

Gen3 Liquid Operators Manual
vApplyHD, vApplyHD section, vApplyBase, FlowSense

Precision Planting®

Contents

Safety Warning	4
Planter Setup.....	5
Control Sections Setup	6
vApply Setup	8
vApplyHD Setup	12
FlowSense Setup	17
Flow Meter Setup	21
Lift Switch	23
Pump Calibration Process.....	25
Procedure for vApplyHD using “Pump Cal” or “Pump Cal with Hold”	25
Procedure for setting a pump with “Constant PWM” with 20 20 Gen3.....	32
vApplyHD procedure for setting the speed of an uncontrolled pump.....	37
vApply Base	41
vApply HD Manual Test	44
Liquid System Control and Homepage	46
Liquid Product Alerts	53
Prescriptions and Boundaries	54
Liquid — Diagnose	57
vApply Sidedress Mode—Gen 3 20 20.....	63

Sidedress Quick Reference Guide	63
Overview	63
Switching into Sidedress Mode	64
Equipment Menu	65
Equipment — Sidedress Bar Measurements	66
Equipment — Tractor Measurements.....	67
System Menu	70
vApply Setup	71
PDM	71
Radar Status.....	73
Home Page.....	73

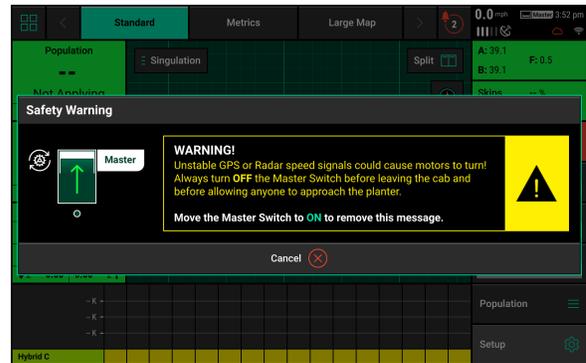
Safety Warning

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. This warning is triggered any time the system is booted up, and when the system has traveled for more than half a mile.

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.



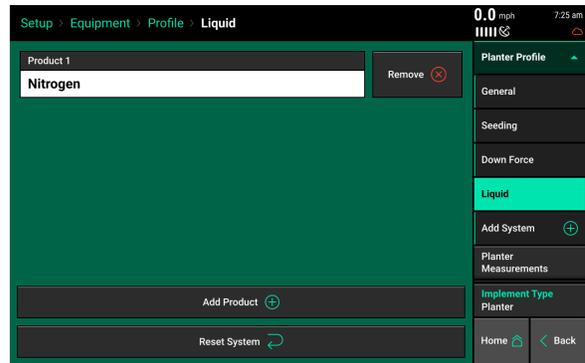
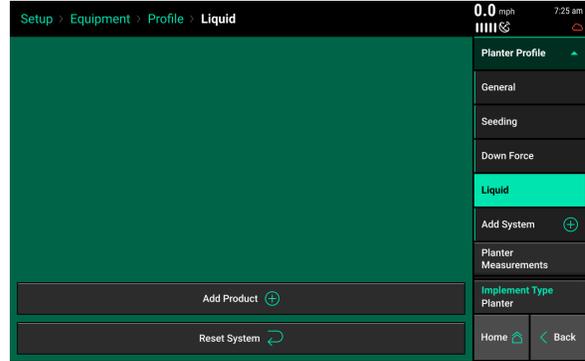
Planter Setup

Begin setting up a vApply system on your planter by pressing “**Setup**” on the home screen and navigating to the Equipment tab on the right-hand menu. Under the Planter Profile menu on the right, select “**Add System**” and then “**Liquid**” from the Add System Menu.

Tap on “**Add Product**” at the bottom of the screen in order to begin the setup wizard for adding a new liquid product to this 20|20.

Next, select or create a custom “**Product Name**” that will be displayed on the home page, diagnose page, and control page to identify the product being applied on the monitor.

Note: The ‘Remove’ button on the right side removes the individual product, and the ‘Reset System’ at the bottom of the screen can be used to reset all liquid settings.



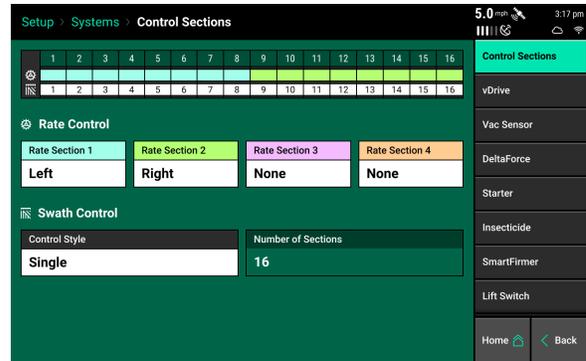
Control Sections Setup

Navigate to Setup — Systems to configure the Control sections of this implement. The Control Sections will apply to all rate control products configured on this monitor. This includes seeding control, liquid fertilizer control, and granular fertilizer control.

Note: This section only applies to 2020.1.x and newer software, for 2020.0.x and older software, proceed to the next section of the manual.

Rate Section Setup

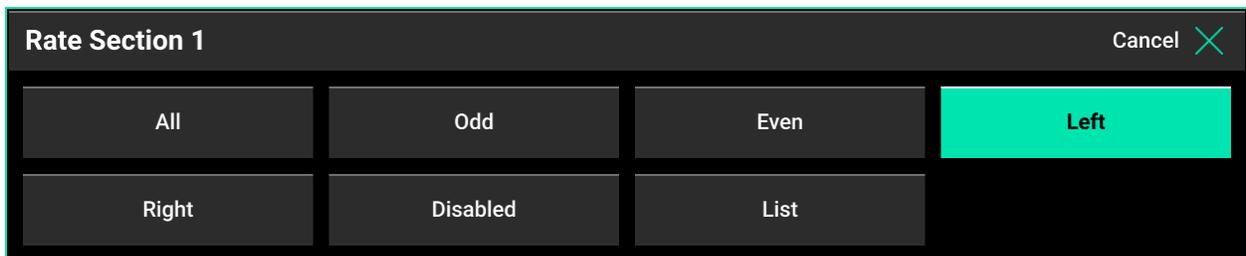
Setup the “Rate Control”. Rate Control Setup allows the operator to determine which rows to set to certain rates. The monitor can control up to 4 different rate sections at once. Each rate section can be assigned a different target rate or prescription attribute. A rate section can be any combination of rows.



If all rows will be controlled with the same rate or the same prescription attribute only one rate section needs to be configured. If only one rate section will be used select “Rate Section 1” and then select “All”. Use multiple rate sections when controlling different rates between rows or sections.

To setup a rate section, select one of the four Rate Sections. Assign appropriate rows to the rate section. This may be Odd, Even, Left, Right or List. When selecting “List”, define which rows are to be used by touching those rows numbers so they turn green.

Note: Ensure that all rows are assigned to a rate section. Any row not assigned to a rate section will not operate.



Swath Setup

Set up the Swath Control. Swath Section Setup allows the operator to divide the planter into different swath sections. There are four different options for Swath Control.

Note: If setting up multiple Swath Sections, they **do not** have to be the same as Rate Sections.

Disabled — Rows will not shut off seeding when entering an area that is already planted.

Single Row — Each row will shut off individually as that row enters an area that is already planted.

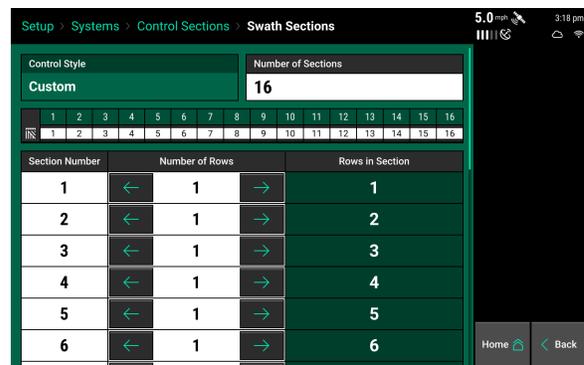
Dual Ends — The outside two rows on each end of the planter are linked together. The inside rows are single row swath. Generally used with WAAS GPS correction.

Custom — If one of the pre-set settings is not acceptable, a custom setting can be selected. This will allow the operator to group any rows together for swath control.

Custom Swath Setup

If Custom is Selected:

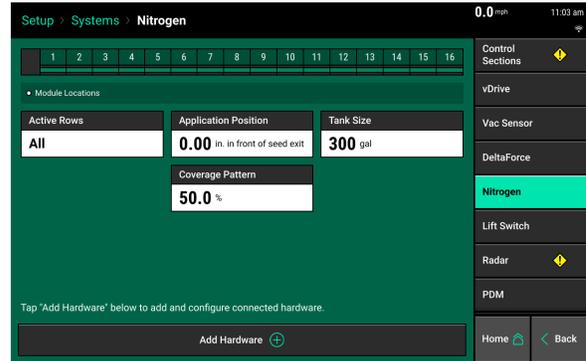
1. Select the total number of sections to set up.
2. For each section select the number of rows by pressing on the white box in the Number of Rows column and manually enter a value or by using the arrows to increase or decrease the number of rows in a section number
3. The Rows in Section will auto-populate as the Number of Rows is determined.
4. If a section does not have rows assigned to it, that section number will be ignored.



vApply Setup

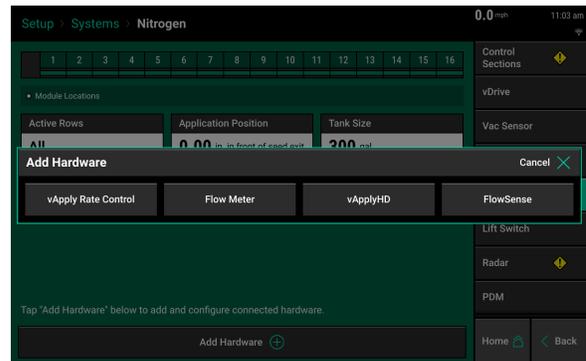
System Setup

The vApply Liquid product suite uses a vApply Module when controlling rates and commands. The vApply Module is used on all vApply Base, vApplyHD Section Control, and vApplyHD Row by Row Control. Set up your vApply Module by navigating to your Liquid product (Setup>Systems>Product Nickname) and pressing on the “Add Hardware” button at the bottom of the screen.



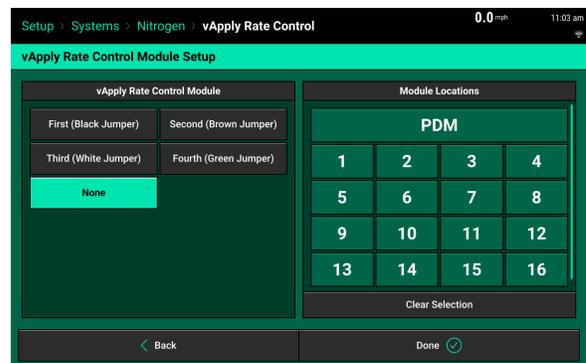
Add Hardware

Tap on “vApply Rate Control” to begin setting up the vApply Rate Control module for this product..



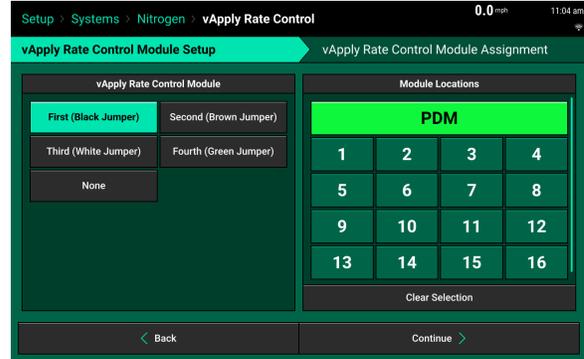
vApply Pump Control Module — Jumper Color

Next, identify what color CAN connection is physically plugged in to the vApply Module that is being used for this product and select that color from the “vApply Pump Control Module” menu. Typically, the first product utilizes a standard Black CAN connection, while Brown, White, and Green are the Second, Third, and Fourth Liquid Products. While this is helpful in keeping each system organized and the same from customer to customer, it is not mandatory on software 2020.1.xx and newer. Selecting the correct color that is physically plugged in, regardless of product number, is compatible. If the module is plugged into the PDM without a colored ID jumper, the selection should be “First (Black Jumper)”.



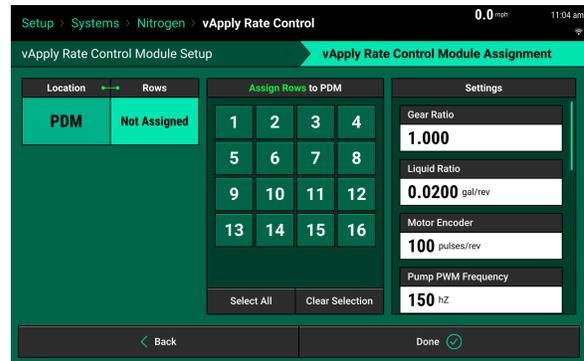
vApply Pump Control Module — Locations

After setting the correct CAN Jumper assignment, use the “**Module Locations**” menu to select where the vApply Module is physically plugged in. 2020.1.xx and newer software allows the vApply Module to be plugged in to either the PDM directly, or any SRM Row CAN Expansion Hub.



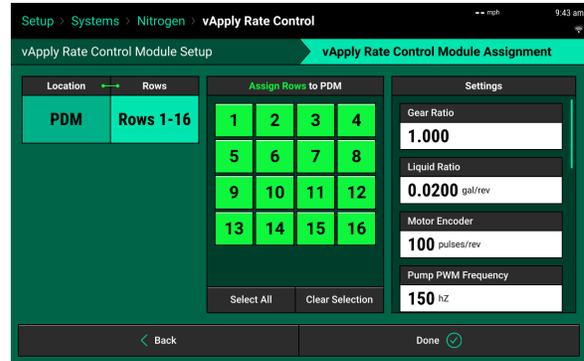
vApply Pump Control Module — Row Assignment

After assigning where the vApply Module is physically plugged in, assign which rows are assigned to this module by selecting the rows under “**Assign Rows**”.



vApply Pump Control Module — Settings

After assigning the rows that are associated with this vApply Module, finish this section by running through the “Settings” list and completing any items needed. See descriptions below for each item.



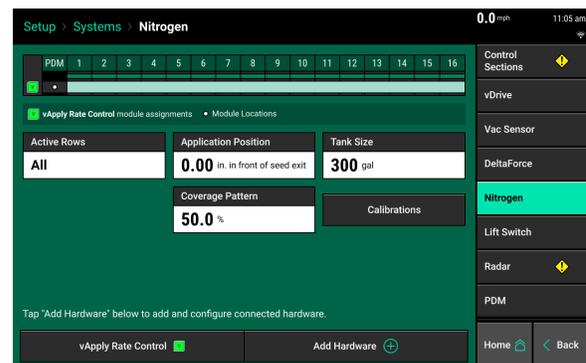
- **Gear Ratio:** This is the gear ratio between the hydraulic drive and the liquid pump. Used only for vApplyBase control system, not used for vApplyHD systems.
- **Liquid Ratio:** The output of the pump in gallons/revolution. This value can be found in the pump owner’s manual or in the calibration process for vApplyBase. Used only for the vApplyBase control system, not used for vApplyHD systems.
- **Motor Encoder:** Number of pulses per revolution of the hydraulic motor shaft speed sensor. Used only for vApplyBase control system, not used for vApplyHD systems.
- **Pump PWM Frequency:** Frequency needed to control the PWM solenoid. Default of 150hz will work for most systems. Changes should reflect the pump manufacturer’s recommendations.
- **PWM Control Set Point:** Percentage of PWM output to control the pump in one of two instances. It is used if “PWM Control Style” is set to “Constant PWM”. It is also used if all vApplyHD modules are swathed off when “PWM Control Style” is set to “Pump Cal w/ Hold”.
- **PWM Control Style:** Used to select what style of control the system will use for the pump with vApplyHD systems.
 - “Pump Cal” will control the pump according to the values entered below for Pump Cal Min PWM, Pump Cal Max PWM, Pump Cal Min Rate and Pump Cal Max Rate.
 - “Pump Cal w/ Hold” will control the pump like the Pump Cal option, but will return the pump to the “PWM Control Set Point” when all rows are swathed off, such as in an already applied area.
 - “Constant PWM” will control the pump to a single speed regardless of system demand, this will be the value set in “PWM Control Set Point”.
 - If the pump is uncontrolled, meaning that the pump speed is controlled by SCV control, ground drive or some other method, any selection is acceptable.
- **Pump Cal Min PWM:** The percentage of PWM that will be used to run the pump when the system demand is at the “Pump Cal Min Rate” or all rows are swathed off. Used for vApplyHD systems with the 20|20 controlling the speed of the pump.
- **Pump Cal Max PWM:** The percentage of PWM that will be used to run the pump when the system demand is at the “Pump Cal Max Rate”. Used for vApplyHD systems with the 20|20

controlling the speed of the pump. The pump CAN be controlled to a higher percentage if the system need is greater than the “Pump Cal Max Rate”. Used for vApplyHD systems with the 20|20 controlling the speed of the pump.

- **Pump Cal Min Rate:** The minimum intended total system demand in gallons/minute. This can be calculated by taking the number of rows times the minimum desired gallons/minute of a single row. Used for vApplyHD systems with the 20|20 controlling the speed of the pump.
- **Pump Cal Max Rate:** The maximum intended total system demand in gallons/minute. This can be calculated by taking the number of rows times the maximum desired gallons/minute of a single row. Used for vApplyHD systems with the 20|20 controlling the speed of the pump.
- **Max Pump Pressure:** The maximum allowable system pressure. If this pressure is exceeded the system will slow the pump by lowering the PWM percentage until pressure is below the “Max Pump Pressure”.
- **Motor Control Gain: DO NOT CHANGE** this setting unless directed by product support. Default value of 1 is used. Increasing or decreasing by 0.1 increments increases or decreases the aggressiveness of PWM control.
- **Minimum PWM:** This is the minimum PWM percentage that the system will output to the pump. This can be set per pump manufacturer recommendation to ensure that the pump will not stall at low PWM.
- **Maximum PWM:** This is the maximum PWM percentage that the system will output to the pump. This can be set per pump manufacturer recommendation to ensure that the pump will not be controlled to an excessive speed and damage the pump.
- **Pressure Source:** “Internal” is for the vApply Rate Control module with built in pressure sensors. “External” is for the vApply Rate Control module that does not have a built in pressure sensor, there is a separate pressure module.
- **Max Pump Speed:** This is the maximum RPM that the liquid pump will be allowed to operate. To utilize this setting, a pump shaft speed sensor is required and the “Motor Encoder” setting is inputted properly. If no shaft speed sensor is installed, this setting is ignored.

vApply Pump Control Module — General Settings

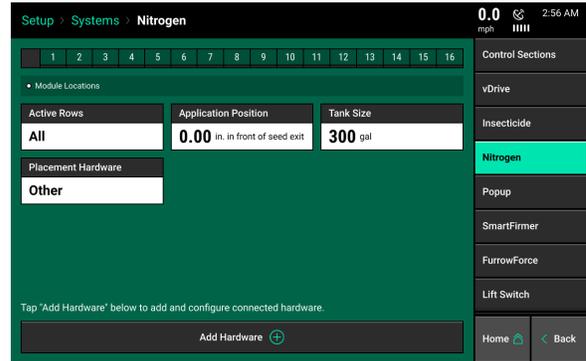
Pressing “Done” on the setup wizard brings the user back to the main screen of the current product setup. A vApply module icon (small box with a “V”) is now shown at the top of the screen. The small white dot indicates the Module location, and the colored bar(s) show which rows it is assigned to. If more hardware is associated with this product (vApplyHD, FlowSense, Flow Meters), select the “**Add Hardware**” button to continue setting up the full system.



vApplyHD Setup

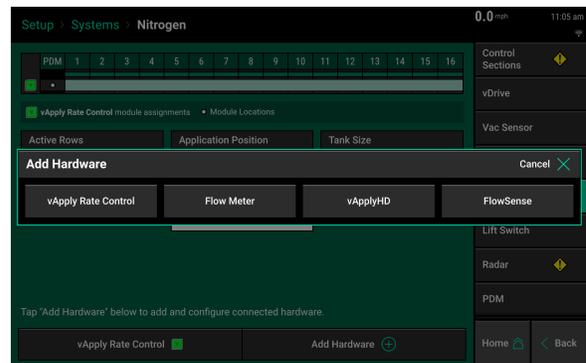
System Setup

When setting up a vApplyHD row-by-row or section control system, vApplyHD modules will need to be set up and configured in the Systems tab for the specific product. Navigate to “Setup>Systems>Product Name” (Nitrogen in this example). Select “**Add Hardware**” at the bottom of the screen to begin configuring the vApplyHD modules.



Add Hardware

Tap on “**vApplyHD**” to begin setting up the vApplyHD modules for this product.

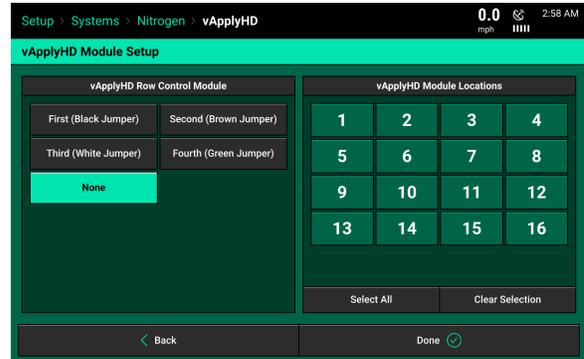


vApplyHD — Jumper Color

Next, identify what color CAN connection are physically plugged in to the vApplyHD Modules being used for this product and select that color from the “**vApplyHD Row Control Module**” menu. Typically, the first product utilizes a standard Black CAN connection, while Brown, White, and Green are the Second, Third, and Fourth Liquid Products. While this is helpful in keeping each system organized and the same from customer to customer, it is not mandatory on software 2020.1.xx and newer. Selecting the correct color that is physically plugged in, regardless of product number, is compatible. If more than one vApplyHD is plugged in on a single row, they MUST have unique CAN Jumpers in order to identify which module controls which product rates for that specific row. If the module is a vApplyHD Flex module plugged directly into the backbone, this module should be selected as “First (Black Jumper)”.

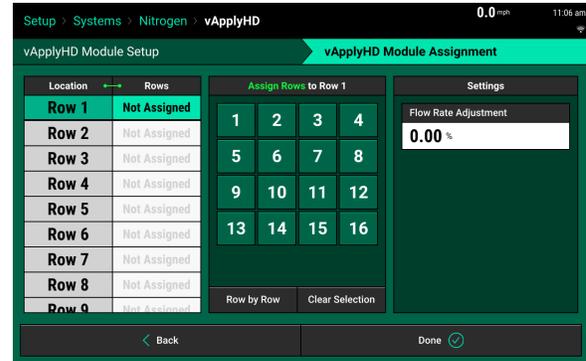
vApplyHD — Locations

After setting the correct CAN Jumper assignment, use the “**vApplyHD Module Locations**” menu to select where the vApplyHD Module is physically plugged in. 2020.1.xx and newer software allows the vApplyHD Module to be identified by the 20|20 based on CAN Jumper color AND location assignment. Select each row that has a vApplyHD plugged in; row-by-row systems will have each row installed, while section controlled systems will have vApplyHD installed on fewer rows than total.



vApplyHD — Row Assignment

After assigning where the vApplyHD Modules are physically plugged in, assign which row(s) are assigned to this module by selecting the row(s) under “Assign Rows”.

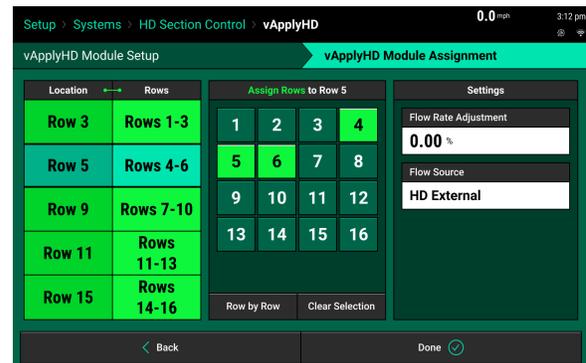


On a row-by-row system, each vApplyHD will have a single row assigned as shown. On a vApplyHD Section Control system, each vApplyHD will have several rows assigned to each vApplyHD module.



Settings — Flow Rate Adjustment

The controlled output of the vApplyHD module can be adjusted by a positive or negative percentage, up to +40% and down to -40%. This is to account for product that is a different viscosity than the average that the vApplyHD module is calibrated for. Generally a timed catch test should be performed prior to inputting a Flow Rate Adjustment. Each component of the system has an individual flow rate adjustment, therefore touch on each row to input the flow rate adjustment for that row.



Important Information!

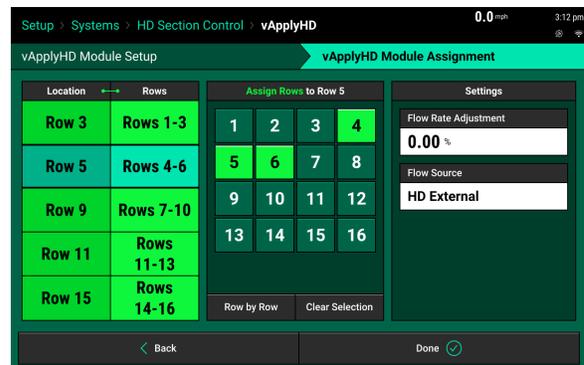
To ensure accurate measurement of the liquid product being applied, it is very important to perform a bucket check to see if a flow rate adjustment is needed. Some product’s viscosity is affected by temperature as well. If your product is affected by temperature, you will need a different flow rate adjustment for very cold product versus very warm product. If you later change tank mix or products, a bucket check will need to be performed again to verify if the flow rate adjustment needs to change.

- To perform a bucket check, first have the liquid product in the tank and prime the system completely.
- Navigate to Setup — Diagnose — Health Checks and scroll down to find the liquid product “Manual Test.”
- Enter the manual test screen and input the application rate and speed.
- Verify on the tab “vApplyHD” that the rate is being achieved by comparing “Flow” to “Flow command”
- Use a bucket to catch all of the liquid outputted from one or more rows with a timed test. The amount of time of the test can be determined based on the rate and size of the container. A one minute test will make calculating the ounces expected easy as you can multiply the GPM from the 20|20 x 128 oz/gal to get the ounces expected for one row. It is recommended to perform the catch three times to get a good average.
- If you catch the same amount as was expected, no flow rate adjustment is needed.
- If you catch more or less than was expected, a flow rate adjustment is necessary. Calculate the flow rate adjustment with the following formula. (oz expected — oz caught) / oz caught x 100 = % flow rate adjustment
- Note: If you caught MORE than expected, a negative flow rate adjustment is needed to decrease the rate. If you caught LESS than expected, a positive flow rate adjustment is needed to increase the rate.

Settings — Flow Source

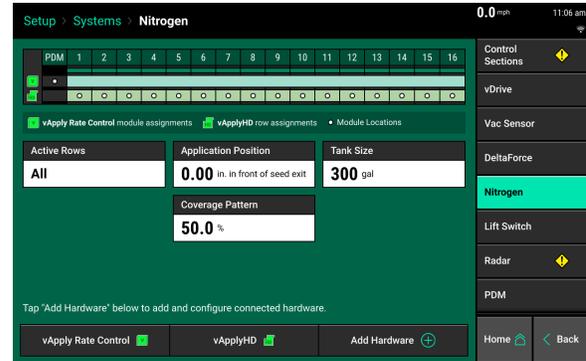
The setting “Internal” is used when the vApplyHD module is utilizing internal turbines to measure flow.

The setting “HD External” is used when the vApplyHD module has had the internal turbines removed. In this case an Electromagnetic (EM) FlowSense will be installed upstream of the vApplyHD module to provide flow rate information for the vApplyHD module to make adjustments to. Note: The vApplyHD and EM FlowSense must be plugged into the same row and have the same color CAN jumper.



vApplyHD — General Settings

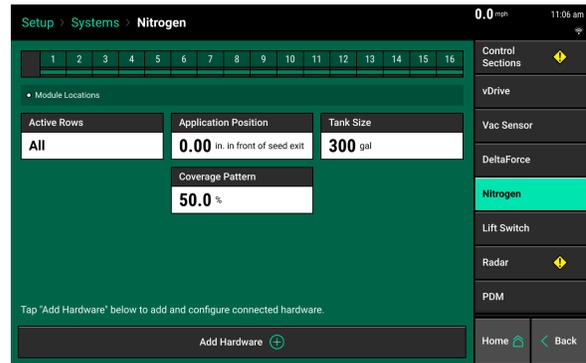
Pressing “Done” on the setup wizard brings the user back to the main screen of the current product setup. A vApplyHD module icon (irregular shaped box with “HD”) is now shown at the top of the screen. The small white dot indicates the Module location, and the colored bar(s) show which rows it is assigned to. If more hardware is associated with this product (vApply, FlowSense, Flow Meters), select the “**Add Hardware**” button to continue setting up the full system.



FlowSense Setup

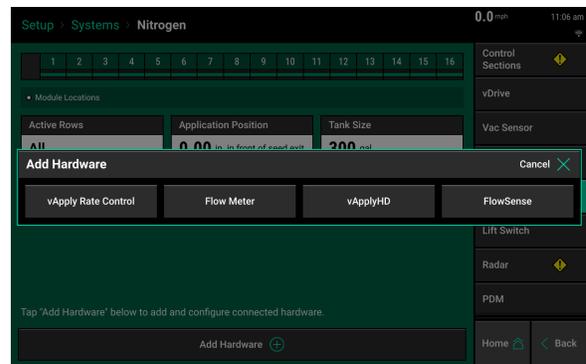
System Setup

FlowSense is used to monitor flow rates of an individual row. Set up your FlowSense modules by navigating to your Liquid product (Setup>Systems>Product Nickname) and pressing on the “Add Hardware” button at the bottom of the screen.



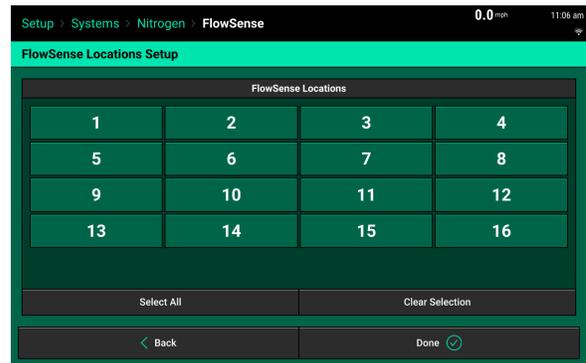
Add Hardware

Select “FlowSense” in order to set up FlowSense for this Liquid Product.



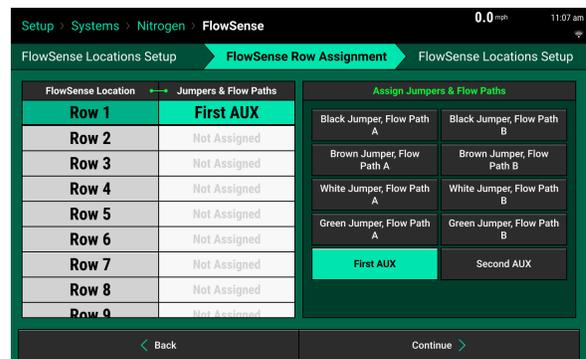
FlowSense — Locations

Under the “FlowSense Locations” page, you will select where you have physically plugged the FlowSense in on the toolbar. If you have a FlowSense on every row, you may press “Select All” to quickly highlight all row locations.

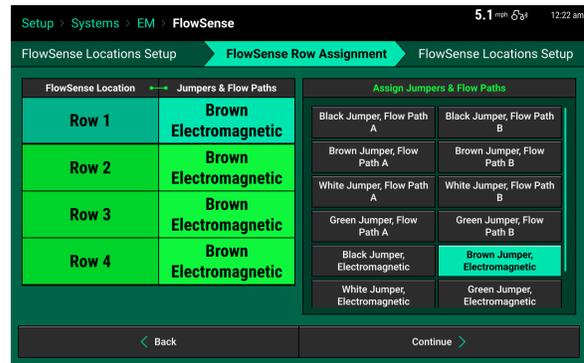


FlowSense — FlowSense Row Assignment

The next step in the setup process is to identify how each FlowSense for this product is plugged in to the SRM network. This way, when multiple products are being monitored by multiple FlowSense, the 20|20 can identify which FlowSense is reporting for each specific product.

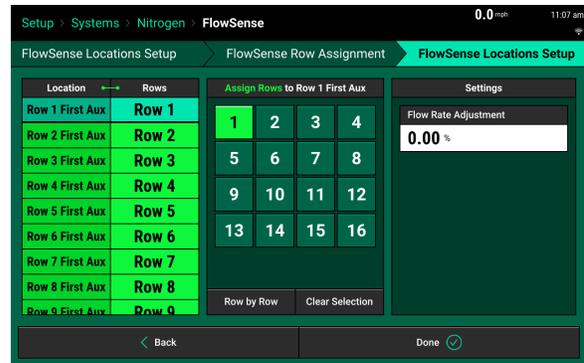


For Electromagnetic (EM) FlowSense you will need to have 2021.1.x or later software on your 20|20 monitor. Then select the correct option for your FlowSense. If you are using a black jumper to connect the FlowSense, choose Black Jumper, Electromagnetic. If you are using a brown jumper, choose Brown Jumper, Electromagnetic as you see in the screen shot. **Make sure and zero the EM FlowSense prior to field operations! See the operations section of this manual for the zeroing procedure.**



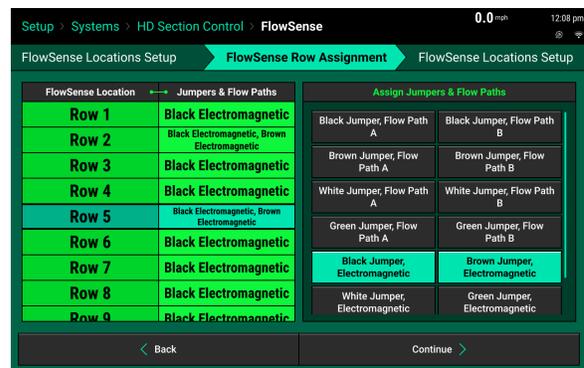
FlowSense — FlowSense Locations Setup

Finally, the FlowSense monitoring path needs to be assigned. This last step identifies which row the FlowSense is actually monitoring and should record and map to. When FlowSense is installed on each row, it will simply require you to select “Row by Row” in order to map each row that FlowSense is monitoring.

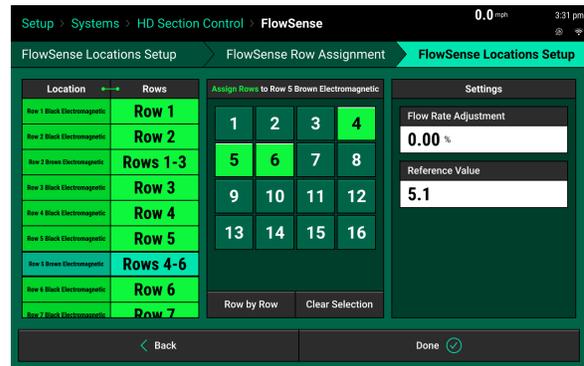


Row Assignment and Locations setup for EM FlowSense + vApplyHD control or vApplyHD section control

In 2022.1.x and later software it is possible to control the vApplyHD from an EM FlowSense providing rate feedback and remove the turbines from the vApplyHD module. This will require an EM FlowSense installed upstream of the vApplyHD and the vApplyHD and EM FlowSense plugged into the same row with the same CAN jumper color. (see the vApplyHD installation resources on the cloud for installation details). For section vApplyHD systems, It is possible to also have EM FlowSense on each row for row by row feedback as well. In a section system setup, the row with the vApplyHD, EM FlowSense for control and EM FlowSense for row by row feedback will have two EM FlowSense assigned to the row.



For the FlowSense locations setup in a section EM FlowSense +vApplyHD control, the EM FlowSense on each row for row by row monitoring will only have one row assigned to the FlowSense. The EM FlowSense that is paired with the vApplyHD module for control will have all rows of the section assigned to that FlowSense.



Flow Rate Adjustment — The measured output of the FlowSense module can be adjusted by a positive or negative percentage, up to +40% and down to -40%. This is to account for product that is a different viscosity than the average that the FlowSense module is calibrated for. Generally a timed catch test should be performed prior to inputting a Flow Rate Adjustment. Each component of the system has an individual flow rate adjustment, therefore touch on each row to input the flow rate adjustment for that row.

Important Information!

To ensure accurate measurement of the liquid product, it is important to know if a flow rate adjustment is needed. FlowSense is calibrated at the factory for “average” viscosity fertilizer, but your fertilizer might flow quicker or slower than the average. Some product’s viscosity is affected by temperature as well. If your product is affected by temperature, you will need a different flow rate adjustment for very cold product versus very warm product. If you later change tank mix or products, it will need to be checked to verify if the flow rate adjustment needs to change.

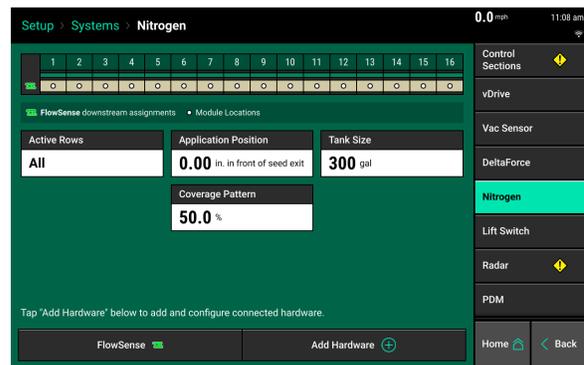
First a bucket check should be performed to verify if the rate expected is being achieved. If not, a change to the control system will be needed to achieve the rate, this could be the “flow rate adjustment” for the vApplyHD in the case of a section vApplyHD system with FlowSense on every row. If it is a system with some other form of control, change the system pressure or other control parameter to change the actual application rate.

- To perform a bucket check, first have the liquid product in the tank and prime the system completely.
- You can view the current measurement of flow in gallons/minute by navigating to Setup — Diagnose — (name of liquid product) — FlowSense
- Use a bucket to catch all of the liquid outputted from one or more rows with a timed test (it is recommended to catch multiple rows to verify the rate is the same out of each row). The amount of time of the test can be determined based on the rate and size of the container. A one minute test will make calculating the ounces expected easy as you can multiply the GPM from the 20|20 x 128 oz/gal to get the ounces expected for one row. You can convert gallons per acre (GPA) to gallons per minute per row with the following formula. (GPM per row = GPA * row spacing inches* speed MPH) /5940. It is recommended to perform the catch three times to get a good average.

- If you catch the same amount as was expected, no change to the control system is needed. If you caught a different amount than expected, make an appropriate change to the control system and then bucket check again to verify.
- Once the control system is accurate, then you can check if a flow rate adjustment is needed for the FlowSense modules.
- Option 1: Go to Setup — Diagnose — (name of liquid product) — FlowSense. View the rate being measured in gallons/minute. Option 2 — Plant and view the rate measured by the FlowSense by clicking on the FlowSense metric. If it is measuring LESS than the actual rate, a POSITIVE adjustment is needed. If it is measuring MORE than the actual rate, a NEGATIVE adjustment is needed. Calculate the adjustment by the following formula.
$$\frac{(\text{rate actual} - \text{rate measured})}{\text{rate actual}} * 100$$
 It is important to verify that the rate outputted is accurate with a bucket check as described above prior to making this change!

FlowSense — Settings

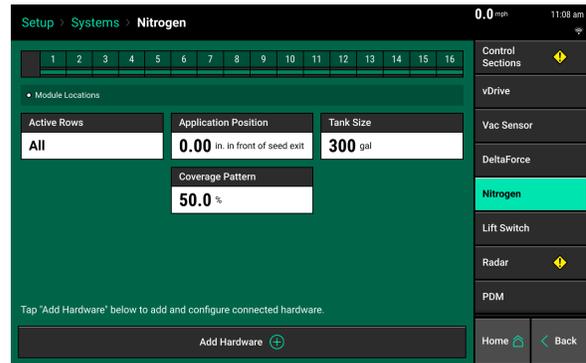
After completing the setup of FlowSense, the Product overview page will show the FlowSense Module Locations across the frame at the top of the screen.



Flow Meter Setup

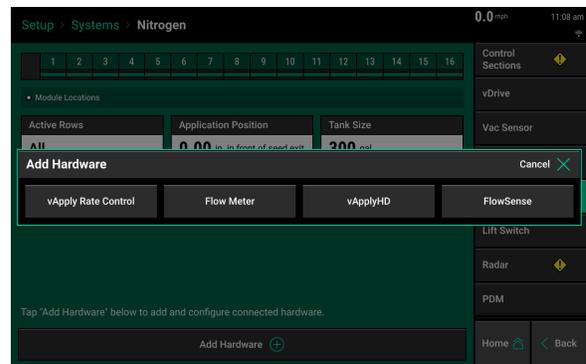
System Setup

A planter-wide flow meter is used to monitor flow rates across a toolbar. Set up your flow meter by navigating to your Liquid product (Setup>Systems>Product Nickname) and pressing on the “Add Hardware” button at the bottom of the screen.



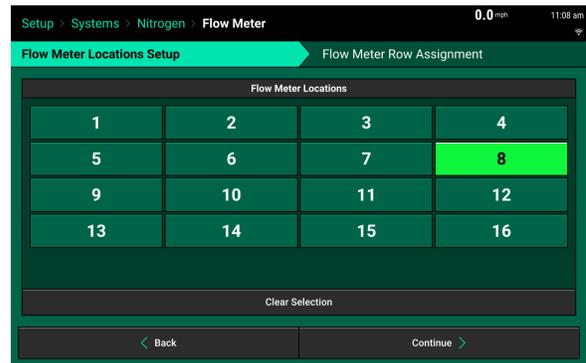
Add Hardware

Select “Flow Meter” in order to set up the flow meter for this Liquid Product.



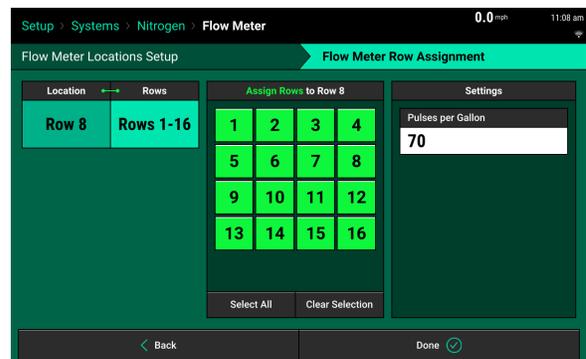
Flow Meter — Locations

Under the “Flow Meter Locations” page, you will select where you have physically plugged the Flow Meter in on the toolbar. Choose the SRM that it is plugged in to.



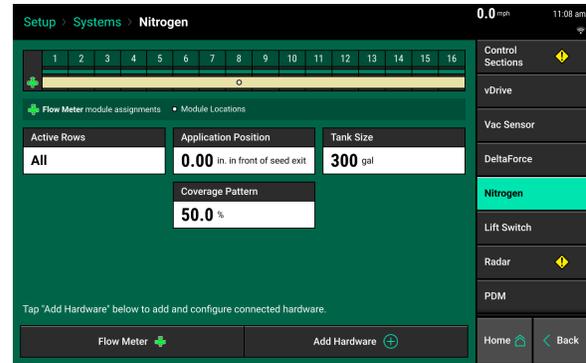
Flow Meter — Row Assignment

Next, assign which rows the Flow Meter is actually monitoring and should record and map. This is also the step where the Pulses per Gallon calibration value is entered in order to accurately measure flow through the Flow Meter.



Flow Meter — Settings

After completing the setup of the Flow Meter, the Product overview page will show the white Module Location dot and which rows are being monitored through that Flow Meter across the frame at the top of the screen.

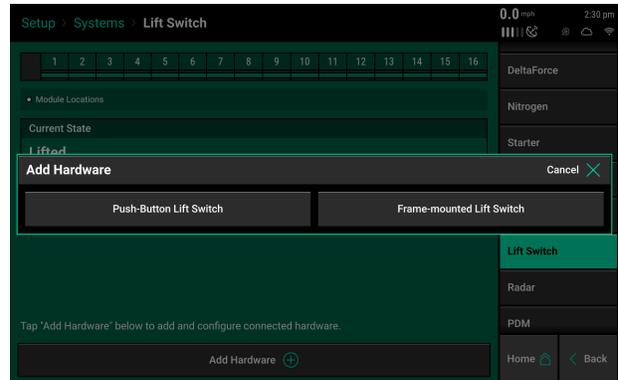
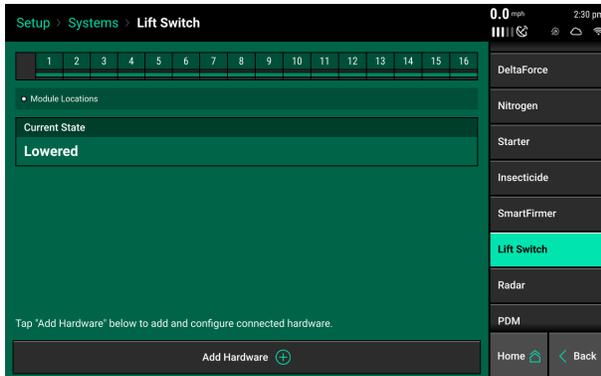


Lift Switch

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

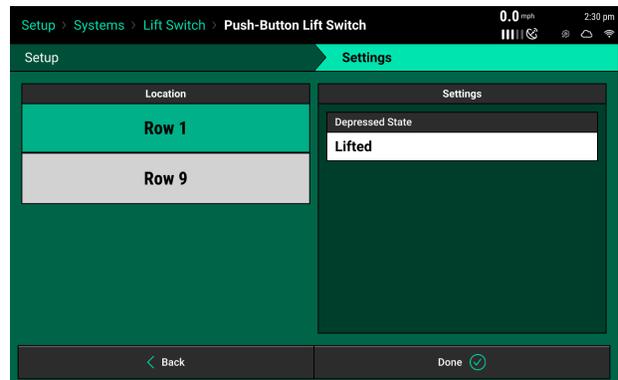
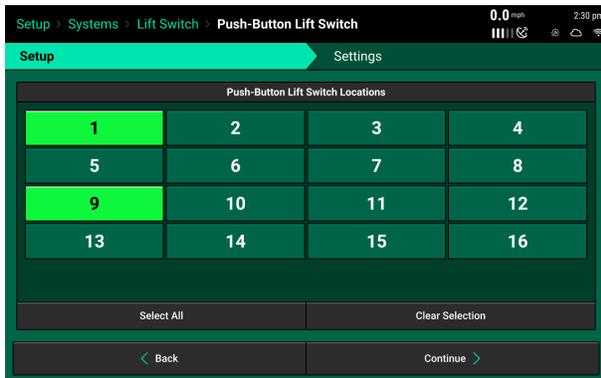
Configure the connected lift switches by selecting 'Add Hardware'. Select the type of lift switch (es) plugged in. A summary of lift switch locations will be displayed at the top of the screen.

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



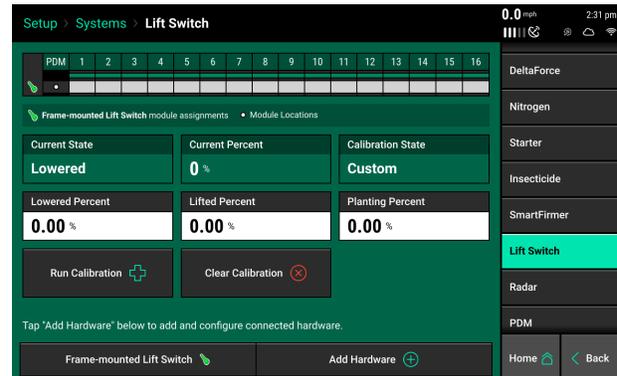
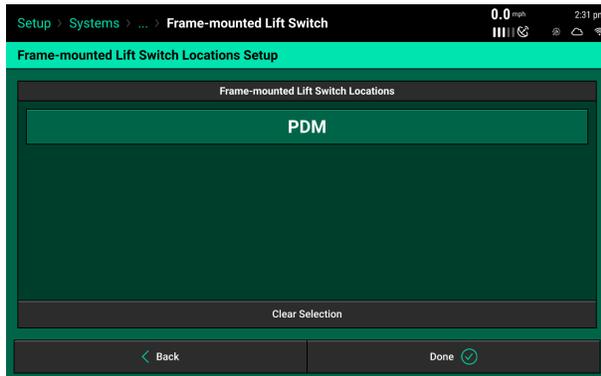
Push Button Lift Switches

Select what rows have push button lift switches installed, then press 'Continue'. In the settings page, select if the push button is depressed (pushed in) when lifted or lowered. A calibration will not need to be performed for push button lift switches.



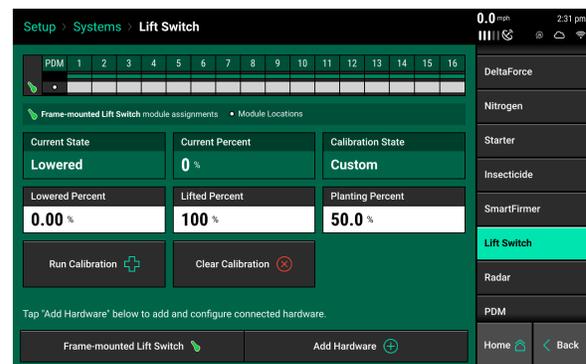
Frame Mounted Lift Switches

For a frame mounted switch, configure the plug in location as the PDM. Once the PDM is selected as the location, the system will then need to be calibrated for lifted and lowered position.



Calibrate Lift Switch

To complete the Lift Switch calibration, press the “Run Calibration” button at the bottom of the screen. Follow the on-screen 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.

Pump Calibration Process

If the 20|20 is controlling the speed of the pump using the setting of “Pump Cal” or “Pump Cal w/ hold” use the following procedure to find the settings for the pump calibration. If the 20|20 is going to control the pump to a single speed using “Constant PWM” or the 20|20 is not controlling the pump (ground drive or SCV control of the pump) then skip to the appropriate section below for finding your pump speed.

Step by step pump calibration for finding the Pump Calibration when 20|20 will control and vary the pump speed.

There is no longer an automated pump calibration process in the 20|20 Gen3 software. **If the system is existing, worked well last season and has had no changes, then it is not necessary to perform this process. In that case, ONLY perform steps 1 and 6 below.**

For new systems or systems that have not worked well in the past, follow the steps listed below. There are videos outlining this process available in the support resources at cloud.precisionplanting.com

Procedure for vApplyHD using “Pump Cal” or “Pump Cal with Hold”

Step 1:

Flush the lines (both new installs and existing systems)

- Disconnect the supply lines from the vApplyHD modules.
- Enter the vApplyHD manual test on the 20|20.
- Set the “Duty Cycle Adjust” to manual and a PWM % that will run the pump smoothly.
- Flush until clean, clear fluid is achieved on all rows.
- Stop the pump and reattach the supply lines to the vApplyHD modules.
- If row strainers are installed, verify the screens are clean.

Step 2:

Set the pressure relief bypass valve to the maximum desired system pressure **Explanation of this step – In this step you are setting the spring pressure on the bypass valve. This will result in setting the maximum system pressure that the system will have, assuming the plumbing for the return is sized so that it is not a significant restriction. .**

- Turn bypass valve all the way out.
- Enter the vApplyHD manual test for this product.
- Make sure the “Rate Adjust” is set to a rate of 0.00 gal/acre.
- Change the “Duty Cycle Adjust” to manual and a PWM % that will run the pump at a reasonable speed to run smoothly and output flow. This needs to be a fairly fast speed but not excessive (hydraulics to the pump on and Master/Section switches must be up to run the pump). **Note: Centrifugal pumps** the procedure is a bit different. Run the pump up to the highest PWM% you may need (while making sure it does not build over 100 psi).
- Adjust the bypass valve until the pump pressure reaches your desired setpoint – Make a note of the pressure that you set as so you can refer to it later _____ psi..
 - Electric pumps 20-25 psi, more pressure will reduce pump lifespan.
 - Most hydraulic pumps 40-60 psi is sufficient.
 - **Centrifugal pumps only** — set the bypass to the maximum pressure that you want to ever have. You will have less pressure than this when running the pump at slower speeds so set this pressure HIGHER than you want system pressure to be when running. Note: output of centrifugal pumps is decreased as pressure is increased.
 - Very high volume systems may need 80 psi.
 - FurrowJet systems should be more than 30 psi as it is desired to have 30 psi at the orifice plate – so system pressure should be 50–60psi or more.
 - Always set below 100 psi. Above this fittings may leak.
 - The setting for maximum pump pressure in the vApply rate control module settings should be at least 20 psi above the pressure you set at the bypass.
- Check that the bypass is sized to handle the full volume of the pump output. **It is very important to do this!!**
 - Increase “Duty Cycle Adjust” by 5-10% at a time and observe the pump pressure does not climb substantially (up to 10 psi higher is ok).
 - Continue this until you reach the maximum PWM % that you are comfortable running the pump (not exceeding max pump RPM) or until you reach 100%.

Note: If the pump pressure increases dramatically, then a change to the bypass system is needed.

- ◆ First check that there is not a restriction in the return system. * This could be an agitation bar in the tank on the return port.
- ◆ Option 1 - if pump is 35 GPM or less, increase the size of the return line.
- ◆ Option 2 - if the pump is 35 GPM —70 GPM, add a second bypass valve and line. 70+ GPM should have three bypass valves.

- ◆ Option 3 — Set the “maximum PWM” setting in the vApply rate control module settings at a PWM % that will not cause pressure to exceed 100 psi.
- The bypass is now set and should not need to be adjusted further for most systems.

Step 3:

Find maximum PWM % for the pump calibration – The goal in this step is to check the health of the system and find the best setting for the maximum PWM %. **Note:** Try and have system voltage as close to field conditions as possible – tractor lights on, Speedtubes running, ect to draw system volts down to get an accurate pump calibration.

- Continue with the manual test.
- Change the “Rate Adjust” to the maximum rate the system will need to apply.
- Change the “Speed Adjust” to the maximum speed that the tractor will go in field.
- Change the “Duty Cycle Adjust” to a speed that the pump will run smoothly.
- Verify that all rows are outputting “Flow”.
 - If any row is not, stop the test and investigate the blockage on that row.
- Check all rows have healthy encoder readings (may require lowering the rate adjust and/or increasing PWM % to get ball positions lower than 75 degrees).
 - If not stop the test and clean the affected turbines.
- Increase pump speed until all rows the “Flow” matches the “Flow Command”.
 - If it does not, observe if there is sufficient pressure, generally 20+ psi is enough, but higher flow systems may need more pressure to achieve the needed rate. If there is not good pressure, increase the “Duty Cycle Adjust” until you have good pressure. Note: Centrifugal pumps will likely have much less pressure than set in step 2.
 - If there is good pressure at the row and you cannot achieve the commanded rate, then there is a restriction after the vApplyHD module preventing the rate from being achieved. If there are orifice plates after the vApplyHD increase the size of the orifice plate (or orifice tubing).
 - Note - if the system is unable to achieve the command rate once you have reached 100% PWM, then you must investigate why the pump is not producing enough flow (also indicated by very low pressure at the vApplyHD module). This could be due to too small of a pump for the maximum rate, insufficient hydraulic flow to the pump, insufficient product flow to the pump, worn or damaged pump, plumbing restriction, air leak in inlet plumbing.
- Once you have the “Flow” matching the “Flow Command”, then you want to optimize the PWM % for the maximum rate. Try various settings for the “Duty Cycle Adjust” to find the optimum PWM %.
Important Note: If the tractor hydraulic oil is cold, it is recommended to choose a higher PWM % that you like the results rather than a lower PWM % that you like (without being excessively fast). The reason for this is cold hydraulic oil will turn a hydraulically driven pump approximately 15% faster than operating temperature oil. Choosing a higher PWM % that produces good results for the below items will return a better pump calibration for field operation.
 - Check the “Ball Position” is not too high – 75 degrees is the maximum position, if ball position is over 50 degrees there is not much extra flow available. Increase the “Duty Cycle Adjust” and see if “Ball Position” can be lowered. If any ball positions are at 75 degrees, this is a problem as this is maximum position and the rate is not likely to be achieved. Generally lower ball positions are better.
 - Observe the “Flow Stability” on the rows (if “Pressure Stability” is shown click on the heading to change to “Flow Stability”). Higher is better. It should be greater than 85%. If you can change “Duty Cycle Adjust” up or down and increase the “Flow Stability” this is better. Also check “Pressure Stability” and try to have it greater than 85% as well.

- Centrifugal pumps **only** – You may need to optimize the PWM % in combination with the pressure relief bypass valve setting. To accomplish this, adjust the speed of the pump and if needed increase the bypass valve spring tension to get additional pressure at lower pump speeds. It is very important to check once you are done that the system cannot build too much pressure with a “Rate Adjust” of 0 and “Duty Cycle Adjust” at your maximum PWM %.
- If you are comfortable with the speed of the pump and all of the above settings, the value in the “Duty Cycle Adjust” is your value for the Pump Cal Max PWM
 - ◆ You may want to exit the tractor and listen to the pump for “hammering” or cavitation.
 - ◆ You may want to check the speed of the pump against the pump manufacturer recommendations to ensure you are not exceeding the maximum pump RPM specification. A low cost laser tachometer will allow you to check the pump actual speed if desired.
- Observe the final “Duty Cycle Adjust” percentage that you have chosen. Write down this number as the Pump Cal Max Duty Cycle here _____. You will enter it during step 5 in settings.
- Find the total flow rate for the planter by taking the “Flow Command” for the row and multiply by number of rows – Write down this number down here _____ as Pump Cal Max Rate. This can also be found by math by $(GPA \times \text{row spacing} \times \text{max speed}) / 5940$ then multiply by the number of rows.

Step 4:

Find the minimum PWM % for the pump calibration

- Continue the manual test.
- Change the “Rate Adjust” to your minimum intended application rate.
- Change the “Speed Adjust” to your minimum intended planting speed.
- Lower the “Duty Cycle Adjust” by 5–10% at a time.
 - Just like step 3, a higher PWM % that the below numbers look good is generally better than a lower PWM % to ensure enough flow in field conditions.
 - Watch the “Flow” still matches the “Flow Command”.
 - Observe the “Flow Stability” – try to have as high as possible, over 85% is preferred.
 - Observe the “Ball Position” is not above 50 degrees – lower is generally better. If ball positions increase, you need a higher PWM % as the system is running out of flow.
 - Observe the “Pump Pressure” it should not fall too far. Generally it should be 20+ psi but higher flow systems may need more to achieve the needed rate. Some systems may have lower pressure and this is ok if the above three items are optimized. Note: Centrifugal pumps the pressure will be significantly lower.
- You can continue to lower the “Duty Cycle Adjust” until the items above are negatively affected. Try to optimize the “Duty Cycle Adjust” so that the above items are optimum. Once you are comfortable with these values and the speed of the pump, this is your minimum PWM%.
 - You may want to check and make sure the pump is not turning too slowly or seem to be laboring. It is ok to run the pump faster if desired and it doesn’t negatively affect flow stability.
- Observe the final “Duty Cycle Adjust” percentage that you have chosen. Write down this number here _____ as the Pump Cal Min Duty Cycle. You will enter it during step 5 in settings.
- Find the total flow rate for the planter by taking the “Flow Command” for the row and multiply by number of rows – Write down this number here _____ as Pump Cal Min Rate. This can also be found by math by $(GPA \times \text{row spacing} \times \text{max speed}) / 5940$ then multiply by the number of rows.

Step 5:

Enter the numbers for the pump calibration into the 20|20 settings

- Turn the pump off by moving the Master and Section switches to the down position.
- Click “Done” on the manual test.
- Navigate to the Setup – Systems – (name for this system) – vApply Rate Control – Continue – Settings and scroll down.
 - PWM Control Style - set to “Pump Cal” or “Pump Cal w/ Hold”.
 - “Pump Cal Min Duty Cycle” – input the “Duty Cycle Adjust” percentage that you chose earlier when at the minimum application rate and speed.
 - “Pump Cal Max Duty Cycle” – input the max “Duty Cycle Adjust” percentage that you chose earlier when running at the maximum application rate and speed.
 - “Pump Cal Min Rate” – input the total rate for the planter that you calculated earlier when at the minimum application rate and speed.
 - “Pump Cal Max Rate” – input the total rate for the planter that you calculated earlier when running at the maximum application rate and speed.

Step 6:

Verify your pump calibration

- Navigate back to the manual test.
- Ensure “Duty Cycle Adjust” is now set to “Automatic”.
- Change the “Rate Adjust” to the maximum rate the system will need to apply and the “Speed Adjust” to the maximum speed that the tractor will go in field.
 - Verify all rows are able to achieve the Flow Command with good ball position and flow stability.
- Change the “Rate Adjust” to your minimum intended application rate and the “Speed Adjust” to your minimum intended planting speed.
 - Verify all rows are able to achieve the Flow Command with good ball position and flow stability.

Procedure for setting a pump with “Constant PWM” with 20|20 Gen3

This procedure is for using the manual test to find a good setting to use when the 20|20 is controlling the pump but a constant speed is desired. Many electric pumps and centrifugal pumps will allow the vApplyHD system to run well with a constant speed. The disadvantage of a constant speed is the pump will not slow down when the rows swath off, or the system demand is lower flow.

Step 1:

Flush the lines (both new installs and existing systems)

- Disconnect the supply lines from the vApplyHD modules.
- Enter the vApplyHD manual test on the 20|20.
- Set the “Duty Cycle Adjust” to manual and a PWM % that will run the pump smoothly and output a strong amount of flow.
- Flush until clean, clear fluid is achieved on all rows.
- Stop the pump and reattach the supply lines to the vApplyHD modules.
- If row strainers are installed, verify the screens are clean.

Step 2:

Set the bypass **Explanation of this step — You are setting the spring pressure on the bypass valve. This will result in setting the maximum system pressure that the system will have, assuming the plumbing for the return is sized so that it is not a significant restriction.**

- Turn bypass valve all the way out.
- Enter the vApplyHD manual test for this product.
- Make sure the “Rate Adjust” is set to a rate of 0.00 gal/acre.
- Change the “Duty Cycle Adjust” to manual and a PWM % that will run the pump at a reasonable speed to run smoothly and output flow. This needs to be a fairly fast speed but not excessive (hydraulics to the pump on and Master/Section switches must be up to run the pump). **Note — Centrifugal pumps** the procedure is a bit different. Run the pump up to the highest PWM % you may need (while making sure it does not build over 100 psi).
- Adjust the bypass valve until the pump pressure reaches your desired setpoint – Make a note of the pressure that you set as it will be needed later _____ psi.
 - Electric pumps generally 20-25 psi, more pressure will shorten pump lifespan.
 - Most hydraulic pumps 40-60 psi is sufficient.
 - **Centrifugal pumps only** — set the bypass to the maximum pressure that you want to ever have. You will have less pressure than this when running the pump at slower speeds so set this pressure HIGHER than you want system pressure to be when running. Note: output of centrifugal pumps is decreased as pressure is increased.
 - Very high volume systems may need 80 psi.
 - FurrowJet systems should be more than 30 psi as it is desired to have 30 psi at the orifice plate – so system pressure should be 50–60 psi or more.
 - Always set below 100 psi. Above this fittings may leak.
 - The setting for maximum pump pressure in the vApply rate control module settings should be at least 20 psi above the pressure you set at the bypass.
- Check that the bypass is sized to handle the full volume of the pump output.
 - Increase “Duty Cycle Adjust” by 5-10% at a time and observe the pump pressure does not climb substantially (up to 10 psi higher is ok).
 - Continue this until you reach the maximum PWM % that you are comfortable running the pump (not exceeding max pump RPM) or until you reach 100%.

Note: If the pump pressure increases dramatically, then a change to the bypass system is needed.

- ◆ First check that there is not a restriction in the return system. * This could be an agitation bar in the tank on the return port.
- ◆ Option 1 - if pump is 35 GPM or less, increase the size of the return line.
- ◆ Option 2 - if the pump is 35 GPM —70 GPM, add a second bypass valve and line. 70+ GPM should have three bypass valves.
- ◆ Option 3 — Set the “maximum PWM” setting in the vApply rate control module settings at a PWM % that will not cause pressure to exceed 100 psi.

- The bypass is now set and should not need to be adjusted further for most systems.

Step 3:

Find the constant PWM % – The goal in this step is to check the health of the system and find the best setting for the constant PWM %. **Note:** Try and have system voltage as close to field conditions as possible – tractor lights on, Speedtubes running, ect to draw system volts down to get an accurate number.

- Continue with the manual test.
- Change the “Rate Adjust” to the maximum rate the system will need to apply.
- Change the “Speed Adjust” to the maximum speed that the tractor will go in field.
- Change the “Duty Cycle Adjust” to a speed that the pump will run smoothly.
- Verify that all rows are outputting “Flow”.
 - If not, stop the test and investigate the problem on that row.
- Check all rows have healthy encoder readings.
 - If not stop the test and clean the affected turbines.
- Increase pump speed until all rows the “Flow” matches the “Flow Command”.
 - If it does not, observe if there is sufficient pressure, generally 20+ psi is enough, but higher flow systems may need more pressure to achieve the needed rate. If there is not good pressure, increase the “Duty Cycle Adjust” until you have good pressure. Note: Centrifugal pumps will likely have much less pressure than set in step 2.
 - If there is good pressure at the row and you cannot achieve the commanded rate, then there is a restriction after the vApplyHD module preventing the rate from being achieved. If there are orifice plates after the vApplyHD increase the size of the orifice plate (or orifice tubing).
 - Note - if the system is unable to achieve the command rate once you have reached 100% PWM, then you must investigate why the pump is not producing enough flow (also indicated by very low pressure at the vApplyHD module). This could be due to too small of a pump for the maximum rate, insufficient hydraulic flow to the pump, insufficient product flow to the pump, worn or damaged pump, plumbing restriction, air leak in inlet plumbing.
- Once you have the “Flow” matching the “Flow Command”, then you want to optimize the PWM % for the maximum rate. Try various settings for the “Duty Cycle Adjust” to find the optimum PWM %.

Important Note: If the tractor hydraulic oil is cold, it is recommended to choose a higher PWM % that you like the results rather than a lower PWM % that you like (without being excessively fast). The reason for this is cold hydraulic oil will turn a hydraulically driven pump approximately 15% faster than operating temperature oil. Choosing a higher PWM % that produces good results for the below items will return a better pump speed for field operation.

 - Check the “Ball Position” is not too high – 75 degrees is the maximum position, if ball position is over 50 degrees there is not much extra flow available. Increase the “Duty Cycle Adjust” and see if “Ball Position” can be lowered. If any ball positions are at 75 degrees, this is a problem as this is maximum position and the rate is not likely to be achieved. Generally lower ball positions are better.
 - Observe the “Flow Stability” on the rows (if “Pressure Stability” is shown click on the heading to change to “Flow Stability”). Higher is better. It should be greater than 85%. If you can change “Duty Cycle Adjust” up or down and increase the “Flow Stability” this is better. Also check “Pressure Stability” and try to have it greater than 85% as well.

- Centrifugal pumps **only** – You may need to optimize the PWM % in combination with the pressure relief bypass valve setting. To accomplish this, adjust the speed of the pump and if needed increase the bypass valve spring tension to get additional pressure at lower pump speeds. It is very important to check once you are done that the system cannot build too much pressure with a “Rate Adjust” of 0 and “Duty Cycle Adjust” at your maximum PWM %.
- Now change the “Rate Adjust” to the minimum rate the system will need to apply and change the “Speed Adjust” to the minimum speed that the tractor will go in field.
 - Observe the “Flow Stability” on the rows. Higher is better. It should be greater than 85%. If you can change the speed of the pump (or output setting) up or down and increase the “Flow Stability” this is better. However you cannot lower so much that it affects the ability for the system to meet all of the parameters discussed under the maximum rate and maximum speed that you observed earlier. If you slow the pump at this point, you will need to recheck the system at maximum rate and maximum speed to verify the system is still healthy at those settings.
- If you are comfortable with the speed of the pump and all of the above settings, the value in the “Duty Cycle Adjust” is your value for the Constant PWM.
 - You may want to exit the tractor and listen to the pump for “hammering” or cavitation.
 - You may want to check the speed of the pump against the pump manufacturer recommendations to ensure you are not exceeding the maximum pump RPM specification. A low cost laser tachometer will allow you to check the RPM if desired.
- Observe the final “Duty Cycle Adjust” percentage that you have chosen. Write down this number as the constant PWM here _____. You will enter it during step 4 in settings.

Step 4:

Enter the settings

- Turn the pump off by moving the Master and Section switches to the down position.
- Click “Done” on the manual test.
- Navigate to the Setup – systems – (name for this system) – vApply Rate Control – Continue – Settings and scroll down.
 - PWM Control Style - set to “Constant PWM”.
 - PWM Control Setpoint – enter the value you used for “Duty Cycle Adjust” in the manual test. This is the PWM that will be output to run the pump.

vApplyHD procedure for setting the speed of an uncontrolled pump

Generally this applies to pumps that are controlled by SCV flow or are ground drive. The 20|20 monitor is NOT controlling the operation of the pump in this setup.

Step 1:

Flush the lines (both new installs and existing systems)

- Disconnect the supply lines from the vApplyHD modules.
- Start the pump and run at a speed where flow is being outputted at a good rate.
- Flush until clean, clear fluid is achieved on all rows.
- Stop the pump and reattach the supply lines to the vApplyHD modules.
- If row strainers are installed, verify the screens are clean.

Step 2:

Set the bypass. **Explanation of this step — You are setting the spring pressure on the bypass valve. This will result in setting the maximum system pressure that the system will have, assuming the plumbing for the return is sized so that it is not a significant restriction.**

- Turn bypass valve all the way out.
- Enter the vApplyHD manual test for this product.
- Make sure the “Rate Adjust” is set to a rate of 0.00 gal/acre.
- Start the pump and run at a speed where the pump is running smoothly and outputting a strong amount of flow. **Note: Centrifugal pumps** the procedure is a bit different. Run the pump up to the highest speed you may need (while making sure it does not build over 100 psi).
- Adjust the bypass valve until the pump pressure reaches your desired setpoint – Make a note of the pressure that you set so you can refer to it later _____ psi.
 - Electric pumps generally 20-25 psi.
 - Most hydraulic pumps 40-60 psi is sufficient.
 - **Centrifugal pumps only** — set the bypass to the maximum pressure that you want to ever have. You will have less pressure than this when running the pump at slower speeds so set this pressure HIGHER than you want system pressure to be when running. Note: output of centrifugal pumps is decreased as pressure is increased.
 - Very high volume systems may need 80 psi.
 - FurrowJet systems should be more than 30 psi as it is desired to have 30 psi at the orifice plate – so system pressure should be 50–60 psi or more.
 - Always set below 100 psi. Above this fittings may leak.
 - The setting for maximum pump pressure in the vApply rate control module settings should be 20 psi above the pressure you set at the bypass
- Check that the bypass is sized to handle the full volume of the pump output.
 - Increase the speed of the pump and observe the pump pressure does not climb substantially (up to 10 psi higher is ok).
 - Continue this until you reach the maximum speed that you are comfortable running the pump (not exceeding max pump RPM) or until you reach full flow.

Note: If the pump pressure increases dramatically, then a change to the bypass system is needed.

- ◆ First check that there is not a restriction in the return system. * This could be an agitation bar in the tank on the return port.
 - ◆ Option 1 - if pump is 35 GPM or less, increase the size of the return line.
 - ◆ Option 2 - if the pump is 35 GPM —70 GPM, add a second bypass valve and line. 70+ GPM should have three bypass valves.
 - ◆ Option 3 — Set the “maximum PWM” setting in the vApply rate control module settings at a PWM % that will not cause pressure to exceed 100 psi.
- The bypass is now set and should not need to be adjusted further for most systems.

Step 3:

Find the best speed or pump stroke setting to run the pump – The goal in this step is to check the health of the system and find the best setting for the pump speed (or if adjustable the pump stroke setting).

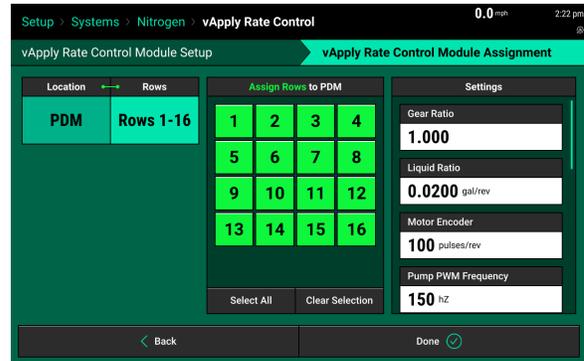
Important note: If the pump is hydraulically driven, and the tractor hydraulic oil is cold, it is recommended to choose a higher speed that you like the results, rather than a lower speed. The reason for this is once the hydraulic oil is warm the pump will turn slower.

- Continue with the manual test.
- Change the “Rate Adjust” to the maximum rate the system will need to apply.
- Change the “Speed Adjust” to the maximum speed that the tractor will go in field.
- Verify that all rows are outputting “Flow”.
- Check all rows have healthy encoder readings.
 - If not stop the test and clean the affected turbines.
- Increase pump speed until all rows the “Flow” matches the “Flow Command”.
 - If it does not, observe if there is sufficient pressure, generally 20+ psi is enough, but higher flow systems may need more pressure to achieve the needed rate. If there is not good pressure, increase the “Duty Cycle Adjust” until you have good pressure. Note: Centrifugal pumps will likely have much less pressure than set in step 2.
 - If there is good pressure at the row and you cannot achieve the commanded rate, then there is a restriction after the vApplyHD module preventing the rate from being achieved. If there are orifice plates after the vApplyHD increase the size of the orifice plate (or orifice tubing).
 - Note - if the system is unable to achieve the command rate once you have reached 100% PWM, then you must investigate why the pump is not producing enough flow (also indicated by very low pressure at the vApplyHD module). This could be due to too small of a pump for the maximum rate, insufficient hydraulic flow to the pump, insufficient product flow to the pump, worn or damaged pump, plumbing restriction, air leak in inlet plumbing.
- Once you have the “Flow” matching the “Flow Command”, then you want to optimize the pump speed/output for the maximum rate. Change the pump speed/output to the the optimum output rate.
 - Check the “Ball Position” is not too high – 75 degrees is the maximum position, if ball position is over 50 degrees there is not much extra flow available. Increase the pump speed/output and see if “Ball Position” can be lowered. If any ball positions are at 75 degrees, this is a problem as this is maximum position and the rate is not likely to be achieved. Generally lower ball positions are better.
 - Observe the “Flow Stability” on the rows (if “Pressure Stability” is shown click on the heading to change to “Flow Stability”). Higher is better. It should be greater than 85%. If you can change the pump speed/output up or down and increase the “Flow Stability” this is better. Also check “Pressure Stability” and try to have it greater than 85% as well.
 - Centrifugal pumps **only** – You may need to optimize the pump speed in combination with the pressure relief bypass valve setting. To accomplish this, adjust the speed of the pump and if needed increase the bypass valve spring tension to get additional pressure at lower pump speeds. It is very important to check once you are done that the system cannot build too much pressure with a “Rate Adjust” of 0 and “Duty Cycle Adjust” at your maximum PWM %.
- Now change the “Rate Adjust” to the minimum rate the system will need to apply and change the “Speed Adjust” to the minimum speed that the tractor will go in field.

- Observe the “Flow Stability” on the rows. Higher is better. It should be greater than 85%. If you can change the speed of the pump (or output setting) up or down and increase the “Flow Stability” this is better. However you cannot lower so much that it affects the ability for the system to meet all of the parameters discussed under the maximum rate and maximum speed that you observed earlier. If you slow the pump at this point, you will need to recheck the system at maximum rate and maximum speed to verify the system is still healthy at those settings.
- Now change the “Rate Adjust” to the minimum rate the system will need to apply and change the “Speed Adjust” to the minimum speed that the tractor will go in field.
 - Observe the “Pressure Stability” on the rows. Higher is better. It should be greater than 85%. If you can change the speed of the pump (or output setting) up or down and increase the “Pressure Stability” this is better. However you cannot lower so much that it affects the ability for the system to meet all of the parameters discussed under the maximum rate and maximum speed that you observed earlier. If you slow the pump at this point, you will need to recheck the system at maximum rate and maximum speed to verify the system is still healthy at those settings.
- If you are comfortable with the speed of the pump and all of the above settings, you have now found a good speed to operate the pump.
 - You may want to exit the tractor and listen to the pump for “hammering” or cavitation.
 - You may want to check the speed of the pump against the pump manufacturer recommendations to ensure you are not exceeding the maximum pump RPM specification. A low cost laser tachometer can allow you to check the pump speed if desired.

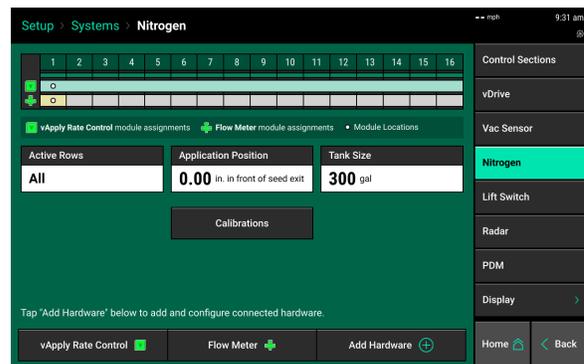
vApply Base

For the test to begin, the user must have a Liquid Ratio input as a starting reference. To input a Liquid Ratio, click on “vApply Rate Control” in the product setup screen and then click “Continue” on the module assignment page. In the pump settings page find the box for the “Liquid Ratio” and input a starting value.

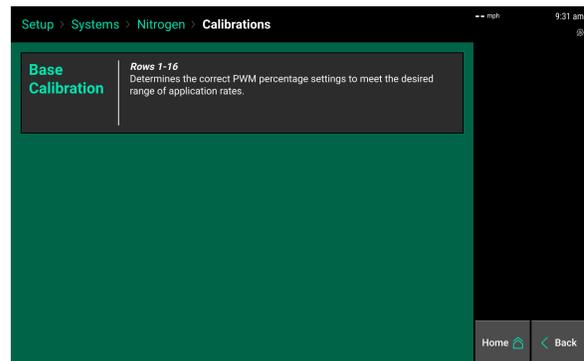


Note: Some manufacturers provide a “displacement” or “output” amount to use. Or, the user can divide the max output of the pump by the max RPM. If none of this information is available, generally .02 gal/rev is a reasonable starting ratio.

After the product has been completely set up, product calibration can be completed. Select “Calibrations”.

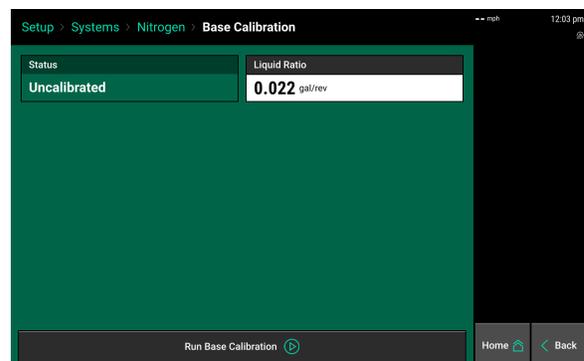


Proceed to the picture on the right where a “Base Calibration” box will appear for all motors assigned under this product. Select the “Base Calibration” box.

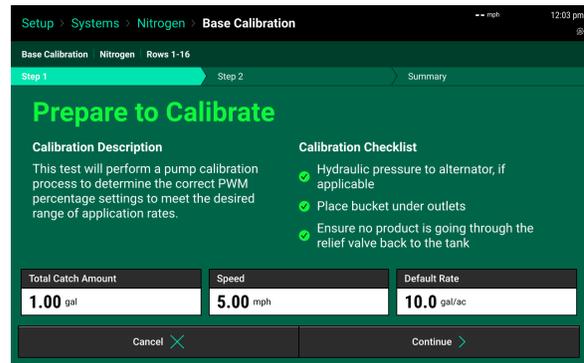


Next, select “Run Base Calibration”.

Note: The calibration will require the user to catch and measure total output. Be prepared to do so before starting the calibration.



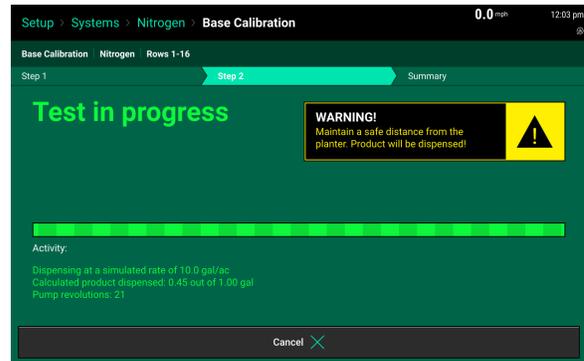
Input a desired amount to catch, speed, and default rate. The speed should be as close to the planters actually planting speed as possible. The default rate should be the rate the grower is using most often.



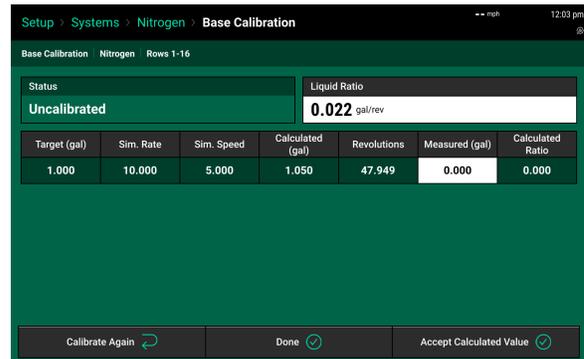
Once this is complete make sure all of the items on the “Pre-test Checklist” are complete and select “Continue”.

Note: It is recommended to catch the total output of the pump. If that is not possible, catching multiple rows will help to get a more accurate representation of the liquid ratio on the planter.

When the test is complete, the 20|20 will take the user to the results page. To input the amount that was caught, click on the white box under “Measured”.

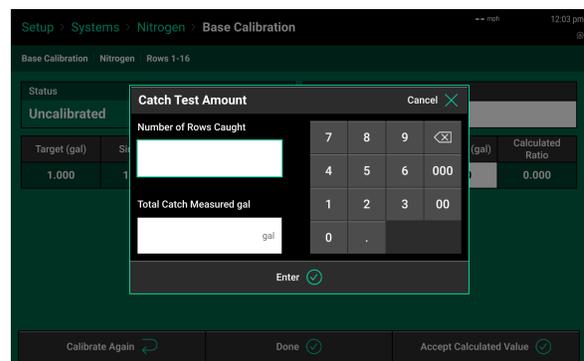


When the test is complete, the 20|20 will take the user to the results page. To input the amount that was caught, click on the white box under “Measured”.

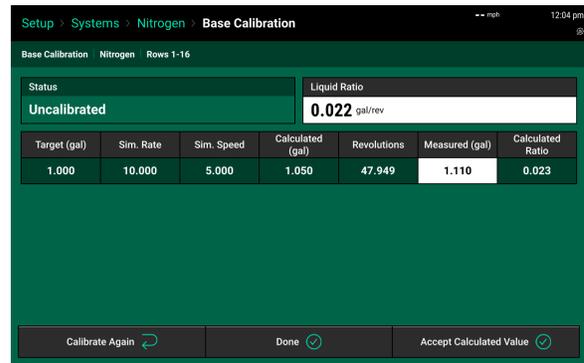


A “Catch Test Amount” box will then appear. Input the number of rows product was caught from. Then input the total amount caught from those rows. When complete, hit “Enter”.

Note: If the product was measured in ounces, convert that number to gallons by dividing by 128.



If not all rows are caught, the 2020 will calculate what the total planter wide amount would be and display that in the “Measured” box. The 2020 will also do the math to calculate the liquid ratio (gal/rev) and display that in the box labeled “Calculated Ratio”.

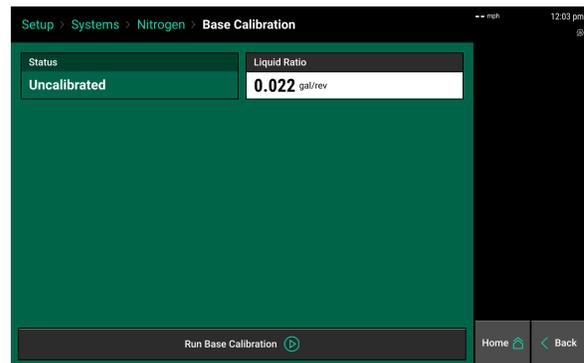


If the user would like for the “Calculated Ratio” to become the “Liquid Ratio” select the button marked “Accept Calculated Value” and the ratio will be saved. If the user does not want to save the proposed value, select “Done” to continue on with the current Liquid Ratio, or “Calibrate Again” to rerun the calibration.

Once an acceptable liquid ratio has been reached, select “Done” to complete the calibration.

The Liquid Ratio will now be displayed in the Base Calibrations screen.

Note: It is not possible to go back and access old calibration screens once the user has left. The only way to re-access the calibrations results screen is to run the calibration again

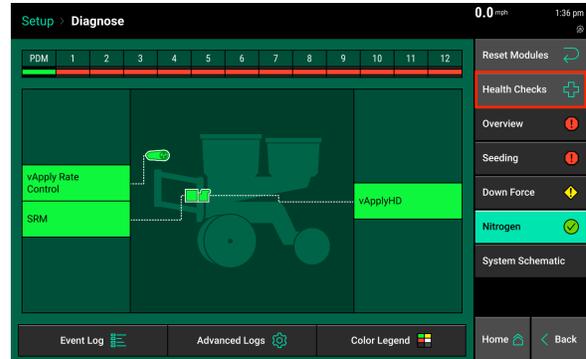


vApply HD Manual Test

Manual Test

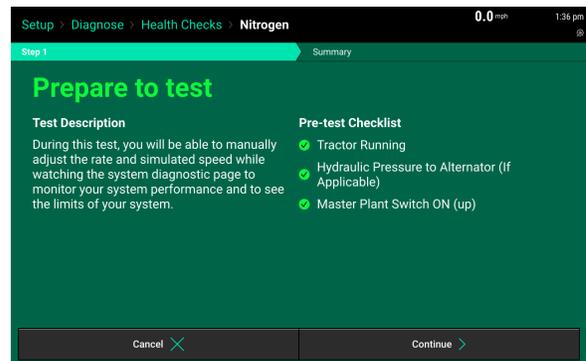
The Manual Test is designed to allow the user an easy way to quickly look for vApply related issues, test product or plumbing changes, or to aid in cleaning/flushing the system. This “sandbox environment” gives the user the ability to enter any rate or speed combination desired without needing to actually drive the machine around. This is a great place to run pre-season water while still in the shop.

Setup > Diagnose > Health Checks



In order to run the Manual test, the following must be enabled:

- Tractor Running
- Hydraulic Pressure to Alternator
- Liquid Pump Enabled
- Master Plant Switch ON



Select “Continue” to start the test. The vApply tab shows information from the vApplyRate control module. All tabs allow you to change various parameters. The Rate Adjust will allow you to change the rate outputted. The Speed Adjust allows you to change the simulated speed. The Duty Cycle Adjust can be set to “Automatic” to run the pump speed based on the values in the rate control module settings for the pump calibration, or you can change to “Manual” and set whatever PWM % you want to run the pump.



The Manual test has multiple tabs at the top that allow you to view various information. The tab for vApplyHD shows the vApplyHD module information. If FlowSense is installed, the tab for FlowSense will show FlowSense information.

The screenshot shows a diagnostic interface for the vApplyHD module. At the top, there are navigation tabs: Setup, Diagnose, Health Checks, and Nitrogen. The current view is for vApplyHD, with a speed of 0.0 mph and a time of 1:38 pm. Below the navigation, there are three adjustment sliders: Rate Adjust (10.0 gal/ac), Duty Cycle Adjust (40%), and Speed Adjust (5.5 mph). The main part of the screen is a data table with 7 rows of sensor readings. At the bottom, there is a 'Done' button with a checkmark icon.

Row	Flow (gal/min)	Flow Command (gal/min)	Encoder Low-Total (counts/sec)	Ball Position (°)	Pressure (psi)	Pressure Stability	Supply (Volts)
1	0.28	0.28	274-31	11	37	85%	13.0
2	0.28	0.28	269-34	11	40	79%	12.9
3	0.28	0.28	272-33	12	37	85%	12.9
4	0.28	0.28	270-32	13	41	77%	12.9
5	0.28	0.28	272-31	13	42	76%	12.9
6	0.27	0.28	277-29	11	39	80%	12.9
7	0.28	0.28	270-32	12	38	82%	12.9

See the Diagnostics section below to help troubleshoot performance issues.

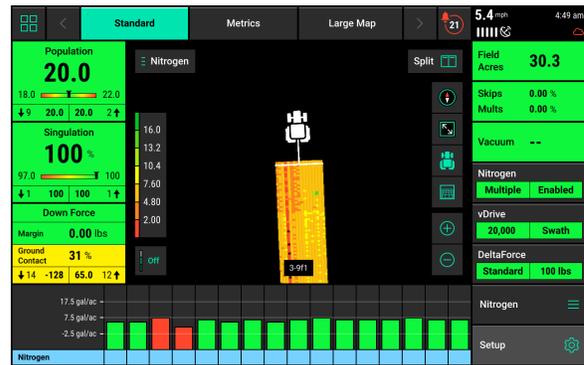
Liquid System Control and Homepage

The home page offers information for monitoring, controlling, and mapping the liquid system. The following information is displayed with screenshots from a vApplyHD system, but ALL liquid systems follow the same instructions. That includes vApplyHD, vApplyHD section, vApplyBase, FlowSense or a planter wide flowmeter.

Controlling the Liquid System (vApplyHD, vApplyBase, FlowSense or planter wide flowmeter)

This information is the same for a control system with vApplyHD, vApplyBase or a monitoring system with FlowSense or a planter wide flowmeter.

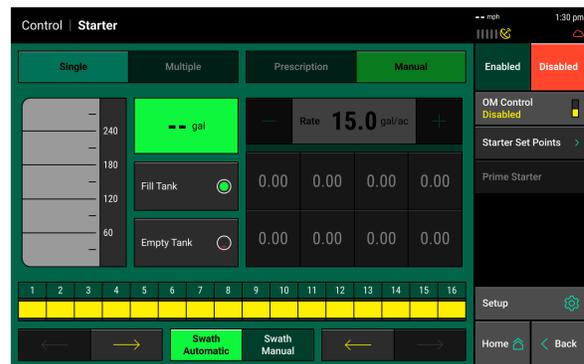
The vApplyHD or FlowSense control screen is the central location for rate and swath control. To access the vApplyHD or FlowSense control page, the control button must first be added. Use the home screen editor to add the control button. It will be called either “Product 1” (if a nickname has not been assigned in the vApplyHD or FlowSense setup page) or it will be called the same name that was entered as the product’s nickname (e.g. Starter, Popup, etc....). See the monitor’s operator’s guide for more information on editing the home screen and adding buttons.



The control button (indicated by the product nickname that was selected during the setup process) will display the rate being commanded as well as the average rate being applied per acre. Pressing on this button will access the vApplyHD or FlowSense control page.

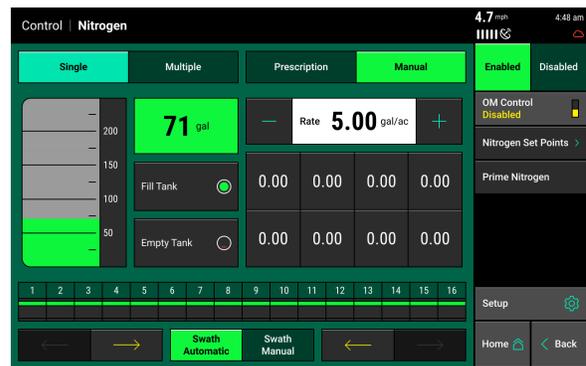
Before the vApplyHD or FlowSense system can be used, the system must be enabled by selecting the “Enabled” button in the top right hand corner.

There MUST be a rate set for any system, including monitoring only systems. This rate MUST appear in the white box in the right central part of the screen. You can set various setpoints by going to the “Set Points” button on the right hand side. You can also use a Prescription by tapping the “Prescription” button at the top of the page.



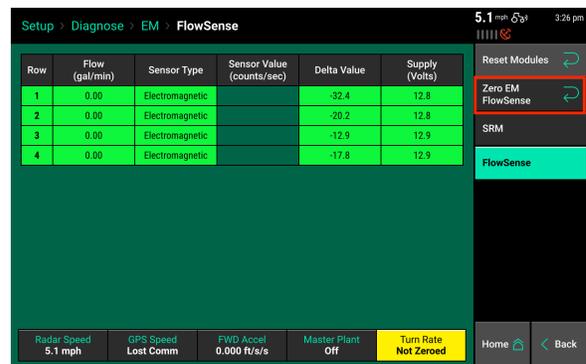
Note: Systems that are monitoring only using FlowSense or a planter wide flowmeter, but are variable rate need additional consideration. With the system set to manual, when the control system changes the rate, you may receive an alert or alarm sound if the rate is outside of the alert or alarms limits from the setpoint you have in the 20|20 for the rate. The best way to operate the system would be to import the Prescription for the variable rate to the 20|20 and set the system to “Prescription” on the control screen. For more information about importing and assigning Prescriptions see the section later in this manual. If you are unable to import your Prescription to the 20|20, then there are two options. Option 1 would be to set the manual rate to the midpoint of your range of rates, and then set the alerts and alarms wide enough to not alert at your highest and lowest rates (see below section on Liquid Alerts). Option 2 would be to disable the alerts and alarms, however this is not recommended as you will not be alerted to possible issues.

The “Load vApply” button on the right hand side of the control page is used to pressurize the system (similar to auto loading meters, but for liquid). Pressing on the button will allow the auto load switches to function for the liquid system. Unless the operator is on this screen, the auto load switches will only spin the meters.



Electromagnetic (EM) FlowSense Zero Procedure

The EM FlowSense device requires a zeroing procedure be performed any time the liquid product is changed from one product to another. This could be a different product or a different tank mix. To zero the EM FlowSense device navigate to Setup - Diagnose - (Product Name) and then click on FlowSense in the middle of the page. Next press the Zero EM FlowSense button on the right side.



To zero the FlowSense the device needs to first be full of product. If the system is not full of fertilizer, run your liquid system until fluid comes out of every row. Then turn off the pump. The pump needs to be turned off so there is no product flowing when performing the zero procedure.

Note: If you zero with water in the system, you will need to re-zero with your fertilizer product in the EM FlowSense device. This will require you to run the system until all of the water is out and then stop the pump and zero the FlowSense.

After the zero process is complete you will see that there are different “Reference Value” numbers on the rows. This is expected. You should see “Flow” at 0.0 when the pump is off.

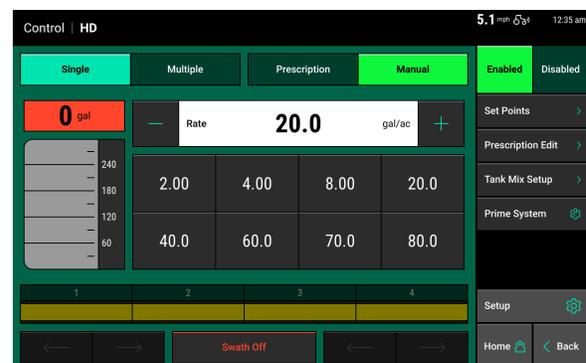
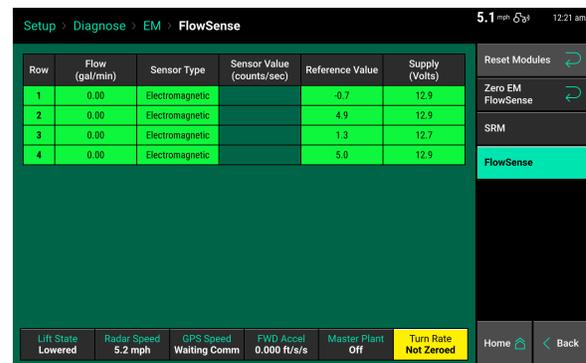
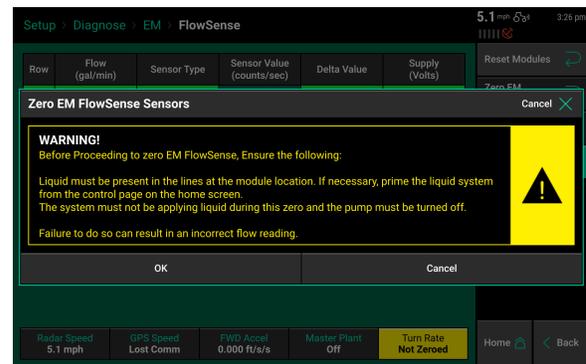
Note: There should be a check valve installed after every FlowSense device and some kind of flow restriction device such as a orifice plate or metering tubing. This is to keep the FlowSense device full. If at any time a FlowSense does not have product in it, it may show a small amount of flow, even if there is not flow present.

Tank Mix

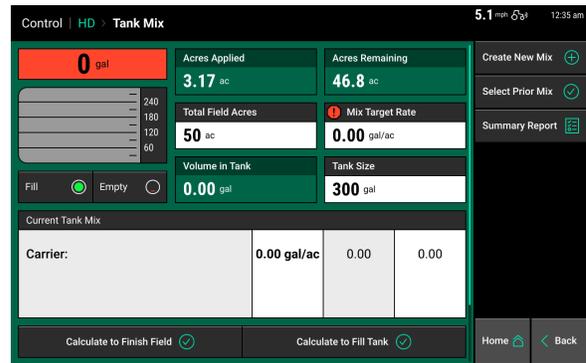
This feature is only available in 2021.1.x and later software.

The liquid tank mix can be used to track product information for each liquid system on the 20|20 platform. Each liquid system set up on the 20|20 records separate tank mixes, and can be exported from the display with field map data.

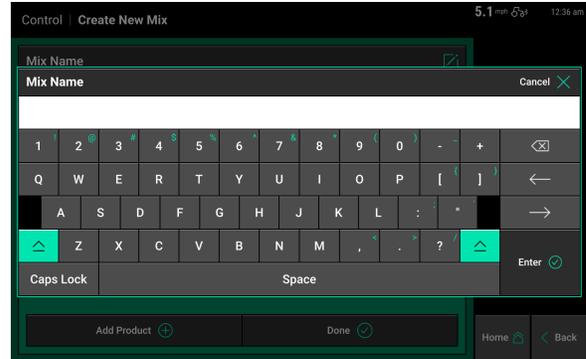
To begin using the tank mix feature, go to the liquid control button which will be named the nickname you assigned (ie Starter or Nitrogen) or labelled “Product 1” if you did not choose a nickname. Then choose the “Tank Mix Setup” button on the right side of the screen.



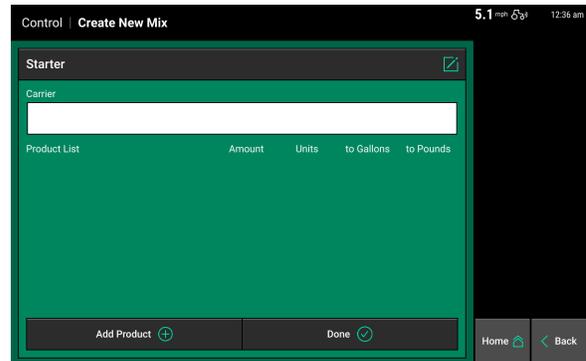
Start by inputting the “Total Field Acres.” Then push the button on the right side to “Create New Mix.”



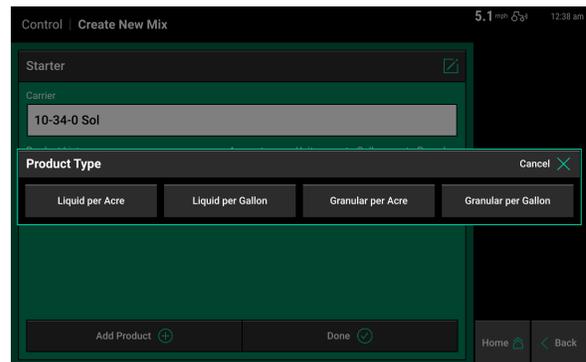
Type the name that you would like for this tank mix.



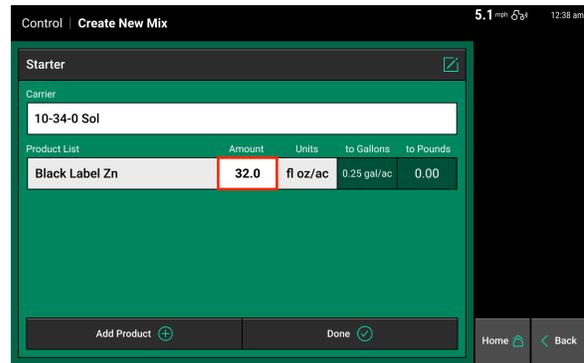
Click the white box under Carrier to input the carrier. You can “Add from database” or “Add Custom”. If your carrier is not available in the database then choose “Add Custom” and type in the name of your carrier.



Click the button at the bottom of the screen for “Add Product.” Select the product type that you are adding to the tank mix. Then you can “Add from database” or if your product is unavailable in the database then “Add custom”.

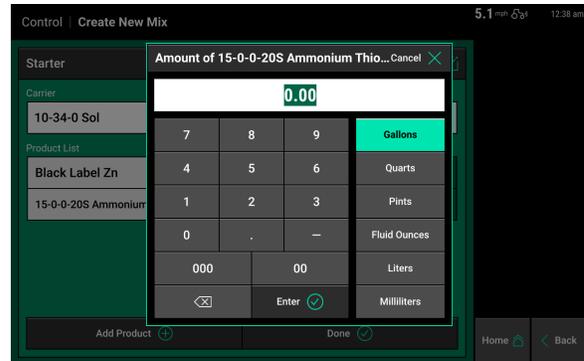


After adding the name, then select the box for “Amount”.



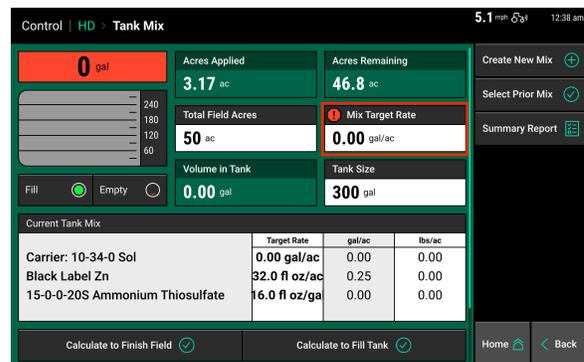
Type in the amount of the tank mix item and the units.

- Per acre is used for products like Nitrogen that are used in gallons per acre.
- Per gallon is used for products you are adding in smaller quantities use as an anti foaming agent.



Add all of the products you need to the tank mix. Once you are done adding items to the tank mix, click “Done” at the bottom of the page.

Now select the box for “Mix Target Rate” and type in the target application rate. If you are using a variable rate prescription it is recommended to use the average rate for the field. Note: This does not set the actual application rate - it is only used for tracking.



Click on the “Tank Size” button and enter the total of all tanks being used for this liquid system.

You can view the amount of each product needed to finish the field based on the Total Field Acres and Acres Remaining by clicking on “Calculate to Finish Field” at the bottom of the page.

You can view the amount of each product needed to fill your tank based on the current tank level by clicking on the button for “Calculate to Fill Tank”.

Tank Mix Summary Report

Once the tank is filled with product and is being applied, a Tank Mix Summary Report will be generated. This button is found on the right side of the Tank Mix setup screen.

Select a Prior Mix

Once tank mixes are created, they are stored in the “Select Prior Mix” button on the right side of the tank mix setup screen. Select any of the available mixes to make it active. A mix can be deleted by selecting the red “X” at the top right of each tank mix.

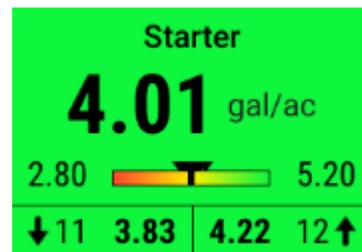
Monitoring Liquid

There are different options for the operator to view for monitoring the feedback from the vApplyHD or FlowSense system. The home screen will need to be configured to view the different options.

Note: For more details in configuring the home screen see the 20|20 operator's guide.

Three different widgets can be added to the home screen for each liquid product that has been configured on the monitor. The name of the widgets will be the same as the nickname assigned to the product during the vApplyHD or FlowSense setup. (If no nickname was selected or vApplyHD or FlowSense has not been setup, the widget names will be Product 1 & Product 2).

The large & extra-large vApplyHD or FlowSense metric displays the planter average in gallons per acre at the top. At the bottom of the metric the low row and the high row will be displayed along with their output in gal/ac.



In the middle of the metric a rainbow chart that displays the planter average as a rectangle and each row as triangles. This chart is designed to give the operator a quick look at where all rows are at compared to the planter average. The low and high values on either end of the chart are determined by the Flow Alarm that is set in the Liquid Alerts.

A smaller metric can be added that only displays the planter wide average in gallons per acre.



Pressing on either the large or small liquid metric will redirect the operator to the level 2 liquid details page. On this page row by row liquid information will be displayed in bar chart form, displaying the current gallons per acre on each row.



At the bottom of this page Planter Average Flow Stability, Product Setup, Actual Flow, and Actual Pressure is displayed.

Planter Average Flow Stability: Defines the percentage of time that the planter is achieving the desired rate, the goal is to be above 85%.

Product Setup: The product nickname that is configured for the current product.

Actual Flow: The planter average flow in gallons per acre.

Actual Pressure: The pressure reading measured at the pump.

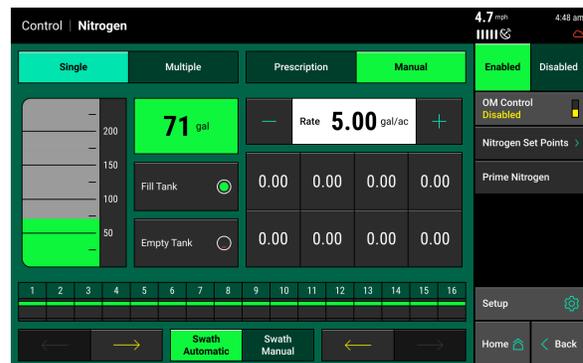
A tank level indicator displaying the number of gallons remaining can be added to the home screen. Pressing on this button will redirect the operator to the vApplyHD or FlowSense control page where the tank level can be reset after refilling.



Tank Level

The liquid tank level can be managed from the vApplyHD or FlowSense control page. The chart on the right indicates the current amount liquid remaining in the tanks (assuming that the tank level was initially set correctly). The total volume of the tank will be equal to the tank volume set in the vApplyHD or FlowSense setup.

Select “Fill Tank” to tell the system the tanks are full, “Empty Tank” to indicate an empty tank, or select the volume remaining (indicated by 0.00 gal in the illustration) to manually enter the number of gallons in the tank.

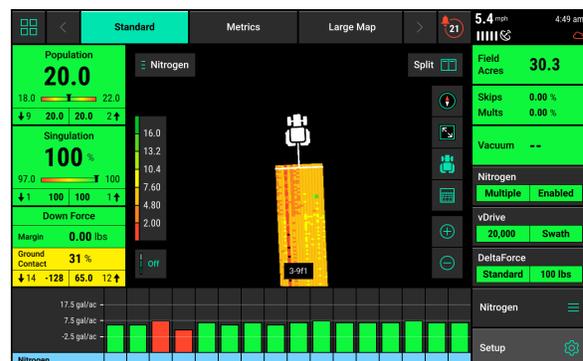


As liquid is applied the volume of the tank will decrease. A tank level metric can be added to the home screen so the operator can view the current volume of liquid remaining in the tank. For the “Tank Level” metric to maintain accuracy, a tank volume must be specified (selecting “Fill Tank” or manually entering a tank volume) when liquid is added to the tanks.

Note: Alert and Alarm settings for tank level can be configured by going to Setup – Crops – Liquid Alerts.

Mapping vApplyHD or FlowSense

A liquid map is available to view on the home screen for vApplyHD or FlowSense. To view the liquid map select the current map type name that is displayed at the top of the map. A list of all different map types available to be viewed will be displayed. Select the map type that matches the product nickname that was selected during the vApplyHD or FlowSense setup process. This map will show row by row liquid information in gallons per acre.

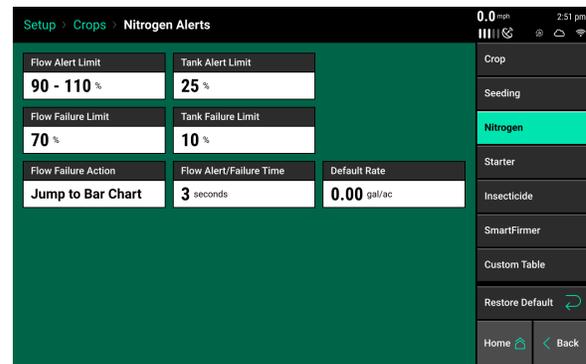


Liquid Product Alerts

Liquid Product Alerts

Configure the Liquid Product Alerts in order to correctly give the operator, the warning and alarms when needed.

Navigate to “Setup” “Crops” and then select the correct liquid product to change the alerts for each product.



Flow Alert Limit: Select a flow percentage range. If flow is outside the selected range, the metric and control buttons on the home screen will turn yellow and the “alert” sound will be activated periodically.

Flow Failure Limit: If the flow drops below the selected threshold, the metric and control buttons will turn red on the home screen and the “alarm” sound will be activated. This feature can be disabled by toggling to “Disabled” and the button will highlight with yellow. Disabling will stop the alarm sound and the “Flow Failure Action” from occurring. If you want to enable the feature again, touch again on the “Enabled” button and it will highlight with a bright green color.

Tank Alert Limit: When the tank level is below the selected percentage, the Tank Volume metric on the home screen will turn yellow and the “alert” sound will activate periodically. This feature can be disabled by toggling to “Disabled” and the button will highlight with yellow. Disabling this feature will prevent the alert sound from occurring. If you want to enable the feature again, touch again on the “Enabled” button and it will highlight with a bright green color.

Tank Failure Limit: When the tank level is below the selected percentage, the Tank Volume metric on the home screen will turn red and the “alarm” sound will be activated. This feature can be disabled by toggling to “Disabled” and the button will highlight with yellow. Disabling this feature will prevent the alarm sound from occurring. If you want to enable the feature again, touch again on the “Enabled” button and it will highlight with a bright green color.

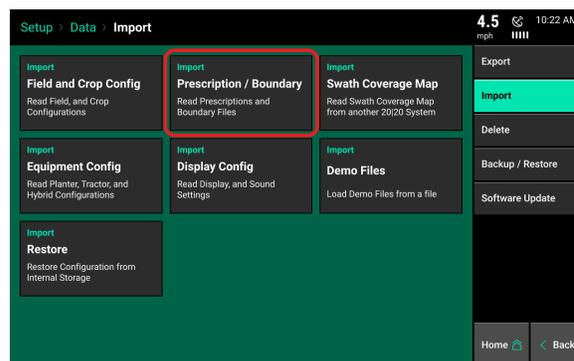
Flow Failure Action: Select the action the monitor should take if the Flow Failure Limit is triggered. Select between Jump to Bar Chart, Jump to Homepage, Jump to Row Details, or No Action.

Flow Alert/Failure Time: Enter the amount of time a failure event needs prior to triggering the alert/alarm.

Prescriptions and Boundaries

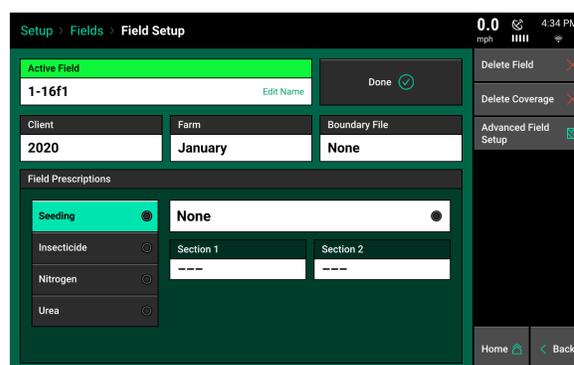
Importing Files onto the Display

When importing Prescriptions and Boundaries onto the display, both the Prescriptions and Boundary files must be in the form of a shape and include at minimum the .shp, .shx, & .dbf file extensions. Load all of the files on the root drive of the UBS drive or in a folder titled “Sendto2020”. Insert the USB drive into the side of the display. Then select “Setup” – “Data” – “Import” – “Prescription/Boundary”



Assigning Prescriptions and Boundaries to a Field Name

Once Prescriptions/Boundaries have been imported into the display, they must then be assigned to the appropriate field names. To assign to a field select “Setup” – “Fields” – Select either the Active Field or another Field name (selecting a different Client or Farm name may be required to locate the appropriate Field name). The Field Setup page has options to assign both a Boundary and Prescription.



Note: 2020.0.x and Older Software Only: Only one prescription can be assigned to each individual field. Prescriptions can be for seeding, liquid, and/or insecticide. To combine multiple types into one prescription, create separate attributes for seeding, liquid, and insecticide. If no seeding prescription is assigned, a manual rate must be selected in the vDrive Control Page.

Note: A field can have either a Boundary or a Seeding Prescription, both a Boundary and Seeding Prescription, or neither assigned to it. A boundary file is only used for swathing off rows on the planter if they go outside of the boundary. A boundary file can have both an exterior and interior zones.

Note: The option to assign a prescription will only be available if vDrive is configured as the Drive Type and a rate section has been configured.

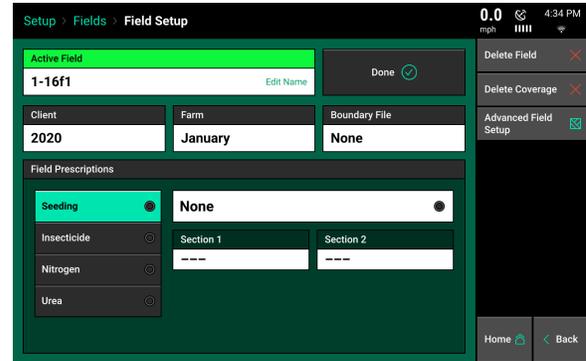
Boundary:

To assign a Boundary File to the selected field, press the “Boundary File” button. This will display ALL shapefiles that have been imported into the display. Ensure that the appropriate boundary file is selected. After selecting the boundary file name, an attribute can be selected. It is not necessary to select an attribute for a boundary file.

Note: Boundary files that have been recorded by the display can also be assigned to the field using the same process.

Seeding Prescription:

To assign a Seeding Prescription to the selected field, press the “Seeding Prescription” button. This will display ALL shapefiles that have been imported into the display. Choose the appropriate prescription for the field name. After selecting the prescription name, an attribute **MUST** be selected for each rate section that has been setup for the planter. An attribute is based on a defined product and contains a single defined rate for each management zone and is defined/named during the creation of the prescription. A different attribute can be selected for each rate section (allowing each rate section to be controlled by a different attribute/seeding rate), or the same attribute can be selected for each rate section.



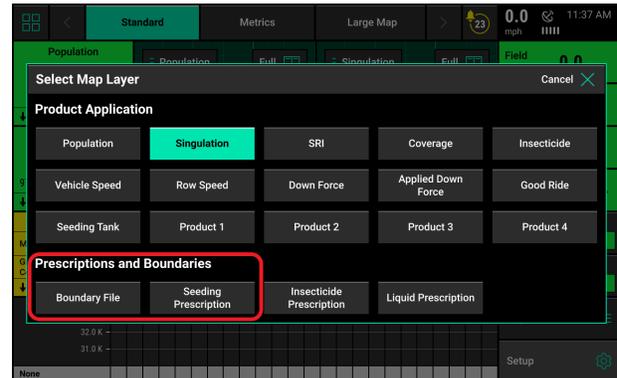
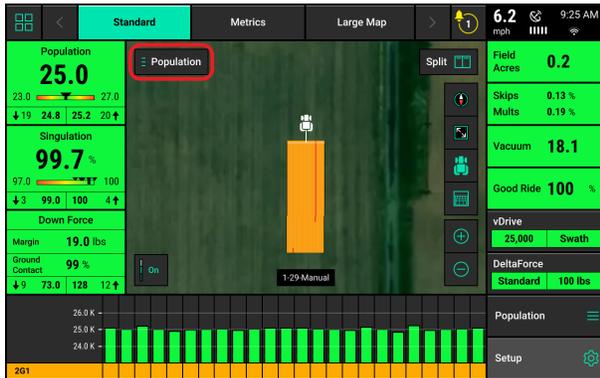
The name of the prescription assigned to the field will be displayed in the Seeding Prescription box while the Attribute names assigned to rate sections will be displayed in the Attribute box.

Prescription & Boundary Processing Modes

Under the Advanced Field Setup screen there is an option to adjust the Prescription Polygon Processing Mode. While this mode can be adjusted, the “Standard” setting is the default setting and is the processing mode most commonly used. Changing the mode to “All Exterior” adjusts the way the monitor reads the polygons that create the different zones. They are changed so the display reads all the zones as exterior polygons (ignores interior polygons). This polygon processing mode should only be changed if there are issues with the display correctly reading the prescription or boundary file.

Viewing the Boundary and Prescription

Boundary and Prescription files that have been assigned to a field can be viewed on the home screen for the active field. Select the current Map Type displayed at the top of the page to see a list of all available map types. Scroll to the bottom of the list and locate the two map types called Boundary File and Seeding Prescription. Select these map types to display the Seeding Prescription map or Boundary map assigned to the active field on the home screen.



Liquid — Diagnose

Prior to planting, ensure that all planter diagnostic information is communicating and healthy. Select “Setup” – “Diagnose”.

Everything should be green on the diagnose page. If there is an issue on a row or rows, it will be indicated on the level 1 diagnose page by displaying the system that is having an issue in a color other than green.



Color Legend

Green: The system is working correctly and communications are good. Select “Color Legend” to view an explanation of what each color indicates.

Yellow: a Device or sub-component is not 100%.

Red: Device has failed, or is expected, but not detected.

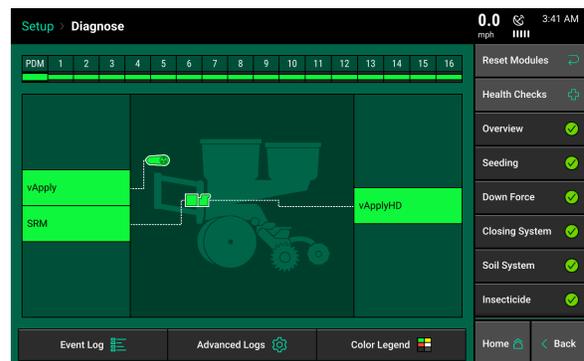
White: Device is detected, but is not expected.

Black: Row has been disabled in the planter configuration.

Gray: Device is being detected, updating firmware, or unreachable.

System Level Two Diagnose Screen

After selecting the desired fertility system, all hardware components within that system will be displayed on the Diagnose page. Select one of these hardware products to view the row details.



vApply Rate Control Diagnose Screen

Selecting **vApply Rate Control** from the Level 2 page brings up the details about the vApply Rate Control module.



The screenshot shows the 'vApply Rate Control' diagnostic screen. At the top, the breadcrumb path is 'Setup > Diagnose > Nitrogen > vApply Rate Control'. The main area contains a table with the following data:

Row	Flow (gal/min)	Flow Command (gal/min)	Pump Pressure (psi)	Filter Pressure (psi)	Duty Cycle (%)	Supply (Volts)
PDM	0.00	4.56	21	0	49%	12.7

Below the table, there are five status indicators: Radar Speed (5.6 mph), GPS Speed (Waiting Comm), FWD Accel (-0.001 ft/s/s), Master Plant (On), and Turn Rate (0.00 deg/s). On the right side, there is a sidebar menu with options: Reset Modules, Health Checks, SRM, vApply Rate Control (highlighted), vApplyHD, and FlowSense. At the bottom right, there are Home and Back navigation buttons.

Flow (Gal/min): Displays the current status of the total flow of the system

Flow Command (gal/min): Displays the commanded total flow of the system.

Pump Pressure (psi): Pressure measured by the vApply rate module at the plumbing essentials kit (pressure relief valve PTC fitting).

Filter Pressure (psi): Pressure measured by the vApply rate module as the differential between the inlet and outlet of the filter. Higher numbers indicate a plugged filter.

Duty Cycle (%): Current commanded PWM % to control the speed of the pump.

Supply (Volts): Voltage supplied to the vApply Rate Control module.

vApplyHD Diagnose Screen

Selecting **vApplyHD** from the Level 2 page brings up the row details about the vApplyHD modules. Each vApplyHD's row details are shown.

The screenshot shows the 'vApplyHD' diagnose screen with the following data:

Row	Flow (gal/min)	Flow Command (gal/min)	Encoder Low-Total (counts/sec)	Ball Position (°)	Pressure (psi)	Pressure Stability	Supply (Volts)
3	0.84	0.85	337-100	35	31	50%	12.8
4	0.85	0.85	322-96	37	34	50%	12.8
9	1.13	1.14	326-132	41	30	53%	12.8
11	0.85	0.85	362-97	37	31	57%	12.8
14	0.85	0.85	316-97	36	32	65%	12.9

Additional metrics at the bottom of the screen:

- Radar Speed: 5.6 mph
- GPS Speed: Waiting Comm
- FWD Accel: -0.001 ft/s/s
- Master Plant: On
- Turn Rate: 0.00 deg/s

Flow (gal/min): Displays the Gallons Per Acre measured for this row. Tapping on this metric heading will toggle the displayed information from Gallons Per Acre (GPA) to Gallons Per Minute (GPM).

Flow Command (gal/min): Displays the Gallons Per Acre commanded for this row. Tapping on this metric heading will toggle the displayed information from Gallons Per Acre (GPA) to Gallons Per Minute (GPM).

Encoder Low-Total: Displays the Low Flow and Total Flow sensor Hz reading.

Low Flow Encoder: Hz values between 1 and 900.

Total Flow Encoder: Hz values between 10 and 200.

Actual Ball Pos. (*): The position of the vApplyHD ball valve.

Values below 0 indicate the valve is shut (-6 or -5 deg. normally).

Maximum open valve position is 75 deg.

Pressure PSI: Pressure measured at the vApplyHD. Not used for control, only used to diagnose plumbing restrictions.

Pressure Stability (or click and change to Flow Stability): Derived by calculating an average PSI (or flow) and the standard deviation of the max or min PSI (or flow) readings. Healthy systems are normally above 85%.

Supply Voltage: Voltage supplied to the vApplyHD module on this row.

FlowSense Diagnose Screen

Selecting **FlowSense** from the Level 2 page brings up the row details about the FlowSense modules.

The screenshot shows the 'FlowSense' diagnostic screen. At the top, it displays the navigation path: Setup > Diagnose > Nitrogen > FlowSense. The status bar at the top right shows '5.6 mph', '3:34 pm', and a signal strength icon. The main content is a table with 12 rows of sensor data. Below the table, there are five status indicators: Radar Speed (5.6 mph), GPS Speed (Waiting Comm), FWD Accel (0.001 ft/s/s), Master Plant (On), and Turn Rate (0.00 deg/s). On the right side, there is a vertical menu with options: Reset Modules (with a refresh icon), SRM, vApply Rate Control, vApply/HD, and FlowSense (which is highlighted in red). At the bottom right, there are Home and Back navigation buttons.

Row	Flow (gal/min)	Sensor Type	Sensor Value (counts/sec)	Supply (Volts)
1	0.27	High Flow	35	
2	0.27	High Flow	35	
3	0.28	High Flow	37	
4	0.28	High Flow	36	
5	0.28	High Flow	37	
6	0.29	High Flow	38	
7	0.28	High Flow	37	
8	0.28	High Flow	36	
9	0.27	High Flow	35	
10	0.30	High Flow	39	
11	0.26	High Flow	33	
12	0.29	High Flow	38	

Flow (gal/min): Displays the flow measured in gallons/minute

Sensor Type: Displays the type of FlowSense installed (Low or High Flow). Must see flow for 3+ seconds before type is displayed. If sensors is jammed and does not spin, no type will be displayed.

Sensor value (counts/sec): Displays the value of the turbine counts per second.

Supply (volts): Displays the supply voltage to the FlowSense module.

Indicator Light Status

The “CAN” FlowSense device has three indicator lights. The single light is the CAN communication light. The two indicators near the electrical connector are the turbine indicator lights and the status of them is discussed below. The “Aux” FlowSense housing has a single indicator light on the outside of the device for the turbine indicator. There are three different light colors that can be observed in this light.

A green light indicates the FlowSense is powered and the sensor is not triggered and not changing. This would indicate that the turbine to measure flow is NOT spinning. This could be due to no flow through the device, or foreign material is preventing the turbine from spinning.

A red or orange light indicates the FlowSense is powered and the sensor is currently triggered, but not changing. This would indicate that the turbine to measure flow is NOT spinning. This could be due to no flow through the device, or foreign material is preventing the turbine from spinning.

A yellow light or light that appears to be flashing rapidly indicates that the FlowSense is powered and the sensor is triggering on and off. This indicates that the FlowSense is measuring flow, therefore if there is flow currently, this is the CORRECT light color and is expected during normal operation.. The faster the light is flashing, the greater the amount of flow being measured.



Electromagnetic (EM) FlowSense Diagnose Screen

Selecting **FlowSense** from the level 2 page brings up the row details about the FlowSense modules.

Row	Flow (gal/min)	Sensor Type	Sensor Value (counts/sec)	Reference Value	Supply (Volts)
1	0.00	Electromagnetic		0.7	12.9
2	0.00	Electromagnetic		4.9	12.9
3	0.00	Electromagnetic		1.3	12.7
4	0.00	Electromagnetic		5.0	12.9

System Status: Lift State: Lowered; Radar Speed: 5.2 mph; GPS Speed: Waiting Comm; FWD Accel: 0.000 ft/s/s; Master Plant: Off; Turn Rate: Not Zeroed.

Flow (gal/min): Displays the gallons per minute measured for this row

Sensor Type: Displays the type of FlowSense installed

Sensor Value (counts/sec): - Not used for EM Flowsense

Reference Value: This is the “zero” value determined during the “Zero EM FlowSense” procedure.

Supply (Volts): Supplied voltage to the EM FlowSense device.

Flow Meter Diagnose Screen

Selecting **Flow Meter** option from the Level 2 page brings up the row details about the Flow Meter module(s).

Row	Actual (gal/ac)	Actual (gal/min)
1	0.0	0.00

System Status: Lift State: Lowered; Radar Speed: Wait Signal; GPS Speed: 0.0 mph; FWD Accel: -0.000 ft/s/s; Master Plant: Off; Turn Rate: 0.00 deg/s.

Flow (gal/min): Displays the flow measured in gallons/minute.

Sensor Value (counts/sec): Displays the values that the flow meter is supplying to the 20|20.

vApply Sidedress Mode—Gen 3 20|20

Sidedress Quick Reference Guide

This is the basic requirements for the sidedress system to operate.

Step 1:

vApplyHD must be configured on the 20|20 monitor.

Step 2:

There must be a speed source.

Step 3:

The Master Plant Switch on the Cab Control Module must be in the up position.

Step 4:

The planter must be lowered.

Step 5:

vApplyHD System must be enabled.

Step 6:

A rate (GPA) must be set.

Before connecting vApplyHD modules to the liquid plumbing, run a Pump Flush Health Check to ensure debris does not contaminate the vApplyHD modules. Details on this Health Check can be found under the Health Check section.

Overview

Consult your Precision Planting Dealer or the Online Order Guide for more information on the hardware and plumbing components required to run in Sidedress Mode.

Follow the below steps to set up the 20|20 for Sidedress mode. Details for each step can be found in the sections of this manual or in the vApplyHD Operator's Guide.

Note: All vApplyHD setup steps can be found in the previous sections of this manual for “vApplyHD Setup”.

The following steps are an overview of setting up your 20|20 for sidedress. Details on each step are found below.

Step 1:

Save Current Implement and Vehicle.

Step 2:

Change Implement Type to ‘Sidedress’.

Step 3:

Configure Sidedress bar setup.

Step 4:

Configure vApplyHD setup.

Step 5:

Configure Liquid Alerts.

Step 6:

Enter in GPS measurements for the Tractor and Sidedress bar.

Step 7:

Verify Diagnose page is green with 100% communication.

Step 8:

Flush the system before connecting the hoses to the vApplyHD modules.

Step 9:

Use the manual test to find the pump calibration or speed to run an uncontrolled pump.

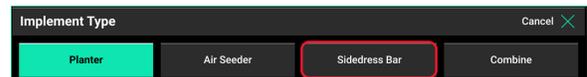
Once the above steps have been completed, the system will be ready for operation. For a detailed explanation on how to operate vApplyHD on a sidedress bar, refer to the previous section in this manual on “Controlling the Liquid System”.

Switching into Sidedress Mode

The Gen3 20|20 has different modes that it can be put into. These modes include Planters, Combines, Air Seeders, and Sidedress Bars. To switch modes, select Setup – Equipment – Implement Type



From the displayed list, select “Sidedress Bar”.



At the time of publishing this document, when the Implement Type is changed the configuration from all other Implement Types (for example: planting) will be reset to factory defaults. There are two ways to save configurations before switching Implement Types.

1. Save all configs to a USB drive.
2. Use the Save/Load option in the equipment menu to save both the Tractor and Planter configurations. Any Tractor configurations that have been saved can be loaded in Sidedress mode and used so the tractor does not have to be set up again.

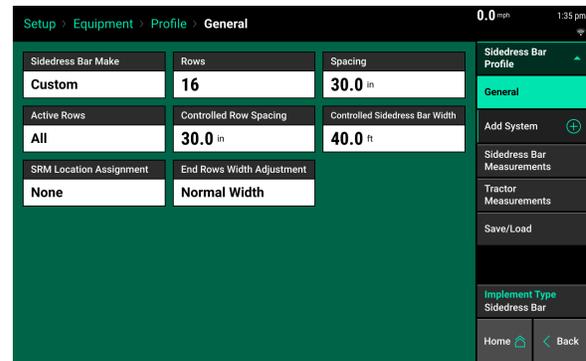
Equipment Menu

The Equipment menu is where the Sidedress bar and tractor are configured. It is important to ensure that all information is entered correctly in the Equipment menu.

Equipment — Profile

The “Sidedress Bar Make” is locked to Custom and cannot be changed.

Press the “Rows” button to enter the correct number of physical rows on the Sidedress bar that will have vApplyHD Flex modules and/or FlowSense installed on.



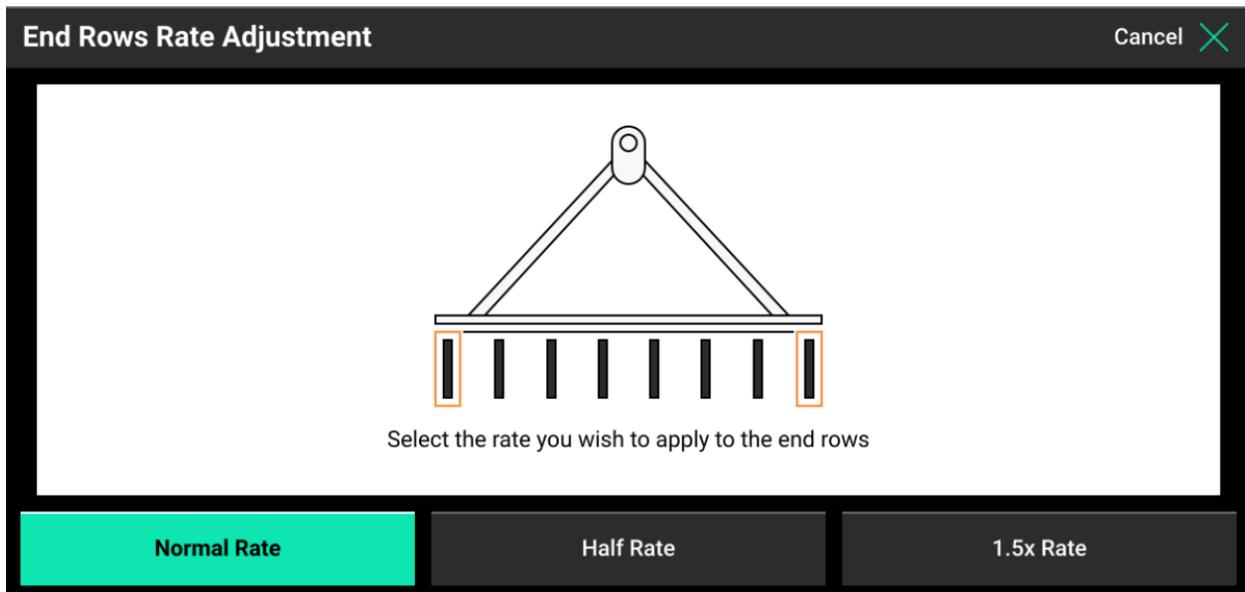
Press the “Spacing” button to select the spacing for the rows on the planter. If the correct spacing is not available, select “Other” to manually enter the row spacing.



Press the “Active Rows” button to define the rows that will actively be applying liquid. The system defaults to all rows active. Preset row options for Odd, Even, Left, or Right rows can be selected. To define specific rows, select “List”. When listing out the active rows, rows marked by a green box are active rows.

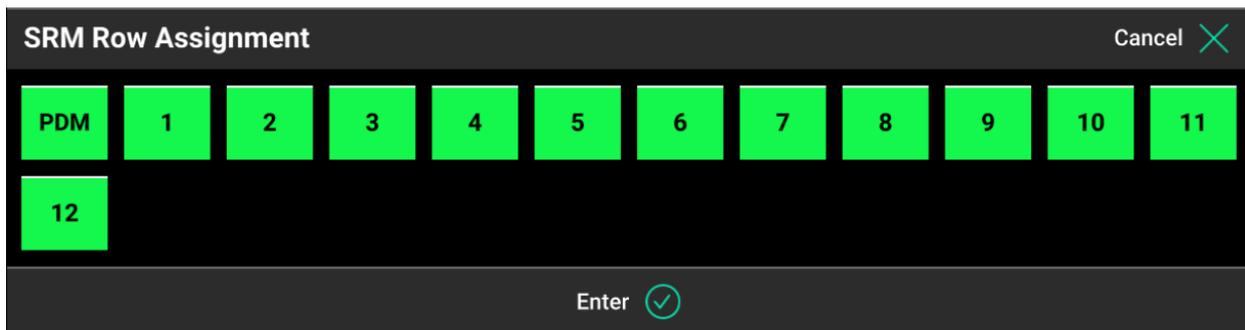


Select the “End Rows Rate Adjustment” button to set different rates for the outside row on each side of the bar. This setting allows for half rate or rate and a half as needed. Typically used for bars with an odd numbered amount of rows.



Effective Row Spacing and Effective Sidedress Bar Width are both automatically calculated from the number of Rows, Spacing, and Active Rows. If these are incorrect, they can be selected and a new value manually entered.

Use the “SRM Row Assignment” to tell the 2020 which rows have an SRM installed. Toolbars that have individual row control with vApplyHD Flex will have all rows assigned (including the PDM). If the toolbar is configured with vApplyHD Flex section control (Section control with FlowSense feedback), select the PDM and the rows that have a vApplyHD Flex plugged into the backbone harness.

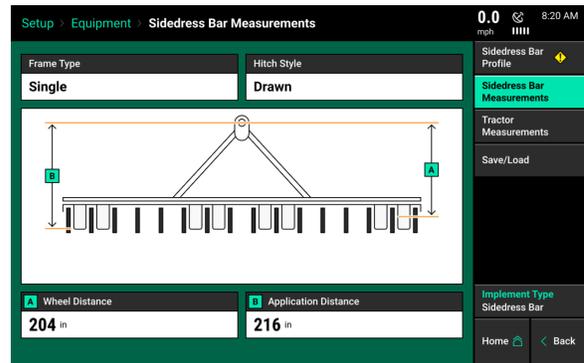


Equipment — Sidedress Bar Measurements

GPS offset measurements must be setup prior to planting in order for the monitor to correctly control and model the Sidedress bar. From the home screen select Setup – Equipment – Planter Measurements.

At this time, the Frame Type can only be set to Single frame type.

A “Hitch Style” must also be defined. Select the hitch style that best fits the sidedress bar.



Measurement A - Wheel Distance: With the Sidedress bar lowered, measure the distance from the center of the drive wheels to the Pivot point. Enter this measurement in box A. Press the check mark button after entering the measurement.

Measurement B – Application Distance: Measure the distance from the pivot point to the point where liquid is being applied.

Note: For a 3-Point hitch style, measure both A and B distances to the center of the tractor’s rear axle.

Equipment — Tractor Measurements

Tractor GPS measurements must also be setup prior to planting in order for accurate modeling and control of the planter. From the home screen select Systems – Equipment – Tractor Measurements to enter measurements for the tractor.

Note: Some GPS systems do not output the location of the actual GPS globe. Verify the GPS output location with the GPS manufacturer.

The options for Tractor Make and Tractor Model provide useful troubleshooting information, but are not necessary information to enter.

A “Steering” type must be selected. There are three steering options: Front, Track, and Articulated. Each steering has different GPS measurements that must be entered.

Steering Type: Front

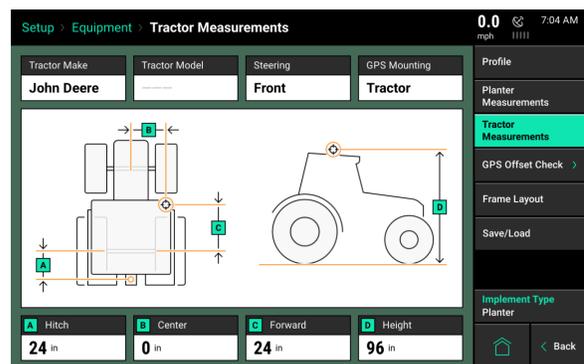
A - Hitch: Measure the distance from the center of the rear axle the hitch (or pivot point on a two point pivot planter hitch).

Note: If a 3 pt planter hitch is connected, enter 0.

B - Center: Measure the distance from the center line of the tractor to the GPS output location.

Then select if the GPS output location is to the left or right side of the tractor's center line.

C - Forward: Measure the distance from the center of the rear axle to the center of the GPS antenna.



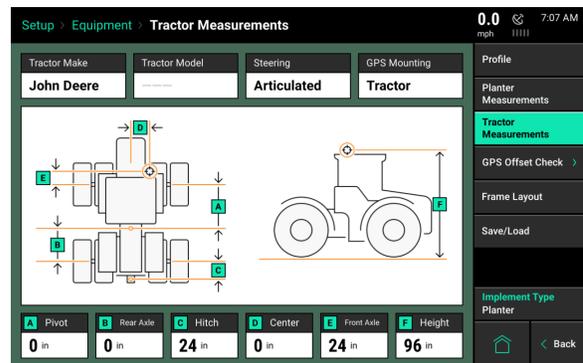
D - Height: Measure the distance from the ground to the base of the GPS output location.

Steering Type: Articulated

A - Pivot: Measure the distance from the center of the front fixed axle to the articulation point.

B - Rear Axle: Measure from the articulation point to the center of the rear fixed axle.

C - Hitch: Measure the distance from the pivot location at the hitch to the center of the rear fixed axle.



D - Center: Measure the distance from the center line of the tractor to the center of the GPS antenna. Then select if the GPS receiver is to the left or right side of the tractor's center line.

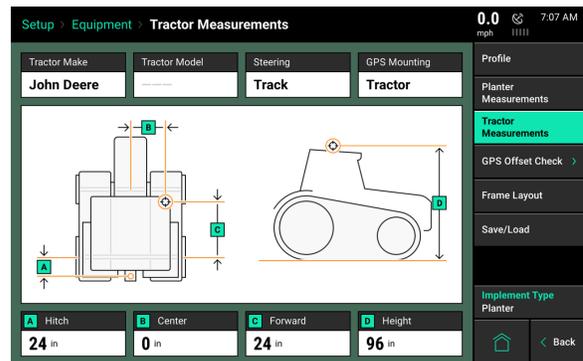
E - Front Axle: Measure the distance from the center of the front fixed axle to the GPS output location. Indicated if the GPS output location is in Front or Back of the front axle.

F - Height: Measure the distance from the ground to the GPS output location.

Steering Type: Tracked

A - Hitch: Measure the distance from the pivot location to the hitch (or pivot point on a two point pivot planter hitch).

B - Center: Measure the distance from the center line of the tractor to the GPS output location. Then select if the GPS output location is to the left or right side of the tractor's center line.



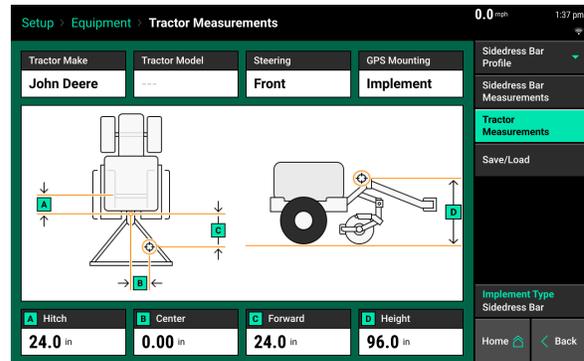
C - Forward: Measure from the track pivot to the GPS output location. Indicate if the GPS output location is in Front or Back of the pivot location.

D - Height: Measure the distance from the ground to the base of the GPS output location.

Implement Mounted GPS

The “GPS Mounting” location can be changed from the “Tractor” to the “Implement”. Select the “GPS Mounting” button to change the GPS measurements to allow for a implement mounted receiver.

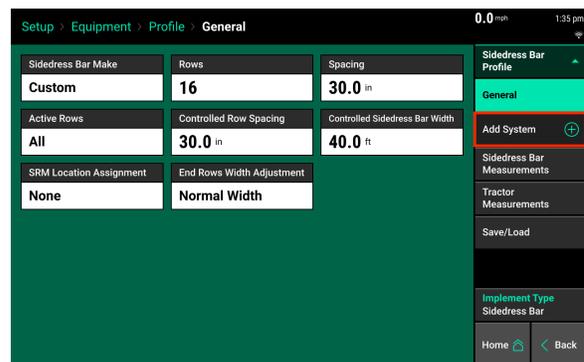
Note: Verify GPS output location from GPS manufacturer. The output location is not always the actual GPS receiver mounted on the implement. Always take measurements from the GPS output location.



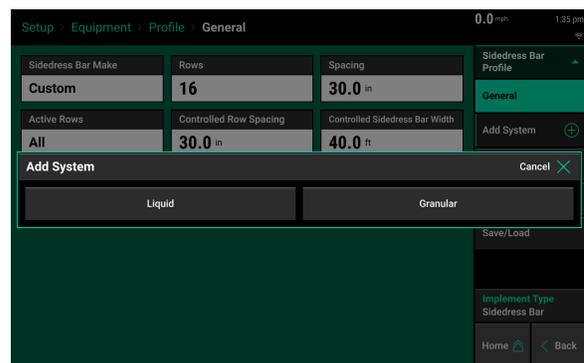
Measurements for implement mounted GPS systems are very similar to tractor mount GPS systems, except that measurements will be taken from the GPS output location on the implement instead of an output location on the tractor.

Adding the system to the Equipment Menu

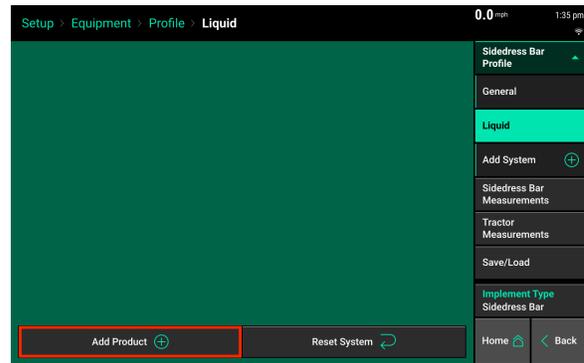
Press the “Add System” button on the right hand side.



Select “Liquid” for a liquid sidedress system or “Granular” for a granular sidedress system.



Select “Add Product” to add the name that the product will be called. You can select from any of the items listed or select “Custom” to create your own nickname. If more than one liquid or granular system is being used, use the “Add Product” button to add each system.

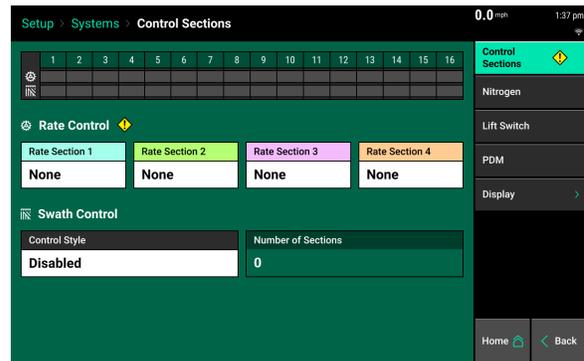


System Menu

Navigate to Setup — Systems to configure the Control sections of this implement. The Control Sections will apply to all rate control products configured on this monitor.

Rate Section Setup

Setup the “Rate Control”. Rate Control Setup allows the operator to determine which rows to set to certain rates. The monitor can control up to 4 different rate sections at once. Each rate section can be assigned a different target rate or prescription attribute. A rate section can be any combination of rows.



Note: Any rows **not assigned** to a rate section **will not operate**.

If all rows will be controlled with the same rate or the same prescription attribute only one rate section needs to be configured. If only one rate section will be used select “Rate Section 1” and then select “All”. Use multiple rate sections when controlling different rates between rows or sections.

To setup a rate section, select one of the four Rate Sections. Assign appropriate rows to the rate section. This may be Odd, Even, Left, Right or List. When selecting “List”, define which rows are to be used by touching those rows numbers so they turn green.

Note: Ensure that all rows are assigned to a rate section. Any row not assigned to a rate section will not operate.

Swath Setup

Set up the Swath Control. Swath Section Setup allows the operator to divide the planter into different swath sections. There are four different options for Swath Control.

Note: If setting up multiple Swath Sections, they **do not** have to be the same as Rate Sections.

Disabled — Rows with not shut off seeding when entering an area that is already planted.

Single Row — Each row will shut off individually as that row enters an area that is already planted.

Dual Ends — The outside two rows on each end of the planter are linked together. The inside rows are single row swath. Generally used with WAAS GPS correction.

Custom — If one of the pre-set settings is not acceptable, a custom setting can be selected. This will allow the operator to group any rows together for swath control.

Custom Swath Setup

If Custom is Selected:

1. Select the total number of sections to set up.
2. For each section select the number of rows by pressing on the white box in the Number of Rows column and manually enter a value or by using the arrows to increase or decrease the number of rows in a section number.
3. The Rows in Section will auto-populate as the Number of Rows is determined.
4. If a section does not have rows assigned to it, that section number will be ignored.

vApply Setup

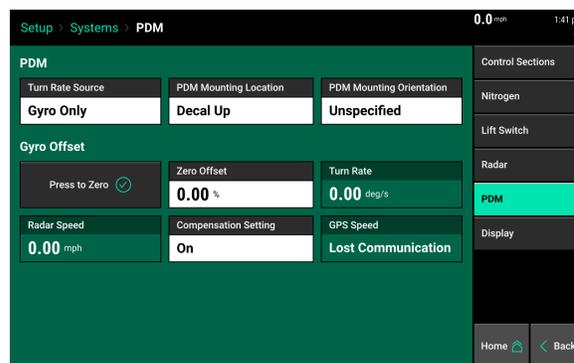
The “System” setup for a sidedress bar with liquid or granular control is the same as the setup on a planter. See the planter setup section of this manual for the systems you need to setup.

All vApplyHD systems need to complete the “vApply Setup” and “vApplyHD Setup”. If installed, complete the setup for “FlowSense” and/or “FlowMeter”.

All systems need to complete the “Lift Switch” setup found in the planter setup section of this manual.

PDM

The Power Distribution Module [PDM] must be configured in order for control products that connect through the SRM infrastructure to operator properly.



Turn Rate Source - Select the input source for calculating turn compensation when planting through curves. Select between “Gyro then GPS”, “Gyro Only”, and “GPS Only”. “Gyro Only” is the recommended setup.

Note: For the system to be able to recognize forward acceleration quickly and start seeding correctly, the position of the Gyro inside of the PDM must be known. Ensure that the PDM Mounting Location and PDM Mounting Orientation are set correctly. Otherwise performance will be degraded.

PDM Mounting Location - Determine if the PDM is mounted with the decal on the PDM facing up or if the decal on the PDM is facing down.

PDM Mounting Orientation - Determine the orientation of the fuses. The orientation is based on the operator sitting in the cab. Fuses can be orientated either: Forward, Right, Backwards, or Left.

“Press to Zero” - use this button to zero the gyro. The gyro should always be zeroed when setting up a new system. There will be a Zero Offset percentage recorded after the gyro has been zeroed. Make sure the planter is straight behind the tractor when zeroing the gyro. If the turn compensation seems to be off or if getting warnings about the gyro, re-zero the gyro.

Radar Speed - displays the speed being read from the Radar. Press on this button to be directed to the Radar Status page.

Turn Rate - Displays the radius of a turn in degrees per second, of the turn that is being read from the gyro while turning. This is the degree that will be used for turn compensation. Press on the “Turn Rate” button to adjust the turn compensation.

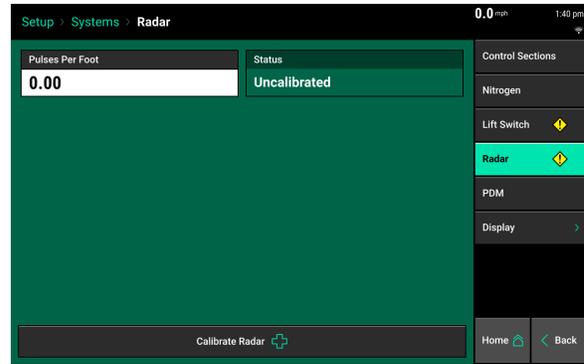
- **On** - This is the RECOMMENDED and default setting for all SRM systems. In this setting, both control and monitoring will be based on the speed of each individual row. For example; all rows will keep a consistent seed spacing around curves.
- **Control Only** - Each row will control to its own calculated speed and will keep consistent seed spacing. However, the reporting will only show a population based on the center of the planter. There will be a higher population on the outside rows and lower population on the inside rows of the curve.
- **Monitor Only** - Control for all rows will be based on the center of the planter. However, reporting will show a population based on the distance each individual row traveled. Resulting in a higher population for the inside rows and lower populations for the outside rows.
- **Off** - both control and monitoring will be based on the speed of the tractor. Seed Spacing will be closer on the inside of the curve and further apart on the outside of the curve.

GPS Speed - displays the speed being read from GPS. Press on this button to be directed to the GPS Communication page.

Radar Status

Receiving a speed reading from a tractor mounted radar is recommended when running a control product. The Radar Status page allows the operator to calibrate the radar.

Select the “Calibrate Radar” button at the bottom of the screen and then follow the on-screen instructions.



The calibration process will require a good GPS signal as well as having the operator drive straight for at least 300 feet at a constant speed of 4 mph or greater.

If the Pulses Per Foot is already known, enter this value manually by selecting the “Pulses Per Foot” box.

Liquid Alerts

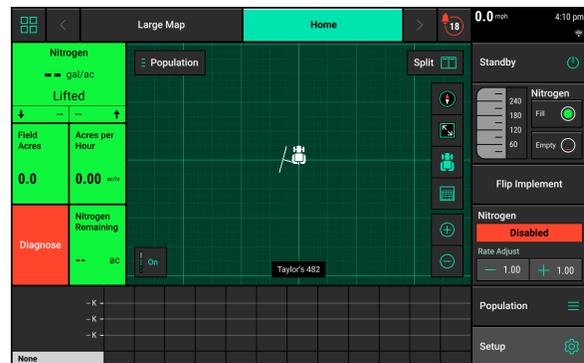
See the previous section in this manual for “Liquid Alerts” to configure your alerts.

Home Page

The manual titled 20|20 Operators Guide - Planters has detailed information on “Customizing the Home Screen”.

At a minimum you will need to add the control button for each control system to one of the screens. This will allow you to enable the system and enter a rate.

This is an example of how you may setup the screen of the 20|20 for sidedress.



Pump Calibration Process

See the previous section in this manual for “Pump Calibration Process”. You will find information there for each of three possibilities.

Option 1 is the 20|20 monitor controlling the speed of the pump and varying the speed of the pump based on output needed.

Option 2 is the 20|20 controlling the pump to a constant speed.

Option 3 is the pump is controlled by SCV or ground drive and finding a good setting for the pump speed or output setting.

Controlling the Sidedress system

See the previous section in this manual for “Controlling the Liquid System (vApplyHD, vApplyBase, FlowSense or planter wide flowmeter)”.

Diagnose Page

See the previous section in this manual for “Liquid - Diagnose”.