at higher pressures.*)

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.

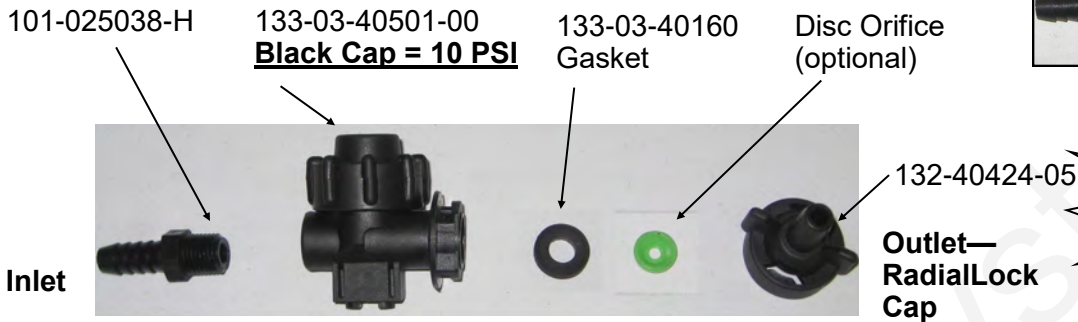
Remove top fitting of each column. Then push the metering orifice into bottom of each outlet fitting.

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

Check Valves

10 lb check valve with 3/8" hose barbs

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



B
Components
Liquid



FLOW →

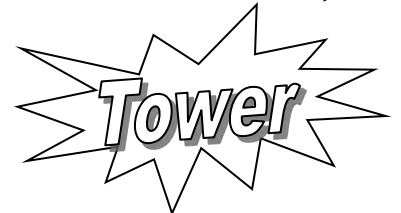


4 lb check valve with 1/4" quick connect fittings

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



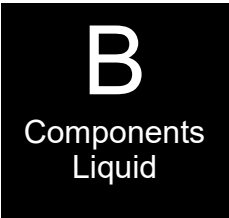
FLOW →



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 (*The pumps will operate up to 60 PSI, but the pump output decreases greatly at higher pressures.*)

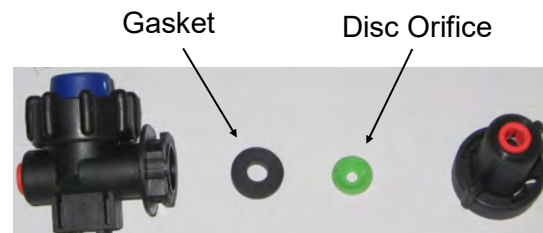
PumpRight Pressure Recommendations (with 10 lb check valves):

- Minimum 20 PSI
- Maximum 80 PSI

Chart is for 28-0-0 Fertilizer @ 70°

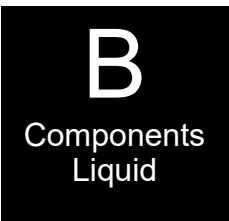
- Heavier fertilizers (like 10-34-0) will have 5-15% less flow than chart indicates for a certain pressure
- Cold fertilizers will cause system pressure to increase at a given application rate.
- Tower Electric Pump Systems will have reduced flow and increased electrical current draw due to cold fertilizer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

Colored Disc Orifice assemblies 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

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

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

Colored Disc Orifice Chart

B

Components
Liquid

22" Spacing

Orifice Color (Approx Size)	MPH								
	PSI	Gal/Min 28-0-0	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
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
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
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
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
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
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
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
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
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
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
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.

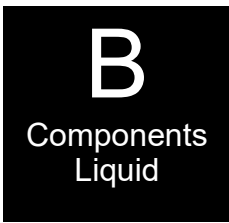
36" Spacing

Orifice Color (Approx Size)	MPH								
	PSI	Gal/Min 28-0-0	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
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
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
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
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
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
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
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
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
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
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
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 on metering tube, see [this article](http://www.surefireag.com/cms/images/Metering-Tube-Maze_Reduced.pdf). (http://www.surefireag.com/cms/images/Metering-Tube-Maze_Reduced.pdf)



SureFire 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).

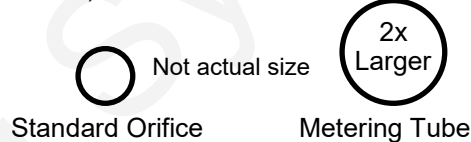
These instructions will show you where all the pieces go. It will provide guidance on how much metering tube to use. There are some optional fittings included in each plumbing kit. These instructions will show you where and why you'd want to use the optional pieces.

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. Black Label ZN and other liquid fertilizers can have a widely variable viscosity range. Therefore, based on temperature, tank mixing and fertilizer batch, the best tube to use will change.

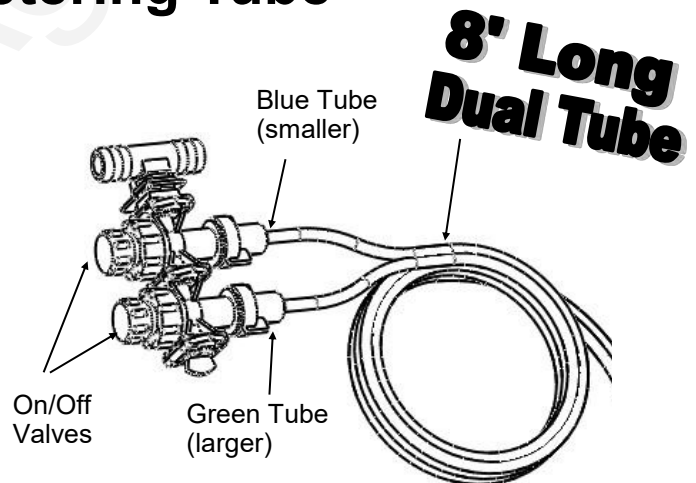
SureFire recommends you start with the Green (or larger) tube ON only. This is the middle application range and is a good starting point. Conduct a test using the test speed mode to determine your system pressure. Recommended pressure is between 8 - 30 PSI. If pressure is below 8 psi, some check valves may not open and row to row distribution will be uneven. If pressure is too high the system will operate less efficiently and Black Label ZN or other liquid fertilizer may react adversely.

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

• **Pressure below 8 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

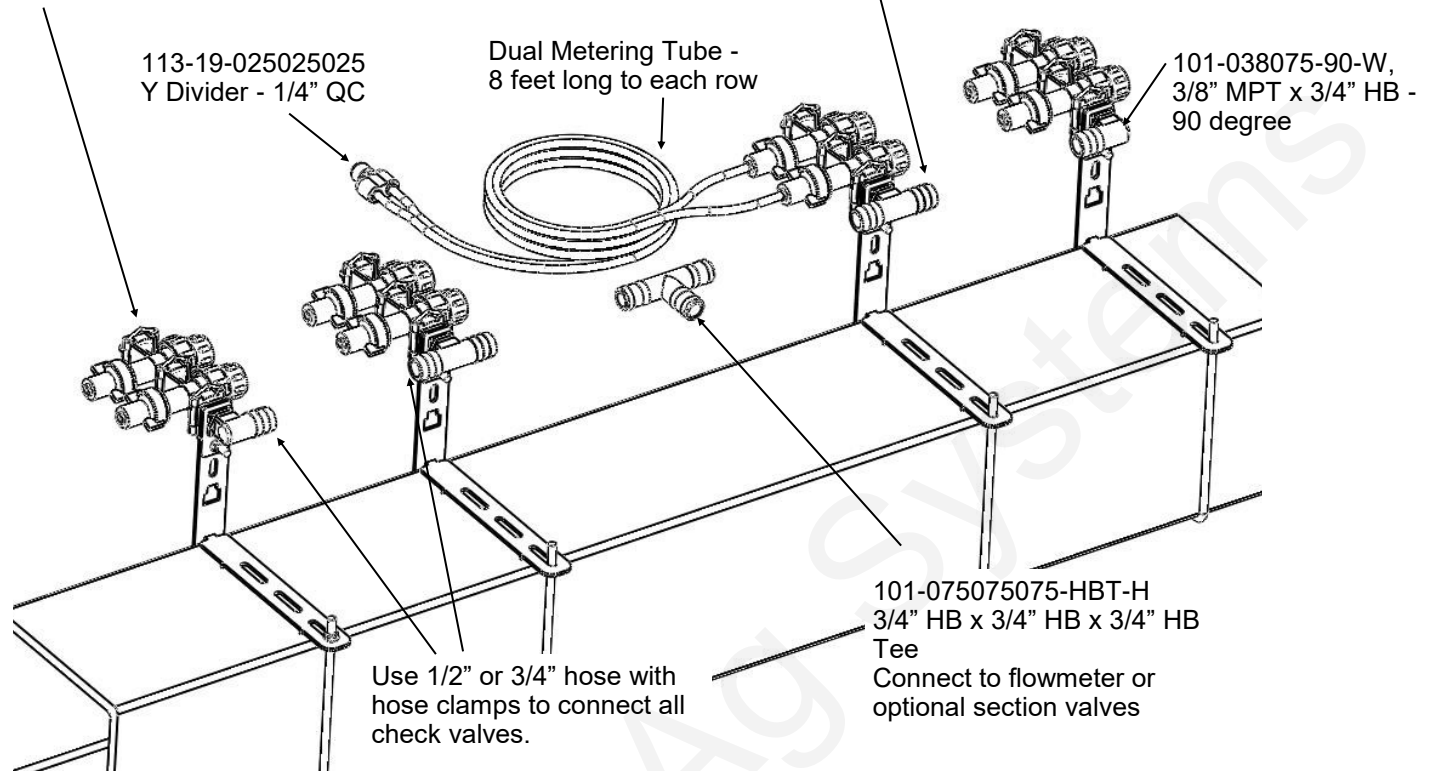
**** Ultra Low Rate Application –For rates from 2-5 oz/min/row use a 12 foot length of metering tube. To calculate oz/min/row: Oz/min/row = (GPA x MPH x spacing (inches)) ÷ 46.4**

Dual Check Valve Plumbing Diagram

4 Row Planter Shown, add rows as necessary

136-04-200400, Dual 4 PSI check valve with 1/4" QC caps and 3/8" FPT inlet

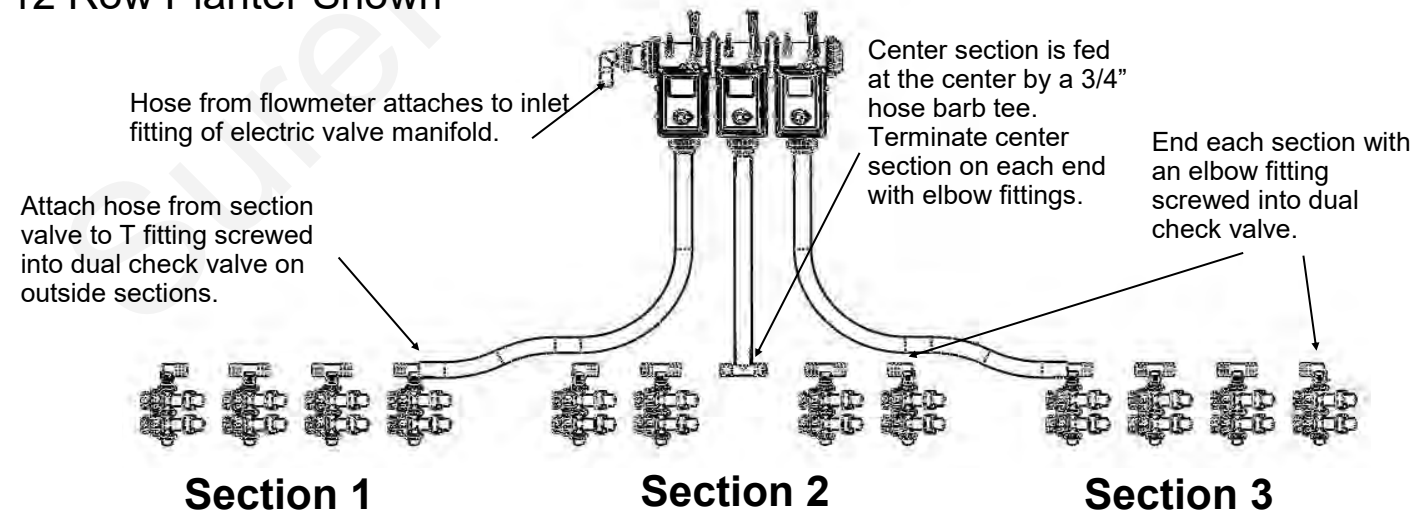
101-075075038-HBT-M-W 3/4" HB x 3/4" HB x 3/8" MPT Tee



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



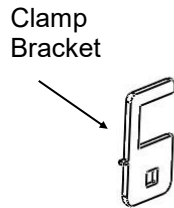
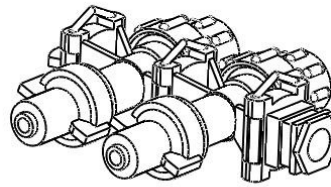
For a **2 section plumbing system**, omit the center section and plumb similar to the outside 2 sections.

Dual Check Valve Assembly Steps

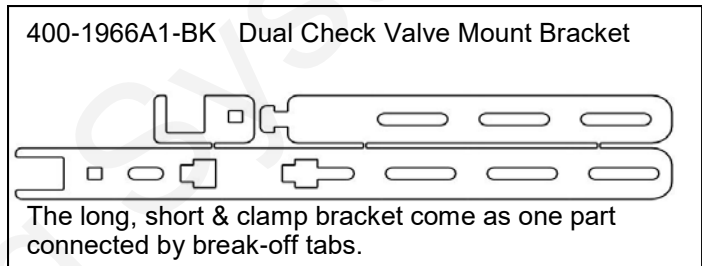
B
Components
Liquid

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

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



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



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 run 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.

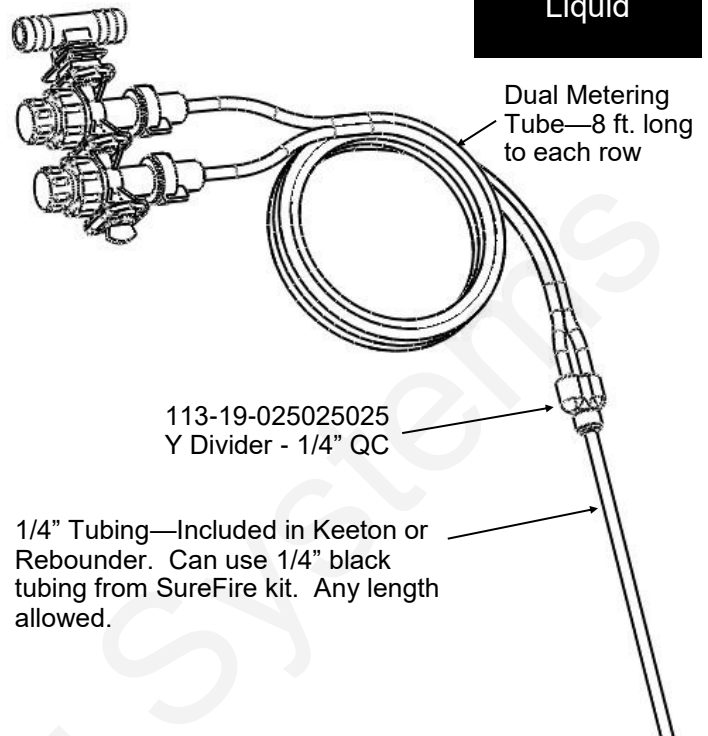
Example 3. Use the long bracket on the front of a 3x7 bar (vacuum tube on some planters). Mount the check valve hanging forward of the bar. The supply line will run directly over the bar. The excess bolt and bracket length can be cut off.

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

B
Components
Liquid

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

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

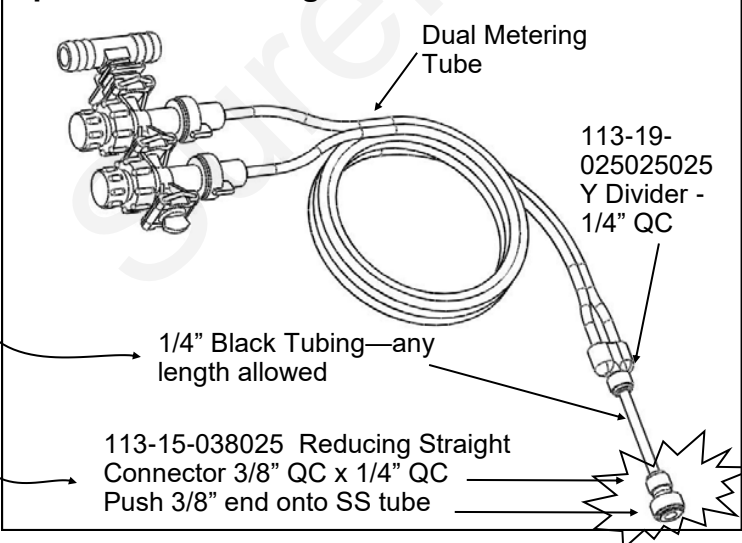


Connection to Totally Tubular or other heavy wall Stainless Steel Tube Ground Application Devices

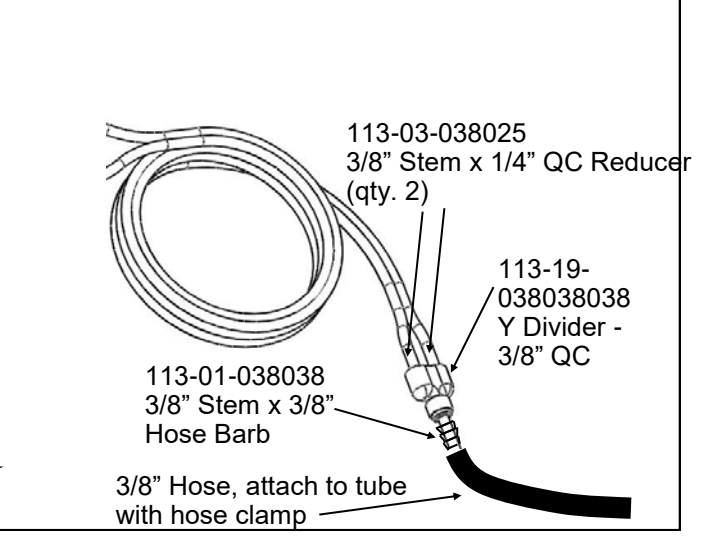
When using a 3/8" OD stainless steel tube to apply fertilizer to the ground, there are two options for the delivery tube plumbing. If the tube ID is less than 1/4" (tubing will not fit inside tube) this attachment method must be used. The description following is for Option 1. See bottom right picture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



Ag Leader Liquid Product Control Module

D

Wiring & Elec.

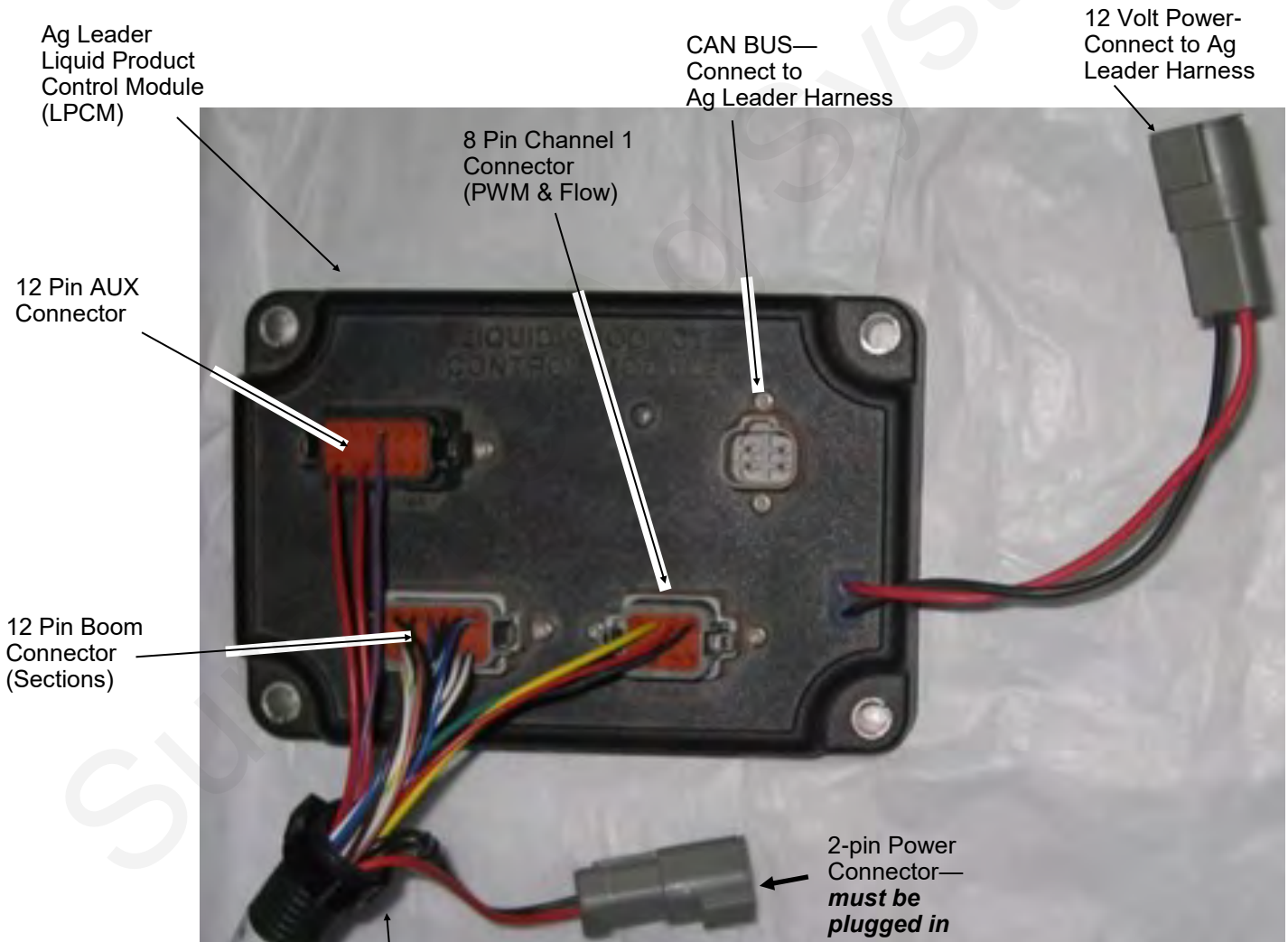
The Liquid Product Control Module is the legacy Ag Leader control module. It is still a very good control module.

Ag Leader also has an ISO Liquid Control module. The following pages show how to connect to both of these.

SureFire Fertilizer Systems begin at the Ag Leader Liquid Product Control Module. The picture below shows this control module. You will need to purchase this module from your Ag Leader dealer.

The rate controller has four harness connections. The function of each connection is labeled in the picture below and on the next page. 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 Ag Leader in cab display are in Section F. Detailed screen shots of the display are included showing exactly what settings are required and recommended for SureFire Fertilizer Systems.



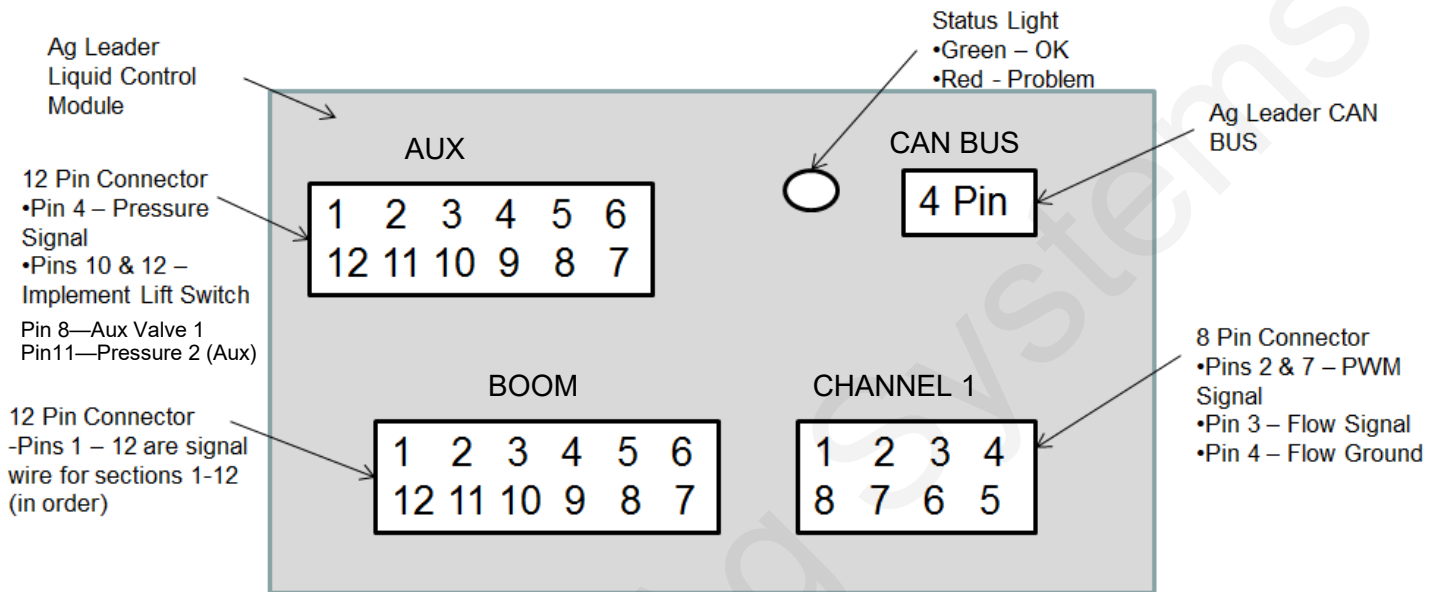
SureFire adapter for Ag Leader LPCM to pump and sections.
SureFire PN **201-215468Y*** or **213-01-3768Y***.

Implement Lift Switch Jumper (included)
MUST be installed if no implement lift switch installed

Ag Leader Liquid Product Control Module



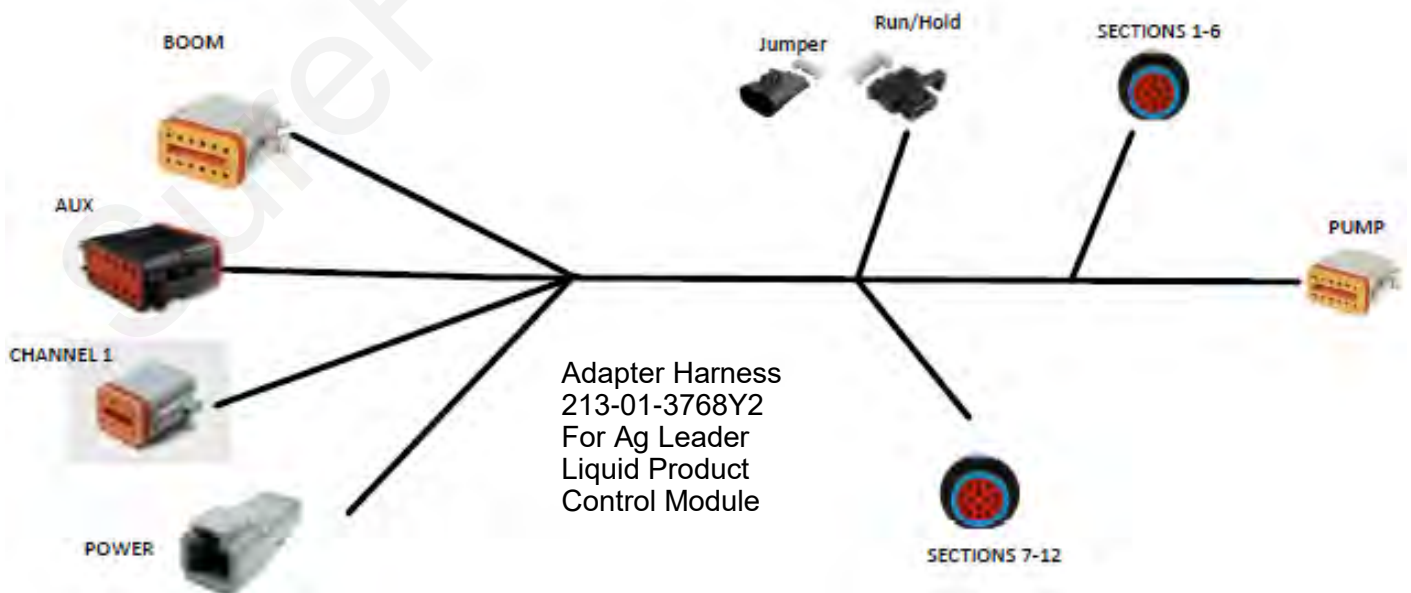
This chart shows you the output functions by pin location on the Ag Leader Liquid Product Control Module. Use this information to verify if the Ag Leader system is providing the correct output. If the module is not providing the correct output, contact your Ag Leader dealer to repair the problem. Also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



Common Troubleshooting:

PWM Signal to Pump: Pin 2 to 7 should have 0-12 volts to turn pump on. Use manual mode to increase signal. Should get up to 12 volts after holding increase button.

Flow meter Tap Test: Pins 4 and 3 are Flow Ground and Signal. 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.

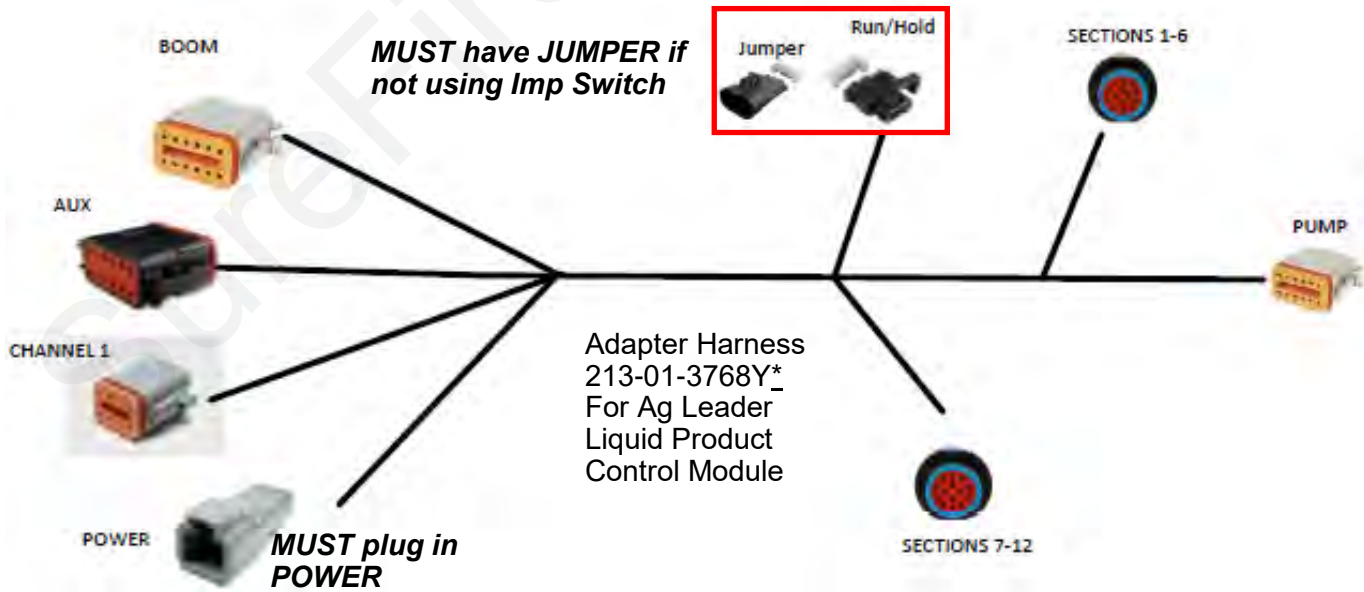
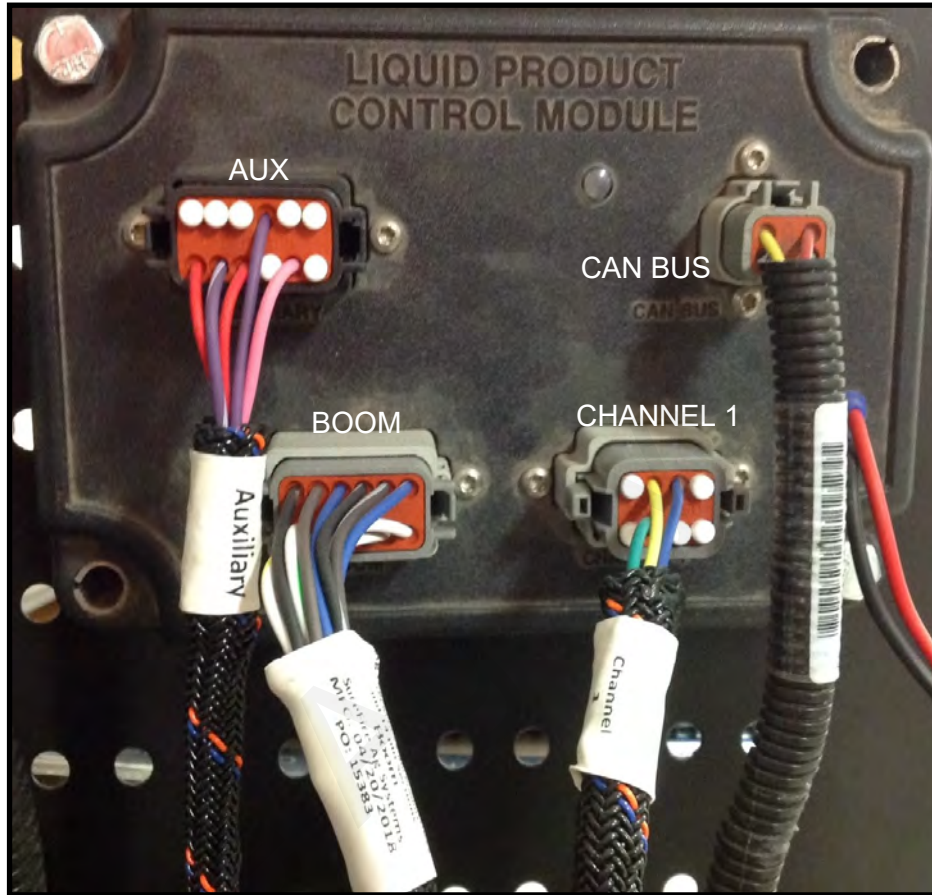


Connecting Liquid Product Control Module

D

Wiring & Elec.

Plug in Adapter Har-
ness
213-01-3768Y_
Or previous Sure Fire
systems used
201-215468Y_

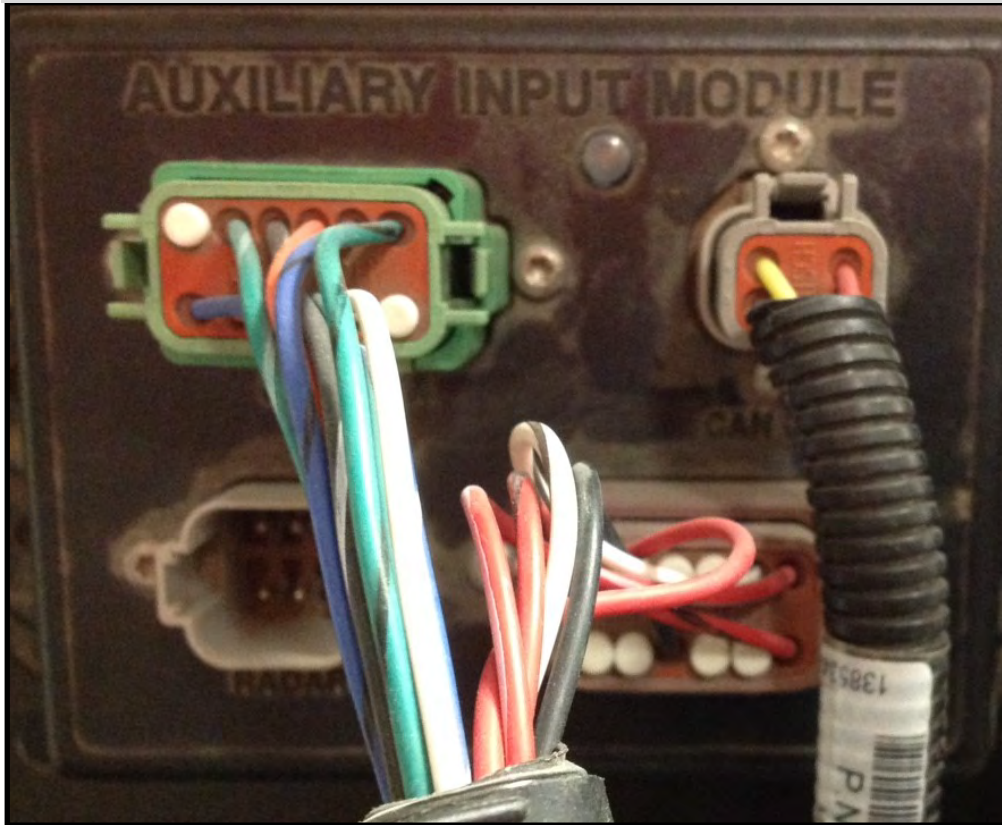


Auxiliary Input Module

Connects to Ag Leader Display with Ag Leader harnessing

D

Wiring & Elec.



Ag Leader ISO Liquid Rate and Liquid Swath Control

D
Wiring & Elec.

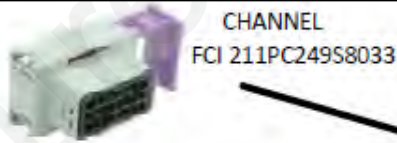
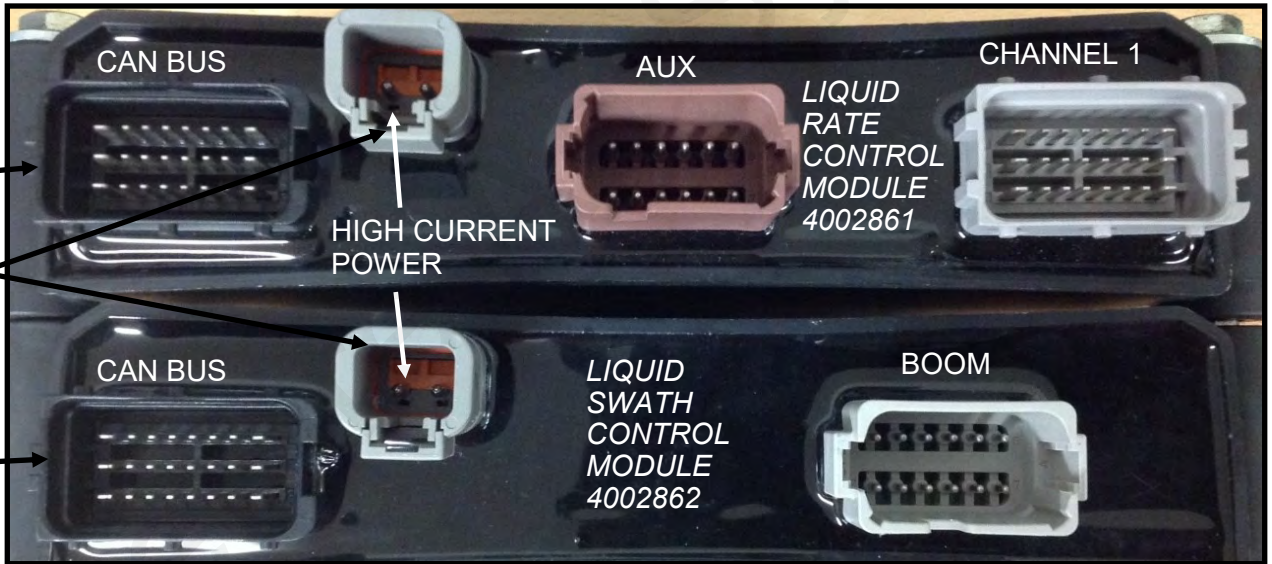


Ag Leader harnesses

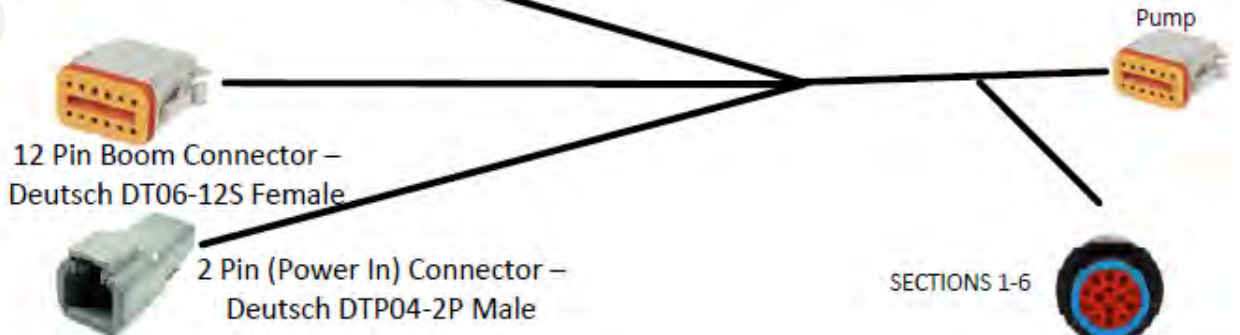
4002597-xxx ISOBUS Breakout

4002767 High Current Power

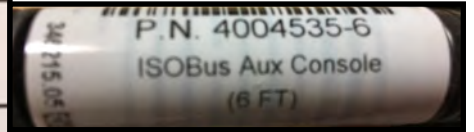
4002567 Local CAN Breakout



Use SureFire Adapter Harness 213-01-3620Y* For Ag Leader ISO Liquid Rate and Swath Modules



Ag Leader ISO Aux Input and Implement Switch Module



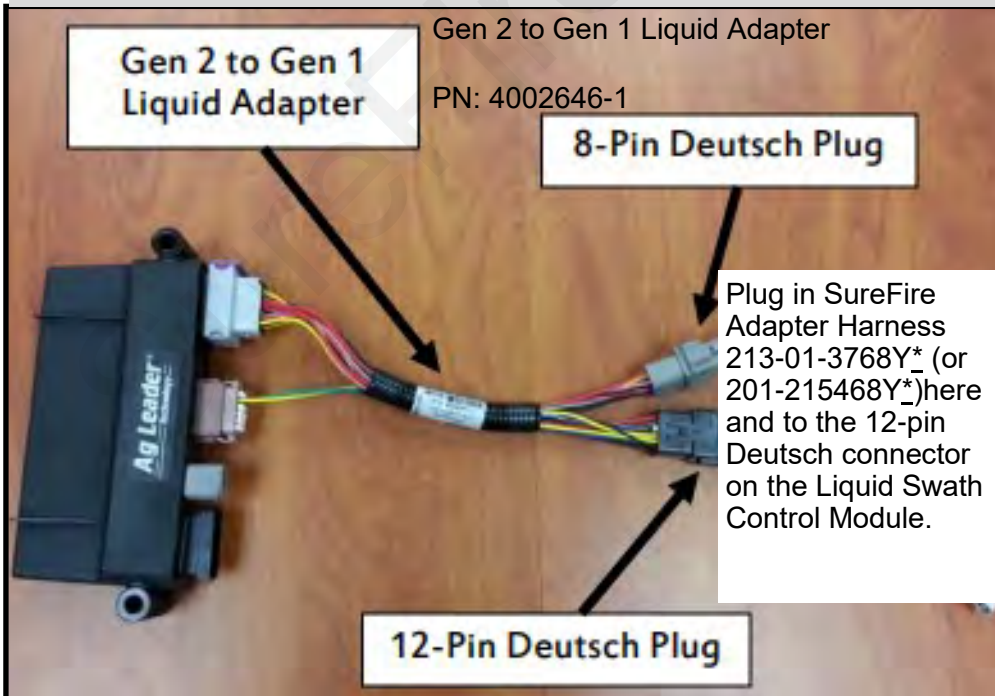
Master
 Boom Sections (1-7)
 Rate 1, Rate 2,
 Manual
 Target Increment,
 Increase/Decrease

Items needed for Implement Switch (Optional)

CAN Implement Switch Module	4002911
CAN Implement Switch Cable	4002658

Some kind of Implement Switch (available from SureFire)

Ag Leader Gen 2 to Gen 1 Liquid Adapter



If the ISO Liquid Module is replacing an Ag Leader Liquid Product Control Module, start with the Gen 2 to Gen 1 Adapter and then use the same harnessing that was used before.

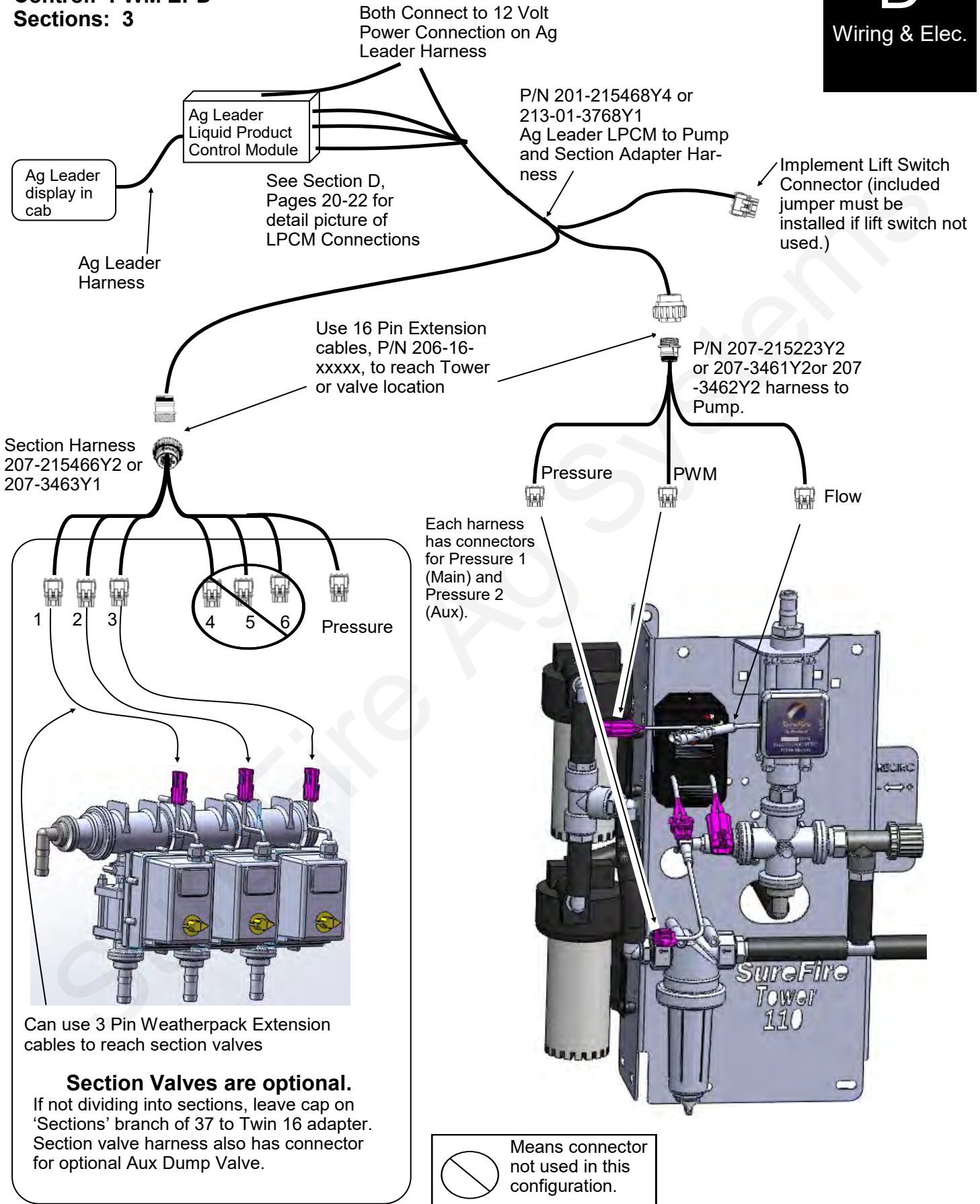
This adapter can also be used on a new setup if you will be using the Gen 1 harnessing from SureFire.

The adapter is not necessary if using SureFire 213-01-3620Y* adapter harness.

Tower & Ag Leader Control Layout

Control: PWM EPD

Sections: 3



40 Amp PWM EPD

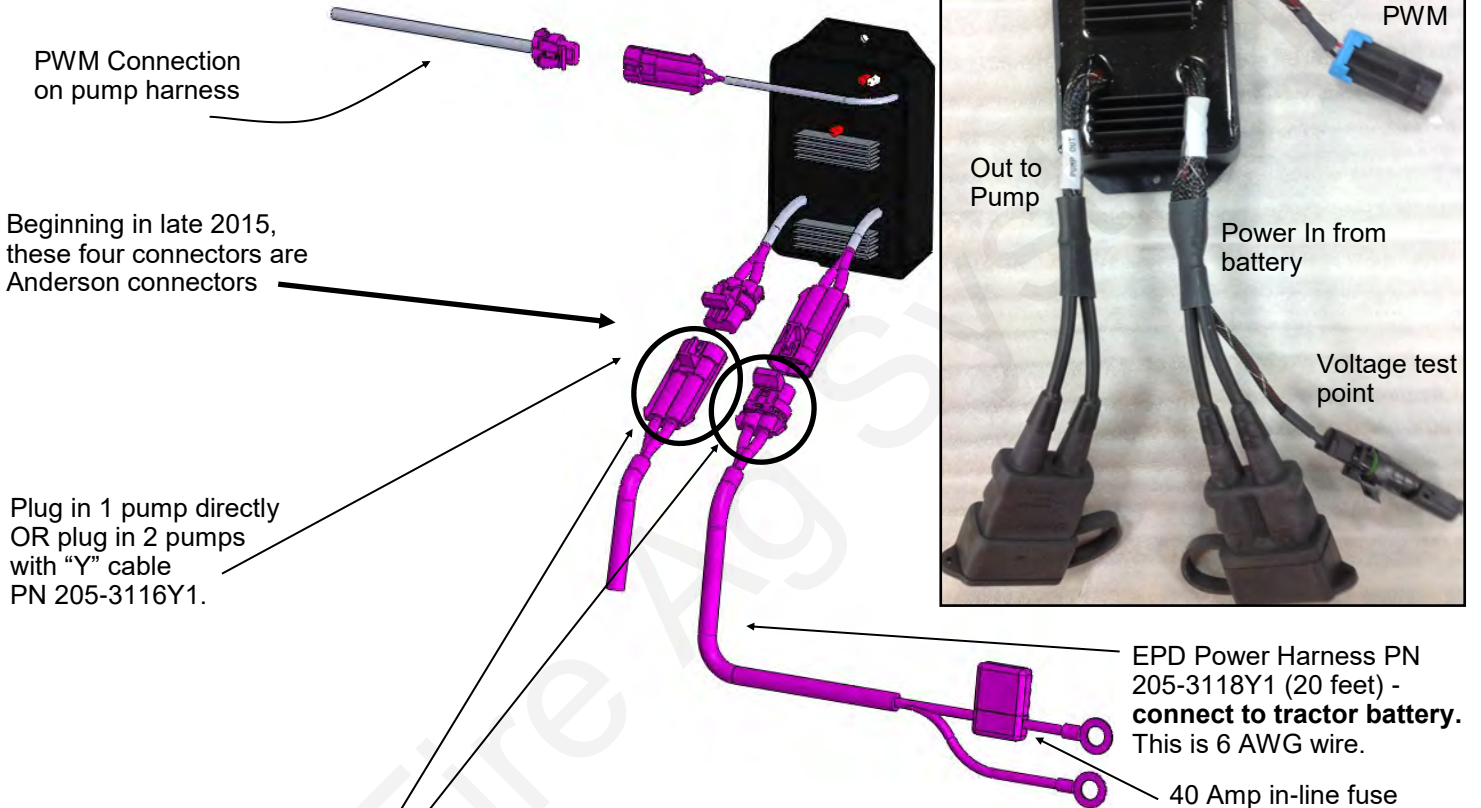
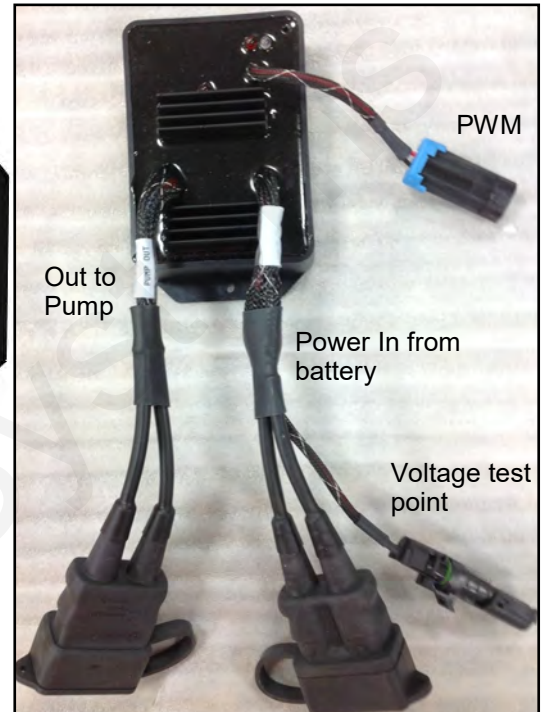
(Pulse Width Modulated Electric Pump Driver)

Item Number: 205-19024 with Anderson connectors (replaces 205-18385 with 480 MP connectors)



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.** SureFire 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.

Use EPD **Power Harness Extensions** as needed
(These have Anderson Connectors)

	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	

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

Ag Leader Harness Wiring Diagrams



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

New Ag Leader harnesses for the 2018 season for Liquid Product Control Module:

Adapter Harness

213-01-3768Y2 Ag Leader LPCM Adapter harness with 12-pin Product and 14-pin Section connectors

Pump Harness

207-3461Y2 12-pin Final Cable for Tower with 1 or 2 Section Valves (PWM, Flow, Pressure, Sections 1 and 2)

Or
207-3462Y2 12-pin Final Cable for SureFire Liquid System (PWM, Flow, Pressure)

Section Harness (if needed)

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

Ag Leader Legacy Harnesses for Liquid Product Control Module

Adapter Harness

201-215468Y4 Ag Leader Liquid Module to twin 16-pin AMP connectors

Pump Harness

207-215223Y2 PWM Pump Cable

Section Harness

207-215466Y2 16-pin 6-Section Harness

Harnesses for Ag Leader ISO Liquid Rate Control Module

Adapter Harness

213-01-3620Y1 Ag Leader Liquid ISO Module Adapter Harness with 6 sections

Pump Harness

207-3461Y2 12-pin Final Cable for Tower with 1 or 2 Section Valves (PWM, Flow, Pressure, Sections 1 and 2)

Or
207-3462Y2 12-pin Final Cable for SureFire Liquid System (PWM, Flow, Pressure)

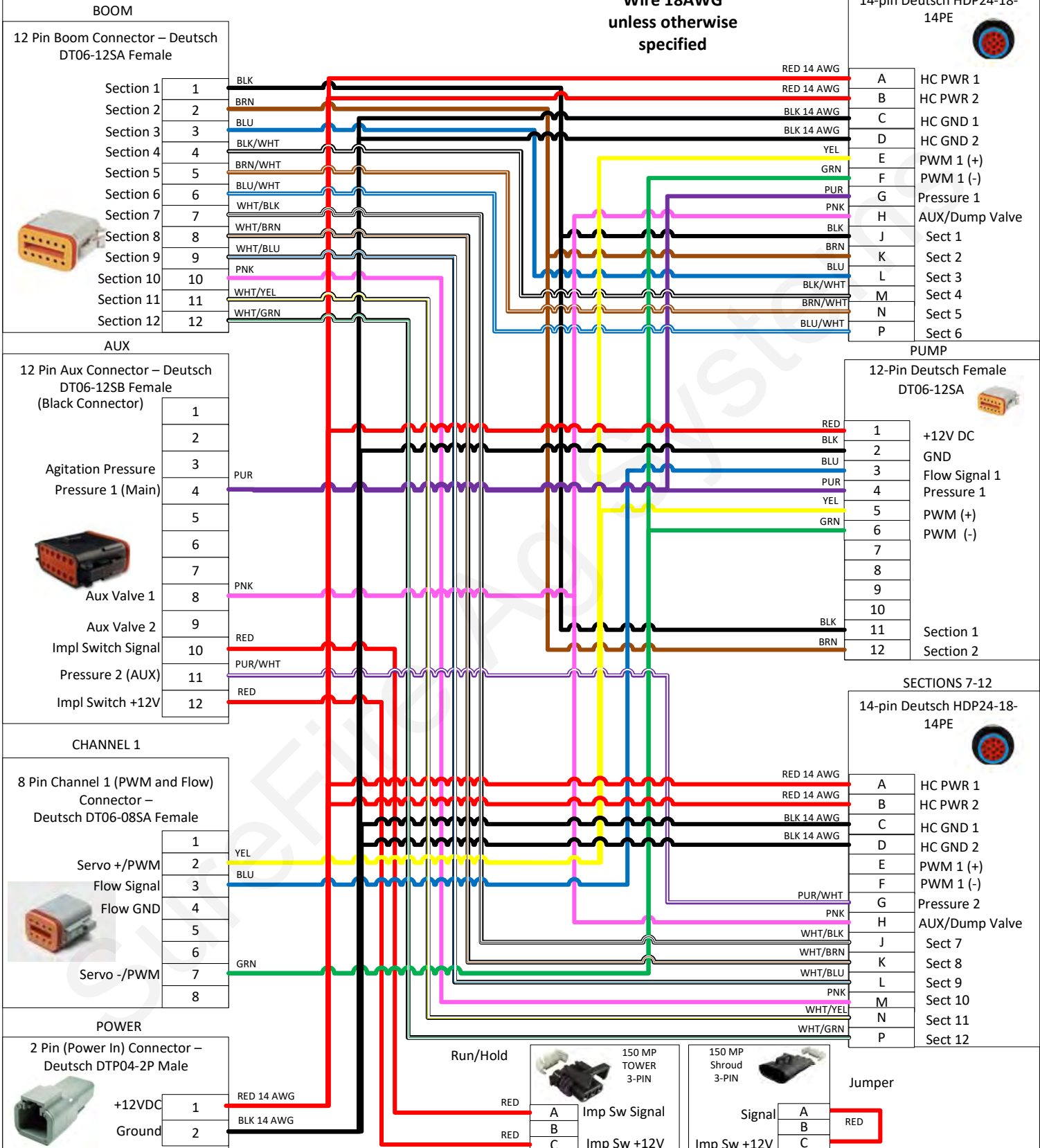
Section Harness (if needed)

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

213-01-3768Y2

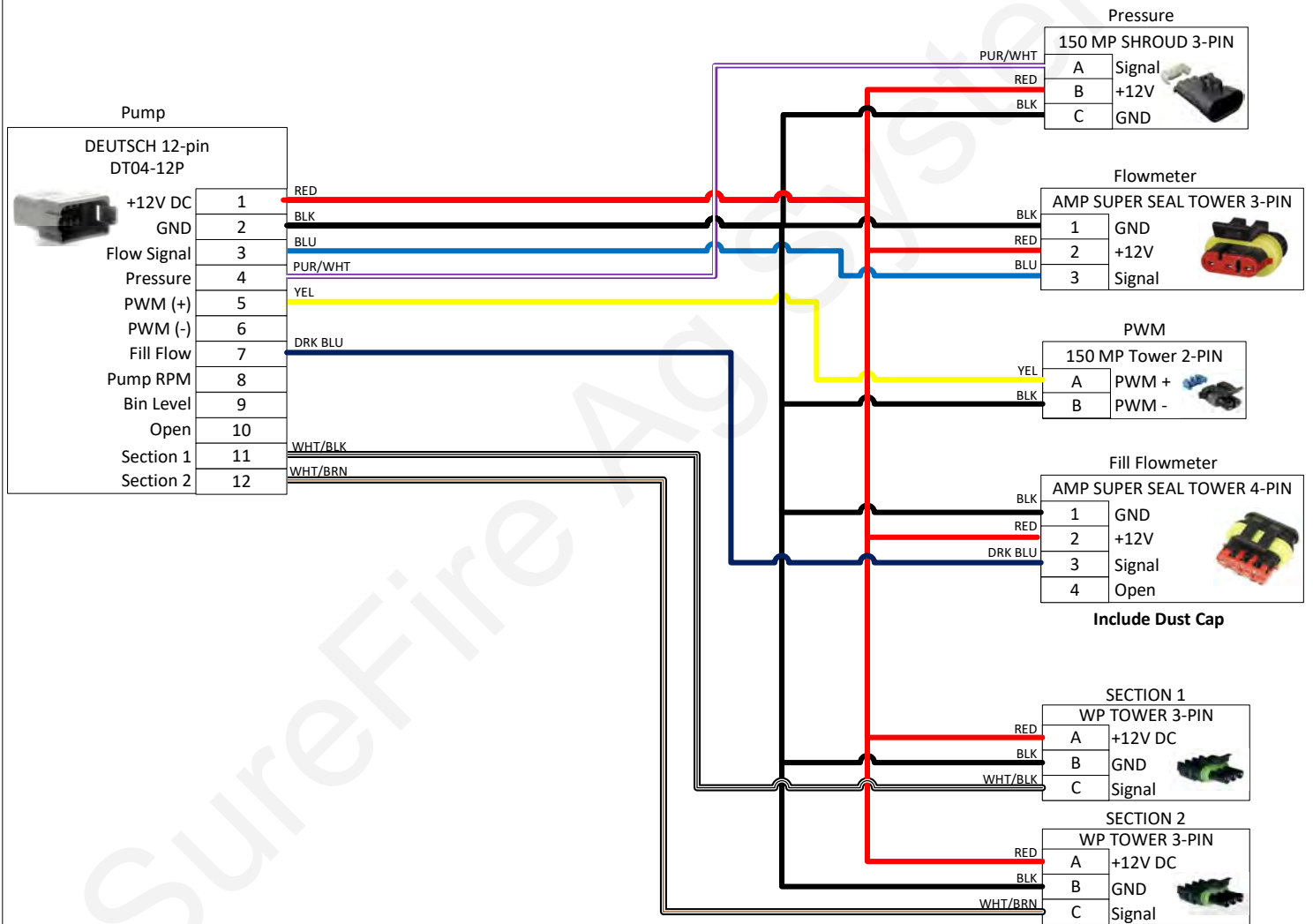
Ag Leader Adapter Cable LPCM to 12-pin Product and 14-pin Sections

**Wire 18AWG
unless otherwise
specified**



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

**Wire 18AWG
unless otherwise
specified**

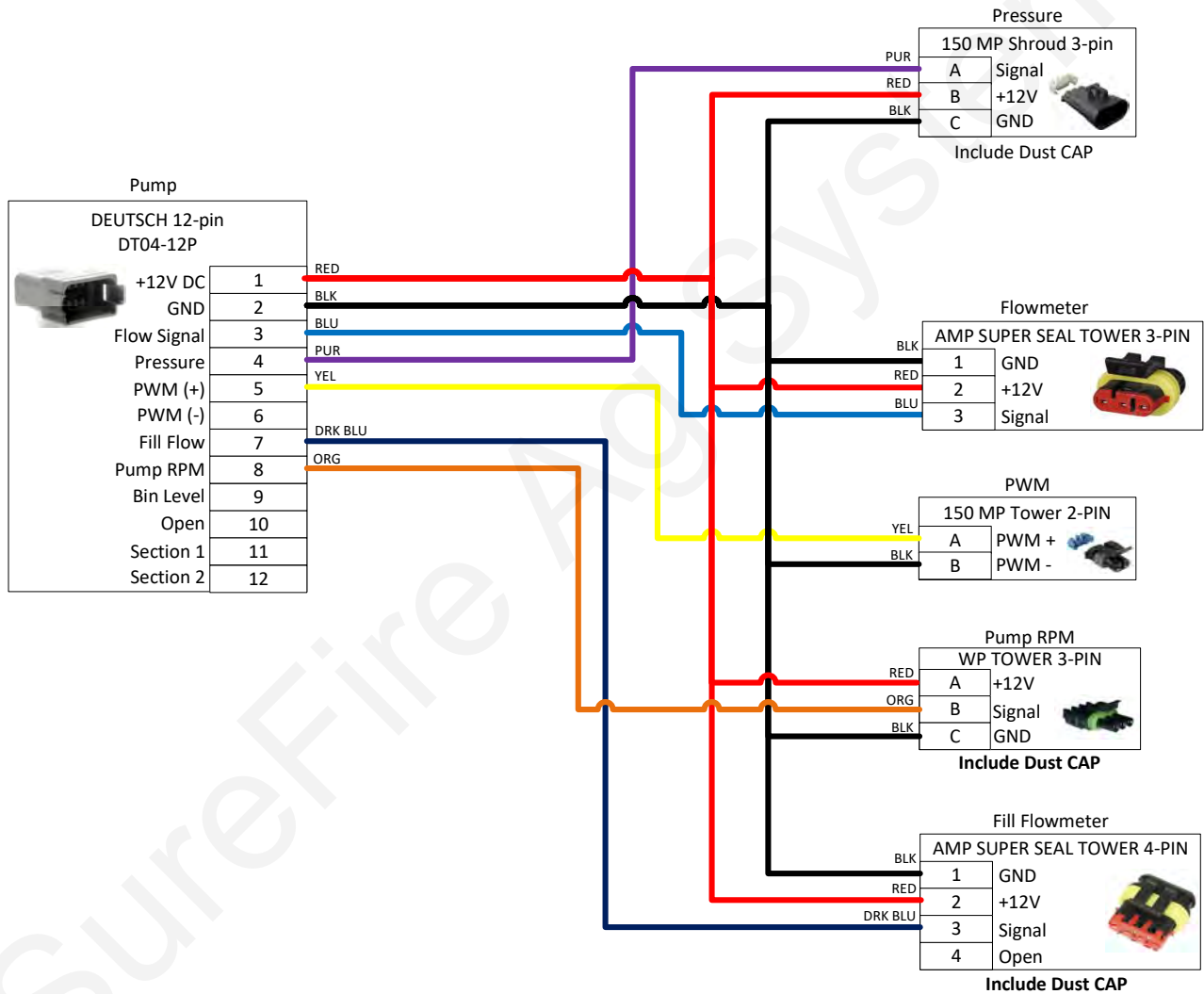


	Part No:	207-3461Y2	Drawn By:	Brandon Cavenee		
	Description:	Final Cable for Tower With 1-2 Section Valves (pwm, flow, pres., sec 1, sec 2, fill flow)	Last Edit Date:	9/4/2018	Revision	A-02
	Copyright 2018 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden			30		

207-3462Y2

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

Wire 18AWG
unless otherwise
specified



Part No:

207-3462Y2

Drawn By:

Brandon Cavenee

Description:

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

Last Edit Date:

9/4/2018

Revision

A-02

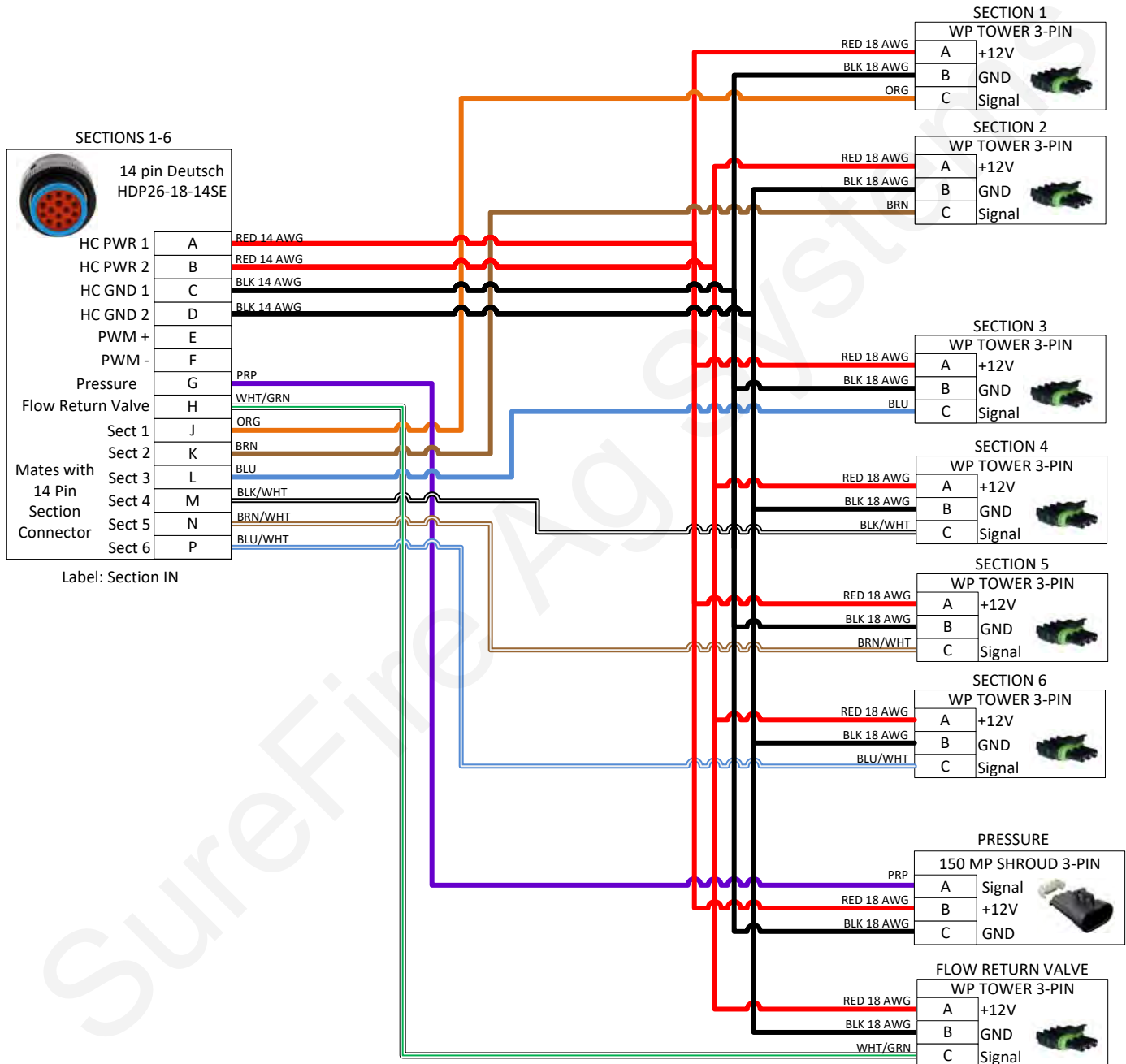
Copyright 2018 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden

207-3463Y1

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

**Wire 18AWG
unless otherwise
specified**

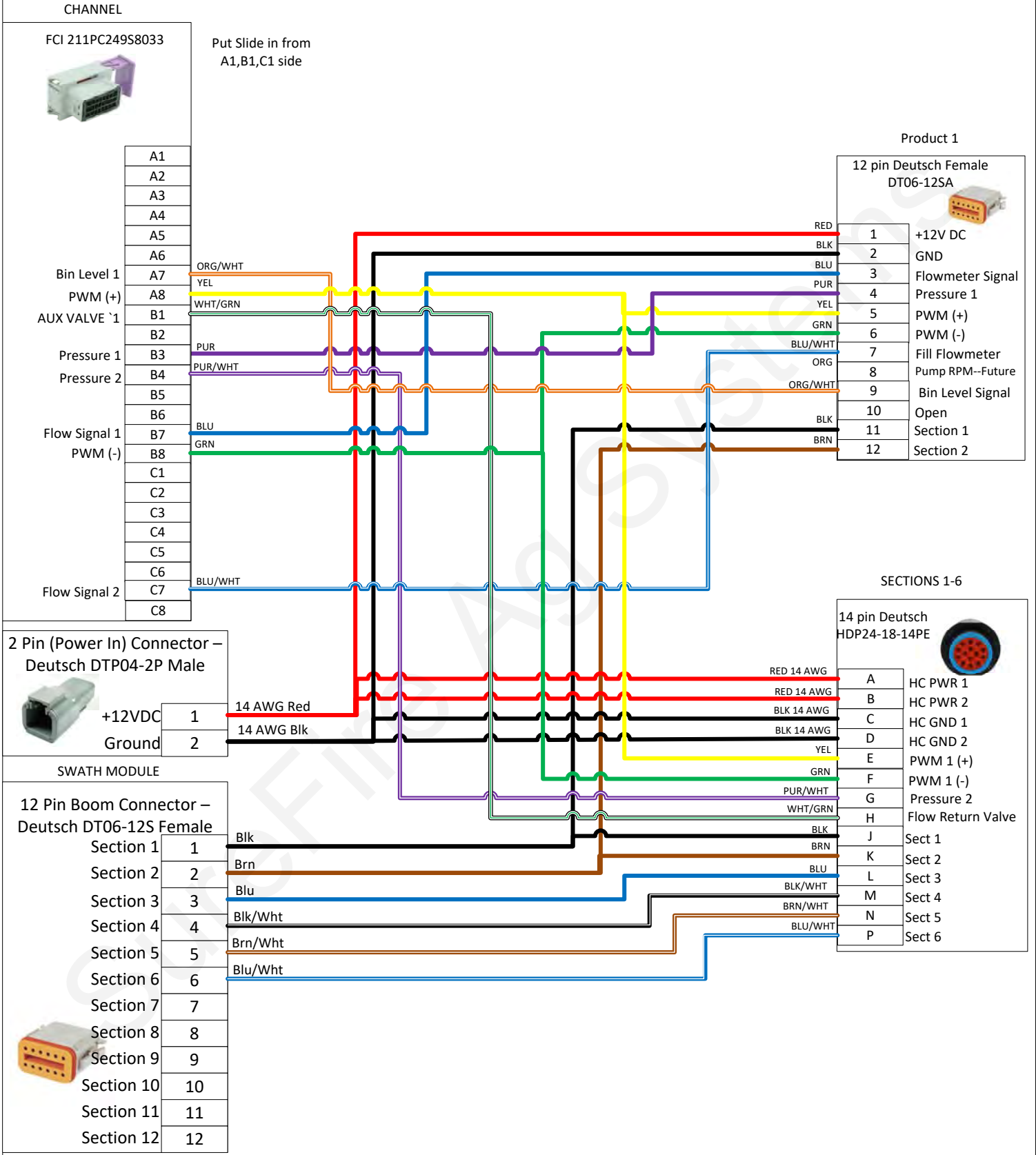
Provide dust caps for WP and MP connectors



	Part No:	207-3463Y1	Drawn By:	Brandon Cavenee		
	Description:	14-Pin 6 Section Final Cable (6 sections, flow return, pressure)	Last Edit Date:	11/2/2016	Revision	A-01
	Copyright 2016 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden			32		

213-01-3620Y1

Ag Leader Liquid ISO Module Adapter Harness (PR 1, Sec 1-6)



Wire Size: 18 AWG unless otherwise specified

201-215468Y4

Length: 2ft

Ag Leader Adapter Cable twin 16 Pins

12 Pin Boom Connector – Deutsch DT06-12S Female

Section 1	1
Section 2	2
Section 3	3
Section 4	4
Section 5	5
Section 6	6
Section 7	7
Section 8	8
Section 9	9
Section 10	10
Section 11	11
Section 12	12



12 Pin Aux Connector – Deutsch DT06-12S Female (Black Connector)

1
2
3
4
5
6
7
8
9
10
11
12

Agitation Pressure 3
Pressure 1 (Main) 4
Aux Valve 1 8
Aux Valve 2 9
Impl Switch Signal 10
Pressure 2 (AUX) 11
Impl Switch +12V 12



8 Pin Channel 1 (PWM and Flow) Connector – Deutsch DT06-08S Female

1
2
3
4
5
6
7
8

Servo +/-PWM 2
Flow Signal 3
Flow GND 4
Servo -/PWM 7



2 Pin (Power In) Connector – Deutsch DTP04-2P Male

+12VDC	1
Ground	2



16 Pin Round – AMP Male pins in male body (with threads for swivel nut)

1	Valve GND
2	Section 2
3	Section 3
4	Section 4
5	Section 5
6	Section 6
7	Section 7
8	Section 8
9	Section 9
10	Section 10
11	Pressure 2(AUX)
12	Aux Valve 1
13	Pressure 1 (Main)
14	Valve Power
15	Section 1
16	Valve Power

Attach Dust cover to Connector
Labeled "Sections"



16 Pin Round – AMP Female pins in female body (with swivel nut)

1	GND
2	Section 2
3	Servo +/- PWM
4	Servo -/ PWM
5	
6	Section 1
7	Labeled "To Pump"
8	
9	Pressure 1 (Main)
10	Pressure 2 (AUX)
11	Flow GND
12	
13	Flow Signal
14	
15	Master On/Off
16	Power



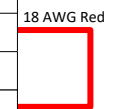
Run/Hold



A	Signal
B	
C	+12V



Signal	A
	B
+12V	C



Project:	201-215468Y4	Drawn By:	Albert Popp Rev. by Mark Wolters
Filename:	Ag Leader Adapter Cable twin 16 pins (2 Pressure and Aux Valve 1)	Date:	10/7/2011 Rev. 09/24/2013 01/13/2015,03/24/2016
Copyright 2011-2016 SureFire Ag Systems		34	

PWM Pump Cable - Flowmeter, PWM and Pressure

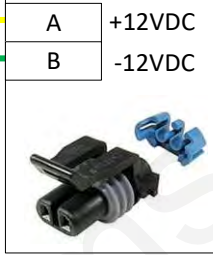
207-215223Y2

Wire Size: 18 AWG

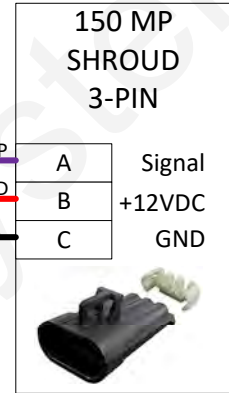
16 Pin Round – AMP
Male pins in male body
(with threads for swivel nut)



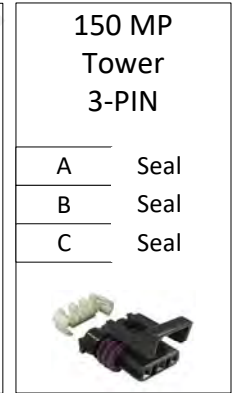
PWM
150 MP
TOWER
2-PIN



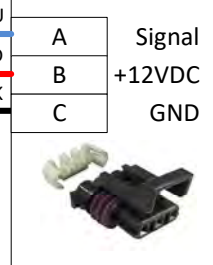
PRESSURE 1



PLUG
(PRESSURE)

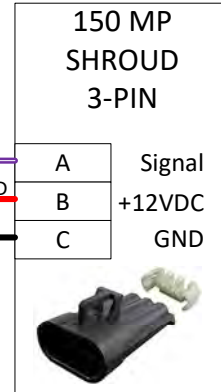


150 MP
Tower
3-PIN

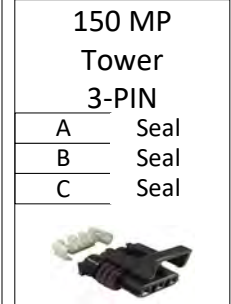


FLOW
Meter

PRESSURE 2



PLUG
(PRESSURE)



Part No:	PWM Pump Cable - Flowmeter, PWM and Pressure	Drawn By:	Brady		
Description:	207-215223Y2	Last Edit Date:	1/22/2019	Revision	A-01
Copyright 2019 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden		35			

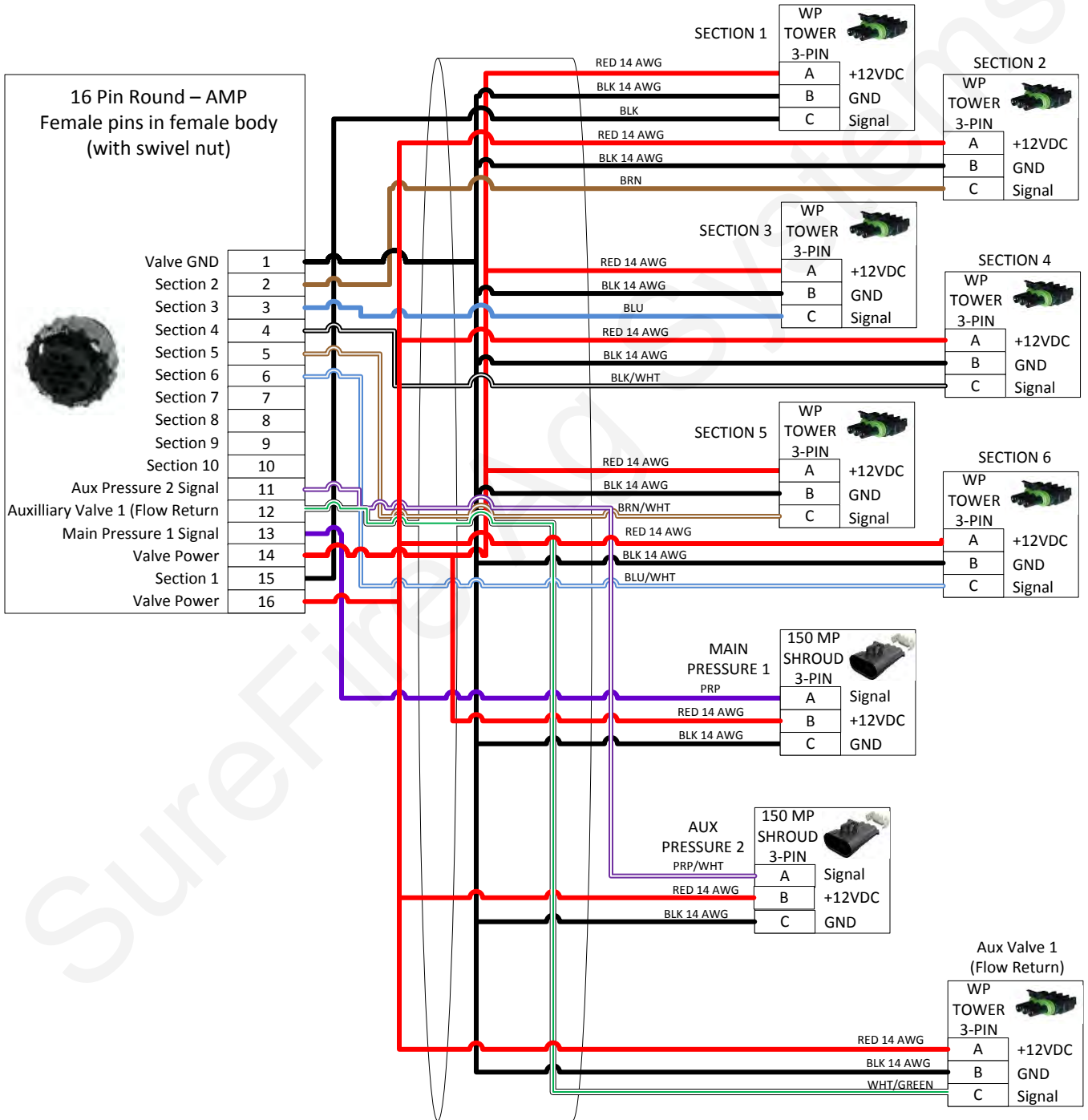
207-215466 Y2

6 Section Boom Harness w/ 2 Pressure and Auxilliary Valve 1 (Flow Return)

Wire Length: 10'

All wire gauge 18 AWG
Unless Specified

Provide dust caps for WP and MP connectors



Project:	207-215466 Y2	Drawn By:	Dirk Ricker Rev. by Mark Walters
Filename:	6 Section Boom Harness w/ 2 Pressure and Aux Valve 1 (Flow Return)	Date:	9/12/2012 08/20/2013
Copyright 2012-2013 SureFire Ag Systems		36	



SureFire Ag Systems

Floating Ball Flow Indicators

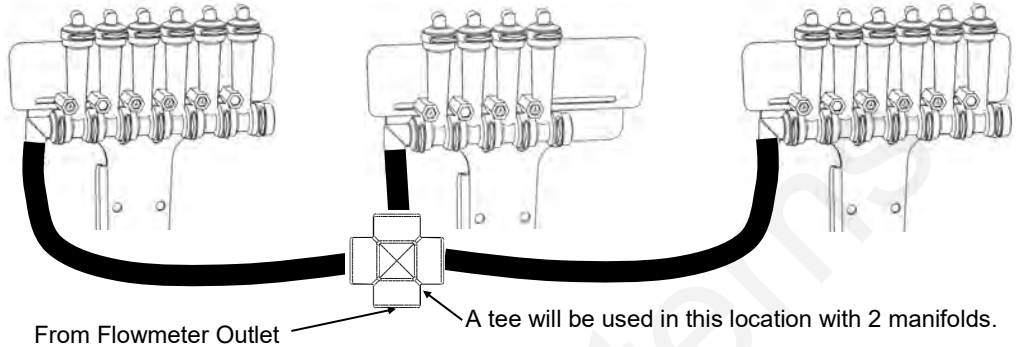
Flow Indicators are extremely flexible and can be mounted in hundreds of different configurations on various types of liquid application equipment. This page is to give you some ideas and let you customize the installation for what works best on your equipment.

E Installation Overview

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.

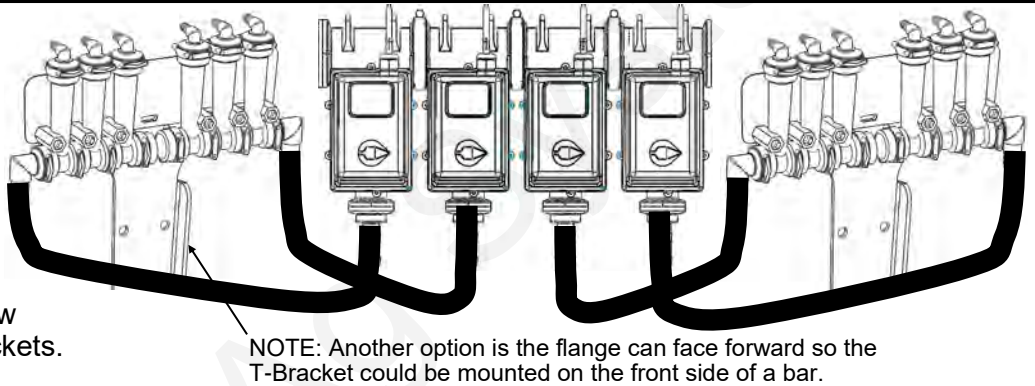


12-Row

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.

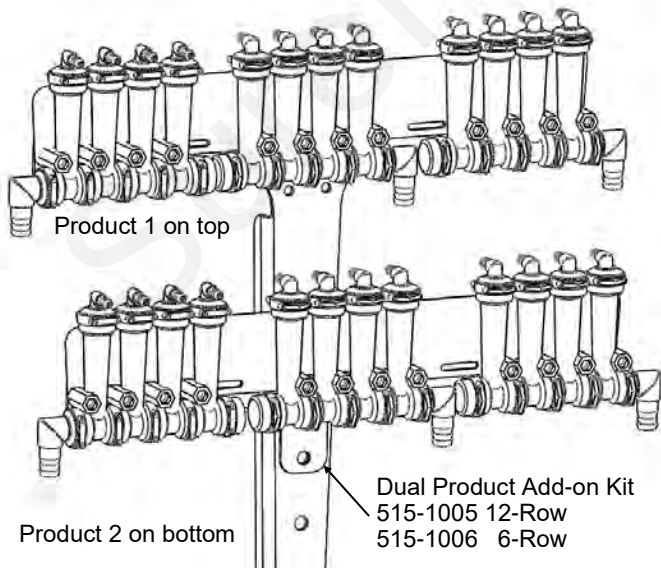
A 4-section 24-row could be similar with four 6-row manifolds on two large T-Brackets.



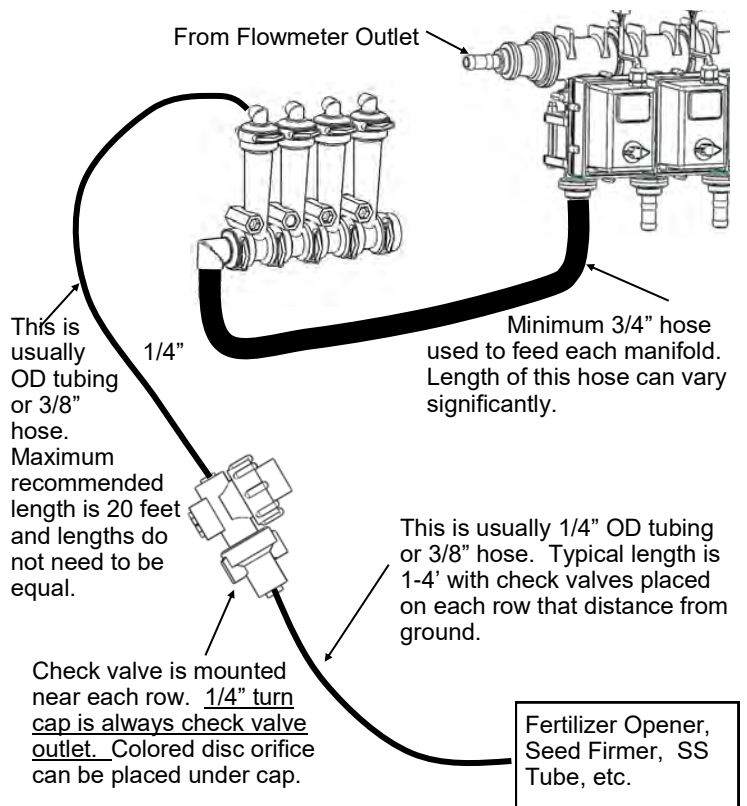
12-Row Dual Product

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

E

Installation
Overview

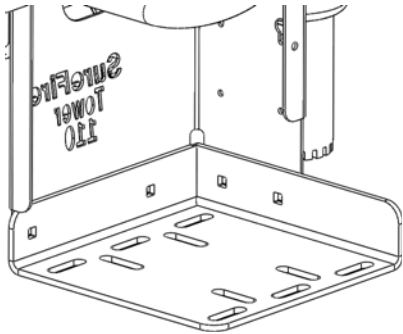
Tower Basic Mounting Bracket

Item Number:

511-1007 (8x16 hitch)

511-1008 (8x12 hitch)

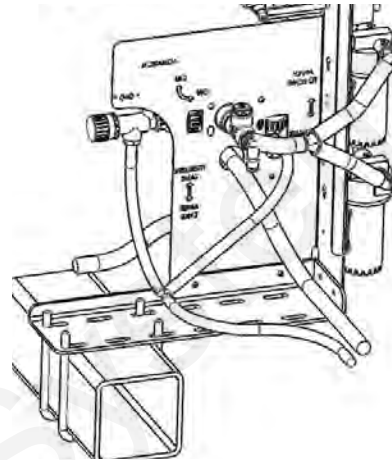
This kit includes a bracket to mount to the top side of a bar or hitch and mount the tower directly over that bar. It is often used on front fold planter hitches. U-bolts to mount to two common hitch sizes are included in the kits as labeled above.



Tower Offset Mounting Bracket

Item Number **511-1010**

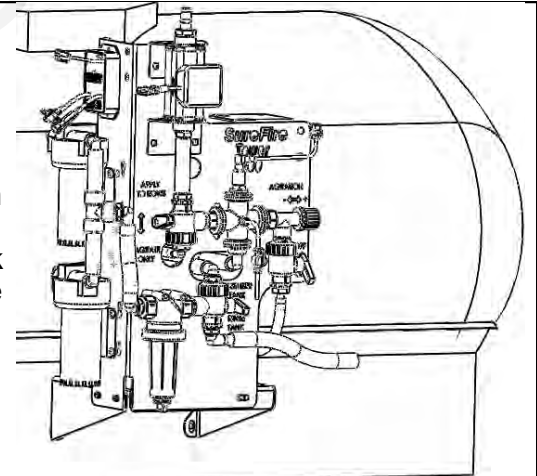
The Tower is available as a stand alone item. This kit includes a bracket to mount to the top side of a bar and hold the Tower. U-bolts are NOT INCLUDED. They must be ordered separately based on mounting bar size. Multiple slots allow the Tower to be mounted away from or directly over the bar.



Tractor Front Mount Elliptical Cradle Tower Mounting Bracket

Item Number **511-1009**

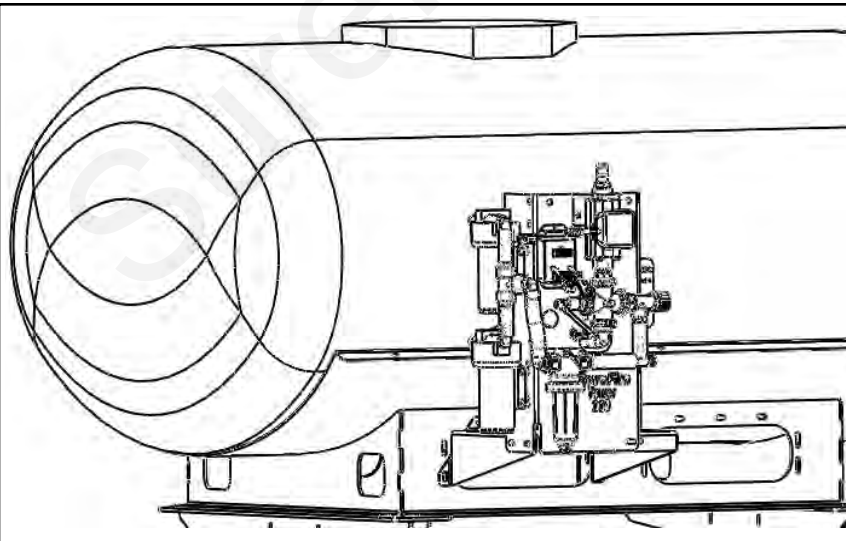
Mounts a Tower directly to the front of tractor front mount 200 & 300 gallon elliptical tank cradles. This bracket will mount the back of the tower just over 4 1/2" forward of the flat bracket mounting face. When using a tractor mounted tank, SureFire recommends mounting the Tower near the tank, not 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 SureFire 500 gallon elliptical tank cradle. This bracket will mount the back of the tower just over 9" forward of the flat bracket mounting face.



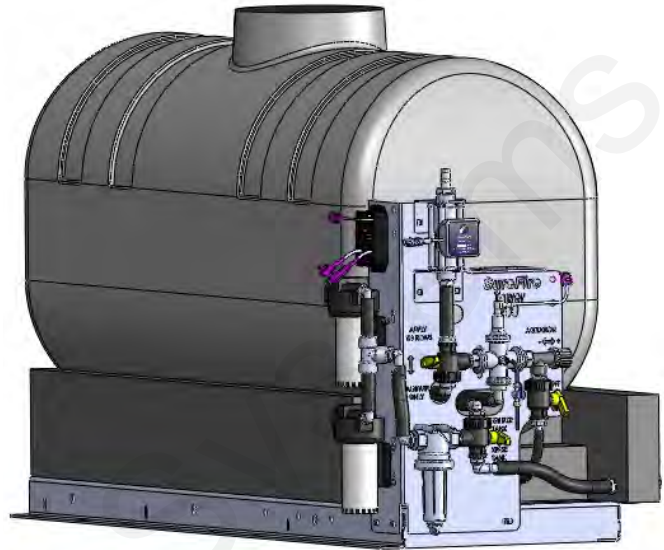
Accelerator with Tower 200 Pump Panel



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.

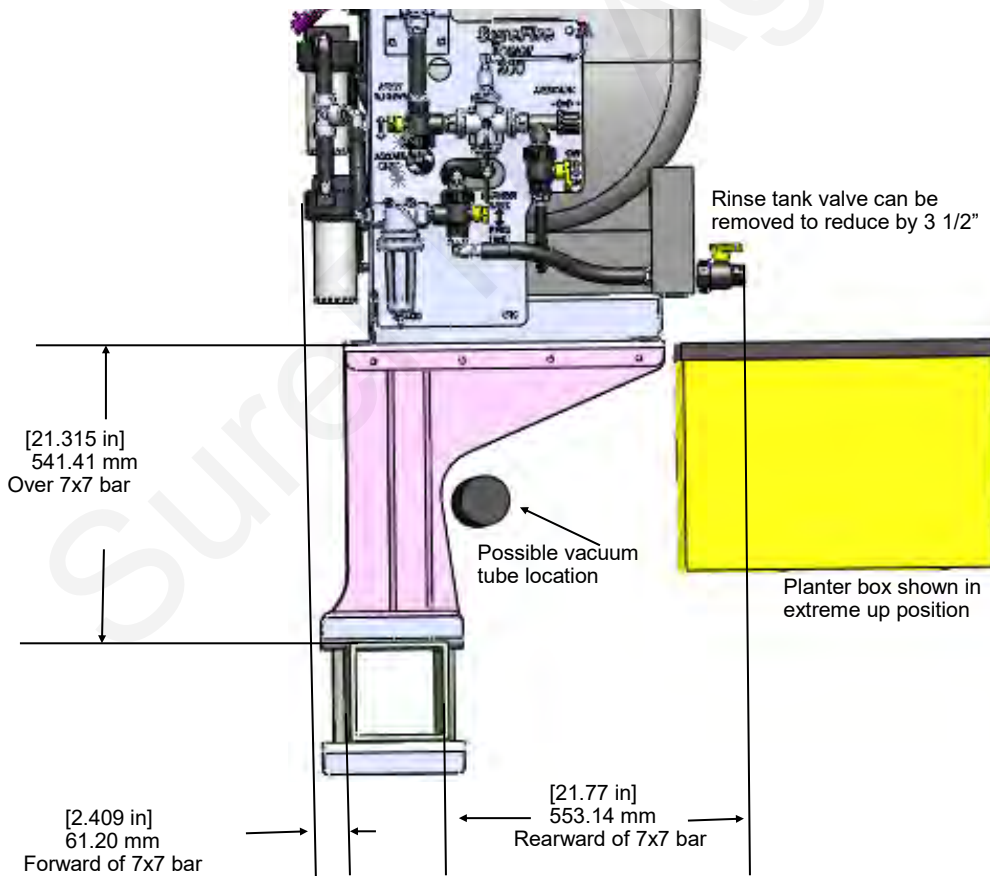
Dimensions:

- 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

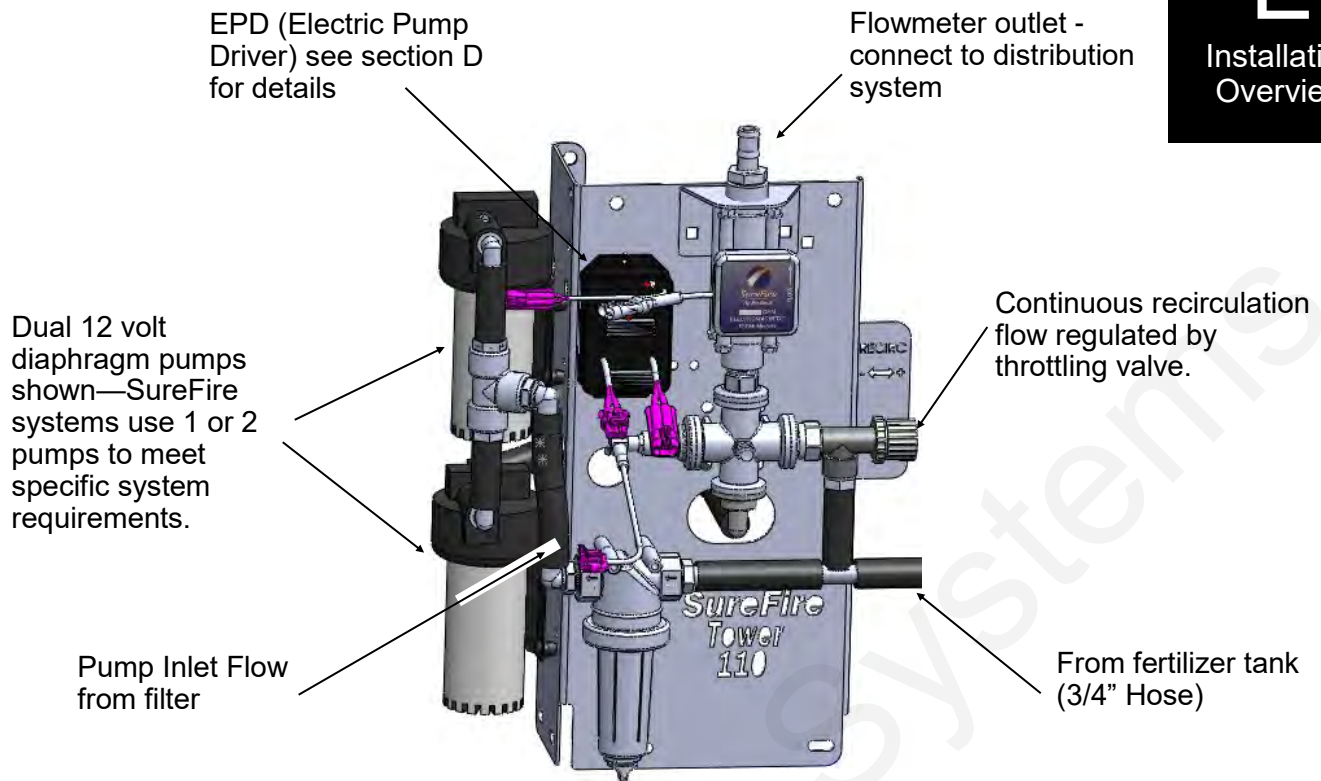
This mount kit includes two welded brackets to mount any of the 3 sizes of accelerator tanks above and offset from the 7x7 planter toolbar as shown.



Tower 110 Plumbing Overview & Valve Operation

E

Installation
Overview



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 Ag Leader 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 Ag Leader display, verify the system has locked on to application rate at your agitation valve setting. (Generally, a quarter to a half turn of the knob is all that is needed.)

Troubleshooting:

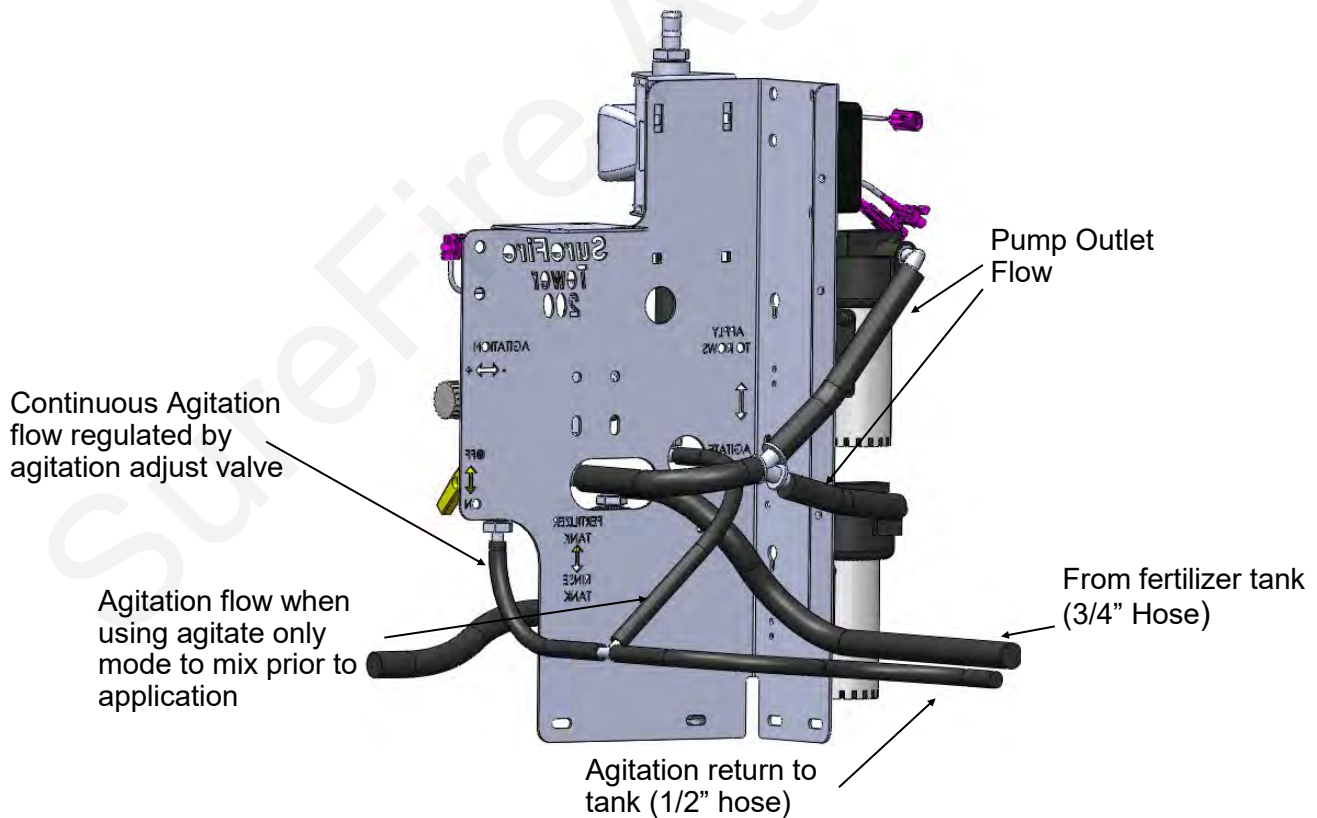
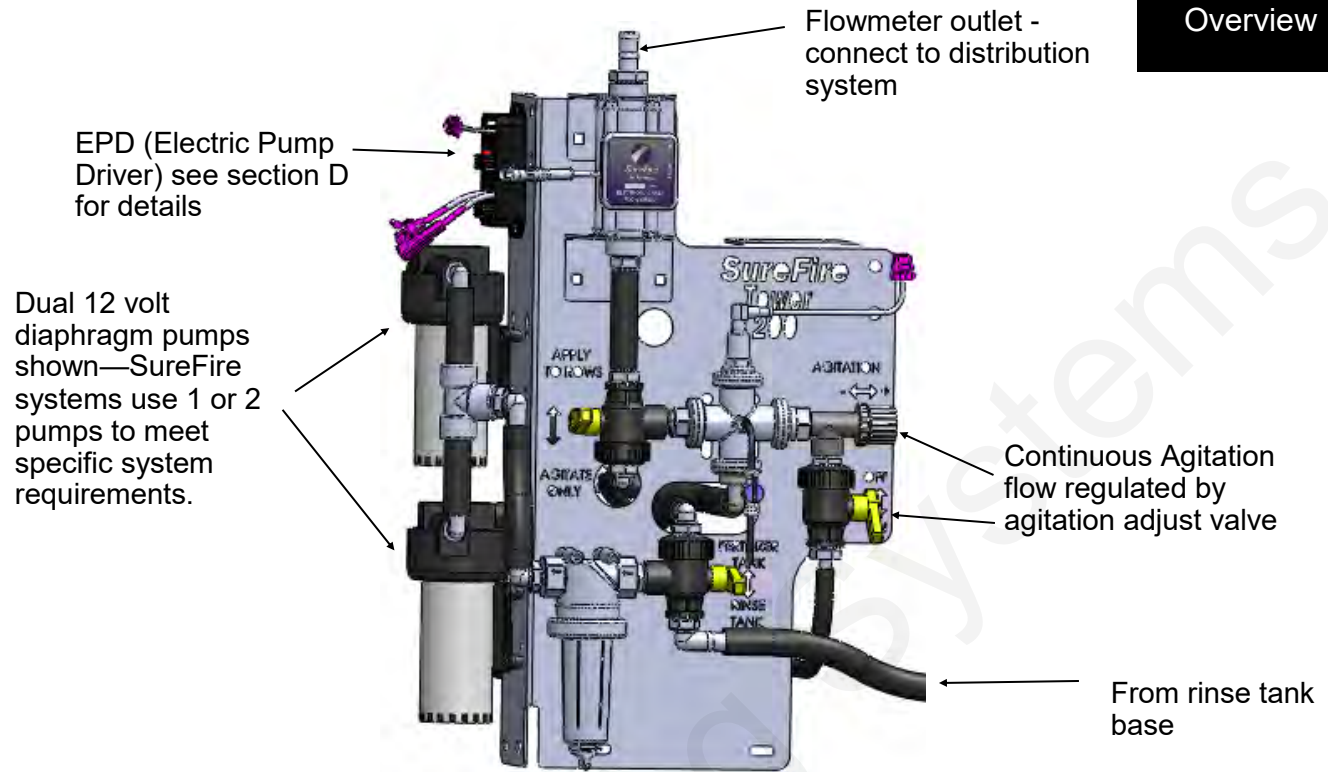
- If the system is applying a rate lower than your target, you need to close the agitation adjust valve some.
- If the system is applying a rate higher than you want and will not lock on rate, you need to open the agitation adjust valve some.
- If the rate is still fluctuating around your target and 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.

Tower 200 Plumbing Overview

E Installation Overview



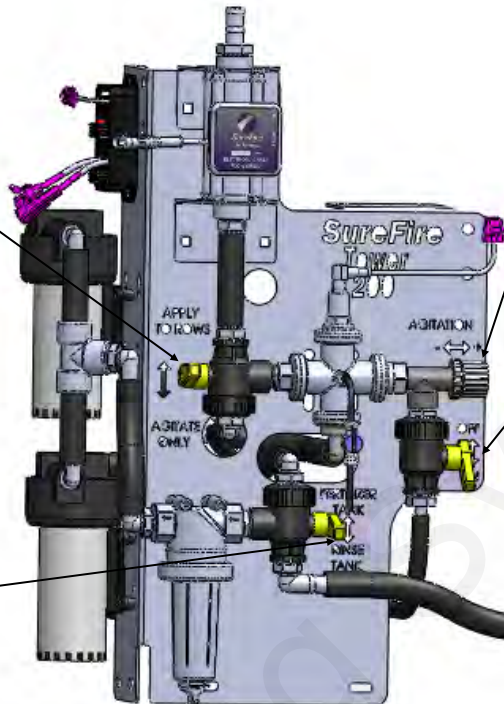
Tower 200 Valve Operation

E

Installation
Overview

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: This valve adjusts how much flow returns to the tank while working in the field.

Agitation On/Off Valve: This valve will shut off agitation flow without the need to move the agitation adjust valve. **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.**

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 Ag Leader 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 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.
5. Set the valve to somewhere in the middle based on visual observation of agitation flow needed.
6. On your Ag Leader display, verify the system has locked on to application rate at your agitation valve setting.

Troubleshooting:

- If the system is applying a rate lower than 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.
- 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.**

Ag Leader Integra Display Setup w/ LPCM



Ag Leader technology is a very flexible control platform with many capabilities. This section will show you the necessary steps to set up your Ag Leader display to control a SureFire Tower Fertilizer System.

Follow the general directions in your Ag Leader Integra Operators Manual (esp. under Configuration and Liquid Rate Control). This manual will show you the specific numbers and settings to use with your SureFire Tower system.

Controller Settings

Flow Meter Calibration

3000 pls/gal

Flow Control Delay

0 s

Control Valve Settings

Rate Off

Flow Control Valve

Close

Auxiliary Valve 1

Close

Auxiliary Valve 2

Close

Rate Error Alarm

Threshold

30 %

Timeout

5 s

SureFire section valve harnesses have a connector for Auxiliary Valve 1 (Flow Return Valve). When using this (Flow Return or Dump Valve) set to OPEN. This is not used very often.

Control Valve Settings

Control Valve PWM 12 volt

PWM Frequency 100

PWM Gain 9999

PWM Standby 15

Zero Flow Offset 15

Allowable Error

2 %

(Not used if Flow Control Valve (above) is set to Close, but still needs to be set.)

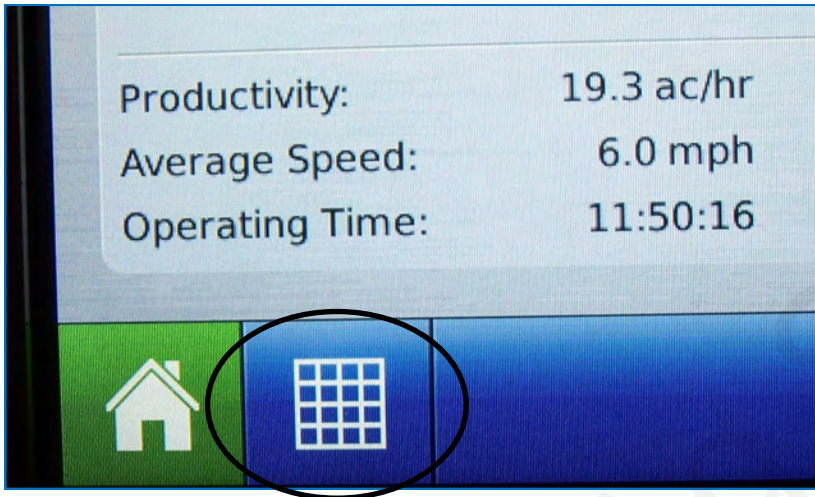
(Can be set higher if system is slow to get to Target Rate when starting. Can be set lower if pump will not go slow enough for low rates.)

Initial Operation Instructions (Integra)

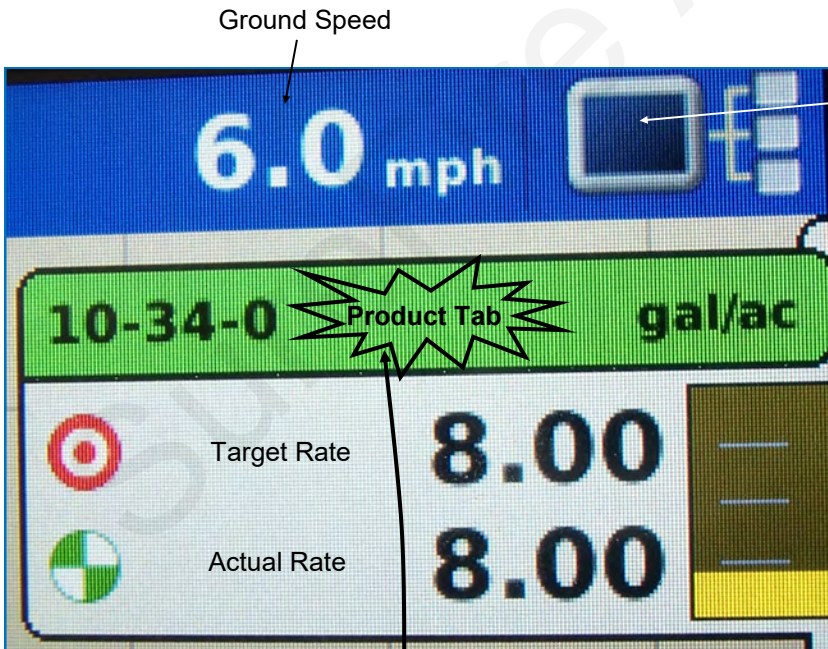


SureFire highly recommends you perform these exact steps with water to verify system is correctly installed and ready for field use.

The Grid button in the lower left corner of the screen brings up the Map screen for Run Time Operations.



The Product Tabs are shown in the upper right corner of the Map screen.



Device Information (Diagnostic) Button- Press on the Device Information Button, then highlight the item marked **DC Liquid**, then press the **Diagnostics** button. The Liquid Diagnostics screen contains the Active Controller Name and Serial Number of the module. Also included are *Main (1) and Auxiliary (2) Pressure readings, PWM Duty Cycle (%), and Flowmeter Signal Frequency and Pulse Count*. This can sometimes be useful troubleshooting information.

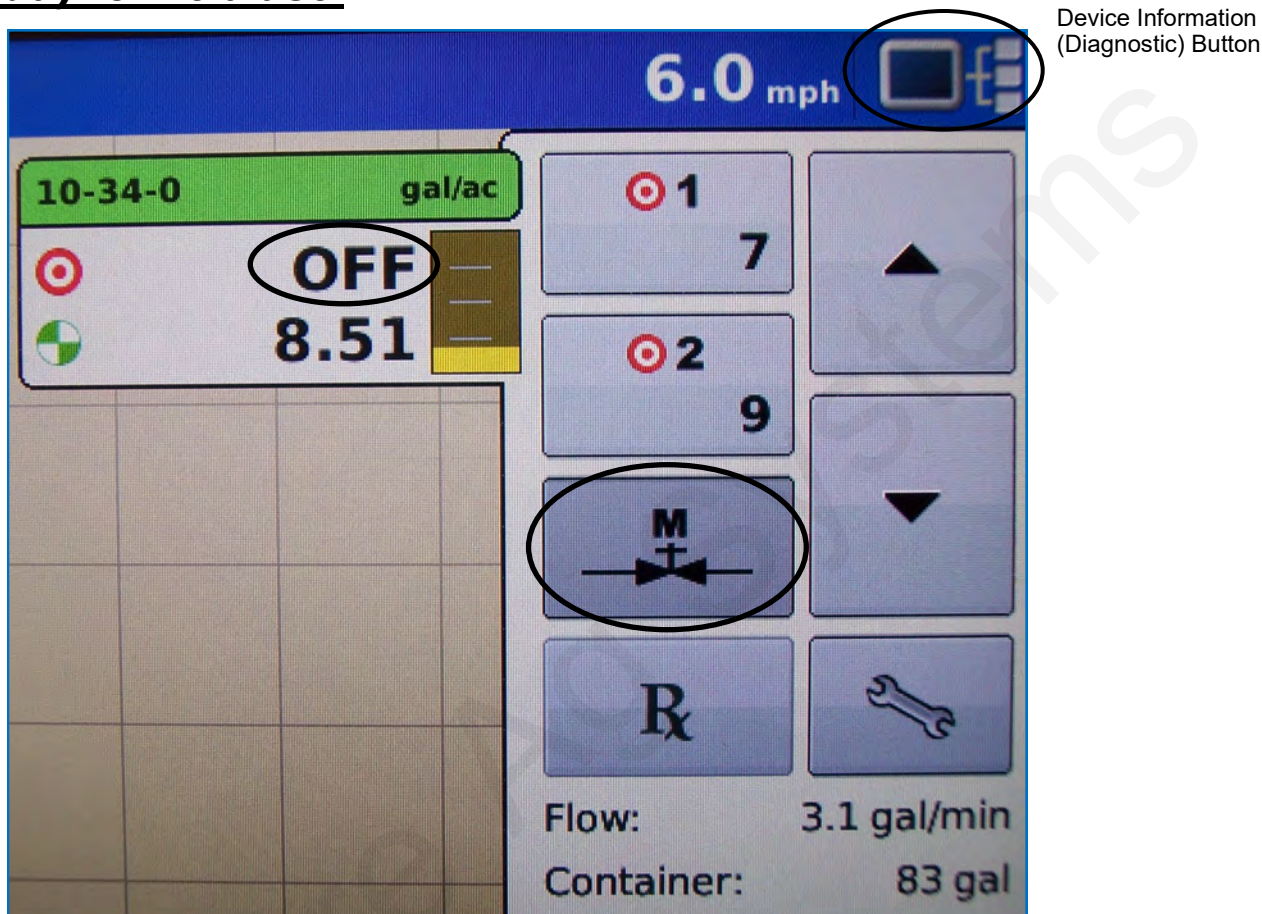
Press the **Product Tab** to bring up an extended view as shown on the next page.

Initial Operation Instructions - Integra- Manual

F

Setup &
Operation

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



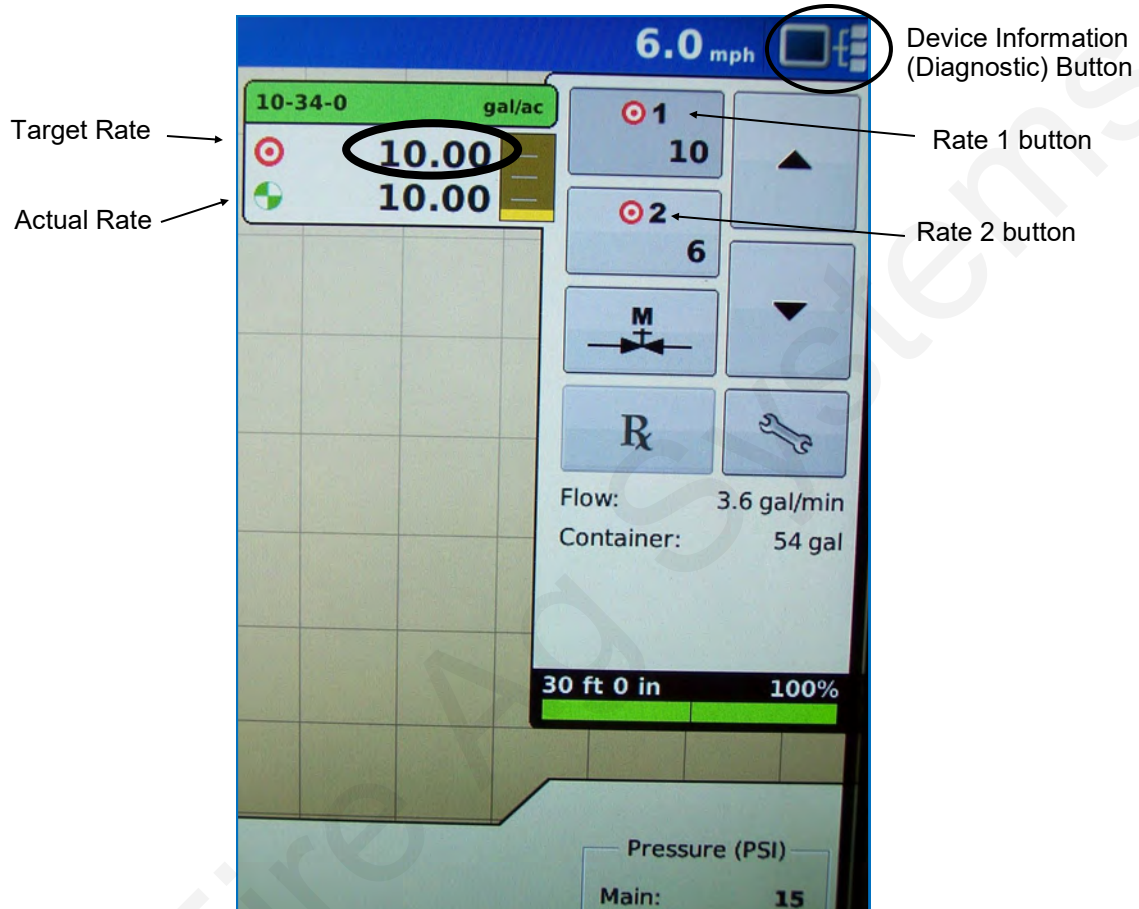
1. Enter manual mode by pushing the "M" button in the upper right corner of the screen. You can tell you are in manual mode when the "Target" Rate says "OFF".
2. Be sure Auto Swath is OFF.
3. If using implement lift switch, move implement switch to lowered position. If not using implement switch, jumper must be installed (see wiring diagram in section D).
4. On the Switch Box, turn the master switch On. Turn section switches On and Off to check proper section valve operation. Leave all section valves On.
5. Use up arrow on right side of screen to increase flow. Does "Flow Rate" display a flow rate? Is it stable after the system is primed? Do increase & decrease buttons increase & decrease flow?
6. When you can increase and decrease flow using the arrows, you are ready to move to the next step.
7. Conduct a catch test to verify the flowmeter calibration is correct. It is unusual if the Flow Cal number needs to be changed. (The most accurate method to measure the volume of water run is to place a container under every nozzle and add together the amount from each nozzle. This assures that 100% of the water is collected and that all rows are equal. At a minimum, collect water from 4-6 rows. **NEVER base a calibration on a single row catch.** It is important to perform this procedure at a flow rate similar to that which will be used in the field.)
8. Press the Diagnostic button (upper right corner) to see more system information while it is running.

Initial Operation Instructions - Integra - Auto

F

Setup &
Operation

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



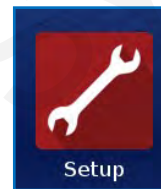
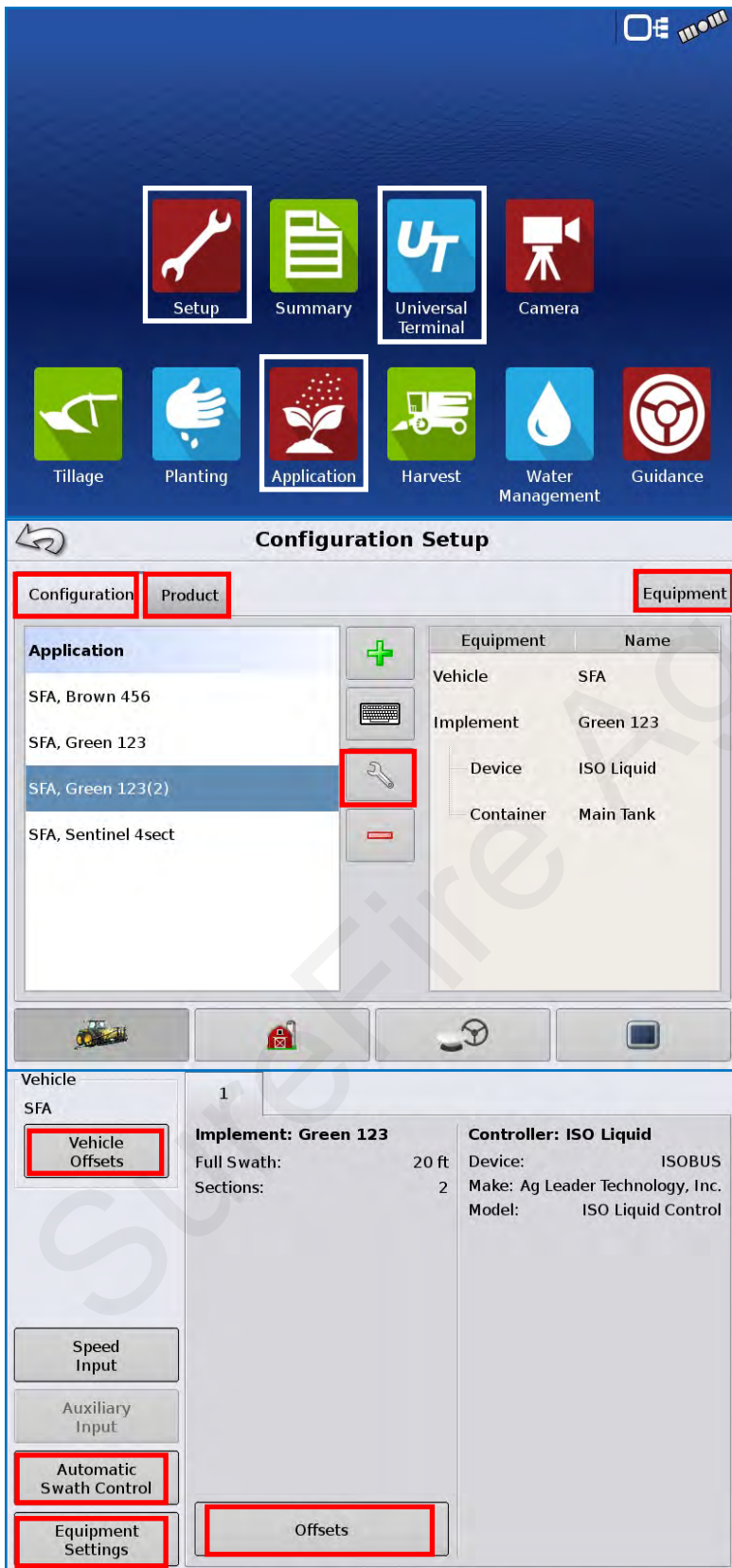
1. Push the grid button in the lower left corner to return to the main Run screen. Verify a speed in MPH is shown. If not, return to setup and enter a manual ground speed.
2. Be sure Auto Swath is OFF.
3. Look at the Extended Product Tab in the upper right corner. Push the “Rate 1” or “Rate 2” button to enter Auto mode. You can tell you are in Auto mode when a rate is displayed under “Target”.
4. Turn on Master and Section switches. 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? (actual rate = target rate?)
5. Change rate using screen buttons for Rate 1 & Rate 2. Does actual rate change to equal new target rate?
6. Close 1 section valve, does flow decrease? Does applied rate still equal target rate?
7. 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)?
8. Press the Diagnostic button (upper right corner) to see more system information while it is running.

Setup and Operation – InCommand / ISO Liquid

F Setup & Operation

Go to support.agleader.com or use the InCommand manual or Quick Reference Guide to help with setup.

Sample screens are shown here. Your set-up will probably be different. Not all the set-up screens are shown here. The screens shown should help you navigate through the system.



You may not use all these screens.

You may use other screens not shown here.

Configuration Setup

Speed Input

Automatic Swath Control

Equipment Configuration Settings



Speed Input

Primary Source
Display GPS ▼

Backup Source
Auxiliary Device ▼

Auxiliary Device Channel
Radar ▼

Auxiliary Channel Calibration
2000 Calibrate Distance
Pulses / 100 ft

Speed Input

Primary Source
Manual Speed ▼

Manual Speed
5 mph

Set a **Manual Speed** to run the system while standing still.

Automatic Swath Control

Application

Outside Boundary Option

- Keep Unchanged
- Turn Section Off

Coverage Option

- Minimize Skip
- Minimize Overlap
- User Defined 100 %

Look-Ahead Settings

ISO Liquid, Boom (2) Turn-On: 1.0 s Turn-Off: 0.5 s

Set the **Look-Ahead Settings** so liquid application starts and stops at the correct time.

Equipment Configuration Settings

Rate Outside of Field
Zero ▼

Rate Display Smoothing

Rate Change Look-Ahead

0 sec ▲
▼

Implement Switch Polarity

None ▼

When using an Implement Switch, set **Implement Switch Polarity** for proper operation.

Implement Switch Polarity

Standard ▼

Implement Switch Polarity

Reversed ▼

When using a variable rate prescription, set **Rate Change Look-Ahead** as desired.

Product Setup



Configuration Setup

Configuration **Product** Equipment

Application

- 28% UAN

+
Keyboard
Wrench
-

Add a product.

Edit a product.

Set up units and other product information.

Set up the Rate Legend as desired.

28% UAN

General **Rate Legend**

Product Units
gallons

Manufacturer
None

EPA Number

Restricted Use Pesticide

28% UAN

General **Rate Legend**

Attribute: Rate

- 30.0 - (36.0)
- 24.0 - 30.0
- 18.0 - 24.0
- 12.0 - 18.0
- 6.0 - 12.0
- (0.0) - 6.0

Average
18

Range Spacing
6

Color Scheme
Green

Ranges
6

Reset to Default Legend

Equipment Setup

Vehicle Implement Controller

F

Setup &
Operation

Vehicle

The screenshot shows the 'Setup' interface with the 'Vehicle' tab highlighted in red. The dropdown menu is set to 'All Vehicles'. A list on the left contains 'SFA'. To the right of the list are three buttons: a green plus sign, a keyboard icon, and a minus sign.

Implement

The screenshot shows the 'Setup' interface with the 'Implement' tab highlighted in red. The dropdown menu is set to 'All Implements'. A list on the left contains 'Brown 456', 'Green 123', and 'Sentinel 4sect'. To the right of the list are three buttons: a green plus sign, a keyboard icon, and a minus sign.

Controller

The screenshot shows the 'Setup' interface with the 'Controller' tab highlighted in red. The dropdown menu is set to 'All Controllers'. A list on the left contains 'DirectLiquid', 'DirectLiquid(2)', 'ISO Liquid', 'Liquid Fertilize', 'SeedCommand', and 'SentinelFlow6'. To the right of the list are three buttons: a green plus sign, a keyboard icon, and a minus sign. On the right side of the screen, there is a data table:

Serial Number:	Unassigned
Device:	DirectCommand
Type:	Liquid
Flow Meter Cal (pls/gal)	3000.00

Below the table is a 'Calibrate Pressure' button. At the bottom right, there is a 'Controller Settings' button highlighted in red.

If **Direct Command** is selected, there will be a button in the bottom right corner—**Controller Settings**- which will take you to the screens on the next page.

Controller Settings



Controller Settings

Flow Meter Calibration

3000 pls/gal

Flow Control Delay

0 s

Control Valve Settings

Rate Off

Flow Control Valve

Close

Auxiliary Valve 1

Close

Auxiliary Valve 2

Close

Rate Error Alarm

Threshold

30 %

Timeout

30 s

Control Valve Settings

Control Valve: PWM 12 volt

PWM Frequency: 100

PWM Gain: 9900

PWM Standby: 10

Zero Flow Offset: 10

Allowable Error: 2 %

Control Valve Settings

Zero Flow Offset may be lowered if pump needs to run slower to get down to rate. Zero Flow Offset may be raised to help system get to rate quicker on startup.

PWM Standby is only used if Flow Control Valve is set to HOLD.

Console Setup / ISO Settings / Universal Terminal

Console Setup

General | Display | Features | AgFiniti | Advanced

Brightness: Auto, Volume: 70 %

Time / Date: 12:51:50 PM, 01/28/2019

Time Zone: America (Chicago)

Language / Country: English / US

Operating Units: Imperial

ISOBUS Settings

Enable Video

ISOBUS Settings

Universal Terminal

- Enable Universal Terminal
- Broadcast Display Speed (ISO GBSD)
- Broadcast GPS (J1939)
- Auxiliary Module Support

Function Instance: 0

Task Controller

- Enable Task Controller
- Section/Rate Compatibility
- ECU Section Delays

Function Instance: 0

File Server

- Enable File Server

Ag Leader Liquid ISO & Universal Terminal

F
Setup &
Operation



Universal Terminal

Ag Leader Liquid ISO

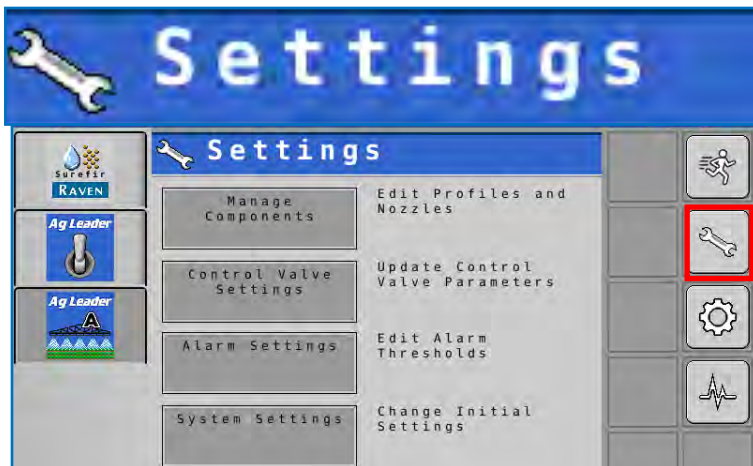
Run Screen

Settings

Calibration

Diagnostics

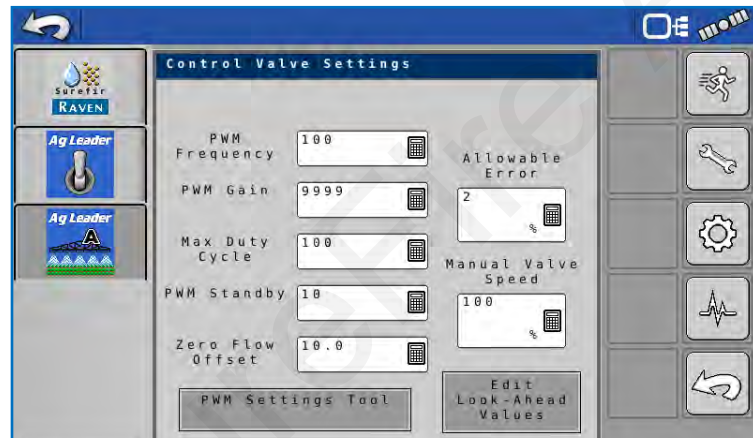
Toolbox



Manage Components



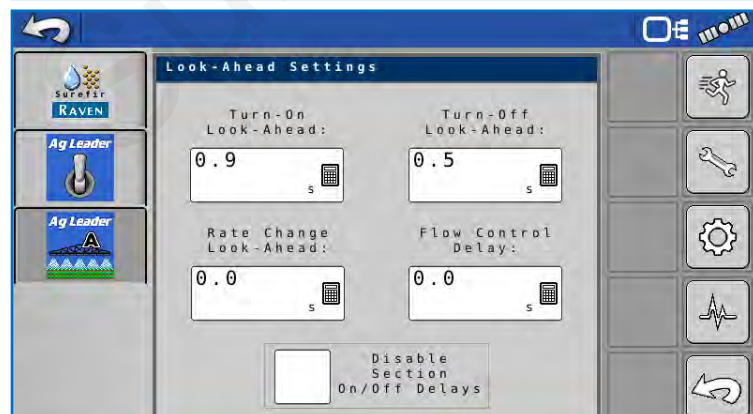
Control Valve Settings



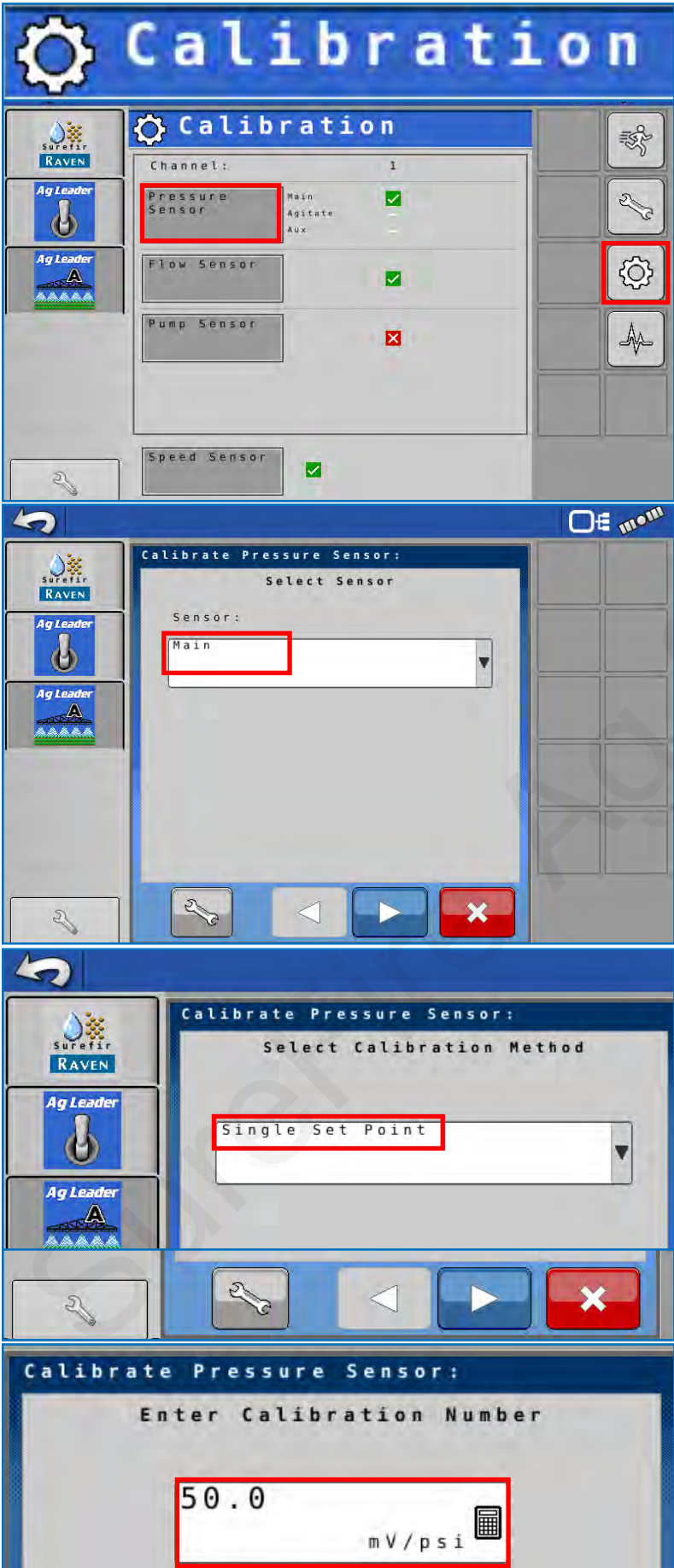
PWM Frequency	100
PWM Gain	9900
Max Duty Cycle	100
PWM Standby	10
Zero Flow Offset	10

Zero Flow Offset is the PWM Low Limit
Lower this if system will not go low enough.
Raise this to get system to Target Rate quicker on startup.

Look-Ahead Settings



Pressure Sensor



Calibration

F
Setup & Operation

Flow Sensor

Pump Sensor

Calibrate Flow Sensor:

Please enter a flow calibration number below

Calibration Number: pulses/gal

Navigation: [Back] [Next] [Cancel]

Calibrate Pump Sensor:

Enter Calibration Number

Calibration Number: pulses/rev

Navigation: [Back] [Confirm] [Cancel]

Diagnostics

Channel 1 CAR PART: A00CB0080C2029FB
SN: 2158818744 CAN ADDR: 8x81

Pressure Sensor		Type	Count
Main	Voltage	44130	
Agitate	None	180	
Aux	None	180	
Flow Sensor		Pulses	Count
Main		0	0
Aux		0	0
Valve	State		
Control	Duty Cycle		
Aux 1	Off		
Aux 2	Off		

Decrease Flow | Increase Flow

Toggle Aux 1 | Toggle Aux 2

Status | Control | Ag Leader Technology

Run Screen Settings

Press on the box on the Run Screen to:
 Enter a Manual Speed
 Set up Rate 1 and Rate 2
 Turn on Rate Smoothing
 Set the amount of liquid in the Tank
 Set up the Pressure Dial on the Run Screen



Speed Source Settings

Speed Source:
 ISO GBS0

Manual Override
 5.0 mph

Run Screen Overview:

- Scale: 10.670 lbs/gal
- Rate 1: 5.00 gal/ac
- Manual Speed: 5.0 mph
- Rate 2: 0.00 gal/ac
- Pressure: 0.1 psi
- Starter Channel 1: 399 gal
- Agitate: 0 psi
- Aux: 0 psi
- ISO 615 rpm

Rate Control Settings

Rate 1: 5.00 gal/ac

Rate 2: 8.00 gal/ac

Increment: 0.50 gal/ac

Actual Rate Settings

Use Rate Smoothing?

Pressure Settings

Max Graph Pressure: 100 psi

Prime/Standby Pressure: 0

Container Settings

399 gal

↑ ? ↓

Container Alarms

Ag Leader Run Screen for ISO Liquid



Select **Application** to go through the screens that will take you to the traditional “Ag Leader run screen” for the Liquid ISO Module.

The Run Screen is shown on the next page.

The liquid may be run from this screen or from the UT screen.

Operating Configuration

✓ SFA, Green 123(2)

Equipment	Name
Vehicle	SFA
Implement	Green 123
Device	ISO Liquid
	<input checked="" type="checkbox"/> Generic ISOBUS
Container	Main Tank

Event Selection

Start New Event
 Event: 2019-01-29_12:31:26

Product Selection

ISO Liquid, Boom (2)

Active
 28% UAN

Options

Region

<1>

Controlling Product

28% UAN (gal)

Management

Growing Season

2019 Crop

Grower

SureFire Ag Systems

Farm

North 40

Field

South 20

Enable Management

Ag Leader Run Screen for ISO Liquid

F

Setup & Operation

The liquid may be run from this screen with the traditional Ag Leader look or from the UT screen.

5.80 ac | 5.0 mph

28% UAN gal/ac

8.00

8.00

1 6

2 8

M

Wrench icon (highlighted)

Flow: 1.6 gal/min

Container: 110 gal

20 ft 0 in | 100 %

16 PSI

ECU MANUAL SPEED

Agitation: 0 PSI

Auxiliary: 0 PSI

Pump Speed: 0 rpm

No Nozzle

Prime

Green arrow icon (highlighted)

UT

Rate Control Settings

Rate Control | Containers

28% UAN (gal)

Rate 1: 6.00

Rate 2: 8.00

Increment: 0.50

Minimum Flow: 0.00 gal/min

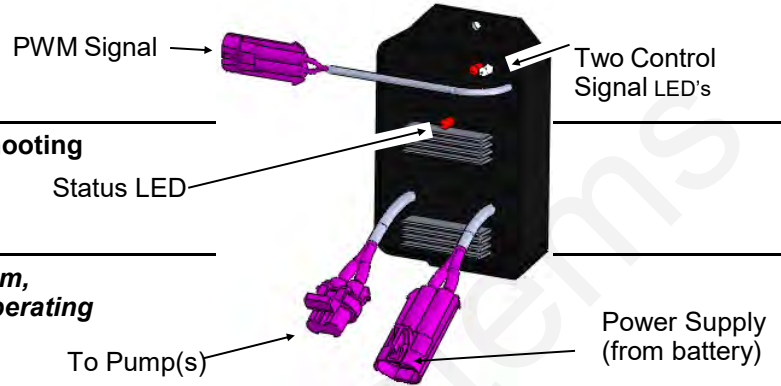
Rx

Electric Pumps Won't Run

Is there a jumper in the Implement Lift Switch connector on the main harness connected to the Liquid Product Control Module? If there is not an implement lift switch plugged in, there must be a jumper between Pins A & C of this connector. If this is not done, the system will not 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	Power input is good and PWM signal is not detected	Typical 'Off' Condition. If pumps should be on: <ol style="list-style-type: none"> 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 pins on LPCM (8-pin Channel 1 connector: Pins 2 and 7)
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.	<ul style="list-style-type: none"> • Check motor wiring
Three blinks, pause, three blinks, pause	Overcurrent condition	<ul style="list-style-type: none"> • 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.
Five blinks, pause	Input frequency out of range.	Check PWM Settings on Rate Controller.
Control Signal LEDs		
Light intensity varies	Off - No PWM Signal 100% brightness - Maximum PWM input signal	Typically, this is shown by the Red light in the top right corner of the EPD module. The red light should light up when the module is receiving a PWM signal from the controller.

Electric Pumps Won't Run (continued)



Electric pumps will not turn on

EPD flashing 4 times

1. Find the EPD (electric pump driver) shown on the previous page. Should have a steady blinking light in the middle when pumps should be off. If Status LED is flashing 4 times, then pausing, EPD has tripped due to low voltage condition. Unplug the Power Supply to the EPD to reset. If condition persists, change to larger orifices to reduce pressure, slow down, or lower application rate. Check Power Supply cables to EPD to insure solid connections and good electrical path.

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.

Will pumps run?

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

Electric pumps only run with 12 volts direct from battery

1. Connect pumps and power harness back to EPD.
2. Go to Rate Control Detail screen to investigate this issue. Be sure Auto Swath is OFF.
3. Turn system on and push the increase button.
4. Remove PWM valve connector and check voltage. You will need 1-12 volts to turn pumps on.
5. If 1-12 volts is not present, check harnesses and review control valve type setup.
6. Go back to the Liquid Product Control Module. Check voltage between pins 2 and 7 of the eight-pin connector. The voltage should be between 6-12 volts after holding increase button in manual mode.
7. If you cannot get voltage at pins 2 and 7, contact your Ag Leader dealer for further assistance.

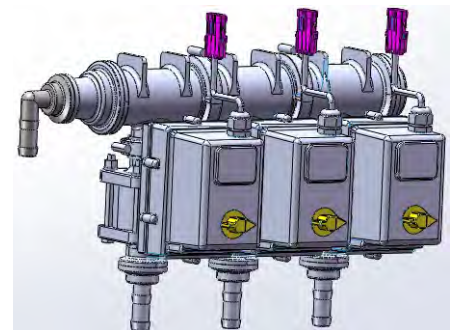
Section Valve(s) will not move

1. Go to Rate Control Detail to investigate this issue. Be sure Auto Swath is OFF.
2. Turn section valve switches on switch box On and Off. Do you have a problem with one or all the valves?

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

3. Check the harness connection to that valve. It is a 3-Pin Weather Pack connector. See Section D for wiring diagrams

4. Check voltage pin A to Pin B. Must be 12 volts, if not, go back to 2-pin power connector to SureFire adapter harness and check voltage.



5. If voltage is present on pins A&B of 3-pin connection to valve, then check pin C to Pin B. This should be 12 volts when the valve is commanded on or open, this should be zero volts when valve is off or closed.
6. If signal voltage is not present to open valve, use diagrams to check at the 16-pin , then the 12-pin on the Ag Leader Liquid Product Control Module for voltage on the proper pin for that section.
7. If constant voltage (Pins A&B) and switched voltage (Pins C&B) are present, inspect, repair or replace the valve.

Application Rate & Flow Troubleshooting

G

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 Rate Control Detail Screen as shown in Initial Operation, Section F.
2. Turn the system on and watch the flow in GPM.
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?
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 PWM gain needs changed. The system is surging because the Liquid Product Control Module is moving the pump driver too much.

1. Go to Controller Settings.
2. Change the settings by reducing the PWM gain (start with increments of 500).

Application Rate is slow to get to the Target Rate

1. You may need to increase the valve calibration. Go to Controller Settings.
2. Change the settings by increasing the PWM gain. SureFire recommends a PWM gain of 9999 for electric pump systems.
3. If the system is slow to get to Target Rate when starting, increase the Zero Flow Offset (see pages 44 and 52).

No Flow shown on Ag Leader display but liquid is being pumped

1. Unplug flowmeter. With voltmeter, check for 12 volts between pins B&C on 3-pin MP (or pins 1 & 2 on AMP SuperSeal) flowmeter connector . If 12 volts not present, inspect wiring harness and troubleshoot all connections per schematic (see Section D).
2. If 12 volts is present, then conduct a tap test. Go to setup and change the flow cal to 10. Have a second person watch GPM on the Rate Control Detail screen while other person taps (use a short piece of wire or a paper clip) between pins A&C on 3-pin MP connector (or between pins 1 & 3 on the AMP SuperSeal connector). A flow value should show up indicating the wiring is not damaged.
3. If the display responded to the tap test, your wiring to that point is good. If still not fixed, inspect adapter harness and test continuity per schematic (see Section D).
4. Replace flowmeter.

Recommended Care and Maintenance



Maintenance
& Parts

Winterization

SureFire recommends flushing your fertilizer pump and complete system with adequate amounts of water first. Next, use RV antifreeze to winterize your system by pumping an adequate amount through all components. At the beginning of the next season, begin with water to verify the system is in working order with no leaks. If the system will be outdoors, consider covering the flow indicator tubes to reduce UV fogging.

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.

Pre-season Service

1. Visually check entire system (hoses, fittings, harnesses, etc.) for any signs of wear or trouble. If harnesses have had fertilizer on them, check to see if any pins are corroded.
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 pump to prime pump the first time.)
4. Unplug one pump at a time to verify that each pump is operating as it should.
5. **Tighten all clamps.** Loose clamps may not always 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.
6. Remove the blue 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.
7. Remove and clean the strainer. Be sure strainer is tightened securely so it will not suck air.
8. Be sure all rows are flowing and that all metering tubes are open. (Note: It will take a higher flow rate with water to create enough pressure to open all the check valves.)
9. Run the system in AUTO Test Speed Mode to verify that system will lock on to a Target Rate. (Water will not build up nearly as much pressure as will a fertilizer product.)