



396-001640

***SureFire Drives and
Harnesses for use
with John Deere Dry
Rate Controller***

**&
SureFire Dry Fertilizer Control
Components**

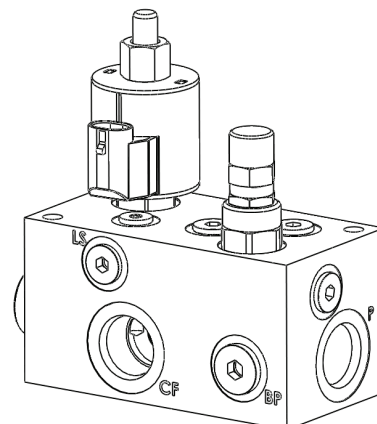
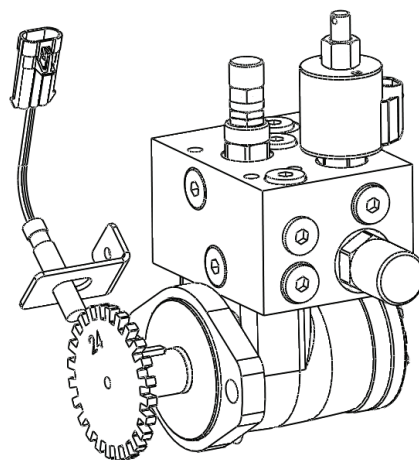
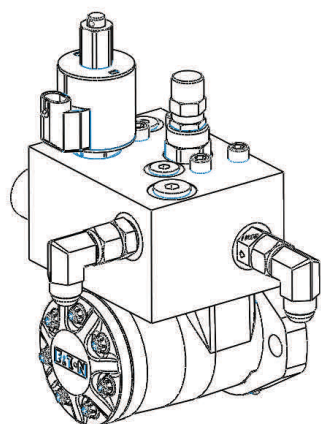


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General Description

A

Introduction

SureFire offers hydraulic motors and valves, wiring harnesses and speed sensors to work with the John Deere Rate Controller Dry. Refer to the John Deere information for final information on Rate Controller Dry specifications and capabilities. In this manual, SureFire will present applications of the Rate Controller Dry we have verified and tested with our components and the accompanying setting and use of the GS3 for these applications.

Basic Applications

1. The most basic application uses a dry rate controller to control the speed of a dry fertilizer meter with a shaft speed sensor for product flow feedback. This will only use two electrical connections on the final harness: one connection to the PWM hydraulic valve and one connection to the speed sensor.
2. In addition to #1, the rate controller can also work with a spinner type dry fertilizer spreader.
 - First, spinner speed can be monitored with a speed sensor. Spinner speed would be set in some other manner (i.e. tractor hydraulic flow control, etc.) and only monitored on the John Deere display.
 - Second, the spinner speed can be controlled. For example, a second PWM hydraulic valve could be installed along with a speed sensor to control spinner speed to a target speed.
3. In place of a spinner, the Rate Controller Dry could be hooked to a fan. Similar to a spinner, the fan speed could simply be monitored or it could be controlled with a PWM hydraulic valve.
4. The Rate Controller Dry has the capability to control up to 4 products. This would require 4 PWM hydraulic valves and 4 speed sensors.

Hydraulic Motor / PWM Valve Combination

Item Number 164-FTA0925

C

Components
Hydraulic

Manual Override - Turn and lift the manual override to check for proper hydraulic connections. Override will completely open valve, so limit tractor hydraulic flow to valve.

Load Sense Port—For power beyond hydraulic use only.

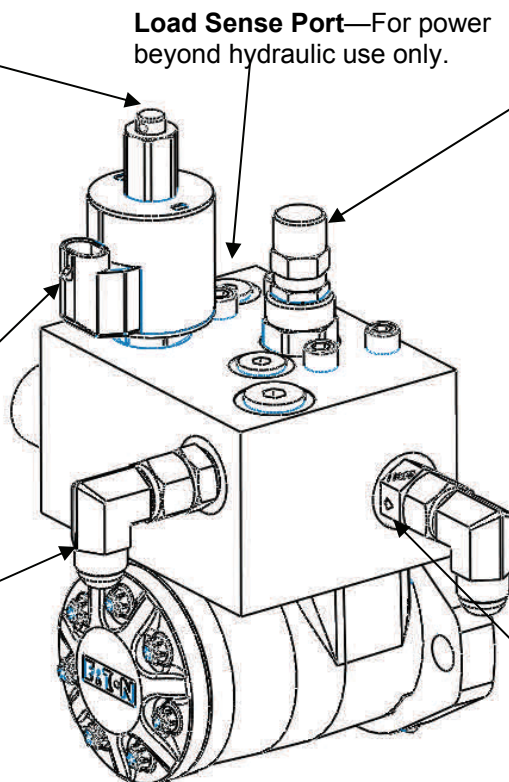
Bypass Valve—Remove the cap to access a bypass needle valve. This valve is shipped from the factory closed. The only case when valve should be open is when running in series with other hydraulic motors.

PWM Valve Connector -2 Pin MP Shroud

Depending on your tractor and exact hydraulic plumbing scenario your motor may turn very slowly when it should stop. To stop the motor completely, open the bypass valve slightly.

Pressure from Tractor

Return oil to Tank - Check valve included on return port



Port Sizes: -8 SAE O-Ring (Load Sense is -6 SAE O-Ring)

Mounting Hardware: Two 1/2" diameter bolts

Shaft Size: 1" with Woodruff Key

Motor Displacement: 4.9 in³/rev

Motor RPM and Oil Usage: 90 RPM @ 2 GPM
450 RPM @ 10 GPM

Minimum recommended motor RPM: 20 RPM

Motor Rotation and Check Valve

The SureFire hydraulic motor/valve rotates CW (clockwise) when viewed from the shaft end.

- The motor rotation direction CAN BE REVERSED using the motor disassembly procedure on the next page.
- The motor rotation direction CAN NOT BE REVERSED by reversing the hydraulic flow through the valve. To function properly, oil must flow in the "P" pressure port and flow out the "T" tank port, with the check valve remaining on the "T" tank port.

A check valve is included on the outlet ("T") port of the hydraulic valve. This prevents the motor from running in the wrong direction and damaging the dry fertilizer system.

How it Works with Power Beyond Hydraulics

This valve is designed to work with power beyond hydraulics. This configuration will not require a standard tractor remote hydraulic valve. First, remove the load sense plug and install a #6 male boss x #6 JIC adapter fitting, SureFire PN 161-01-6MB-6MJ. Then run a 3/8" or 1/4" hydraulic hose back to the tractor. This hose will connect to the load sense port on the tractor. The bypass valve must be closed to use power beyond hydraulics. The load sense line will signal the tractor hydraulic system to supply the flow needed by the pump to meet your application rate. The SureFire valve has an internal load sense check valve, which is required for power beyond hydraulics.



Hydraulic Motor / PWM Valve Reversing Procedure

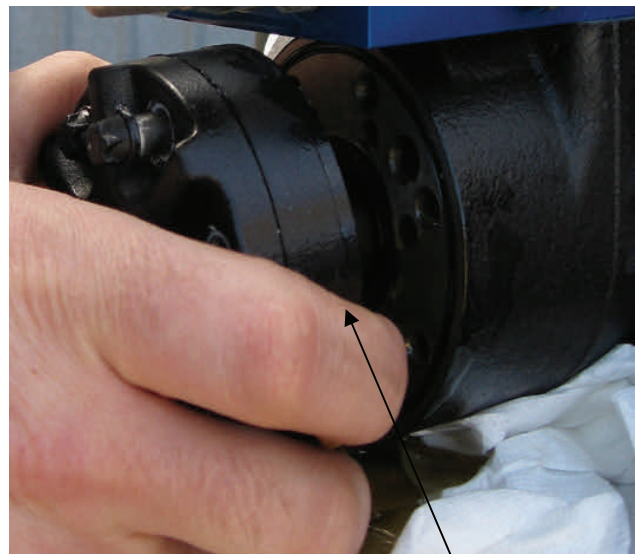
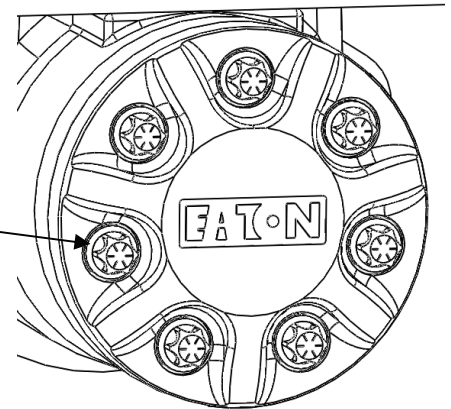
C

Components
Hydraulic

The SureFire Hydraulic Motor/PWM Valve combination's standard rotation is CW viewed from the shaft end.

- The motor rotation direction CAN BE REVERSED using the motor disassembly procedure shown here.
- The motor rotation direction CAN NOT BE REVERSED by reversing the hydraulic flow through the valve. To function properly, oil must flow in the "P" pressure port and flow out the "T" tank port, with the check valve remaining on the "T" tank port.

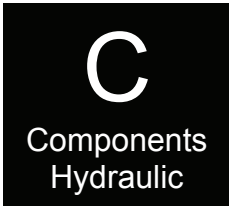
1. Ensure the motor is not under hydraulic pressure. Also make sure the motor is cool enough to hold and complete this procedure.
2. Using an E10 external Torx socket, remove the 7 bolts on the end of the motor.
3. Hold all the motor sections together (3 plates).
4. Pull the motor sections gently away from the motor. There is a shaft (dog bone) with splines on both ends.
5. Ideally, the shaft will slide with the sections you are removing. When the sections are approx. $\frac{3}{4}$ " away from the motor, the shaft should be disengaged from the splines inside the motor housing. Rotate the shaft while pressing in slightly to jump the spline just 1 tooth.
6. Push the sections back together. Make sure the O-ring between the sections is in the O-ring groove.
7. Reinstall and tighten the bolts evenly. Check the motor for proper rotation before connecting it to any other components which may be damaged.
8. Since the "jumping of a tooth" procedure must be completed almost "blind", it may take a couple tries to get the rotation reversed.
9. REVERSAL OF MOTOR ROTATION MUST BE CONFIRMED VISUALLY.



Pull these three sections away from the motor body to jump the "dog bone" shaft 1 tooth. This will reverse the motor rotation.

Stand-alone PWM Valve

Item Number 165-P15618A-3



Manual Override - Turn and lift the manual override to check for proper hydraulic connections. Override will completely open valve, so limit tractor hydraulic flow to valve.

Bypass Valve—Remove the cap to access a bypass needle valve. This valve is shipped from the factory closed. The only case when valve should be open is when running in series with other hydraulic valves & motors.

Depending on your tractor and exact hydraulic plumbing scenario your motor may turn very slowly when it should stop. To stop the motor completely, open the bypass valve slightly.

OPENING THE BYPASS VALVE HAS NO EFFECT UNTIL THE “BP” PORT IS HOOKED TO A RETURN LINE

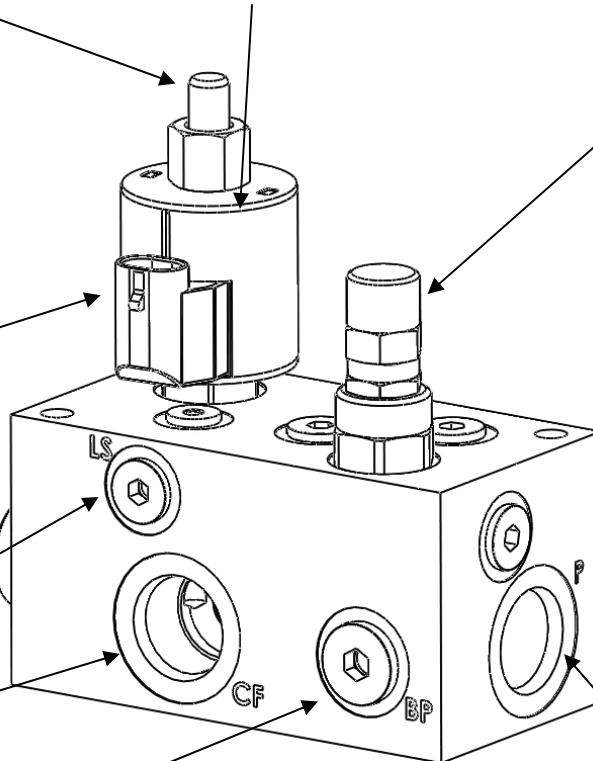
PWM Valve Connector -2 Pin MP Shroud

“LS” Port - Load Sense for power beyond hydraulic use only.

“CF” Port - Controlled Flow to hydraulic motor inlet

“BP” Port - Hook up to allow valve to function as open center valve (requires opening bypass needle valve). Typically tee into return line from motor back to tractor.

“P” Port - Pressure from Tractor



Pressure and Controlled Flow Port Sizes: -12 SAE O-Ring

Bypass Port Size: -8 SAE O-Ring (usage is optional)

Load Sense Port Size: -6 SAE O-Ring (usage is optional)

Mounting Hardware: Two 5/16” bolts, minimum 4” length

Minimum recommended flow to control: 0.5 GPM

Maximum Flow: 25 GPM

Motor Rotation Check Valve

The SureFire stand-alone hydraulic valve DOES NOT have a check valve. SureFire recommends you install a check valve on your hydraulic motor to protect from damage due to reverse rotation.

How it Works with Power Beyond Hydraulics

This valve is designed to work with power beyond hydraulics. This configuration will not require a standard tractor remote hydraulic valve. First, remove the load sense plug and install a #6 male boss x #6 JIC adapter fitting, SureFire PN 161-01-6MB-6MJ. Then run a 3/8” or 1/4” hydraulic hose back to the tractor. This hose will connect to the load sense port on the tractor. The bypass valve must be closed to use power beyond hydraulics. The load sense line will signal the tractor hydraulic system to supply the flow needed by the pump to meet your application rate. The SureFire valve has an internal load sense check valve, which is required for power beyond hydraulics.

Shaft Speed Sensor

C

Components
Hydraulic

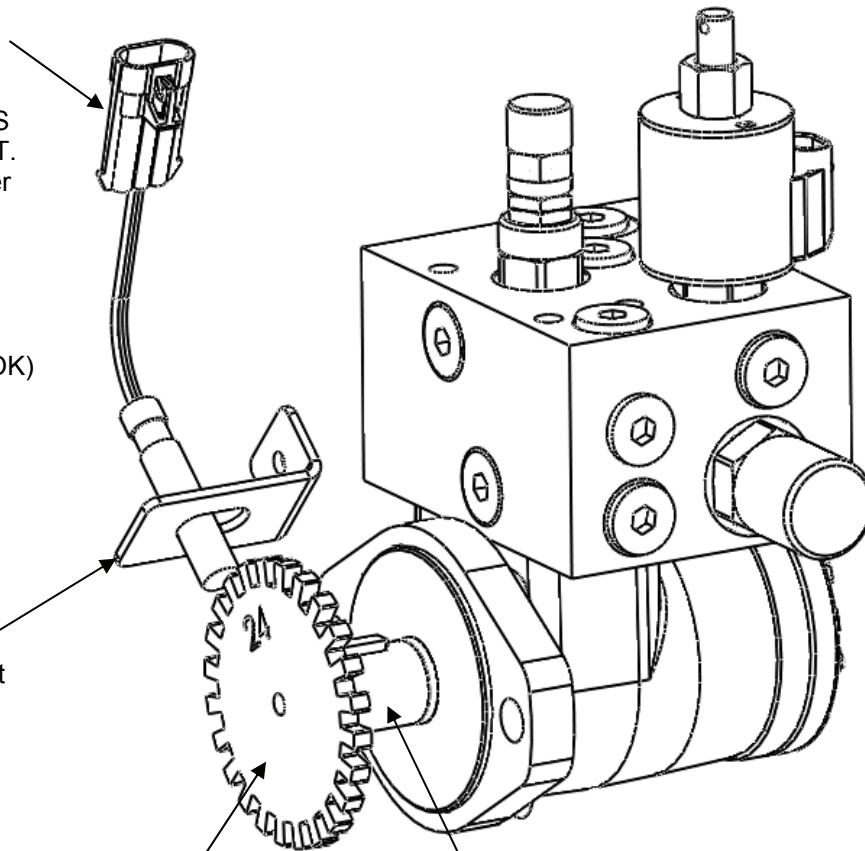
Speed Sensor - Item number 204-04-1002 - Requires metal target to sense on. Can sense on a sprocket WHERE CHAIN IS NOT RUNNING ON SPROCKET. Adjust to 1/16" gap squarely over target teeth.

Wiring Connector:
Metri-Pack 150 Shroud
Pin A—Black, Signal
Pin B—Tan, +12 Volts (5 volts OK)
Pin C—Blue, Ground

Bracket - Item Number 405-1168A1 - Speed Sensor Bracket attaches to frame with 1/4" bolt.

24 Tooth Target - Item Number 400-1211A1 - This attaches to the end of the hydraulic motor shaft with a 1/4" bolt.

1" Drive sprocket attaches to hydraulic motor shaft inside of 24 tooth target.



John Deere Rate Controller Dry for GS2 & GS3

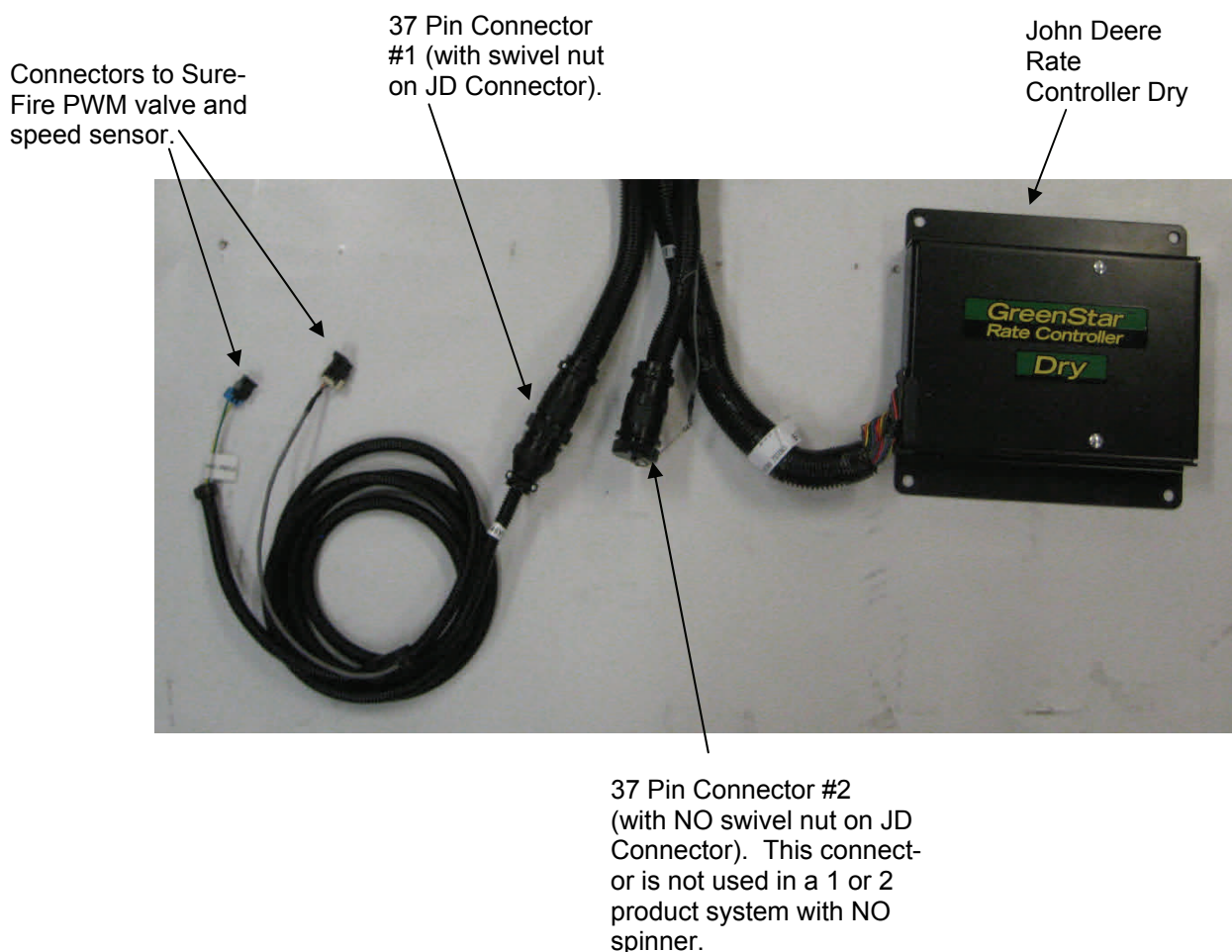
D

Wiring & Elec.

SureFire Fertilizer Systems begin at the John Deere Rate Controller Dry, which you will need to purchase from your John Deere dealer. The picture below shows the John Deere Rate Controller Dry, which can control up to 4 dry products. The John Deere Rate Controller communicates with the John Deere GS2 or GS3 display in the cab.

The harness coming from the rate controller has two 37 pin Amp connectors. SureFire Fertilizer System harnesses begin at these 37 pin connectors. The following page shows a system layout to illustrate how the harnessing is connected to all components. Detailed harness drawings follow for information and troubleshooting.

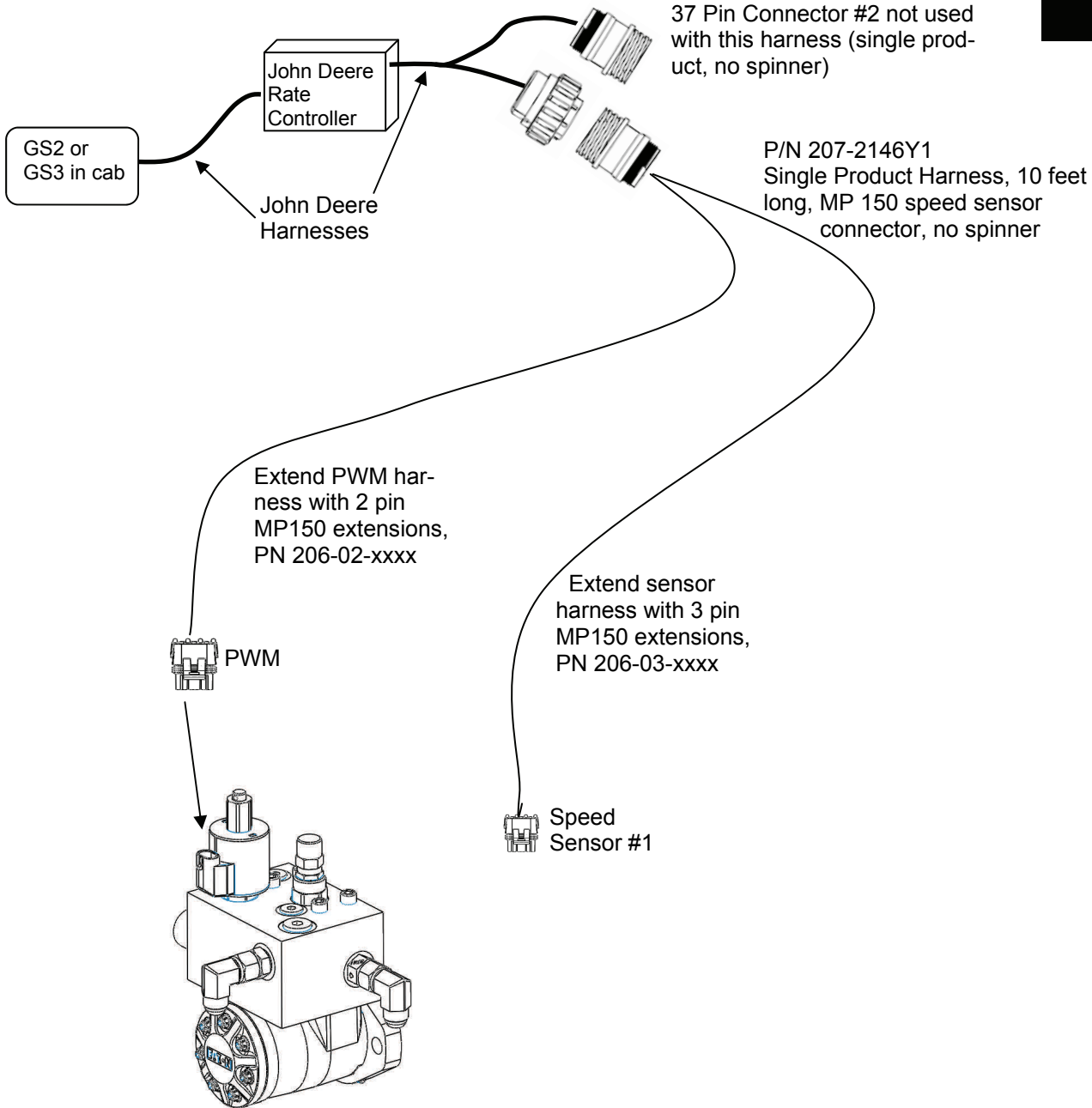
Instructions for setting up the GS2 or GS3 display are in Section F. Detailed screen shots of the display are included showing exactly what settings are required and recommended for SureFire components.



John Deere Rate Controller Dry Layout

Control: PWM Hydraulic Valve

Products: 1



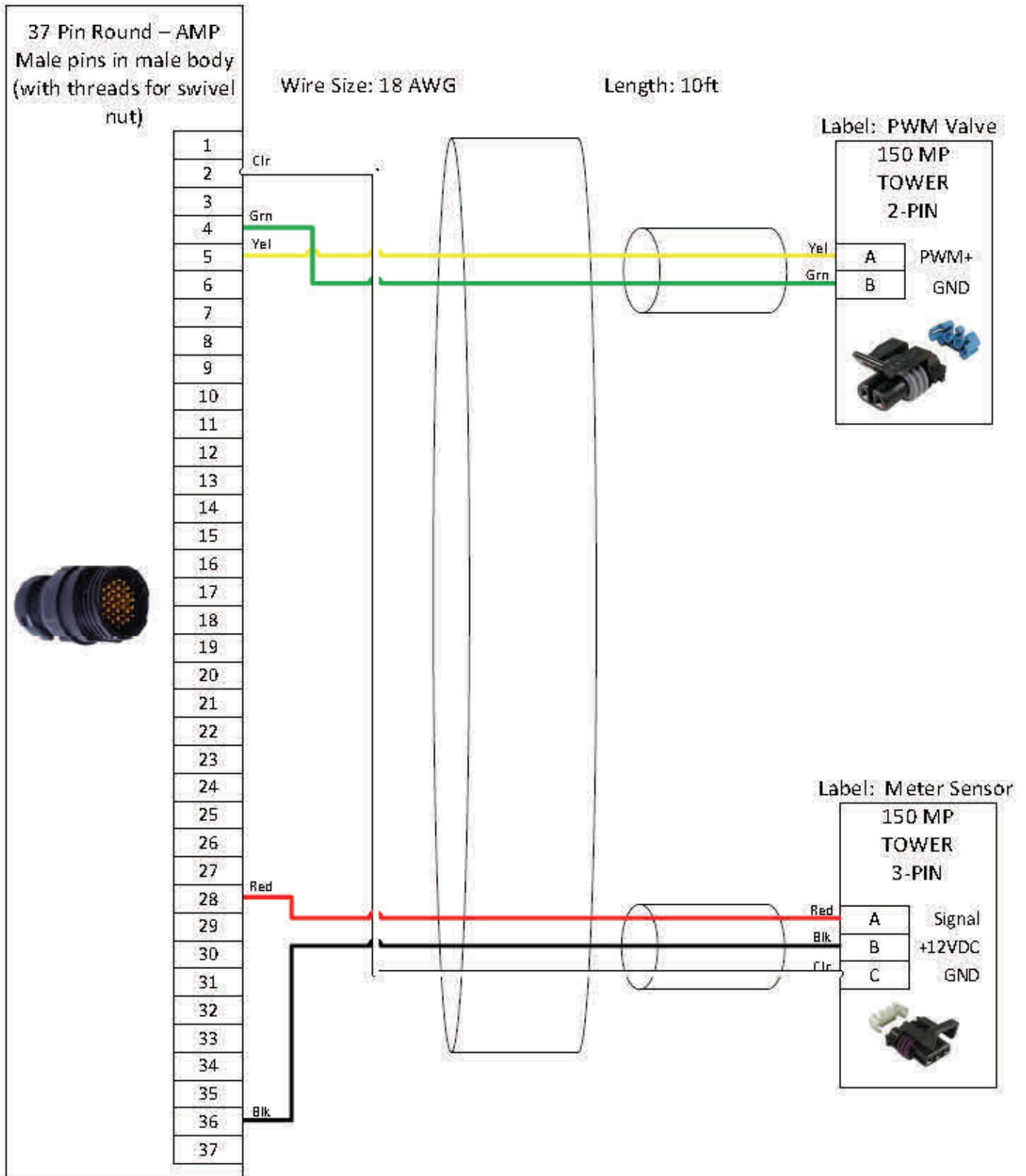
Additional Harness for John Deere Rate Controller Dry

Part Number	Number of Products	Speed Sensor Connector Type	Spinner PWM Connector	Spinner Speed Connector
207-2146Y1	1	Metri-Pack 150	None	None
207-2147Y1	2	Weather Pack	None	None

John Deere Rate Controller Dry Harness



Single Product Cable for John Deere Dry Rate Controller
 (MP150 meter connector, no spinner)
 207-2146Y1



Rate Controller Dry Setup

This manual is written for the John Deere GS2 & GS3 displays. The Deere software used for the screen shots is Part Number PFP11697, version 01.01M, on a GS3 2630. Your screens may vary some if using an older or newer version. The software version can be found in Diagnostics under the Readings tab.



To access the GS2/GS3 Rate Controller Functions, push "GRC DRY" button from the home screen. If this button is not present the rate controller is not communicating with the GS2/GS3 display. See your John Deere operators manual or your John Deere dealer for assistance.



This button will take you to the Main Rate Controller Screen below.

Main Rate Controller Dry Screen

Gate opening

Master Switch Indicator

Actual Rate

Target Rate

Tractor Speed

Dry Fertilizer Shaft Speed

Navigation Buttons

- Diagnostics
- GRC DRY Main Rate Controller Screen
- Impl. Setup
- Prod. Setup
- CAL Calibration
- Totals

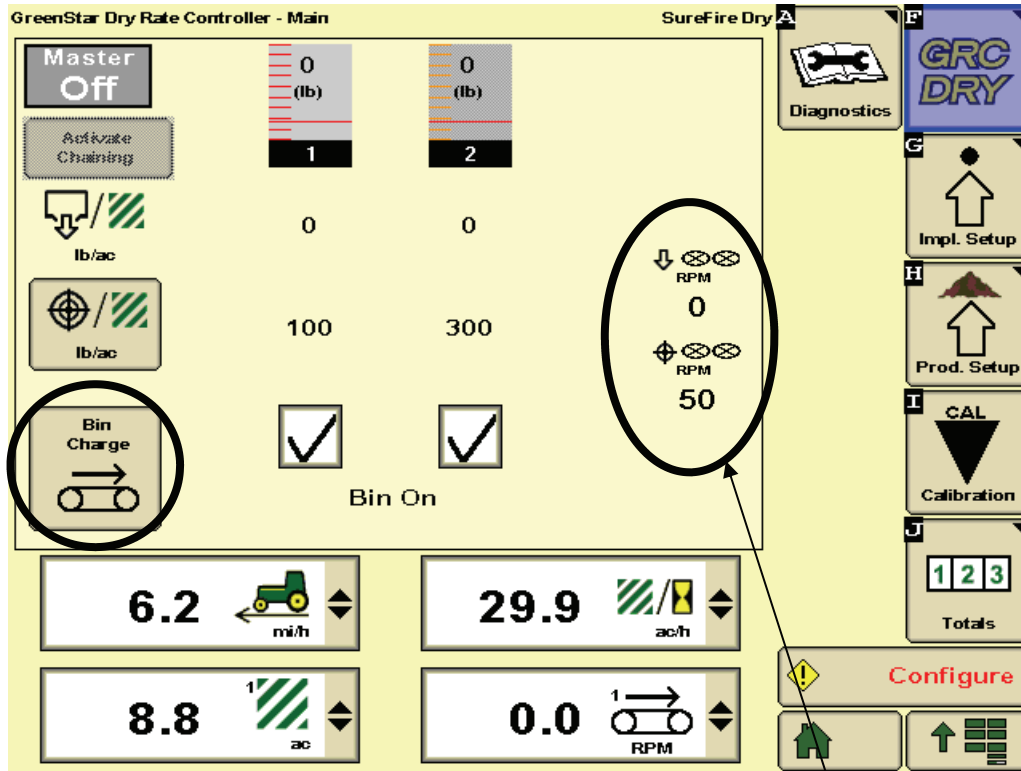
Low Volume

Menu Structure

Implement Setup	Product Setup	Calibration	Totals	Diagnostics
<ul style="list-style-type: none"> Implement System Alarms Smoothing 	<ul style="list-style-type: none"> Name Type Density Units 		<ul style="list-style-type: none"> Current Job Summaries Lifetime Totals 	<ul style="list-style-type: none"> Readings Tests

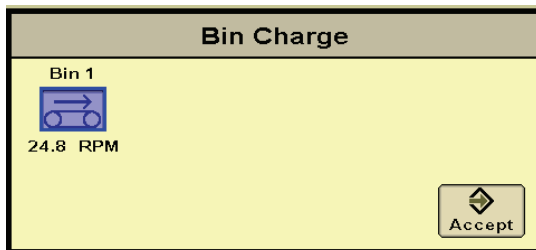
Rate Controller Dry Setup

The John Deere Rate Controller Dry can control up to 4 products. If additional products are selected they will show up on the Home screen as shown below.



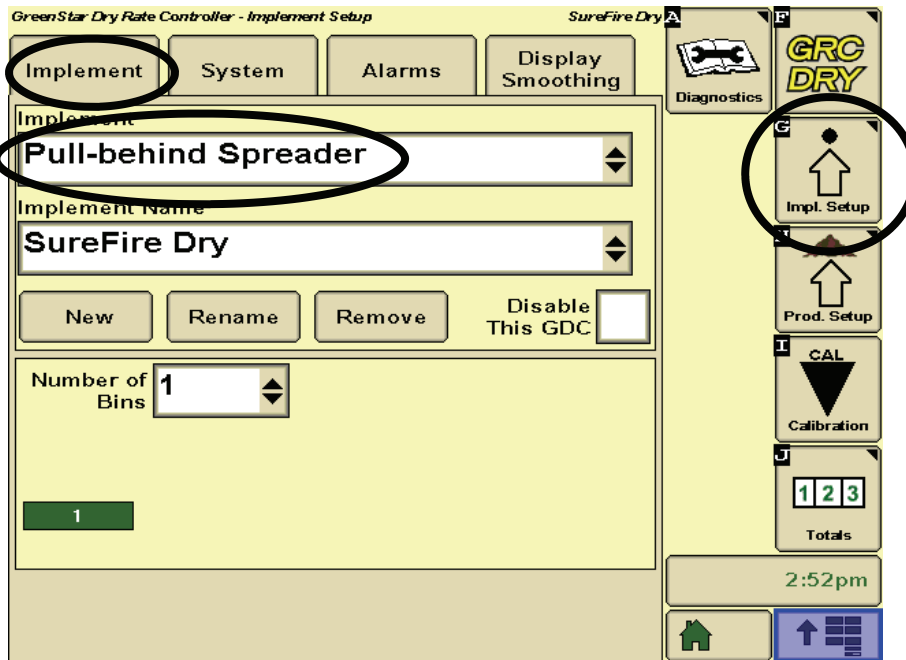
The **Bin Charge** button on the home screen will bring up the screen below. Push and hold the button to run the meter or conveyor for that bin manually. The RPM will be shown. When the button is released the hydraulic motor will stop.

Home Screen with Spinner - If using a spinner speed sensor the home screen will show spinner speed on the right side. The target spinner speed is set in Product Setup.



Implement Setup - Implement

Here you will enter the type, name, and number of bins for your spreader.

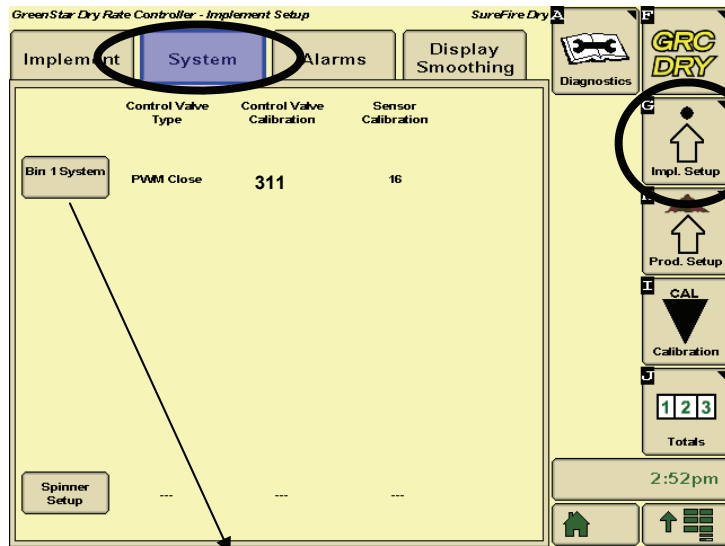


Implement Type, Name & Number of Bins

1. Choose implement type “Pull-behind Spreader”
2. Enter a Name for the Implement where “SureFire Dry” is shown above.
3. Select Number of Bins

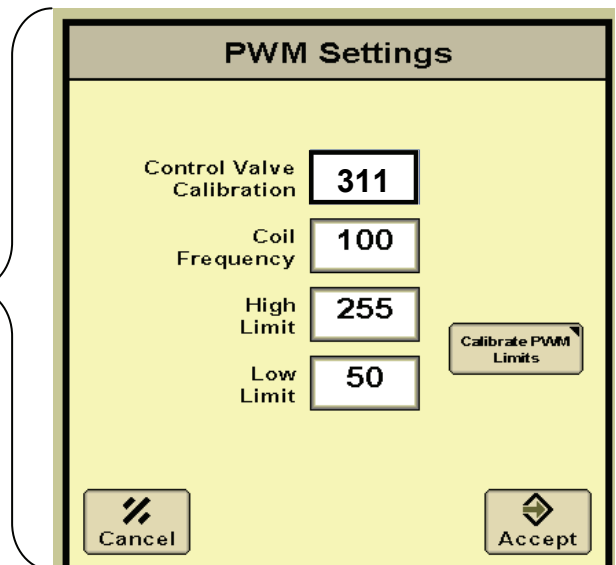
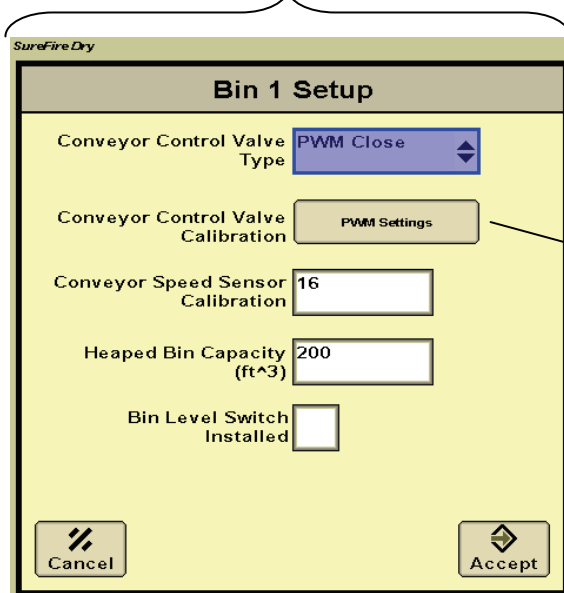
Implement Setup - System

System setup is where you will set the GS2/GS3 to be compatible with the SureFire fertilizer system components.



The **John Deere 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 too 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 Operators Manual for more information. For example, to slow your response speed, change the number from 311 to 211, reducing the valve response from 3 to 2.

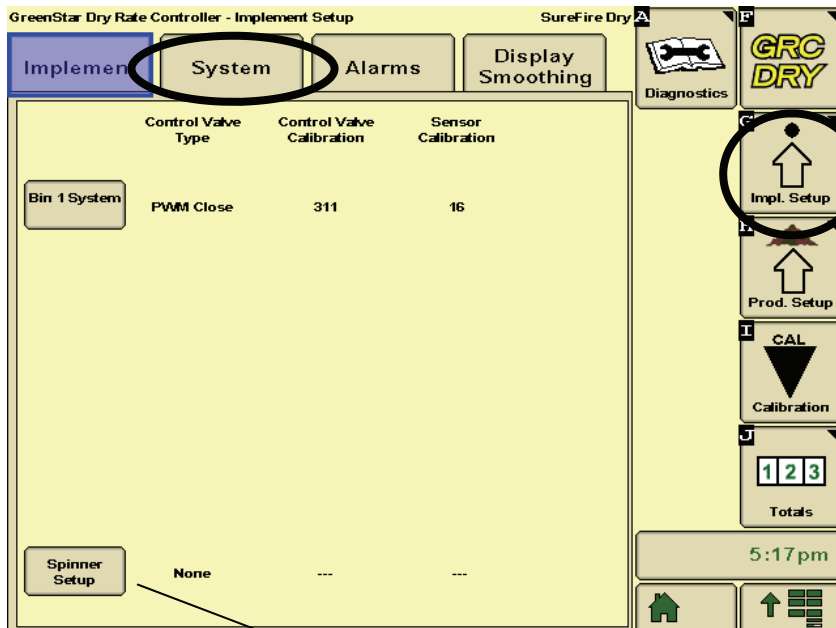
SureFire has found a very low valve speed such as 3 provides best performance.



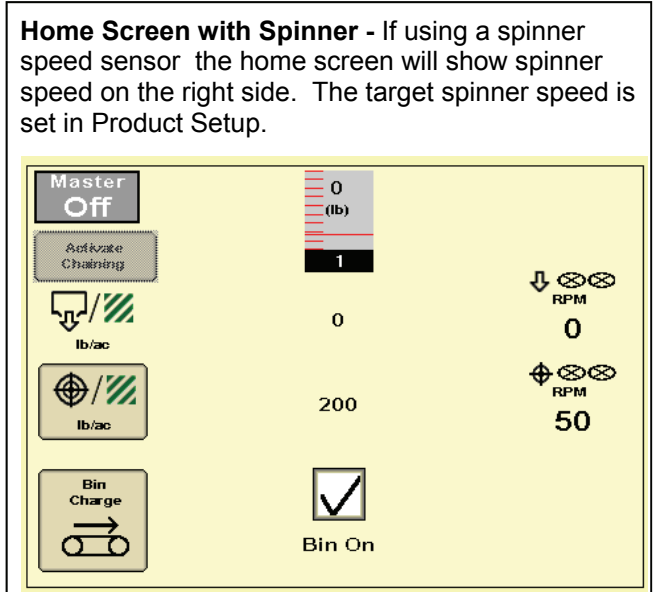
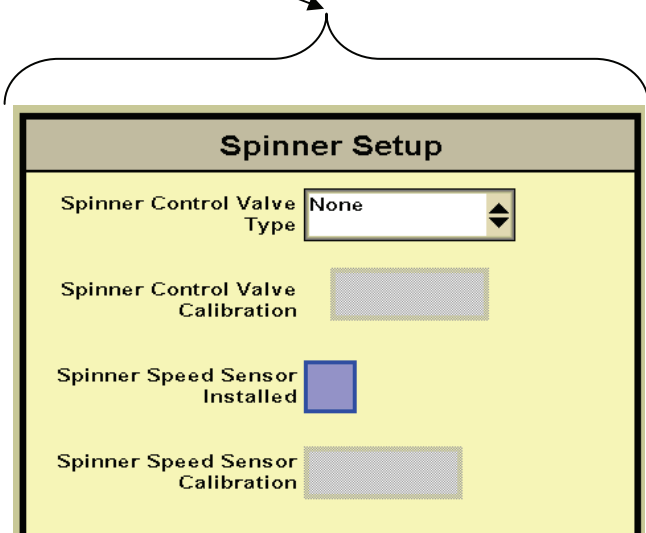
1. Conveyor Control Valve Type: PWM Close
2. Conveyor Speed Sensor Calibration: Enter the pulses per revolution (teeth on sprocket or sensor target)
3. Enter the bin capacity
4. Do not check bin level sensor switch as most SureFire dry harnesses do not include this connector.
5. Control Valve Calibration: 311
6. Coil Frequency: 100
7. Set High Limit to 255 (maximum allowed) and Low Limit to 40 (SureFire hydraulic valve will crack open at output of about 50).
8. You can run the "Calibrate PWM Limits" to assist you in setting the PWM high and low limit.

Implement Setup - System (continued)

In system setup, you MUST go to spinner setup even if you do not have a spinner.



Fan Speed - The spinner speed can also be used to monitor or control a distribution fan if using a dry fertilizer system of that type.



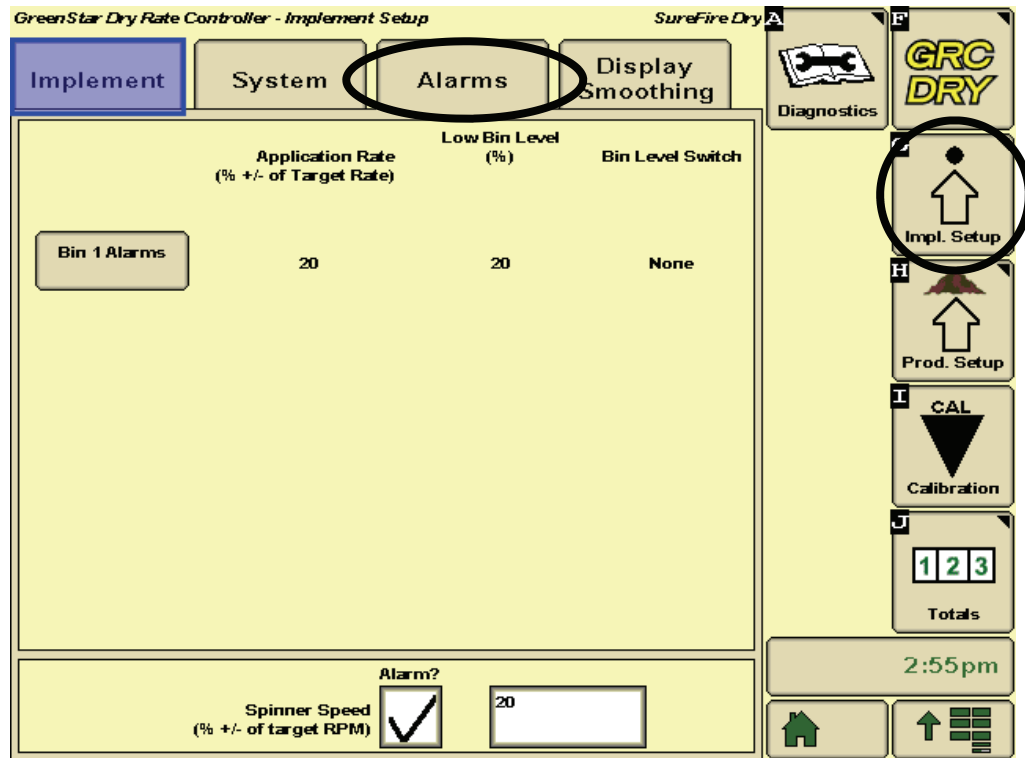
1. Spinner Control Valve type - set to None if not using a spinner. The dry fertilizer conveyor or meter will not run without a spinner speed unless this is set to none.
2. A SureFire PWM valve can control spinner speed if a harness with spinner control is used. Set to PWM Close in this case.
3. A spinner speed sensor can be used with or without a control valve. If no control valve is used, the GS2/ GS3 will just display spinner speed and you will set it via some other method (tractor hydraulic flow control, etc.) Check the box if using a spinner speed sensor.
4. The spinner speed sensor calibration is the pulses per revolution of number of teeth on the sensor target.
5. If using a control valve start with the same 311 Control Valve Calibration that Bin1 uses.

Implement Setup - Alarms



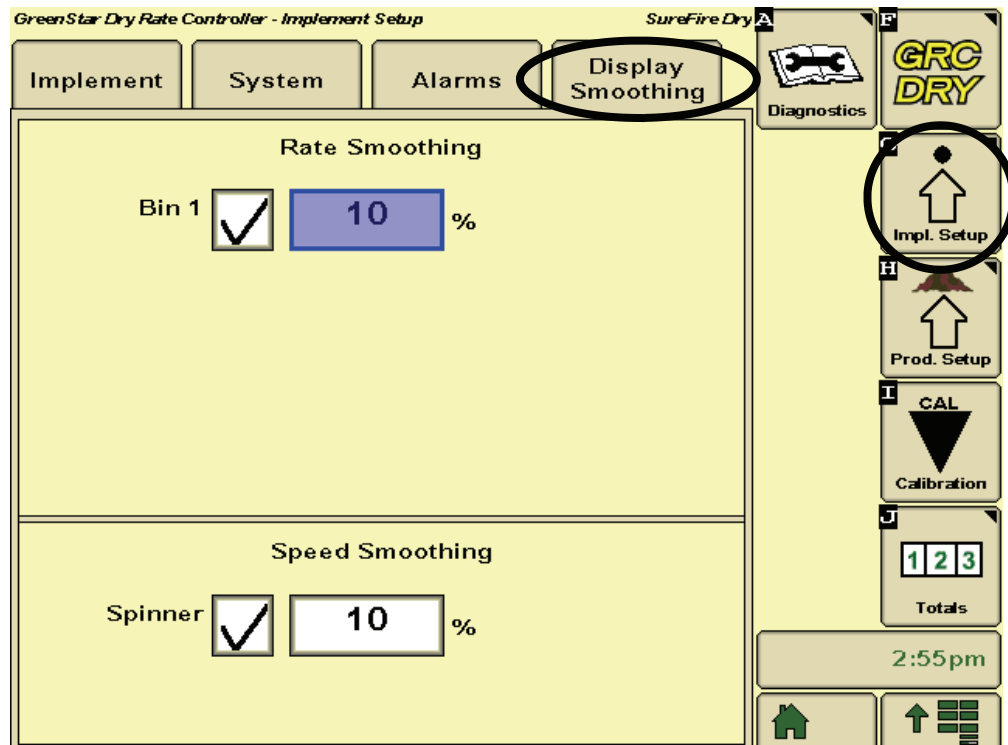
Customize your alarms on this page.

1. Press the Bin 1 Alarms button.
2. Application Rate Alarm: 20% is the John Deere default and SureFire recommended setting. These alarms can not be disabled.
3. 20% is the low bin level alarm default.
4. Spinner Alarm - uncheck the box if not using a spinner.



Implement Setup - Smoothing

1. SureFire recommends 10% rate smoothing.
2. Uncheck the box if not using a spinner speed sensor.



Product Setup - Information

Enter the specific information for each dry product to be applied on this page.

1. Enter the product name.
2. Enter the product type.
3. Enter the product application units (usually pounds or tons)
4. Enter the product density.
5. Enter the rate mode. This is either Manual or Map Based.
6. Enter the spread width of this product.
7. Leave the spinner settings blank if not using spinner control. Enter the rate change increment.

Product Setup—Bin


1. Check the box to enable the bin. Push Bin 1 Setup button.
2. Select the product name.
3. Enter a feed gate opening.
4. Enter an estimated CFR. Wait to calibrate the CFR until after basic operation is tested and bin is filled.

Product Setup - Summary

The product summary shows a summary of what was setup on the Product Information and Product Bin Setup screens. Review this information for correctness. The CFR will be calibrated in a later step.



GreenStar Dry Rate Controller - Product Setup *SureFire Dry*

Product Information	Product Bin Setup	Product Summary
Bin 1		
Bin Enabled	Enabled	
Product Name	Urea	
Product Density (lb / cu. ft)	45.0	
CFR (cu. ft/rev)	0.0014	
Feed Gate Opening (in)	2.0	
Rate Mode	Manual	
Spinner Frame (in)	 RPM	
Spread Width (ft)	40.00	Values are based on: Bin 1, Urea

Initial Operation Instructions - Step 1

SureFire highly recommends you begin with this simple test to verify all components are functioning correctly before filling with fertilizer and calibrating.

F

Setup &
Operation

The screenshot shows the 'GreenStar Dry Rate Controller - Diagnostics' interface. At the top, there are tabs for 'Readings' and 'Tests', with 'Tests' selected and circled. A 'Diagnostics' icon is also circled. On the left, a 'Tests available in Drop Down Menu' lists: Control Valve Test (selected), Flow Control Test, Spreader Check, Bin Cleanout, and Control Valve Test. The main display area is titled 'Control Valve Test' and contains the following instructions:

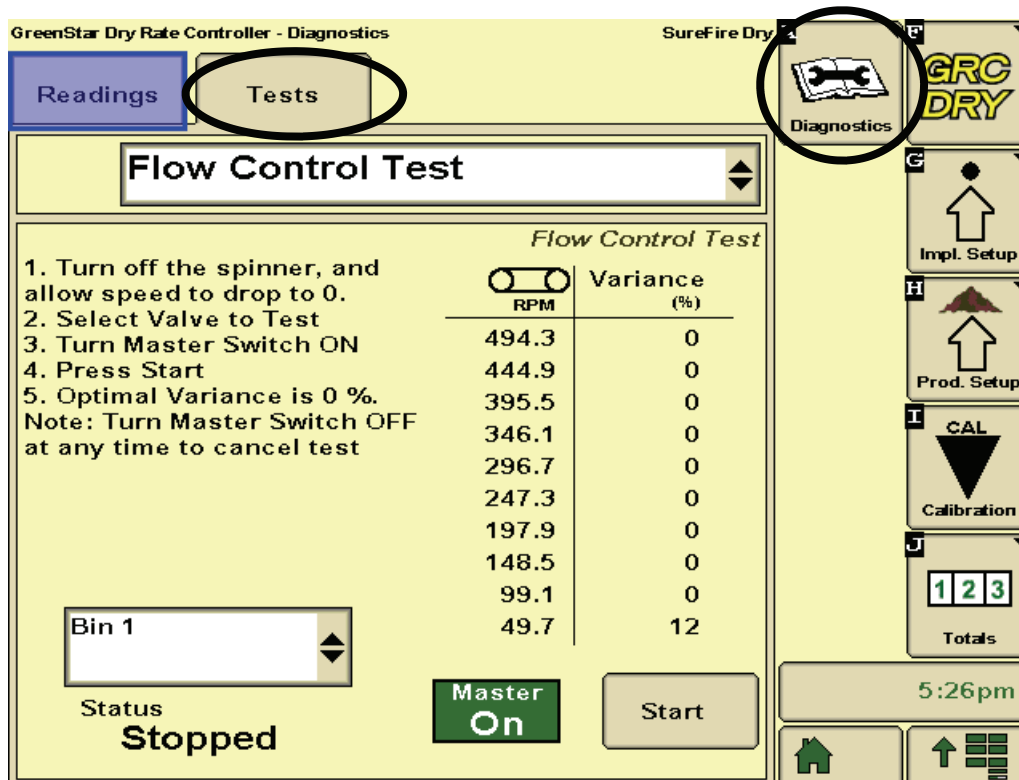
1. Turn off the spinner and allow speed to drop to 0.
2. Select the bin or spinner from the list
3. Turn the Master switch ON.
4. Press the Start button.
5. Press and hold the - or + button to operate the control valve.

Note: Turn the Master Switch OFF at any time to cancel test.

Below the instructions, there is a 'Bin 1' dropdown menu, a 'Status' label, and a 'RPM' reading of 124.9 with a tractor icon. At the bottom, there are buttons for 'Master On', 'Start', '-', and '+'. On the right side, there is a vertical toolbar with icons for 'Impl. Setup', 'Prod. Setup', 'CAL Calibration', 'Totals' (displaying 1 2 3), and a time display of 5:23pm.

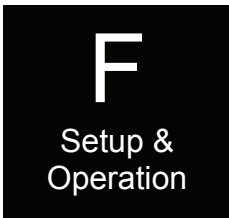
1. Go to the Control Valve Test (Diagnostics, Tests, Control Valve Test). Control Valve Test essentially functions like a MANUAL mode where you have direct control of the hydraulic motor shaft speed.
2. Turn the tractor hydraulic valve on.
3. Turn the Master switch on.
4. Push Start button. Push and hold the '+' button until the hydraulic motor begins to turn.
5. Does an RPM reading show up? Is the reading stable? If a stable RPM reading is not shown, inspect the sensor mount, air gap and check the Conveyor Speed Sensor Calibration.
6. Push the '+' button. Does the shaft speed up and RPM reading increase?
7. Push the '-' button. Does the shaft slow down and RPM reading decrease?
8. **Go to Initial Operation Step 2 when you can increase and decrease the RPM reading using the + and - buttons.**

Initial Operation Instructions - Step 2



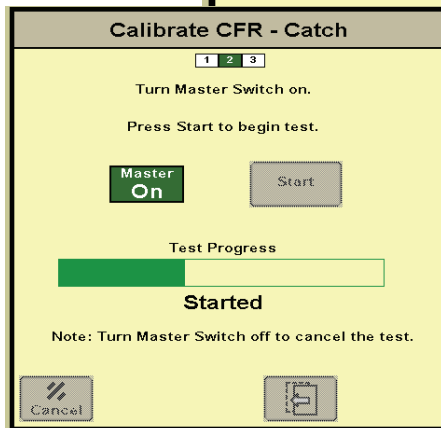
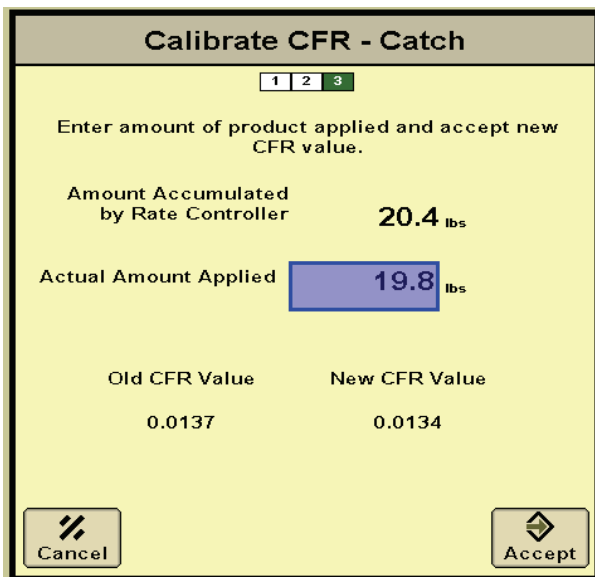
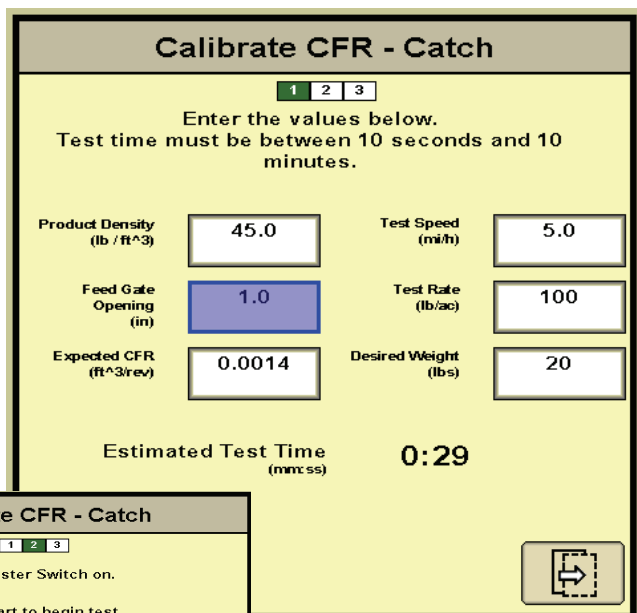
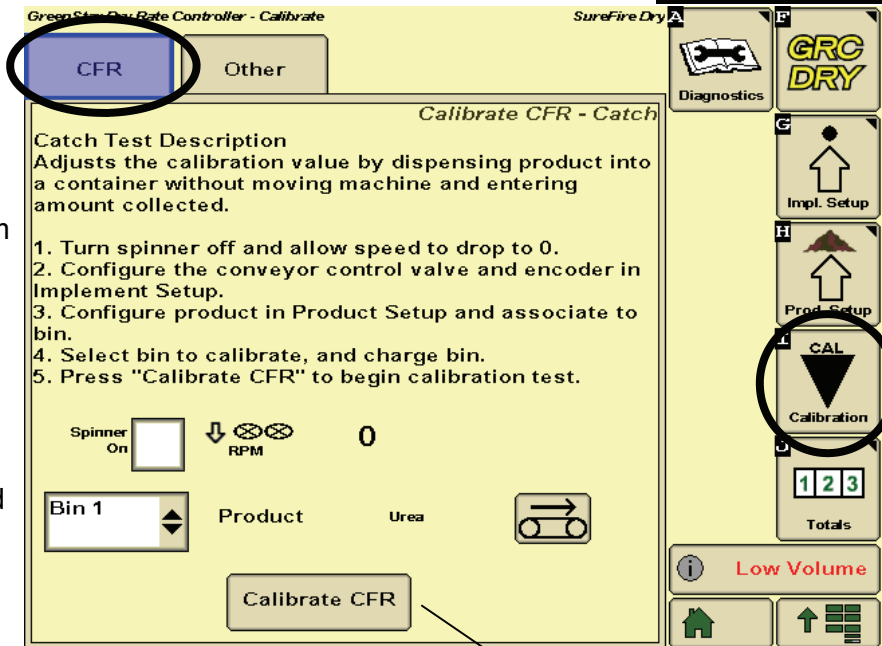
1. Go to the Flow Control Test (with no fertilizer loaded). This will automatically operate the meter or conveyor at a series of speeds from the PWM minimum up to maximum. It will provide a deviation percentage to show if the target speed is achieved. When properly setup, the deviation percentages should be low. If they are higher than 15%, consider lowering the PWM Control Valve Calibration.
2. If you get a high variance at an upper speed in this test, it most likely can be improved by reducing the PWM Maximum setting. However, if the fastest your meter or conveyor needs to run is 350 RPM, you can ignore a variance at any RPM higher than that.
3. If you get a high variance at a low RPM you can likely improve it by changing the Control Valve Calibration. Move this number in small increments. The SureFire recommended Control Valve Calibration is 311. Move this by a single digit to 211 or 411 as you begin to adjust it. Control Valve Calibration that is set too high will produce high variances and the motor shaft will be seen surging during this test. Also consider if you will run at the low rpm or not. If not in your operating range, the variance can be totally ignored.

CFR (Cubic Feet / Revolution) Calibration



This test is required before applying dry fertilizer.

1. Go to Calibrate, then CFR.
2. Select the correct Bin, then push Calibrate CFR button.
3. The 3 items on the left side of the screen will show up at the settings from the product information setup. If those aren't correct, you can enter new values right here.
4. Enter the Test Speed and Test Rate that you will typically use in the field.
5. Enter the amount of material you want to catch and weigh for calibration.
6. When the data is entered an Estimated Test Time will be computed, which must be between 10 seconds and 10 minutes.
7. Push the button in the lower right corner to proceed with the test.
8. Turn the hydraulics on, Master on and push Start button.
9. After the test batch of fertilizer is dispensed, weigh it and enter the amount. A new CFR value will be computed.



Troubleshooting

G

Troubleshooting

Hydraulic Motor Will Not Turn

Turn hydraulics off, go to the SureFire PWM valve (on motor or stand-alone) and use the manual override on top of the electric coil to manually open the valve (Manual Override UP = valve fully open). Turn hydraulics on **at a low flow only** as the valve is 100% open. Try hydraulic lever in opposite direction. Does the pump turn? If it turns, your problem is electric / electronic. If the pump still does not turn, you have a hydraulic problem.

Electric / Electronic Problem

1. Close manual override (lock down)
2. Go to Diagnostics, Control Valve Test to investigate this issue.
3. Verify hydraulics are on.
4. In Control Valve Test, hold down "+" button for a few seconds. A single tap of this button produces a very small change in signal to the valve, so you must hold it.
5. Take a metal object and hold it next to the coil. If the coil is working, you will feel the magnetic pull.
6. If no magnetic force is felt, disconnect the PWM valve connector and check voltage. You will need 6-12 volts to get hydraulic valve to open.
7. If 6-12 volts is not present, check harnesses and review control valve type setup.
8. Go back to the 37 pin connector at the John Deere Rate Controller. Check voltage between pins 4 & 5, should be between 6-12 volts while in section test after holding "+" button.
9. If you cannot get voltage at pins 4 & 5, contact your John Deere dealer for further assistance.

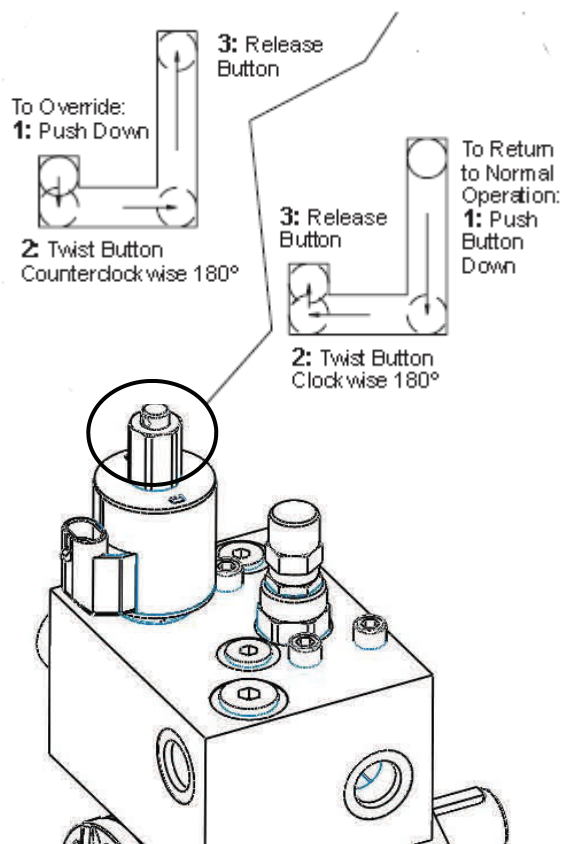
Hydraulics Problem

1. Leave the manual override open on the SureFire valve.
2. Check the hose routings. The "P" port on the SureFire valve should hook to pressure. The "T" port is the return that should flow back to the tractor.
3. Try hoses in a different hydraulic remote. Inspect hydraulic connectors for damage or restrictions.

Hydraulic Manual Override

Down - Normal Operation

Up - Override, valve 100% open



Troubleshooting

G

Trouble-
shooting

Application Rate Fluctuates

First, you need to determine if the fluctuation is caused by the controller sending fluctuating signals to the valve.

1. Go to Control Valve Test as shown in Initial Operation, Section F.
2. Turn the system on and watch the RPM.
3. Is the RPM steady within a very small range. For example a fluctuation from 89 to 92 RPM would be considered normal. A fluctuation from 70-95 RPM is a problem. If only a small normal fluctuation is seen in section test, proceed to "Application Rate Fluctuates in Field " below.
4. If there is a large fluctuation, watch the motor shaft to see if it is rotating steadily or if it is actually jerking.
5. If there is a large fluctuation and the motor is turning steadily, check the speed sensor for distance to target and alignment. Make sure all components are securely mounted.

Application Rate fluctuates in field, but RPM in Control Valve Test mode is stable.

This problem indicates the valve calibration needs changed. The system is surging because the Rate Controller is moving the hydraulic valve too much.

1. Go to Setup - System - PWM Setup.
2. Change the Valve Calibration by reducing the valve speed (first two digits). For example reduce the number for 311 to 211, which changes valve speed from 3 to 2.

Application Rate is slow to get to the Target Rate

1. You may need to increase the valve calibration. Go to Setup - System - PWM Setup.
2. Change the Valve Calibration by increasing the valve speed (first two digits). For example increase the number from 311 to 411, which changes valve speed from 3 to 4.
3. You can also increase the minimum PWM setting. This will start the pump at a faster speed when it initially turns on.

No Flow or RPM shown on GS2/GS3 but liquid is being pumped

1. Unplug meter / conveyor sensor. With voltmeter, check for 12 volts between pins B&C of Metri-Pack 150 speed sensor connector. If 12 volts not present, inspect wiring harness and troubleshoot all connections per schematic (see Section D).
2. If 12 volts is present, then conduct a tap test. Have a second person watch RPM on the 1,2,3 screen while other person taps (use a short piece of wire or a paper clip) between pins A&C of Metri-Pack 150 speed sensor connector. An RPM value should show up indicating the wiring is not damaged.
3. If GS2/GS3 responded to the tap test, your wiring to that point is good.
4. Adjust or Replace speed sensor.

PWM Valve and Motor Parts



- 164-FTA0925 4.9 CID Hydraulic Motor with PWM Valve and Bypass Valve, CW Rotation (includes all parts below EXCEPT hydraulic adapter fitting and elbows.)
- 164-FTA0994 same as above EXCEPT smaller 4.0 CID motor
- 165-P15618A-3 Stand Alone PWM Valve - Stand-alone valve uses the same 12 volt coil, solenoid valve and needle valve as shown below.

166-SP10-20M-0-N-00
H/F Prop 2-W Solenoid Valve with Manual Override (cartridge valve only, does NOT include electrical coil)

166-NV10-22C-O-N
Needle valve for hydraulic PWM motor

164-60564
Hydraulic Motor Seal Kit for Eaton T Series hydraulic motor with 1" shaft

166-4303512
Coil, 12 Volt DC EY Coil

166-050308-SS
.312 (5/16) x 3 - 1/2" SS bolts for hydraulic motor
166-05LW-SS
5/16" SS lock washer for hydraulic motor

165-P15648-2
PWM Hydraulic Valve with Bypass, Complete Manifold Only for mounting to Eaton T Series Motor

Qty 4 each

166-158-1042-001
Eaton T Series Motor, 1" Shaft, 4.9 CID, Manifold Ports

Alternate: 166-158-1543-001
Eaton T Series Motor, 1" Shaft, 4.0 CID, Manifold Ports — The smaller 4.0 CID motor is used where hyd flow is limited, but full PumpRight output is necessary, an example is plumbed in series behind John Deere CCS Fan.

161-02-8MJ-8FJX-90
Elbow - #8 Female JIC x #8 Male JIC - 90 (optional)

161-01-8MB-8MJ
Adapter - #8 Male O-Ring Boss x #8 Male JIC

161-07-1108R
Hydraulic Check Valve - #8 Male O-Ring Boss Inlet x #8 Male JIC Outlet

166-ORING-012
O-ring for manifold ports between valve and motor
Qty 2

