



# OHIO VALLEY AG

Precision Application & AG Spray Headquarters

Operations Manual

## **“Endeavor Fertilizer Controller”**

**Electric Pump  
Fertilizer System  
for John Deere GS2/GS3  
with PWM Control**

- » **Trimble - EZ Boom & Field IQ**
- » **Ag Leader - Insight**
- » **Case - Pro 600/700**
- » **Raven - 440/450**



**ENDEAVOR**

### **Controller Manufacturer:**

The ENDEAVOR fertilizer controller automatically controls 12 volt pumps applying liquid fertilizer and other at plant in furrow treatments. It's capable of controlling up to 10 sections and can be used with any swath control system to automatically shut on/off sections. The ENDEAVOR can be controlled by many existing third party controllers such as John Deere GS2/GS3, Ag Leader Integra/Insight, Trimble EZ Boom/Field IQ, Case Pro600/700, and Raven 440/450. Microtrak 3, 5, and 7 section consoles will control the ENDEAVOR when third party controllers are not being used.

The ENDEAVOR comes pre-assembled, plumbed, and wired on a slim profile mounting stand for simple installation. Wilger flow indicators with mounting stand included allows you to monitor flow to each row while low pressure diaphragm check valves keep all fertilizer lines fully charged. The ENDEAVOR can be configured with multiple size pumps to fit grower's demands. Application rates from 1 to 8 gallons per acre are achievable. The ENDEAVOR comes with a 1 year warranty on all components, and KZ section valves will be warranted for 2 years.

### ***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:***

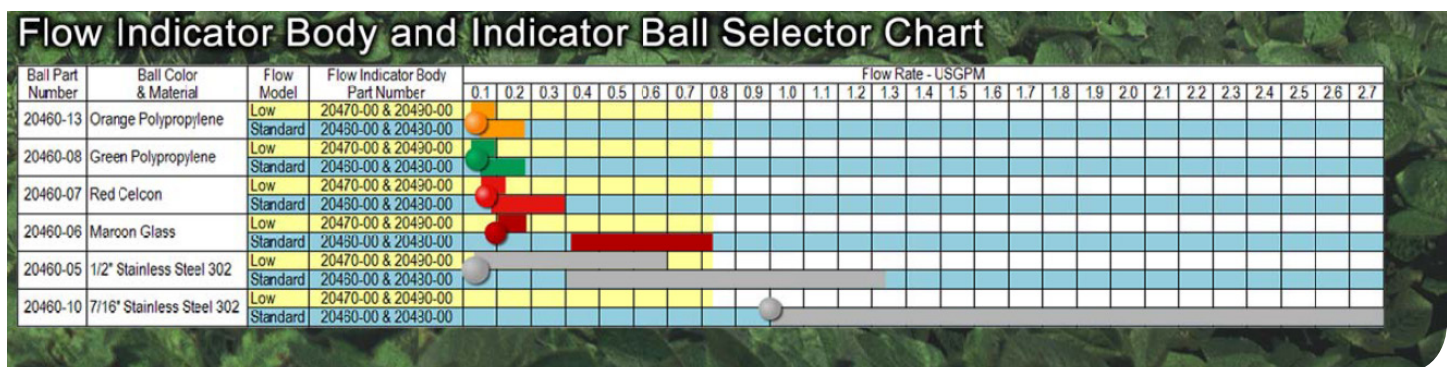
Up to 3 rates can be entered for quick changes between these rates. Check the Rate Smoothing box on this screen for best performance.

## **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 (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. ***(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.)***
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.

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:**

$$\text{Flow Rate} = \text{Application Rate} \times \text{Speed} \times \text{Spacing} \times \text{Nozzles or Openers} \times \text{Conversion Factor} / 5940$$

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 or 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					
	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	21080-XX	0.16	0.22	0.27	0.32	0.39	0.45	21120-XX	0.63	0.89	1.09	1.26	1.54	1.78
21011-XX	0.005	0.008	0.010	0.011	0.014	0.016	21081-XX	0.18	0.23	0.29	0.33	0.40	0.47	21125-XX	0.69	0.98	1.20	1.39	1.70	1.98
21013-XX	0.008	0.011	0.013	0.016	0.019	0.022	21083-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	21084-XX	0.18	0.26	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	21085-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	21087-XX	0.20	0.28	0.34	0.39	0.48	0.56	21135-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	0.98	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	0.55	0.67	0.77	0.95	1.09	21171-XX	1.23	1.83	2.30	2.63	3.26	3.76
21039-XX	0.067	0.096	0.12	0.13	0.17	0.19	21096-XX	0.42	0.59	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	0.86	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	1.59	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	5.98
21056-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	0.86	1.05	1.22	1.49	1.72	21250-XX	2.83	4.00	4.90	5.68	6.93	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.

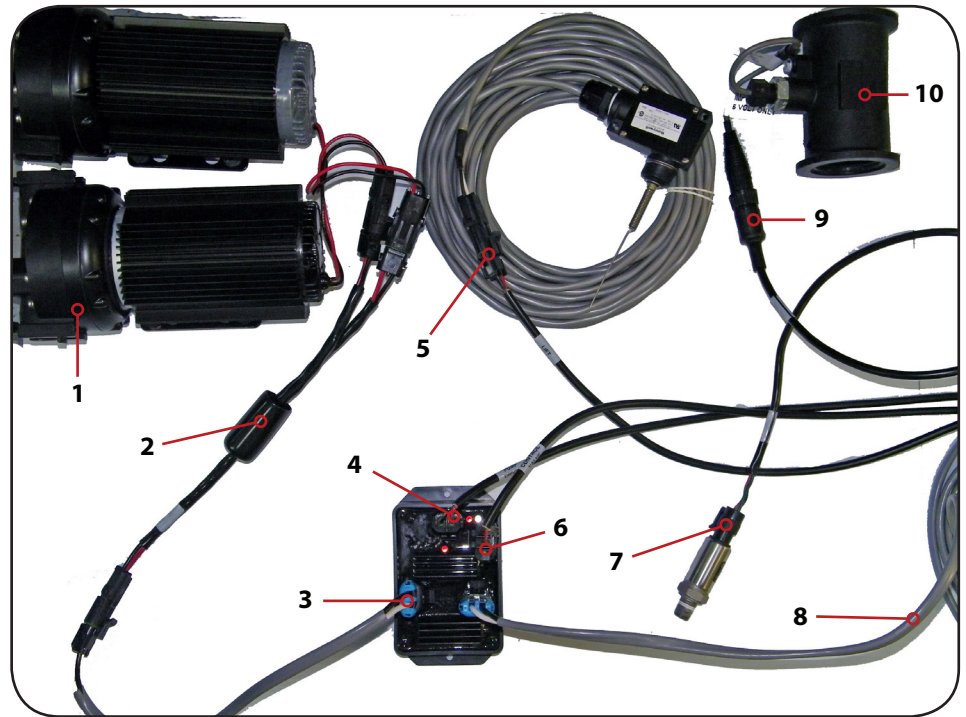
Nominal distance between holes*	1-9/16"
Hole size to drill	9/32"
Bolt size to use (+) (+ mount thickness)	1/4" x 2"+

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



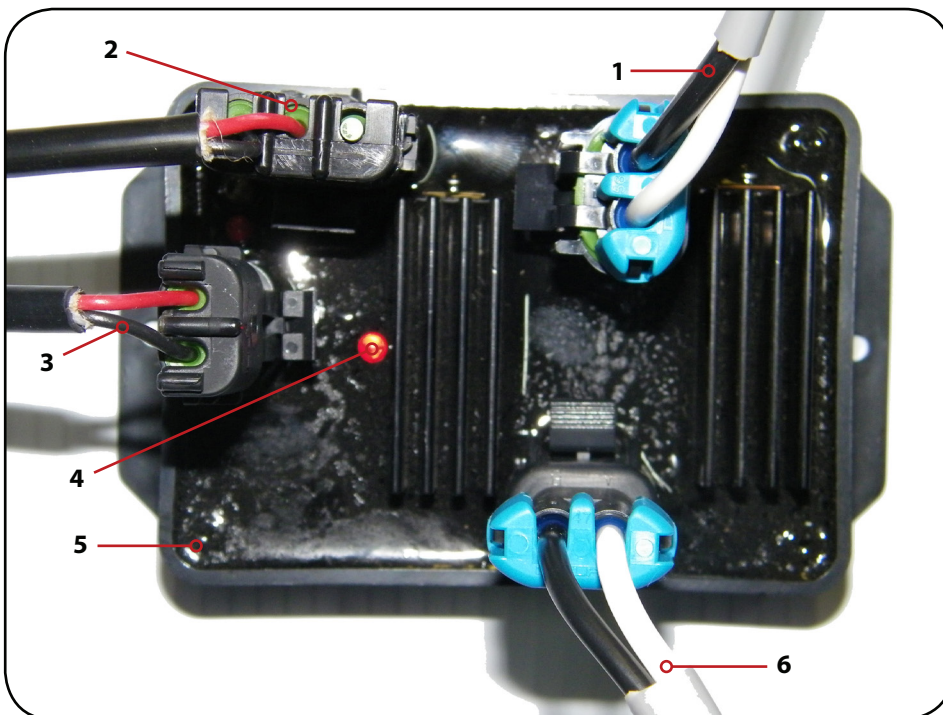
### System Components:

1. 12 Volt Pumps
2. Pump Y Adapter Harness
3. To Pump Y Adapter Harness
4. Pump Driver
5. Lift Switch
6. Control Valve
7. Raven Pressure
8. 17871
9. Flow Meter
10. Flow Meter



### 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.



1. To Pump Y Adapter
2. Control Valve
3. Pump Driver
4. Led Indicator
5. Electric Pump Driver
6. EPD Power To Harness



## Installation Instructions

### Step 1 Mounting Pump Stand

Mount pump stand on tongue of planter with pumps facing the front of the planter. Install the supplied U-bolt using the flat washer and nut. Tighten U-bolt evenly until lock washer is compressed. Do not over tighten, this will cause the U-bolt to break.

### Step 2 Mounting Valve Tower

Install valve tower immediately behind pump tower with valves facing the back of the planter. Install U-bolt as described in step one.

*Note: Mounting locations will vary from planter to planter, make sure there is adequate clearance between the pump and valve stands and any moving parts of planter before installing.*



### Step 3 Mounting the Flow Indicator Stands

Mounting stands are supplied to mount flow indicators to the planter for optimal view. Mount the flow indicator stands on the planter so that you have a good view and can be easily seen from the cab of the tractor. Most common installation locations are on the wings of the planter or right behind the pump and valve stands. Mounting locations will vary from planter to planter.

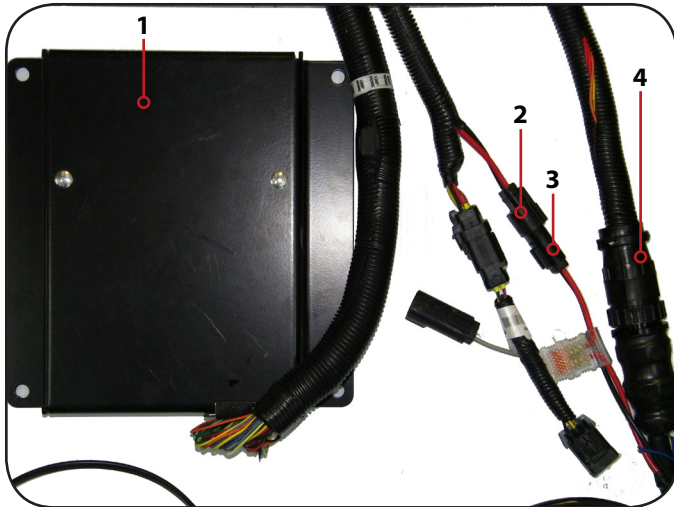
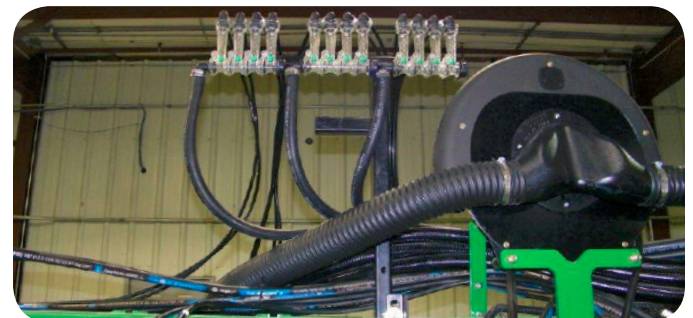
### Step 4 Mounting Flow Indicators

Flow indicators can be arranged in clusters by clipping together individual flow indicators. Depending on how many rows each shutoff valve is feeding.

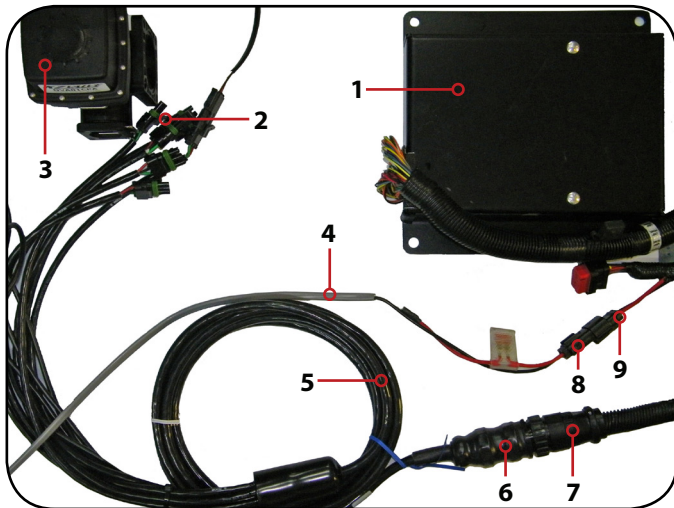
#### Examples

- 2 valve system on 12 row planter will have 2 clusters of 6
- 6 valve system on 24 row planter will have 6 clusters of 4

Each cluster will have one 3/4" 90° hose barb fitting on one end and one end cap fitting on the opposite end, with 90° pushlock connectors and orifice on the top of the flow indicators. Assemble flow indicator clusters before mounting to stands. Drill two holes in the horizontal square tubing on the stands per cluster. Use the 1/4" x 3" bolts supplied to mount the clusters to the stand. OVA recommends using the green ball for rates 2 to 5 gallons. For rates above 5 gallons the red ball works best.



1. JD Rate Controller
2. JD Controller Harness
3. PEPD Power
4. 37 Pin Connector



1. JD Planter Module
2. Boom 1-6
3. Shut Off Valve
4. 17871
5. OVA0615K
6. OVA 37 Pin
7. JD 37 Pin
8. EPD Power
9. JD Rate Controller

### Step 5 Check Valve Installation

Install check valve closest to row unit as possible. The preferred method for installing check valve to row unit is by using two #10 self drilling screws to secure the check valve. They can also be installed with zip ties.



### Step 6 Plumbing System

Using the 3/4" rubber hose supplied, connect product tank to the pump stand inlet located on the top of the pump stand. Next connect the output hose barb on the pump stand to the flowmeter hose barb on the valve stand. Next connect each ball valve to each corresponding flow indicator cluster. It is very important to route each hose supplying the system carefully avoiding any sharp bends or kinks. Make sure there is adequate length for any hose supplying flow indicators out on the wings. Next connect the bypass/agitation hose barb located on the backside of the pump stand back to the supply tank. Connect each hose to barb fittings using the hose clamps supplied.

### Step 7 Plumbing Row Units

Plumb the row units using the 3/8" black tubing supplied in kit. Route the tubing from each flow indicator back to the check valve installed on the row units. Check to make sure the tubing is not smashed or kinked. Secure tubing using zip ties. Insert end of tubing into pushlock fitting on flow indicator and check valve.

**Note:** The 3/8" tubing does NOT have to be all the same length.

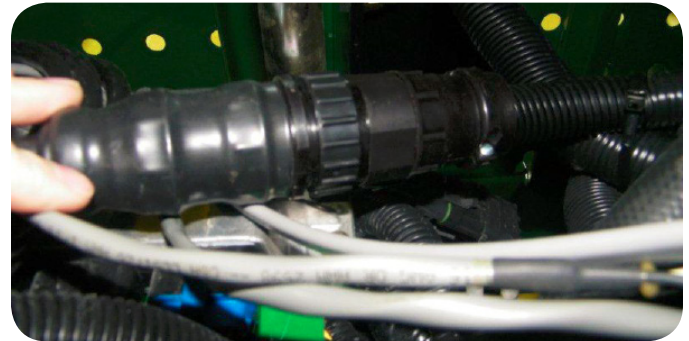
Next install 1/4" black tubing from the check valve down to the row unit. Connect the other end of the 1/4" tubing to whatever method to used to apply liquid. For in furrow applications options include seed firmers, total tubular or the 1/4" tubing can be zip tied directly to seed tube allowing the liquid to dribble into furrow. Another option is to T-band (spray) liquid into furrow using spray arms.

### Step 8 Main Harness Installation

**Note:** Microtrack Controller Systems owners refer to microtrack manual for wiring installation. John Deere systems using 2600 and 2630 continue with step 8.

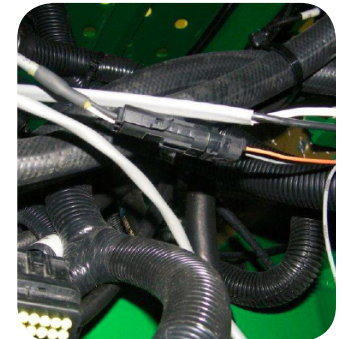
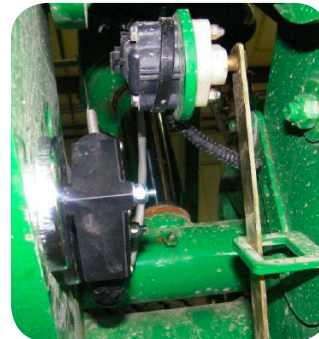
Locate gray power harness (part #17871 or #18419). Next locate power Acc. port on the planter harness, remove terminator from power port and connect power harness connector (end with fuse holder) to planter power port. Connect opposite end of power harness to the epd located on the pump tower. Next locate main Endeavor harness (part #OVA0615K). Next locate the round 37 pin connector on the JD Liquid Rate Controller, connect the female 37 pin connector to the male 37 pin connector on the Endeavor harness. Next identify labeled connectors on Endeavor harness, connect to appropriate component on pump and valve stand, pump driver, flow

meter, control valve, pressure switch and ball valves. Ball valves are labeled Boom 1 through 6. Use zip ties to secure harness to planter avoiding situations where harness could possibly become pinched or cut.



### Step 9 Installing Lift Switch

Install lift switch by bolting magnets to lift switch body. Next position lift switch to planter wheel linkage so when the planter is down there is tension on lift switch spring and no tension when planter is up. Next plug lift switch into the short leg of Y-cable supplied. Plug the long leg of the Y-cable into the lift switch plug on the JD rate controller. Last plug the remaining connector plug into the main wiring harness labeled lift switch.



### Step 10 System Setup and Testing

Refer to "System Setup and Calibration" on page 2 of this booklet. Continue on the "Implement Setup", "System Setup", "Alarms Setup", "Rates Setup" and "Initial System Operation Procedure" to complete system installation.

If any additional information is required please feel free to contact OVA for further assistance.

### End of Season Cleaning and Winterization

OVA 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.



# ENDEAVOR



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