



Tower Low Rate Electric Pump Fertilizer System for John Deere GS2 with Servo Control

Subject:

Single and multiple section liquid fertilizer application with 12 volt electric pump systems controlled via John Deere GS2 Display

**Controller
Manufacturer:**



The John Deere GS2 Controller can directly control 12 volt pumps applying liquid fertilizer. This can be a single section where the fertilizer flow is turned on or off for the entire machine. It can also use the John Deere Swath Pro feature to automatically turn off fertilizer flow for 2-5 sections using electric ball valves.

Application Ranges:

The SureFire Tower with 2 electric pumps can deliver 5 GPM of 10-34-0 fertilizer. The chart below shows what application rates are possible on common equipment sizes. NO AGITATION flow is possible at the maximum rate.

Maximum Application Rates in GPA on 30" Rows at 6 MPH (no agitation)				
Rows	8	12	16	24
Max GPA	20	13	10	6

John Deere

Components required:

GS2 2600 Display
GS2 2600 Rate Controller with 37 Pin Connector

This bulletin provides important information for using a SureFire electric pump system such as The Tower with the John Deere GS2. Consult your GS2 operators manual for GS2 operating instructions.

System Components:

The SureFire electric pump system can be controlled from the John Deere GS2 display. A John Deere rate controller is required to do this. The rate controller is a black box which will be mounted outside the cab, usually on the implement. The John Deere GS2 will have a speed signal and in some cases uses an implement height switch to turn off fertilizer flow. The speed and height inputs are part of the GS2 system and not included in the SureFire kit.

The rate controller has a large round 37 pin connector for application equipment. The SureFire system uses an adapter to convert the 37 pin to a standard 16 pin connector used on application systems. Extension harnesses may be needed depending on equipment size. SureFire has 16 pin extension harnesses to be used immediately after the 37 to 16 pin adapter.

In a single section system, the next harness is a 16 pin final harness. This converts the 16 pin into the multiple connections for all system components. The components the harness attaches to are the flow meter, the on/off connection on Electric Pump Driver (EPD) and the servo connection on the EPD. A diagram of the EPD with connections is shown on page 13. The Ion flow meter connection will require an adapter, see page 4 for details.

The Electric Pump Driver (EPD) has 4 connections.

1. Servo—Increases and Decreases pump speed
2. On/Off—Turns pumps on and off (also called enable)
3. Power—12 volt wires carrying up to 40 amps wired directly to battery
4. Pump—Connection to 1 pump or 2 pumps via a Y cable

The power connection is very important. If too many connectors or a light gauge wire is used, the system will not deliver the maximum application rates shown on page 1.

How the Electronics Work:

When the GS2 commands the fertilizer system to turn on, 12 volts is supplied to the on/off EPD connection. The flow meter output pulses are converted to a flow measurement based on the user entered flow calibration (see page 4). The servo connection is provided a signal to increase or decrease flow to achieve the target application rate requested via the GS2.

How the pump system works:

The Electric Pump Driver (EPD) sends a PWM modulated signal to the pump(s). This causes the pumps to operate from 10% to 100% of their full speed. Varying pump speed causes a change in pump flow. The pump flow is sent to the manifold system. Most commonly floating ball flow indicator manifolds are used. These divide the flow from a common inlet at the bottom to each individual column which sends flow to each row. At the top of each flow indicator is an orifice. Each row has an equal sized orifice to provide the same flow to each row. As pump speed increases, more flow is sent through each orifice. This increases the pressure drop across each orifice. A small orifice will cause a higher pressure. Electric pumps operate most efficiently at pressures under 30 psi. An orifice must be chosen to keep pump pressure low enough to supply the desired application rate. Cold fertilizer increases pressure at each orifice and must be considered when sizing orifices. See pages 7-10 for floating ball size and orifice selection.

Multiple Section Liquid Fertilizer Systems:

SureFire systems can optionally include electric ball valves that will divide an implement into sections. Working with the John Deere GS2 Swath Pro feature, these ball valves will automatically open and close to minimize overlapping application.

SureFire systems will work with 2-5 sections. With the GS2, these sections can be of varying widths. For example on a 24 row front fold planter, 5 sections work well with two sections of 5 rows on each wing and 1 section of 4 rows in the center.

The wiring harnesses are different for a multiple section implement to provide a connection for each electric ball valve. The 37 pin connector from the rate controller is converted to a 16 pin connector by a short adapter harness. If extensions are needed, add 16 pin extensions at this point. Next, the 16 pin is converted to a 10 pin and 7 pin connector. These attach to the master switching module. This module monitors each section status (on or off) sent from the GS2. If any section is on, the module turns the pump(s) on. When all sections are off the pump(s) are turned off.

The master switching module has two outputs, a 10 pin and 7 pin. The 10 pin harness has connectors for the flow meter, servo valve, and EPD on/off control. The 7 pin harness breaks out into 5 connectors for up to 5 section valves.

The multiple section wiring schematic on page 12 shows all the above harnesses, including part numbers for each item.

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.

System Setup & Calibration

From the Rate Controller Screen, push the up arrow button on the right hand side. This will take you to the system setup screens. The tabs on the top of the screen will guide you to each section listed below.

Implement Setup

Make the necessary settings for you implement width and each section width if using multiple sections.

System Setup

Section Valve Type: 3 Wire

Control Valve Type: Standard

Flow Return Box: NOT checked

Control Valve Cal: 9911

The GS2 Control Valve Calibration can be changed to optimize performance on your specific equipment. The 4 digit number is formatted XYZ. Increase XX to make the system respond quicker. If set to high, the actual rate will oscillate around the target. Y is the output deadband and Z is the control deadband. Generally leave these two digits low. Read your GS2 Operators Manual for more information. For example, to slow your response speed, move the number from 9911 to 8011, changing the valve response from 99 to 80. SureFire has found a very fast valve response (99) works best with electric pumps.

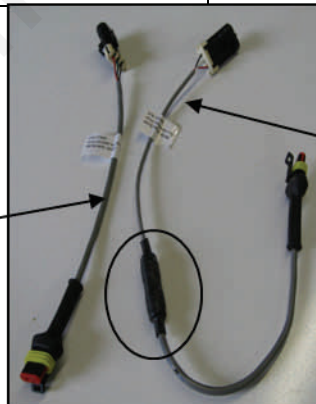
Flow Meter Calibration: see chart

Flow Meter Units: gal

Flow Range (GPM)	Raw Pulses / Gallon	John Deere GS2 Flow Calibration
0.13 – 2.6	22710	2839 w/ divide by 8 harness
0.3 – 5	11355	1419 w/ divide by 8 harness
0.6 – 13	4542	4542

SureFire recommends you perform a Calibration Test on your Flow Meter. The ION flow meter is very accurate, but the only way to confirm that all information is setup correctly is to catch liquid product and verify the correct amount is dispensed. See Section 40 of your GS2 Manual for instructions on how to perform a "Calibration Test" on your flow meter.

With the 0.6 – 13 GPM the standard adapter harness is PN 201-17842.



With the 0.13 – 2.6 and 0.3 – 5 GPM models, the 'Divide by 8' adapter harness MUST be used. It is PN 201-17827. It must be used because the GS2 controller limits the maximum calibration number. The 'divide by module' is circled.

Pressure Sensor:
NOT checked

Agitator Valve:
NOT checked

System Setup & Calibration (cont)

Alarms Setup

SureFire recommends you use the default alarm settings. Change according to operators preference.

Rates Setup

Up to 3 rates can be entered for quick changes between these rates. Check the Rate Smoothing box on this screen for best performance.

Initial System Operation Procedure

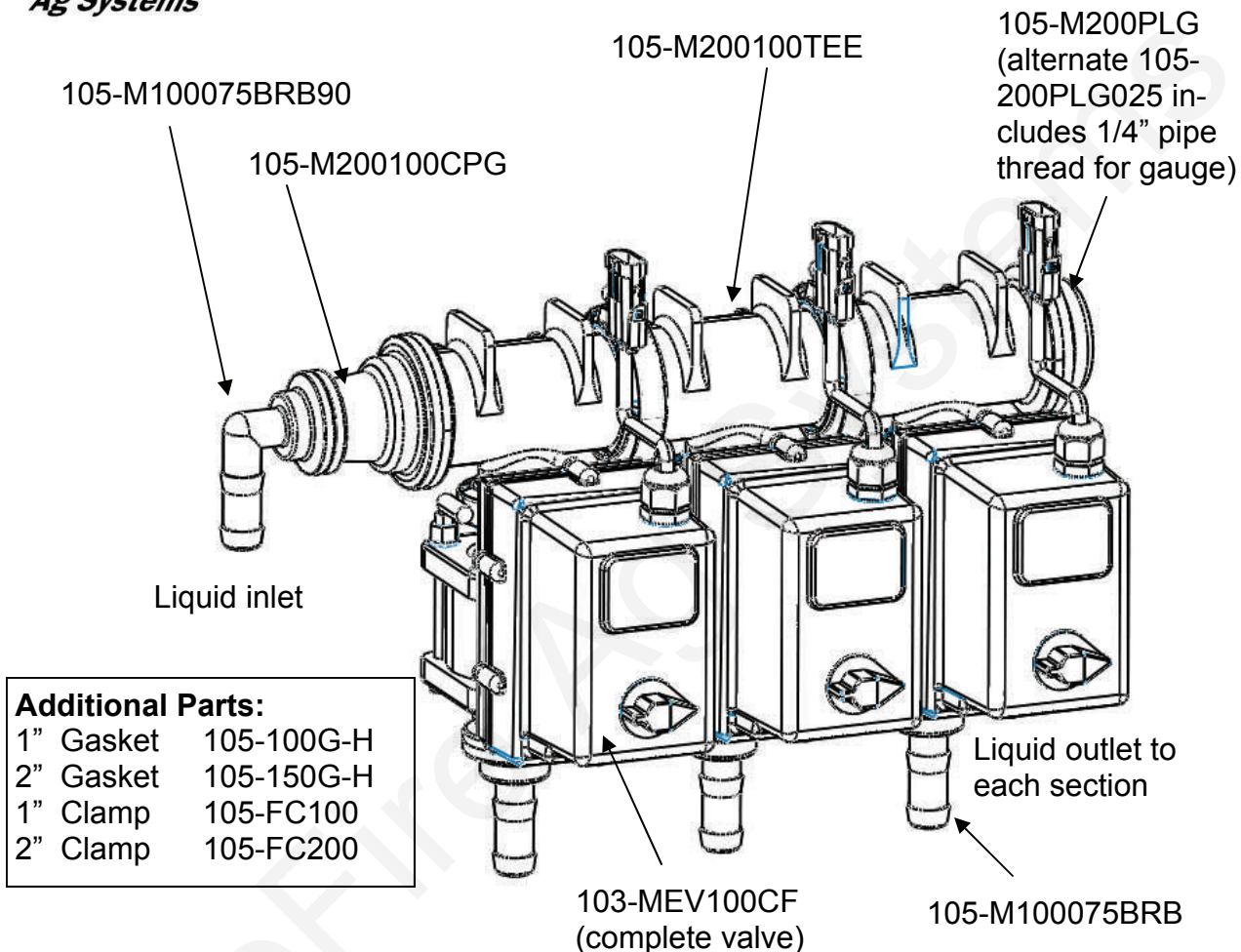
Thorough testing of the system at installation will prevent delays when field operation begins. All initial testing should be conducted with water. Enter all setup and calibration information prior to beginning testing.

1. From GS2 Rate Controller screen, choose the wrench on the right hand side.
2. Choose Tests tab at top of screen.
3. Choose Section Test from the drop down list
4. Turn the Master switch on
5. Push Start button with 1 or more section boxes checked
6. Pump(s) should begin running and dispensing water once primed. If pump is not running, push the (+)Open button to increase flow.
 - A. Check for 12 volts (measured to ground) at the Pump On/Off connector plugged into the electric pump driver (EPD). 12 volts will turn the pump on (0 volts is off).
 - B. While a person is holding the (+)Open and (-)Close buttons, check for 12 volts at the servo valve connection. One direction should have 12 volts and the other -12 volts.
 - C. Check for 12 volts at the EPD power connection (large wires going to tractor battery)
7. If pump is running but no water is being dispensed, check the pump inlet for obstructions or closed valves.
8. With water being dispensed, push the Rate Controller icon in top right corner. (Do NOT stop the test)
9. Read the flow in gallons / minute. If no flow is reported, check the flow meter wiring.
10. Push the wrench icon, then push the (-) close button 10-15 times.
11. Go back to the rate controller screen, did the pump flow in gallons / minute decrease.
12. Try the same with the (+) increase button.
13. When you can read an increasing and decreasing flow using the (+) and (-) buttons, the pump system is working correctly.
14. Finally, check and uncheck section boxes to test each section valve. Verify the valve is working properly by looking the on/off indicator on the valve and the floating ball flow indicators for each section.

When the system passes the above tests, you're ready to go to the field.



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. Common assemblies use up to 5 valves, however, more can be used where practical. Many alternate fittings can be used to accommodate different hose sizes and configurations.

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

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

Mounting Hardware:	
Two U-Bolt Kit	302-UB202
2 Valve Bracket	400-1196A1
3-5 Valve Bracket	400-1070A1



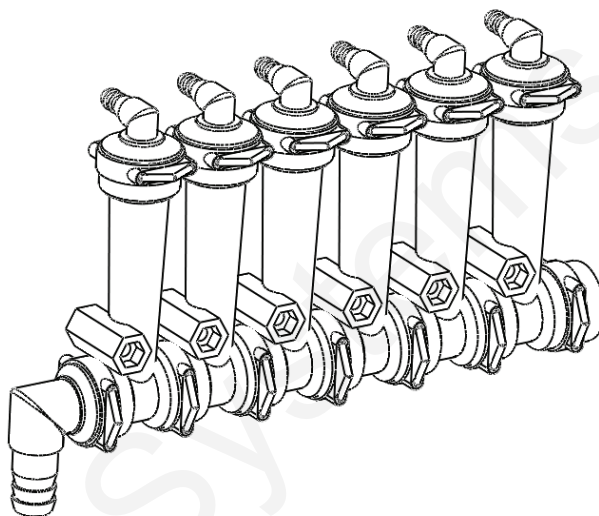
Floating Ball Flow Indicator and Manifold System

Flow Indicators

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 1/4" push to connect outlet is recommended for rates under 10 GPA. For rates over 10 GPA the full flow column with 3/8" hose barb outlet is preferred.



Parts List

Complete Columns

701-20460-95	Single Full Flow Column with 3/8" HB - 90 Degree Outlet
701-20460-96	Single Full Flow Column with 1/4" FPT - 90 Degree Outlet
701-20460-97	Single Low Flow Column with 1/4" Push To Connect Outlet

Fittings

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

Service Parts Only

701-20460-00	Full Flow Column
701-20470-00	Low Flow Column
701-20460-04	Wilger Lock U-clip
701-20460-05	Flow Indicator Ball - 1/2" SS Ball
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
701-40225-05	Viton O-Ring for Orifice

Brackets & U-Bolts

400-1037A1	3-6 Row Bracket
400-1036A2	7-12 Row Bracket
380-1018	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"

Fits Tube Size

4" x 4"
5" T x 7" W
6" T x 4" W
7" x 7"
7" T x 5" W



Floating Ball Flow Indicators- Full Flow Column

701-20460-95
Full Flow Column
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

400-1036A2
7-12 Row Bracket

380-1001
Fits 7"x7" Tube

Full Flow Indicators

The standard or 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. 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 (GPM): .05-2.70 GPM

Equivalent Application 2-70 GPA
Rate on 30" Rows
at 6 MPH

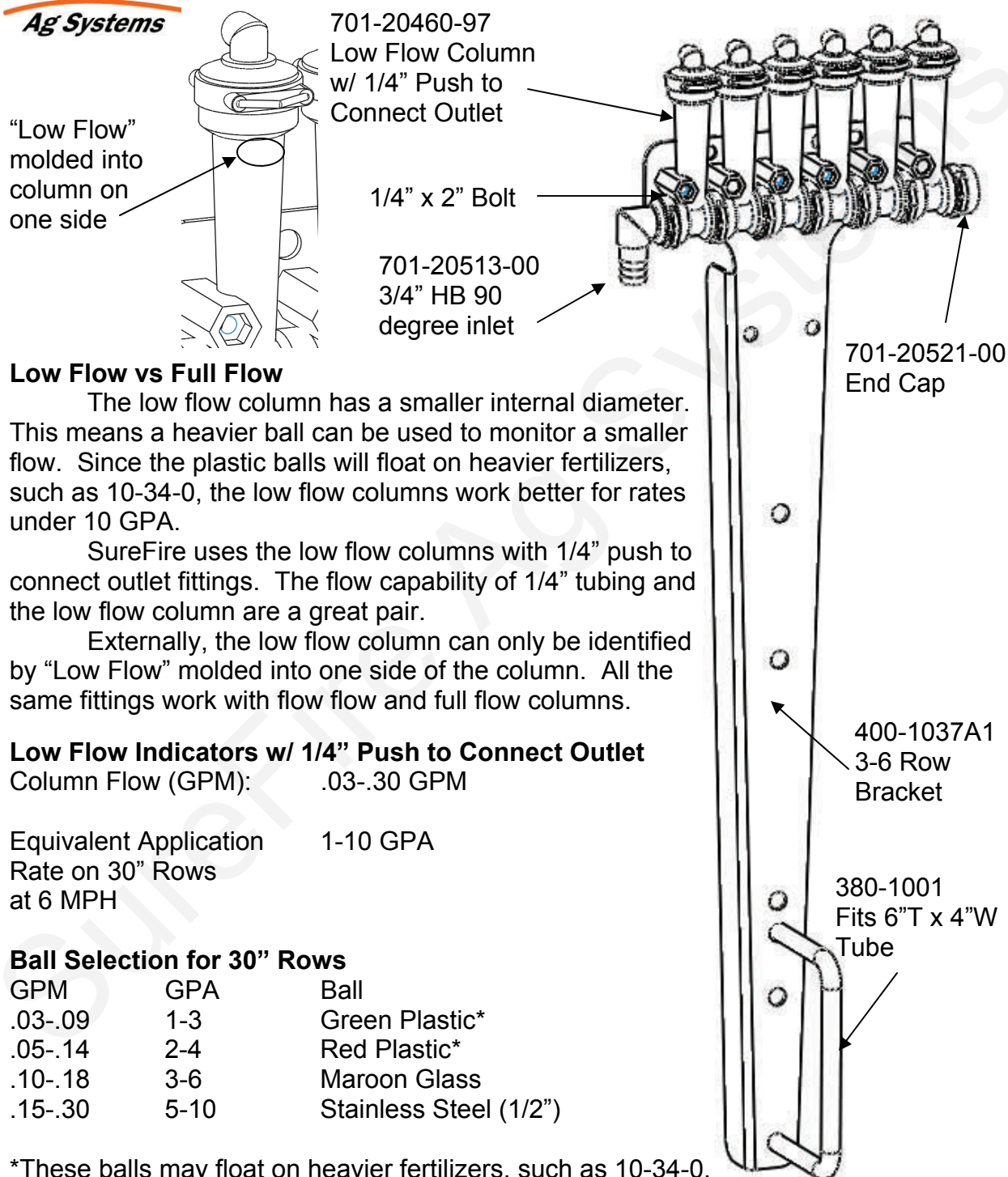
Ball Selection for 30" Rows

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.



Floating Ball Flow Indicators- Low Flow Column



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 capability 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 flow flow and full flow columns.

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

Column Flow (GPM): .03-.30 GPM

Equivalent Application 1-10 GPA

Rate on 30" Rows
at 6 MPH

Ball Selection for 30" Rows

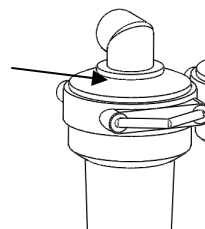
GPM	GPA	Ball
.03-.09	1-3	Green Plastic*
.05-.14	2-4	Red Plastic*
.10-.18	3-6	Maroon Glass
.15-.30	5-10	Stainless Steel (1/2")

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



Floating Ball Flow Indicators- Metering Orifice Selection

Metering orifices push into place underneath each outlet fitting



Application Rate (gal/ac) 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 PN 701-21035	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
	50	0.176	7.71	6.85	6.17	5.61	5.14	4.74	4.41
40 PN 701-21040	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
	50	0.228	9.99	8.88	7.99	7.26	6.66	6.15	5.71
46 PN 701-21046	5	0.095	4.16	3.70	3.33	3.03	2.77	2.56	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	0.27	11.83	10.51	9.46	8.60	7.88	7.28	6.76
	50	0.302	13.23	11.76	10.58	9.62	8.82	8.14	7.56
52 PN 701-21052	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	0.29	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
	50	0.375	16.43	14.60	13.14	11.95	10.95	10.11	9.39
63 PN 701-21063	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
	50	0.549	24.05	21.38	19.24	17.49	16.03	14.80	13.74
78 PN 701-21078	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	0.77	33.73	29.98	26.98	24.53	22.49	20.76	19.27
	50	0.861	37.72	33.53	30.17	27.43	25.14	23.21	21.55
98 PN 701-21098	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	1.08	47.31	42.05	37.85	34.41	31.54	29.11	27.03
	40	1.25	54.76	48.67	43.81	39.82	36.50	33.70	31.29
	50	1.4	61.33	54.51	49.06	44.60	40.88	37.74	35.04
130 PN 701-21130	5	0.774	33.91	30.14	27.12	24.66	22.60	20.86	19.37
	10	1.1	48.19	42.83	38.55	35.04	32.12	29.65	27.53
	20	1.55	67.90	60.35	54.32	49.38	45.27	41.78	38.80
	30	1.9	83.23	73.98	66.58	60.53	55.49	51.22	47.56
	40	2.19	95.93	85.27	76.75	69.77	63.96	59.04	54.82
	50	2.45	107.32	95.40	85.86	78.05	71.55	66.04	61.33

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

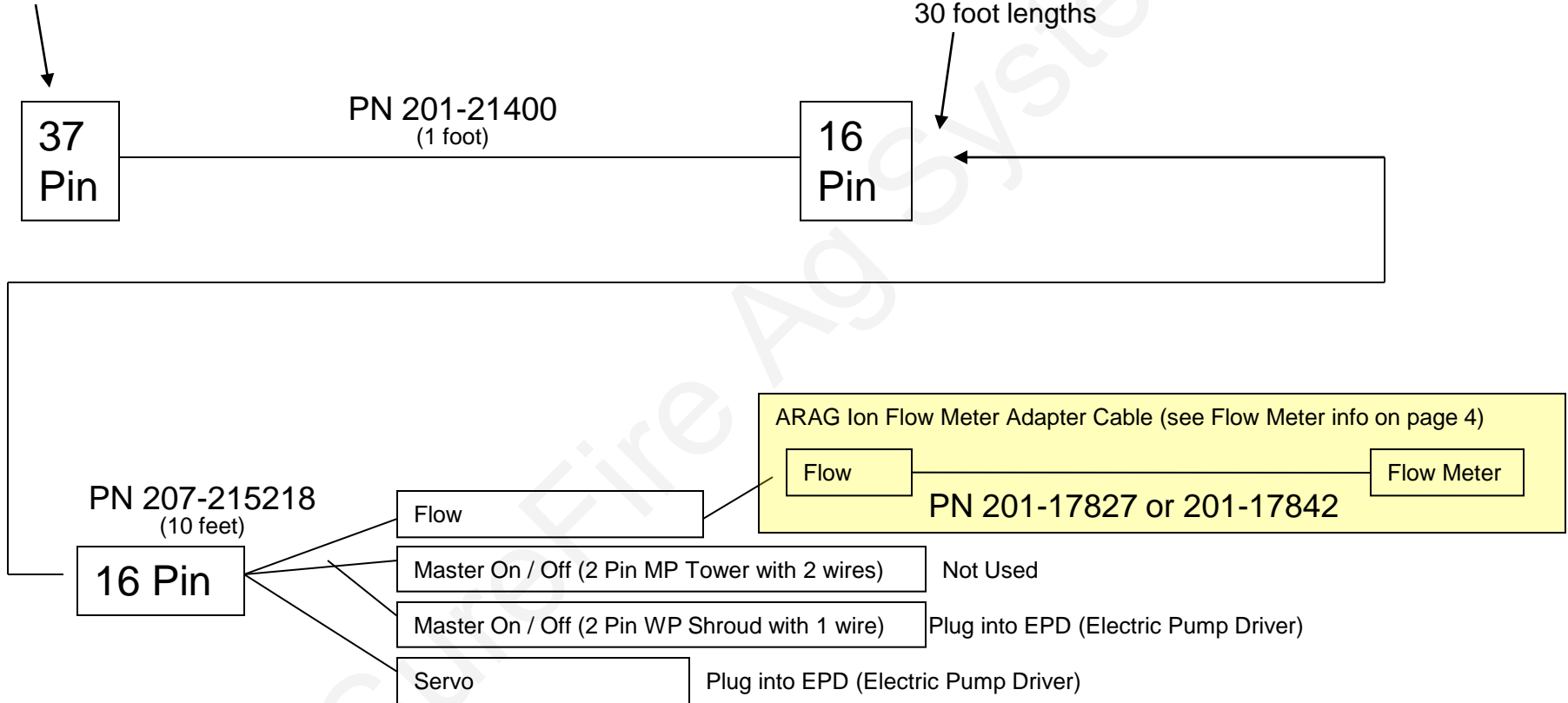


John Deere GS2 Wiring Schematic

Single Section for Electric Pump Liquid Application

37 Pin round connector
plugs into harness from
John Deere Rate Controller

Add 16 pin extensions as
necessary, available in 10, 20, and
30 foot lengths

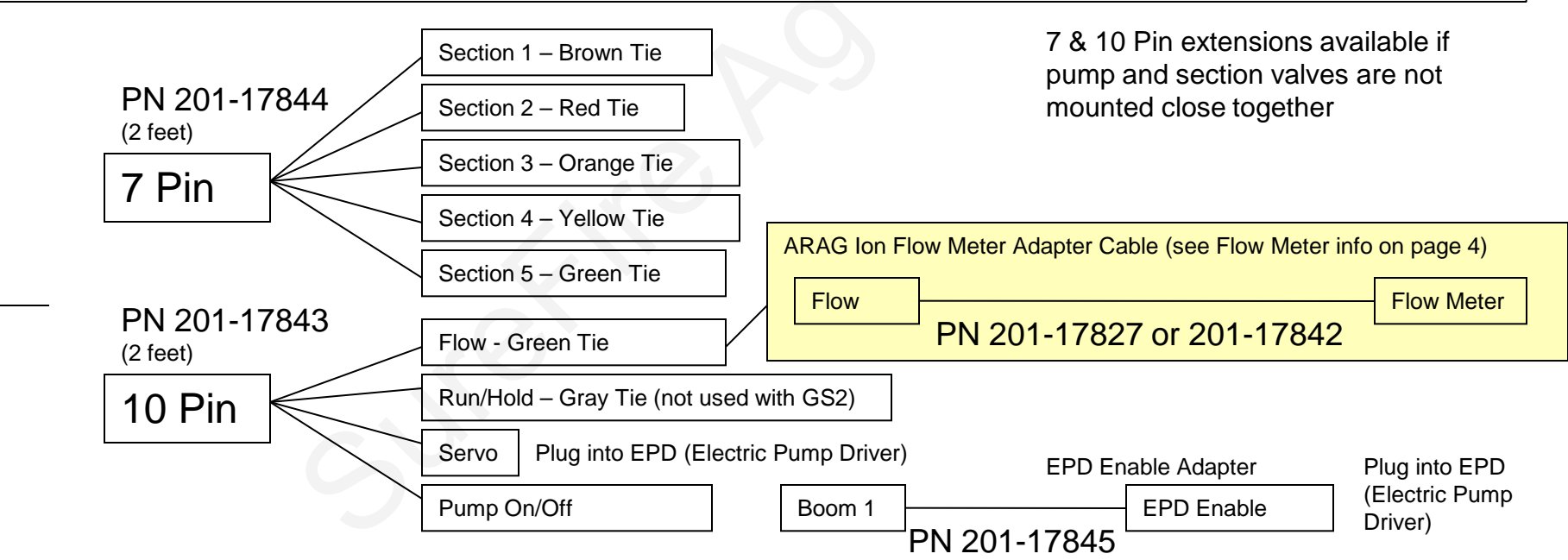
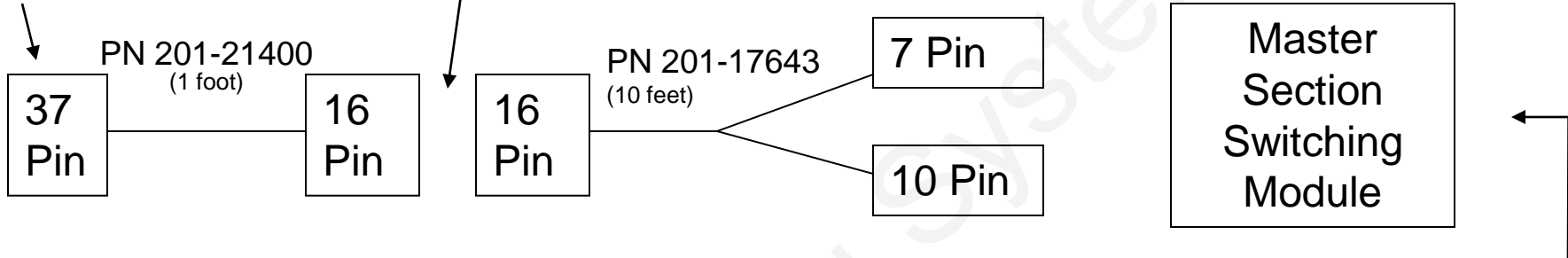




John Deere GS2 Wiring Schematic

2-5 Sections for Electric Pump Liquid Application

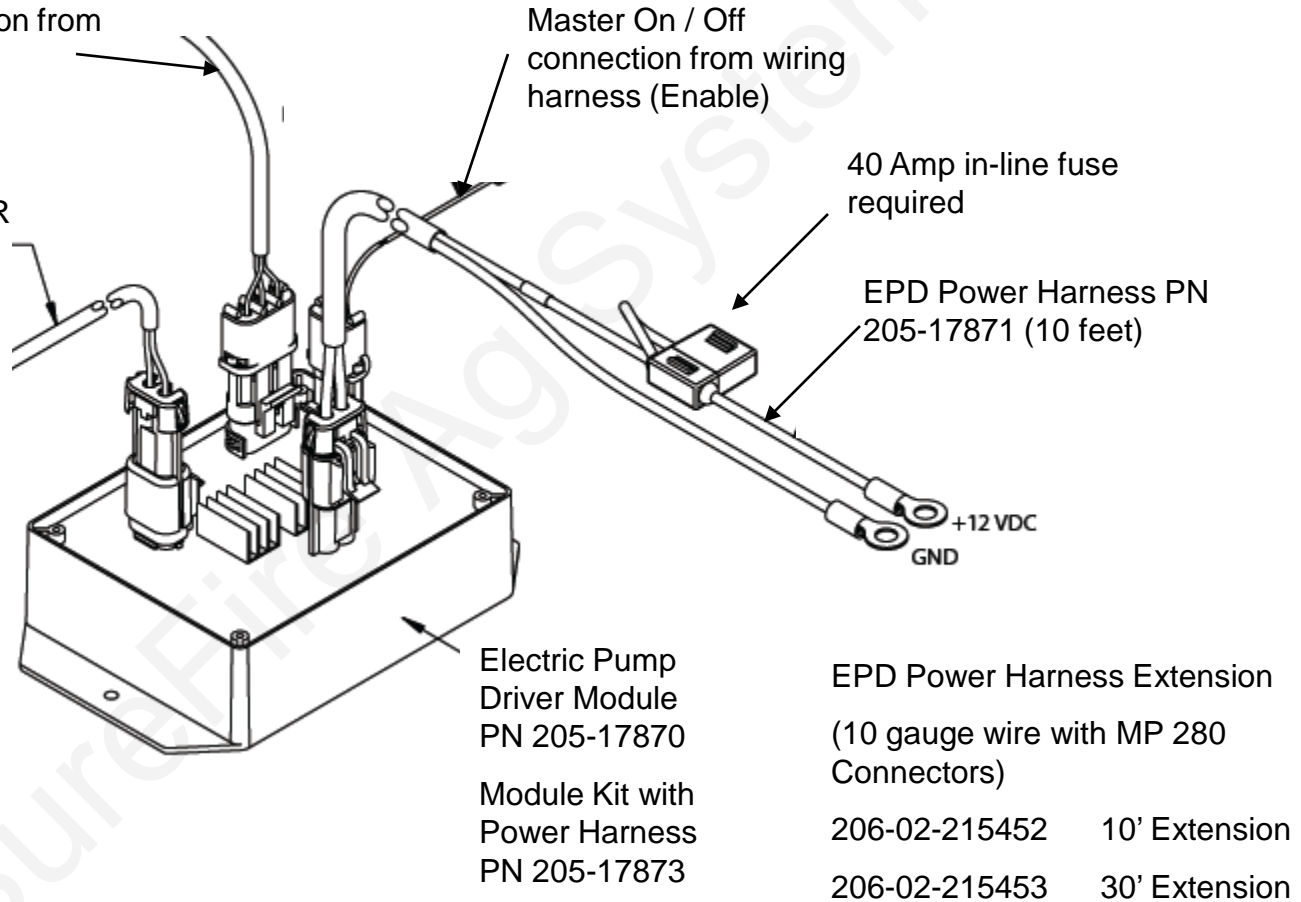
37 Pin round connector plugs into harness from John Deere Rate Controller





John Deere GS2 Wiring Schematic

40 Amp Electric Pump Driver (EPD) Harness Connections For Servo Input Signal



Plug in 1 pump directly OR plug in 2 pumps with "Y" cable, PN 205-215455.

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 10 gauge wire if extending harnesses in the field.



Wiring Harness Appendix for GS2 Compatible Systems

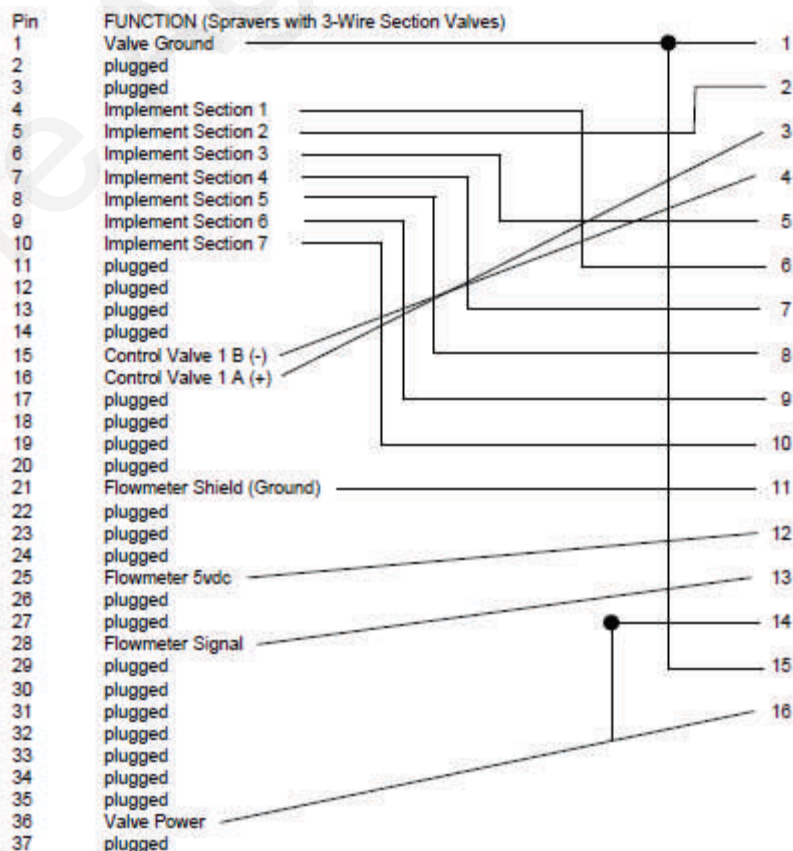
Pictures and schematics of wiring harnesses are attached. Use this information for troubleshooting if system is not functioning correctly.

Description: 37 Pin to 16 Pin Adapter

Part Number: 201-21400

Application: This harness converts the 37 pin connector that comes out of the GS2 Rate Controller to a 16 pin connector commonly used in application control systems.

Harness (37-Pin Connector to 16 Pin Adapter)





Wiring Harness Appendix

Description: GS2 Flow, Servo, Pump On/Off Cable

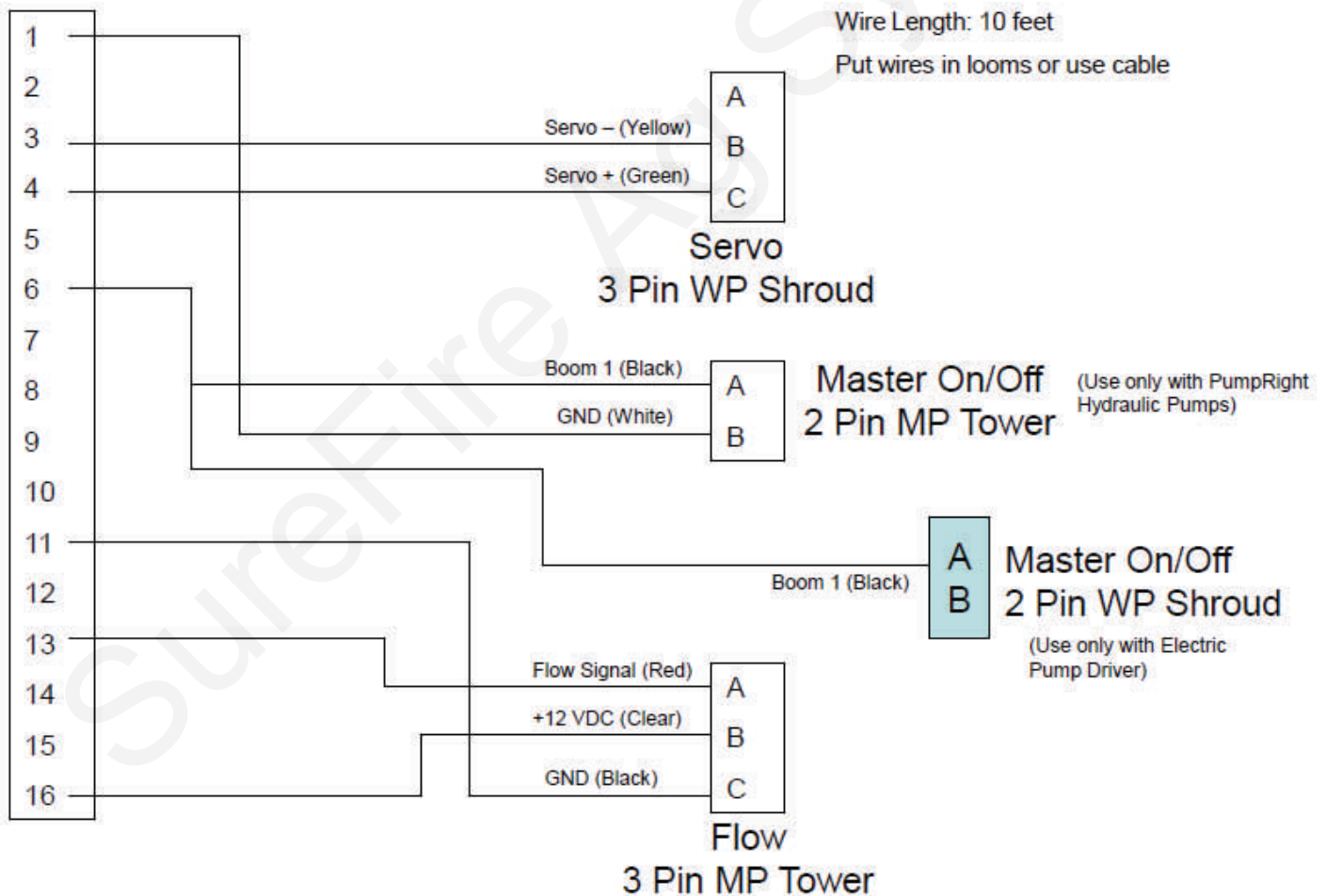
Part Number: 207-215218

Length: 10 feet

Application: Used in single section systems this harness goes from the 16 pin connector out to the fertilizer system components. On all systems, it attaches to the flow meter.

In electric pump systems the servo and Master On/Off attach to the EPD.

On PumpRight hydraulic pumps, servo wires attaches to the hydraulic servo valve. The Master On/Off attaches to the valve contained on the motor mounted



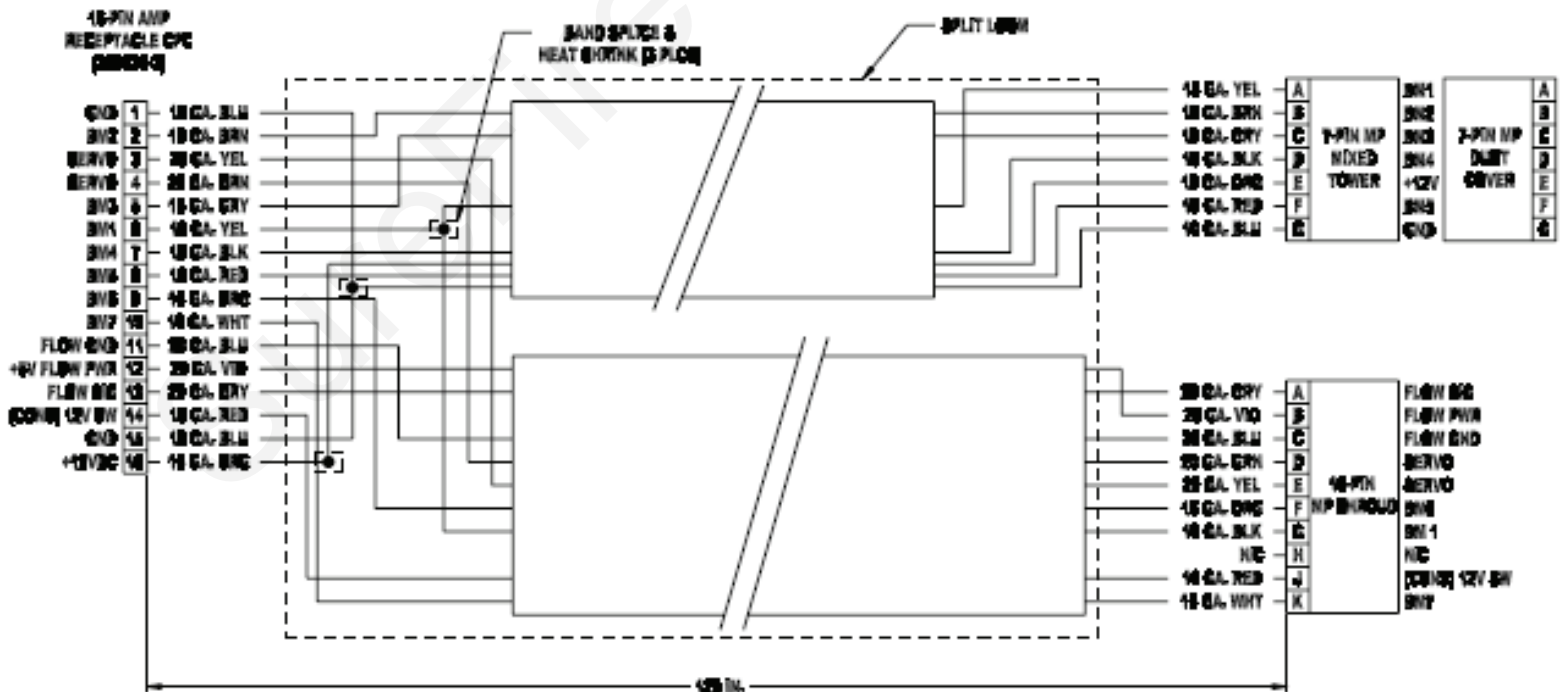
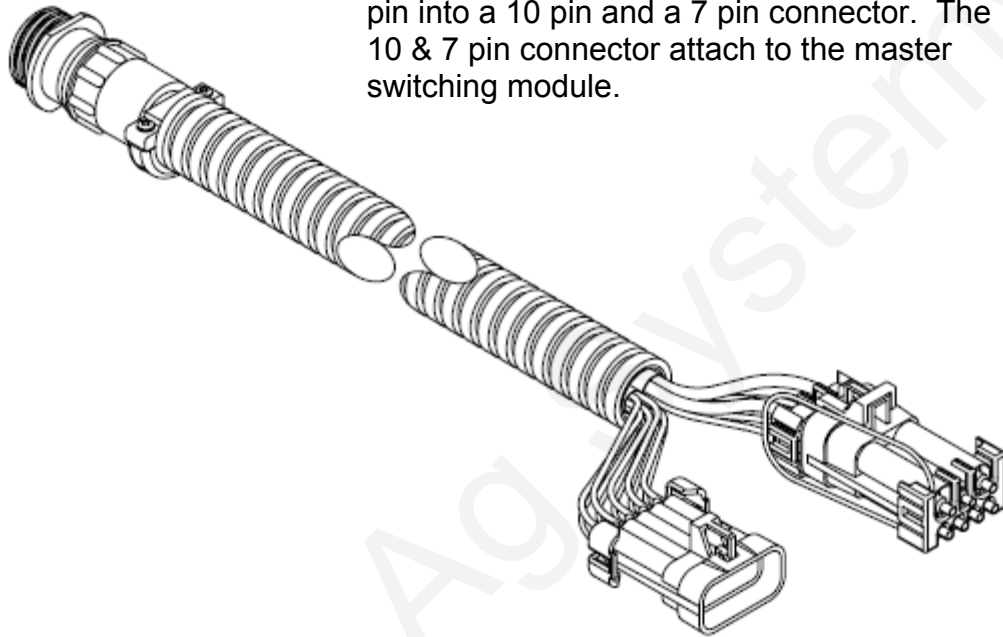


Wiring Harness Appendix

Description: 16 Pin to 10&7 Pin Adapter
Part Number: 201-17643

Length: 10 feet

Application: Used in multiple section systems (2-5 sections), this harness splits the 16 pin into a 10 pin and a 7 pin connector. The 10 & 7 pin connector attach to the master switching module.

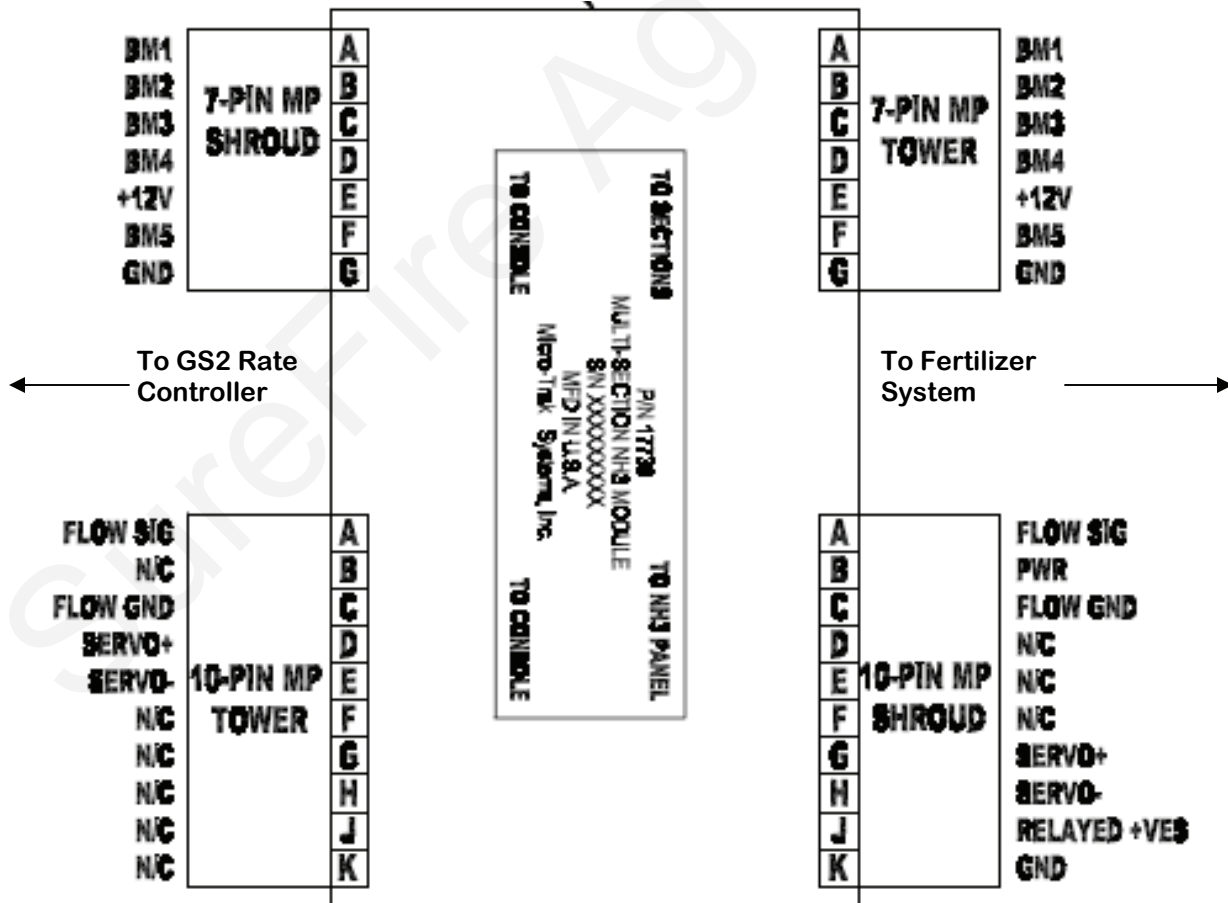
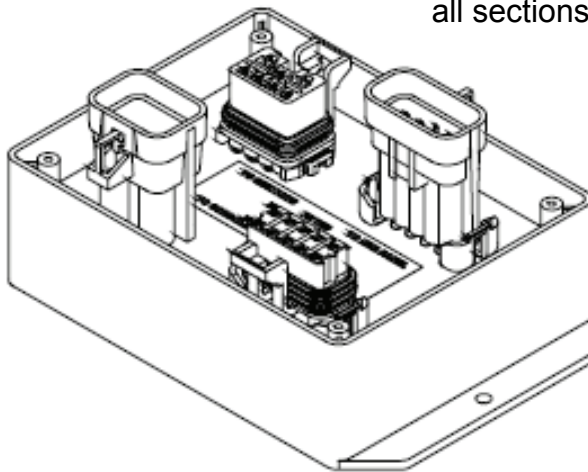




Wiring Harness Appendix

Description: Master Section Switching Module
Part Number: 201-17739

Application: Used in multiple section systems (2-5 sections), this module turns the pump(s) on and off. If any section is on, the pump is turned on. If all sections are off, the pump is turned off.



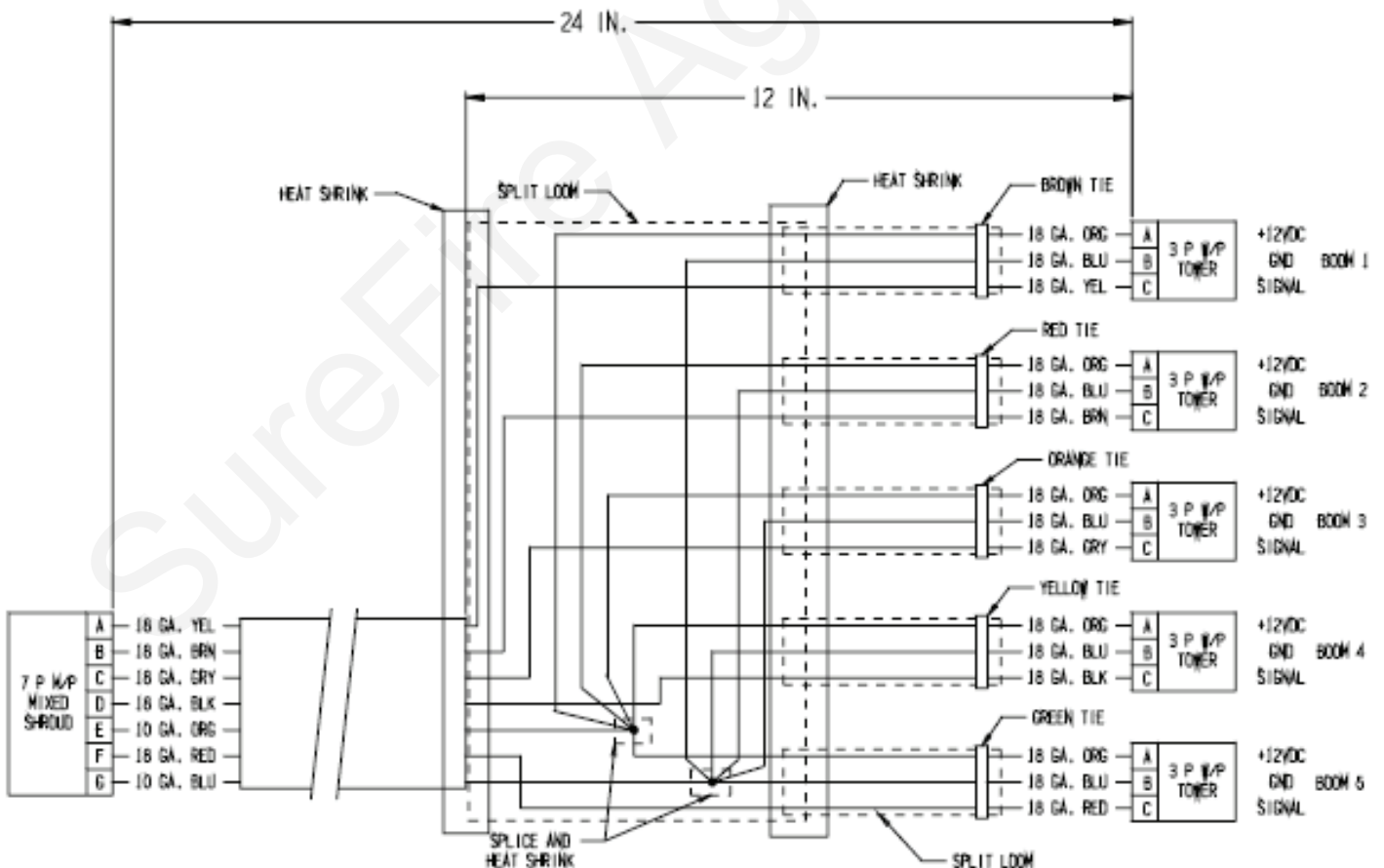
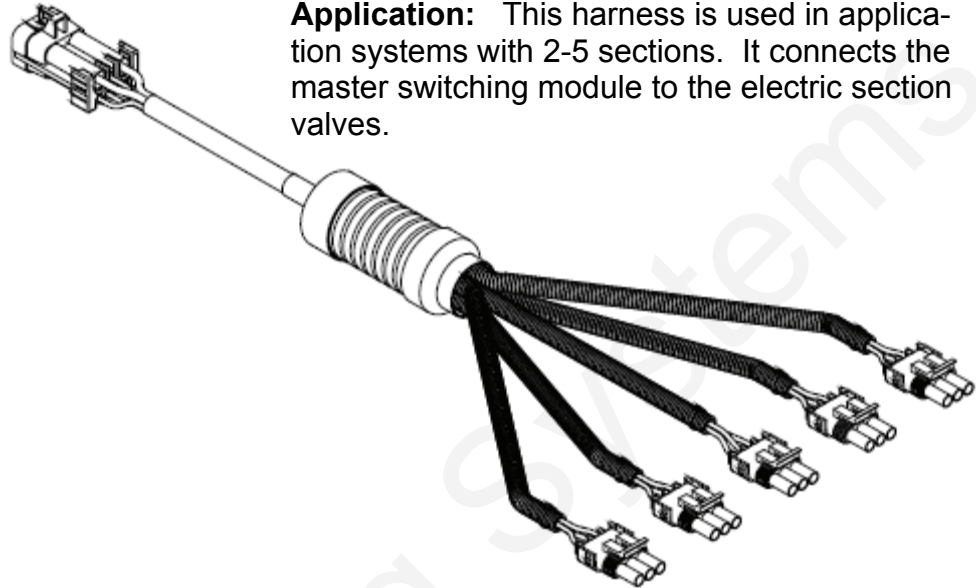


Wiring Harness Appendix

Description: 5 Section Branch Harness
Part Number: 201-17844

Length: 2 feet

Application: This harness is used in application systems with 2-5 sections. It connects the master switching module to the electric section valves.





Wiring Harness Appendix

Description:

Part Number: 201-17843

Length: 2 feet

Application: This harness is used in application systems with 2-5 sections. It connects the master switching module to the flow meter and electric pump driver (EPD). The Run/Hold connector is not used in GS2 applications.

