

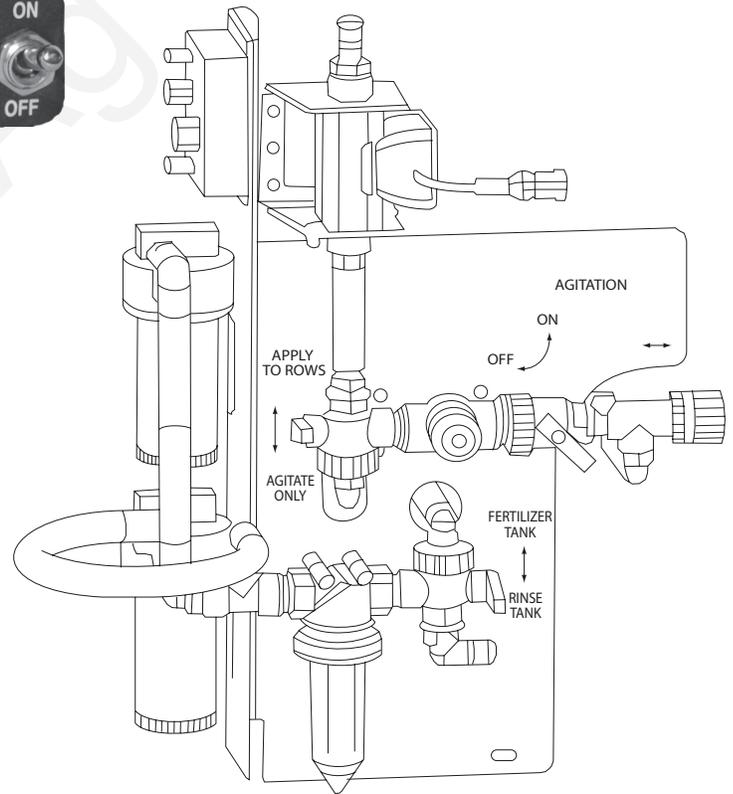


SureFire
Ag Systems



Commander
Controller

Electric Pump
Application Systems



OPERATOR'S MANUAL

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Fertilizer System Information

General

Before installing your SureFire Commander and PumpRight system, you should review your application requirements and verify the system components you have will meet those needs.

FOLLOW THE STEPS BELOW:

1. Use the Fertilizer Pump Flow Charts on the following pages. Locate the chart for your implement size. Find your operating speed and application rates. Record the flow in gallons per minute (GPM) for your maximum speed and rate and your minimum speed and rate.

a. Maximum Flow _____ GPM

b. Minimum Flow _____ GPM

2. Locate your PumpRight model on the Hydraulic Oil Use and Management page. Will the pump model provide the maximum flow you recorded in step 1? If not, the system is not designed correctly.
3. Find your flowmeter in the kits on page 15 & 16. Will the flowmeter work at both the maximum and minimum flow you recorded in step 1? If not, a different flow meter is required.
4. If using section valves you must complete this step.

a. Minimum Flow (GPM) ÷ Number of Sections (2 or 3)

= _____ GPM

b. Will your flowmeter measure the flow from step 4a? If not, this may only be a minor concern. Consider how much of the time you will operate at the minimum speed and application rate from step 1.

Fertilizer System Information (cont)

Fertilizer Pump Flow Charts (in GPM)

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	.06	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	.07	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	.07	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	.08	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	.08	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 Information (cont)

Fertilizer Pump Flow Charts (in GPM) (cont)

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

Commander Accessories

Mercury Run/Hold Switch

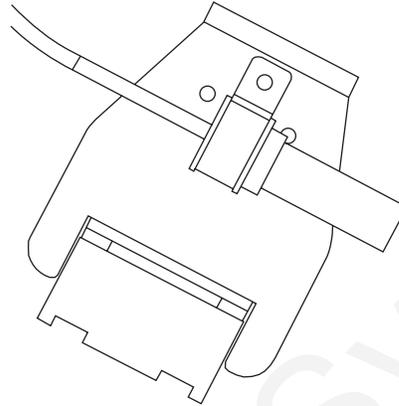
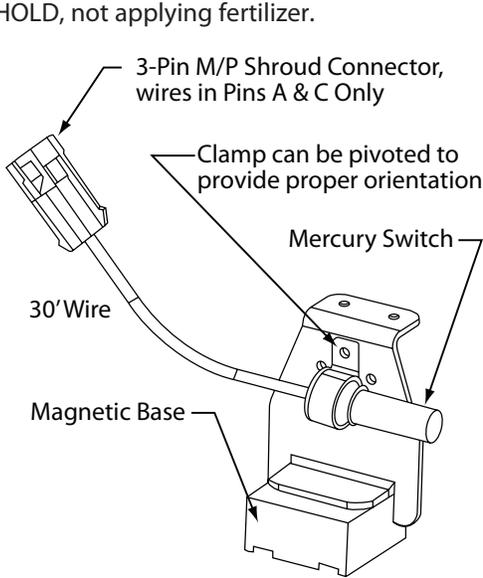
HOW IT WORKS

The Run/Hold circuit on the Commander simply requires a switch to open and close to turn the fertilizer flow on or off. Place the mercury switch on a 3 point arm or wheel frame that changes angle as the implement is raised and lowered.

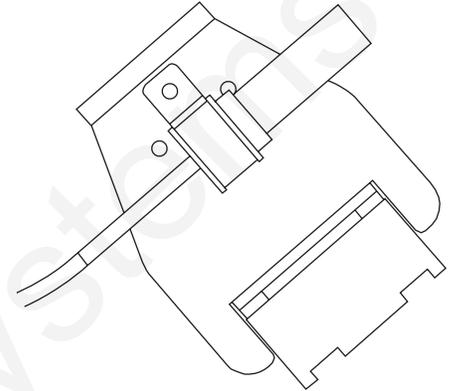
When the mercury in the switch flows away from the wires (wires up), the switch is open. the Commander will be in HOLD, not applying fertilizer.

When the mercury in the switch flows against the wires (wires down), the switch will be closed. The Commander will be in RUN, applying fertilizer.

When using the mercury switch with the Commander, the Run/Hold switch on the Commander console will NOT be used.



HOLD Position with Wires UP



RUN Position with Wires DOWN

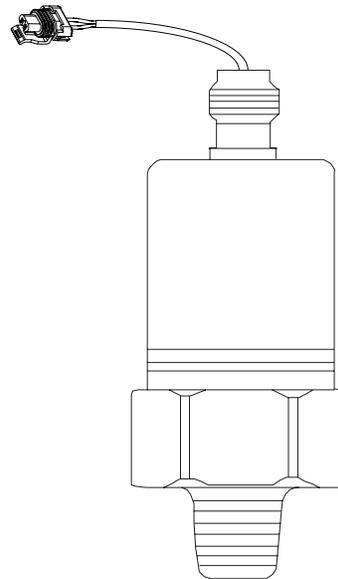
* The mercury work switch will work with many other controllers. However, the polarity might be reversed from the positions described above. For example, the MT-3405 Series Controllers operate in reverse direction to what is described above.

Pressure Transducer

The SureFire Commander has the capability to show system pressure on the in-cab display. To do this, the optional pressure transducer must be installed in the fertilizer plumbing on the outlet side of the pump. The pressure transducer used is a 100 psi transducer that has the capability to measure pressures down to 5 psi. In addition, the Commander has a high pressure warning that will flash on the display if the pressure exceeds a user selected pressure.

The pressure function has two settable parameters. The first is "Max Pressure", which is the pressure when exceeded the Commander will display a high pressure warning. The second is "Full Scale", which must be set to the maximum pressure of the transducer used. Most often, a 100 psi transducer is used. See Special Calibration on page 28-30 for instructions on setting these items.

Two additional pressure related parameters should not require changing. However, you can use the "Min Pressure Freq" to adjust the zero point of the transducer. The "Max Pressure Freq" can be used to calibrate the transducer to match a known pressure from a gauge.



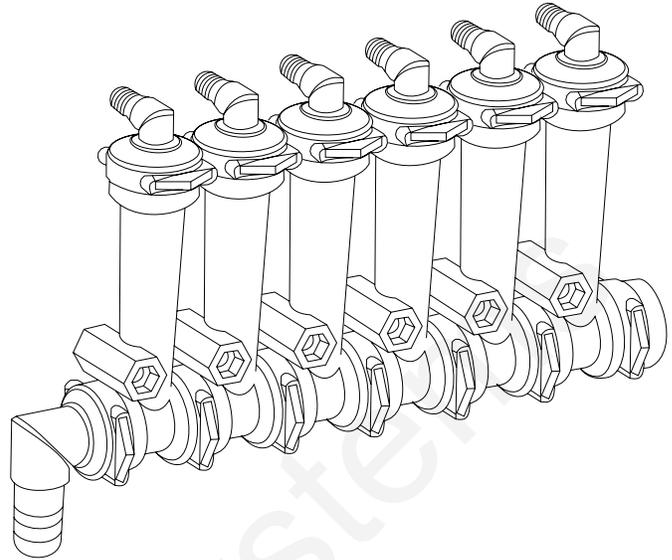
Fertilizer System Accessories

Floating Ball Flow Indicator and 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. The low flow column with a 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 Column

PART NUMBER	DESCRIPTION
701-20460-95	Single Full Flow Column with 3/8" HB - 90° Outlet
701-20460-96	Single Full Flow Column with 1/4" FPT - 90° Outlet
701-20460-97	Single Low Flow Column with 1/4" Push to Connect Outlet

Fittings

PART NUMBER	DESCRIPTION
701-20503-00	ORS x 3/4" HB - Straight
701-20511-00	ORS x 3/8" HB - 90°
701-20513-00	ORS x 3/4" HB - 90°
701-20516-00	ORS x 1/4" QC - 90°
701-20518-00	ORS x 1/4" FPT - 90°
701-20519-00	ORS x 1/4" FPT - Straight
701-20520-00	ORS Male x ORS Female - 90°
701-20521-00	Wilger End Cap
701-20523-00	ORS Male x ORS Female x 3/8" FPT - Isolator
701-20525	ORS Male x ORS Male x 1" FPT - Tee

Service Parts Only

PART NUMBER	DESCRIPTION
701-20460-00	Full Flow Column
701-20470-00	Low Flow Colum
701-20460-04	Wilger Lock U-Clip
701-20460-05	Flow Indicator Ball - 1/2" SS Ball
701-20460-06	Flow Indicator - 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
701-40225-05	Viton O-Ring for Orifice

Brackets & U-Bolts

PART NUMBER	DESCRIPTION
400-1037A1	3 - 6 Row Bracket
400-1036A2	7 - 12 Row Bracket
XXX-XXXXXX	1/2" x 4" x 5"
380-1014	1/2" x 5" x 8 1/2"
380-1017	1/2" x 6" x 5"
380-1001	1/2" x 7" x 8 1/2"
380-1016	1/2" x 7" x 6"

Fertilizer System Accessories

Floating Ball Flow Indicators - Full Flow Column

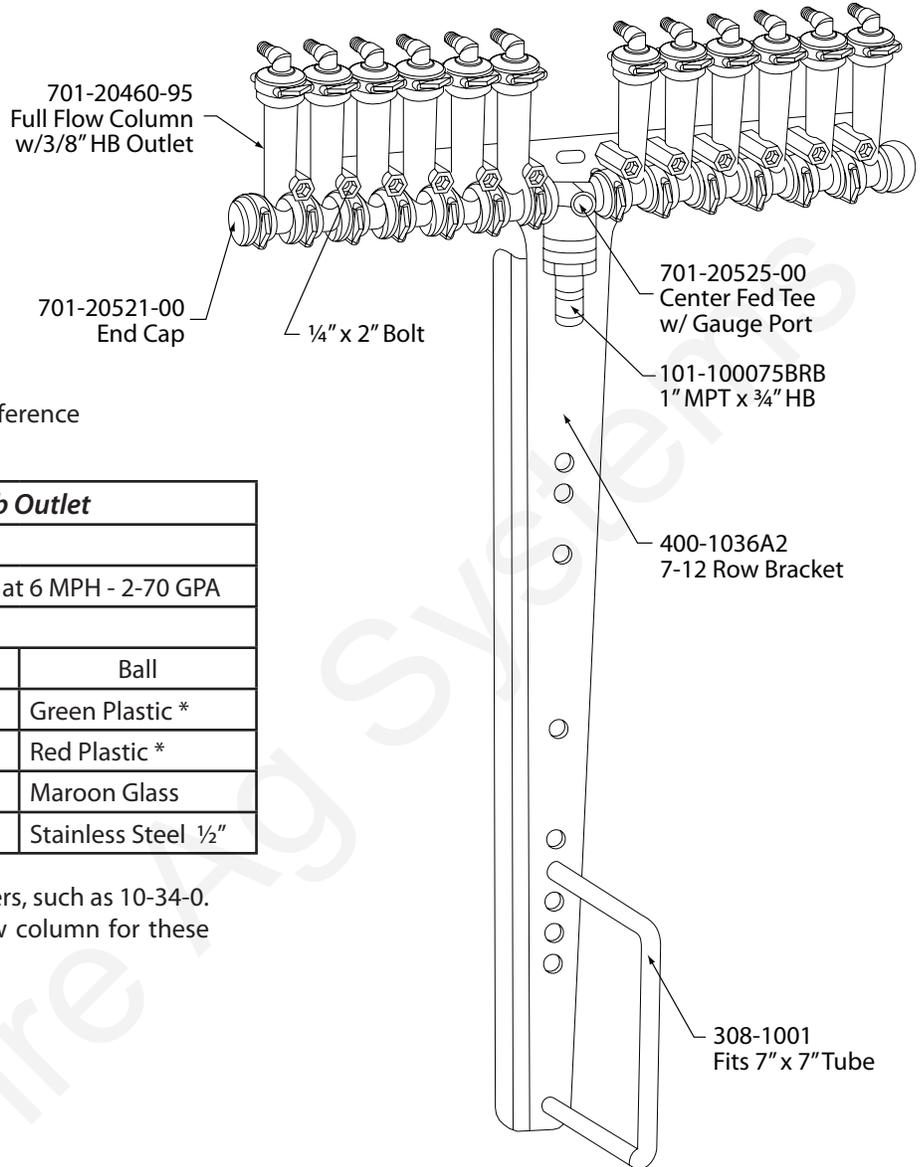
FULL FLOW INDICATORS

The standard of 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 fitting.

The full flow columns are most often assembled with 3/8" hose barb outlets. Then 3/8" hose can be used to run to each row.

See the low flow page to tell the difference between the full and low flow columns.

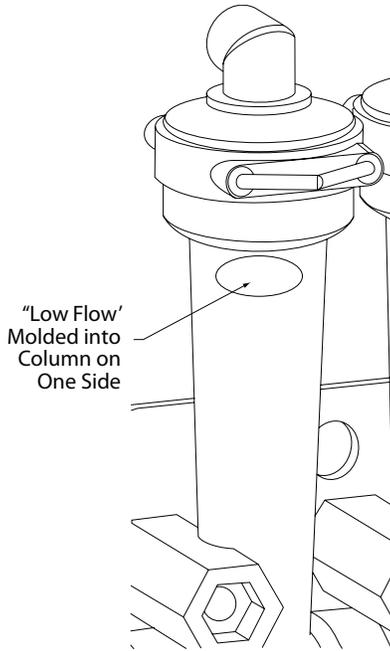


Full Flow Indicators w/ 3/8" Hose Barb Outlet		
Column Flow (GPA): .05 - 2.7 GPA		
Equivalent Application Rate on 30" Rows at 6 MPH - 2-70 GPA		
BALL SELECTION FOR 30" ROWS		
GPM	GPA	Ball
.05 - .18	2 - 6	Green Plastic *
.09 - .30	3 - 10	Red Plastic *
.31 - .72	10 - 20	Maroon Glass
.40 - 2.1	13 - 70	Stainless Steel 1/2"

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

Fertilizer System Accessories

Floating Ball Flow Indicators - Low Flow Column



701-20460-97
Low Flow Column
w/ 1/4" Push to
Connect Outlet

1/4" x 2" Bolt

701-20513-00
3/4" HB 90° Inlet

701-20521-00
End Cap

LOW FLOW vs FULL FLOW

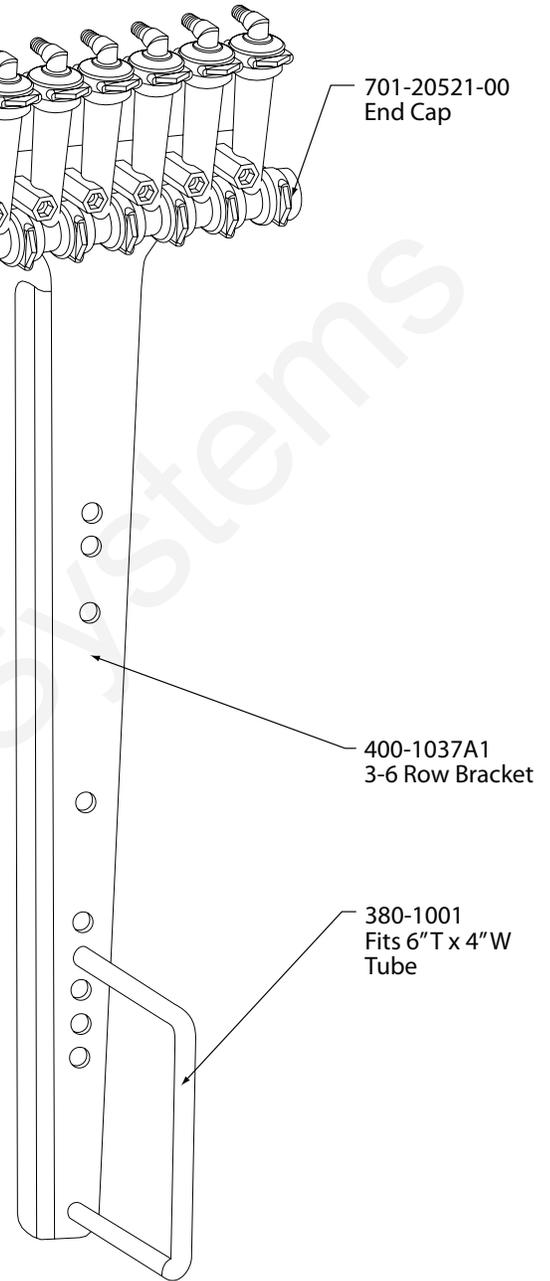
The low flow column has a smaller internal diameter. This means a heavier ball can be used to monitor a smaller flow. Since the plastic balls will float on heavier fertilizers, such as 10-34-0, the low flow columns work better for rates under 10 GPA.

SureFire uses the low flow columns with 1/4" push to connect outlet fittings. The flow capacity of 1/4" tubing and the low flow column are a great pair.

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 (GPA): .03 - .30 GPM		
Equivalent Application Rate on 30" Rows at 6 MPH: 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 - 30	5 - 10	Stainless Steel 1/2"

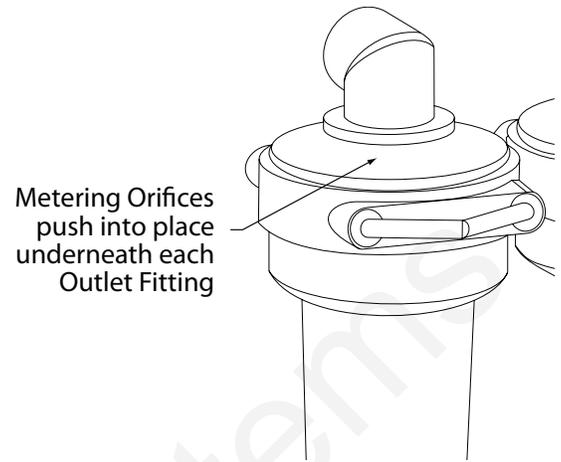
* These balls may float on heavier fertilizers, such as 10-34-0.



Fertilizer System Accessories

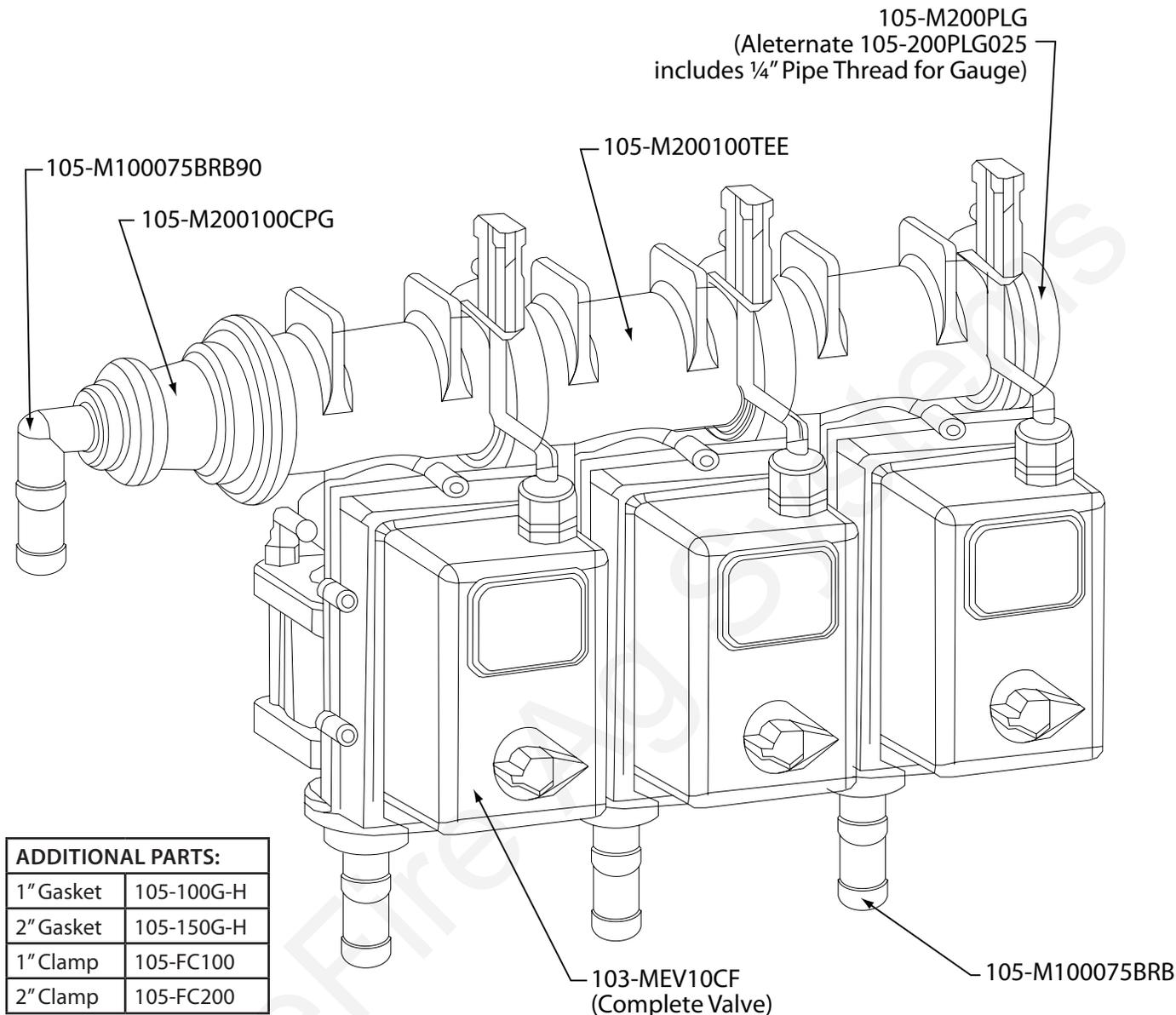
Floating Ball Flow Indicators - Metering Orifice Selection

APPLICATION RATE (GAL/ACRE) FOR WILGER ORIFICES ON 30" SPACINGS									
Orifice	PSI	Gal/Min	MPH						
			4.0	4.5	5.0	5.5	6.0	6.5	7.0
35	5	0.056	2.45	2.18	1.96	1.78	1.64	1.51	1.40
	10	0.079	3.46	3.08	2.77	2.52	2.31	2.13	1.98
	20	0.111	4.86	4.32	3.89	3.54	3.24	2.99	2.78
	30	0.136	5.96	5.30	4.77	4.33	3.97	3.67	3.40
	40	0.157	6.88	6.11	5.50	5.00	4.58	4.23	3.93
40	5	0.072	3.15	2.80	2.52	2.29	2.10	1.94	1.80
	10	0.102	4.47	3.97	3.57	3.25	2.98	2.75	2.55
	20	0.144	6.31	5.61	5.05	4.59	4.21	3.88	3.60
	30	0.177	7.75	6.89	6.20	5.64	5.17	4.77	4.43
	40	0.204	8.94	7.94	7.15	6.50	5.96	5.50	5.11
46	5	0.096	4.16	3.70	3.33	3.03	2.77	2.55	2.38
	10	0.135	5.91	5.26	4.73	4.30	3.94	3.64	3.38
	20	0.191	8.37	7.44	6.69	6.08	5.58	5.15	4.78
	30	0.234	10.25	9.11	8.20	7.45	6.83	6.31	5.86
	40	0.270	11.83	10.51	9.46	8.60	7.88	7.28	6.76
52	5	0.118	5.17	4.59	4.14	3.76	3.45	3.18	2.95
	10	0.168	7.36	6.54	5.89	5.35	4.91	4.53	4.21
	20	0.237	10.38	9.23	8.31	7.55	6.92	6.39	5.93
	30	0.290	12.70	11.29	10.16	9.24	8.47	7.82	7.26
	40	0.335	14.67	13.04	11.74	10.67	9.78	9.03	8.39
63	5	0.174	7.62	6.78	6.10	5.54	5.08	4.69	4.36
	10	0.246	10.78	9.58	8.62	7.84	7.18	6.63	6.16
	20	0.347	15.20	13.51	12.16	11.05	10.13	9.35	8.69
	30	0.425	18.62	16.55	14.89	13.54	12.41	11.46	10.64
	40	0.491	21.51	19.12	17.21	15.64	14.34	13.24	12.29
78	5	0.272	11.92	10.59	9.53	8.67	7.94	7.33	6.81
	10	0.385	16.87	14.99	13.49	12.27	11.24	10.38	9.64
	20	0.544	23.83	21.18	19.06	17.33	15.89	14.66	13.62
	30	0.667	29.22	25.97	23.37	21.25	19.48	17.98	16.70
	40	0.770	33.73	29.98	26.98	24.53	22.49	20.76	19.27
98	5	0.442	19.36	17.21	15.49	14.08	12.91	11.92	11.06
	10	0.625	27.38	24.34	21.90	19.91	18.25	16.85	15.64
	20	0.884	38.72	34.42	30.98	28.16	25.82	23.83	22.13
	30	1.080	47.31	42.05	37.85	34.41	31.54	29.11	27.03
	40	1.250	54.76	48.67	43.81	39.82	36.50	33.70	31.29
130	5	0.774	33.91	30.14	27.12	24.66	22.60	20.86	19.37
	10	1.100	48.19	42.83	38.55	35.04	32.12	29.65	27.53
	20	1.550	67.90	60.35	54.32	49.38	45.27	41.78	38.80
	30	1.900	83.23	73.98	66.58	60.53	55.49	51.22	47.56
	40	2.190	95.93	85.27	76.75	69.77	63.96	59.04	54.82
50	2.450	107.32	95.40	85.86	78.05	71.55	66.04	61.33	



Fertilizer System Accessories

Commander Electric Section Valves for Liquid Fertilizer Application



ADDITIONAL PARTS:	
1" Gasket	105-100G-H
2" Gasket	105-150G-H
1" Clamp	105-FC100
2" Clamp	105-FC200

HOW IT WORKS

Section valves can be assembled into groups with a common inlet to control flow to each section. The Commander controls up to 3 valves. Many alternate fittings can be used to accommodate different hose sizes and configurations.

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

WIRING CONNECTOR:

- Pin A - Red, 12 Volts +
- Pin B - Black, Ground -
- Pin C - White, Signal
- 12V = On; 0V = Off

MOUNTING HARDWARE:

- Two U-Bolt Kits 302-UB202
- 2 Valve Bracket 400-1196A1
- 3 Valve Bracket 400-1070A1

SECTIONS VALVES:

- 2 Section Valve Kit 520-00-0502
- 3 Section Valve Kit 520-00-0503

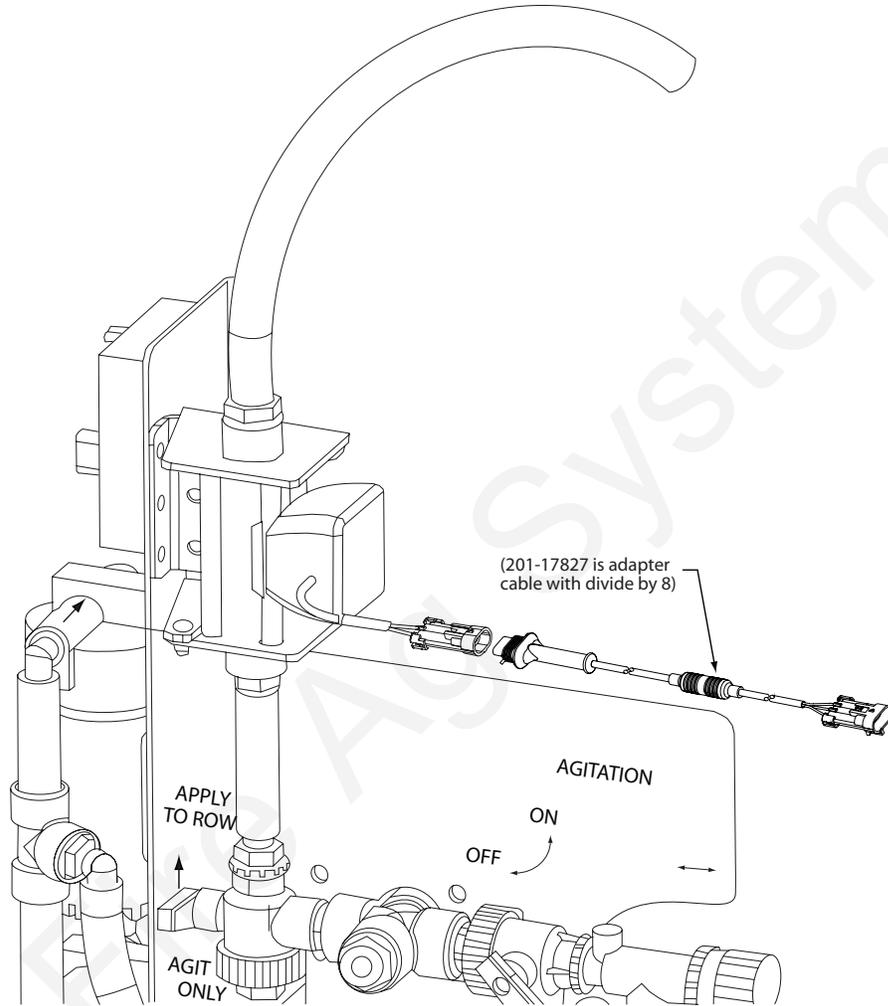
Fertilizer System Accessories

Ion Flowmeter Kits

.13 - 2.6 GPM Item Number 500-02-3040 (Includes Divide by 8 Adapter)

.3 - 5 GPM Item Number 500-02-3050 (Includes Divide by 8 Adapter)

.6 - 13 GPM Item Number 500-02-3060 (Includes Divide by 8 Adapter)



Ion 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, Ion flowmeters detect the flow of ions which makes them independent of viscosity or density of the fluid measured. They are extremely accurate using standard calibration number. SureFire Ag recommends you perform a catch test to verify the system is properly installed and configured.

Flow Range	Pulses/Rev.	Commander Flow Cal Divide by 8 adapter required
.13 - 2.6 GPM	22710	5677
.3 - 5 GPM	11355	2839
.6 - 13 GPM	4542	1135

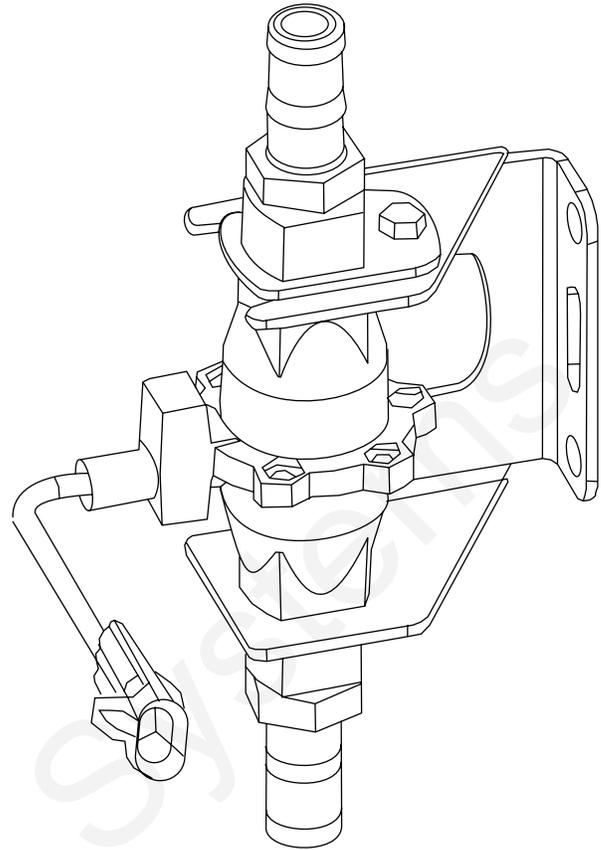
Fertilizer System Accessories

FM750 Low Rate Flowmeter Kits

.3 - 13 GPM Item Number 500-02-1010

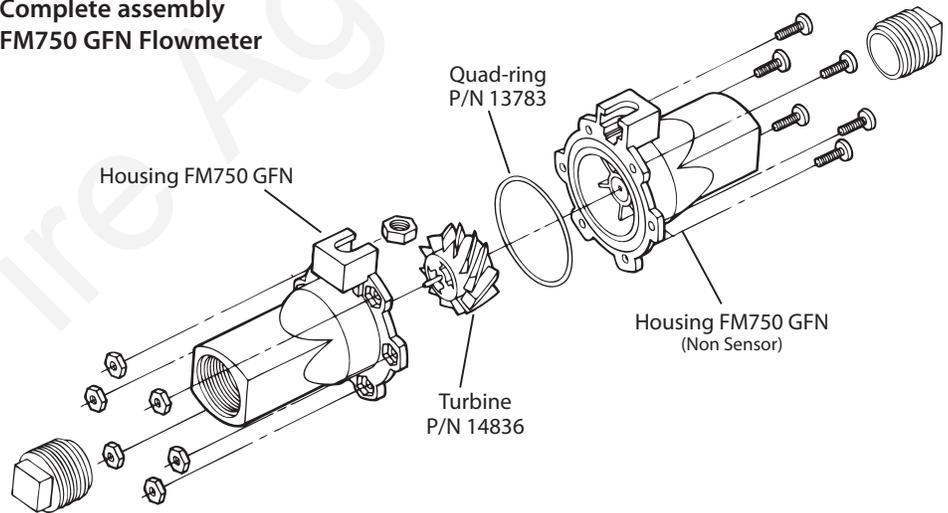
The FM750 turbine flowmeter is shown attached to the PumpRight base. A minimum of 24" of hose with a gentle curve should be used after the flowmeter outlet before any fittings. The FM750 works with flow in either direction.

The flow calibration for this flowmeter is found on a metal tag wired to the flowmeter. It will range from 450 to 500.



The FM750 may need to be disassembled for cleaning or to remove an obstruction. This diagram shows the components and proper location of each. If necessary use a mild detergent and brush to clean the flowmeter. The turbine should spin freely in the housing. After disassembly, recalibration of the flowmeter is recommended as its flow characteristics may change.

Complete assembly FM750 GFN Flowmeter



Installation

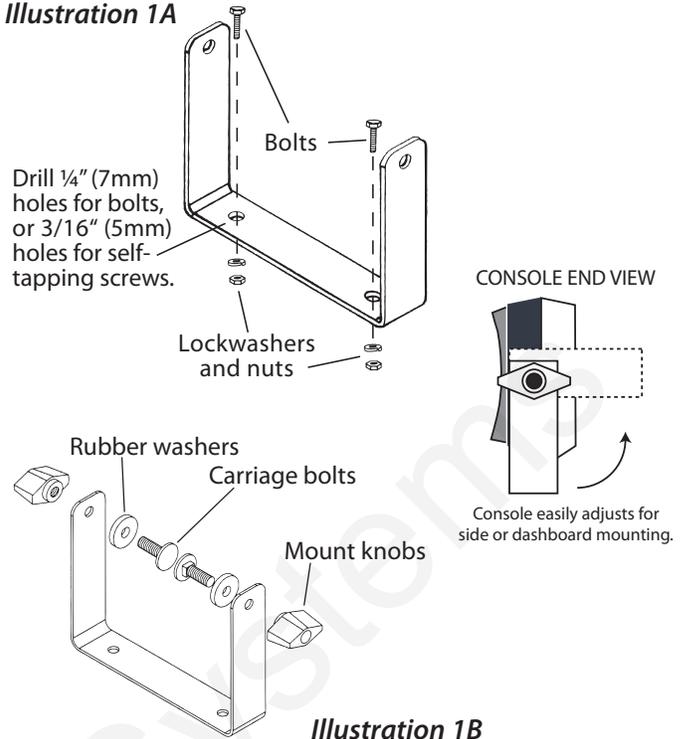
Mounting the Display Console

Select a mounting location which seems most workable, and that best fits your needs. It should be convenient to reach and highly visible to the operator. **DO NOT INSTALL IN A POSITION THAT OBSTRUCTS THE VIEW OF THE ROAD OR WORK AREA.** Whenever possible, avoid locations that expose the console to direct sunlight, high temperature, strong chemicals or rain.

Place the mounting bracket in selected location, mark holes, drill 1/4" (7mm) holes and mount bracket with bolts, lock washers and nuts provided. (Use self-tapping screws if not practical to use bolts.) See Illustration 1A.

Put rubber washers on carriage bolts and put the bolts through the bracket holes from the inside out. Loosely attach the mount knobs onto the bolts. Place console over carriage bolt heads and tighten knobs to secure the console. See Illustration 1B.

Illustration 1A

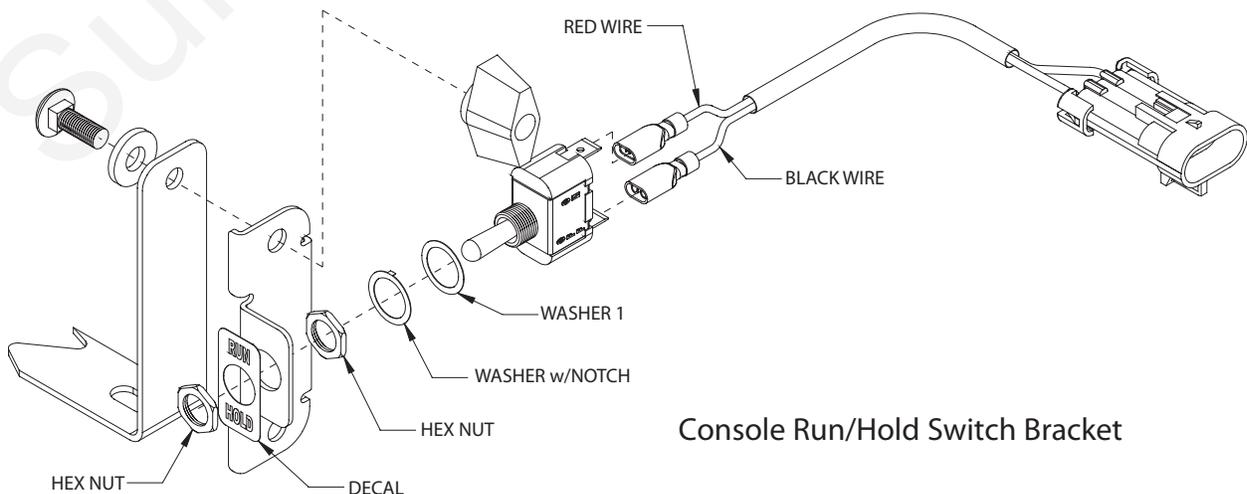


Attaching the Power and Run/Hold Control Switches

Mounting the Run/Hold Switch Kit

Remove the mount knob from either side of the console. Install the bracket over the carriage bolt and along side the console bracket. Install the mount knob on the carriage bolt and tighten to secure the console and run/hold switch bracket in place.

Install the switch in the bracket and attach the quick disconnects on the switch harness to the switch. Then install the switch harness connector into the mating connector (gray tie) on the console harness. Install the Console Power Switch (P/N 14360) in the same fashion.



Console Run/Hold Switch Bracket

Installation (cont)

Electrical

This section explains how to connect your SureFire Commander to a 12-volt power source.

NOTE: *The SureFire Commander must be connected to a 12-volt DC negative ground electrical system.*

POWER/BATTERY CONNECTION:

Locate the power cable for the SureFire Commander and route to the battery. When routing cable to console, avoid areas where the cable may be subjected to abrasion or excessive heat. Attach the BLUE wire (ground) to a screw or bolt on the equipment frame. **See Illustration 2.** Be sure there is a good metal-to-metal contact. Connect the ORANGE wire to the positive battery terminal.

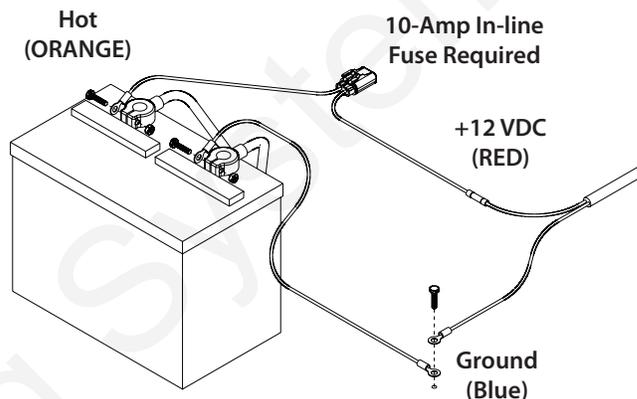
Connect the power to the SureFire Commander console by plugging the 2-pin W/P tower on the power cable into the 2-pin W/P shroud of the display console.

ON/OFF SWITCH CONNECTION

To install the power switch, simply mount the switch bracket as shown on page 7, and plug the connector into the mating cable from the console.

Your Commander is equipped with a non-volatile memory which does not require a constant supply of power to retain daily totals or calibration values. This type of memory conserves battery power and will not discharge the vehicle's battery when equipment is not in use.

Illustration 2



Speed Sensor Options

Astro II GPS Speed Sensor

The Astro is an easy-to-install economical alternate to radar speed sensors. The Astro is available with either a 1 HZ or 5 HZ GPS receiver. The sensor converts GPS signals to a pulsed speed signal, providing an accurate speed input even in conditions where radar does not perform well. Calibration for the Astro II is 0.189.

GPS Speed Sensor Interface

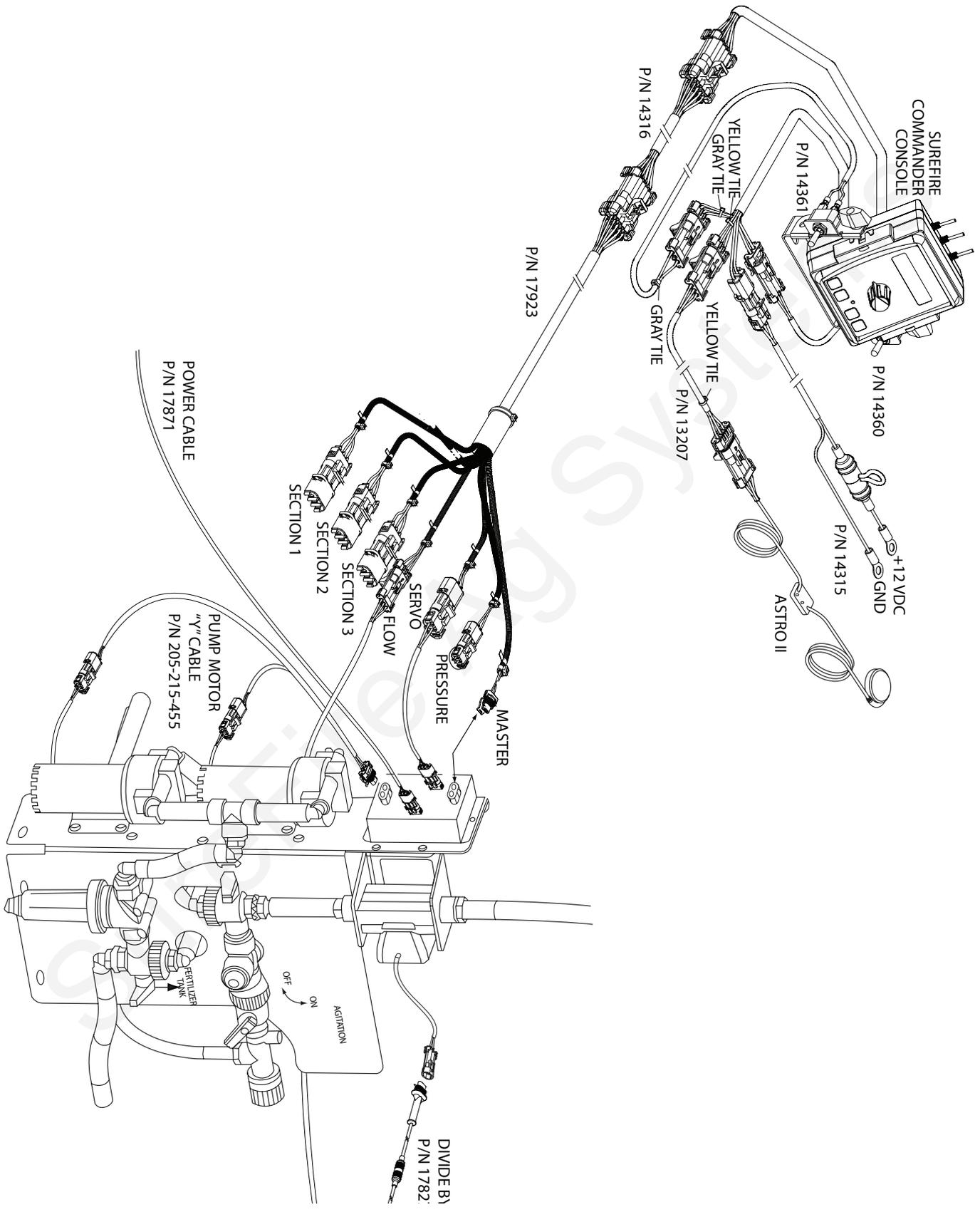
The Commander may also be used with most other GPS speed sensors that output a pulsed signal, such as SkyTrak or Dickey-John GPS speed sensors. An adapter cable may be required.



Astro II GPS Speed Sensor

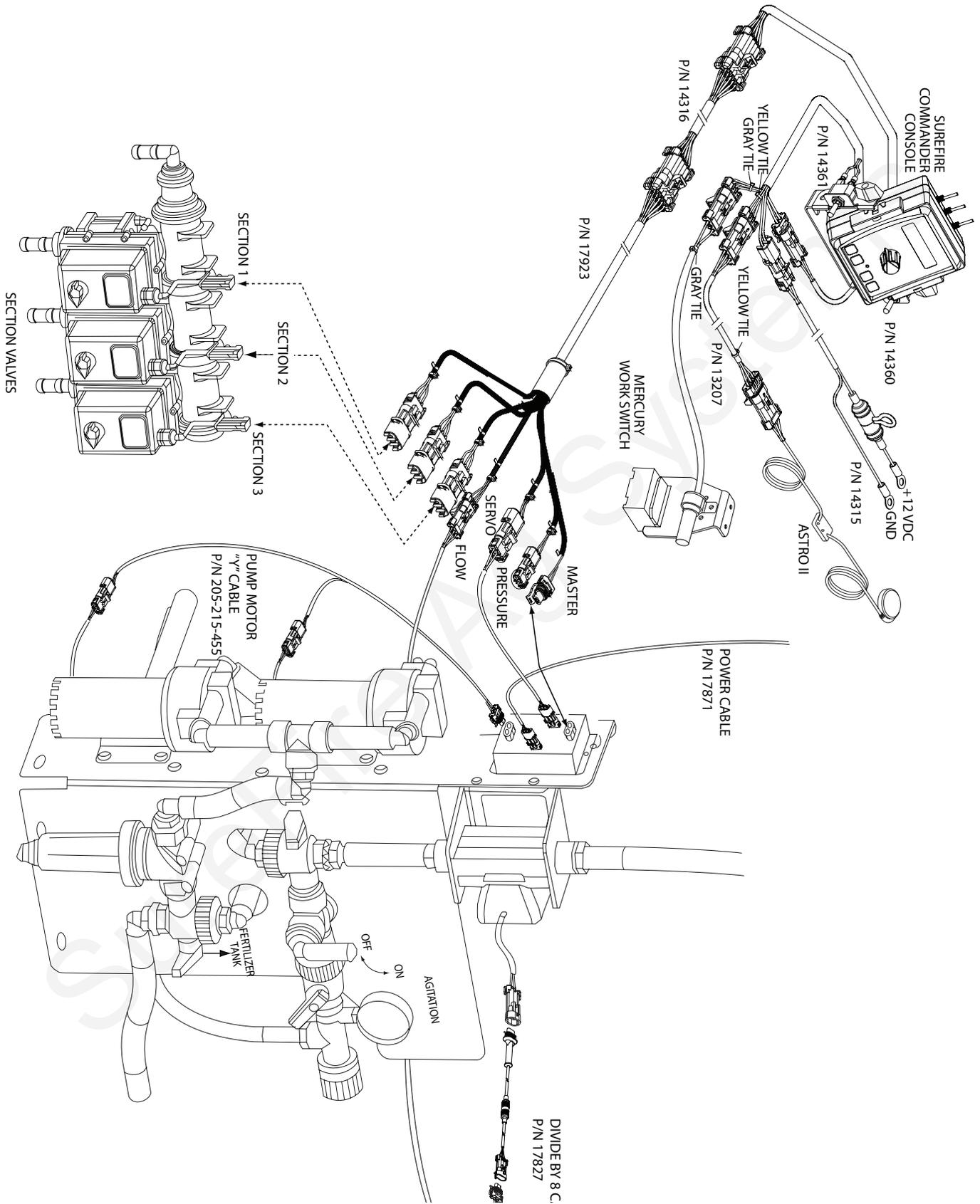
Installation (cont)

Commander Basic System Overview



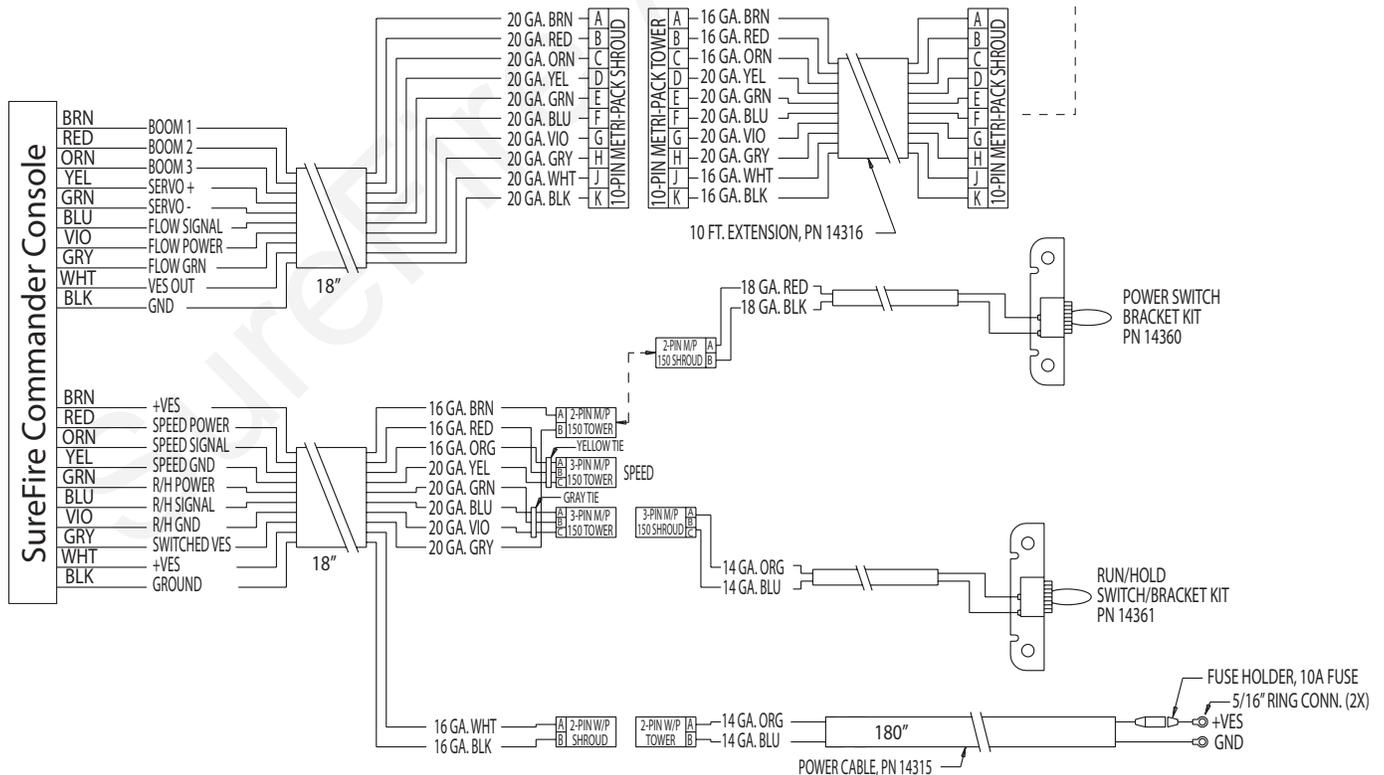
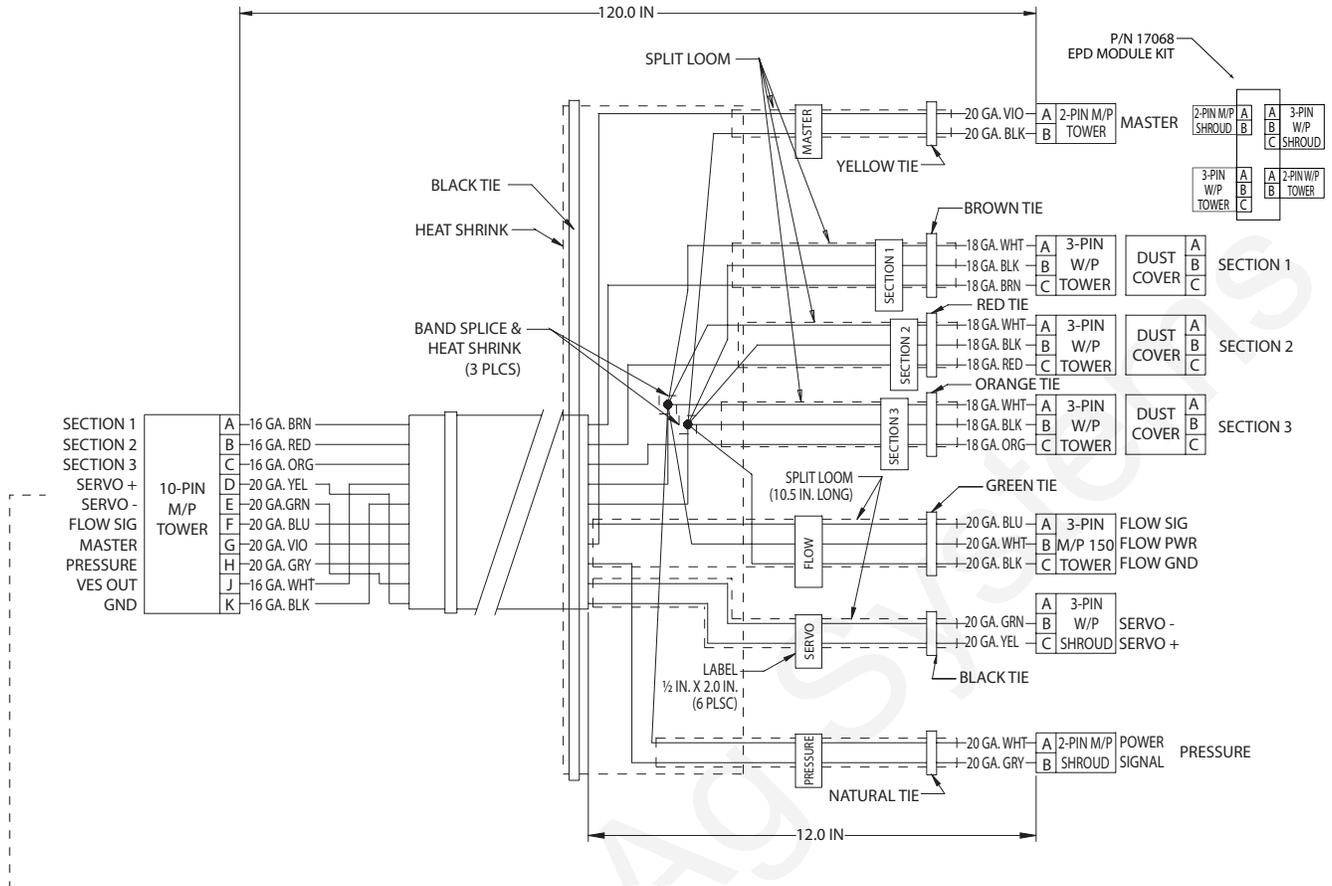
Installation (cont)

Commander Alternate System Overview



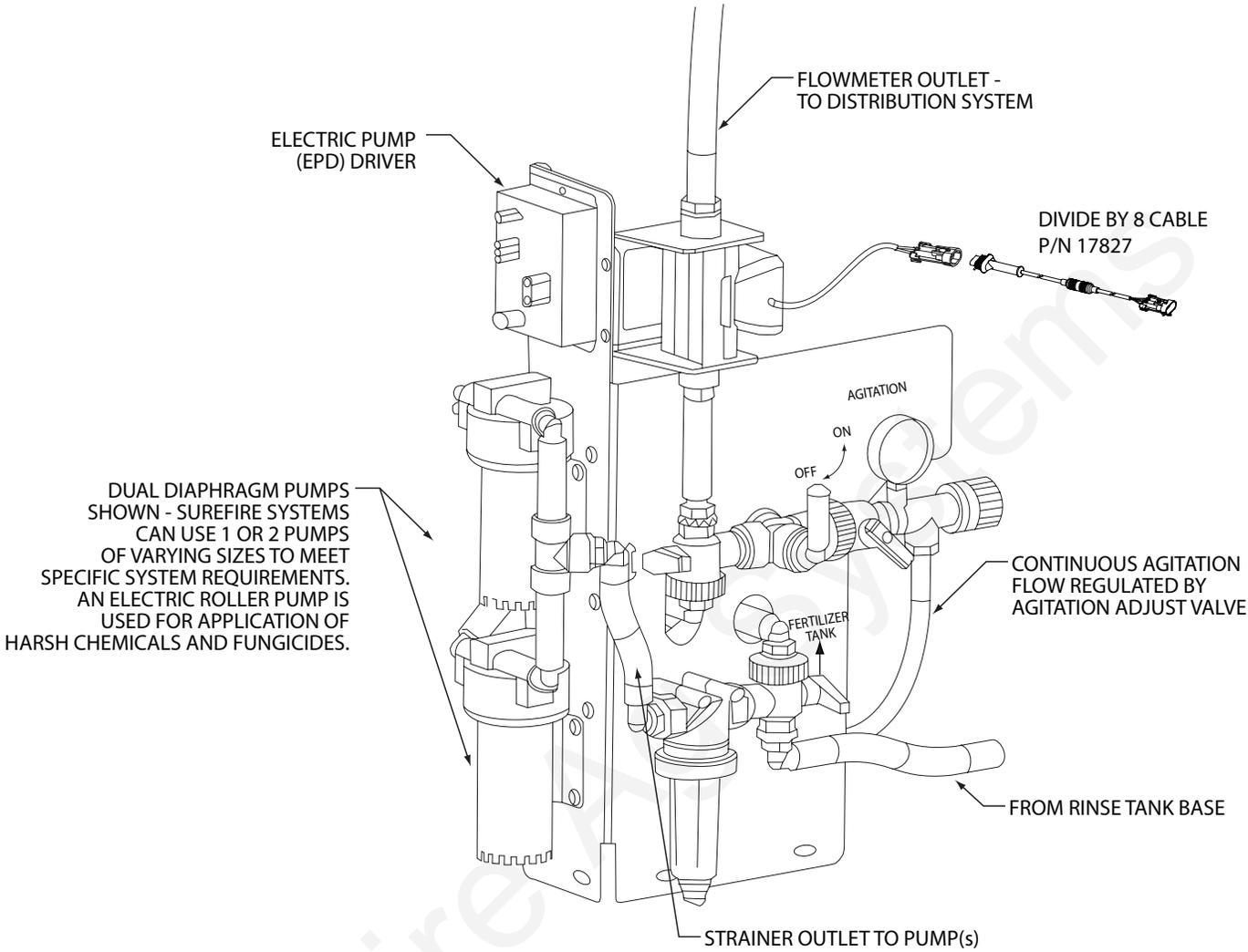
Installation (cont)

Commander Basic Wiring System Overview



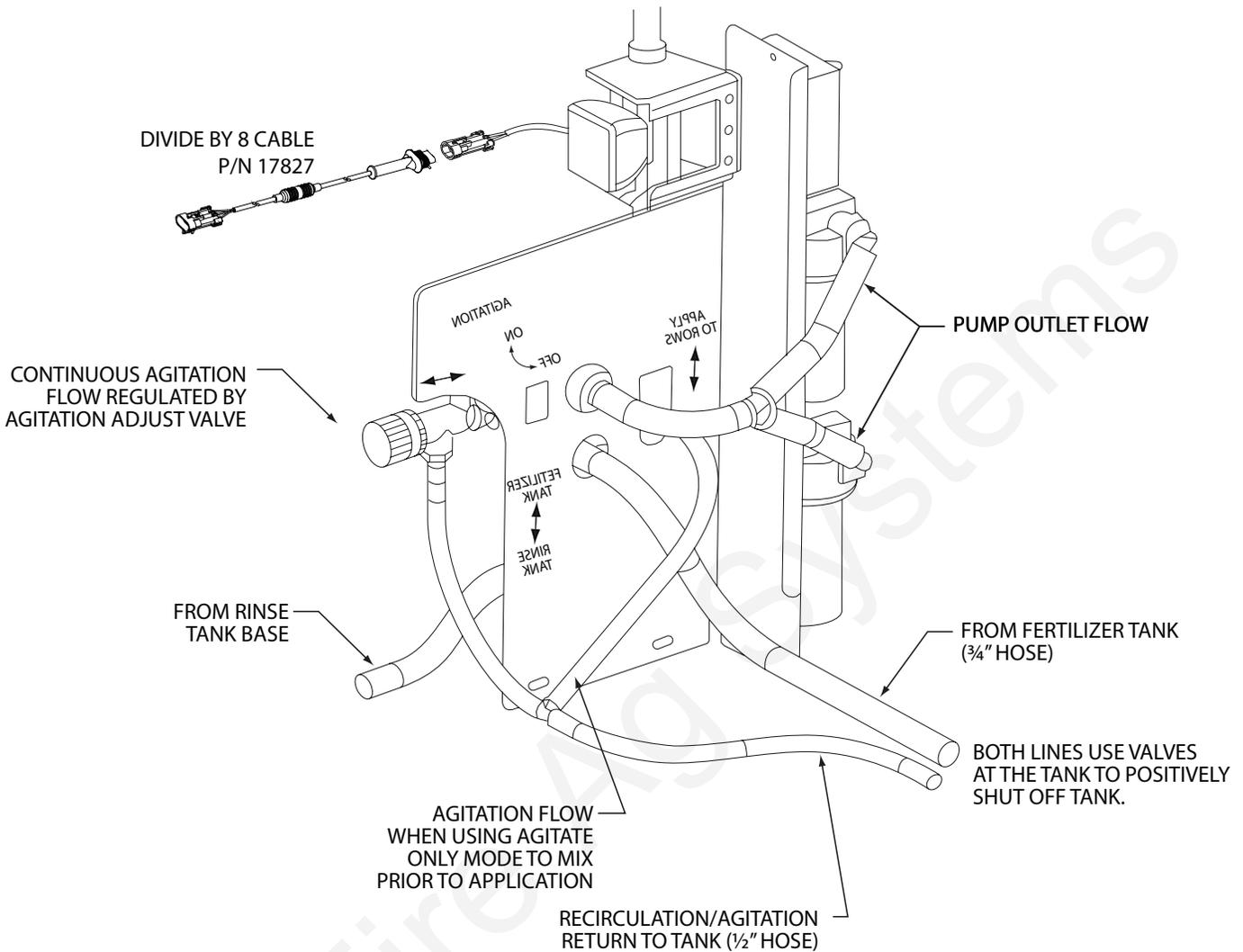
Installation (cont)

Plumbing Overview

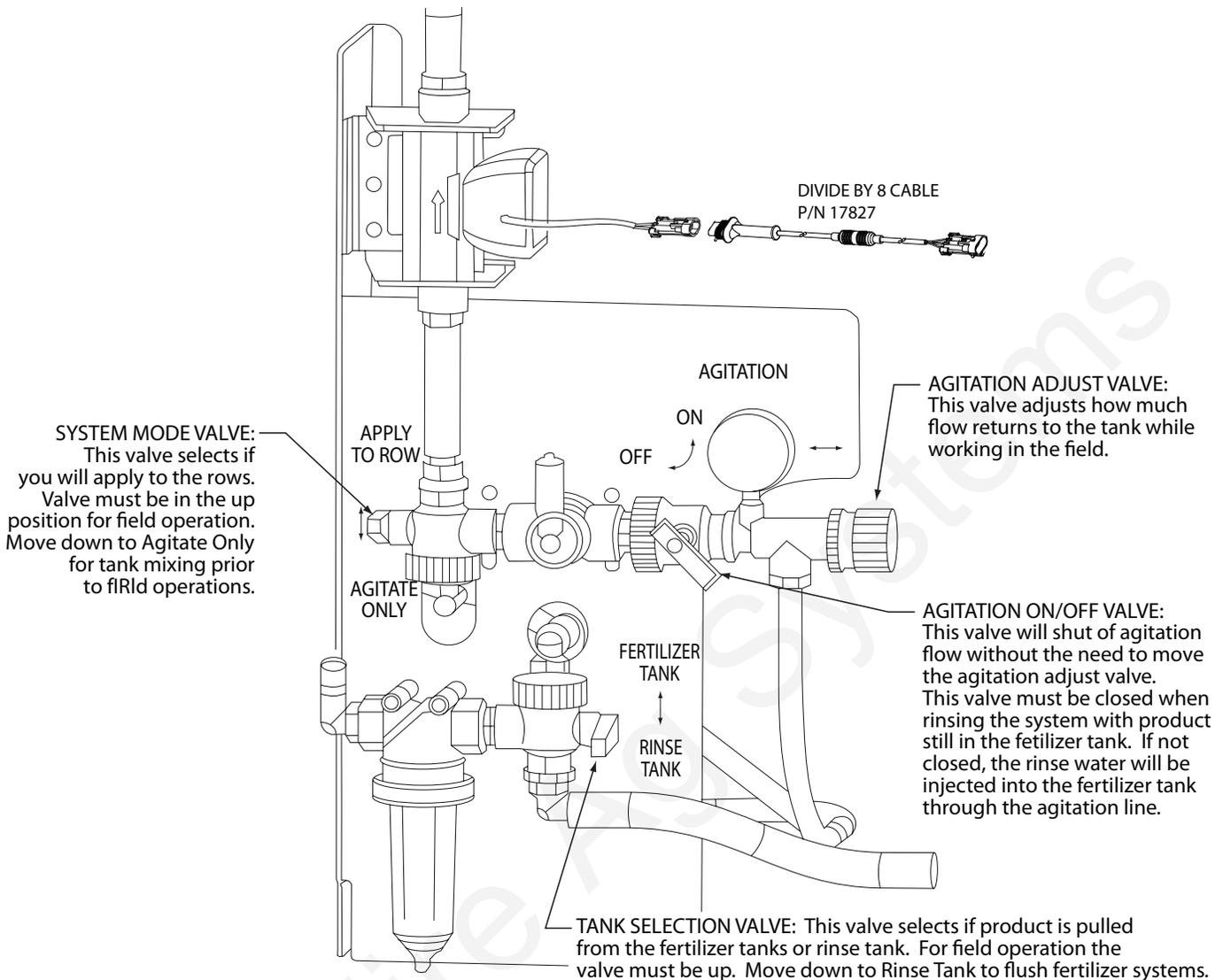


Installation (cont)

Plumbing Overview (cont)



Fertilizer System Operation



HOW TO USE THE AGITATION ADJUST VALVE

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

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

1. Use the test speed mode to set the system for the rate and speed you will operate at.
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 agitation adjust valve slowly and note the increased pump speed and noise. The system is applying the same amount to the ground, the pumps are now running faster due to more recirculation flow.
5. Set the valve to somewhere in the middle based on visual observation of agitation flow needed.
6. On the Commander, verify the system has locked on rate at your valve setting. Read the Volume/Minute from the Commander at your rate and speed.
7. Use the MAN (manual) mode to increase flow above and below this setting. The Commander should be able to increase and decrease flow from this amount.

Troubleshooting

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

The Commander features a large, easy-to-read liquid crystal display, easy-to-use rotary dial and lighted panel for night use.

VOLUME/MINUTE: Displays total gallons (liters) of liquid applied per minute, or lbs. (kg) NH₃ per minute.

DISTANCE: Displays distance traveled in feet (meters). May be reset.

TANK: Displays gallons (liters) of liquid remaining or lbs. (kg) of NH₃ remaining.

PRESSURE: Displays the pressure at the location of the optional pressure sensor. In addition to displaying the Pressure the console will compare the input Pressure to the Pressure Limit ("Special" Cal factor) and warn the operator with *H iPS!* (High Pressure) message when the input pressure exceeds this limit. The *H iPS!* warning will flash (alternate) with normal data in all rotary positions. If the Tank Level is low the *F iLL* message will not be shown when displaying *H iPS!*.

RATE: Displays application rate GPA(LPH), or lbs. N/acre (kg of N/hectare).

WARNING LIGHT: Indicates over or under application of 10% of the Target Rate. Also lit when in CAL.



SPEED: Displays ground speed in miles per hour (kilometers per hour).

Calibration Positions

FLOW CAL: Used in calibration mode to enter the calibration value assigned to your flowmeter (*see flowmeter tag.*)

MIN FLOW: Used in the calibration mode to view the current minimum flow setting (GPM/LPM).

ADJUST RATE: Used in calibration mode to enter an amount of change for on-the-go adjustments to the target rate (GPA/LPH), or lbs/acre (kg/hectare) N.

TARGET RATE: Used in calibration mode to enter the target application rate (GPA/LPH) or lbs/acre (kg/hectare) N.

Calibration Positions

WIDTH CAL: Used in calibration mode to enter the working width of your equipment.

SPEED CAL: Used in calibration mode to enter the speed calibration number in inches (cm) per pulse.

INLINE/BYPASS: For establishing servo polarity. (If servo is in the main spray line, select "Inline". If servo is installed in a return line, select "Bypass".)

TEST SPEED: Used in calibration mode to enter a test speed in miles per hour (kilometers per hour).

Soft Key Functions



Key which changes operation from automatic control to manual.



This key is used to enter & exit the calibration mode.

PROGRAM KEYS: Used to increment and decrement the different calibration values.



- RESET when not in CAL, clears the selected counter when held for two seconds.

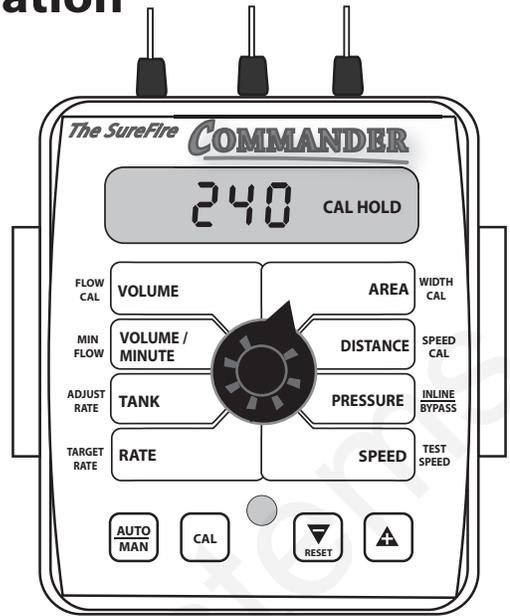


- When in CAL, the "+" key increases and the "-" decreases the value displayed.

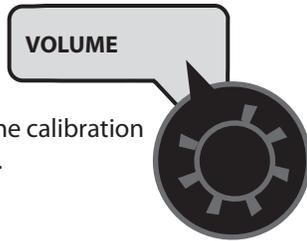
Commander Calibration and Operation

Standard Calibration Procedure

1. Turn all section switches off and put system in hold.
2. Press CAL key for one (1) second to enter calibration mode. 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.



FLOW CAL: Enter the calibration number for your flowmeter here. On turbine flowmeters, the **FLOW CAL** calibration number is on a metal tag attached to the flowmeter. On Ion flowmeters the calibration number is from the chart below.



Flow Range	Pulses/Rev.	Commander Flow Cal Divide by 8 adapter required
.13 - 2.6 GPM	22710	5677
.3 - 5 GPM	11355	2839
.6 - 13 GPM	4542	1135

MIN FLOW: Tells controller never to go below a certain flow. Set to ZERO in nearly every application. **NOTE:** See "Special" Cal to adjust.

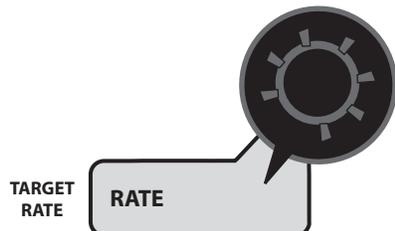
APPLICATION NOTE: Over-application may occur with MIN FLOW set if ground speed is too slow.



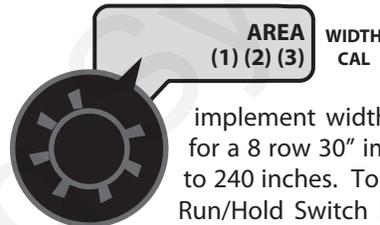
ADJUST RATE: Sets amount of rate change by pressing "+" or "-" button once. Usually set to 1.0. This allows you to change from 8 GPM to 9 GPM to 10 GPM etc.



TARGET RATE: Set to your intended target rate in Gallons per Acre.



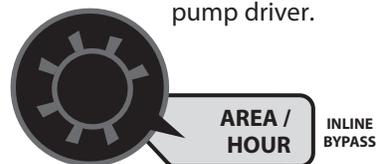
WIDTH CAL: Enter the width of each fertilizer or chemical section of your implement. For a single section system, set Section One to the full implement width in inches. For example, for a 8 row 30" implement, set Section One to 240 inches. To set the section widths the Run/Hold Switch has to be in Run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



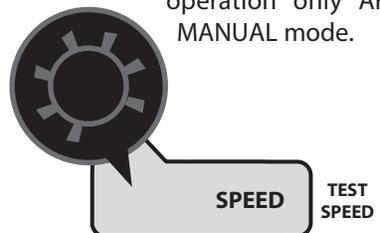
SPEED CAL: For the Astro II, set this to 0.189. For any other sensor, use the procedure found in the appendix. To match to a known good speed reading in your tractor, you can adjust the calibration value. To increase speed shown on the Commander, increase the Speed Cal value.



INLINE/BYPASS: Set to BYPASS to control the electric pump driver.



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



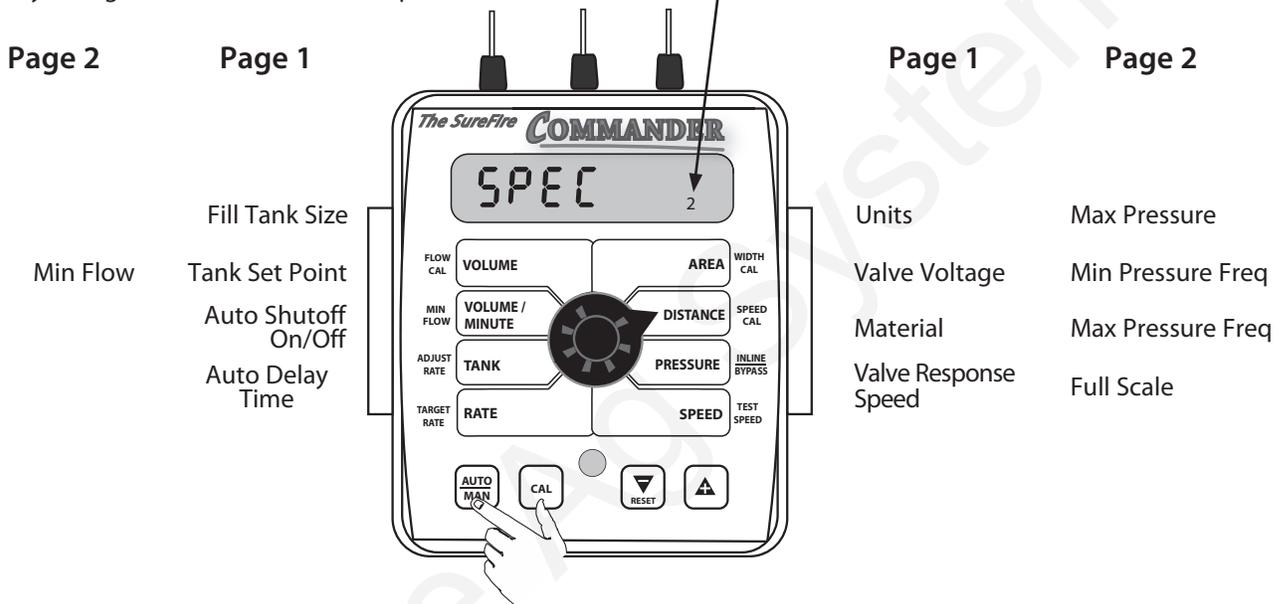
Commander Calibration and Operation (cont)

“Special” Calibration Procedure

The “Special” calibration mode is used to set up system parameters that rarely need to be changed or adjusted. To enter Special Cal, put the system in HOLD, turn the console OFF, press and hold both the AUTO/MAN button and CAL button while turning console ON. The console will display SPEC for 2 seconds to show that the console is in the Special Calibration mode. Release the AUTO/MAN and CAL buttons. The CAL icon and Warn LED will turn on. The desired Special Calibration parameter(s) can then be accessed with the rotary switch per the illustration below. To exit Special Calibration, press and hold the CAL button for 2 seconds. The console will store any changes and revert to normal operation.

NOTE: You must exit “Special” Calibration to save changes.

Press CAL button again momentarily to switch between page 1 and page 2. Notice the numeric icon change. *See Illustration below.*



NOTE: The following table describes the special cal parameters and shows the factory settings. More detailed descriptions follow the table.

Parameter	Description	Factory Setting
Units	System of units: EnG (English) / mEt (Metric) /TurF (Turf)	EnG (English)
Valve Voltage	Servo Valve Drive Voltage (8/12)	12
Material	Choose Liquid (H ₂ O) or Anhydrous (NH ₃)	H ₂ O
Valve Response Time	Set Valve Response (-4 to 3)	-4
Fill Tank Size	Size (volume) of Full Tank (Off or 1-65,535)	Off
Tank (Norm) Set Point	Sets alarm point if using Tank Function (Off or 1-65,535)	Off
Auto Shutoff	Runs servo toward minimum when in hold (On/Off)	Off
Auto Time Delay	Delay servo response when going from Hold to Run (Off to 4 sec.) <i>Allows slow shutoff valves to open before adjusting servo</i>	1
Min Flow	Tells Commander to NEVER go below this setting (GPM)	0.0
Max Pressure	Alarms operator if pressure exceeds this value	25
Min Pressure Freq	Factory Setting	Factory Setting
Max Pressure Freq	Factory Setting	Factory Setting
Full Scale	Maximum pressure for sensor	100

Commander Calibration and Operation (cont)

“Special” Calibration Procedure (cont)

Page 1

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. Depending on the “UNITS” setting, the TANK SIZE units will be either gallons or liters. If “material” is set to NH3, the Tank Size will be in lbs. or kg. Anhydrous Ammonia (NH3).



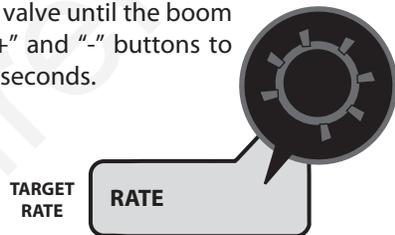
TANK ALARM SET POINT: Use the “+” and “-” buttons to set the level where the Warning LED starts flashing and the word “FILL” flashes on the display. Range is OFF or 1-65,535. When the tank value drops below the set point, the alarms will notify the user that the tank level is low.



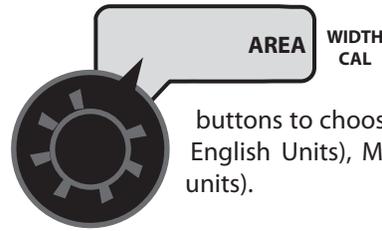
AUTO SHUTOFF ON/OFF: When Auto Shutoff is enabled (ON) the servo will run toward minimum flow for 4 seconds any time the system is put in HOLD or all booms are turned off, or if in AUTO mode and speed goes to zero. This feature is normally used only in Dry Application systems where the HOLD condition must stop a hydraulic auger or conveyor belt.



AUTO DELAY TIME: 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.



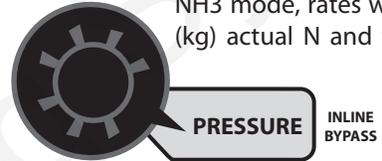
UNITS: Choose the system of units desired. Turf units are the same as English units except Area is in thousands of square feet. Use the “+” and “-” buttons to choose between EnG (American English Units), MEt (Metric) and TurF (Turf units).



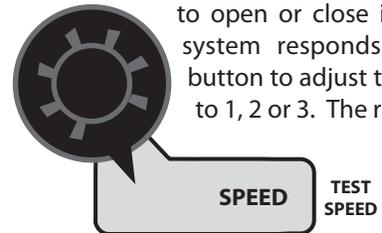
VALVE VOLTAGE: Selects the operating voltage for the servo valve. Factory setting is 12 volts. **NOTE: ALWAYS set to 12.**



MATERIAL: Use “+” and “-” buttons to select between liquid (H2O displayed) or anhydrous ammonia (nH3 displayed). If in NH3 mode, rates will be displayed in pounds (kg) actual N and totals will be displayed in pounds (kg) anhydrous ammonia (NH3).



VALVE RESPONSE SPEED: Allows adjustment of response to “tune” the system for use with very fast or slow valves. For example, if using a ball valve that takes several seconds to open or close in manual mode, and the system responds sluggishly, use the “+” button to adjust the valve response number to 1, 2 or 3. The range of adjustment is -4 to +3, factory setting is -4. **NOTE: Exercise caution when increasing the valve response speed.**



If using a relatively fast valve (1-3 seconds open-to-close), the system may become unstable with higher valve response speed numbers entered.

NOTE: A beginning valve response of -1 is recommended for hydraulic servo valves.

To exit Special Calibration, press and hold the CAL button for 2 seconds. The console will store any changes and revert to normal operation.

NOTE: You MUST exit “Special” Calibration to save changes.

Commander Calibration and Operation (cont)

“Special” Calibration Procedure (cont)

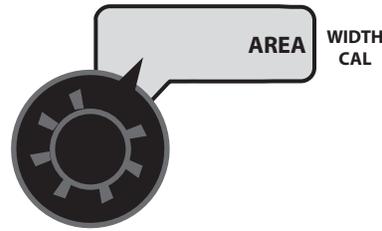
Page 2

MIN FLOW: The purpose of this calibration value is to prevent the system from applying below the recommended minimum rate for the nozzles. The minimum flow rate in gallons per minute (liters per minute) based on the nozzles being used, 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. This value should be checked/ changed for each different nozzle that you use.

APPLICATION NOTE: Over-application may occur with MIN FLOW set if ground speed is too slow.



MAX PRESSURE: Adjust the Max Pressure to the pressure you wish not to exceed.



This valve should not exceed the Full Scale setting.

MIN PRESSURE FREQ: Factory set. **DO NOT** change unless authorized to do so.



Can be used to adjust zero pressure. Reduce Min Pressure Frequency

until a pressure is displayed with the pumps off and pressure relieved (approximately 100). Increase Min Pressure Frequency until zero pressure is displayed.

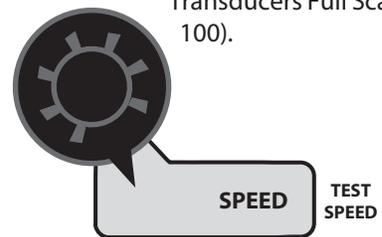
MAX PRESSURE FREQ: Factory set. **DO NOT** change unless authorized to do so.



With the system running check display pressure vs gauge. If pressure displayed is below actual pressure, increase Max Pressure Frequency. If displayed pressure is below actual

pressure, decrease Max Pressure Frequency.

FULL SCALE: Adjust this valve to match your Pressure Transducers Full Scale Specifications (Typically 100).



Commander Calibration and Operation (cont)

Initial Operation to Test System Setup

First we will test the system in Manual Mode.

1. Fill tank with water.
2. Push the AUTO/MAN button until MAN is displayed on the Commander. You are now in Manual mode.
3. Put the system in RUN. Turn the console switch to RUN or lower the implement if using a mercury Run/Hold Switch,
4. Turn Section 1 switch ON.
5. Turn dial to VOLUME/MINUTE position. Is a number displayed? If so push the "+" button. Does the flow increase? Push the "-" button. Does the flow decrease? If the buttons work backwards, see calibration and change the INLINE/BYPASS setting.
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 the next step when you can increase and decrease the VOLUME/MINUTE reading using the "+" and "-" keys on the Commander

8. 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.

You are now ready to test AUTO mode. You can drive the tractor and verify the system works correctly. If you want to sit still, you can enter Calibration Mode, then turn the dial to TEST SPEED. Using the "+" key increase the speed to your operating speed. Turn the Run/Hold and Section switches ON. The system will now perform as if it is traveling at the speed you entered.

Troubleshooting

General

All Commander consoles, flowmeters and servo valves are tested prior to packaging, so unless there has been damage in shipment you can be confident that everything will be operational when you receive it.

However, if you do encounter a problem that appears to be related to equipment failure, **PLEASE DO NOT OPEN THE CONSOLE**. Your system is protected by a warranty, and SureFire Ag will gladly correct any defect.

Many problems are the result of mistakes in installation or operation. Before returning any parts for service, carefully check your installation and review the operating instructions. *For easy-to-follow guidelines, refer to the troubleshooting section which follows.*

CONSOLE APPEARS DEAD

Using your test light, check for 12 volts at the power source. Also check for damaged power cable or reversed terminals. (*Console requires 12 volts for proper operation*). Check connections of ignition or power switch.

SPEED IS ALWAYS ZERO OR ERRATIC

Review speed sensor installation and connections.

DISTANCE COUNT IS INACCURATE

Speed Cal was incorrectly entered. Review calibration, re-adjust and test.

AREA COUNT IS INACCURATE

Implement width or Speed Cal was measured programmed incorrectly. Go back through the original procedures, make changes, and test for acre (hectare) count again. (**Make sure no width is entered for unused booms.**) Verify accuracy with formula:

$$\begin{aligned} \text{Acres} &= \text{Distance} \times \text{Width in feet} / 43560 \\ \text{Hectares} &= \text{Distance} \times \text{Width in meters} / 10,000 \end{aligned}$$

NO READOUT OF GALLONS (LITERS), OR GALLONS (LITERS) PER MINUTE

Check to see that the pump and equipment are operating properly. If liquid is moving through the line, check the flow sensor to be sure it is screwed all the way into the flowmeter.

Check to see that a FLOW CAL number has been entered. Also check cable for breaks or incomplete connection.

If the flowmeter is new or has not been used for a long period of time, the turbine may be sticky. Flushing the system out with water should make the turbine spin freely.

Flow rate may be too low to register a reading, or foreign material may be lodged in the flowmeter.

BOOMS SHUT-OFF

If you are in AUTO with no speed, the booms will shut-off.

TOTAL LIQUID USED IS INACCURATE

This may result from an incorrectly-entered "FLOW CAL" value. Check the number stamped on the flowmeter tag, and be sure this is entered in the console's "FLOW CAL" position. If the meter has been used for some time, wear may have changed the Flow Cal value.

Check the mounting position of the flowmeter. With lower flow rates, the meter should be mounted vertically with flow traveling upward. Also check to see that the flow sensor is screwed all the way into the flowmeter.

Other causes may be inaccurate tank markings, a flow rate too low to register, or foreign material lodged in the flowmeter.

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 cable away from electric solenoids, air conditioning clutches and similar equipment.

Check the VALVE SPEED calibration number in Special Calibration. If the RATE tends to overshoot or oscillate, the VALVE SPEED setting may be too high for the control valve being used; reduce the VALVE SPEED setting by 1 (range is -4 to +3).

DISPLAYED MEASUREMENTS DO NOT MAKE SENSE

The console may be in the incorrect measurement mode (English or metric).

DISPLAY READS "OFL"

DISTANCE, AREA, and VOLUME counters read OFL when they have exceeded their maximum count. Reset to zero to resume counting.

SYSTEM OPERATION (CONTROL) IS SLUGGISH IN AUTOMATIC MODE

Check the VALVE SPEED setting in Special Calibration. If using a slow valve (4 seconds or more, close to open) increase the VALVE SPEED setting.

Troubleshooting (cont)

Checking Individual Components

CONSOLE

The only way to field test a console is to connect it to a harness on a vehicle with a known working console or install it on an E-POP (Electronic Point of Purchase) display stand.

HARNESS

The harness can be checked using an ohmmeter or continuity tester. The main wiring diagram shows the pin out of all connectors. *See page 21.*

ELECTRICAL INTERFERENCE

Erratic operation of the system may be the result of electrical interference from ignition wires or inductive loads (electrical clutch, fan, solenoid, etc.). Always try to route wires as far away from suspect areas as possible. If problems occur, you may need to relocate the console and/or wiring harness, or install a noise suppressor.

POWER

Check power source with a test light. If there is no power, trace cable toward battery looking for breaks. Also check any fuses or circuit breakers that supply power to the console.

ACCESSORY POWER

The speed, flow and run/hold cables all have an accessory power wire. Check for 12 volts between B (usually white) and C (usually black) of these connectors. If power is not present, make sure the accessory power wire is not open or shorted to ground or to another wire. If this wire has a problem, the console may exhibit erratic behavior or not function at all.

RUN/HOLD JUMPER DUST COVER

To test for proper continuity on the jumper wire, connect the ohmmeter to the pins of the dust cover with the jumper wire. There should be continuity — near zero ohms.

MAGNETIC HALL-EFFECT SPEED AND FLOW SENSORS

Caution: Improper connection or voltage could damage the Hall-effect sensor. The Hall-effect sensor works similar to a reed switch, but requires power in order to function. Also, this particular type of Hall-effect sensor requires alternating magnetic polarities in order to switch. This means that the north pole of a magnet will “open” the Hall effect and the south pole of a magnet will “close” the Hall effect.

Ground pin C (black) and connect clean 12 volts to pin B (white) of the Hall-effect sensor cable. Connect the positive lead (red) of an ohmmeter or continuity tester to pin A (red) and the negative lead (black) of the ohmmeter or continuity tester to pin C of the Hall-effect sensor cable.

Holding the tip of the sensor up to the north pole of a magnet should result in a very high resistance (infinite), while holding the tip of the sensor up to the south pole of a magnet should result in a very low resistance (around 300 ohms).

ASTRO II SPEED SENSOR

1. Carefully check your installation and operating instructions. The following are tips for troubleshooting;
2. Disconnect the radar adapter cable from the console harness
3. Check for 12 VDC between pins B and C of the main harness connector (yellow tie). If not present, console or harness may be defective.
4. Using a jumper wire (paper clip bent into a “U”), rapidly short together positions A and C of the main harness speed connector (yellow tie) several times. The console should respond with some speed reading. If not, the console or harness may be defective.

Troubleshooting (cont)

Checking Console Inputs

CONSOLE INPUTS

If there is no response from any of the following tests, refer to the main wiring diagram to locate the next connector in line toward the console and repeat the test at that connector. If there is a response at that connector, the problem may be in the cable between the two connectors (or the connectors themselves).

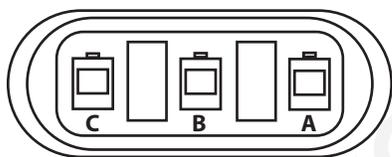
SPEED INPUT

Turn rotary switch to speed position and disconnect the speed sensor (yellow tie) from the main harness. Check for 12 volts between pins B (white) and C (black) of the main harness speed cable (yellow tie). Using a clip lead or other jumper wire (such as a paper clip bent in a "U"), several times rapidly short together pins A (red) and C (black) of the 3-pin connector (*See Illustration 3*). The console should respond with some speed reading.

FLOW INPUT

Turn rotary switch to VOLUME/MINUTE and disconnect the flow sensor (green tie) from the main harness. Check for 12 volts between pins B (white) and C (black) of the main harness flow cable (green tie). Using a clip lead or other jumper wire (paper clip bent in a "U"), several times rapidly short together pins A (red) and C (black) of the 3-pin connector. The console should respond with some flow rate reading.

Illustration 3



Three-Pin Connector

REMOTE RUN/HOLD INPUT

Disconnect the remote run/hold sensor (or jumper cover) from the main harness.

Check for 12 volts between pins B (green) and C (violet) of the main harness remote run/hold cable (grey tie). Placing a clip lead or other jumper wire (such as a paper clip bent in a "U") between pins A (blue) and C (violet) of the main harness run/hold connector (grey tie) should turn off the "HOLD" icon on the console display. Removing the jumper should turn on the "HOLD" icon on the console display.

TURBINE FLOWMETER

Shaking the Flowmeter end to end should produce a "rattling" sound (shaft end play). Blowing in the meter from either end should spin the turbine freely. If the turbine spins freely but the meter will not register flow with a known working sensor, the turbine may be defective.

SERVO VALVE CONTROL SIGNAL

With the console turned ON, put the console in MANUAL mode, place the remote Run/Hold switch in the RUN position and turn at least one boom switch to ON. Using a voltmeter or simple test light, check from a good frame ground to each of the servo wires on the main harness connector. You should get 0 volts on each wire. Holding the "+" button should cause the RED wire to pulse toward 12 volts (light will pulse). Holding the "-" button should cause the BLACK wire to pulse toward 12 volts (light will pulse).

SERVO VALVE

The best way to test the servo valve is with a known working console. Turn console ON, put the console in MANUAL mode, place the remote Run/Hold in the RUN position, turn the rotary switch to RATE and turn at least one boom switch to ON. With the servo valve connected to the servo valve lead on the main harness, holding the "+" button should close the servo valve and holding the "-" button should open the servo valve NOTE: assuming you are in bypass configuration (provided the console has passed the Servo Valve Control Signal test). The servo valve should operate smoothly in both directions, from fully open to fully closed.

You may also use a 9-volt transistor battery. Connecting the battery to each terminal on the servo valve should cause the servo valve to run in one direction. Reversing the battery connections should cause the servo valve to run the other direction. The servo valve should operate smoothly in both directions, from fully open to fully closed.

PLUMBING

Proper plumbing is a very important factor in obtaining optimal performance from your SureFire Commander system. At this point, it is assumed that your plumbing basically matches that of the system diagram and that the servo valve and flowmeter are known to be installed correctly and functioning properly. In addition, make certain that you have selected and installed the correct orifice for the application, speed and rate that you intend to maintain. Don't forget the obvious such as leaky fittings and hoses, pinched hoses and plugged or worn nozzles.

Winterization

END OF SEASON CLEANING & WINTERIZATION

SureFire recommends flushing your fertilizer pump and complete system with adequate amounts of water. 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.

Appendix A

Fine Tuning Speed/Distance Calibration Value (With Run/Hold Switch Kit Installed)

This procedure is used to verify the calibration of systems **WITH** the Run/Hold Switch Kit or an optional remote run/hold kit installed. In order to achieve accurate measurements, each step in this fine tuning procedure should be performed as precisely as possible.

Note: If your system does not have a run/hold switch kit or remote Run/Hold sensor installed, refer to next page for instructions.

PREPARATION

- Once the system is fully installed and calibrated, select a straight tract of ground that is similar to your actual field conditions and as level as possible.

NOTE: Using a course with a different ground surface, such as a hard-surface road, will result in different readings than exact field conditions.

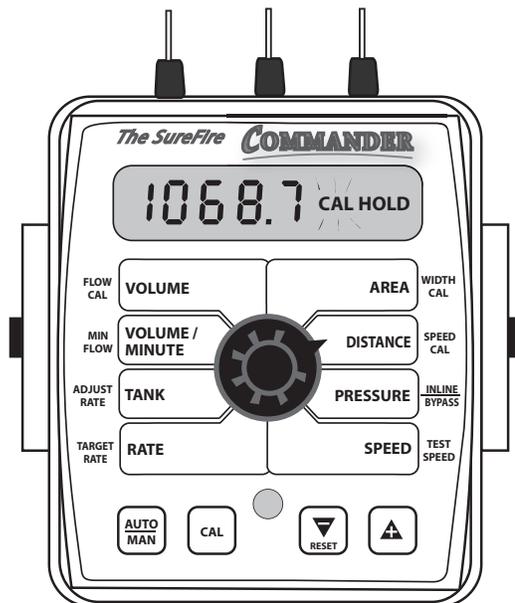
- Measure a distance of 1000 feet (500 meters). Clearly mark the beginning and end points with flags or something highly visible to the operator.

PROCEDURE

- 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). The word CLEAR will be displayed when reset is pressed.
- You are now ready to drive the measured course. Pick a location on the vehicle to use as a marker for starting and stopping the distance counting function (door handle, mirror, step, etc.). You should begin driving the course well ahead of the starting flag and drive past the ending flag, using the Run/Hold switch to start and stop the counting function. It is not recommended to start from a dead stop at the starting flag and stop at the ending flag.
- Place the Run/Hold switch in RUN when the marker on 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 marker on the vehicle passes the ending flag, to stop the distance counting function. The console display should read "HOLD". **See Illustration to the right.** Stop the vehicle in a level and safe area and continue with this procedure.

- 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. **See illustration below.**
- 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.
- When the number shown on the display matches (as closely as possible) the actual distance driven, you have arrived at the correct calibration value. If you cannot adjust the displayed distance to exactly match the actual distance driven, adjust the figure as close as possible to the actual distance. 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.

The speed sensor is now calibrated. To verify proper calibration, repeat the procedure a second time. Write down the new speed calibration number and keep it in a safe place. If the calibration values are ever accidentally changed, you can simply re-enter this number.



Appendix B

Fine Tuning Flowmeter Calibration Value

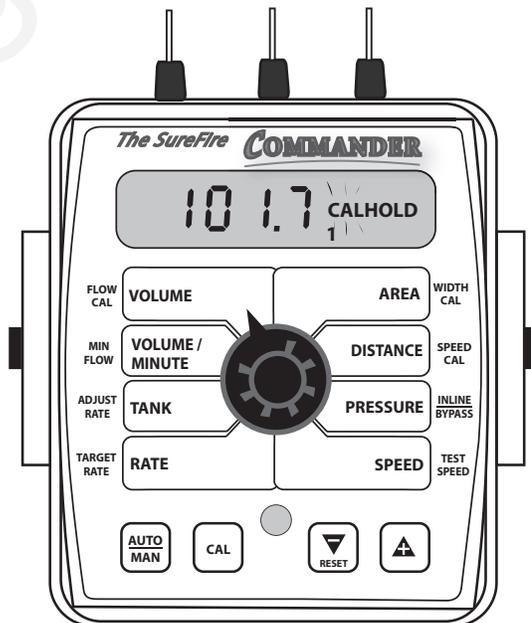
This procedure is used to verify and fine-tune the flowmeter calibration. Every flowmeter is calibrated with water at the factory and stamped with a calibration value. Enter that value as a starting point and use this procedure to fine-tune that value for your specific installation and spraying application. This procedure should be repeated each time a new solution is being applied (*Differing solutions will have a different specific gravities and different flow characteristics*) or when the flowmeter installation has been altered.

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 booms. 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 booms, and run a known amount of water.
5. Turn off all booms. Compare the console's VOLUME reading with the known amount of water run. *See Illustration.* 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 nozzles are spraying equally. At a minimum collect water from 4 - 6 nozzles. NEVER base a calibration on a single nozzle catch. It is important to perform this procedure at a flow rate similar to that which will be used in the field. It is also possible to disconnect the main boom line and run it to a large measuring container but a valve must be installed and properly adjusted to simulate actual field conditions.



SureFire Ag Systems

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Commander Calibration and Operation

Standard Calibration Procedure

1. Turn all section switches off and put system in hold.
2. Press CAL key for one (1) second to enter calibration mode. 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.

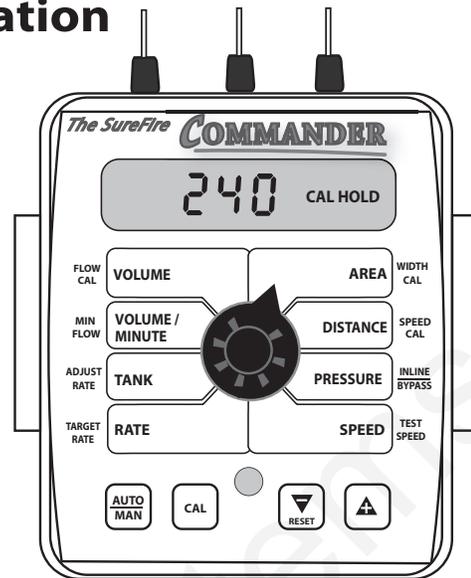
FLOW CAL: Enter the calibration number for your flowmeter here. On turbine flowmeters, the calibration number is on a metal tag attached to the flowmeter. On Ion flowmeters the calibration number is from the chart below.

Flow Range	Pulses/Rev.	Commander Flow Cal Divide by 8 adapter required
.13 - 2.6 GPM	22710	5677
.3 - 5 GPM	11355	2839
.6 - 13 GPM	4542	1135

MIN FLOW: Tells controller never to go below a certain flow. Set to ZERO in nearly every application.

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

TARGET RATE: Set to your intended target rate in Gallons per Acre.



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 a 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.

SPEED CAL: For the Astro II, set this to 0.189. For any other sensor, use the procedure found in the appendix. To match to a known good speed reading in your tractor, you can adjust the calibration value. To increase speed shown on the Commander, increase the Speed Cal value.

INLINE/BYPASS: Set to BYPASS to control the electric pump drive.

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

Initial Operation to Test System Setup

First we will test the system in Manual Mode.

1. Fill tank with water.
2. Push the AUTO/MAN button until MAN is displayed on the Commander. You are now in Manual mode.
3. Put the system in RUN. Turn the console switch to RUN or lower the implement if using a mercury Run/Hold Switch,
4. Turn Section 1 switch ON.
5. Turn dial to VOLUME/MINUTE position. Is a number displayed? If so push the "+" button. Does the flow increase? Push the "-" button. Does the flow decrease? If the buttons work backwards, see calibration and change the INLINE/BYPASS setting.
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 the next step when you can increase and decrease the VOLUME/MINUTE reading using the "+" and "-" keys on the Commander

8. 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.

You are now ready to test AUTO mode. You can drive the tractor and verify the system works correctly. If you want to sit still, you can enter Calibration Mode, then turn the dial to TEST SPEED. Using the "+" key increase the speed to your operating speed. Turn the Run/Hold and Section switches ON. The system will now perform as if it is traveling at the speed you entered.