

# FurrowForce™

## **FurrowForce Operator's Guide**

## Precision Planting®

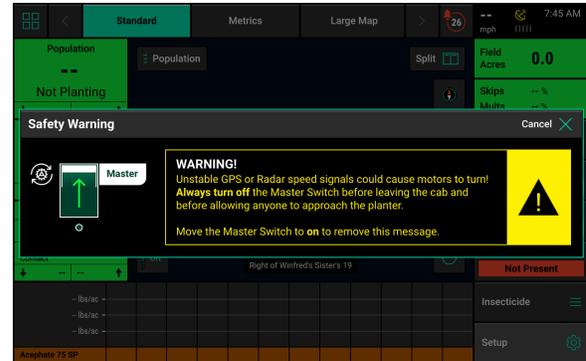
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## Safety Warning

Once any control product is configured on the 2020 display, the system will require a Cab Control Module (CCM) and will prompt the user to toggle the Master Plant switch on the CCM before any control products can be used.

**Note:** This Safety Warning will only appear in 2020.1.x and newer software.

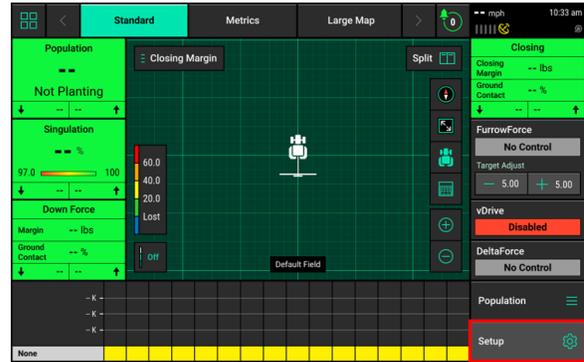


If a CCM is not installed, the cancel button can be used to bypass this warning. No control systems will operate until the Master Plant switch is toggled. This icon will be present in the status button in the top right if the Safety Warning was bypassed using the cancel button.

# Assign FurrowForce as the Closing System

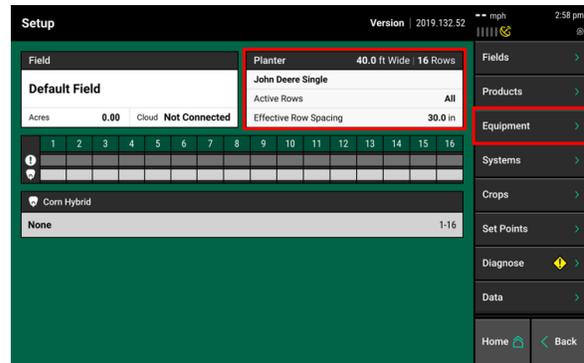
## Step 1:

From the Home Screen, press “Setup”.



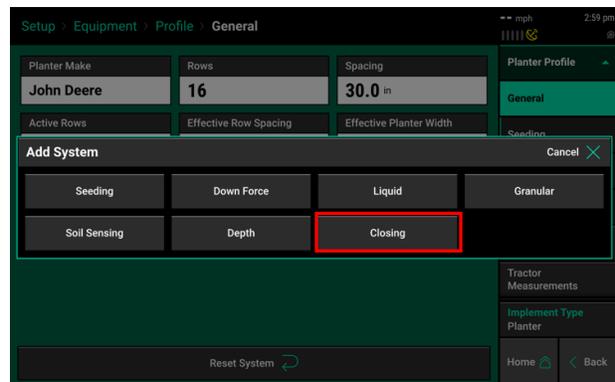
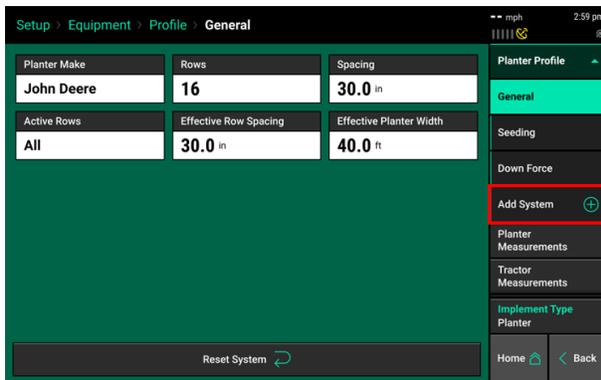
## Step 2:

Select “Equipment” from the right menu, or select the “Planter” box to go to the Equipment Profile page.



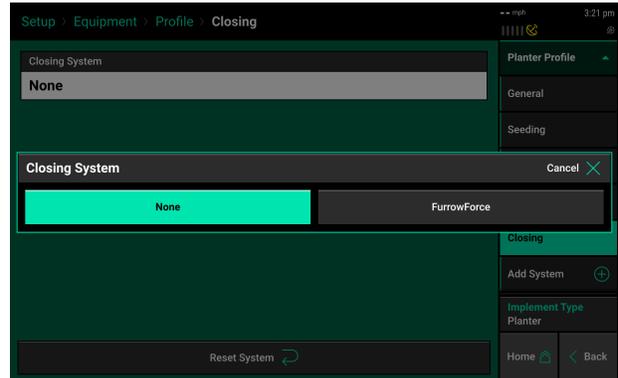
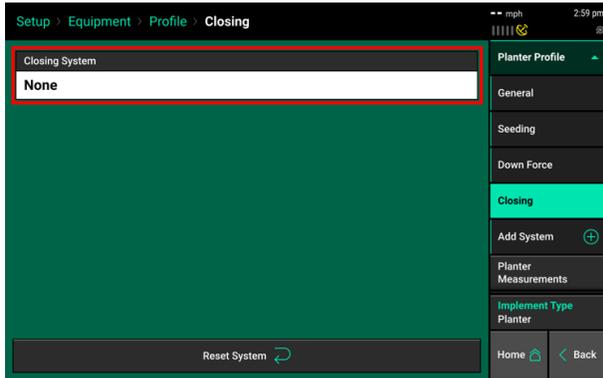
## Step 3:

Select “Add System”, then select “Closing”.



**Step 4:**

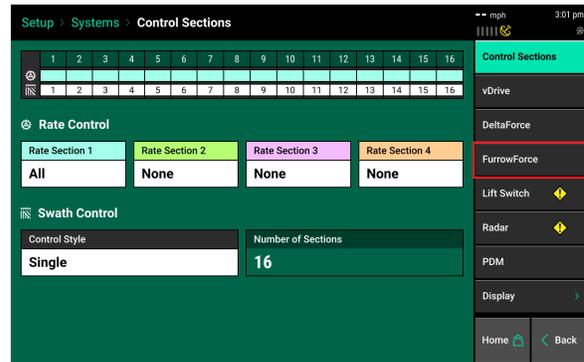
Select the “Closing System” box then select “FurrowForce”.



# FurrowForce Setup

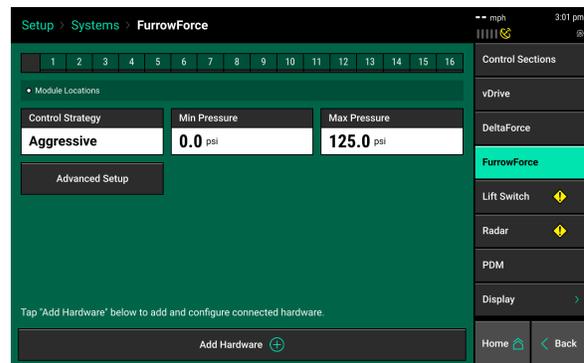
## Step 1:

Navigate to “Setup”, “Systems”, “FurrowForce”.



## Step 2:

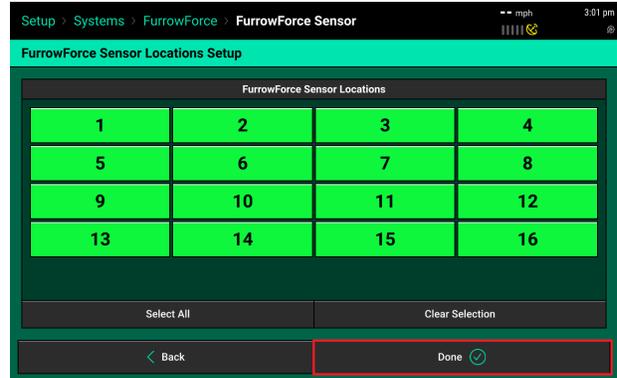
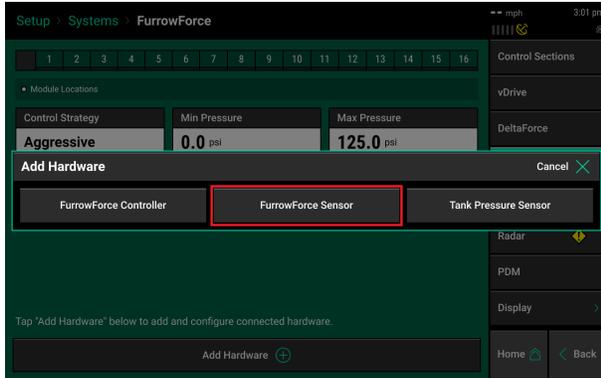
Once on the FurrowForce setup page, select the “Add Hardware” button at the bottom of the screen to configure the appropriate components.



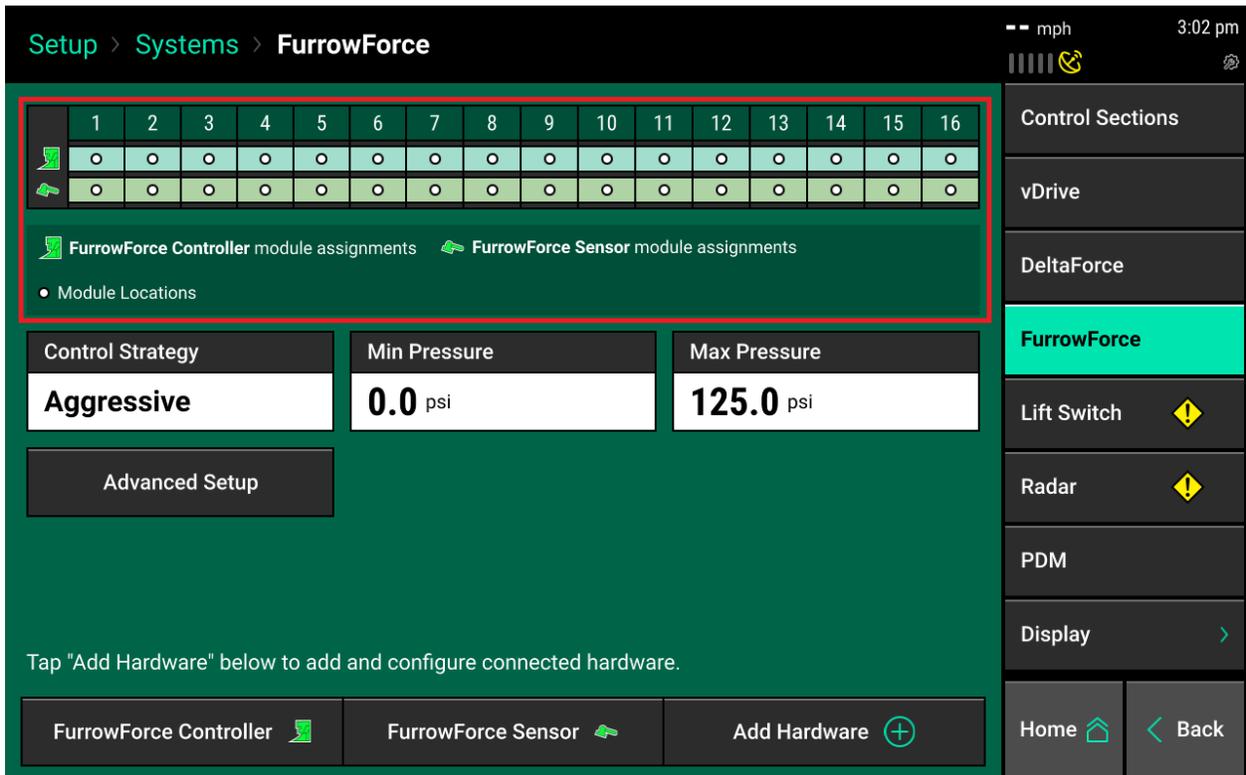
### Step 3:

Select “FurrowForce Sensor” and then select the planter rows that sensors are installed on. If installed on all rows, choose “Select All”. Select “Done”.

**Note: Row boxes will turn green when selected.**

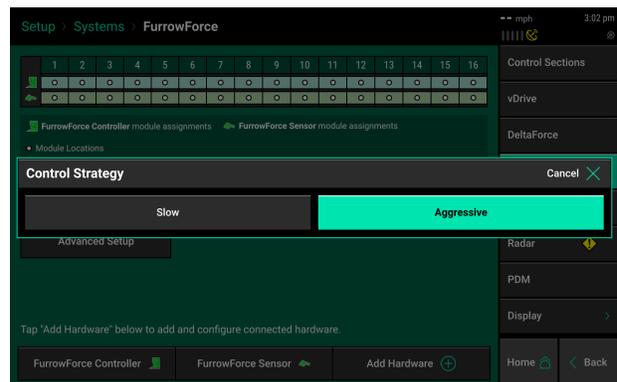
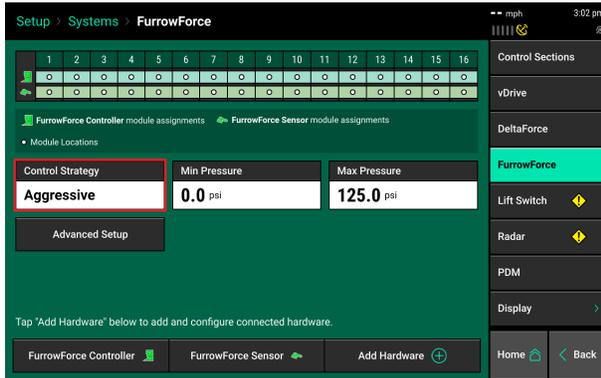


Repeat this step for the FurrowForce Controller and Tank Pressure Sensor if installed. Once complete, the graphic at the top of the screen will indicate how each component was configured and should match the physical installation.



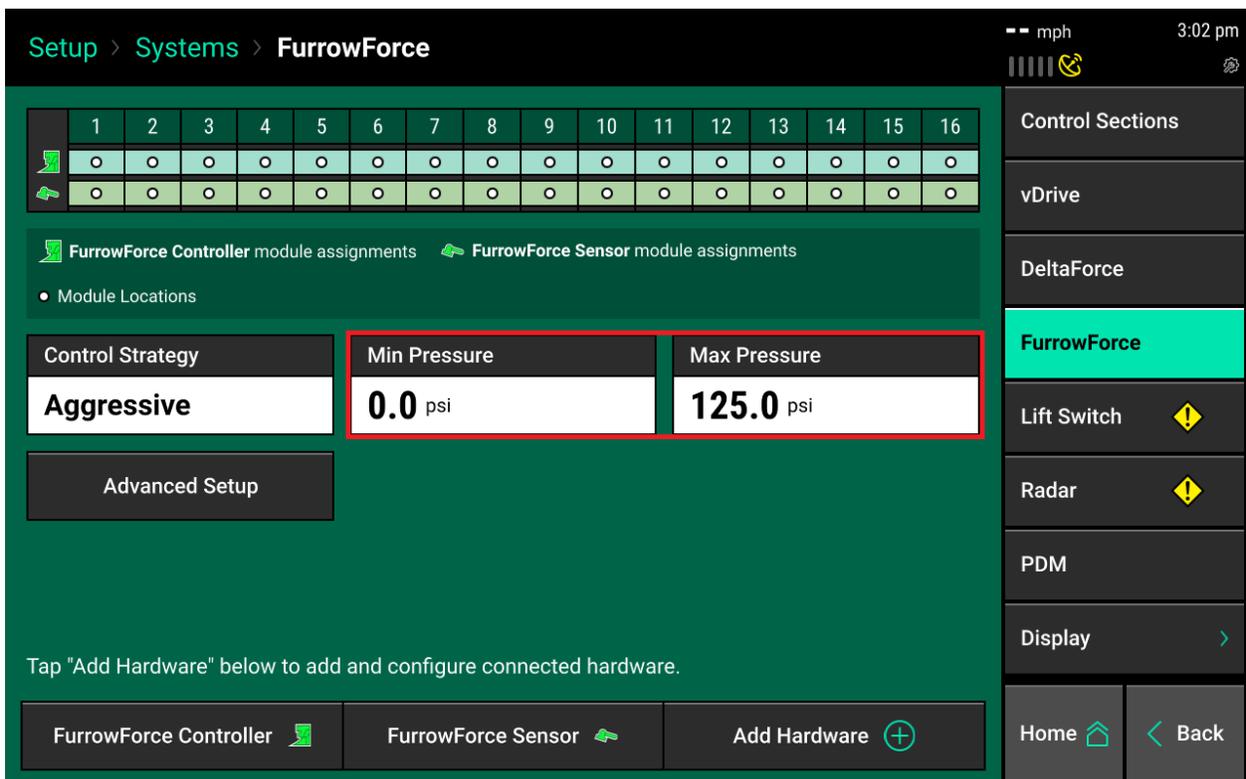
The remaining setup items are set to default values and do not require an initial setting to be made.

**Control Strategy** — Adjusts how quickly FurrowForce Control Modules will make a control value change. The default value is “Aggressive”. “Slow” will limit module reaction time and should only be used in instances where a compressor is unable to keep up with airflow requirements, for example.



**Min. Pressure** — Default value is 0 psi. Adjusting this will change the minimum pressure FurrowForce Control Modules will adjust to.

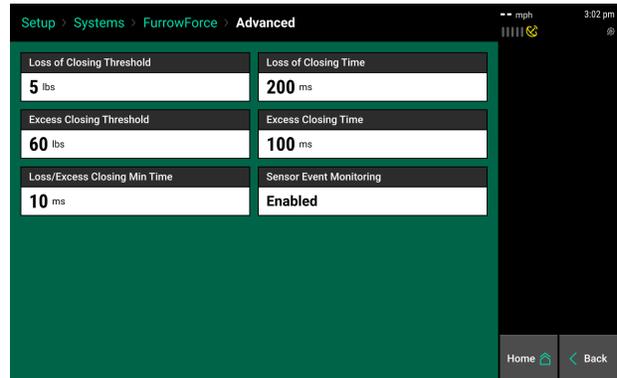
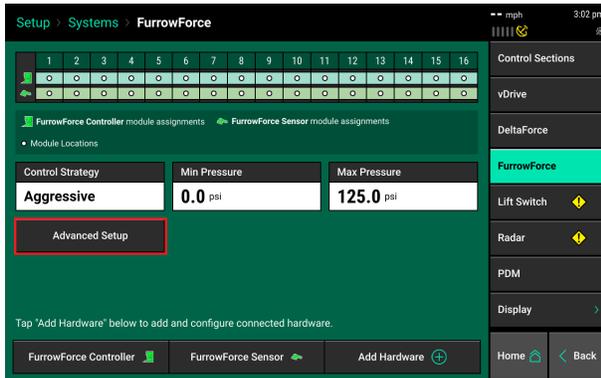
**Max Pressure** — Default value is 125 psi. Adjusting this will change the maximum pressure FurrowForce Control Modules will adjust to.



## Advanced Setup

The “Loss” and “Excess” selections change how the FurrowForce Load Sensor data is mapped, but does not change how the system is controlled. **DO NOT adjust these values unless directed.**

**Sensor Event Monitoring** — Allows FurrowForce component diagnostics to be disabled. The default setting is “Enabled”. **DO NOT change to “Disabled” unless directed.**

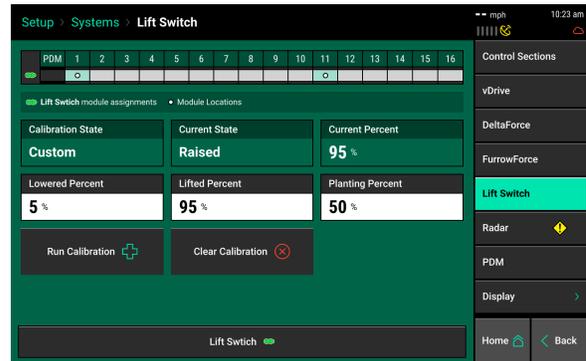


# Lift Switch

One of the requirements for all control products to function is for a lift switch to be installed, and reading lowered.

Configure the connected lift switches by selecting ‘Add Hardware’. Select all of the rows (or PDM) where lift switch(es) are plugged in at. A summary of lift switch locations will be displayed at the top of the screen.

**Note:** Configuration of lift switch row locations is only required on 2020.1.x and newer software.



## Calibrate Lift Switch

To complete the Lift Switch calibration, press the “Run Calibration” button at the bottom of the screen. Follow the onscreen instructions for the different positions the planter must be in. The results will then be displayed on the main Lift Switch Page. For issues with the lift switch not calibrating or functioning correctly, see the Troubleshooting Guides for Lift Switches in the Dealer Service Manual. After a calibration has been completed, verify the system is reading the lift switch correctly by watching the “Current State” information on the Lift Switch page. Ensure the “Current State” is correct when lowering and lifting the planter.

Manual entry of values can be done by selecting the “Lowered Percent”, “Lifted Percent”, or “Planting Percent” buttons and entering a value.

To clear out the current calibration press the “Clear Calibration” button located at the bottom of the screen.

# Configure and Enable FurrowForce Control

**Note:** If operating a sensing and manual control system, it is only necessary to configure the Closing Margin widget. Control and adjustments will be made with the manual pressure regulator in the cab.

Once FurrowForce Setup is complete, the Closing Margin widget and FurrowForce Control widget should be added to a home screen layout.

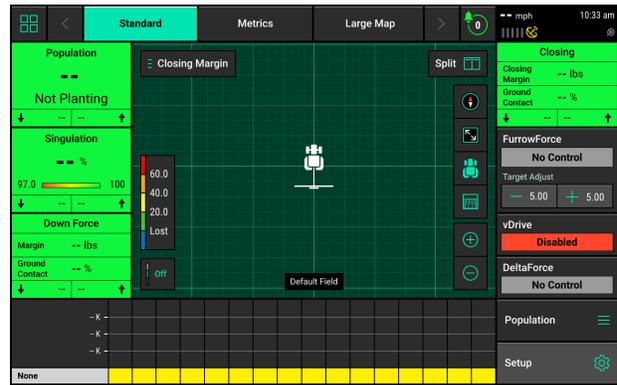
Select the “edit home screen” button in the upper left corner of the home screen to open the edit widget page, then select “Add Widget” in the bottom right corner.



Select “Metrics”, then choose the “Large” size option. Scroll through the list and select the “Closing Metric” widget.



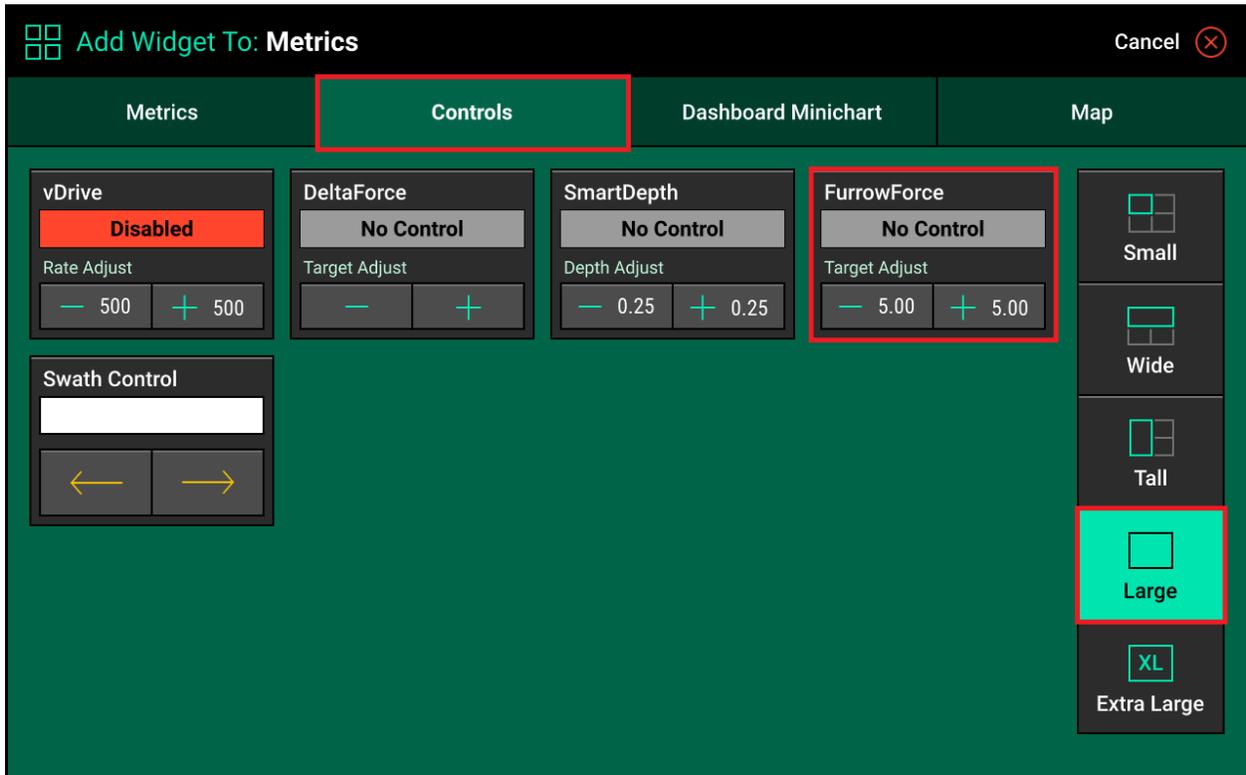
Place the widget in the desired position on the home screen layout and select the “check mark” in the upper left corner to save the layout.

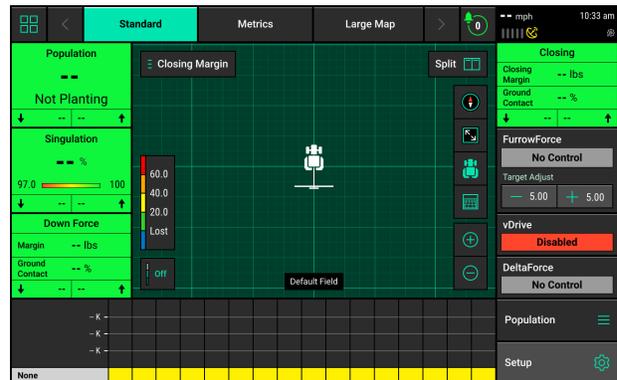
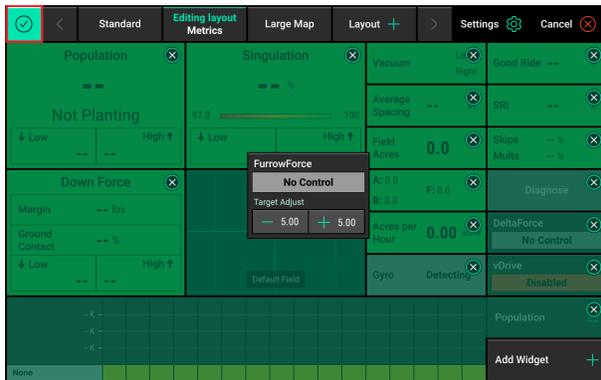


Go through the same steps to add a widget, select “Controls” and choose the desired widget size.

**Note: The large size is recommended as it provides a  $\pm 5$  lb. closing target adjustment directly from the home screen.**

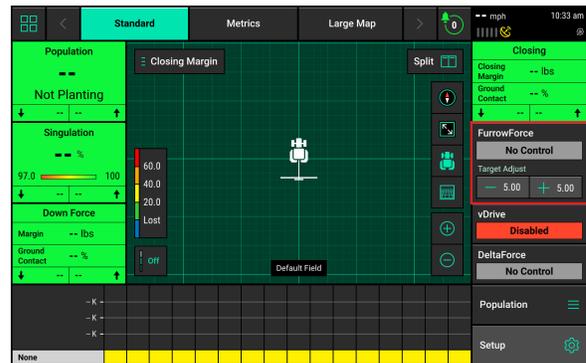
For the size chosen, select the “FurrowForce” control widget to add it to the screen layout. Place the widget in the desired position on the home screen layout and select the “check mark” in the upper left corner to save the layout.



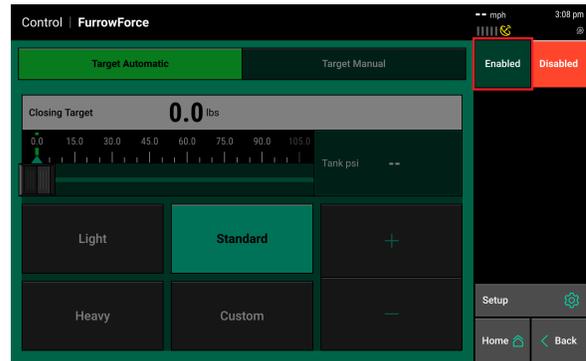


## Enable FurrowForce Control

Select the “FurrowForce” widget on the home screen to navigate to the FurrowForce control screen.



Select “Enabled” to enable FurrowForce Control. FurrowForce must be enabled for the system to function. If all other requirements are met, but control is not enabled, it will not function.



**Note:** When FurrowForce is “Disabled”, bag pressure will release and go to 0 psi. If FurrowForce remains enabled and the Master Plant switch is shut off, the current pressure will remain in the airbags.

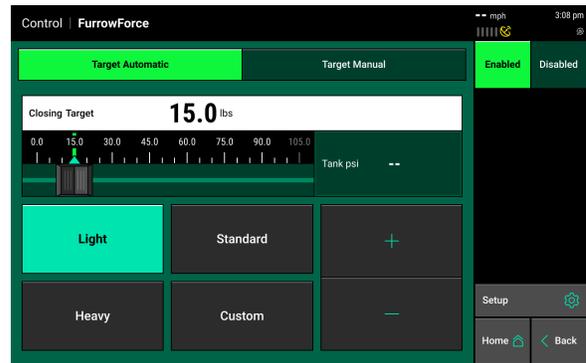
There are two control modes available: “Target Automatic” and “Target Manual”.

### Target Automatic

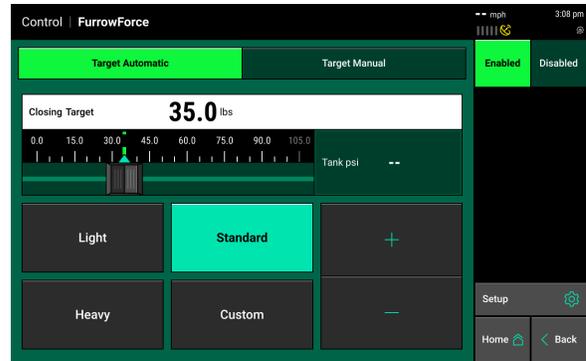
Target Automatic should be selected as default. The operator will set a closing target value of weight to maintain on the second stage wheels. The system will automatically adjust the airbag pressure (row by row) to maintain the Closing Target setting (lbs) based on sensor readings.

When Target Automatic is selected, there are four Closing Target Settings:

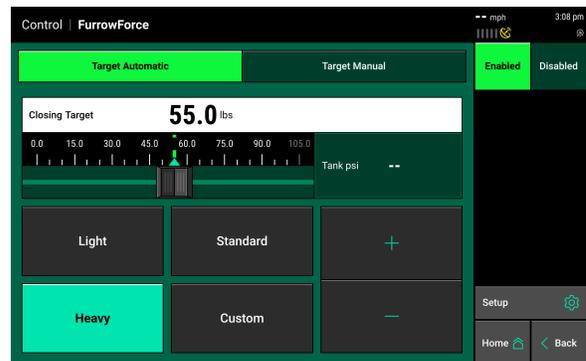
**Light** — Closing Target is set to 15 lbs.



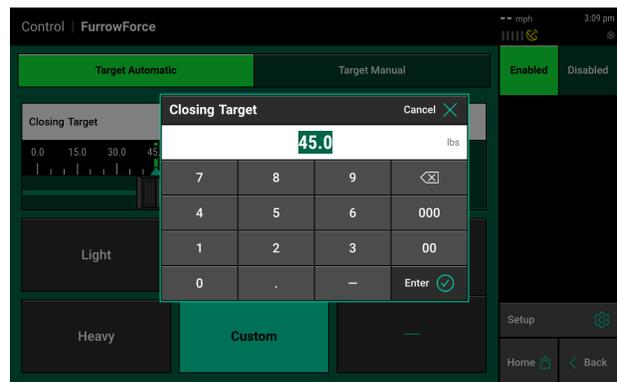
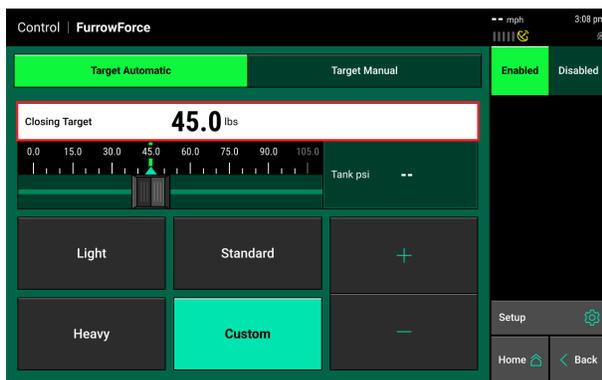
**Standard** — Closing Target is set to 35 lbs.



**Heavy** — Closing Target is set to 55 lbs.

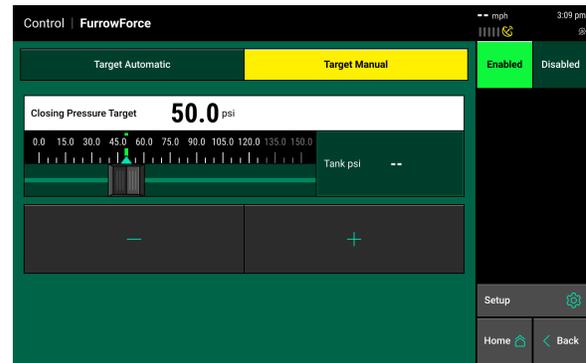


**Custom** — This setting is user defined and allows for target adjustments of 5 lbs. using the “+” and “-” buttons. Selecting the value box or using the slider under the Closing Target value can also be used for even finer adjustments if needed.

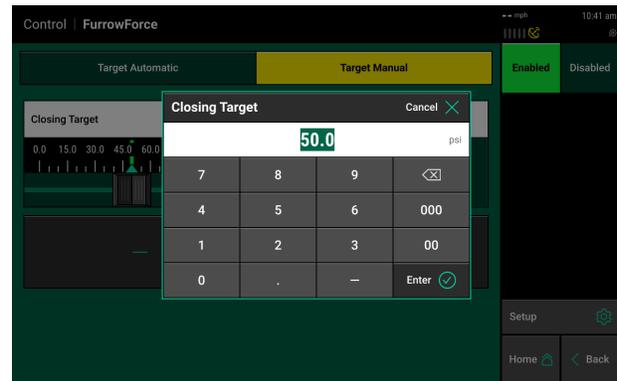
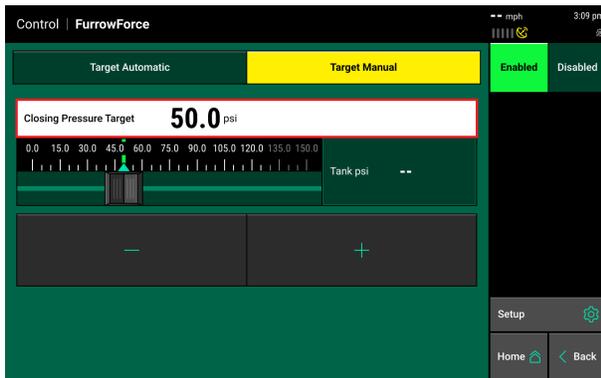


## Target Manual

If Target Manual is selected, the operator sets a static planter wide airbag pressure (psi) to be maintained by the system. Load sensor(s) data will be reported, but is not used for control or automatic adjustment. This mode could be used for plot work, or if a compressor is unable to keep up with automatic control airflow requirements.

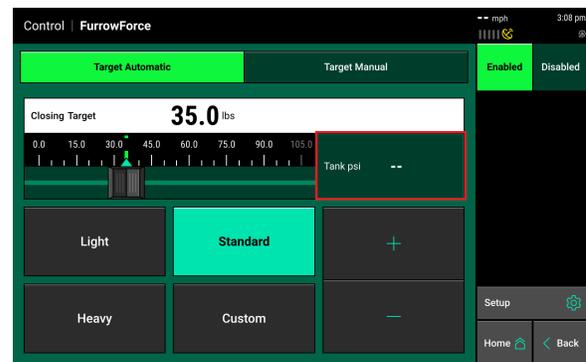


Select the Closing Target box or use the +/- buttons to adjust the target.



## Tank PSI

Tank PSI will display the system pressure if the optional (756555) Tank Pressure Sensor is installed and configured.



# FurrowForce Metrics and Operation

## Closing Metric Box

**Closing Margin** — The lowest measured sensor reading in a given period of time for each row.

The Closing Margin value displayed in the metric box is an average value across all sensors installed and functioning on the planter.

**Ground Contact** — The percentage of time the second stage wheels have a load on them (greater than 5 lbs.). 100% would indicate the first stage wheels are achieving the closing depth setting.

**Low and High Row** — The average sensor reading for the lowest and highest rows.

<b>Closing</b>			
<b>Closing Margin</b>	<b>33.1 lbs</b>		
<b>Ground Contact</b>	<b>95.9 %</b>		
↓ 8	11.1	44.5	7 ↑

Select the Closing Metric box to view row by row FurrowForce information.

**FurrowForce Details**
-- mph 1:00 pm

Row #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Closing Margin -- lbs																
Closing Margin -- lbs																
Closing Margin -- lbs																

DMC Auto Scroll  
**Disabled**

Row Details

Soil Temp

Organic Matter

CEC

SmartFirmer Details

**FurrowForce**

Swath Control

Home < Back

Row #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Closing Actuator Pressure -- psi																
Closing Actuator Pressure -- psi																
Closing Actuator Pressure -- psi																

Row #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Ground Contact 100%																
Ground Contact 95.0%																
Ground Contact 90.0%																

Closing Margin

-- lbs

Closing Actuator Pressure

-- psi

Ground Contact

--%

This page displays Closing Margin, Closing Actuator Pressure (Automatic Control Systems only), and Ground Contact for each row with the appropriate components installed. Planter average values are displayed at the bottom of the page.

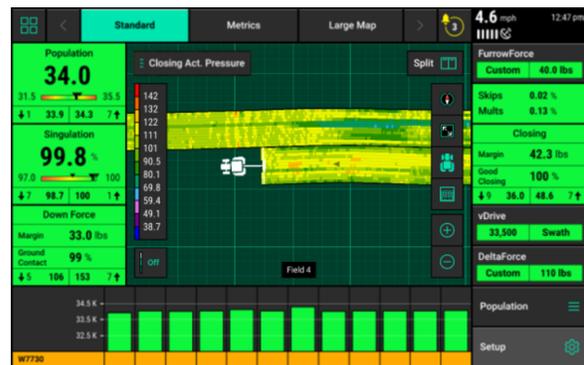
## FurrowForce Maps

**Closing Margin** — Displays the weight (lbs.) on the second stage wheels for each row as reported by FurrowForce Load Sensors. A blue dot represents a potential loss of closing, or a spot where the furrow may not be closed. Select the legend to edit the map range and number of steps. Refer to the “FurrowForce Operation” section below for more information on how to use this map.



**Closing Act. Pressure** — Only available with Automatic Control Systems. Displays the pressure (psi) in the airbag for each row as reported by the FurrowForce Control Module.

This map can be useful for diagnosing potential issues with a compressor or FurrowForce Control Module(s), for example. Select the legend to edit the map range and number of steps.



## Initially Setting FurrowForce

Below are general recommendations for initially setting the FurrowForce Closing Target for Automatic Control Systems.

### How to Initially Set the Closing Target?

#### Light Target (10 – 20 lbs.)

- Conditions prone to compaction
- Marginal or wet conditions in all tillage practices
- Running too heavy in these conditions will reduce emergence

#### Standard Target (25 – 40 lbs.)

- Most good planting conditions
- Not prone to compaction or drying out
- No-Till, Strip Till, Stale Seedbed, Conventional Till **IF** it is not cloddy and has had substantial rain after field cultivator

#### Heavy Target (40 – 55 lbs.)

- Conditions prone to drying out
- Concerned about trying to preserve moisture
- Most Conventional Till, Loose Vertical Till, or Strip Freshener
- Use the higher end for very cloddy conditions

**Note:** These are only recommendations. Each operator is responsible for using all the available information and checking in-ground performance to ensure the system is set correctly for specific conditions. Refer to the section below for details on when/how to make in-season adjustments.

## **FurrowForce Operation**

**Note:** Before considering a Closing Target adjustment, ensure the closing depth is set properly for the specific crop/planting condition. Refer the “Setting the First Stage Wheel Depth” section at the end of this document, or in the FurrowForce Installation Manual.

**Closing Margin Map** — This will provide the operator the most comprehensive and accurate view of FurrowForce performance, but is only one piece of information to consider. As stated above, a blue dot indicates a potential loss of closing. If blue dots are appearing consistently on the Closing Margin map and closing ground contact is dropping below 100%, in-ground closing performance should be checked and the Closing Target should be increased as needed.

A red dot on the Closing Margin map indicates potentially running to high of a Closing Target, which could cause compaction from FurrowForce. Again, in-ground performance should be checked and the Closing Target should be decreased as needed.

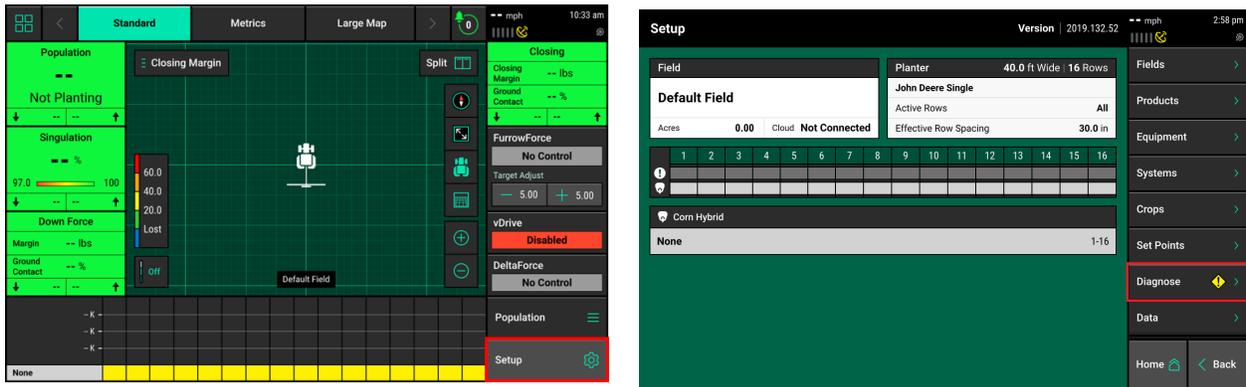
**Note:** Ensure the map legend is displaying a representative operating range before making Closing Target adjustments.

**Ground Contact %** — The Closing Metric box displays ground contact % as a planter wide average. The goal is to maintain 100% ground contact or as close to 100% as possible. There could be certain conditions however that 100% or close to 100% will not be obtainable, but the furrow is still being closed properly. It is also possible to achieve 100% ground contact, but the closing target is too heavy, creating compaction. It is critical to use ground contact as an indicator to check the closing margin map and in-ground performance before making a Closing Target adjustment.

**In-Ground Checks** — Investigating and confirming in-ground closing performance is an important step in verifying system operation. Digging should be performed on the initial start-up/operation, when conditions change, or if inconsistencies are seen in the Closing Margin map, for example. There are conditions that will not be viewable on a map/metric and can only be confirmed by digging and evaluating the furrow. For best results, the operator should balance using the available information on the 20|20 and confirming operation by evaluating how the furrow is physically being closed.

# FurrowForce Diagnostic Information

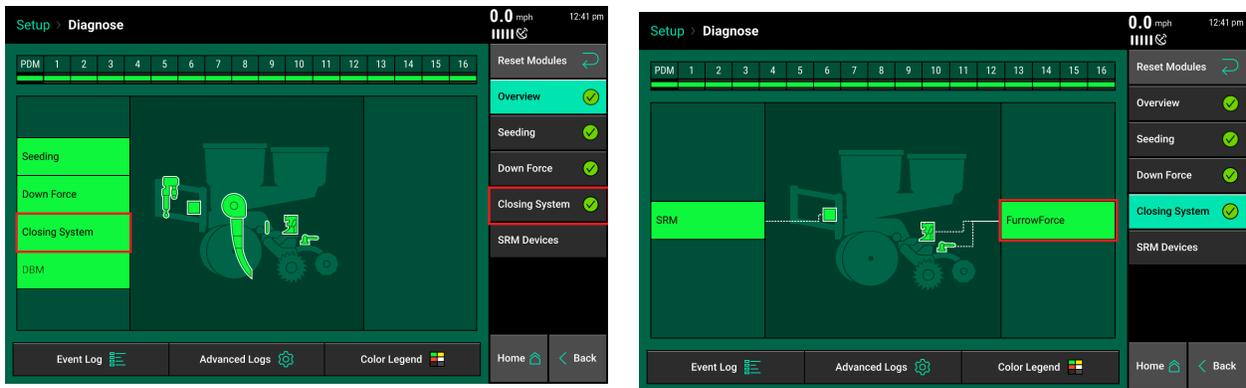
Prior to planting, ensure that all planter diagnostic information is ok. Select “Setup”, “Diagnose”.



All systems should be green on the diagnose page. Select “Color Legend” to view an explanation of what each color indicates.

**Note: Modules may be updating during initial connection. Once updates are complete, all modules should be green. If the modules are not green, confirm the planter/system setup is correct.**

Select the “Closing System” box in the diagram or from the right menu. Select “FurrowForce” to view the FurrowForce Level 2 Diagnose Page, which includes detailed information for FurrowForce components.



Setup > Diagnose > FurrowForce 4.8 mph 12:41 am

Row	Supply Volts Sensor	Supply Volts Control	Reading (lbs)	Status	Reference Value	Pressure Cmd (psi)	Pressure Actual (psi)
1	11.4	11.7	24.6	Active	90.0	5.0	7.0
2	11.4	11.6	27.1	Active	96.0	5.0	8.0
3	11.4	11.6	30.5	Active	80.0	5.0	8.0
4	11.4	11.6	22.3	Active	74.0	7.0	9.0
5	11.4	11.7	31.7	Active	80.0	5.0	6.0
6	11.4	11.6	28.9	Active	78.0	5.0	10.0
7	11.4	11.6	32.2	Active	74.0	5.0	6.0
8	11.4	11.7	29.0	Active	68.0	5.0	9.0
9	11.4	11.6	26.8	Active	88.0	5.0	6.0
10	11.4	11.6	22.9	Active	84.0	5.0	6.0
11	11.3	11.6	26.7	Active	86.0	5.0	6.0
12	11.3	11.6	24.0	Active	104.0	5.0	8.0

Reset Modules  
Zero FurrowForce  
SRM  
FurrowForce  
Home < Back

Lift State Lowered   Radar Speed Wait Signal   GPS Speed 4.8 mph   Master Plant On   Active Sensors 16   Control Mode Enabled

The following information is listed for each FurrowForce row:

**Supply Volts Sensor** — Displays the supply voltage for the FurrowForce Load Sensor

**Supply Volts Control** — Displays the supply voltage for the FurrowForce Control Module

**Reading (lbs.)** — Weight being carried on second stage wheels as measured by the FurrowForce Load Sensor

**Status** — Sensor state/status (Active, Faulted, Ignored)

**Reference Value** — Baseline for each sensor

**Pressure Cmd. (psi)** — Commanded pressure needed to achieve closing target based on sensor reading

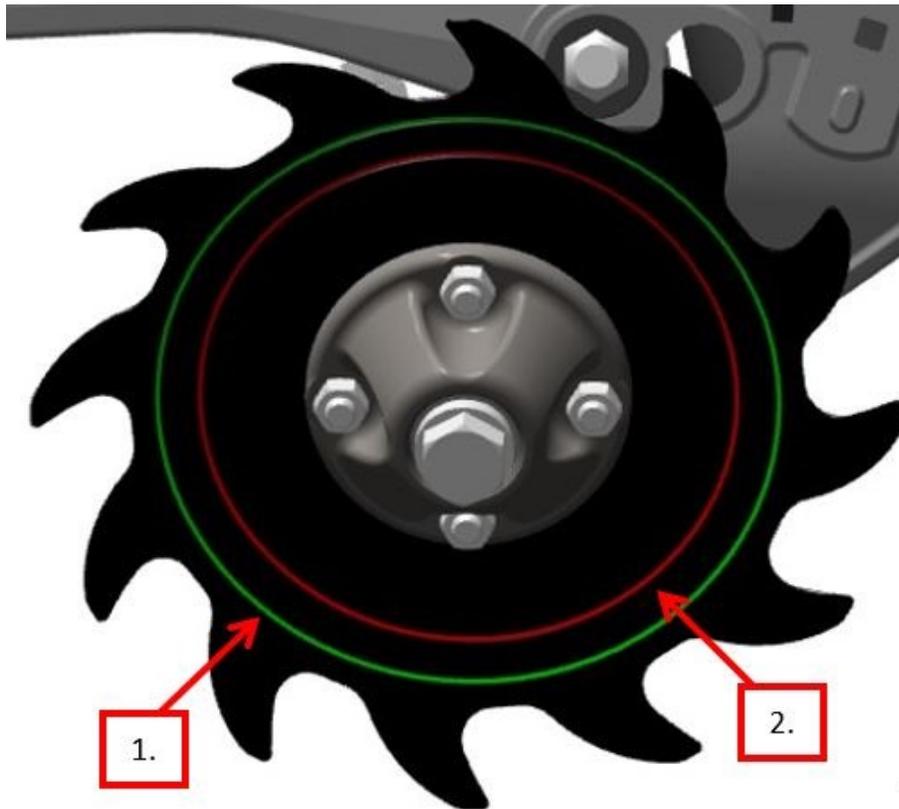
**Pressure Actual (psi)**— Actual airbag pressure as measured by the FurrowForce Control Module

**Note:** If a FurrowForce Load Sensor is ignored, that row will control FurrowForce to the average of all other properly operating rows.

## Setting the First Stage Closing Wheel Depth

After installation is complete, the first stage closing wheel depth needs to be set. This will need to be done and checked in the field.

The first stage wheels have two closing depth indicator rings cast into the outside face of the wheel. The outer diameter ring indicates approximately 1.5 inch closing depth (1.) The inner diameter ring indicates approximately 2 inch closing depth (2.).



For planting depths of 1.5” or deeper, start with the wheel depth set to approximately 1/4”-1/2” shallower than planting depth. For example, if planting depth is 2 inches, initially set the closing depth to operate at the 1.5 inch ring. **When initially setting closing depth, operate the closing force target to ensure the closing system is fully in the ground and achieving 100% closing ground contact. Check closing performance in-field to further adjust as necessary.**

**Note:** For shallower planting depths, it may be necessary to run the first-stage wheels deeper relative to seed depth, and possibly closer together (by removing spacers).