

OHIO VALLEY AG

Fertilizer & Application Equipment Headquarters

***“Endeavor
Electric Pump
Fertilizer System
for John Deere GS2
with Servo Control”***



ENDEAVOR

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 2-6 sections using electric ball valves.

Application Ranges: The Endeavor system with two 4.2 electric pumps can deliver 5 GPM of 10-34-0 fertilizer or 6 GPM of 10-34-0 with the two 5.3 electric pumps. NO AGITATION flow is possible at the maximum rate. John Deere Components required: GS2 2600 Display GS2 2600 Rate Controller with 37 Pin Connector. Please consult your GS2 operators manual for GS2 operating instructions.

System Components:

The Endeavor 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 the Endeavor system will use 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 Endeavor kit.

The rate controller has a large round 37 pin connector for application equipment. The Endeavor system will plug straight into the 37 pin connector on the Deere rate controller used on application

systems. Extension harnesses may be needed depending on equipment size. 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.

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.**

How the pump system works:

The Electric Pump Driver (EPD) sends a Servo 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.

Multiple Section Liquid Fertilizer Systems:

Endeavor 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.

Endeavor system will work with 2-6 sections. With the GS2, these sections can be of varying widths.

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 XXYZ. 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. The Endeavor system will work best with 9911.

Alarms Setup:

OVA 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.

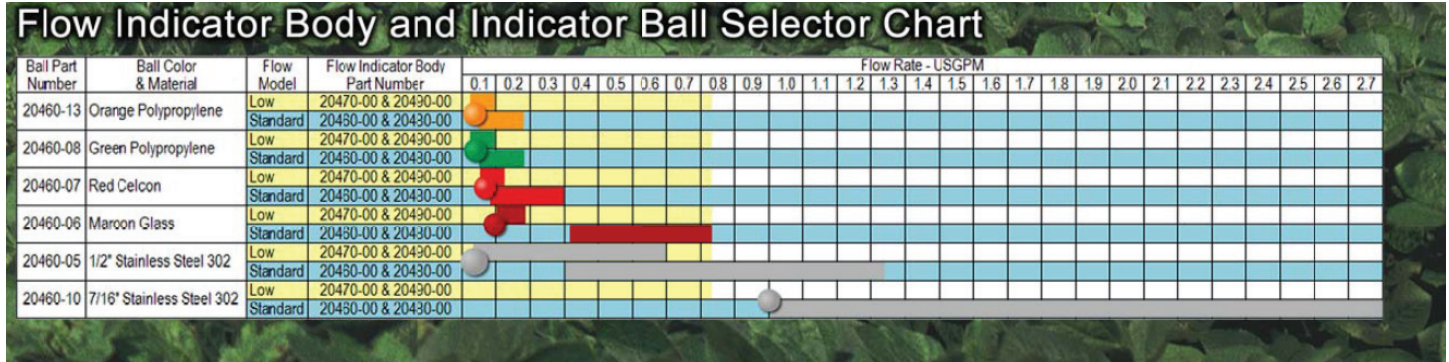
Initial System Operation Procedure:

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 (0volts 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.
 - When operating at low speed and or low rates, opening the throttling valve will allow for higher pump speed and will produce a more stable flow rate to the units.

- When you can read an increasing and decreasing flow using the (+) and (-) buttons, the pump system is working correctly.
- 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.

To select an Indicator Ball please use graph below.



To select a Metering Orifice from the chart below, follow these steps:

Step 1 - Calculate the Flow Rate required per nozzle or opener with the following formula:
 $Flow\ Rate = Application\ Rate \times Speed \times Spacing \times Nozzles\ or\ Openers \times Conversion\ Factor / 5940$
 Where:
 - Flow Rate per nozzle or opener (USGPM) - Application Rate (US gal/acre)
 - Speed of applicator (mph) - Spacing of nozzles or openers (inches)
 - Nozzles or Openers supplied by Flow Indicator (#) - Conversion Factor* (#)

* The Metering Orifice selection chart is based on water. Fertilizer is more viscous than water so a larger orifice is required for a given flow rate of fertilizer, compared to water. To determine the conversion factor for a given fertilizer, obtain the weight for one US gallon and the specific gravity of the fertilizer and select the applicable conversion factor below. The Conversion Factor can also be calculated using the Conversion Factor Calculator which is included with the Flow Indicator Ball & Metering Disc Selector which can be downloaded from the FLOW VIEW Ball Flow Indicators section of the Downloads page of www.wilger.net.

Weight (lbs/US gallon)	10.00	10.50	11.00	11.50	12.00	12.50	13.00	13.50	14.00
Specific Gravity	1.20	1.26	1.32	1.38	1.44	1.50	1.56	1.62	1.68
Conversion Factor	1.10	1.12	1.15	1.17	1.20	1.22	1.25	1.27	1.30

Step 2 - Select a Metering Orifice and operating pressure
 On the chart below, locate the flow rates closest to your requirement. Select a Metering Orifice with an operating pressure in the middle of its range.

Part Number	Pressure (psi)						Part Number	Pressure (psi)						Part Number	Pressure (psi)					
	5	10	15	20	30	40		5	10	15	20	30	40		5	10	15	20	30	40
21009-XX	0.004	0.005	0.006	0.007	0.009	0.010	21050-XX	0.16	0.22	0.27	0.32	0.39	0.45	21120-XX	0.63	0.89	1.09	1.28	1.54	1.78
21011-XX	0.008	0.008	0.010	0.011	0.014	0.016	21061-XX	0.16	0.23	0.29	0.33	0.40	0.47	21125-XX	0.69	0.98	1.20	1.39	1.70	1.96
21013-XX	0.008	0.011	0.013	0.016	0.019	0.022	21063-XX	0.17	0.25	0.30	0.35	0.43	0.49	21128-XX	0.72	1.02	1.25	1.45	1.77	2.04
21015-XX	0.010	0.014	0.018	0.020	0.025	0.029	21064-XX	0.18	0.25	0.31	0.36	0.44	0.51	21130-XX	0.75	1.06	1.30	1.50	1.84	2.12
21018-XX	0.015	0.021	0.025	0.029	0.036	0.042	21065-XX	0.18	0.26	0.32	0.37	0.45	0.52	21132-XX	0.78	1.10	1.34	1.55	1.90	2.19
21020-XX	0.018	0.026	0.032	0.037	0.045	0.052	21067-XX	0.20	0.28	0.34	0.39	0.48	0.56	21136-XX	0.84	1.19	1.46	1.68	2.06	2.38
21022-XX	0.022	0.031	0.037	0.043	0.053	0.061	21070-XX	0.22	0.31	0.37	0.43	0.53	0.61	21140-XX	0.89	1.26	1.55	1.79	2.19	2.53
21025-XX	0.028	0.039	0.048	0.056	0.068	0.079	21073-XX	0.23	0.33	0.40	0.47	0.57	0.66	21144-XX	0.93	1.31	1.61	1.85	2.27	2.62
21026-XX	0.030	0.043	0.052	0.060	0.074	0.085	21075-XX	0.25	0.35	0.42	0.49	0.60	0.69	21147-XX	0.95	1.35	1.65	1.90	2.33	2.69
21028-XX	0.035	0.049	0.060	0.069	0.085	0.098	21078-XX	0.27	0.39	0.47	0.54	0.67	0.77	21150-XX	1.02	1.44	1.77	2.04	2.50	2.89
21029-XX	0.038	0.054	0.066	0.077	0.094	0.11	21081-XX	0.29	0.41	0.50	0.58	0.71	0.82	21152-XX	1.05	1.49	1.82	2.10	2.58	2.98
21031-XX	0.043	0.061	0.075	0.087	0.11	0.12	21086-XX	0.33	0.47	0.57	0.66	0.81	0.94	21156-XX	1.10	1.55	1.90	2.20	2.69	3.11
21033-XX	0.052	0.073	0.090	0.10	0.13	0.15	21089-XX	0.35	0.49	0.60	0.69	0.85	0.99	21161-XX	1.16	1.63	2.00	2.31	2.83	3.27
21035-XX	0.055	0.079	0.096	0.11	0.14	0.16	21091-XX	0.37	0.52	0.64	0.74	0.91	1.05	21166-XX	1.21	1.71	2.10	2.42	2.97	3.43
21037-XX	0.061	0.086	0.11	0.12	0.15	0.17	21093-XX	0.39	0.56	0.67	0.77	0.95	1.09	21171-XX	1.33	1.89	2.30	2.66	3.26	3.76
21039-XX	0.067	0.096	0.12	0.13	0.17	0.19	21096-XX	0.42	0.60	0.72	0.83	1.02	1.18	21177-XX	1.41	2.00	2.45	2.83	3.46	4.00
21040-XX	0.072	0.10	0.13	0.14	0.18	0.20	21097-XX	0.43	0.61	0.74	0.85	1.05	1.21	21182-XX	1.47	2.08	2.55	2.95	3.61	4.17
21043-XX	0.082	0.12	0.14	0.16	0.20	0.23	21098-XX	0.44	0.62	0.76	0.88	1.08	1.25	21187-XX	1.56	2.21	2.70	3.12	3.82	4.41
21047-XX	0.097	0.14	0.17	0.19	0.24	0.27	21103-XX	0.46	0.65	0.80	0.92	1.13	1.30	21196-XX	1.73	2.45	3.00	3.46	4.24	4.90
21049-XX	0.10	0.15	0.18	0.21	0.26	0.29	21104-XX	0.48	0.68	0.83	0.96	1.17	1.35	21205-XX	1.87	2.65	3.25	3.75	4.59	5.30
21052-XX	0.12	0.17	0.21	0.24	0.29	0.33	21107-XX	0.52	0.73	0.90	1.04	1.27	1.47	21213-XX	2.02	2.85	3.49	4.03	4.94	5.70
21053-XX	0.12	0.17	0.21	0.24	0.30	0.35	21110-XX	0.55	0.77	0.95	1.09	1.34	1.55	21218-XX	2.11	2.98	3.65	4.21	5.16	5.95
21055-XX	0.13	0.19	0.23	0.27	0.33	0.38	21113-XX	0.58	0.82	1.01	1.16	1.42	1.64	21234-XX	2.45	3.47	4.25	4.91	6.01	6.94
21057-XX	0.14	0.20	0.24	0.28	0.35	0.40	21116-XX	0.61	0.88	1.05	1.22	1.49	1.72	21250-XX	2.83	4.00	4.90	5.58	6.83	8.00

Part Number Code: The 3 numbers following 21 are the orifice size in 0.000"; Suffix (XX): -00 for Buna, -V0 for Viton. Some orifice sizes are not shown. Please consult factory for additional orifice sizes.

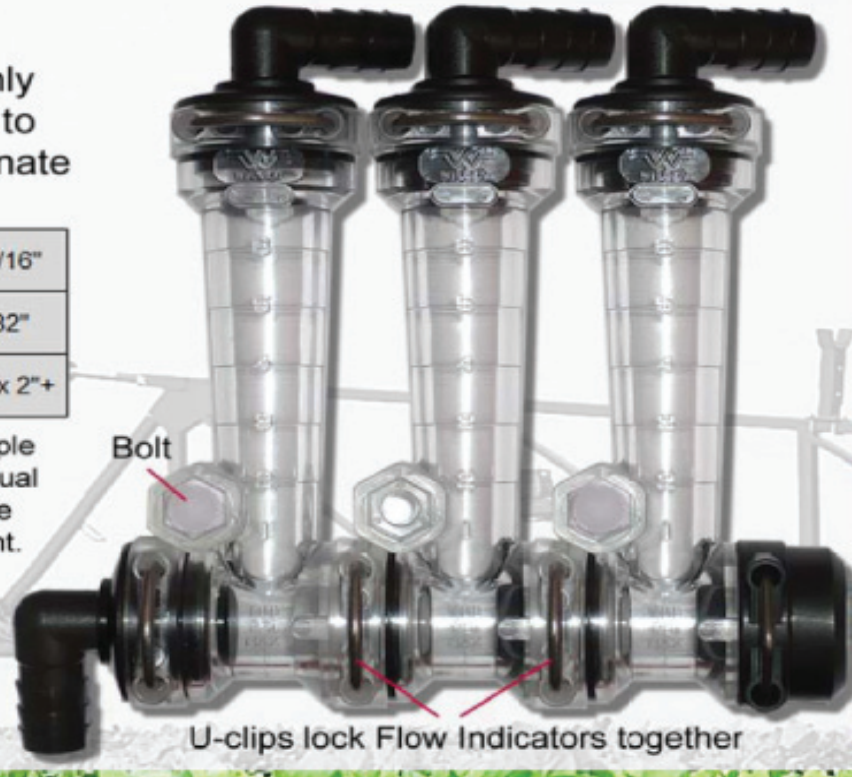
Manifold models

Multiple Flow Indicators are fed by a single line and lock to the adjacent Indicator with a U-clip.

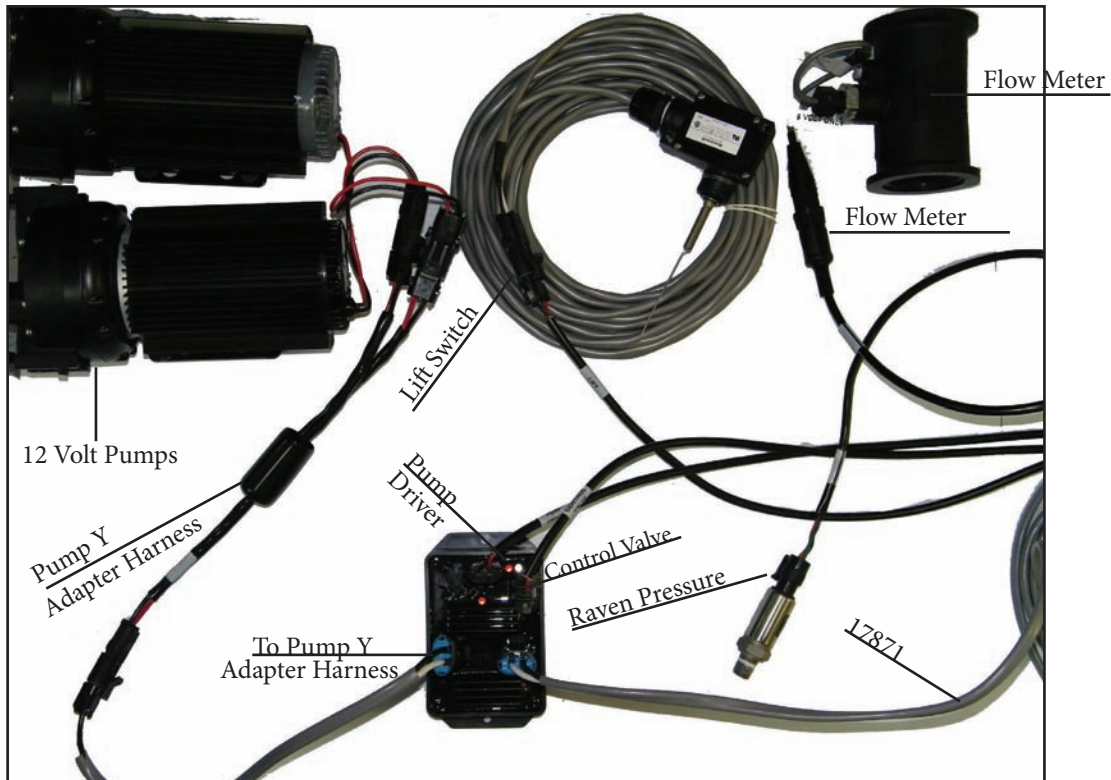
Flow Indicators only need to be bolted to the mount at alternate mounting holes.

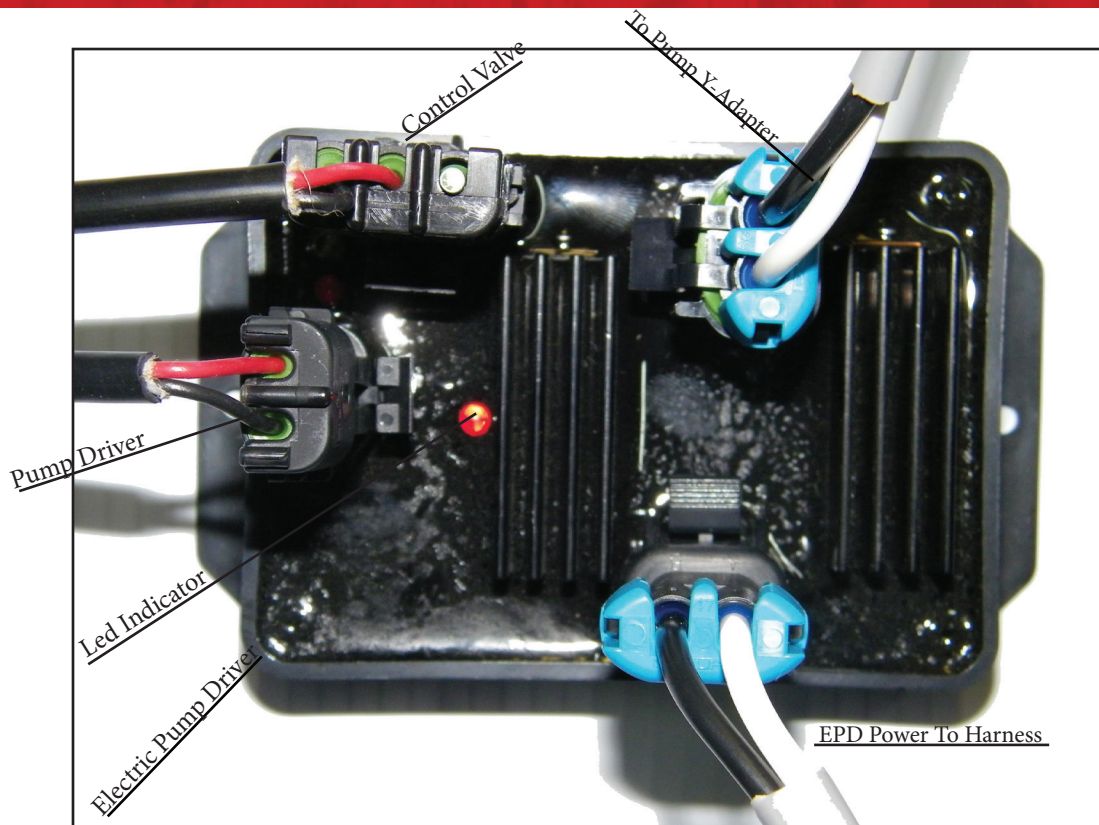
Nominal distance between holes*	1-9/16"
Hole size to drill	9/32"
Bolt size to use (+) (+ mount thickness)	1/4" x 2"+

* When mounting multiple units measure the actual hole spacing to ensure correct hole placement.



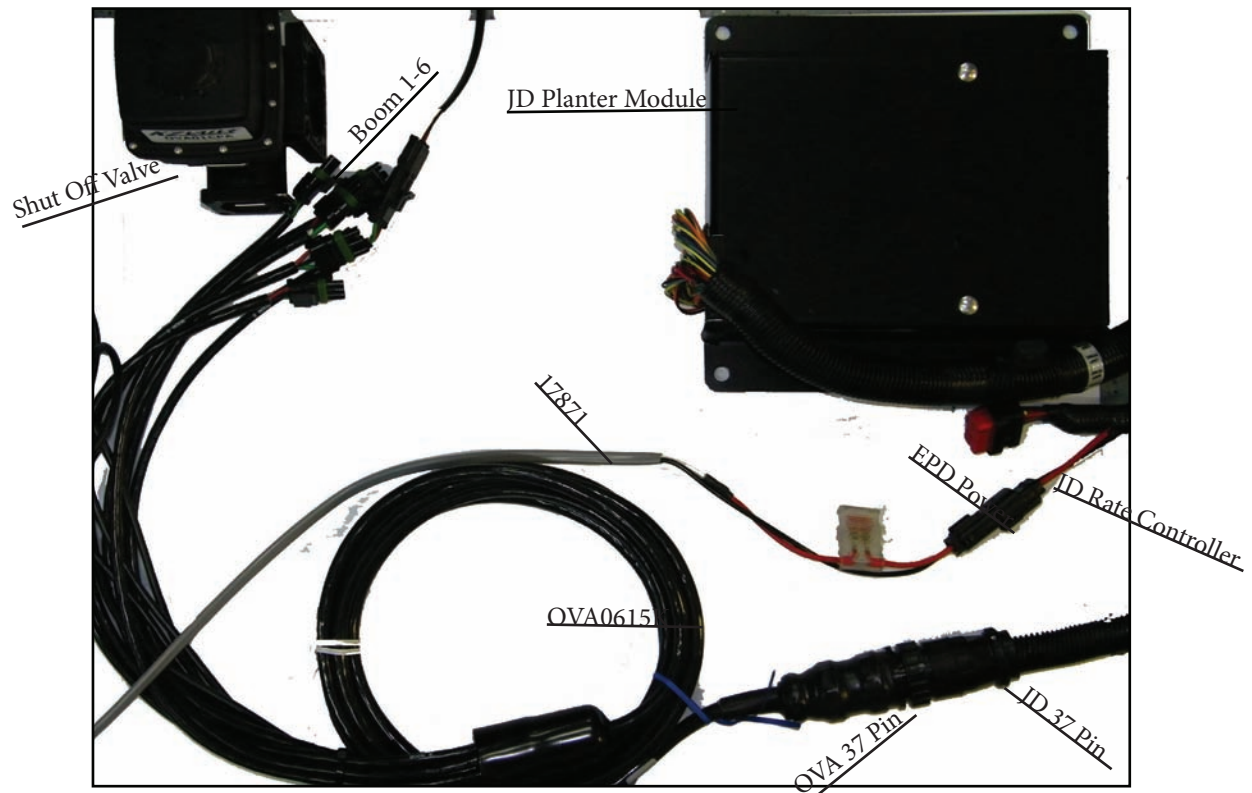
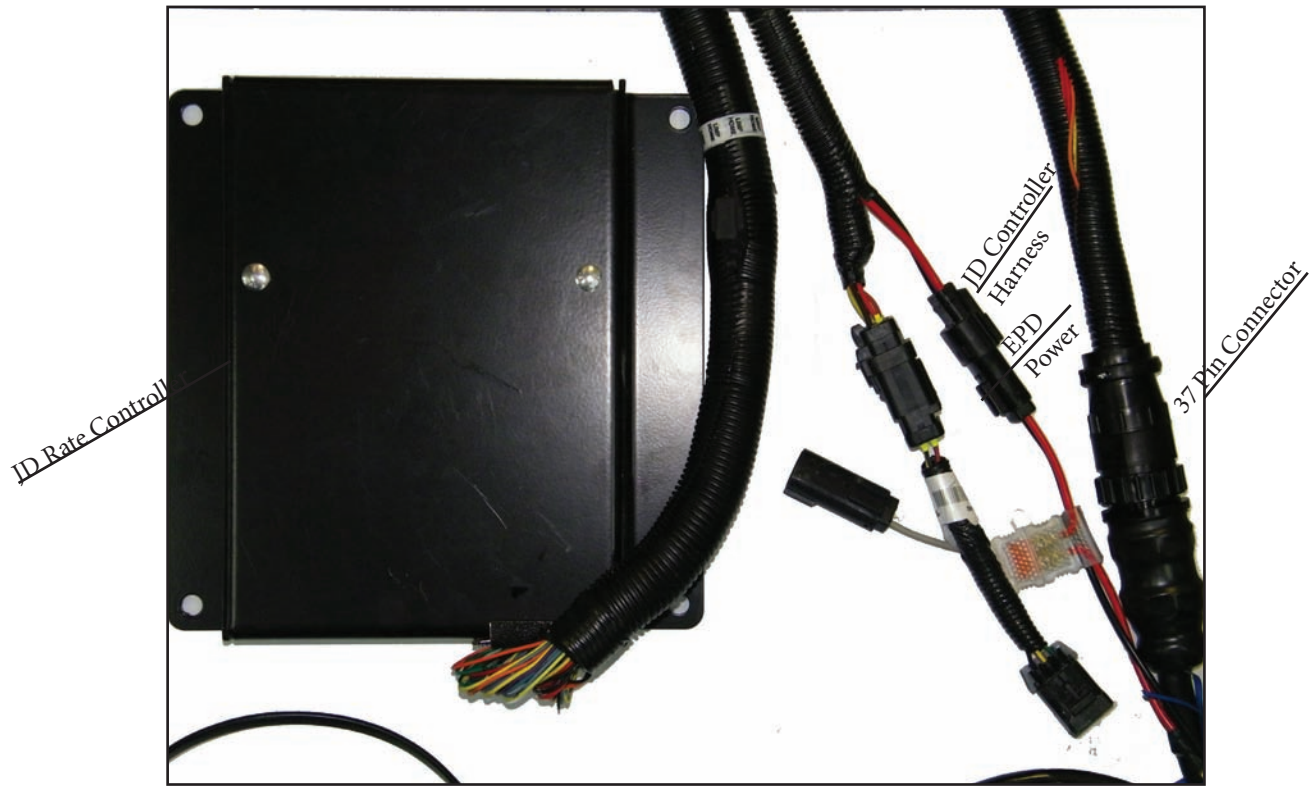
System Components:



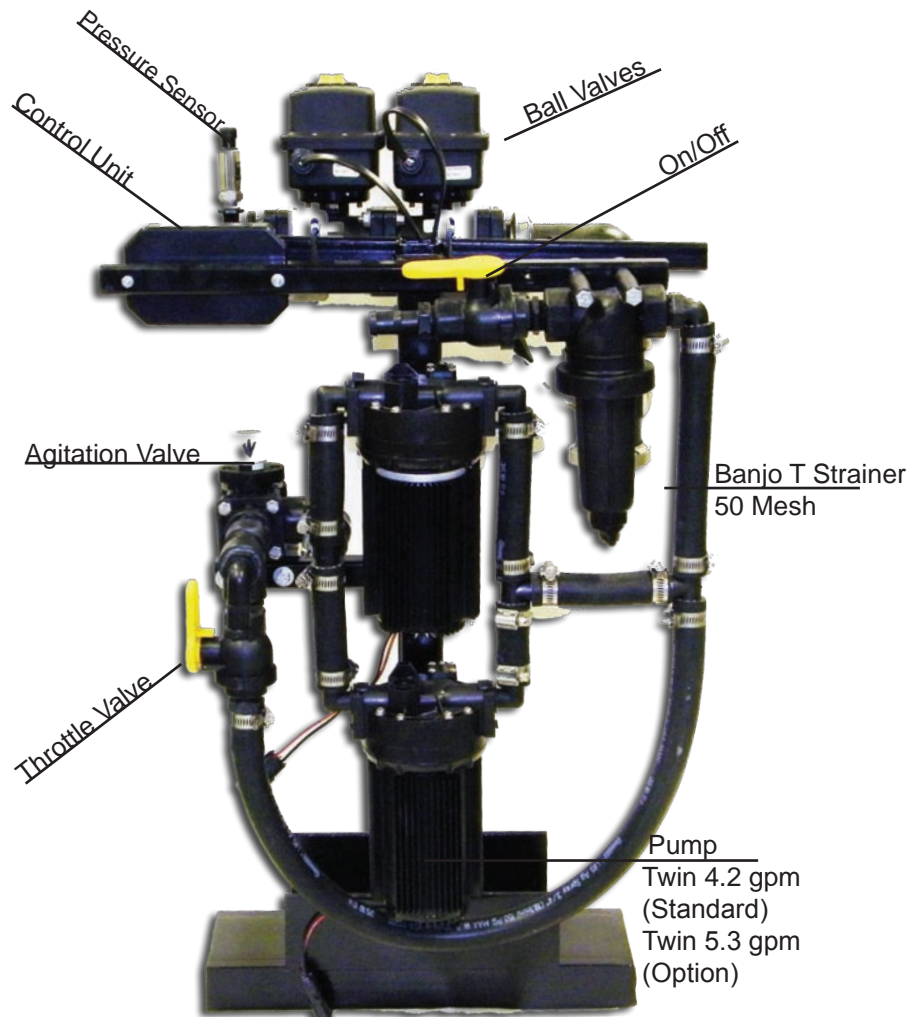


Functions of System Status LED:

1. On steadily if switch is on and controller is operating normally.
2. Flashes steadily when in **HOLD**.
3. If there is a problem with the wiring or motor, the light will flash to indicate the system status.
 - If the console shuts down due to thermal overload due to a shorted motor or motor leads, the lamp will flash twice, pause, flash twice, pause, etc.
 - If other system problems occur requiring a call to Ohio Valley Ag, please count the number of flashes to help with troubleshooting.



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