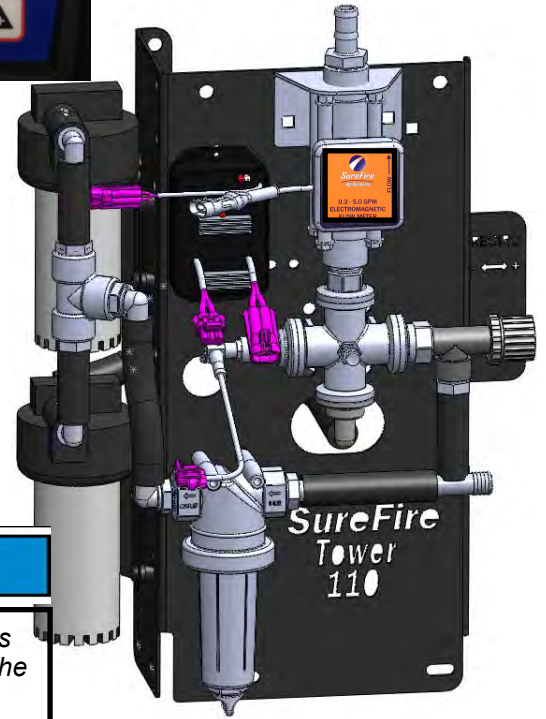
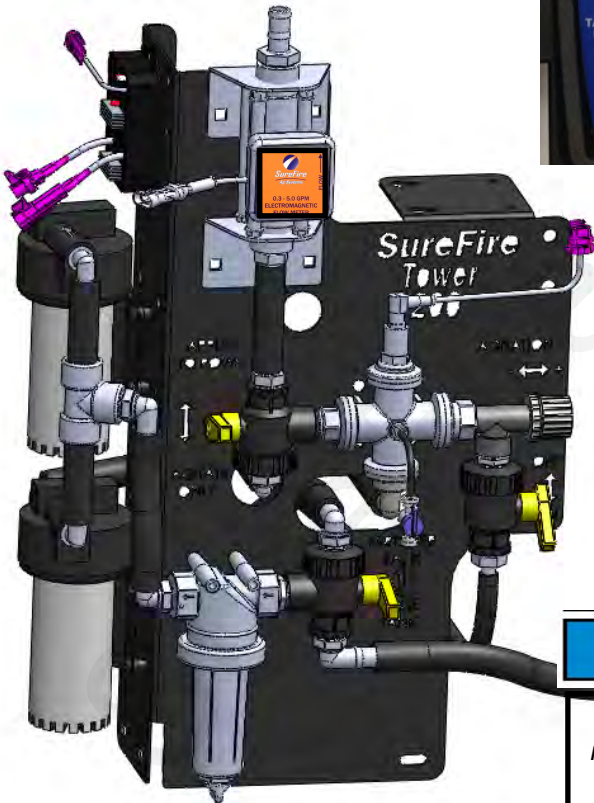


**396-001450**

**Tower Electric Pump  
Fertilizer System  
and SureFire  
Commander II**



**NOTICE**  
Operator should read this manual before operating the system.

**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



# Table Of Contents

## Introduction

- Safety Information ..... 1
- Basic Steps to Install your Fertilizer System ..... 1
- Complete Fertilizer System Example Drawings ..... 2-3

A

Introduction

## Components - Liquid

- Flowmeters ..... 4
- Section Valves ..... 5
- Pressure Sensor, Pump Priming and Air Bleed Valve ..... 6
- Floating Ball Flow Indicators and Manifolds ..... 7-9
- Check Valves ..... 10
- Orifice Charts ..... 11-14
- Metering Tube Flow Charts ..... 15
- Dual Metering Tube and Dual Check Valve Systems ..... 16-19

B

Components  
Liquid

## Components - Wiring & Electrical

- Typical Layouts and Schematics ..... 20-27
- Main Harness (18220) Diagram ..... 28
- Mercury Run/Hold Switch ..... 29
- Astro GPS Speed Sensor ..... 30
- EPD (Electric Pump Driver Module) ..... 31

D

Components  
Wiring & Elec.

## Installation Overview

- Floating Ball Flow Indicators ..... 32
- Tower Mounting Options ..... 33-34
- Tower 110 Plumbing, Valve Operation, Recirculation, Agitation ..... 35
- Tower 200 Plumbing Overview and Valve Operation, Agitation ..... 36-37

E

Installation  
Overview

## Setup & Operation *\*(Use this to get started)\**

- Commander II Console Setup ..... 38
- Special Cal Quick Setup, System Defaults ..... 39
- Standard Calibration Procedure, System Defaults ..... 40
- Tests to Verify Proper Operation (**DO THIS**) ..... 41
- Special Calibration (Special Cal—SPEC) Procedure ..... 42-44

F

Setup &  
Operation

## Troubleshooting

- Pump Will Not Run—EPD Lights ..... 45
- Pump Not Running Issues ..... 46
- Section Valve Won't Move ..... 47
- Fast clicking sound from Commander II ..... 47
- Commander II—Erratic Console, Error Messages ..... 48
- Application Rate Fluctuates, Slow Getting to Target Rate ..... 49
- No Flow Shown, Flowmeter Tap Test ..... 49
- Flowmeter is Inaccurate, Speed is Inaccurate ..... 50
- System Flow Requirements and Flow Charts ..... 51-53

G

Trouble-  
Shooting

## Maintenance & Parts

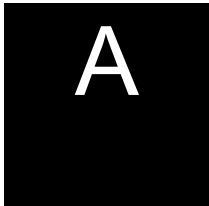
- Winterization ..... 54
- **Pre-season Service** ..... 54

H

Maintenance  
& Parts



# Safety



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



**THIS SYMBOL MEANS  
ATTENTION!**

**BECOME ALERT!**

**YOUR SAFETY IS INVOLVED!**

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



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



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



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

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





## Hydraulic Fluid and Equipment Safety

If your system uses hydraulic equipment with hydraulic fluid under extremely high pressure, please note:

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

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

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

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



## A Word to the Operator

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

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

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

SureFire Ag Systems



# General Description

## A

### Introduction

You have purchased a SureFire fertilizer system for your equipment. This system will be controlled by your SureFire Commander II. The Commander II will adjust the speed of the SureFire electric pumps based on feedback from the flowmeter and vehicle speed.

The SureFire Tower Fertilizer system can be customized to meet the unique liquid application requirements of many producers. **Your system will not have every single component covered in this manual.**

## Basic Installation Steps

1. Open the packages and familiarize yourself with the components. See the System Overview Examples on the following pages to see the big picture of how SureFire Fertilizer Systems are installed. Refer to manual sections B, C & D for component information.
2. Mount the Tower or Accelerator Tank on your equipment. The electric pumps should be mounted close to the tank they will be pulling from.
3. Plumb the tank to the Tower inlet. See section E for details.
4. 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.
5. Attach the flowmeter outlet to section valve or manifold inlet. Attach section valve outlets to flow indicator inlets.
6. Attach harnesses as shown in Section D.
7. Set up SureFire Commander II for Tower fertilizer system as shown in Section F.
8. Fill system with water, conduct initial operation and tests per Section F.
9. Winterize system with RV Antifreeze if freezing temperatures are expected.
10. Do pre-season service each year as described on page 54.

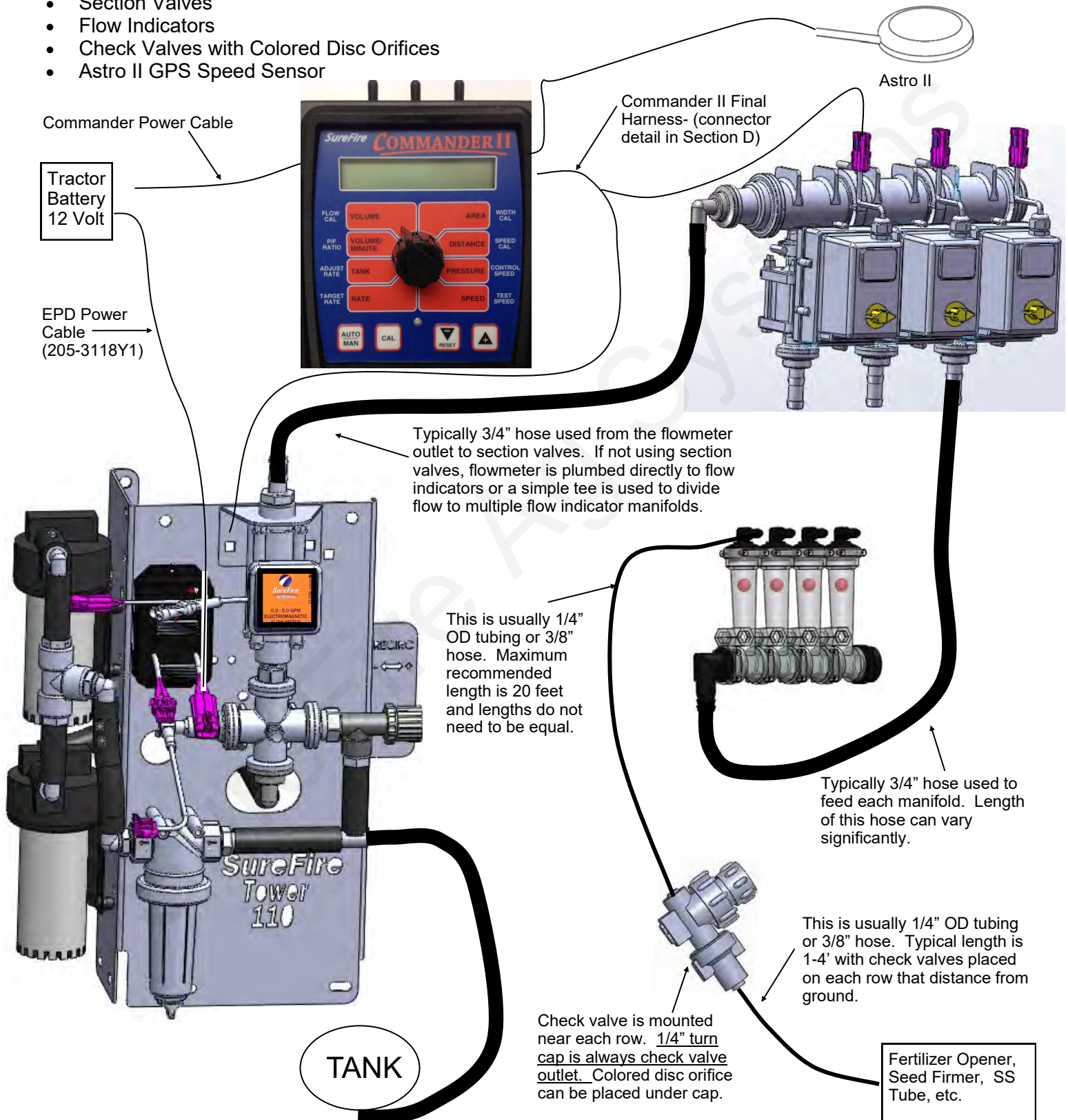
# System Overview - Example 1

# A

Introduction

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

- Commander II
- Tower 110
- Section Valves
- Flow Indicators
- Check Valves with Colored Disc Orifices
- Astro II GPS Speed Sensor





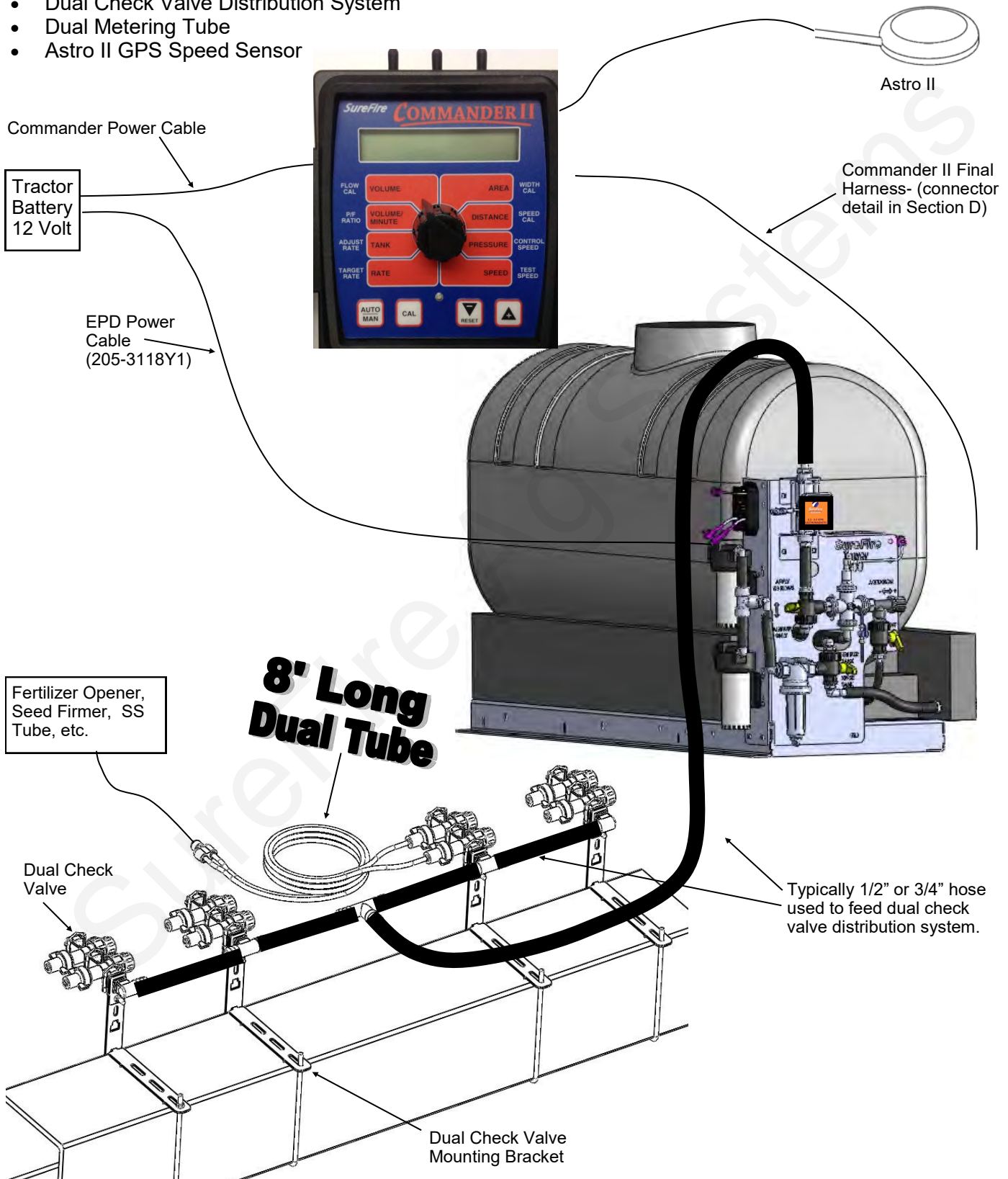
# System Overview - Example 2

# A

## Introduction

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

- Commander II
- Accelerator with Tower 200
- Dual Check Valve Distribution System
- Dual Metering Tube
- Astro II GPS Speed Sensor



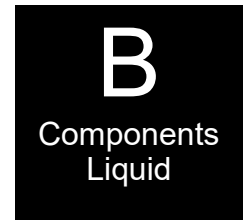
# Electromagnetic Flowmeter Kits

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)

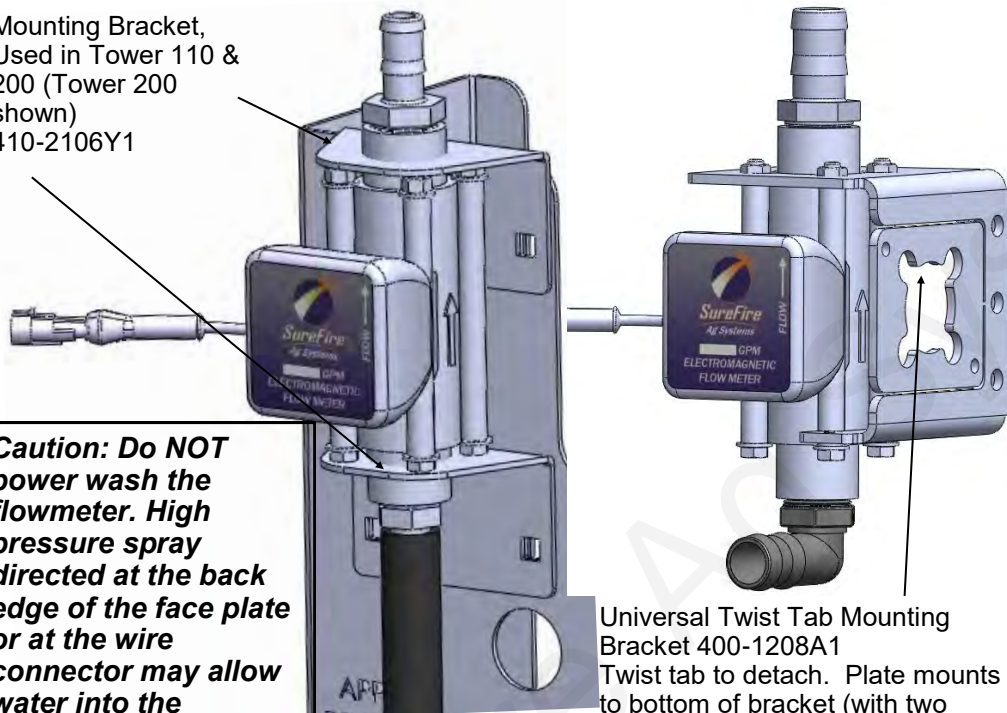
Kits include flowmeter, mounting bracket, hose barb fittings & hose clamps.



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

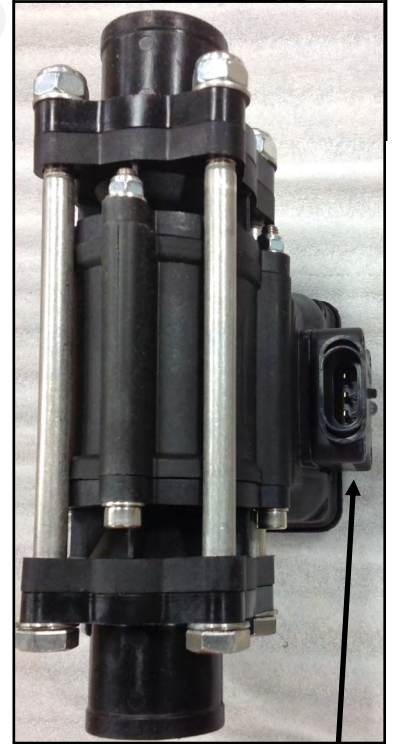
**New Look in 2017—Black body with orange label. Same accurate, reliable electromagnetic technology. 3-pin Amp SuperSeal connector is sealed to flowmeter body for tighter, cleaner connection.**

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	Commander II Flow Cal Number	FPT Size	Hose Barb In kit
0.13 - 2.6 GPM	3000	6000	3/4"	3/4"
0.3 - 5.0 GPM	3000	6000	3/4"	3/4"
0.08-1.6 GPM	22700	45400	3/4"	3/4"



Serial number label on side also shows pulses per gallon.

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



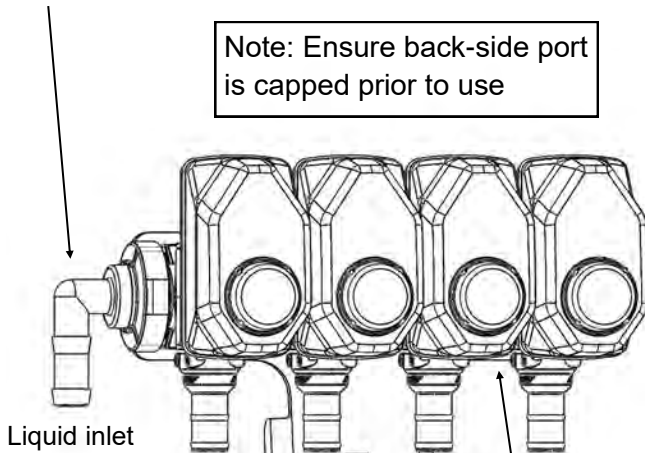
# Section Valves

**B**  
Components  
Liquid

105-100075BRB90

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

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



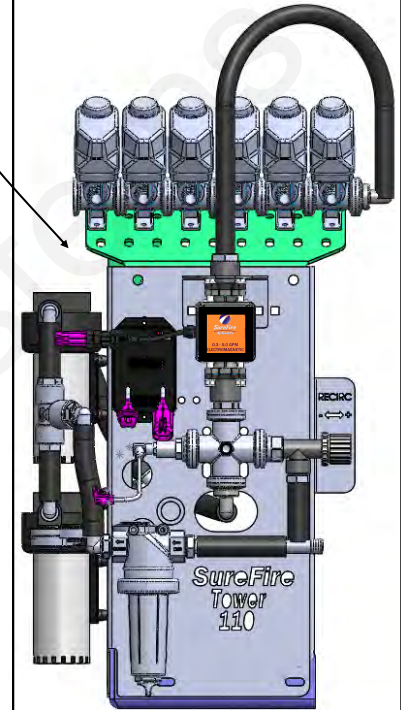
117-211-0066  
Liquid outlet to each section

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

**Additional Parts:**

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

**Tower 110 Section Valve  
Bracket**  
Item Number 410-2110Y2



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

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



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

## How it Works

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

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

**Wiring Connector:**

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

**Mounting Hardware:**

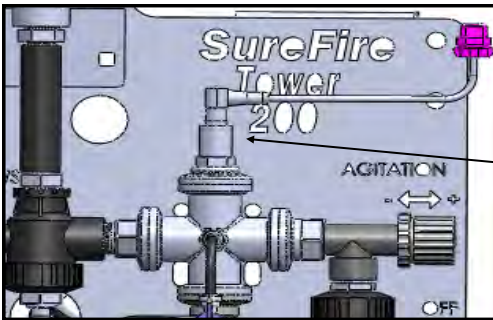
- 2 Valve Bolt Kit 384-1100
- Mounting Bracket 400-2493Y1

# Pressure Sensor

The Tower 110 and 200 come equipped with a 100 psi pressure sensor to work with the Commander II controller. This sensor is a 2-wire (4-20mA) type sensor for compatibility with the Commander II. The sensor has a 1/4" MPT fitting.

The Commander II display will show the system pressure on the in cab controller. **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.

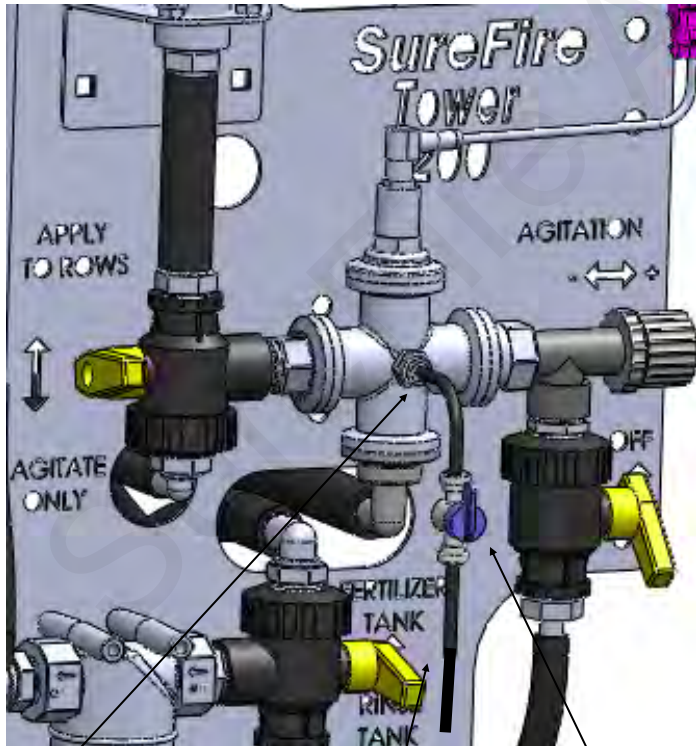


The pressure transducer is factory calibrated and will display a very accurate pressure reading on the Commander II. No manual gauge is required.

Pressure Sensor (2 wire type) with harness  
521-05-050100

# Pump Priming and Air Bleed Valve

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



Shipped from factory with plug installed.

1/4" Tubing

1/4" air bleed valve

## Why use an air bleed valve:

Most fertilizer systems are equipped with a 4 lb. or 10 lb. check valve on the end of each hose delivering fertilizer to the ground. These valves do not let air escape from the system, unless it is pressurized. 12 volt liquid pumps are not good air compressors. Therefore, the pump can struggle to prime due to air trapped on the outlet side of the pump.

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

## How to install the air bleed valve:

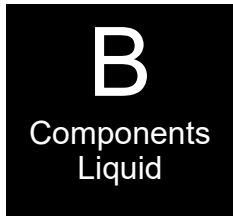
Remove the 1/4" plug from the quick connect fitting on the center cross on the Tower (see picture). Next, insert the 1/4" tubing in the quick connect fitting. Run the 1/4" tubing to an easily accessible spot on your equipment. Next, cut the tubing and push the 1/4" valve onto the tubing. Finally, run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

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

# Product Distribution

**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. This is not used very often. (See photos on page 9)
2. A metering orifice may be placed in the check valve cap in the line that leads to each row. (See photo on page 11)
3. A dual metering tube kit with dual check valves may be used. (See pages 16-19)

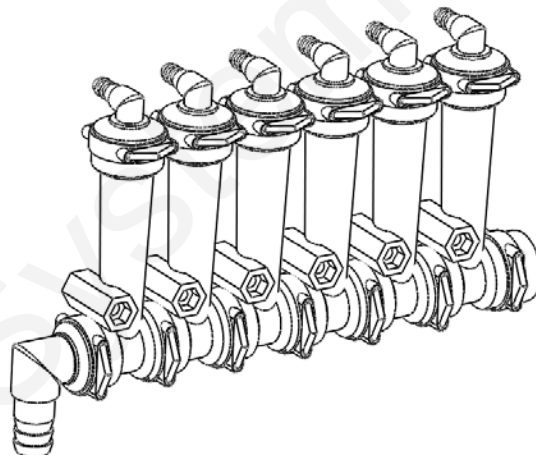


## Floating Ball Flow Indicator & Manifold System

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

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

#### Fittings

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

#### Service Parts Only

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

#### Brackets & U-Bolts

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

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

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

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

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

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

### Ball Selection for 30" Rows

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

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

400-2010A1  
12 Row White  
Visibility Backer  
Plate

701-20460-95  
Full Flow Col-  
umn w/ 3/8"  
HB Outlet

701-20521-00  
End Cap

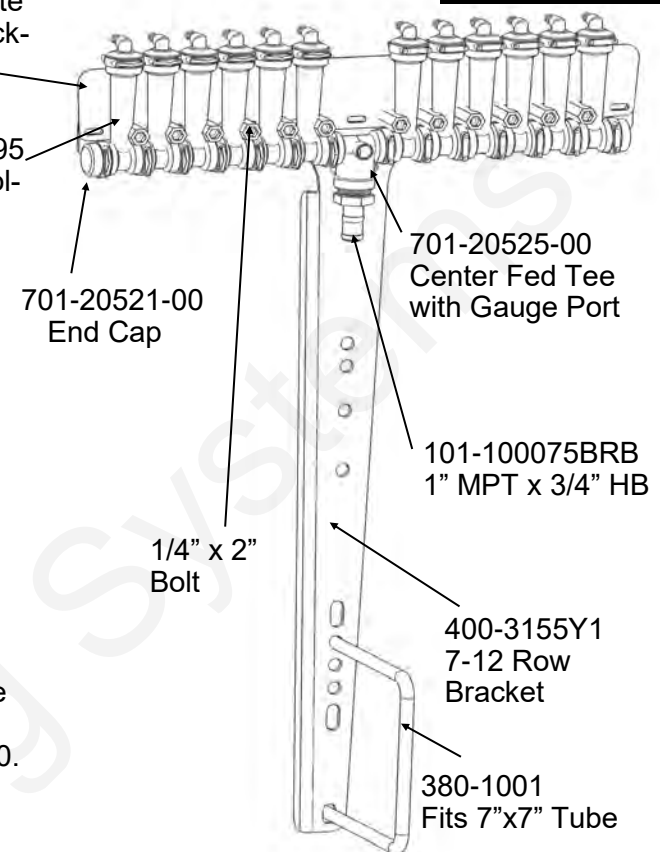
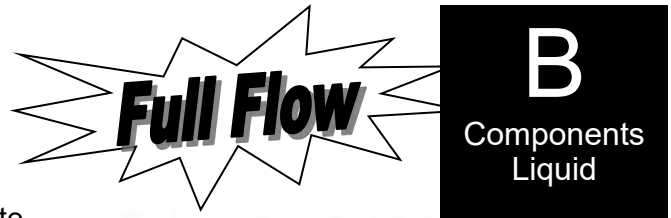
1/4" x 2"  
Bolt

701-20525-00  
Center Fed Tee  
with Gauge Port

101-100075BRB  
1" MPT x 3/4" HB

400-3155Y1  
7-12 Row  
Bracket

380-1001  
Fits 7"x7" Tube



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

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

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

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

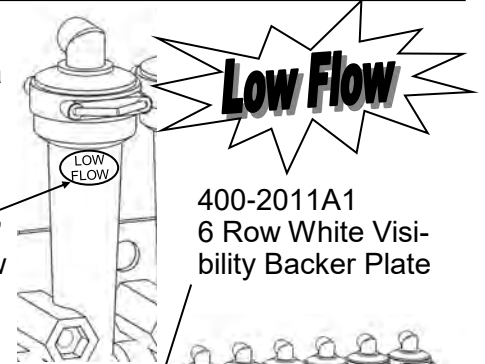
### Low Flow Indicators w/ 1/4" Push to Connect Outlet

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

### Ball Selection for 30" Rows

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

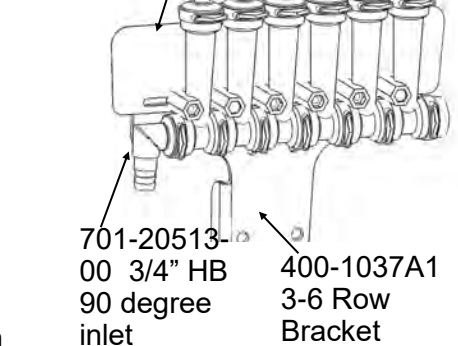
\*These balls may float on heavier fertilizers, such as 10-34-0. Use Maroon Glass in this case.



400-2011A1  
6 Row White Visi-  
bility Backer Plate

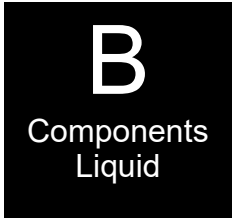
701-20513-  
00 3/4" HB  
90 degree  
inlet

400-1037A1  
3-6 Row  
Bracket



# Floating Ball Flow Indicators— Metering Orifice Selection for 30” Rows

See [www.surefireag.com](http://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 30-35 PSI (*The pumps will operate up to 60 PSI, but the pump output decreases greatly at higher pressures.*)

**PumpRight Hydraulic Pump 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.**



or



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 metering orifice into bottom of each outlet fitting. **(This orifice is not used very often. See next page.)**

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

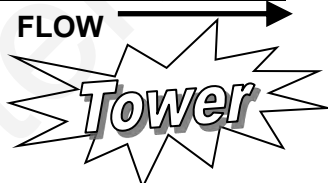
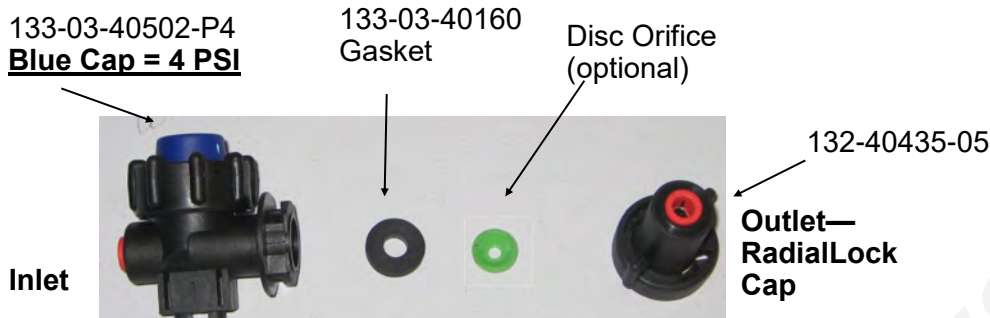
# Check Valves

**B**

Components  
Liquid

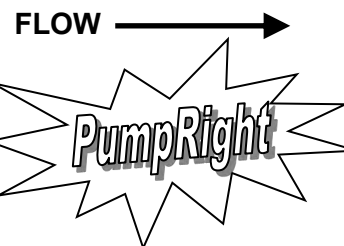
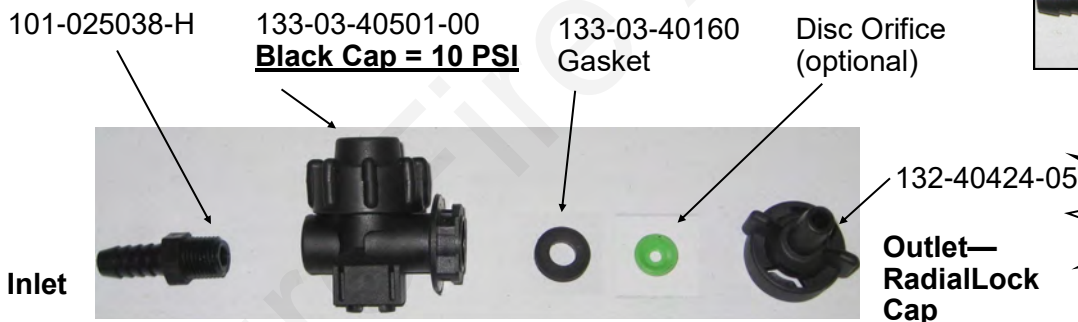
## 4 lb check valve with 1/4" quick connect fittings

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.



## 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.



## 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 <b>PumpRight</b> & 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 <b>Electric Pumps</b>
136-04-08HB08HB	1/2" HB x 1/2" HB 4 lb	> 50 GPA with <b>PumpRight</b>
136-10-08HB08HB	1/2" HB x 1/2" HB 10 lb	> 50 GPA with <b>PumpRight</b>



# Colored Disc Orifice Chart for 30" rows

# B

Components  
Liquid

## 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 30-35 PSI (The pumps will operate up to 60 PSI, but the pump output decreases greatly at higher pressures.)

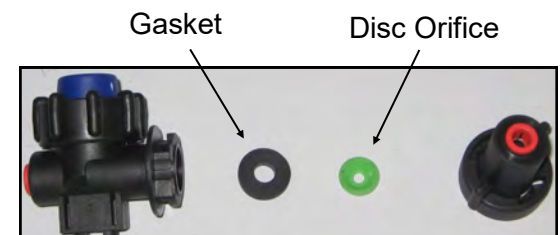
PumpRight Hydraulic Pump Pressure Recommendations (with 10 lb check valves):

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



FLOW → 1/4 Turn Cap is Outlet

# Colored Disc Orifice Chart Common Grain Drill Row Spacings

**B**  
Components  
Liquid

## 7.5" Spacing

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

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

## 10" Spacing

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

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







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

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

**10-40 PSI 60°F**

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

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

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

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

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

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

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



# Dual Metering Tube Plumbing Kits with Dual Check Valve

# B

Components  
Liquid

For more information, read [Navigating the Metering Tube Maze](#) or [Metering Tube / LiquiShiftTube Charts](#).

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 or other liquids.

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

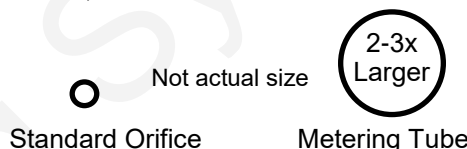
These instructions will show you where all the pieces go. It will provide guidance on how much metering tube to use. There are some optional fittings included in each plumbing kit. These instructions will show you where and why you'd want to use the optional pieces.

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

## Dual Advantage of Dual Metering Tube

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

By using two metering tubes, the fertilizer system can handle Black Label ZN (or most other liquid solutions) and provide the proper system pressure as the fertilizer properties change due to temperature, mixtures and other factors.



## Field Operation of Dual Metering Tube - Dual Check Valve System

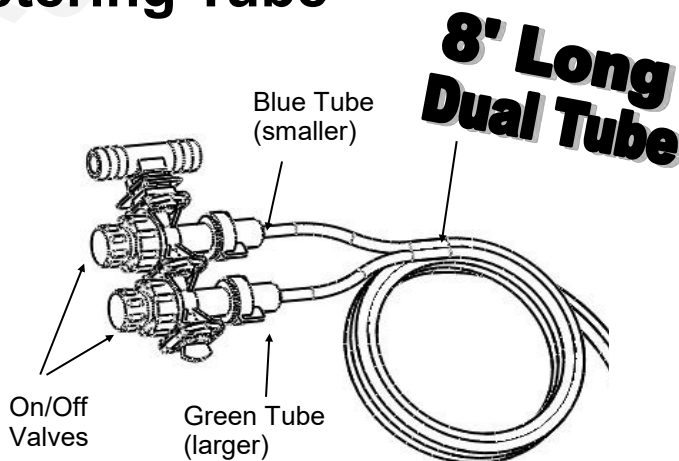
The dual metering tube allows for three application rate ranges. Some fertilizers can have a widely variable viscosity range. Therefore, based on temperature, tank mixing and fertilizer batch, the best tube to use will change.

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

**Start with larger tube ON, smaller tube OFF:**

• **Pressure below 10 PSI: Turn larger tube OFF and smaller tube ON.**

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



<b>Example: Starter blend</b>	GPA on 30" rows (approx, will vary)
<b>11.2 lb/gal at 5 mph</b>	
Blue Tube	2 - 4
Green Tube	3 - 7
Blue & Green Tube	5- 10
Minimum Recommended flow for Blue Tube (8 ft)	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:  $Oz/min/row = (GPA \times MPH \times spacing \text{ (inches)}) \div 46.4$

## Dual Check Valve Plumbing Diagram

4 Row Planter Shown, add rows as necessary

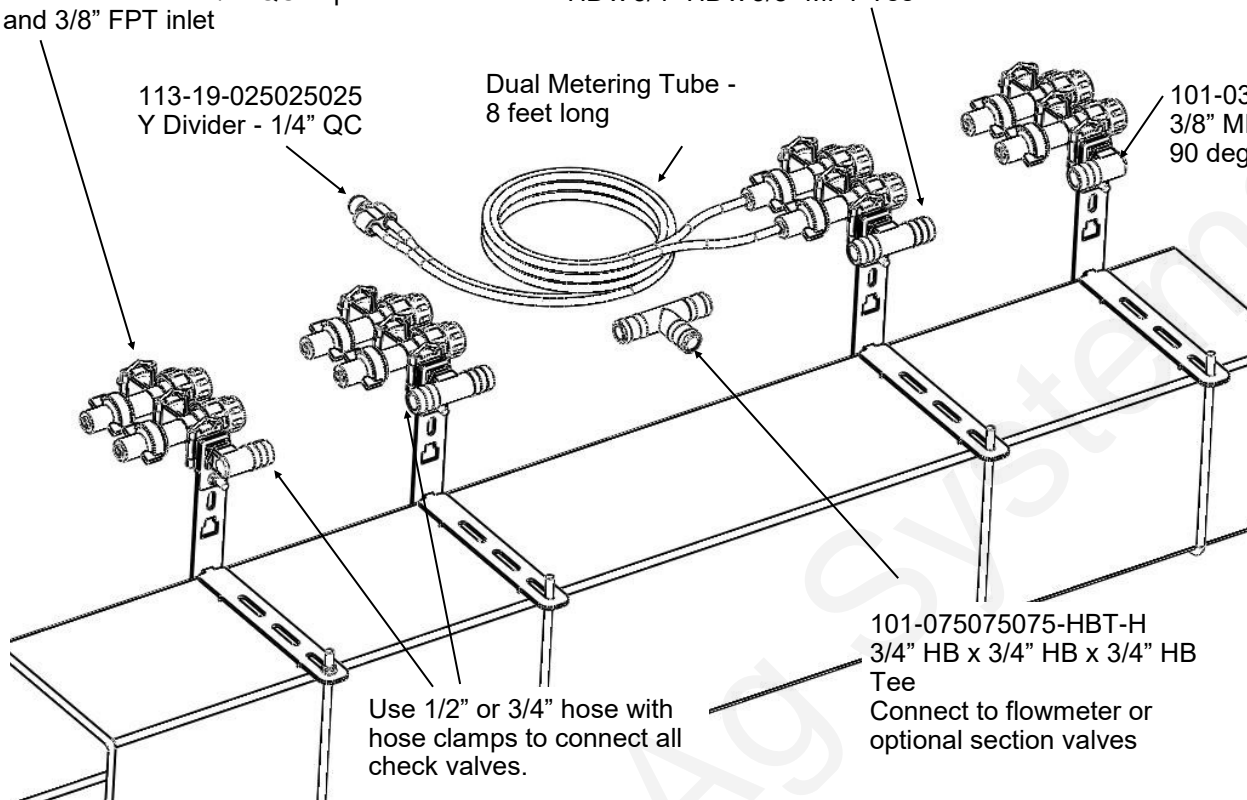
136-04-200400, Dual 4 PSI check valve with 1/4" QC caps and 3/8" FPT inlet

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

113-19-025025025 Y Divider - 1/4" QC

Dual Metering Tube - 8 feet long

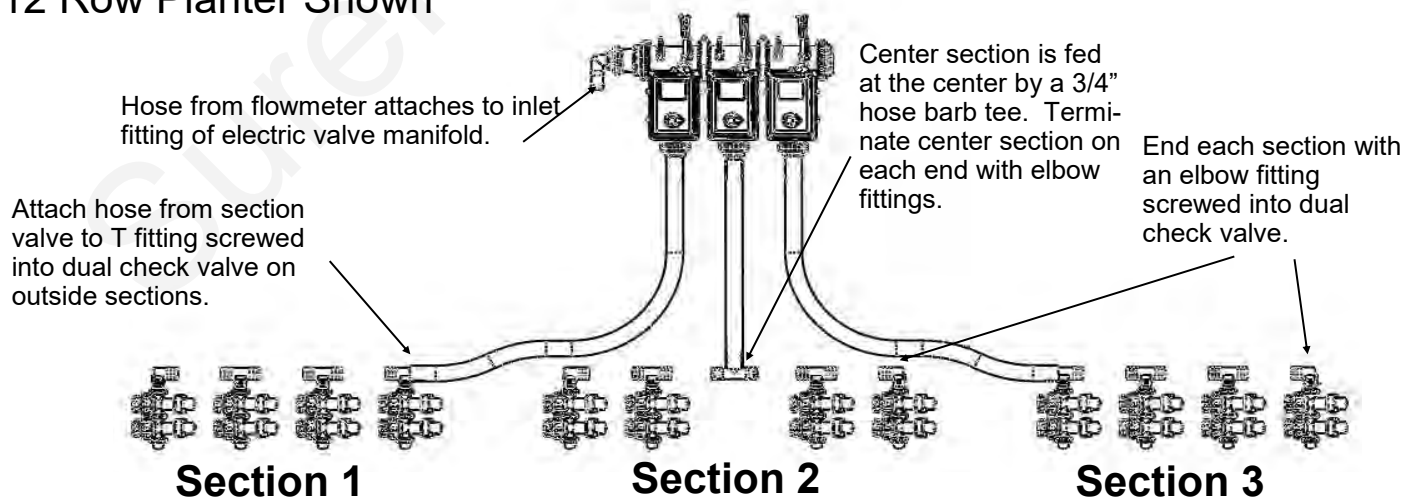
101-038075-90-W, 3/8" MPT x 3/4" HB - 90 degree



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



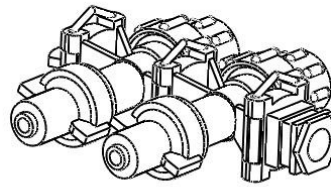
For a 2 section plumbing system, omit the center section and plumb similar to the outside 2 sections.

# Dual Check Valve Assembly Steps

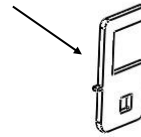
**B**  
Components  
Liquid

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.

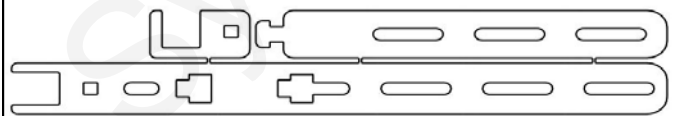


Clamp Bracket



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

400-1966A1-BK Dual Check Valve Mount Bracket

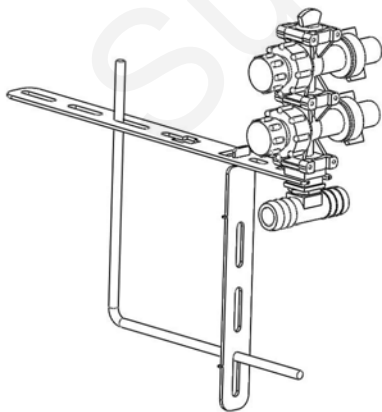


The long, short & clamp bracket come as one part connected by break-off tabs.

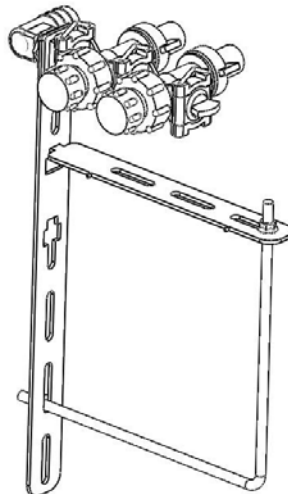
## Check Valve Mounting Options

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

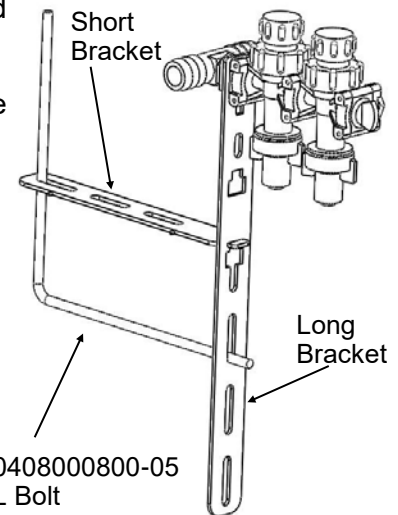
**Example 1.** Use the long bracket on the top of a bar. The check valve is mounted vertically. The liquid supply hose is ran directly on the front side of the bar. The U-bolt is placed in slots to clamp on a 4x6 inch tube.



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



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

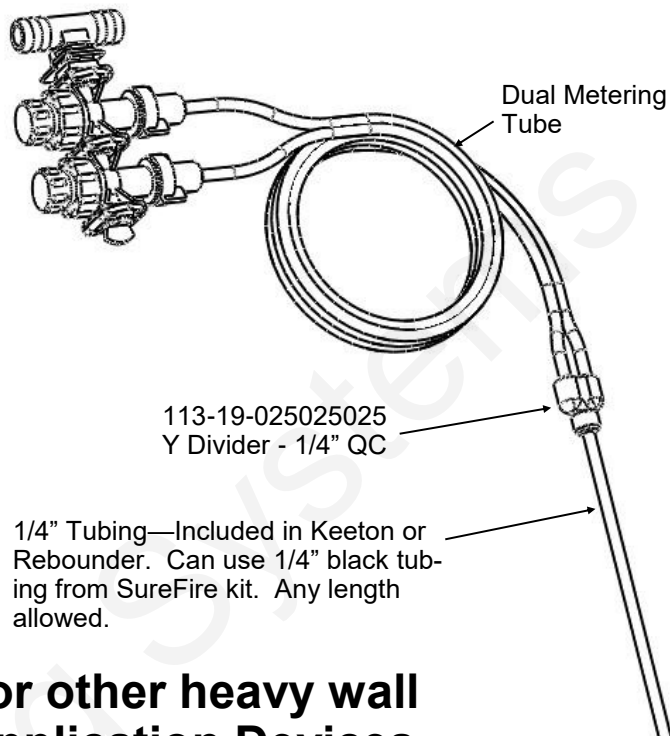


311-0408000800-05  
1/4" L Bolt



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

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



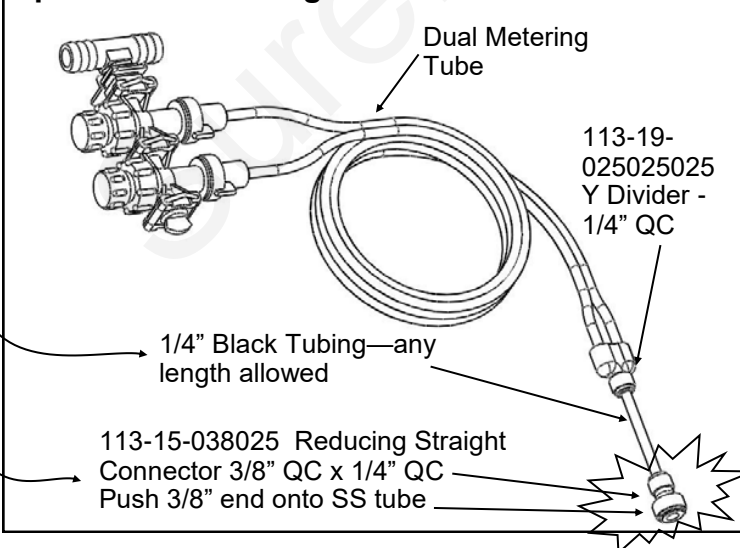
For thin wall stainless steel tubes, you can push the 1/4" black tubing all the way through the stainless steel tube so fertilizer will run directly from the tubing onto the ground.

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

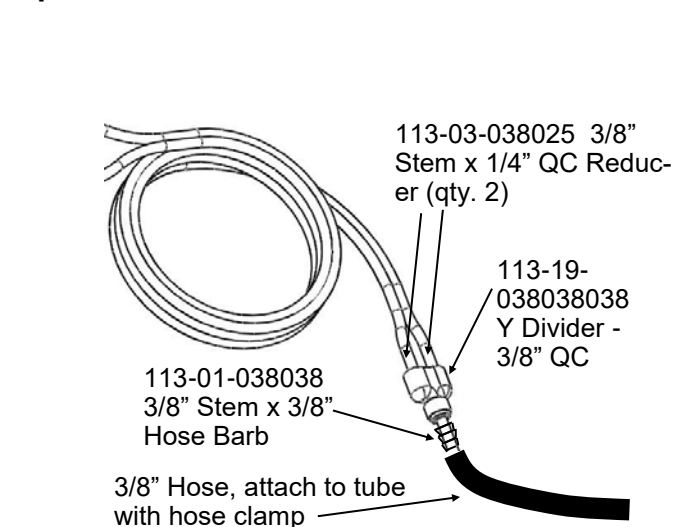
When using a 3/8" OD stainless steel tube to apply fertilizer to the ground, there are two options for the delivery tube plumbing. If the tube ID is less than 1/4" (tubing will not fit inside tube) this attachment method must be used.

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



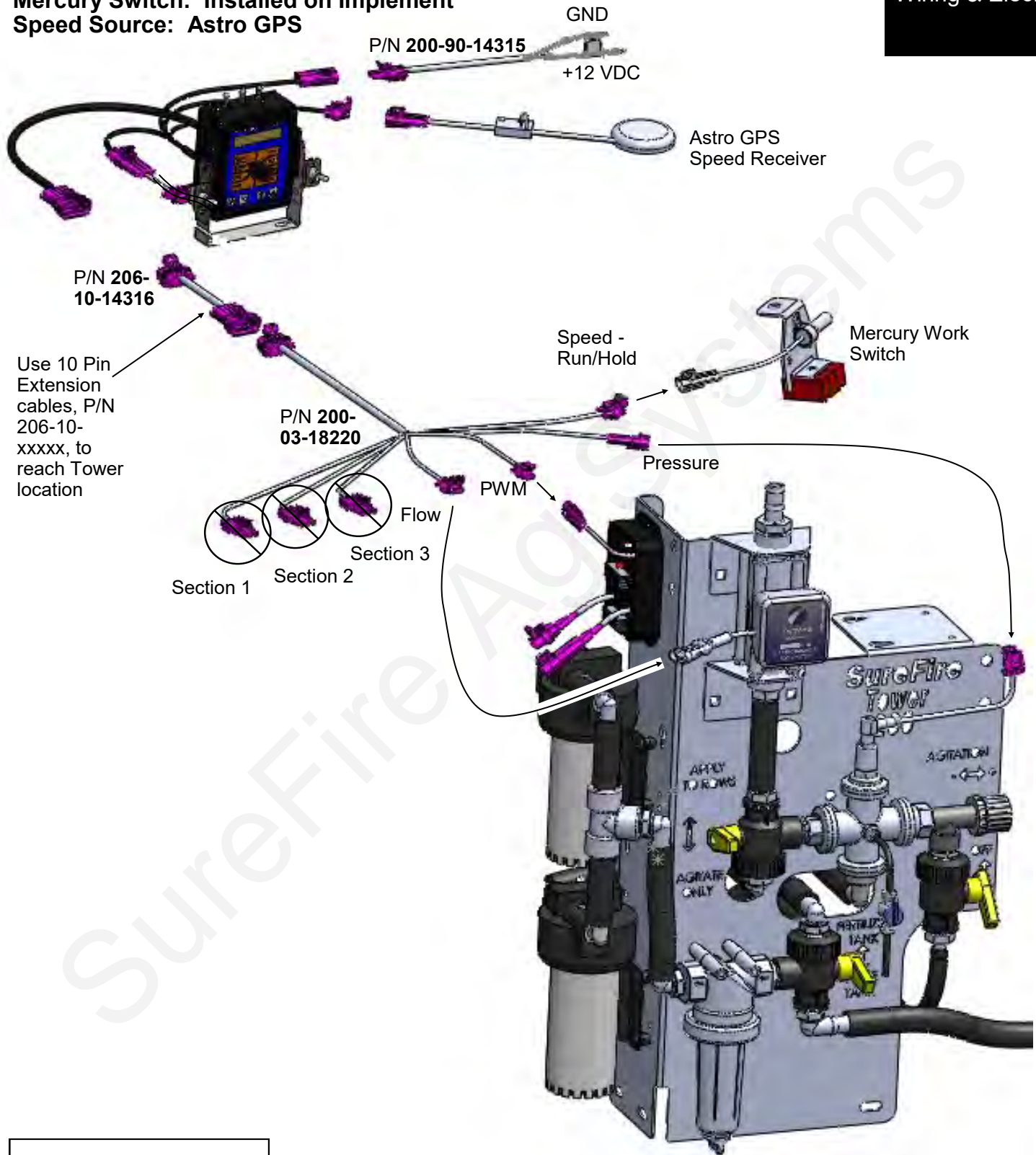
# Tower & Commander II Layout #1 - Basic Single Section

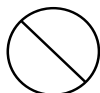
Control: PWM EPD

Sections: 1

Mercury Switch: Installed on Implement

Speed Source: Astro GPS



 Means connector not used in this configuration.

# Tower & Commander II Schematic #1 - Basic Single Section

Control: PWM EPD

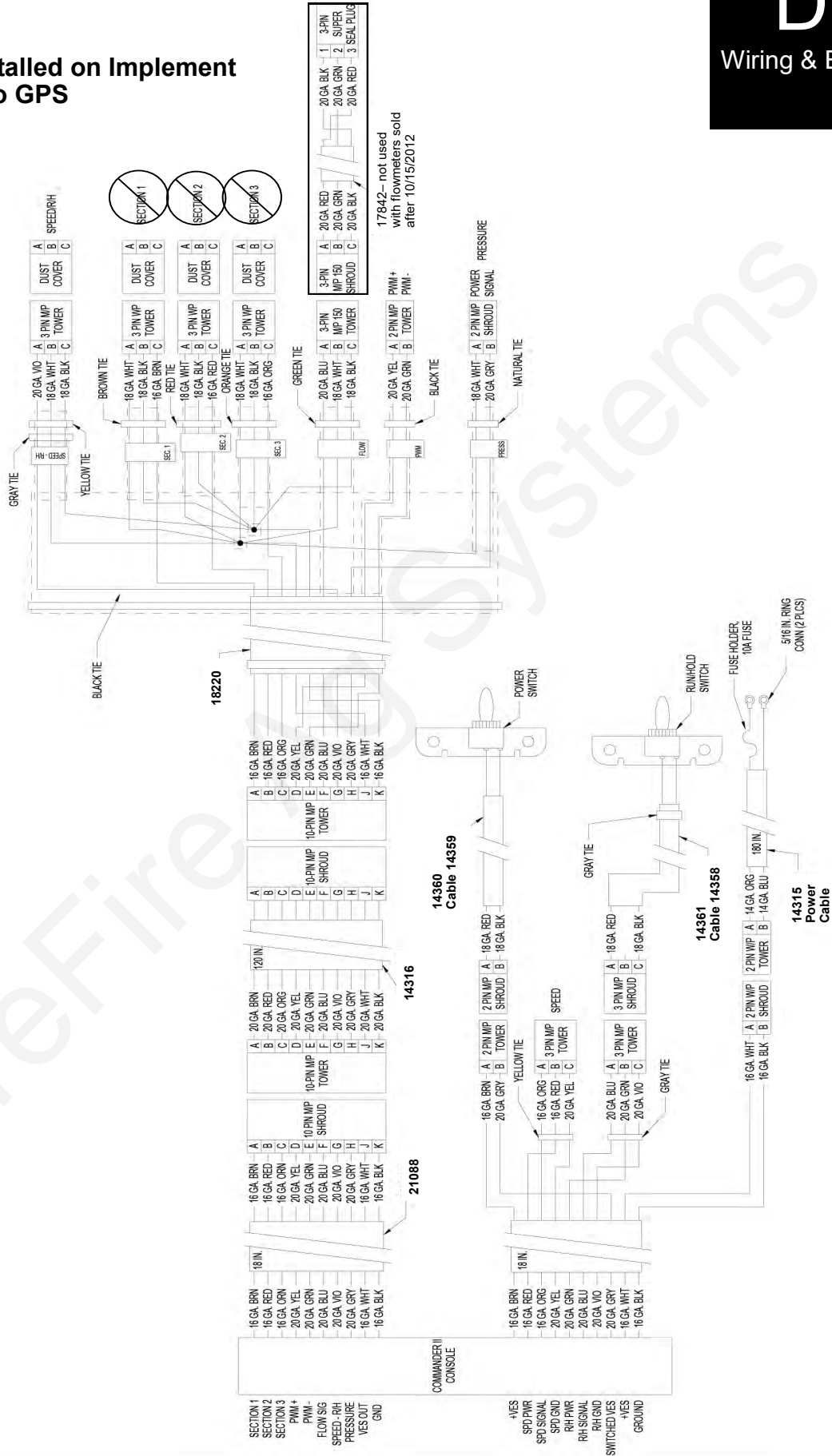
Sections: 1

Mercury Switch: Installed on Implement

Speed Source: Astro GPS



Means connector not used in this configuration.



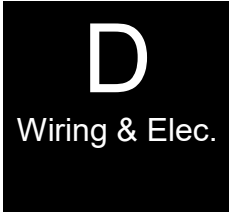
# Tower & Commander II Layout #2 - With Section Valves

Control: PWM EPD

Sections: 3

Mercury Switch: Installed on Tractor 3-point

Speed Source: Astro GPS



P/N 18048  
Install "Y"  
at R/H  
switch on  
controller.

P/N 200-90-14315 GND  
+12 VDC

Astro GPS  
Speed Receiver

P/N 206-10-14316

Use 10 Pin Extension  
cables, P/N 206-10-xxxx, to reach  
Tower location

P/N 200-03-18220

Mercury Work Switch

NOTE: Hook to controller with  
18048 "Y" when using 3-point

Not used in  
this layout

Pressure

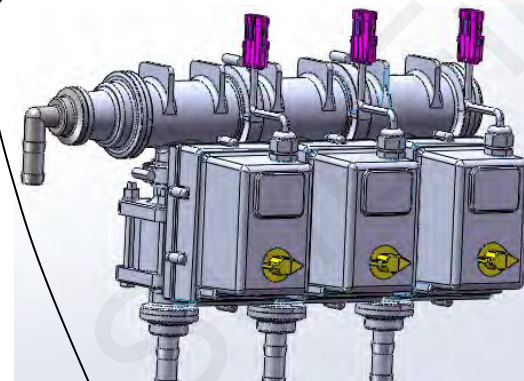
Flow

PWM

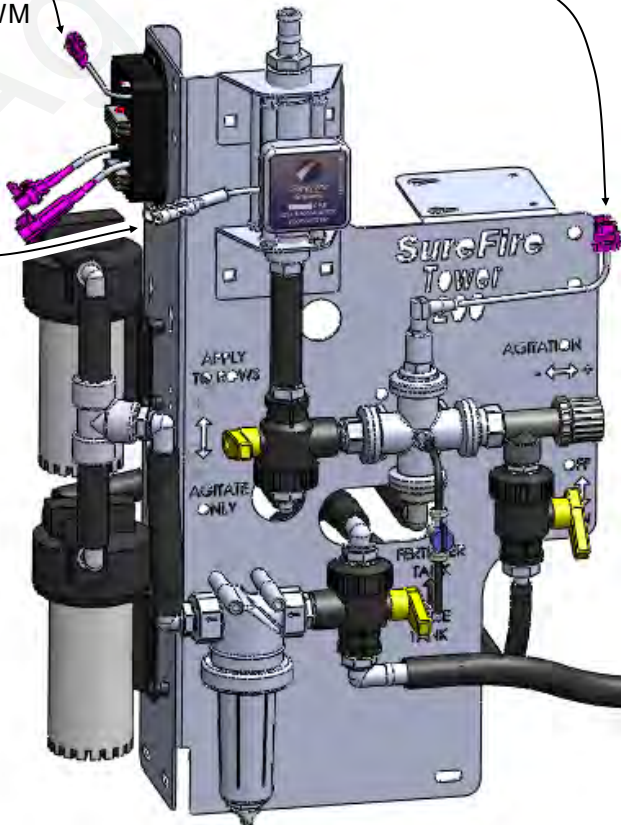
Section 1

Section 2

Section 3



Can use 3 Pin Weatherpack  
Extension cables to reach section  
valves (206-03-xxxx)



Means connector  
not used in this  
configuration.



# Tower & Commander II Schematic #2 - With Section Valves

Control: PWM EPD

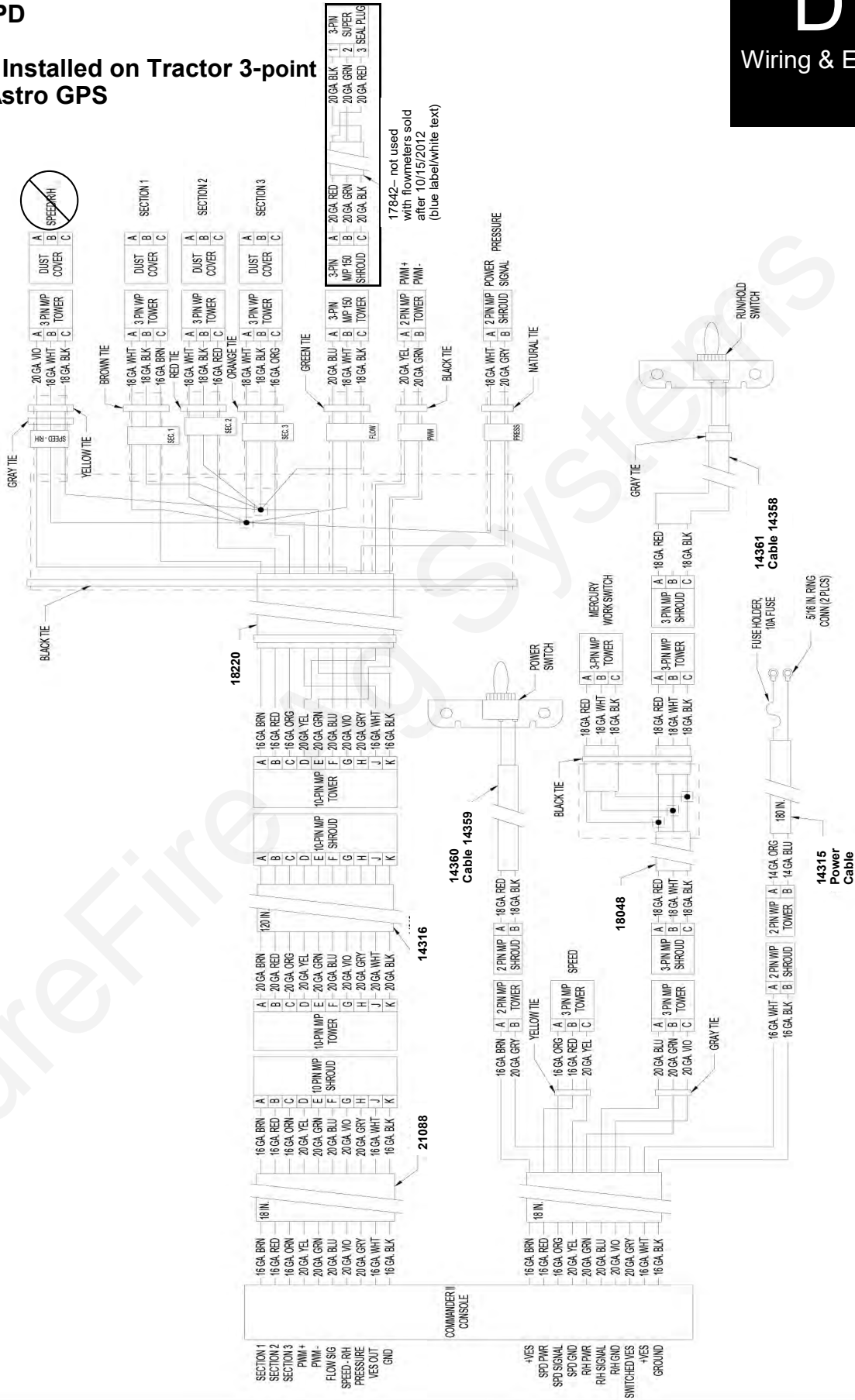
Sections: 3

Mercury Switch: Installed on Tractor 3-point

Speed Source: Astro GPS



Means connector not used in this configuration.



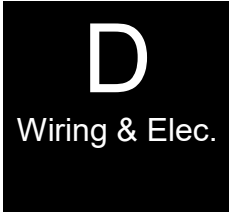
# Tower & Commander II Layout #3 - Tower on Tractor

Control: PWM EPD

Sections: 3 - Mounted on Implement (long distance from Tower)

Mercury Switch: Installed on Tractor 3-point

Speed Source: Astro GPS



P/N 18048  
Install "Y" at R/H switch on controller.

P/N 200-90-14315  
GND  
+12 VDC

Astro GPS  
Speed Receiver

Mercury Work Switch  
NOTE: Hook to controller with 18048 "Y" when using 3-point

P/N 200-03-18140

P/N 200-01-14584 (10 ft)  
(or 14585 - 30 ft)

Section 1

Section 2

Section 3

P/N 206-10-14316

P/N 200-03-18220

Speed / RH

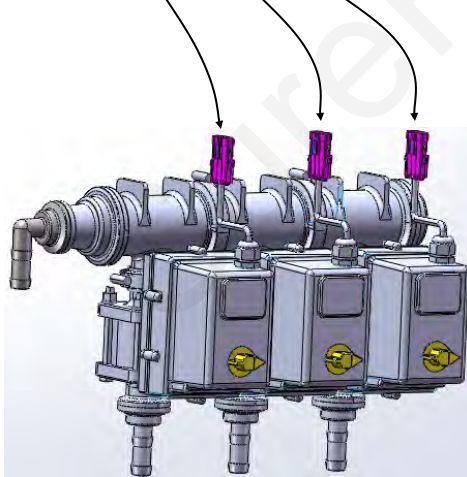
Use 10 Pin Extension cables, P/N 206-10-xxxxx, to reach Tower location

Pressure

Flow

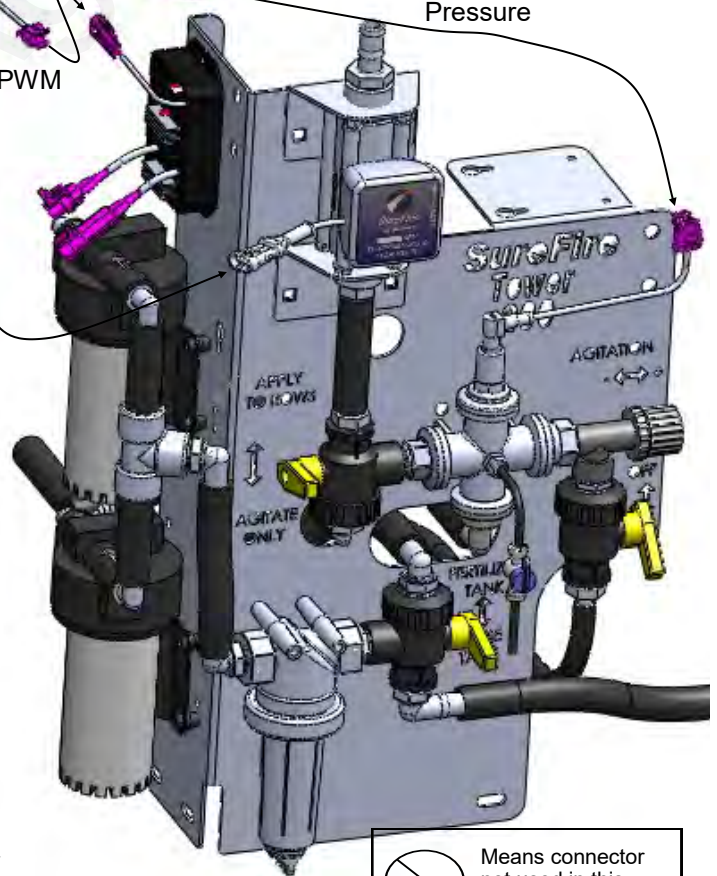
PWM

These section connectors not used in this layout



Section valves on implement

Tower on Tractor (near tanks)



Means connector not used in this configuration.



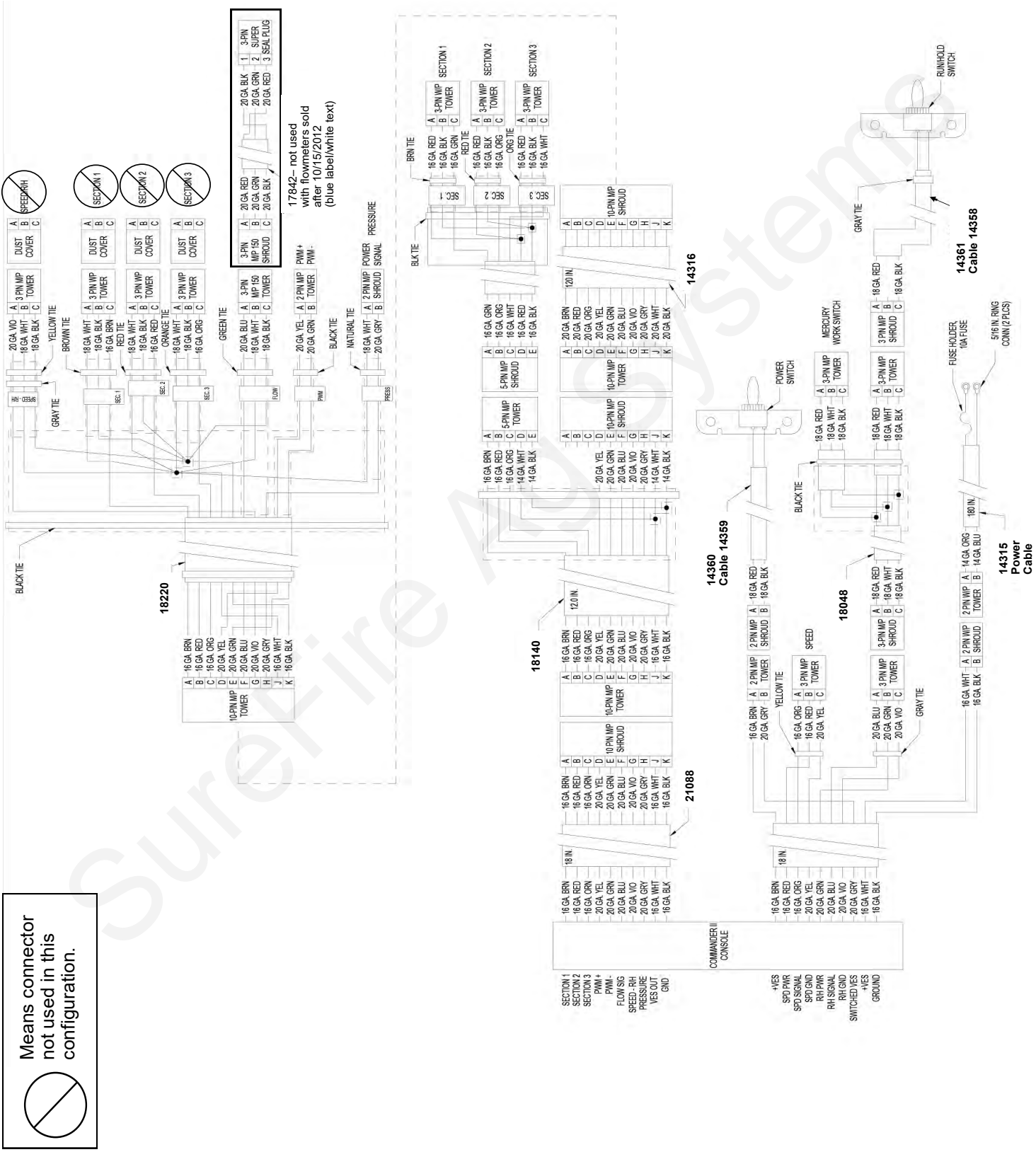
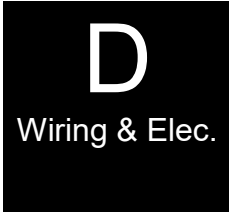
# Tower & Commander II Schematic #3 - Tower on Tractor

Control: PWM EPD

Sections: 3 - Mounted on Implement (long distance from Tower)

Mercury Switch: Installed on Tractor 3-point

Speed Source: Astro GPS



Means connector not used in this configuration.



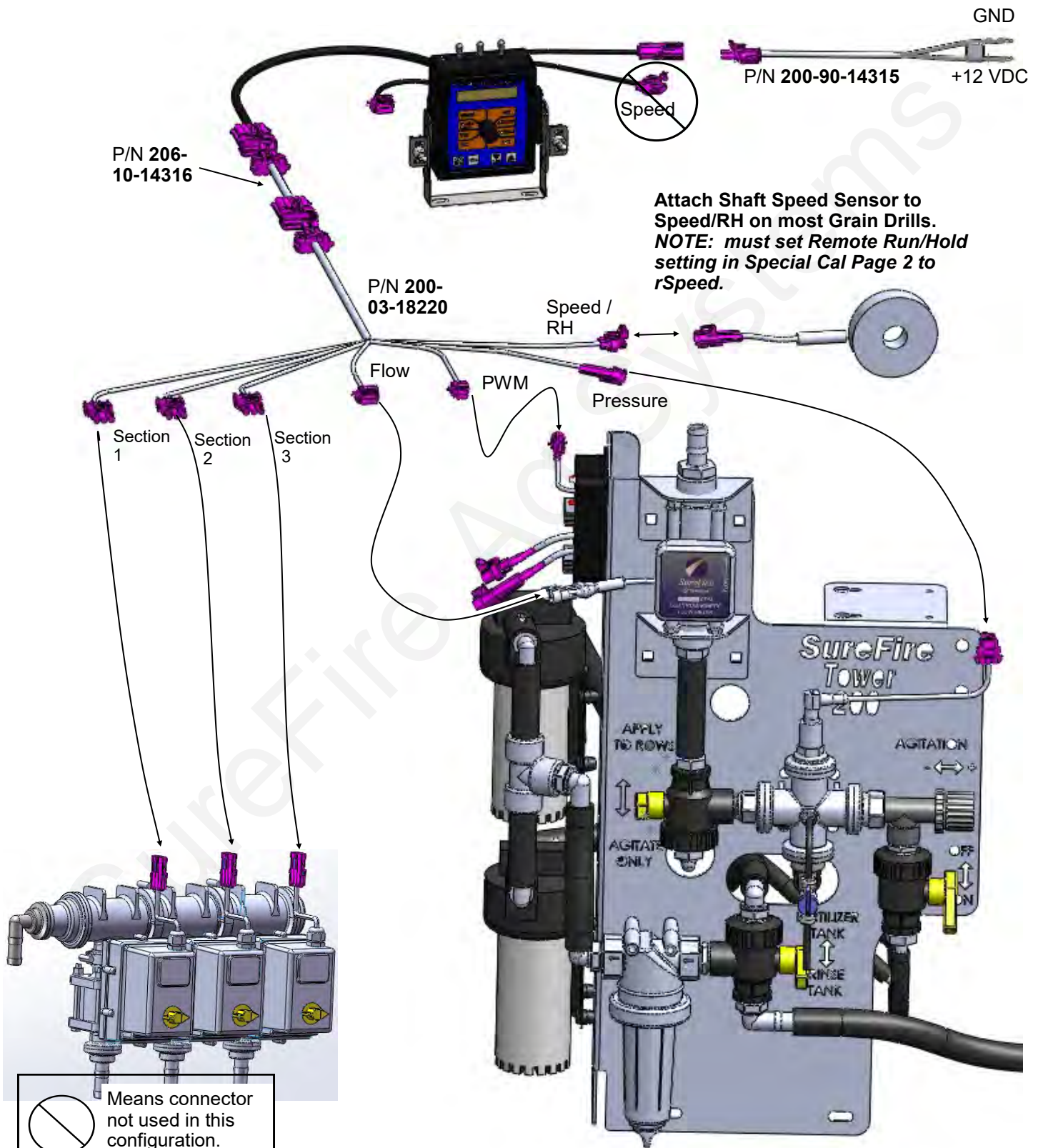
# Tower & Commander II Layout #4 - Typical Grain Drill

Control: PWM EPD

Sections: 3

Mercury Switch: None

Speed Source: Shaft Speed sensor installed on drill





# Tower & Commander II Schematic #4 - Typical Grain Drill

Control: PWM EPD

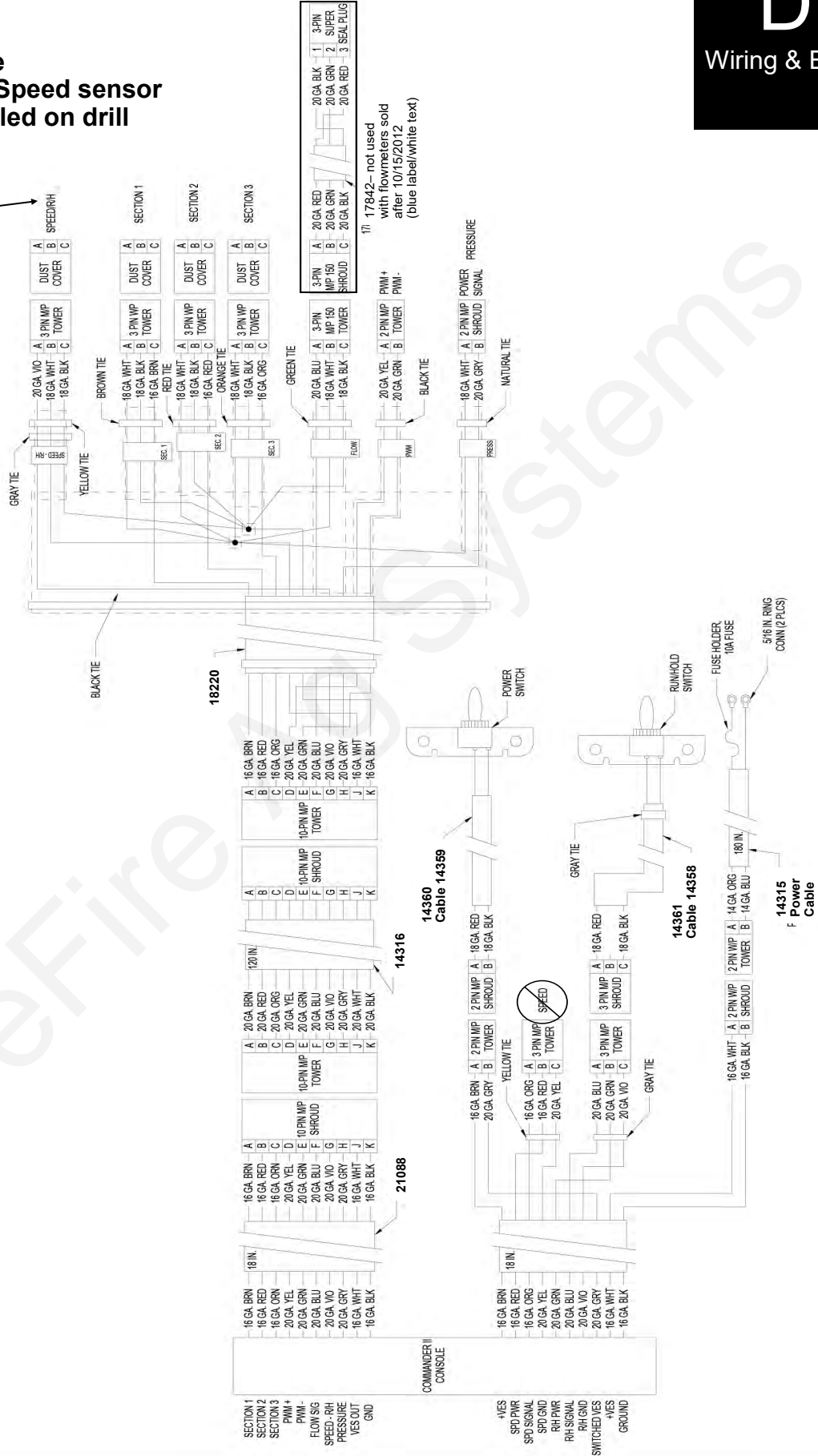
Sections: 3

Mercury Switch: None

Speed Source: Shaft Speed sensor installed on drill



Attach Shaft Speed Sensor to Speed/RH on most Grain Drills.  
NOTE: must set Remote Run/Hold setting in Special Cal Page 2 to rSpeed.

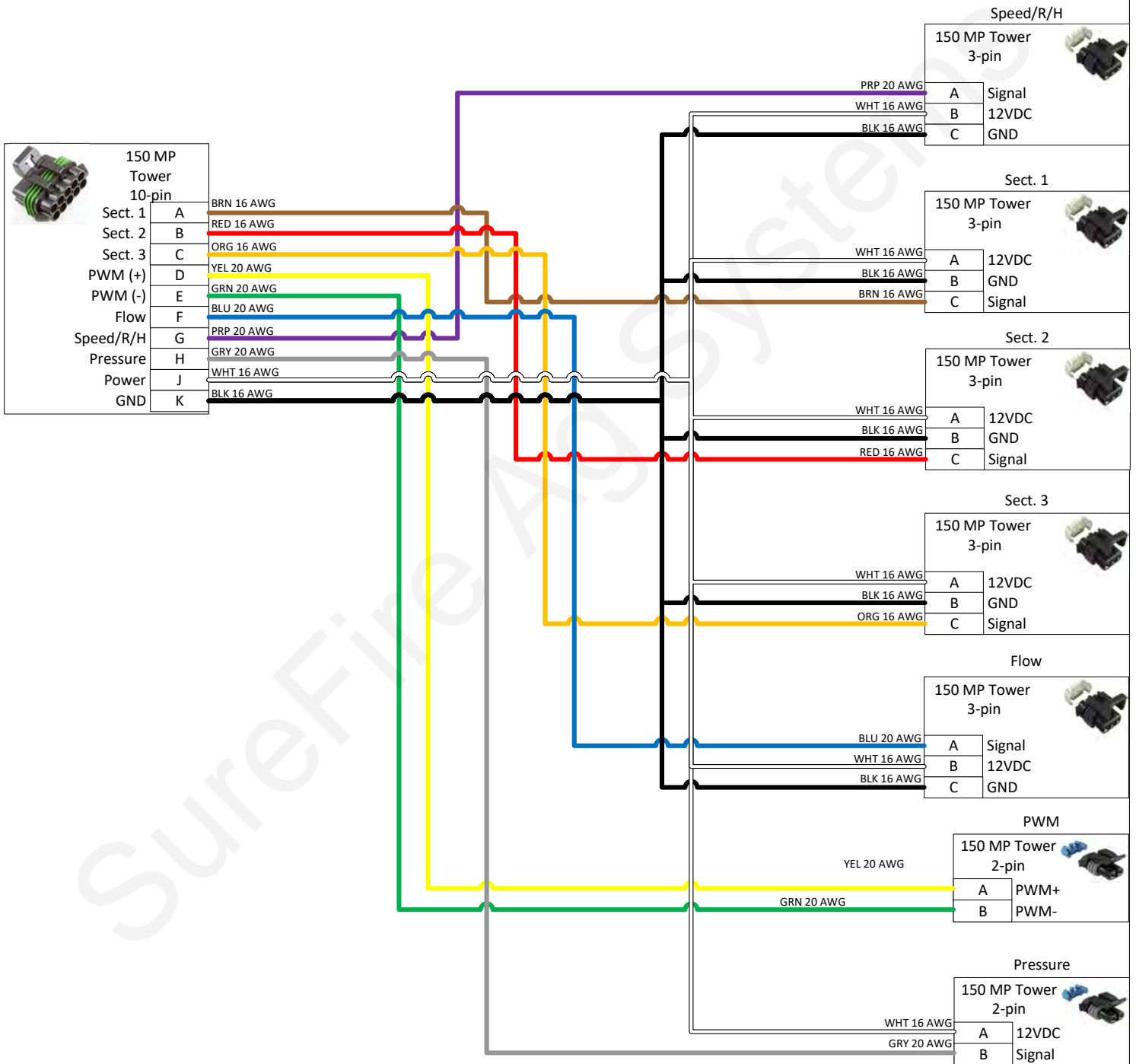


Means connector not used in this configuration.



# 18220 Commander II Harness

**Wire 18AWG  
unless otherwise  
specified**



Part No:	18220	Drawn By:	Matthew Fritz		
Description:	Commander II Harness	Last Edit Date:	5/26/2020	Revision	A-01
Copyright 2019 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden		<b>28</b>			

# Mercury Run/Hold Switch for Commander II



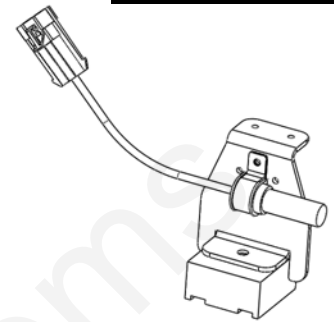
The Mercury Run/Hold Switch turns liquid application on and off automatically when the implement is raised or lowered. The switch is mounted on a component that rotates when the implement is raised and lowered. The switch is attached to a magnetic base for easy mounting to any metal part of your tractor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

### For mounted 3-point equipment:

- Mount the switch on the tractor 3 point arms.
- See the pictures below for switch orientation in run and hold positions.
- Use the 18048 “Y” Run/Hold adapter (included in box with Commander II controller) to plug the switch in at the back of the Commander II controller. See Layout #2 or #3 showing this wiring connection.

### For hitch drawn implements:

- Mount the switch on a wheel frame that rotates as it lifts the wheels up and down to raise and lower the implement.
- See the pictures below for switch orientation in run and hold positions.
- Connect the switch to the Commander II Final Harness (200-03-18220). See Layout #1 showing this wiring connection.

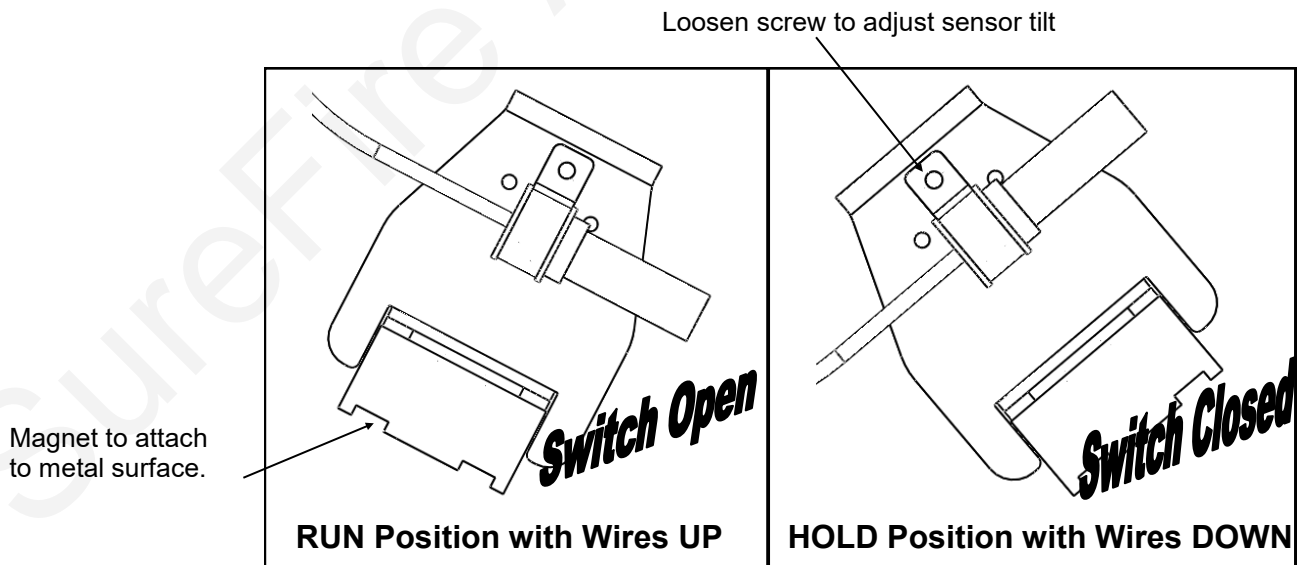


## Commander II Run/Hold Switch Logic

### How to Adjust:

If your controller is turning off product application before or after you want, tilt the switch. If it turns off after you want when lifting the implement, tip more to the HOLD position. If product application should begin sooner when you lower the implement, tip more to the RUN position.

You can adjust the switch by moving the magnet or by loosening the screw and rotating the mercury switch.



### How to Test:

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

# Astro GPS Speed Sensor

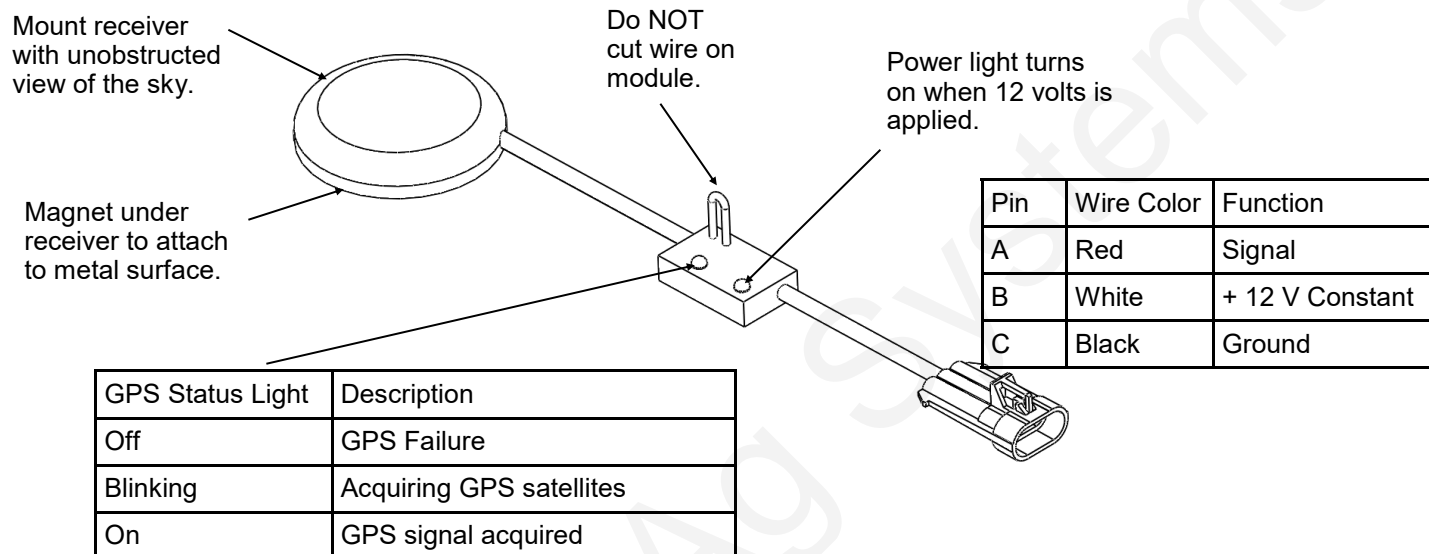
D

Wiring & Elec.

The Astro GPS Speed Sensor is the simplest speed sensor to use with the SureFire Commander II Controller. The GPS receiver uses the GPS satellites to track only speed. The output from Astro is a pulse to communicate speed to the Commander II.

PN **203-01-01410** Astro 2, 2 Hz GPS Receiver (most common with Commander II)  
 PN **203-01-01425** Astro 5, 5 Hz GPS Receiver

Speed Calibration for Commander II: **0.189**  
 Astro Minimum Operating Speed: **1.0 MPH**



# 40 Amp PWM EPD

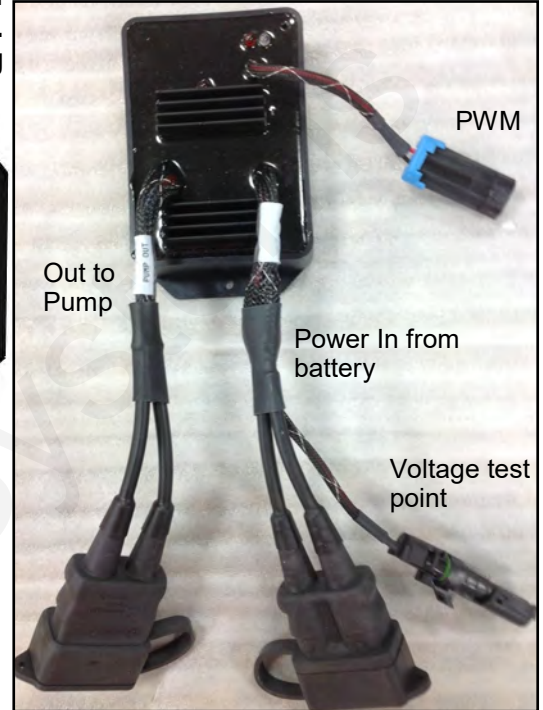
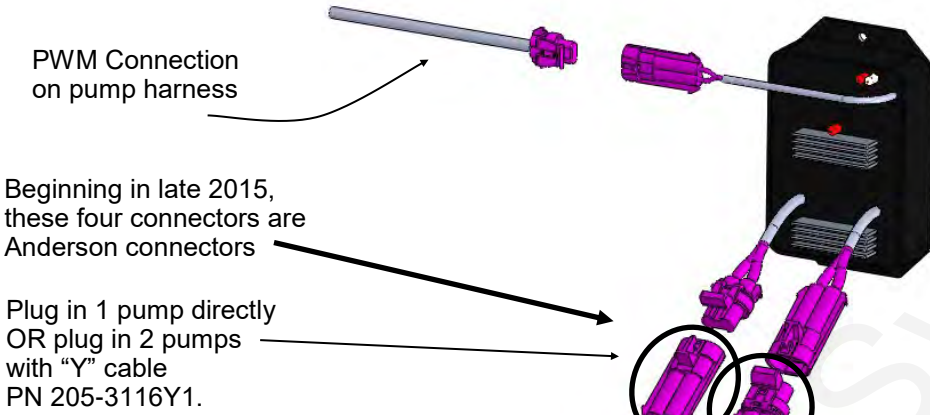
(Pulse-Width-Modulated Electric Pump Driver)

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

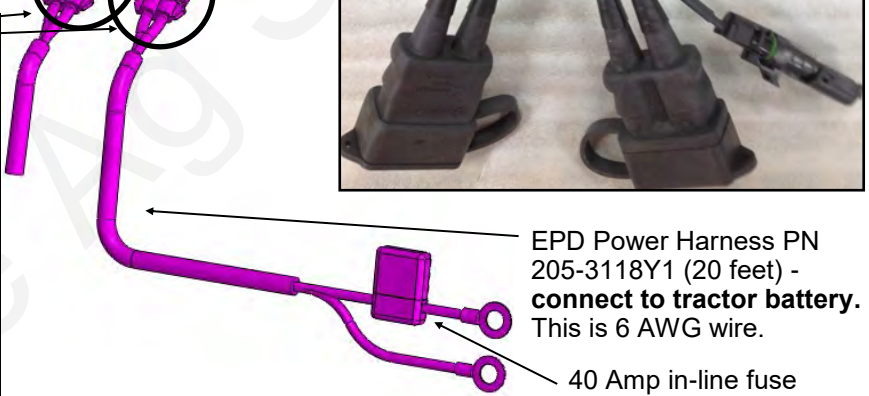


The Electric Pump Driver powers 1 or 2 electric pumps by providing a pulse-width-modulated signal to control pump speed. It needs to have a power connection and wiring capable of carrying up to 40 amps of current. **It must be connected directly to the tractor battery.** SureFire recommends 8 gauge wire (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.  
**The most common issue with the EPD will be a low voltage condition (under load) delivered to the EPD from the battery. Voltage drop occurs anytime current is moved through a wire. A low-voltage (12 v) system with long runs (60-80 feet) may have unacceptable voltage drops if any part of the system is weak or the load is high. This could be bad (corroded, weak, loose or burnt) connectors (at the battery, at the hitch, and at the EPD), too small of wire used (smaller wire equals more voltage drop), low source voltage, and heavy load. Any or all of these may contribute to a low voltage condition under load that may shut down the processor in the EPD module. This will be indicated by 4 quick flashes of the red light, followed by a short pause. Unplug the power-in connector to reset the EPD.**



Use EPD Power Harness Extensions as needed (These have Anderson 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.

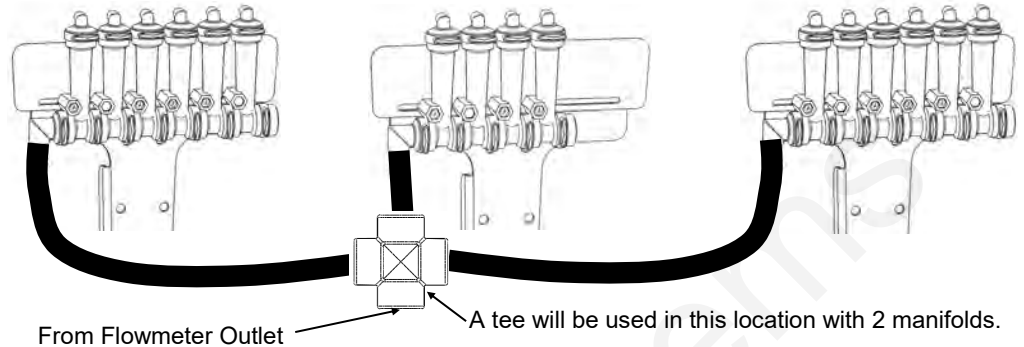
# Floating Ball Flow Indicators

## E Installation Overview

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

### 16 Row Split 6 - 4 - 6

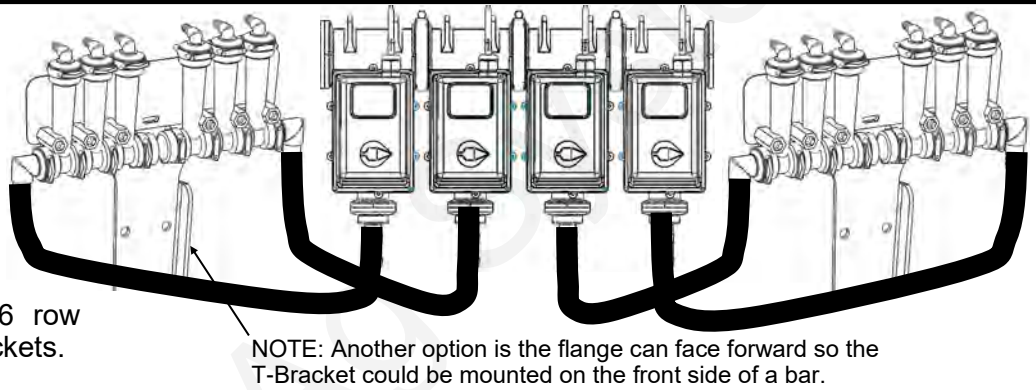
This configuration works well on a 16 row front fold planter. Each flow indicator manifold is shown fed by a cross in a single section installation. Each manifold could be fed by a section valve if desired.



### 12 Row Split 3 - 3 - 3 - 3

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

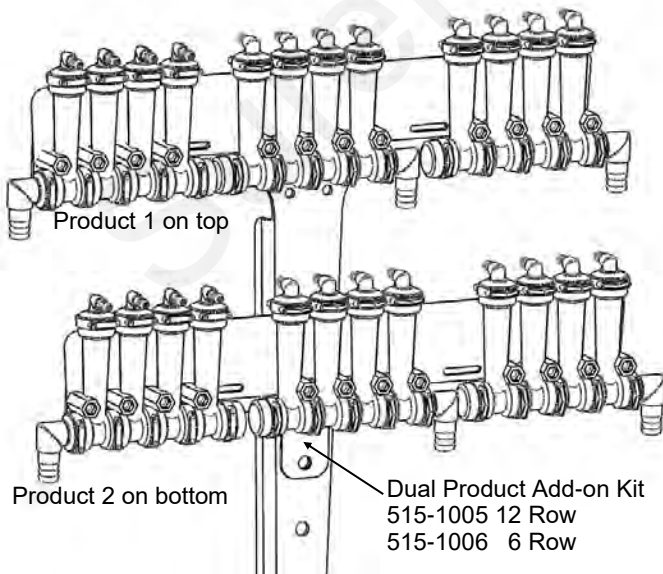
A 4 section 24 row could be similar with four 6 row manifolds on two large T-Brackets.



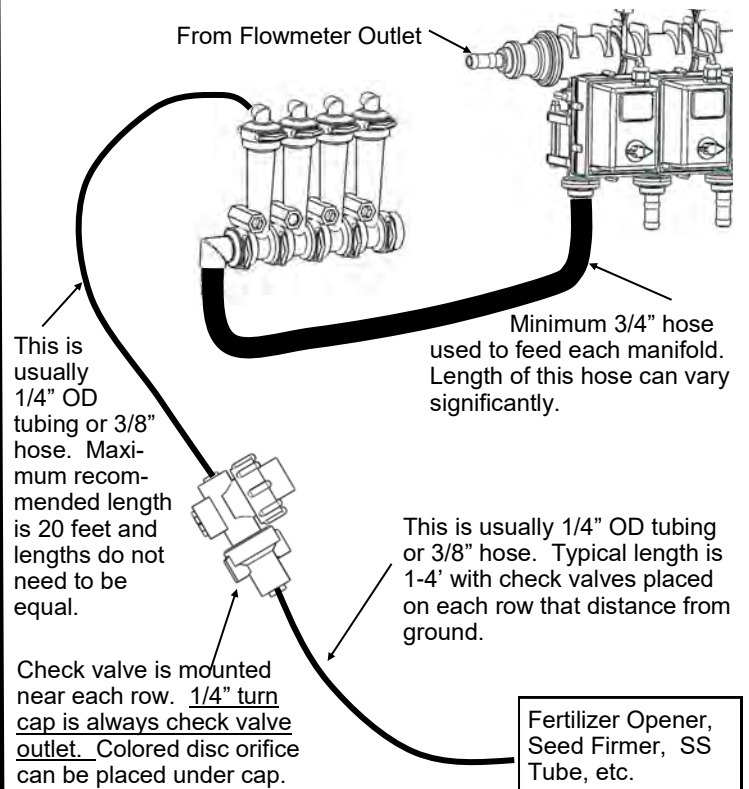
### 12 Row Dual Product

#### Product 1 Split 4 - 4 - 4 / Product 2 Split 4 - 4 - 4

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



### General Plumbing Guidelines



# Tower 110 & 200 Mounting Options

# E

## Installation Overview

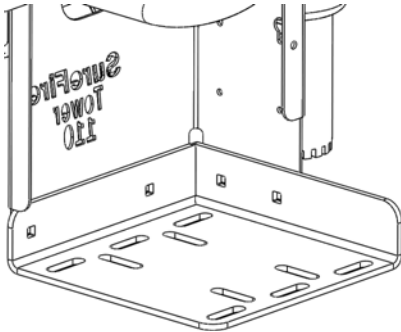
### Tower Basic Mounting Bracket

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.

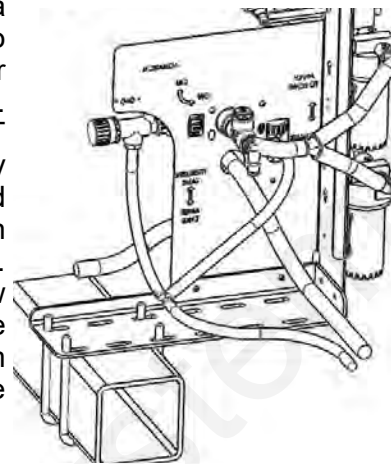


### Tower Offset Mounting Bracket

Item Number **511-1010**

The Tower is available as a stand alone item.

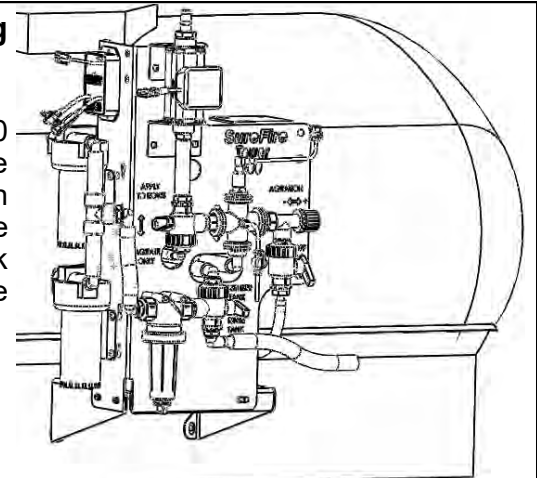
This kit includes a bracket to mount to the top side of a bar and hold the Tower. U-bolts are NOT INCLUDED. They must be ordered separately based on mounting bar size. Multiple slots allow the Tower to be mounted away from or directly over the bar.



### Tractor Front Mount Elliptical Cradle Tower Mounting Bracket

Item Number **511-1009**

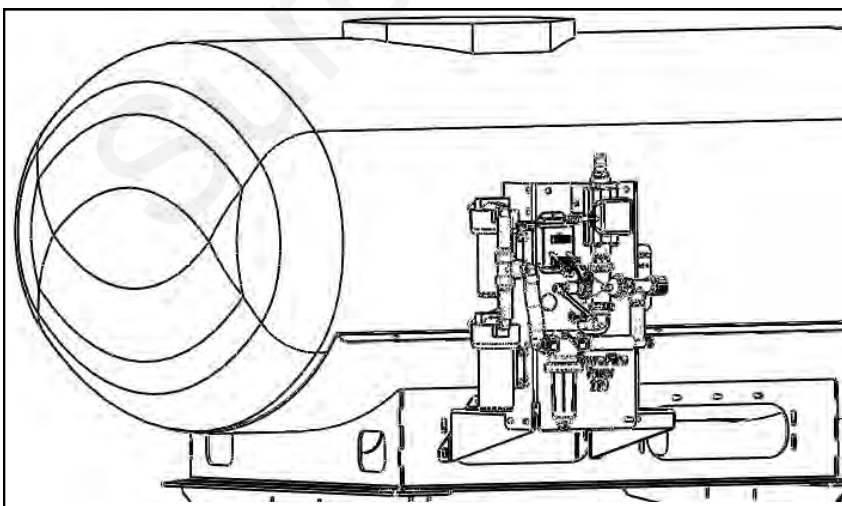
Mounts a Tower directly to the front of tractor front mount 200 & 300 gallon elliptical tank cradles. This bracket will mount the back of the tower just over 4 1/2" forward of the flat bracket mounting face. When using a tractor mounted tank, SureFire recommends mounting the Tower near the tank, not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



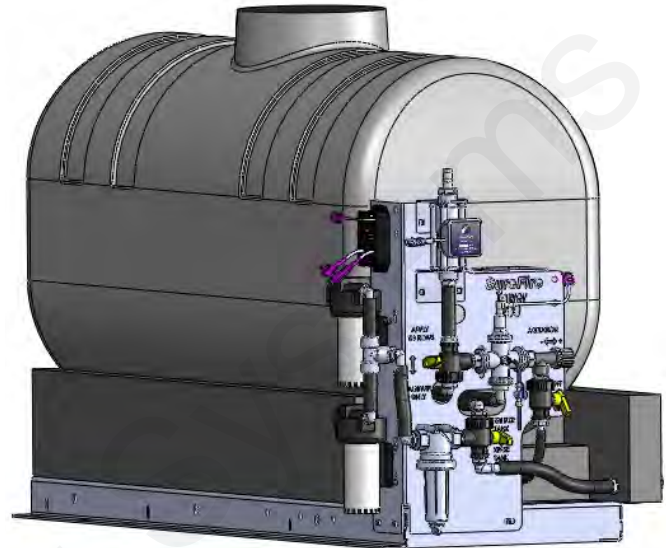
# Accelerator with Tower 200 Pump Panel



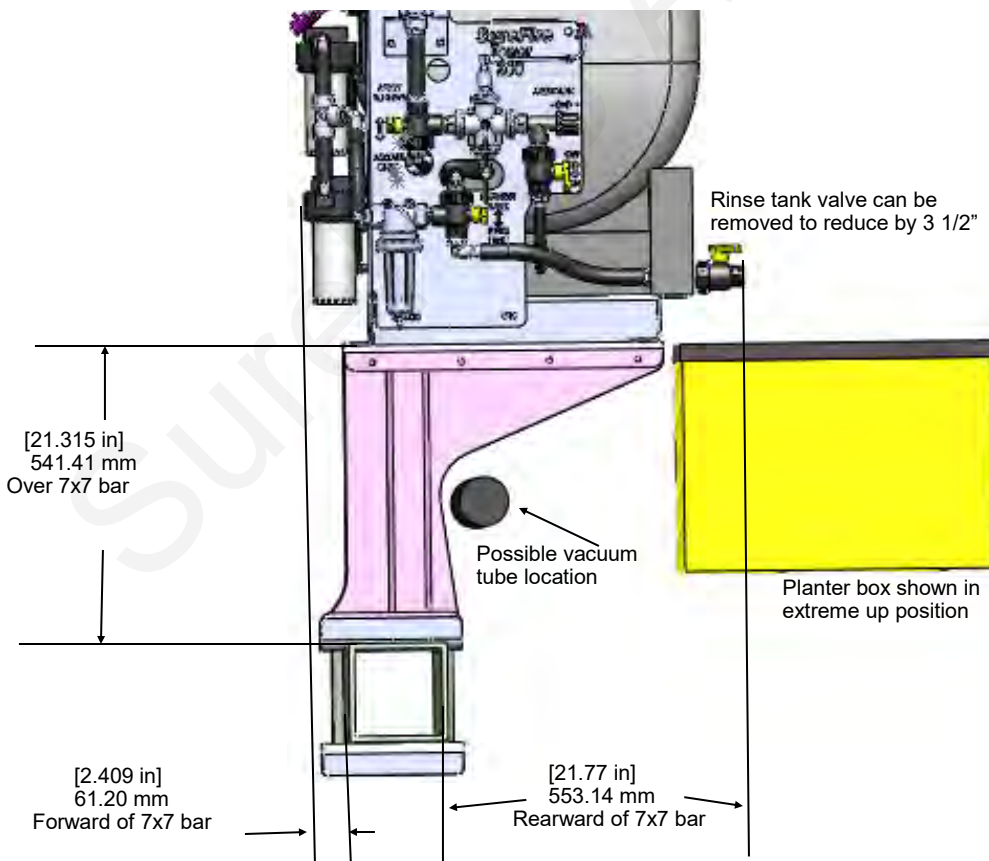
The Accelerator is a completely assembled and tested fertilizer system. It has a 55, 110, or 155 gallon tank resting in a custom molded tank base that doubles as a rinse water tank. This bolts to a steel frame with eighteen 5/8" mounting slots for flexible mounting to fit many situations. The Tower 200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



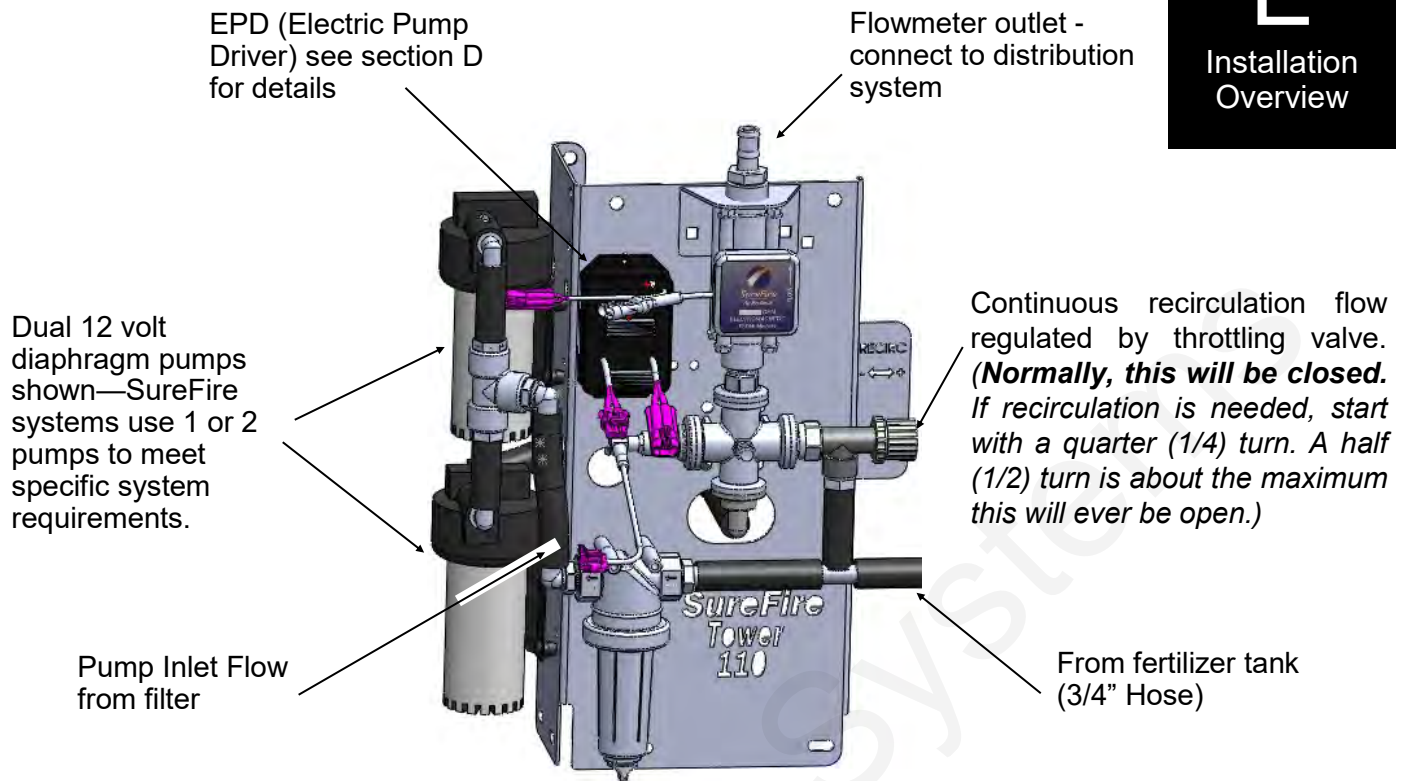
This mount kit includes two welded brackets to mount any of the 3 sizes of Accelerator tanks above and offset from the 7x7 planter toolbar as shown.



# 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 Commander II console, enter Calibration and turn Commander II dial to Test Speed. . Enter your field operating speed. Turn your section switches and Run/Hold switch on. The Commander II 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 Commander II console, verify the system has locked on to application rate.

## Troubleshooting:

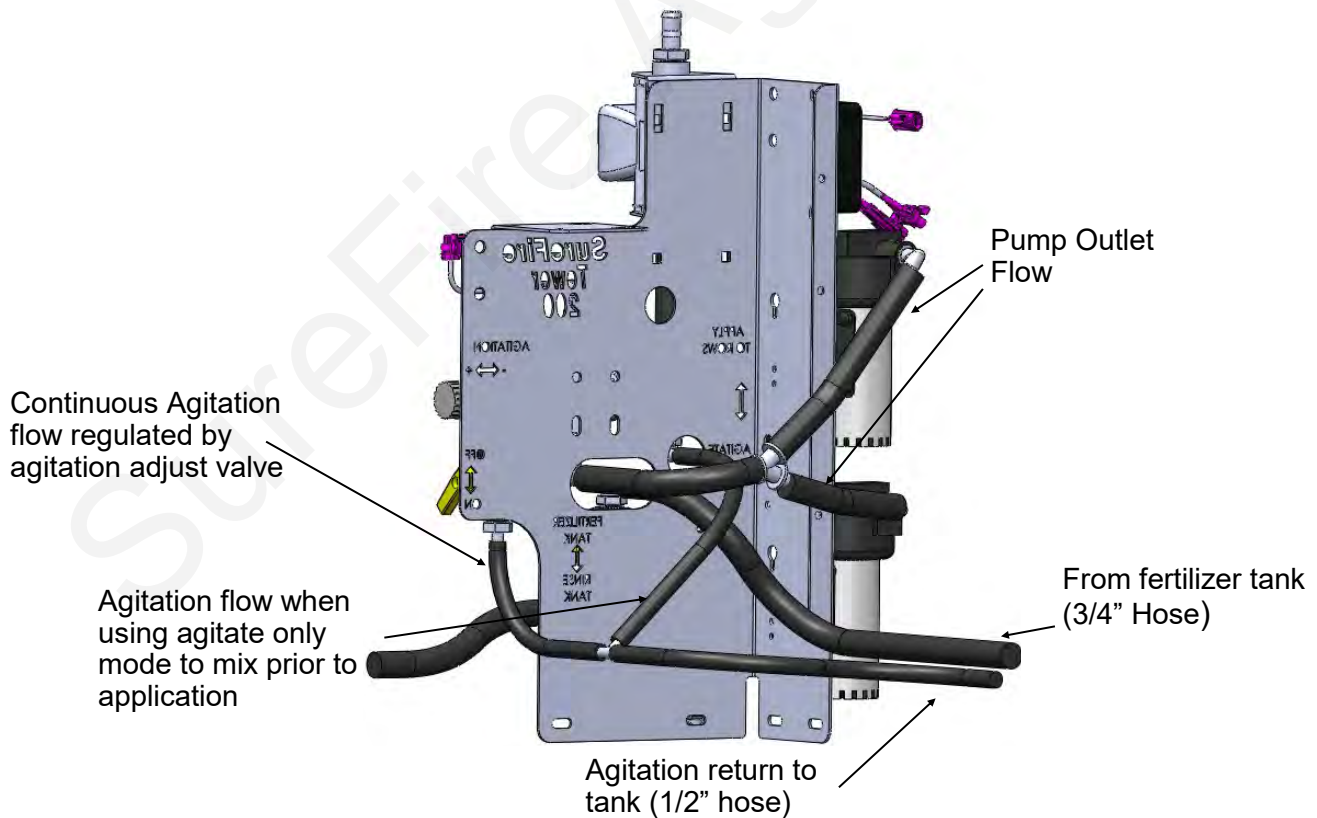
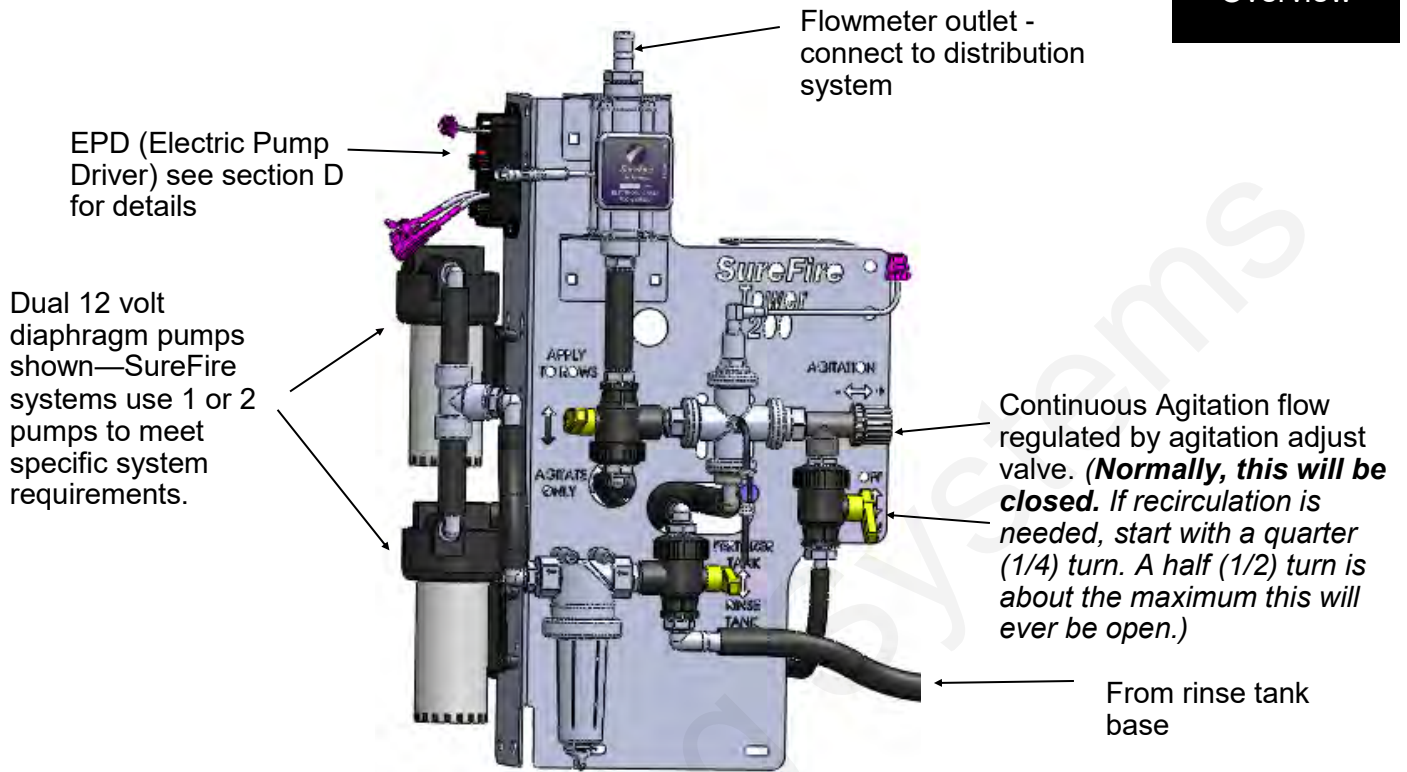
- If the system will not reach your target, you need to close the agitation adjust valve some.
  - If the system is applying a rate higher than you want and will not lock on rate, you need to open the agitation adjust valve some.
  - If the rate is still fluctuating around your target and you have a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



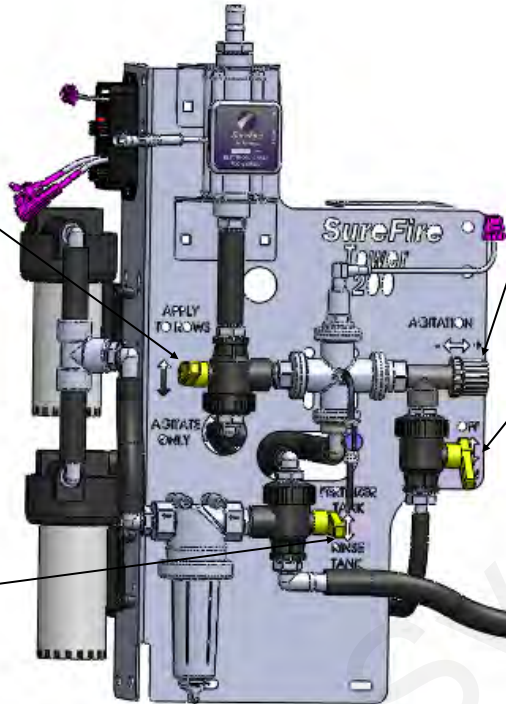
# Tower 200 Valve Operation

# 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. *(If using, start with a 1/4 to 1/2 turn.)*

**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 the 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. Enter **Calibration** and turn Commander II dial to Test Speed. Enter your field operating speed. Turn your section switches and Run/Hold switch on. The Commander II will now operate at your Target Rate and Test Speed.
2. Open the Agitation On/Off valve.
3. Start with the agitation adjust valve completely closed and note the slow pump speed (by pump noise).
4. Open the agitate adjust valve slowly (*start with 1/4 turn*) and note the increased pump speed and noise. The system is applying the same amount to the ground, the pumps are now running faster due to more recirculation flow. *This will typically be open 1/2 turn or less.*
5. Set the valve to somewhere in the middle based on visual observation of agitation flow needed.
6. On your Commander II, 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.

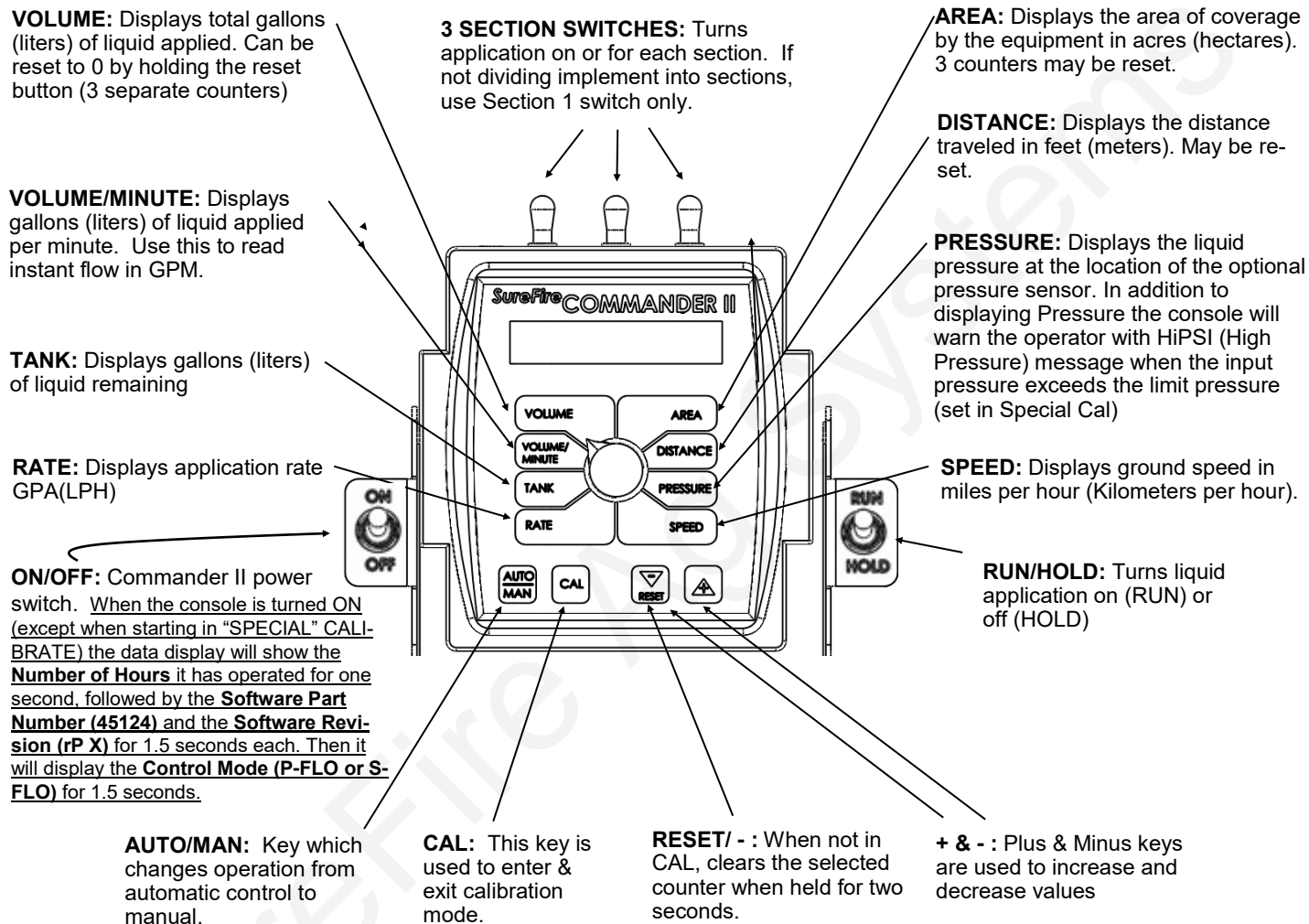
# Commander II Console Functions

The Commander II is a very robust rate controller with manual section control for 3 sections. It will operate in either PWM or servo mode. Typical operation is PWM control.

# F

Setup & Operation

## In Field Operating Instructions



## Five Steps for Commander II Setup for Tower Electric Pump Systems

1. **Commander II Special Cal Quick Setup** (Factory defaults are for Tower Electric Pump Systems so skip this step with brand new Commander II)
2. **Standard Calibration**
3. **Initial Operation in Manual Mode**
4. **Test Speed Operation in Automatic Mode**
5. **Speed Signal Verification & Field Operation**

# Commander II Special Cal Quick Setup

## Step 1

### F

#### Setup & Operation

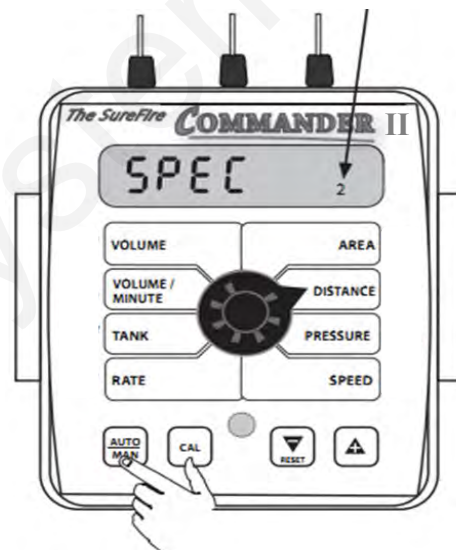
The Commander II is shipped from the factory set up for PWM driven Tower Electric Pumps. If installing a new Tower system you can skip this procedure. The defaults for EP-E (see below) are already loaded.

The Commander II has a quick setup feature to load the necessary defaults for a SureFire Tower or PumpRight system. **Follow the steps below BEFORE performing standard calibration on next page.**

To change defaults:

1. Power off Commander II.
2. Enter Special Cal by holding both the AUTO/MAN and the CAL button down while turning on the power switch.
3. You should see "SPEC" on the screen, if not, repeat steps one and two.
4. Ensure "1" displays to indicate Page 1 in Special Cal. Press CAL to change if necessary.
5. Turn dial to point at AREA.
6. Select desired defaults from chart below. (Press the Up or Down arrow to change selection)
  - Select "EP-E" for Tower Electric Pumps-PWM control and English units. (EP-E is Electric PWM-English)
  - Select "HP-E" for PumpRight or other Hydraulic Pumps
7. Save changes by holding CAL until red light goes out (about 3 seconds).

This number tells you which special CAL screen you are on. Pressing the CAL button will change this number.



**NOTE: The above procedure will load all default values in the Commander II. It must be done before standard calibration.** For example, if you entered your implement width, then did the quick setup above, the Commander II would default back to 240 inches.

**Complete Table of System Defaults (for Software Revision rP E and later. Earlier Revisions will have different default Flow Cal numbers. Software Revision identification displays briefly on console startup.)** The following table shows the unique values that are loaded in the above procedure. The first letter, **E** or **H** stands for **electric** or **hydraulic** pumps. The second letter, **P** or **S**, stands for the type of control used, **PWM** or **Servo**. Finally, the last letter, **-E** or **-M**, is for **English** or **metric** units. Turf utilizes 1,000 square feet for the area measurement.

The Commander II is typically sold with new PWM controlled application systems. However, it is compatible with Servo controlled systems. A special wiring harness is needed for the servo controlled systems.

Load Defaults Selection	PWM Electric Pumps	PWM Hydraulic Pumps	Servo Electric Pumps	Servo Hydraulic Pumps
	EP-E, EP-M, TURF	HP-E, HP-M	ES-E, ES-M	HS-E, HS-M
Control Rate	-2	-2	-1	-2
Min PWM	0	15	----	----
Max PWM	100	80	----	----
Start Time	Off	1	Off	Off
PWM Start %	----	50	----	----
Flow Cal	<b>6000</b>	<b>4000</b>	<b>6000</b>	<b>4000</b>
Control Mode	P-FLO	P-FLO	S-FLO	S-FLO
Max Pressure	50	80	50	80

# Standard Calibration Procedure:

## Step 2

### F Setup & Operation

1. Press CAL key for one (1) second to enter calibration mode.
2. Red light will be on steady and CAL will be displayed in CAL mode.
3. Turn the dial to the items listed below and set as instructed.
4. When complete, press CAL for one (1) second to exit CAL mode. Red light should go out and CAL will not be displayed. **You MUST exit Calibration mode to save your settings.**

**VERIFY—FLOW CAL:** Enter the calibration number for your **flowmeter** here. On electromagnetic flowmeters the calibration number is from the chart below. **(These numbers are for flowmeters sold after 10/15/2012. These meters have an orange label or a blue label with white text. Earlier flowmeters (white label with black text) use different FLOW CAL numbers.)** On turbine flowmeters, the calibration number is on a metal tag attached to the flowmeter.

*Quick Tip: To quickly change the flow cal, press the AUTO/MAN button to allow you to directly change the 2 left digits (thousands). Then press the UP or DOWN arrow to change the number. Press AUTO/MAN again to change the right 3 digits.*

Flow Range (GPM)	Pulses/Gallon	Commander II Flow CAL
0.08-1.6	22710	45420
0.13 - 2.6	3000	6000
0.3 - 5	3000	6000
0.6 - 13	2000	4000
1.3 - 26	2000	4000
2.6 - 53	2000	4000

**P/F Ratio:** Not used at this time.

**ADJUST RATE:** Sets amount of rate change by pressing "+" or "-" button once. Usually set to 1.0. This allows you to change from 8 GPA to 9 GPA to 10 GPA etc.

**DO THIS—TARGET RATE:** Set to your intended target rate in Gallons per Acre.

### Standard CAL Factory Defaults: (for Software Revision rP E & after)

Software Revision identification displays briefly when Commander II is started.

**Electric Pumps: 6000**  
**Hydraulic Pumps: 4000**

Off

1.0 GPA

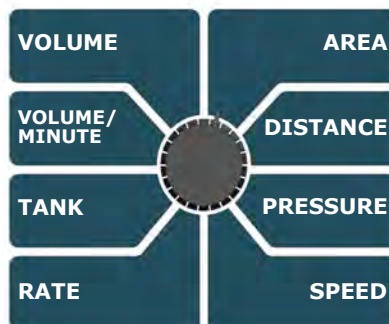
10.0 GPA

**FLOW CAL**

**P/F RATIO**

**ADJUST RATE**

**TARGET RATE**



**WIDTH**

**SPEED CAL**

**CONTROL SPEED**

**TEST SPEED**

Boom 1: 240 Inches  
Boom 2: 0 Inches  
Boom 3: 0 Inches

0.189

PWM Electric: -2  
PWM Hydraulic: -2  
Servo Electric: -1  
Servo Hydraulic: -2

Off

**NOTE:** This indicates you are in CAL mode.

**DO THIS—WIDTH CAL:** Enter the width of each fertilizer or chemical section of your implement. For a single section system, set Section One to the full implement width in inches. For example, for an 8 row 30" implement, set Section One to 240 inches. To set the section widths the Run/Hold Switch has to be in Run and the Section Switch must be ON. If using a single section implement, set Section 2 and 3 to ZERO.

**VERIFY—SPEED CAL:** Used in calibration mode to enter the speed calibration number in inches per pulse. Default is 0.189 for SureFire Astro GPS speed sensor.

**When using the shaft speed sensor on grain drills, this will need calibrated.** SureFire recommends you enter a value of 1.0 as a starting point. See section G for that calibration procedure under "Ground Speed Displayed is not correct".

**CONTROL SPEED:** Typically -2 for Tower Electric Pumps & -2 for PumpRight Hydraulic Pumps.

Allows adjustment of response to "tune" the system for use with fast or slow valves. For example, if response is too slow, use the "+" button to adjust the valve response number to 1, 2 or 3. The range of adjustment is -4 to +3.

**TEST SPEED:** Use this mode to verify controller automatic operation only AFTER initial operation in MANUAL mode.

# Initial Operation Instructions

# F

Setup &  
Operation

*SureFire highly recommends you perform these exact steps with water to verify system is correctly installed and ready for field use. Note: When testing with water, the system will develop much less pressure than it will have with fertilizer, and all rows may not flow.*

- ◆ Test the system in **MANUAL mode**.

## Step 3

1. Push the AUTO/MAN button until **MAN** is displayed on the Commander II. You are now in Manual mode.
2. Put the system in **RUN**. Turn the console switch to RUN or lower the implement if using a mercury Run/Hold Switch. When HOLD Is not displayed on the screen the system is in RUN.
3. Close the recirculation knob on the tower. Open the Air Bleed valve on the Tower. Be prepared to close the valve when water comes out.
4. Turn **Section 1 switch ON**.
5. Turn dial to **VOLUME/MINUTE** position. Is a number displayed? Push and hold the (+) button. Does the flow increase? Push the (-) button. Does the flow decrease?
6. If no reading in VOLUME/MINUTE, is the pump turning and is there water present at the pump inlet?  
**NOTE: Feel if pump is vibrating to tell if it is running.**
7. If water is being pumped, but no reading on the Commander VOLUME/MINUTE, check the flowmeter connections and the Flow Cal value.

**Proceed to STEP 4 ONLY when you can increase and decrease the VOLUME/MINUTE reading using the (+) and (-) keys on the Commander II.**

- ◆ Test the system in **Test Speed (AUTO) mode**.

## Step 4

1. Enter calibration by pushing and holding the **CAL** button until CAL is displayed on the Commander II and the red light is on.
2. Push the AUTO/MAN button until **AUTO** is displayed, indicating you are in automatic mode.
3. Turn the dial to **Test Speed** in the bottom right corner. Use the + key to adjust to your field operating speed.
4. Turn Run/Hold switch on Commander II to **RUN**.
5. Turn Run/Hold **mercury switch to run** by lowering the implement, unplugging it, or manually tilting the switch.
6. Turn at least **Section 1 switch on**.
7. You should now be dispensing liquid as if you were traveling through the field at the test speed you entered. *The system will develop much less pressure with water than it will have with fertilizer. If the pressure is too low, not all of the check valves will open, and some rows may not flow.*

**Proceed to the next step when liquid application is verified in AUTO mode.**

- ◆ Verify the Commander II Speed is correct.

Turn the dial to **SPEED**. Drive the tractor. Does the speed reading seem reasonable and correct? The ASTRO II will be a more accurate speed than an un-calibrated tractor speedometer.

**Proceed to the next step when your Commander II Ground Speed is correct.**

- ◆ You are now ready to verify regular field application.

See the complete system manual, 396-001450, for more information.

## Step 5

© 2010-2020 SureFire Ag Systems

## NOTICE

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



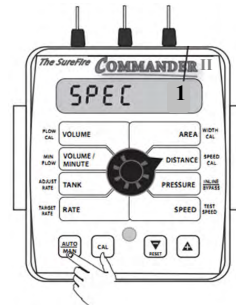
# Special Calibration Procedure - Page 1



**Special Cal Parameters should not need changed in most cases.** Consult with your SureFire dealer or representative before adjusting.

To enter Special Cal:

1. Power off Commander II
2. Enter Special Cal by holding both the AUTO/MAN and the CAL button down while turning on the power switch.
3. You should see "SPEC" on the screen, if not, repeat steps one and two.
4. When finished, save changes by holding CAL until red light goes out (about 3 seconds)



This number tells you which special CAL screen you are on. Pressing the CAL button will change this number.

**FILL TANK SIZE:** If using the Tank feature, this setting can be used to enter the volume of the tank. Use the "+" and "-" buttons to choose OFF or any value from 1-65,535. Then when the tank is filled, the tank counter can be reset to full by simply turning the rotary switch to the TANK position and pressing the "+" button.

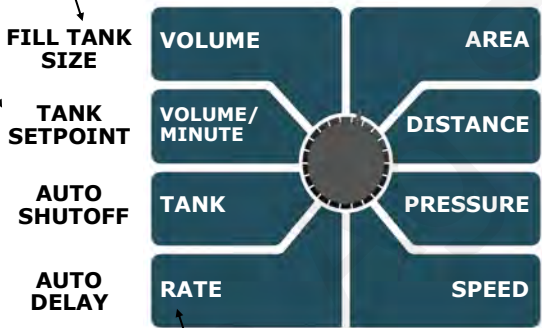
**TANK ALARM SET POINT:**

Use the "+" and "-" buttons to set the level where the Warning LED starts flashing and the word "FILL" flashes on the display. Range is OFF or 1-65,535. When the tank value drops below the set point, the alarms will notify the user that the tank level is low.

**AUTO SHUTOFF ON/OFF:**

Not used for PWM systems. When Auto Shutoff is enabled (ON) the servo will run toward minimum flow for 4 seconds any time the system is put in HOLD or all booms are turned off, or if in AUTO mode and speed goes to zero. This feature is normally used only in Dry Application systems where the HOLD condition must stop a hydraulic auger or conveyor belt.

**Special CAL 1 Settings**



**AUTO DELAY TIME:** Not used for PWM systems. Typically used when using relatively slow ball valves for boom shut-off, this feature delays adjustment of the servo valve until the boom valves are open. Use "+" and "-" buttons to set from zero (OFF) to 4 seconds.

**SET DEFAULTS / COMMANDER II SPECIAL CAL QUICK SETUP:** See page titled COMMANDER II SPECIAL CAL QUICK SETUP.

**FLOW CAL DEC:** Sets the number of decimals available when entering the Flow CAL number in standard calibration mode. Defaults to 1 (Flow cal sets to whole number).

**CONTROL MODE:** Allows the selection of either Servo mode or PWM mode. The selection is made based upon your specific equipment. On power up, the mode is displayed briefly as "S Flo" for servo mode and "P Flo" for PWM mode.

**VALVE POLARITY:** Not used for PWM systems. For establishing servo polarity. If pushing increase button causes flow to decrease and vice versa, switch this setting between Inline and Bypass.

**Special CAL Page 1 Factory Defaults:**

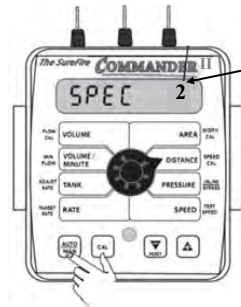
	Special CAL 1 Settings		
Off	FILL TANK SIZE	VOLUME	SET DEFAULTS
		AREA	EP-E
Off	TANK SETPOINT	VOLUME/MINUTE	FLOW CAL DEC
		DISTANCE	1
---	AUTO SHUTOFF	TANK	CONTROL MODE
		PRESSURE	P-Flo
1	AUTO DELAY	RATE	VALVE POLARITY
		SPEED	---



# Special Calibration Procedure - Page 2



**Special Cal Parameters should not need changed in most cases.** Consult with your SureFire dealer or representative before adjusting.



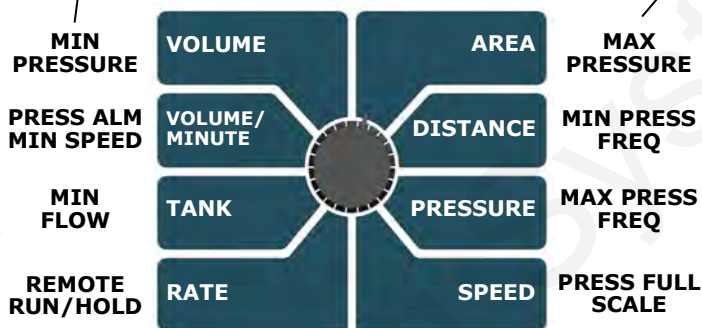
This number tells you which special CAL screen you are on. Pressing the CAL button will change this number.

**MIN PRESSURE:** Sets the value of the minimum pressure alarm. When the pressure drops below this setting, an alarm will occur. PRESS ALM MIN SPEED can be used to disable alarm when speed drops below MIN SPEED.

**MIN PRESSURE ALARM**  
**MINIMUM SPEED:** This setting is used in conjunction with the MIN PRESSURE setting. It is disabled when MIN PRESSURE is off and sets the MIN SPEED at which the MIN PRESSURE alarm can occur when a setting is present in the MIN PRESSURE location. If MIN PRESSURE is set to 5 PSI and PRESS ALM MIN SPEED is set to 2 MPH, then the alarm will only occur if you are moving faster than 2MPH, otherwise it will be disabled.

**MAX PRESSURE:** The system alarms if the pressure gets above this setting. This cannot be set higher than the pressure full scale setting.

## SPECIAL CAL 2 Settings



**MIN PRESSURE FREQ:** Set at the factory. Do not change.

**MIN FLOW:** The purpose of this calibration value is to prevent the system from applying below the recommended minimum rate for spray nozzles.  
**For non-spraying applications, nearly always leave this at ZERO.**  
To use, enter the minimum flow rate in gallons per minute for the entire boom on the sprayer. DO NOT enter the actual flow of your spray application. For example: If the minimum flow rate for the nozzle you are using is .22 GPM at their minimum recommended pressure and your boom has 20 nozzles, enter 4.4 as the MIN FLOW value (.22 x 20 = 4.4). The system WILL NOT apply at a rate lower than this value when spraying in AUTO.

**REMOTE RUN/HOLD:** Set to rHold to use a remote hold switch such as the SureFire mercury work switch. Set to rSpeed for using a remote speed sensor such as a wheel speed sensor on a drill. When set to rSpeed, the normal speed connector on the Commander II will be disabled and only the remote speed connection on the implement will be active.

**MAX PRESSURE FREQ:** Set at the factory. Do not change.

**PRESSURE FULL SCALE:** Set this to the maximum reading of the pressure transducer. For all SureFire Systems this is set to 100.

### Special CAL Page 2 Factory Defaults:

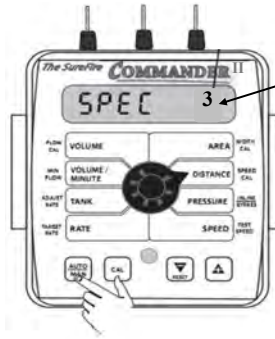
	Special CAL 2 Settings				
Off	MIN PRESSURE	VOLUME	AREA	MAX PRESSURE	Electric: 50 Hydraulic: 80
----	PRESSURE ALARM	VOLUME/MINUTE	DISTANCE	MIN PRESS FREQ	approx. 200—do not change
0.0	MIN FLOW	TANK	PRESSURE	MAX PRESS FREQ	approx. 1000—do not change
rHold	REMOTE RUN/HOLD	RATE	SPEED	PRESS FULL SCALE	100



# Special Calibration Procedure - Page 3



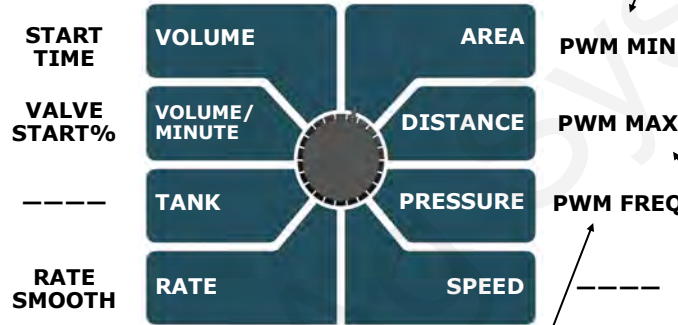
**Special Cal Parameters should not need changed in most cases.** Consult with your Sure-Fire dealer or representative before adjusting.



This number tells you which special CAL screen you are on. Pressing the CAL button will change this number.

**START TIME & VALVE START %:** These settings set how far open the valve will open and how long it will stay at that setting on startup. These settings are only available in PWM mode. If the START TIME parameter is Off, then the VALVE START % will be unavailable. These settings will allow the system to get up and operate at a predetermined speed for a predetermined amount of time. Once the START TIME has been reached, the auto control takes over from that point. This is a very good method of smoothing out startup (switching from hold to run).

## Special CAL 3 Settings



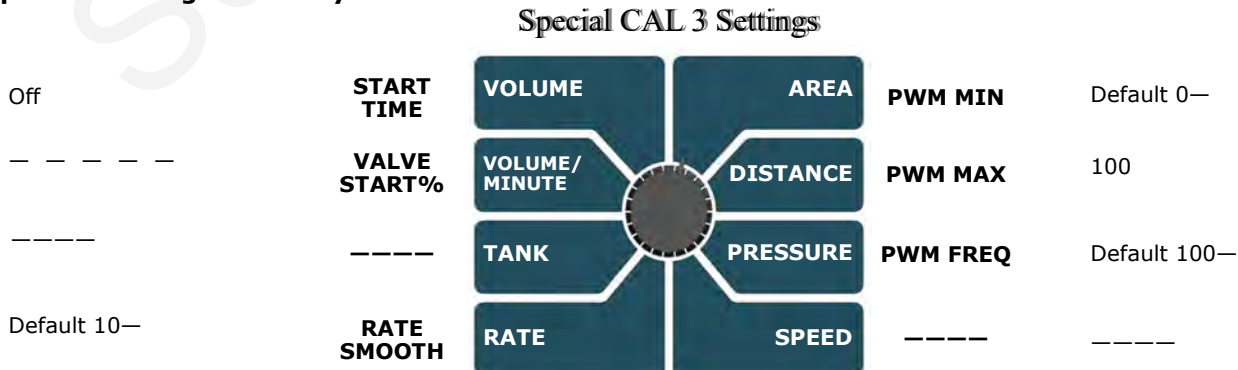
**PWM MIN %:** This setting affects how low the PWM signal can go. If set to 10, then the PWM signal can go down to 10%. If set to 20, then the PWM signal can go down to 20%. Most valves have a bottom end where they no longer change any flow. This is the point where the PWM MIN should be set. If this is set too high, it will keep the system from getting to your lowest rates.

**RATE SMOOTHING:** This value is used to help the system lock on to the target if all system parameters seem to be functioning appropriately.

**PWM FREQ:** Set this to match your PWM valve frequency or set it to the PWM frequency expected by the device you are connecting to.

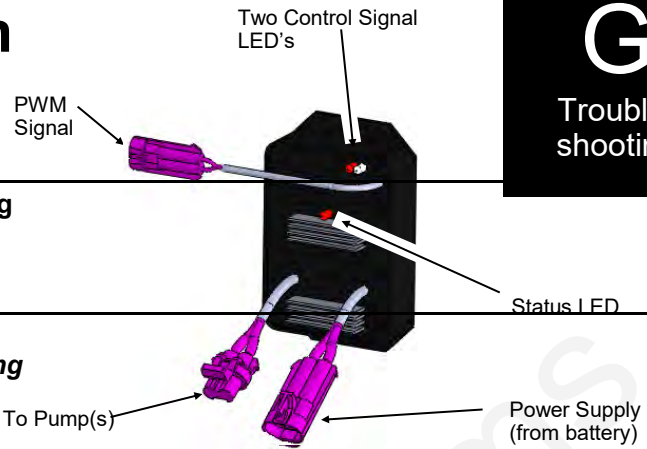
**PWM MAX %:** This setting affects how high the PWM signal can reach. If set to 100, then the PWM signal can reach 100%. If set to 80, then the PWM signal can reach 80%. If a valve is being used that does not have any control after it gets to a certain point, then that point should be your PWM MAX % setting. If this is set too low, it will keep the system from reaching maximum rate.

### Special CAL Page 3 Factory Defaults:



# Electric Pumps Won't Run

## EPD Status Lights



Status LED	Status Description	Troubleshooting Steps
<b>On Steady</b>	<b>Power input is good and PWM input Signal is detected</b>	<b>No Problem, Typical operating condition.</b>
<b>Steady Blink</b>	<b>Power input is good and PWM signal is not detected</b>	<b>Typical 'Off' Condition. If pumps should be on:</b> <ol style="list-style-type: none"> <li><b>Inspect wiring and connectors</b></li> <li><b>Check voltage at PWM connector to EPD, should be 1-12 volts to turn on.</b></li> <li><b>Check voltage on PWM wires on back of Commander II console (top cable (10 pin connector—Pins D &amp; E—yellow and green wire).</b></li> </ol>
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"> <li>Check motor wiring</li> </ul>
Three blinks, pause, three blinks, pause	Overcurrent condition	<ul style="list-style-type: none"> <li>Check total load</li> <li>Clean cooling fins on EPD</li> </ul>
<b>Four blinks, pause, four blinks, pause</b>	<b>Input power fault. Low voltage condition in power to EPD.</b>	<b>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.</b>
Five blinks, pause	Input frequency out of range.	Check PWM Settings on Rate Controller.
<b>Control Signal LEDs</b>		
<b>Light intensity varies</b>	<b>Off - No PWM Signal 100% brightness - Maximum PWM input signal</b>	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.

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

## Electric pumps will not turn on

G

Trouble-  
shooting

### EPD flashing 4 times

1. Find the EPD module (electric pump driver—black module on Tower). Should have a steady blinking light (one blink per second) in the middle when pumps should be off. On new EPDs this light will go off after 5 minutes of inactivity. In Run mode, the center light should be steady red, the upper right should be steady red (indicates it is receiving a PWM signal). If Status LED (center light) is *flashing 4 times, then pausing*, EPD has tripped due to low voltage condition. Unplug the Power Supply to the EPD to reset. If condition persists, check Power Supply cables from battery to EPD to insure solid connections and good electrical path. Check connections at battery. Check connectors at the hitch and at the EPD. (*There should be 11.5-13 volts at the point where the EPD connects to the battery power harness, when **tested under load**. This voltage may show up when there is no load, but the harnessing may not be good enough to deliver 11.5-13 volts under load.*)

### No Lights on EPD

1. There should be a steady blinking light in the middle of the EPD. If no light is ON, check the 40-amp fuse in the EPD harness near the battery. Use a voltmeter to verify that there is 12-13 volts at the Power Supply connector that plugs into the EPD. *If there is good voltage here, but no light on the EPD, replace the EPD module. (Note, on EPDs sold after 2019, the center light will go off after 5 minutes of inactivity.)*

### Connect pumps directly to battery

1. Find the EPD (electric pump driver) shown above. Connect the two large connectors 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. Plug the pumps in with a jumper cable connected to a good battery to verify pump operation.
3. If 2 pump system, plug pumps in by themselves to check both. If the pumps won't run, connect them to a battery with jumper cables to verify that they have are getting power, but will not run.

### Pumps run, but won't pump anything—

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

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

1. Connect pumps and power harness back to EPD.
2. Push Auto/Man button to enter Manual mode.
3. Turn on section (boom switch) and run/hold switch. Turn dial to Volume/Minute and hold '+' button for 10 seconds.
4. Remove PWM connector at EPD module and check voltage. You will need 6-12 volts to turn pumps on.
5. Push '-' button, voltage should decrease, push '+' button voltage should increase (should go over 12 v at maximum).
6. If 6-12 volts is not present and it will not increase and decrease, inspect wiring harnesses and connectors. See schematics in section D to test PWM signal directly at 10-pin connector on back of Commander II.

# Section Valve(s) will not move

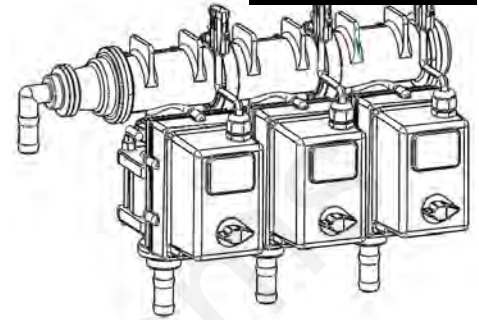
G

Troubleshooting

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

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

2. If a valve does not open, switch the connector that is plugged into that valve with a connector from a working valve. Also, plug in the connector from the non-working valve to a valve that is working.



3. Check voltage pin A to Pin B. Must be 12 volts, if not, go back to 10-pin on Commander II and check voltage (pins J & K, white and black wire).
4. 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.
5. If signal voltage is not present to open valve, use diagrams to check at the 10-pin connector on back of Commander II.
6. Remove the actuator from the valve and see if the actuator will operate. Rotate the valve ball manually to be sure it is free to move. Return it to the same orientation where it was.
7. If constant voltage (Pins A&B) and switched voltage (Pins C&B) are present, inspect, repair or replace the valve.

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



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

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

# Commander II makes a fast clicking sound

## Check the Harness Connections

Be sure the harnessing is plugged in correctly. The cable from the **Astro speed sensor** must be plugged into the connector with the **Yellow zip tie** on the back of the Commander II. If it is plugged into the Gray zip tie, as soon as you start driving, the Commander will have a fast, clicking sound and it will switch quickly and repeatedly between RUN and HOLD as the pulses from the speed sensor change the system from RUN to HOLD and back quickly. This will also happen if you are using a speed sensor or shaft sensor on the implement that is plugged into the RUN HOLD / SPEED connector on the final harness and you didn't change SPEC CAL page 2 from rHold to SPEED.

There is also a place on the implement where connections can be made wrong. If the RUN/Hold connector on the implement is plugged into the flowmeter, as soon as product starts flowing, the pulses from the flowmeter will make a fast clicking sound on the Commander II as the system switches between RUN and HOLD.

# Commander II Console

# G

Trouble-  
shooting

## Console is Erratic in Operation

- If you have a **two-way radio**, it may be mounted too close to the console. Keep all cables away from the radio, its antenna and power cable.
- **Ignition wires** may be causing the console to malfunction. Keep cables away from ignition wires or install ignition suppressor.
- Reroute all cables away from **electric solenoids, air conditioning clutches** and similar equipment.

## Console Appears Dead

- Using your voltmeter, check for 12 volts at Commander power connector. Check for damaged power cable or reversed terminals. Check fuse in power cable and any other fuses or circuit breakers in path. Inspect connections to Commander II power switch.

## Commander II Error Messages

Message	Description
Lo P	Low Power to Commander II, check all power and ground connections
no SPEEd	(When vehicle is not moving, this is a normal condition) Will flash in display if dial is in RATE position and there is no speed signal regardless of all other conditions. Check speed sensor and connections.
no FLo	Will flash in display if rotary switch is in Rate position and should have flow (In Run, some sections on, speed greater than zero) but no flow is detected. Check flowmeter and flow harness connections. Check EPD and pumps. Check strainer.
no FLo StoP	Pumps will stop and this message will be displayed if no FLo condition continues for 60 seconds. Console Power must be cycled to reset this condition. Check flowmeter and connections. Use Manual mode for priming and plumbing troubleshooting to avoid this error.
no boom	Will flash in display if dial is in Width position in Cal mode and no sections are turned on.
FILL	Will flash in display if tank level is equal to or less than tank set point. Adjust these settings in Special Calibration.
SPEC	Appears when entering Special Calibration mode
CLEAR	Alerts user that the currently selected counter will be reset to zero if RESET button is held for 2 seconds.
OFL	Displayed when a DISTANCE, AREA or VOLUME counter has overflowed their maximum value. Hold RESET button for 2 seconds to reset the counter.

# Application Rate & Flow Troubleshooting

# G

Trouble-  
shooting

## 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 **Manual Mode** and turn system on.
2. Turn dial to VOLUME/MINUTE position. Use the +/- buttons to get to a flow similar to field operation.
3. If there is a large fluctuation in flow on the Commander II, visually observe the liquid flow. Is the discharge a steady stream; are the flow indicator balls floating steady?
4. If visually the flow is steady, but the display reports a fluctuation in GPM, inspect the flowmeter. See section B for flowmeter information.
5. If visually the flow is unsteady, the flowmeter is working correctly reporting a flow problem. Is the pump turning steady or surging?
6. 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.
7. Look for air bubbles in the flow. These can be seen in the flow indicators. Air bubbles indicate an air leak on the pump inlet allowing the pump inlet to suck some air.

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

1. Turn dial to SPEED. Look for any wild fluctuations in speed indicating a sensor problem.
2. Change the Valve Control Speed in Cal Mode by reducing the value (range is -4 to +3).

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

1. You may need to increase the Control Speed in Cal mode (range is -4 to +3) if system is slow in returning to Target Rate when speed changes.
2. Increase the Valve Start %, see Special Cal page 3.
3. If slow getting to target when starting, increase PWM minimum on Special Cal page 3. (*Caution: If this is set too high, the pump will not be able to slow down enough at times, and may over-apply.*)

## No Flow shown on Commander II but liquid is being pumped

1. Unplug flowmeter. With voltmeter, check for 12 volts between pins B&C of flowmeter connector and 9 volts between pins A&C (on main harness PN 18220). If voltage is not present, inspect wiring harness and troubleshoot all connections per schematic (see Section D).
2. If voltage is present, then conduct a tap test. Enter CAL mode and change the flow cal to 10. Have a second person watch VOLUME/MINUTE while other person taps (use a short piece of wire or a paper clip) between pins A&C of flowmeter connector (on 18220 harness). A flow value should show up indicating the wiring is not damaged.
  - If working alone, you can set dial to VOLUME and reset a counter to zero. Put in MAN, RUN, Boom Switch ON. Then tap approximately 20 times and see if the Commander II volume counter has changed.
3. If Commander II 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. Sometimes, cleaning the inside tube of the flowmeter with warm, soapy water will remove a film from the electrodes.
5. Replace flowmeter.

# Flowmeter is inaccurate

This procedure is used to verify and fine-tune the flowmeter calibration. With Electromagnetic flowmeters, it should not be necessary to change the Flow Cal. However, **SureFire recommends always running a catch test to verify accuracy and that Commander II is setup correctly.**

## PROCEDURE

1. Put enough water in the tank to perform this test. **(The larger the volume of water used, the more accurate the calibration will be).**
2. Start pump and turn on sections. Run enough water to purge all air from lines. Turn off pump.
3. Turn console rotary selector to the VOLUME position. Select the counter (1-3) that you want to use. Press and hold the RESET button until the display reads 0 **(about 2 seconds).**
4. Turn on all sections, and run a known amount of water.
5. Turn off all sections. Compare the console's VOLUME reading with the known amount of water run. If the two amounts are within one or two percent, no fine tuning is required. If the two amounts are more than two or three percent different, continue with the next step.
6. With the console still in the VOLUME position, enter calibration **(Boom switches OFF, hold the CAL button until red warning light comes on; about one second).** The display will show the flowmeter calibration value and the CAL icon.

7. Momentarily press the CAL button. The CAL icon will begin to flash and the total volume will be displayed.
8. When the TOTAL FLOW value is displayed, use the "+" or button to adjust the value to match the amount of water run.
9. Momentarily press the CAL button. The word CAL and the flowmeter calibration number will be displayed. You will notice that the flowmeter calibration value has changed. Write down the new flowmeter calibration value. This is your "fine tuned" calibration value, keep it for future reference.
10. Exit calibration by holding the "CAL" button until the red warning light goes out (about one second).

**NOTE: 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 percent 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.**

# Speed is inaccurate

This procedure is used to drive a known distance and find the Speed Cal for your setup. The Astro GPS Speed Sensor Cal should be 0.189 and should not need to be changed.

1. With the console turned ON, place the Run/Hold switch in the HOLD position. The HOLD icon will be displayed. Turn the rotary dial to the "DISTANCE" position. Be sure the display shows 0. If not, reset the distance counter by pressing and holding "RESET" until the display returns to 0 (approximately one second).
2. Place the Run/Hold switch in RUN when the vehicle passes the starting flag to activate the distance counting function. The console display numbers will increase, adding to the distance total as you drive. Drive the pre-measured course and place the Run/Hold switch in HOLD, when the vehicle passes the ending flag, to stop the distance counting function. The console display should read "HOLD". **Stop the vehicle in a level and safe area** and continue with this procedure.
3. With the rotary dial still at DISTANCE (SPEED CAL), press and hold the "CAL" key for one second. Once the console is in "CAL," CAL and the speed calibration value will be displayed. Momentarily press CAL and the word CAL will begin to flash and the distance travelled will be displayed.
4. When the display shows distance ("CAL" is flashing), verify whether the number displayed is the exact distance you drove (within +/- 1 - 2 %). If not, press the "+" or "-" key to adjust the figure to match the distance you actually drove. If the display reads too high, use the "-" key to lower the displayed value. If the display reads too low, use the "+" key to raise the displayed value.
5. When the number shown on the display matches (as closely as possible) the actual distance driven, you have arrived at the correct Speed Cal. You may check the calibration number by momentarily pressing CAL. The word CAL and the SPEED CAL number will appear. Exit "CAL" by pressing "CAL" for one second.

# I want to match Commander II speed to Tractor Speed

Use the equation below to calculate a new Speed Cal to enter in Cal mode. The Astro GPS Speed Sensor Cal should be 0.189 and should not need to be changed.

*Hint: If you change the Commander II Speed Cal to 1.0 first, it makes the math very easy.*

$$\text{New Speed Cal} = \text{Old Speed Cal} \times \text{Tractor Speed} \div \text{Commander II Speed}$$



# Fertilizer System Flow Verification

I can't get up to my desired rate. How much flow is required?  
Can I achieve a new application rate with my current system?

# G

Trouble-  
shooting

## Follow the steps below:

1. Use the Fertilizer System Flow Charts on the next two pages to find your required flow. First, locate the chart for your implement size. Next, find your operating speed on the left side and your application rate on the top. Record the flow in gallons per minute for your maximum speed and rate and your minimum speed and rate.

A. Maximum Flow \_\_\_\_\_ GPM (Max Rate & Max Speed)

B. Minimum Flow \_\_\_\_\_ GPM (Min Rate & Min Speed)

2. Locate your pump model on the chart on this page. Will the pump model provide the maximum flow you need from above?

3. Find your flowmeter model in the chart on this page. Will the flowmeter work at both the maximum and minimum flow your recorded in step 1? If not, a different flowmeter is required.

4. If using section valves you must complete this step.

A. Minimum Flow (from above) ÷ Total Rows = \_\_\_\_\_ GPM / Row

B. GPM / Row (from line above) x Rows per section = \_\_\_\_\_ GPM / Section

Will your flowmeter measure the minimum GPM / section?

## Tower (Electric Pump) Flow Table

	Max Flow GPM
1-5.3 GPM Pump	3.0
2-5.3 GPM Pumps	5.0
Roller Pump	4.5

## PumpRight Flow Table

	Number of Diaphragms	Max Flow GPM
D70	2	15
D115	3	25
D160	4	35
D250	6	55

## Flowmeter Table

Model	Type	Min GPM	Max GPM
FM750LR	Turbine	0.3	12
FM750	Turbine	2	40
FlowMaster 270	Turbine	3.5	70
.13—2.6	E-Mag	0.13	2.6
.3—5	E-Mag	0.3	6.5
.6—13	E-Mag	0.6	13
1.3—26	E-Mag	1.3	26
2.6— 53	E-Mag	2.6	53

# Fertilizer System Flow Charts

Use the correct implement width chart to find the required pump flow (in gallons per minute) based on travel speed and application rate

# G

Trouble-shooting

## Implement Width

### 15 feet

MPH	Application Rate in Gallons Per Acre												
	2	4	6	8	10	15	20	25	30	35	40	45	50
4	0.2	0.5	0.7	1.0	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.5	6.1
4.5	0.3	0.5	0.8	1.1	1.4	2.0	2.7	3.4	4.1	4.8	5.5	6.1	6.8
5	0.3	0.6	0.9	1.2	1.5	2.3	3.0	3.8	4.5	5.3	6.1	6.8	7.6
5.5	0.3	0.7	1.0	1.3	1.7	2.5	3.3	4.2	5.0	5.8	6.7	7.5	8.3
6	0.4	0.7	1.1	1.5	1.8	2.7	3.6	4.5	5.5	6.4	7.3	8.2	9.1
6.5	0.4	0.8	1.2	1.6	2.0	3.0	3.9	4.9	5.9	6.9	7.9	8.9	9.8
7	0.4	0.8	1.3	1.7	2.1	3.2	4.2	5.3	6.4	7.4	8.5	9.5	10.6
8	0.5	1.0	1.5	1.9	2.4	3.6	4.8	6.1	7.3	8.5	9.7	10.9	12.1
9	0.5	1.1	1.6	2.2	2.7	4.1	5.5	6.8	8.2	9.5	10.9	12.3	13.6
10	0.6	1.2	1.8	2.4	3.0	4.5	6.1	7.6	9.1	10.6	12.1	13.6	15.2

## Implement Width

### 20 feet

MPH	Application Rate in Gallons Per Acre												
	2	4	6	8	10	15	20	25	30	35	40	45	50
4	0.3	0.6	1.0	1.3	1.6	2.4	3.2	4.0	4.8	5.7	6.5	7.3	8.1
4.5	0.4	0.7	1.1	1.5	1.8	2.7	3.6	4.5	5.5	6.4	7.3	8.2	9.1
5	0.4	0.8	1.2	1.6	2.0	3.0	4.0	5.1	6.1	7.1	8.1	9.1	10.1
5.5	0.4	0.9	1.3	1.8	2.2	3.3	4.4	5.6	6.7	7.8	8.9	10.0	11.1
6	0.5	1.0	1.5	1.9	2.4	3.6	4.8	6.1	7.3	8.5	9.7	10.9	12.1
6.5	0.5	1.1	1.6	2.1	2.6	3.9	5.3	6.6	7.9	9.2	10.5	11.8	13.1
7	0.6	1.1	1.7	2.3	2.8	4.2	5.7	7.1	8.5	9.9	11.3	12.7	14.1
8	0.6	1.3	1.9	2.6	3.2	4.8	6.5	8.1	9.7	11.3	12.9	14.5	16.2
9	0.7	1.5	2.2	2.9	3.6	5.5	7.3	9.1	10.9	12.7	14.5	16.4	18.2
10	0.8	1.6	2.4	3.2	4.0	6.1	8.1	10.1	12.1	14.1	16.2	18.2	20.2

## Implement Width

### 30 feet

MPH	Application Rate in Gallons Per Acre												
	2	4	6	8	10	15	20	25	30	35	40	45	50
4	0.5	1.0	1.5	1.9	2.4	3.6	4.8	6.1	7.3	8.5	9.7	10.9	12.1
4.5	0.5	1.1	1.6	2.2	2.7	4.1	5.5	6.8	8.2	9.5	10.9	12.3	13.6
5	0.6	1.2	1.8	2.4	3.0	4.5	6.1	7.6	9.1	10.6	12.1	13.6	15.2
5.5	0.7	1.3	2.0	2.7	3.3	5.0	6.7	8.3	10.0	11.7	13.3	15.0	16.7
6	0.7	1.5	2.2	2.9	3.6	5.5	7.3	9.1	10.9	12.7	14.5	16.4	18.2
6.5	0.8	1.6	2.4	3.2	3.9	5.9	7.9	9.8	11.8	13.8	15.8	17.7	19.7
7	0.8	1.7	2.5	3.4	4.2	6.4	8.5	10.6	12.7	14.8	17.0	19.1	21.2
8	1.0	1.9	2.9	3.9	4.8	7.3	9.7	12.1	14.5	17.0	19.4	21.8	24.2
9	1.1	2.2	3.3	4.4	5.5	8.2	10.9	13.6	16.4	19.1	21.8	24.5	27.3
10	1.2	2.4	3.6	4.8	6.1	9.1	12.1	15.2	18.2	21.2	24.2	27.3	30.3

# Fertilizer System Flow Charts

# G

Trouble-shooting

Use the correct implement width chart to find the required pump flow (in gallons per minute) based on travel speed and application rate

## Implement Width 40 feet

MPH	Application Rate in Gallons Per Acre												
	2	4	6	8	10	15	20	25	30	35	40	45	50
4	0.6	1.3	1.9	2.6	3.2	4.8	6.5	8.1	9.7	11.3	12.9	14.5	16.2
4.5	0.7	1.5	2.2	2.9	3.6	5.5	7.3	9.1	10.9	12.7	14.5	16.4	18.2
5	0.8	1.6	2.4	3.2	4.0	6.1	8.1	10.1	12.1	14.1	16.2	18.2	20.2
5.5	0.9	1.8	2.7	3.6	4.4	6.7	8.9	11.1	13.3	15.6	17.8	20.0	22.2
6	1.0	1.9	2.9	3.9	4.8	7.3	9.7	12.1	14.5	17.0	19.4	21.8	24.2
6.5	1.1	2.1	3.2	4.2	5.3	7.9	10.5	13.1	15.8	18.4	21.0	23.6	26.3
7	1.1	2.3	3.4	4.5	5.7	8.5	11.3	14.1	17.0	19.8	22.6	25.5	28.3
8	1.3	2.6	3.9	5.2	6.5	9.7	12.9	16.2	19.4	22.6	25.9	29.1	32.3
9	1.5	2.9	4.4	5.8	7.3	10.9	14.5	18.2	21.8	25.5	29.1	32.7	36.4
10	1.6	3.2	4.8	6.5	8.1	12.1	16.2	20.2	24.2	28.3	32.3	36.4	40.4

## Implement Width 60 feet

MPH	Application Rate in Gallons Per Acre												
	2	4	6	8	10	15	20	25	30	35	40	45	50
4	1.0	1.9	2.9	3.9	4.8	7.3	9.7	12.1	14.5	17.0	19.4	21.8	24.2
4.5	1.1	2.2	3.3	4.4	5.5	8.2	10.9	13.6	16.4	19.1	21.8	24.5	27.3
5	1.2	2.4	3.6	4.8	6.1	9.1	12.1	15.2	18.2	21.2	24.2	27.3	30.3
5.5	1.3	2.7	4.0	5.3	6.7	10.0	13.3	16.7	20.0	23.3	26.7	30.0	33.3
6	1.5	2.9	4.4	5.8	7.3	10.9	14.5	18.2	21.8	25.5	29.1	32.7	36.4
6.5	1.6	3.2	4.7	6.3	7.9	11.8	15.8	19.7	23.6	27.6	31.5	35.5	39.4
7	1.7	3.4	5.1	6.8	8.5	12.7	17.0	21.2	25.5	29.7	33.9	38.2	42.4
8	1.9	3.9	5.8	7.8	9.7	14.5	19.4	24.2	29.1	33.9	38.8	43.6	48.5
9	2.2	4.4	6.5	8.7	10.9	16.4	21.8	27.3	32.7	38.2	43.6	49.1	54.5
10	2.4	4.8	7.3	9.7	12.1	18.2	24.2	30.3	36.4	42.4	48.5	54.5	60.6

## Implement Width 90 feet

MPH	Application Rate in Gallons Per Acre												
	2	4	6	8	10	15	20	25	30	35	40	45	50
4	1.5	2.9	4.4	5.8	7.3	10.9	14.5	18.2	21.8	25.5	29.1	32.7	36.4
4.5	1.6	3.3	4.9	6.5	8.2	12.3	16.4	20.5	24.5	28.6	32.7	36.8	40.9
5	1.8	3.6	5.5	7.3	9.1	13.6	18.2	22.7	27.3	31.8	36.4	40.9	45.5
5.5	2.0	4.0	6.0	8.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
6	2.2	4.4	6.5	8.7	10.9	16.4	21.8	27.3	32.7	38.2	43.6	49.1	54.5
6.5	2.4	4.7	7.1	9.5	11.8	17.7	23.6	29.5	35.5	41.4	47.3	53.2	59.1
7	2.5	5.1	7.6	10.2	12.7	19.1	25.5	31.8	38.2	44.5	50.9	57.3	63.6
8	2.9	5.8	8.7	11.6	14.5	21.8	29.1	36.4	43.6	50.9	58.2	65.5	72.7
9	3.3	6.5	9.8	13.1	16.4	24.5	32.7	40.9	49.1	57.3	65.5	73.6	81.8
10	3.6	7.3	10.9	14.5	18.2	27.3	36.4	45.5	54.5	63.6	72.7	81.8	90.9

# Recommended Care and Maintenance

# H

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.

Clean all harness connections.

## 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. Clean all harness connections and 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 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. Push all QuickConnect (QC) fittings together to be sure they are seated. Leaks may not show if they are not seated, but air can be drawn into the system through unseated QC fittings.
7. 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.
8. Remove and clean the strainer. Be sure strainer is tightened securely so it will not suck air.
9. Be sure all rows are flowing and that all metering tubes are open. (Note: It will take a higher flow rate with water to create enough pressure to open all the check valves.)
10. 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 so all of the rows may not flow until you increase the Rate. )
11. Drive the tractor and check the speed on the Commander II. The Astro may be more accurate than the speed shown on the tractor (especially if there is any slippage at the time of the test).

SureFire Ag Systems  
9904 Hwy 25  
Atwood, KS 67730  
[www.surefireag.com](http://www.surefireag.com)  
©2010-2020 SureFire Ag Systems

