vApplyHD™

vApplyHD Operator's Guide
Gen2 2020 SeedSense Displays

With notes for using SureFire PumpRight PR Hydraulic Pumps

Precision Planting®

955656_2 6/5/18

Preliminary notes on using SureFire PumpRight PR Hydraulic Pumps with vApply HD: 05/24/2019

Without taking precautions to control the speed of the pump, you may cause damage (major damage) to the pump and to the other components of the system.
The pump is rated at 500 RPM. Given adequate oil and unlimited PWM Duty Cycle, the pumps may spin up to 700 RPM (or more). Because they are positive displacement pumps, the pump output continues to increase as the RPM increases. This output is not necessary to meet the flow requirements to the rows, so a big percentage of it is being recirculated. If this recirculation is directed back to the pump inlet, the inlet is being slammed with high velocity, high pressure, high volume flow that will damage (or destroy) the inlet valves. Also, much of this recirculation is through the pump PRV, so the flow has a hammer-like dynamic as the PRV spring actuates. (Even though the pressure limit on the vApply HD may be set to 80 PSI or less, the 100 PSI PRV may still be activated if the vApply HD recirculation plumbing cannot handle the flow being sent to it by a pump that is running too fast.)

In short, the speed of the pump must be limited to pump specifications (but that alone may not be sufficient).

The pump speed may also be limited by limiting the hydraulic flow with the in--cab hydraulic flow control. This is only possible if the pump is attached to its own hydraulic remote.
The recirculation impact may be lessened by plumbing all recirculation back to the tank and not to the pump inlet. This would include recirculation from the pump PRV.

Even with the pump spinning at rated RPM, there may be a very large recirculation flow. For example, a PR30 spinning at rated RPM in a scenario that calls for 10 gpm to the rows will have 20 gpm of recirculation flow. A PR30 spinning at 700 RPM will output approximately 40 gpm.

Before running the Pump Calibration, set the Maximum PWM Limit to 50%. Depending on PWM voltage, hydraulic flow and plumbing, the pump may reach maximum rated RPM at 55-60% PWM DC.

Advanced Setup
(Setup > Systems > vApplyHD > Advanced Setup).

Minimum/Maximum PWM

Minimum PWM / Maximum PWM - these are the two extremes for how open the PWM valve can be. The control will not exceed the maximum or minimum PWM command. The default setting is 0% to 95%. This is not the Min/Max PWM values from the pump cal. (?Set this to 50% MAX and 0-10% MIN for SureFire PumpRight pumps?)

Contents

vApplyHD System Setup, Calibration, and Operation

There are six requirements for the vApplyHD System to function:

1. vApplyHD must be configured on the 20/20 monitor.

2. There must be a speed source.

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

4. The planter must be lowered.

5. vApplyHD System must be enabled.

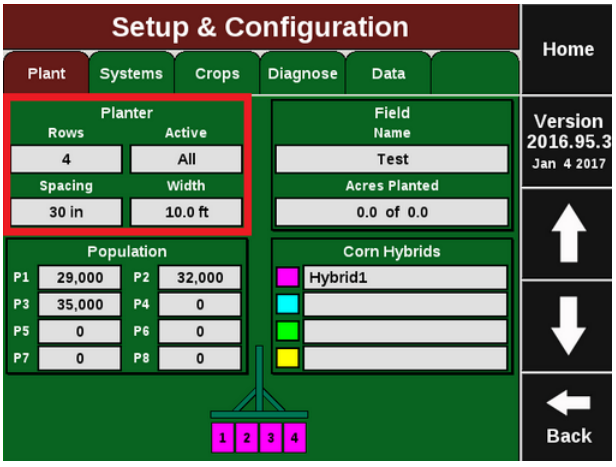
6. A rate (GPA) must be set.

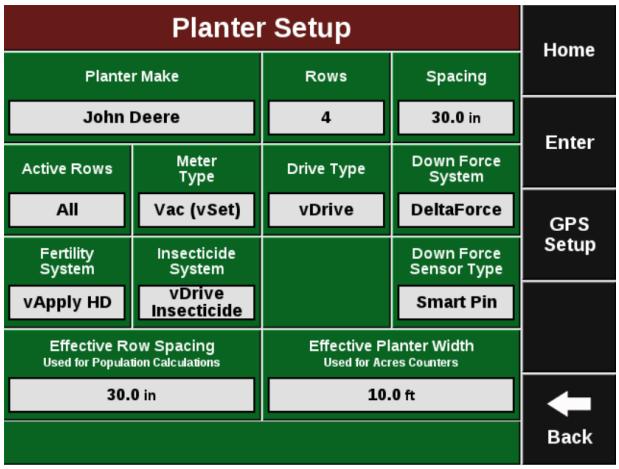
Before connecting vApplyHD modules to the liquid plumbing, run a Pump Flush Health Check to ensure debris does not contaminate the vApplyHD modules. Details on this Health Check can be found under the Health Check section.

Configuring 20/20 for vApplyHD

Step 1:

Navigate to the Planter Setup (Setup > Plant > Planter) in order to begin vApplyHD setup.

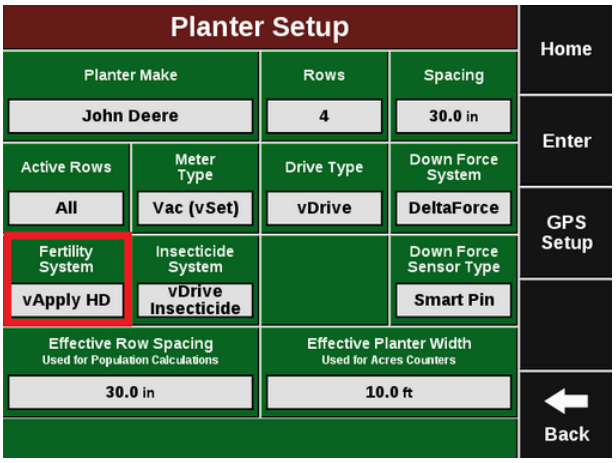


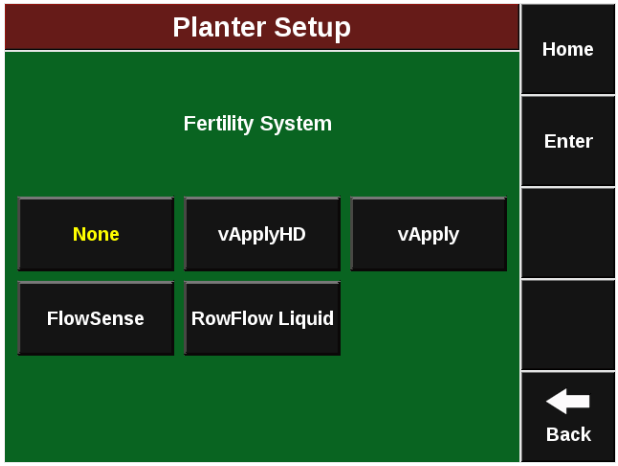


Step 2:

Press on the “Fertility System” section to choose the correct control type.

Note: If both vApplyHD modules and FlowSense are installed, select vApplyHD as the Fertility System.

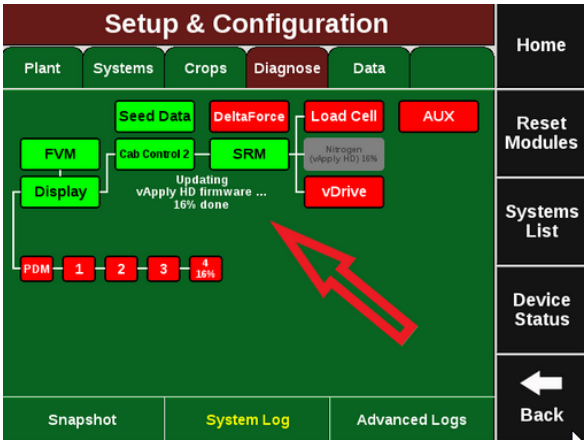




Step 3:

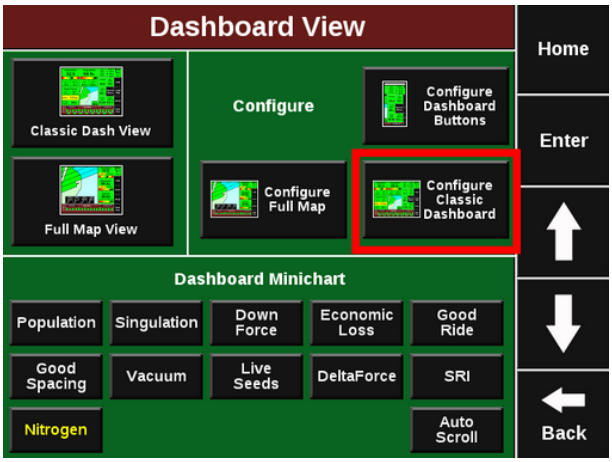
Navigate to the Diagnose tab and confirm that systems are communicating properly (all green).

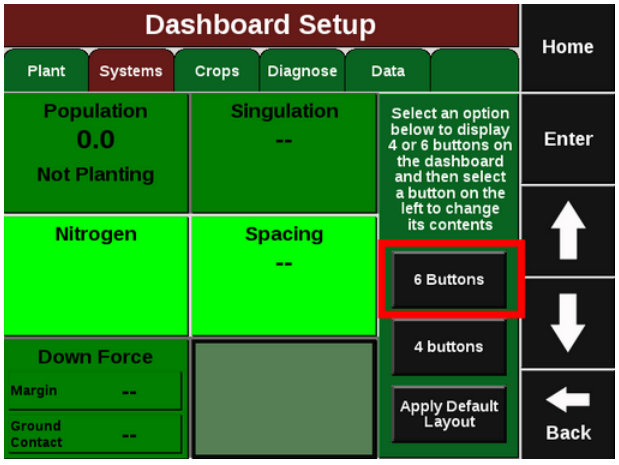
Note: Modules may be updating during initial connection. Once updates are complete all modules should be green. If the modules are not green, confirm that the number of rows and planter setup is correct. If any issues exist, refer to the Precision Planting Service Manual for troubleshooting procedures.



Step 4:

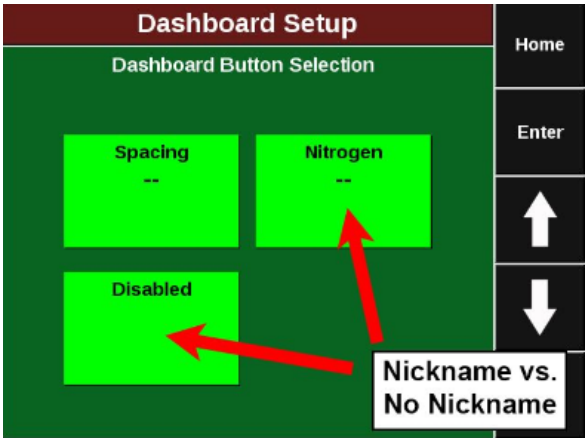
Set up the Home Screen for the best vApplyHD control. Change the default layout by navigating to the Dashboard Setup menu (Dash View>Configure Classic Dashboard) and selecting “6 Buttons”.





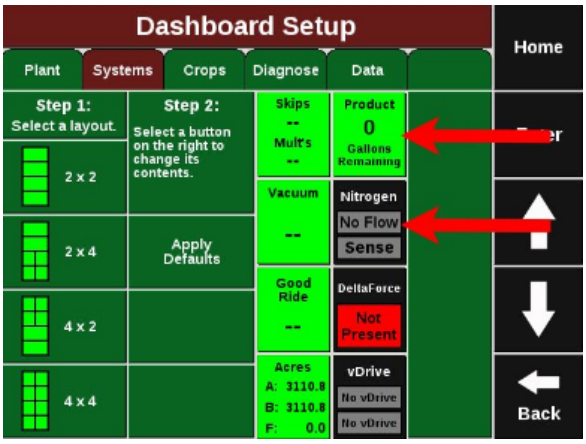
Step 5:

The two new middle display icons may be changed. Select your liquid product as one of the new icons. Unless a product nickname has already been selected, the icon will display “Disabled”.



Step 6:

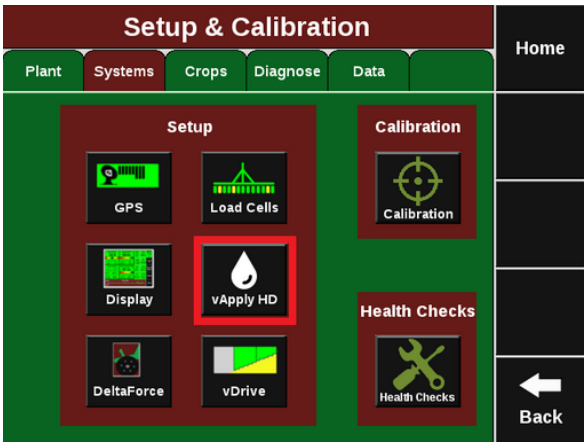
Next add the vApplyHD control button to the right hand side of the home screen. (Dash View>Configure Dashboard Buttons). Tap on a dashboard icon and select from the list to change the desired function.



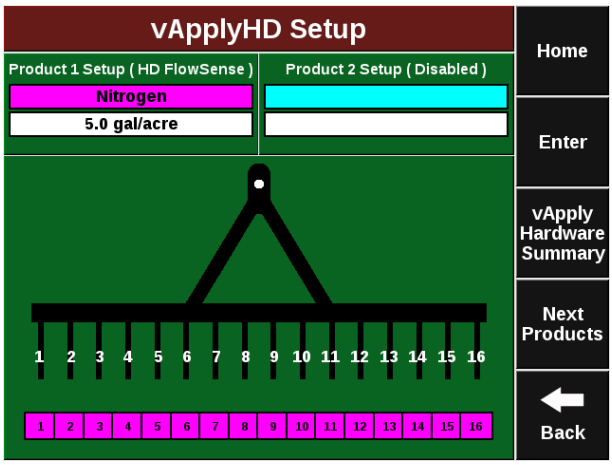
Product Setup and Configuration

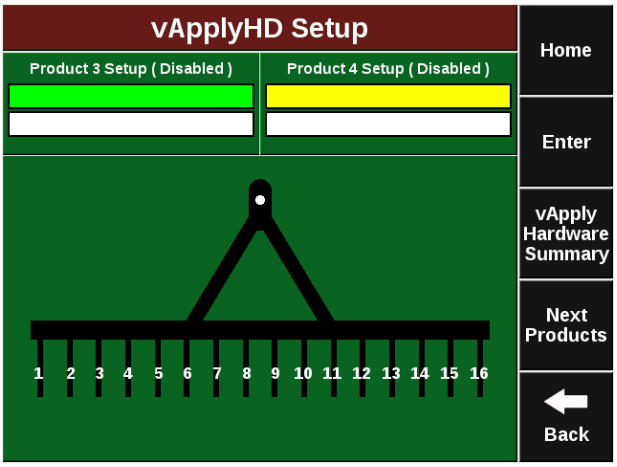
Product Setup

Navigate to the vApplyHD Setup menu (Setup > Systems>vApplyHD) in order to setup your first product.

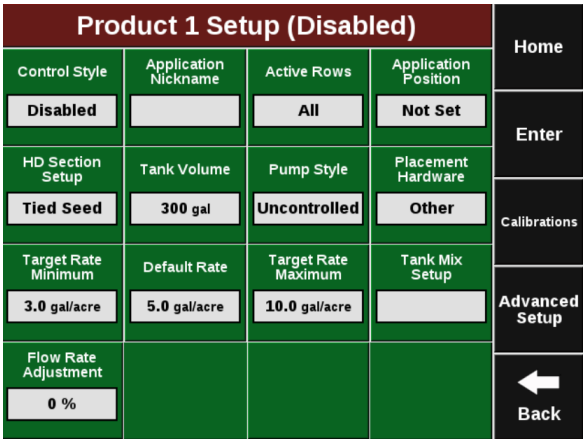


For single vApplyHD systems only, the first product setup will need to be completed. Press on the Product 1 setup button on the top left side to begin the setup process. For multiple liquid systems (vApplyHD and/or FlowSense) each system will need to be setup individually. Up to four liquid systems can be configured.





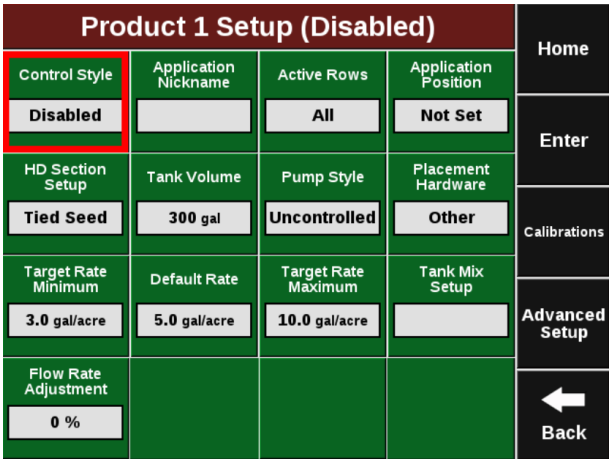
To successfully configure a vApplyHD system all settings on this page must be set correctly. In order for the liquid product to be viewed on the home page and diagnose page the Control Style and Product Nickname must be set.

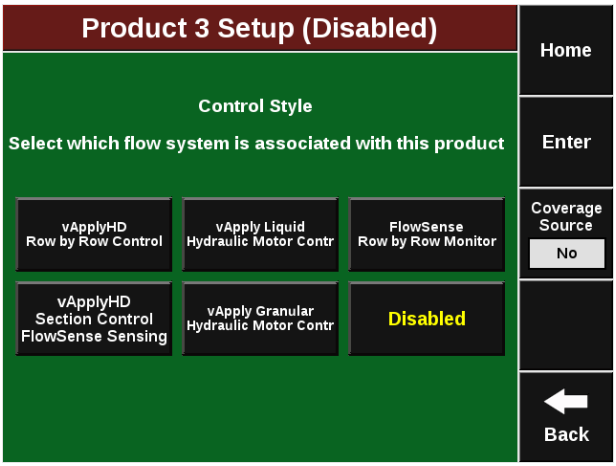


Control Style

Change “Control Style” from Disabled to “vApplyHD” to allow the 2020 to begin using vApplyHD. To successfully configure a vApplyHD system all settings on this page must be set correctly. In order for the liquid product to be viewed on the home page and diagnose page the Control Style and Product Nickname must be set.

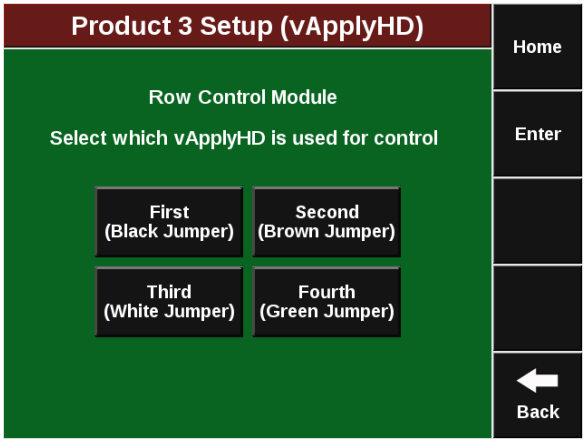
Note: Enable the Coverage Source on the right for the liquid system to define the coverage source for all liquid system swathing. If multiple liquid systems are configured, only one system can be set to the coverage source.





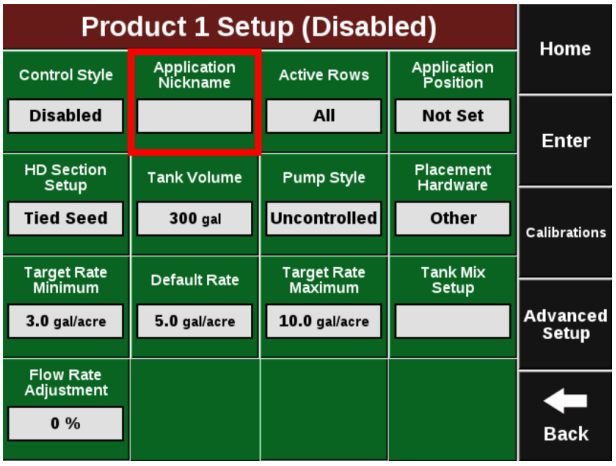
Once you have selected “vApplyHD” for the control style you will need to select the vApplyHD’s control ID. This is determined by what jumper color is being used to connect the vApplyHD module to the system.

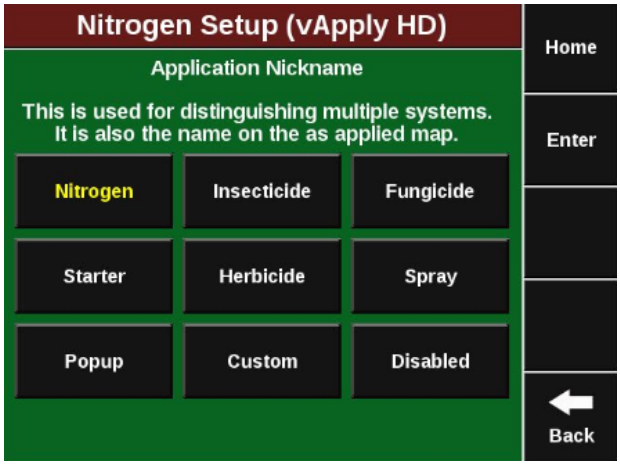
- First Control Module/Product.
- Second Control Module/Product.
- Third Control Module/Product.
- Fourth Control Module/Product.



Application Nickname

Give your product a “Nickname” by selecting the empty box and selecting from the list. If necessary, a “Custom” name may be entered for your products “Nickname”. The nickname chosen will be displayed on the homepage, diagnose page, and control pages instead of vApplyHD.



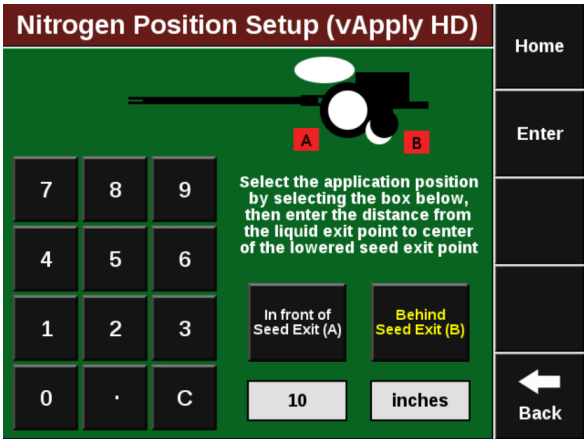


Active Rows

“Activate Rows” lets the 2020 know which rows should be actively controlled. When rows are not active, they will remain off and not apply any product.

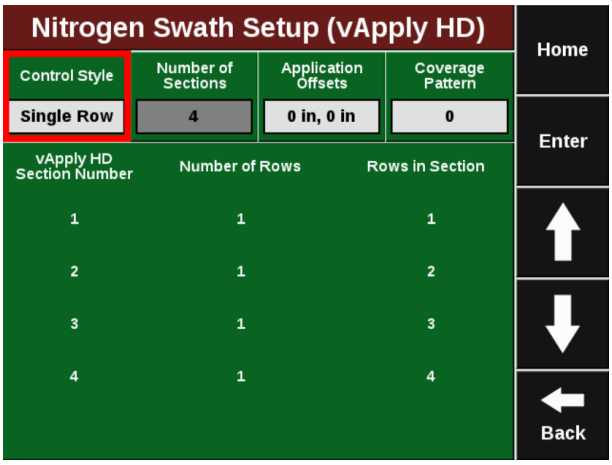
Application Position — Planters Only

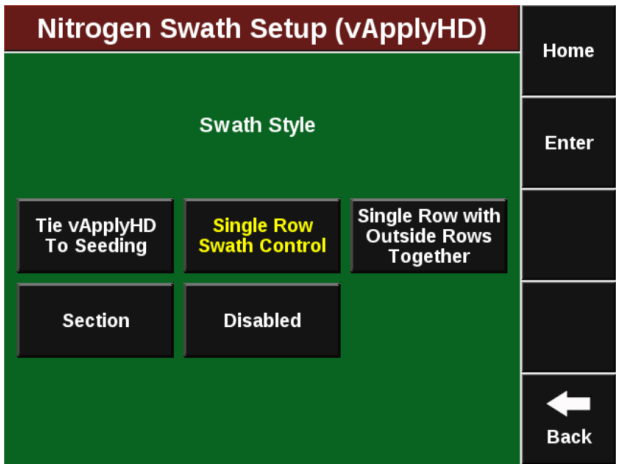
Enter the position of the liquid exit point in order for swath control to work properly. Select “In front of Seed Exit” (marked A in the diagram) if you are applying your liquid prior to the seed tube exit. Measure how far in front of your Seed Tube Exit and enter in the number of inches. Select “Behind Seed Exit” (marked B in the diagram) if you are applying your liquid behind the seed tube exit. Measure how far behind your Seed Tube Exit and enter in the number of inches.



Swath Section Setup

Configure how the vApplyHD modules swath off and on.





Tied to seeding: Select "Tied to Seeding" in order to automatically control vApplyHD swath settings to the same vDrive swath settings.

Single Row Swath Control: Single Row Swath Control allows each row with vApplyHD to control individual rates and swath off as needed on a per row basis.

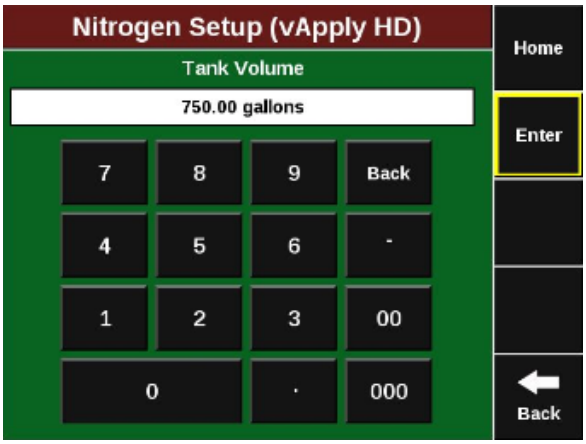
Single Row with Outside Rows Together: This option allows just the outside two rows on each wing to control together and swath off as a pair in order to safeguard a potential GPS signal drift discrepancy.

Section: This option allows the operator to customize the swath sections. Set the total number of swath sections at the top of the screen. Then use the arrows to assign rows to sections or press on the "Rows in Section" box to list rows in the section. Not recommend for individual row vApplyHD.

Disabled: Disabled swath will prevent the vApplyHD from turning off in a swath event. This will cause overlap in product at end rows and headlands.

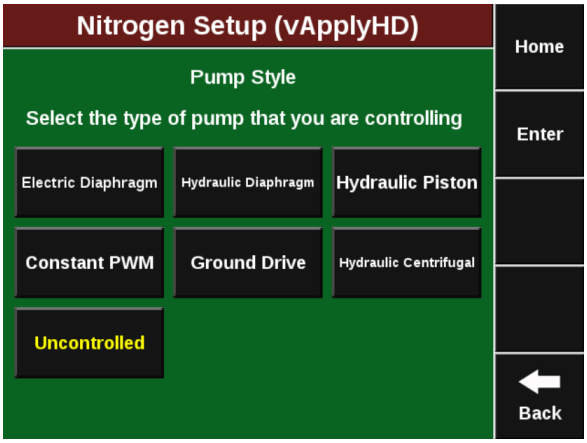
Tank Volume

Tank volume is designed to allow the user to track how many gallons of the active product are available to apply. Tank volume will be used to trigger the low product alarms that can be configured in the "Liquid Alerts" section of the "Crops" tab (see liquid alerts section). If there are multiple tanks feeding the liquid system add the volume of each tank together.



Pump Style

Select the pump style that you are controlling with a vApply module. NOTE: The vApply module will only control electric or hydraulic pumps that are also equipped with PWM control (PWM valve or electric PWM drivers). Additionally, a Pressure Maximum value must be entered - this is the maximum pressure that you want in the system. This should be no higher than what the pump and plumbing is rated for and should never exceed 100 psi.



Note: The vApply Module will only control electric or hydraulic pumps that are equipped with a PWM driver or valve.

Electric Diaphragm: Select this option when using an electric diaphragm pump WITH an electric pump driver (electric PWM control).

Hydraulic Diaphragm: Select this option when using a hydraulically driven diaphragm pump WITH a hydraulic PWM valve.

Hydraulic Piston: Select this option when using a hydraulically driven piston pump WITH a hydraulic PWM valve.

Hydraulic Centrifugal: Select this option when connected to a centrifugal pump that hydraulic driven and has a PWM valve.

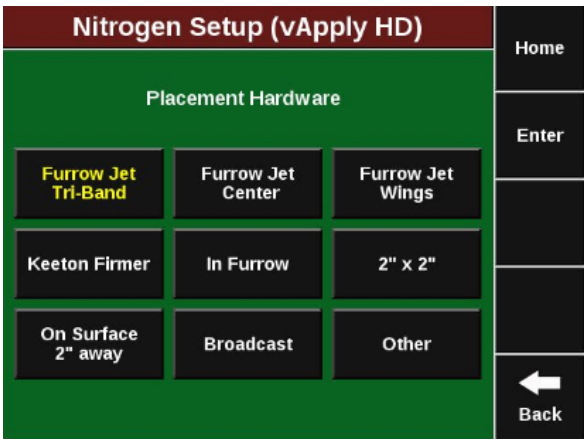
Constant PWM: Select this option when one of the previous three pump setups must be driven at a static rate.

Ground Drive: Select this option when using a ground drive pump.

Uncontrolled: Select uncontrolled for any pump setup that is not being controlled by the vApply module.

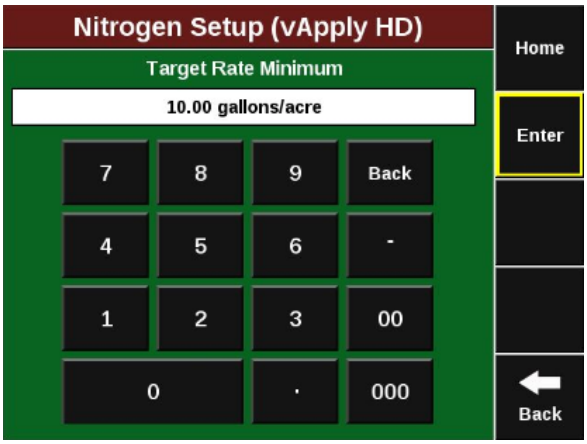
Placement Hardware

Select what Hardware device will be applying the liquid going through the vApplyHD modules. This is for record keeping only and will not affect any settings or controls.



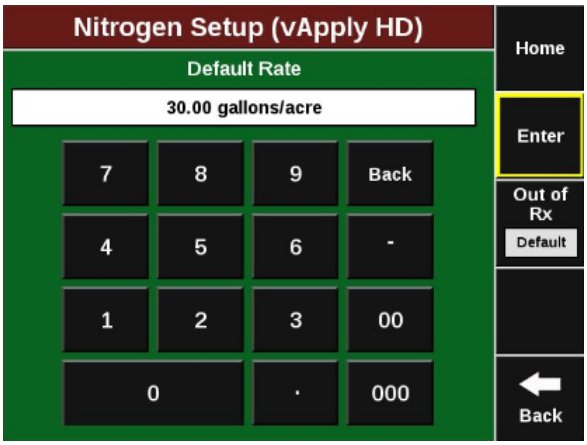
Target Rate Minimum

Setting the minimum target rate will allow the 2020 to effectively alert the user in the event that the control of product drops below the minimum expected control. The rate entered here will also be used when calibrating the pump to ensure that the minimum rate can successfully be applied.



Default Rate

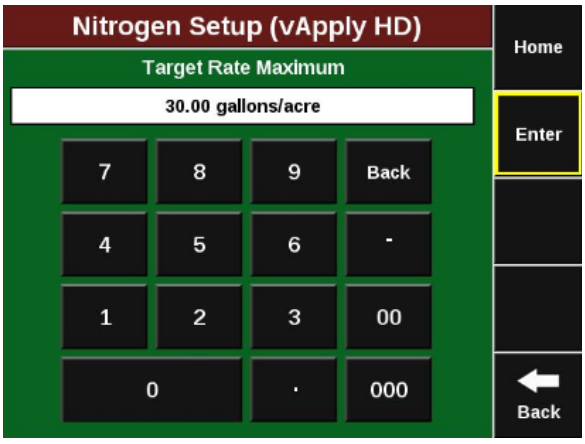
Setting the Default Rate that you want for this product. The rate entered here will also be used as a starting point when no RX is active.



Note: The default rate will be used when the "load vApply" button is used in the control screen.

Target Rate Maximum

The Target Rate Maximum entered here will also be used for calibration and Quick Test Health Check to ensure that the maximum rate can successfully be applied.



Tank Mix Setup

Use the Tank Mix Setup page to enter your Carrier and what Products are being added to the mixture. Future software updates will record and give field summaries of total used carriers and product separately.

Flow Rate Adjustment

Warning: This option provides the ability to implement minor rate adjustments. Our recommendation is to consult your dealer or Precision Planting Product Support prior to making any Flow Rate Adjustments. Proper rate measurements prior to adjustment are critical to ensure accurate control. Enter a percentage to adjust the vApplyHD control on the flow rate. Positive numbers increase vApplyHD output and negative numbers decrease the output. For example, if the current rate is 10 gpa and a bucket test shows it is actually doing 10.5 gpa (5% excess), enter -5% into the Flow Rate Adjustment to adjust the vApplyHD control to correctly display and apply the desired 10 gpa.

Advanced Setup

Note: Consult with Precision Planting dealer prior to changing any advanced settings.

(Setup > Systems > vApplyHD > Advanced Setup).

- **Pressure Sensor Type**

Select the type of pressure sensor that is plugged into the vApply Module. Currently, the only supported option is a Precision Planting Pressure Sensor.

Pressure Maximum

The maximum pump pressure the grower is comfortable reaching in the system without exceeding the maximum pressure the pump is capable of. A diagnostic event will also be logged if this pressure is exceeded. This is the same Maximum Pressure that is set when a pump style is selected.

- **Minimum/Maximum Gallon Per Minute (Beta)**

If these configurations are set, they will enforce a minimum and maximum limit on the rate being commanded from the vApply control page. These options are put in place allow growers who are using a spray nozzle that require a minimum or maximum flow (in gpm) to create the desired spray pattern. In order for vApply to have the maximum range or operation, keep the default “No Limit” setting for both minimum and maximum options.

- **Pump PWM Frequency**

The default rate of 150hz PWM frequency will work for most types of electric and hydraulic controlled pumps. Changes to this value should reflect the pump manufacturer's recommendations.

- **Manual PWM**

Enter a PWM percentage to maintain as a constant for the pump. This constant PWM percentage only works if the pump style selected is ‘Constant PWM’ on the main vApplyHD setup. If any other pump style is chosen other than Constant PWM, then this field is not used by the control system.

- **Minimum/Maximum PWM**

Minimum PWM / Maximum PWM - these are the two extremes for how open the PWM valve can be. The control will not exceed the maximum or minimum PWM command. The default setting is 0% to 95%. These are not the Min/Max PWM values from the Pump Calibration. *(?Set this to 50% MAX and 0-10% MIN for SureFire PumpRight pumps?)*

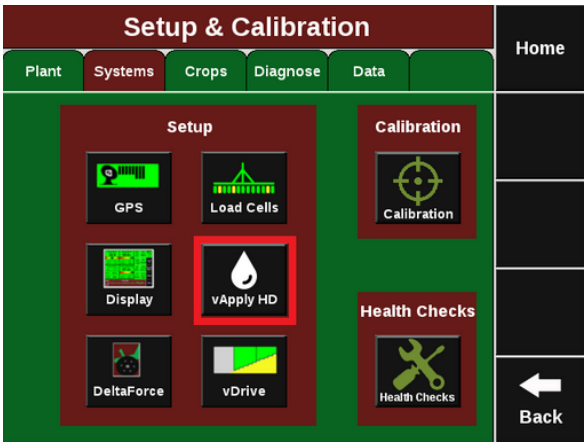
- **Rum Updates**

Rum Updates is only used when using FlowSense on planters with RUMs and NOT SRMs. Enabling the update will allow the 2020 to update the RUM Firmware so that the FlowSense can be read through the RUM.

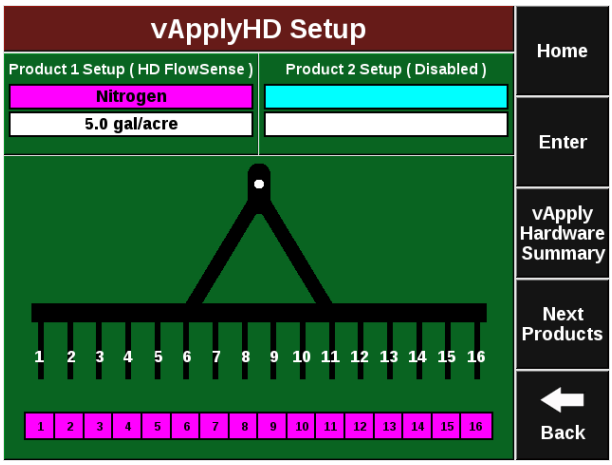
Product Setup and Configuration For vApplyHD Section Control

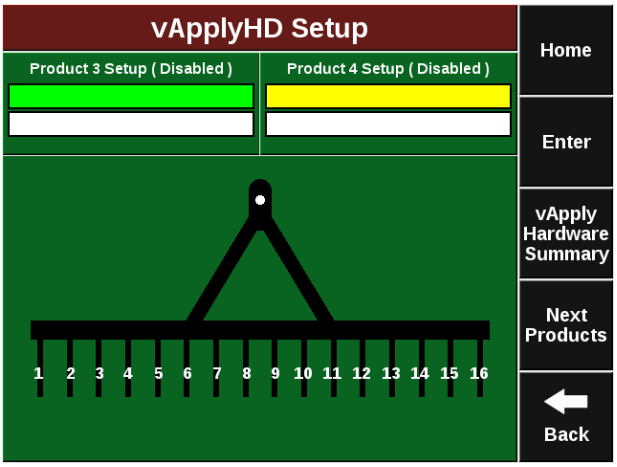
Product Setup

Navigate to the vApplyHD Setup menu (Setup > Systems>vApplyHD) in order to setup your first product.



For single vApplyHD systems only, the first product setup will need to be completed. Press on the Product 1 setup button on the top left side to begin the setup process. For multiple liquid systems (vApplyHD and/or FlowSense) each system will need to be setup individually. Up to four liquid systems can be configured.





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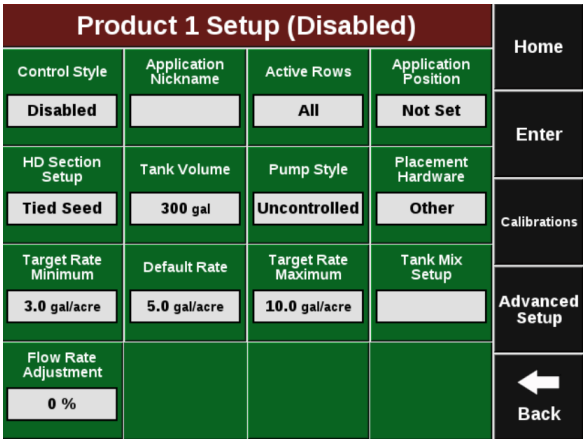
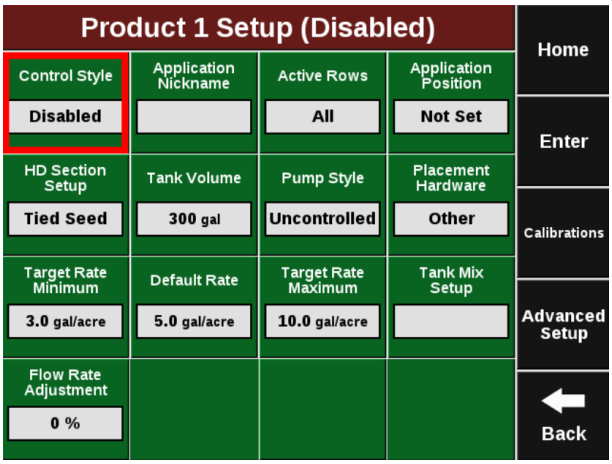
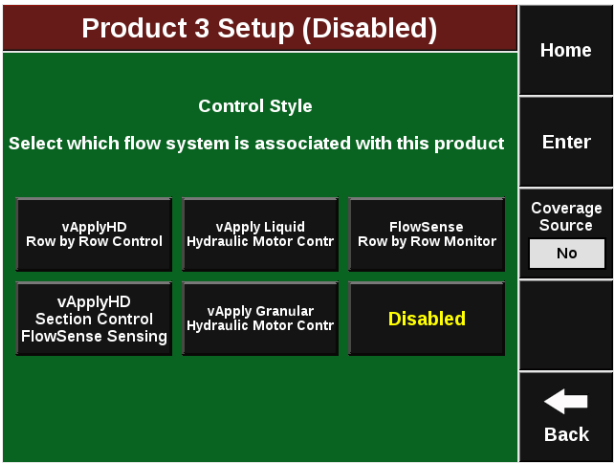


Control Style

Change “Control Style” from Disabled to “vApplyHD Section Control FlowSense Sensing” to allow the 2020 to begin using vApplyHD section control. To successfully configure a vApplyHD system all settings on this page must be set correctly. In order for the liquid product to be viewed on the home page and diagnose page the Control Style and Product Nickname must be set.

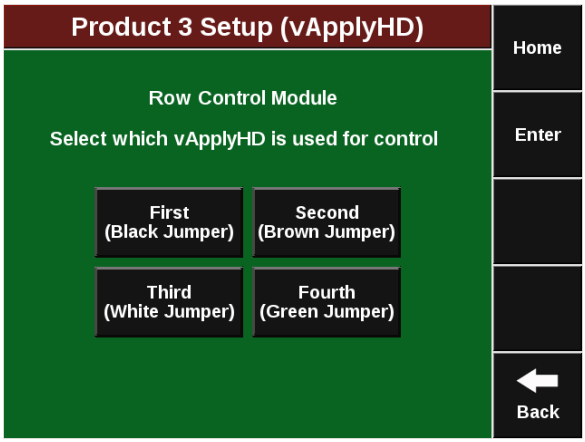
Note: Enable the Coverage Source on the right for the liquid system to define the coverage source for all liquid system swathing. If multiple liquid systems are configured, only one system can be set to the coverage source.





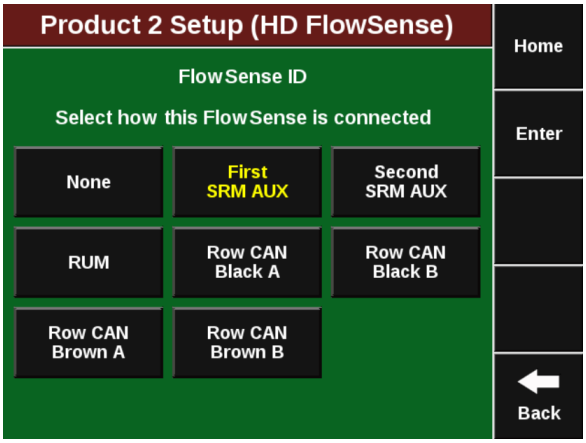
Once you have selected “vApplyHD” for the control style you will need to select the vApplyHD’s control ID. This is determined by what jumper color is being used to connect the vApplyHD module to the system.

- First Control Module/Product.
- Second Control Module/Product.
- Third Control Module/Product.
- Fourth Control Module/Product.



FlowSense ID

After selecting the “Row Control Module” ID, a FlowSense ID window will appear. The correct FlowSense needs to be selected so that the 2020 understands which FlowSense module it expects to see flow on from the controlling vApplyHD you previously selected. See the list below for FlowSense options:



None: This option should not be selected if you are using vApplyHD Section control.

First SRM AUX: Select this option if you have a single AUX FlowSense plugged in to an SRM AUX plug.

Second SRM AUX: Select this option if you have two separate AUX FlowSense plugged in to an SRM AUX plug **AND**this product is using the second AUX FlowSense.

RUM: Use this option if you are using an AUX FlowSense plugged into the AUX plug on a RUM (non SRM planters).

Row CAN Black A: Select this option if you are using a CAN FlowSense with a **Black** CAN Jumper harness **and** have physically plumbed the product from the controlling vApplyHD into the port labeled **"A"** on the CAN FlowSense.

Row CAN Black B: Select this option if you are using a CAN FlowSense with a **Black** CAN Jumper harness **and** have physically plumbed the product from the controlling vApplyHD into the port labeled **"B"** on the CAN FlowSense.

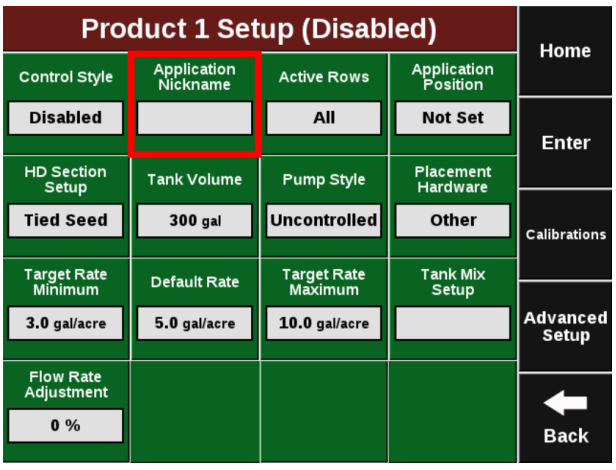
Row CAN Brown A: Select this option if you are using a CAN FlowSense with a **Brown** CAN Jumper harness **and** have physically plumbed the product from the controlling vApplyHD into the port labeled **"A"** on the CAN FlowSense.

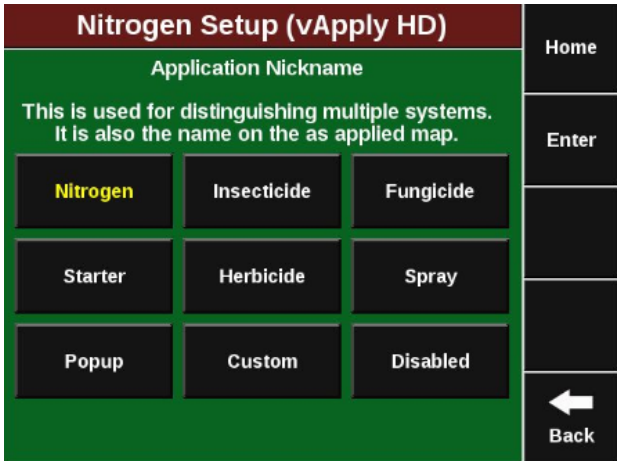
Row CAN Brown B: Select this option if you are using a CAN FlowSense with a **Brown** CAN Jumper harness **and** have physically plumbed the product from the controlling vApplyHD into the port labeled **"B"** on the CAN FlowSense.

Row Can Sequential: CAN Sequential allows for vApplyHD FLEX modules to do section control.

Application Nickname

Give your product a "Nickname" by selecting the empty box and selecting from the list. If necessary, a "Custom" name may be entered for your products Nickname. The nickname chosen will be displayed on the homepage, diagnose page, and control pages instead of vApplyHD.

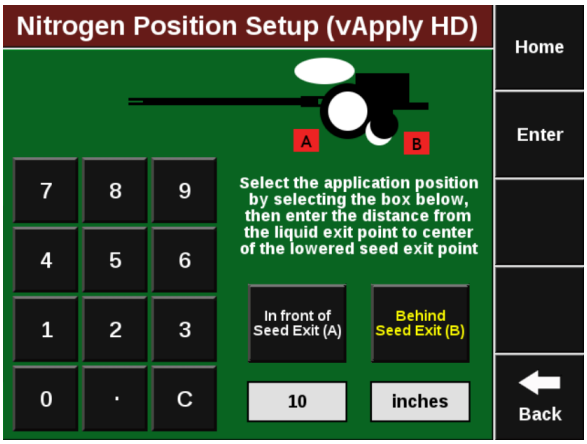




Active Rows

"Activate Rows" lets the 2020 know which rows should be actively controlled. When rows are not active, they will remain off and not apply any product.

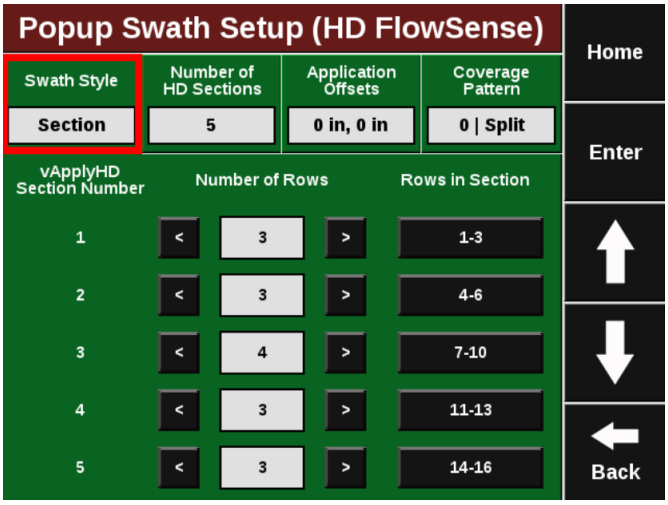
Application Position



Enter the position of the liquid exit point in order for swath control to work properly. Select "In front of Seed Exit" (marked A in the diagram) if you are applying your liquid prior to the seed tube exit. Measure how far in front of your Seed Tube Exit and enter in the number of inches. Select "Behind Seed Exit" (marked B in the diagram) if you are applying your liquid behind the seed tube exit. Measure how far behind your Seed Tube Exit and enter in the number of inches.

Swath Section Setup

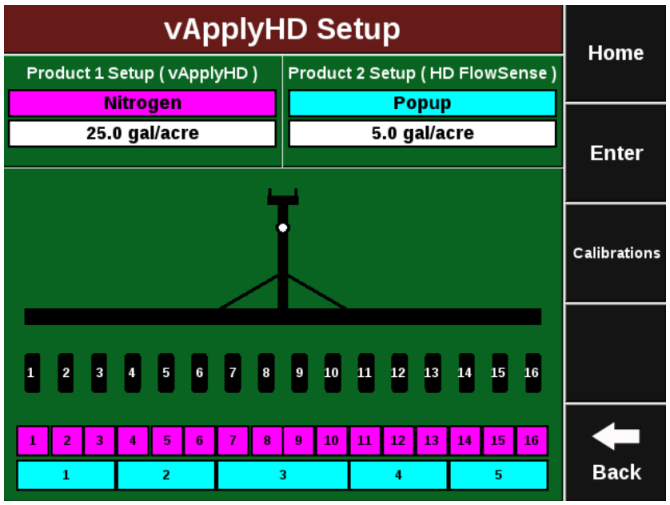
Configure how the vApplyHD modules swath off and on.



Section: This option allows the operator to customize the swath sections. Set the total number of swath sections at the top of the screen. Then use the arrows to assign rows to sections or press on the "Rows in Section" box to list rows in the section.

Assigning Row To Sections: In the Swath Setup window, select the "Number of HD Sections" option and enter how many sections you have for this product. This number will be the total number of vApplyHDs controlling the sections of this product.

As displayed in the image above, you can then select the number of rows in a specific section and which rows in that section. The main vApplyHD Product Setup window will show the products and sections in the planter diagram (This example image has 16 individual row vApplyHD control on Product 1 and five vApplyHD sections on Product 2).



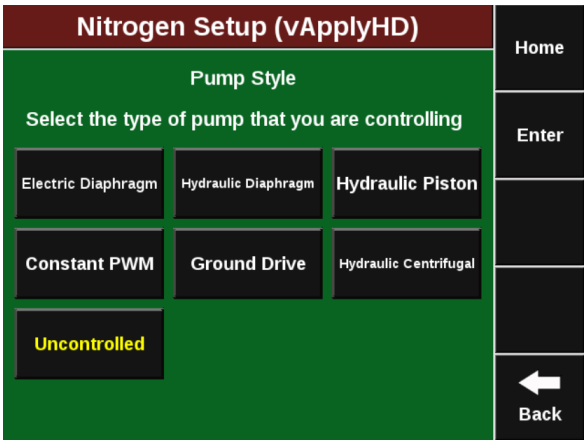
Disabled: Disabled swath will prevent the vApplyHD from turning off in a swath event. This will cause overlap in product at end rows and headlands.

Tank Volume

Tank volume is designed to allow the user to track how many gallons of the active product are available to apply. Tank volume will be used to trigger the low product alarms that can be configured in the "Liquid Alerts" section of the "Crops" tab (see liquid alerts section). If there are multiple tanks feeding the liquid system add the volume of each tank together.

Pump Style

Select the pump style that you are controlling with a vApply module. NOTE: The vApply module will only control electric or hydraulic pumps that are also equipped with a PWM control (PWM valve or electric PWM drivers). Additionally, a Pressure Maximum value must be entered - this is the maximum pressure that you want in the system. This should be no higher than what the pump and plumbing is rated for and should never exceed 100 psi.



Note: The vApply Module will only control electric or hydraulic pumps that are equipped with a PWM driver or valve.

Electric Diaphragm: Select this option when using an electric diaphragm pump WITH an electric pump driver (electric PWM control).

Hydraulic Diaphragm: Select this option when using a hydraulically driven diaphragm pump WITH a hydraulic PWM valve.

Hydraulic Piston: Select this option when using a hydraulically driven piston pump WITH a hydraulic PWM valve.

Hydraulic Centrifugal: Select this option when connected to a centrifugal pump that hydraulic driven and has a PWM valve.

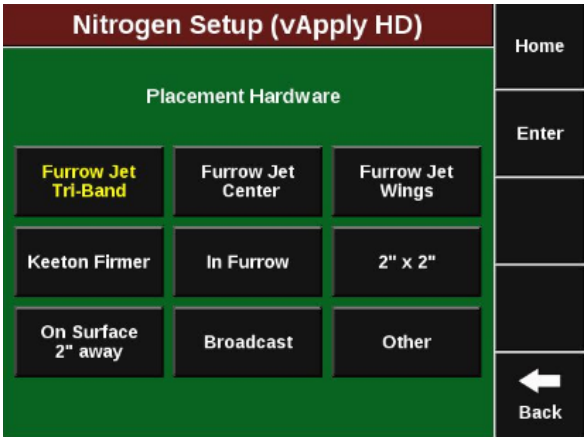
Constant PWM: Select this option when one of the previous three pump setups must be driven at a static rate.

Ground Drive: Select this option when using a ground drive pump.

Uncontrolled: Select uncontrolled for any pump setup that is not being controlled by the vApply module.

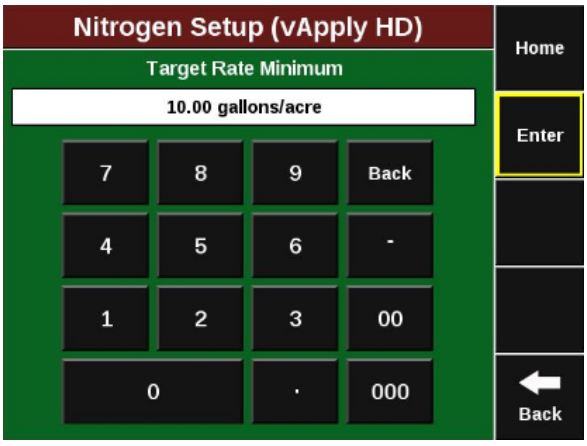
Placement Hardware

Select what Hardware that will be applying the liquid going through the vApplyHD modules. This is for record keeping only and will not affect any settings or controls.



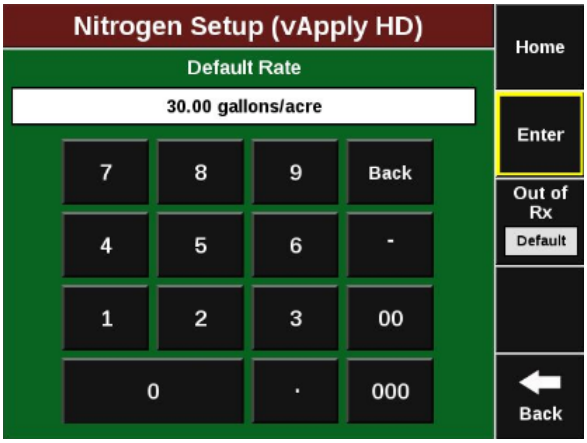
Target Rate Minimum

Setting the minimum target rate will allow the 2020 to effectively alert the user in the event that the control of product drops below the minimum expected control. The rate entered here will also be used when calibrating the pump to ensure that the minimum rate can successfully be applied.



Default Rate

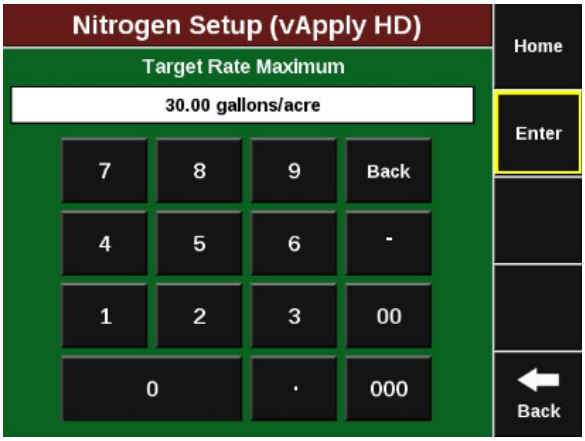
Setting the default rate that you want for this product. The rate entered here will also be used as a starting point when no Rx is active.



Note: The default rate will be used when the "load vApply" button is used in the control screen.

Target Rate Maximum

The Target Rate Maximum entered here will also be used for calibration and Quick Test Health Check to ensure that the maximum rate can successfully be applied.



Tank Mix Setup

Use the Tank Mix Setup page to enter your Carrier and what Products are being added to the mixture. Future software updates will record and give field summaries of total used carriers and product separately.

Flow Rate Adjustment

This option provides the ability to implement minor rate adjustments. Our recommendation is to consult your dealer or Precision Planting Product Support prior to making any Flow Rate Adjustments. Proper rate measurements prior to adjustment are critical to ensure accurate control.

vApplyHD Control Adjustment: Enter a percentage to adjust the vApplyHD control on the flow rate. Positive numbers increase vApplyHD output and negative numbers decrease the output. For example, if the vApplyHD rate is 10 gpa and a bucket test shows it is actually doing 10.5 gpa (5% excess), enter -5% into the Flow Rate Adjustment to adjust the vApplyHD control to correctly apply the desired 10 gpa.

FlowSense Sensing Adjustment: Enter a percentage to adjust the FlowSense rate feedback on the 2020. Positive numbers increase the FlowSense GPA displayed and negative numbers decrease the GPA displayed. For example, if the vApplyHD rate is 10 gpa and a bucket test shows it is correct, but the FlowSense shows feedback of 10.5 gpa (5% excess), enter -5% into the FlowSense Sensing Adjustment to adjust the feedback to correctly display 10 gpa.

Advanced Setup

(Setup > Systems > vApplyHD > Advanced Setup).

Note: Consult with Precision Planting Dealer prior to changing any Advanced Settings.

- **Pressure Sensor Type**

Select the type of pressure sensor that is plugged into the vApply Module. Currently, the only supported option is a Precision Planting Pressure Sensor.

Pressure Maximum

The maximum pump pressure the grower is comfortable reaching in the system without exceeding the maximum pressure the pump is capable of. A diagnostic will also be logged if this pressure is exceeded. This is the same Maximum Pressure that is set when a pump style is selected.

- **Minimum/Maximum Gallon Per Minute**

If these configurations are set, they will enforce a minimum and maximum limit on the rate being commanded from the vApply control page. These options are put in place allow growers who are using a spray nozzle that require a minimum or maximum flow (in gpm) to create the desired spray pattern. In order for vApply to have the maximum range or operation, keep the default “No Limit” setting for both minimum and maximum options.

- **Pump PWM Frequency**

The default rate of 150hz PWM frequency will work for most types of electric and hydraulic controlled pumps. Changes to this value should reflect the pump manufacturer's recommendations.

- **Manual PWM**

Enter a PWM percentage to maintain as a constant for the pump. This constant PWM percentage only works if the pump style selected is “Constant PWM” on the main vApplyHD setup. If any other pump style is chosen other than Constant PWM, then this field is not used by the control system.

- **Minimum/Maximum PWM**

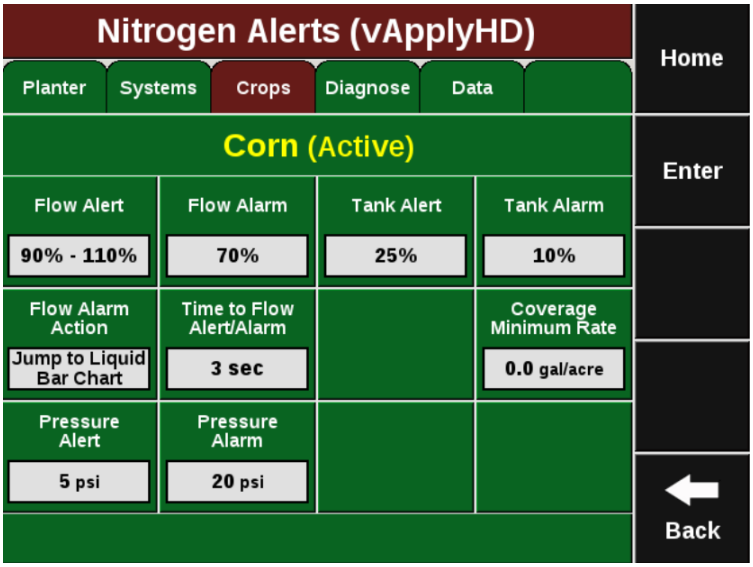
Minimum PWM / Maximum PWM - these are the two extremes for how open the PWM valve can be. The control will not exceed the maximum or minimum PWM command. The default setting is 0% to 95%. This is not the Min/Max PWM values from the pump cal. *(?Set this to 50% MAX and 0-10% MIN for SureFire PumpRight pumps?)*

- **Rum Updates**

Rum Updates is only used when using FlowSense on planters with RUMs and NOT SRMs. Enabling the update will allow the 2020 to update the RUM Firmware so that the FlowSense can be read through the RUM.

Liquid Alerts

Navigate to the Crops Tab in your 2020 setup. Select “Liquid Alerts” towards the bottom of the page (Planting) or “Setup” — “Liquid Alerts” (Sidedress) to adjust 2020 alerts related to your vApply system.



Flow Alert

- Select a flow percentage range. If flow is outside of the selected range, the vApply Control button on the home screen will turn yellow. The Flow Alert can be disabled by pressing the green “Enabled” button which will then turn it yellow and “Disabled”. Select it again to re-enable the Flow Alert.

Flow Alarm

- If the flow drops below the selected percent the vApply Control button will turn red on the home screen. The Flow Alarm can be disabled by pressing the green “Enabled” button which will then turn it yellow and “Disabled”. Select it again to re-enable the Flow Alert.

Tank Alert

- Select a tank level percentage so that if the level of liquid in the tanks falls below the percent, the Tank Volume metric on the home screen will turn yellow. The Tank Alert can be disabled by pressing the green “Enabled” button which will then turn it yellow and “Disabled”. Select it again to re-enable the Tank Alert.

Tank Alarm Amount

- Select a tank level percentage so that if the level of liquid in the tanks falls below the percent, the Tank Volume metric on the home screen will turn red and sound an alarm. The Tank Alarm can be disabled by pressing the green “Enabled” button which will then turn it yellow and “Disabled”. Select it again to re-enable the Tank Alert.

Flow Alarm Action

- Select the action the monitor should take if the Flow Alarm is triggered. Select between Jump to DMC (this is row by row details of flow rates), Jump to Homepage, or None.

Time to Flow Alert/Action

- Enter the amount of time a failure event needs prior to triggering the alert/alarm.

Coverage Minimum Rate

- Coverage minimum rate sets the minimum rate needed in order for the 20/20 to to 'paint' coverage for vApply. Any rate below this minimum will NOT create a coverage layer and vApplyHD will not shut off if this area is passed over again.

Low Pressure Warning

- This warning will trigger if the system pressure is lower than the selected PSI level. Pressure reading taken by the vApply Module. To disable an Alert, press on the alert and then on the right hand side of the screen press on 'Flow Alert Enabled'. This will change it to say 'Flow Alert Disabled'. Press on the same button to switch it back to 'Flow Alert Enabled'.

Pressure Alert

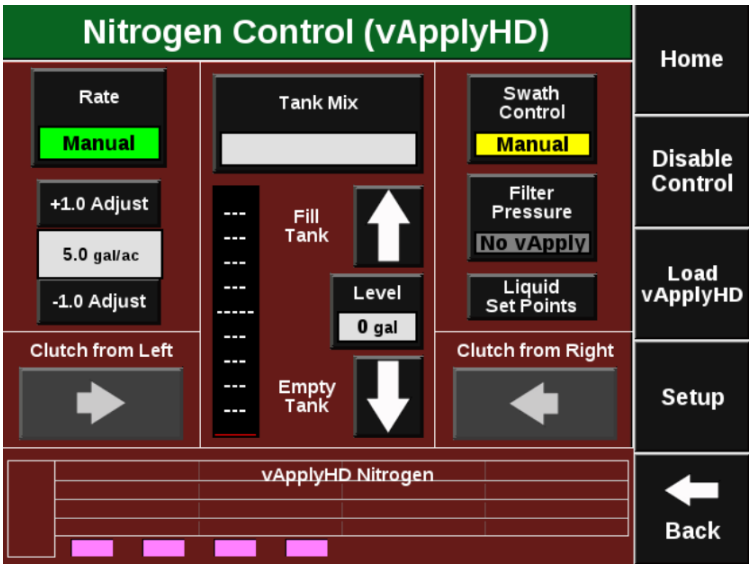
- Pressure alert sets a minimum PSI. If pressure drops below this value, an alert is triggered to warn the user of a potential issue.

Pressure Alarm

- Pressure alarm sets the maximum pressure for the system. If pressure at the pump raises above this value, an alarm is triggered to warn the user of a potential issue.

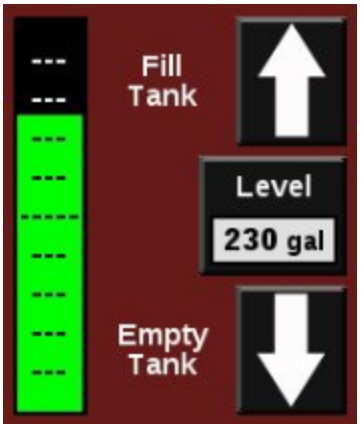
Control Page

The vApplyHD control screen is the central location for rate and swath control features in the 20/20 SeedSense display. To access the vApplyHD control page, the control button must first be added to the home screen. See Step 1 for information on how to add the control button to the home screen. The control button will have the product nickname listed as the name of the button. Press on this button to access the vApplyHD control screens.



Tank Level

Tank level information is found in the center of vApplyHD control page. To reset the volume of liquid in the tank(s) either press on the up arrow to fill the tank with the total tank volume specified in the vApplyHD setup pages (section 2.8), press on the box specifying the gallons left to manually enter a volume, or press on the down arrow to specify zero gallons remaining. If the tank information is not displayed, press on the button titled “Liquid Tank” to display the tank information.



Tank Mix

The Tank Mix is optional information that can be added to help keep track of what mix is being applied to the field (similar to a hybrid/variety). By pressing on the Tank Mix button a customer mix can be created for what is being applied. Both a Carrier and Products (that are being mixed with the carrier) can be entered along with the volume of each. This way the exact mixture being applied to the field can be recorded.

On the right hand side of the screen a separate tank size measurement can be entered. This is the size of the tank that the mix is being carried in. It does not have to be equal to the tank volume size entered for the planter in the vApplyHD setup. As the carrier and products are being entered for the tank mix, the number of gallons for each can be entered. The system will keep deducting the remaining volume left for the mix from this new tank size measurement.

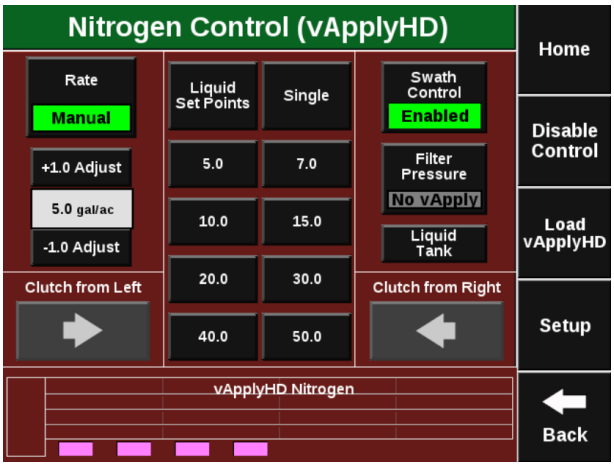
Once the mix has been created it can be given a name and saved by pressing on the Load/Save/ Rename button on the right hand side of the screen. Once tank mixes have been saved, the same button can be pressed to load a previously used tank mix.

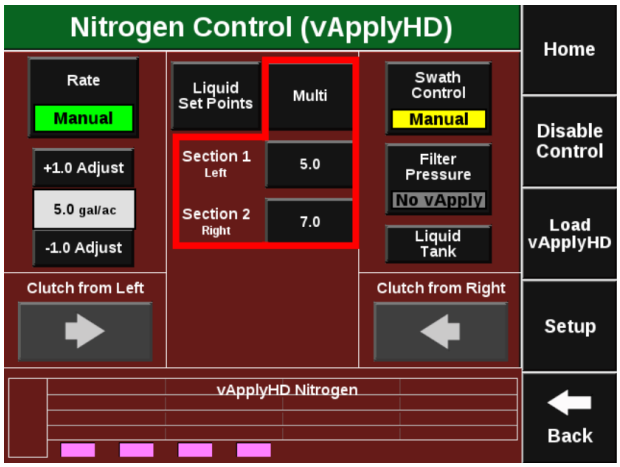
Rate Control

If a variable rate liquid prescription is being used the status button at the top left hand corner will say “Variable”. Below the status button the current rate is displayed along with the next rate in the prescription.

Pressing the “Variable Rate” button switches the system to Manual control. This ignores the prescription and continues to apply the rate being applied at the time the system was disabled. To control the rate again based on the prescription, press the “Manual Rate” again.

If no prescription is assigned, the status button will be set to Manual. When in Manual rate mode, the rate displayed in the white box is the rate being commanded. This rate can be adjusted manually by either pressing on the Liquid Setpoint button and selecting one of eight preset rates (set points can be set by pressing on Liquid Set points button found near the top of the page) or adjusted one gallon per acre at a time by pressing the +1.0 gal/ac or -1.0 gal/ac buttons.



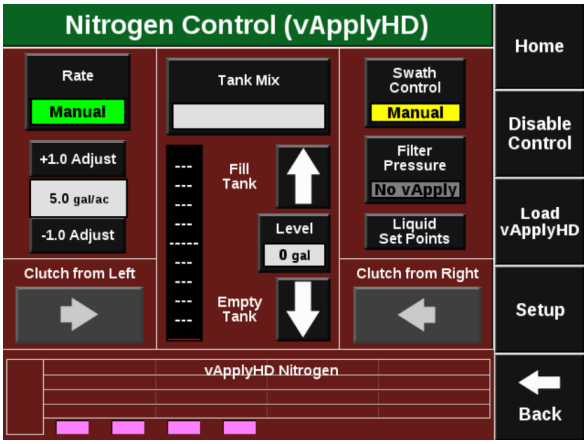


Within manual mode the operator can choose a single rate or multiple manual rates. To change between “Single” and “Multi”, select the button at the top center of the screen. If “Single” is showing, the planter will apply a single rate across all rows. If “Multi” is showing, a different rate can be assigned to each drive section. (Drive sections must be configured in the vDrive setup.) Change the rate for each drive section by pressing on the rate displayed next to each section number.

Note: This is only available in Planting mode.

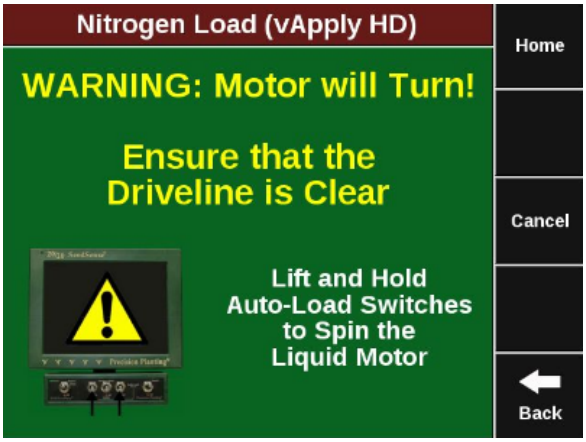
Swath Control

The default Swath Control state (Swath Control button located near the top right corner) is set to “Enabled” meaning the system will swath on and off automatically. Pressing the Swath Control button will switch the system between “Enabled” and “Manual”. When in manual mode the left and right arrows can be pressed to swath off rows from either the left or right side. **Manually swathing off rows will shut off both seeding and liquid applications on the rows.**



Load vApply

The Load vApply button on the right hand side of the control page is used to pressurize the system (similar to autoloading 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.



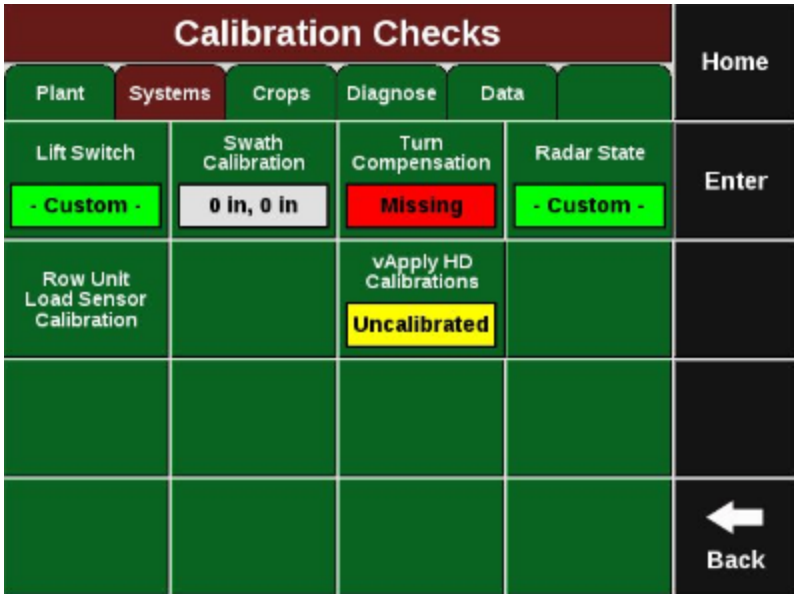
SFA Note: What PWM DC does this use?
How fast does it turn the pump?
What pressure builds up?
Positive displacement pump can build a lot of pressure quickly with no where for product to go.

Calibration

Pump Calibrations can be found in the “Calibration” page under the “Systems” tab (Setup>Systems>Calibration). Use the pump calibration to allow the SeedSense software to learn the controlling aspects of the connected pump. During this process the required PWM control will be learned to effectively control the pump during rate and or speed changes.

Note: We recommend first flushing the system thoroughly prior to plumbing in the vApplyHD and/or FlowSense. This will ensure a clean system and allow you to check for leaks prior to running a system calibration.

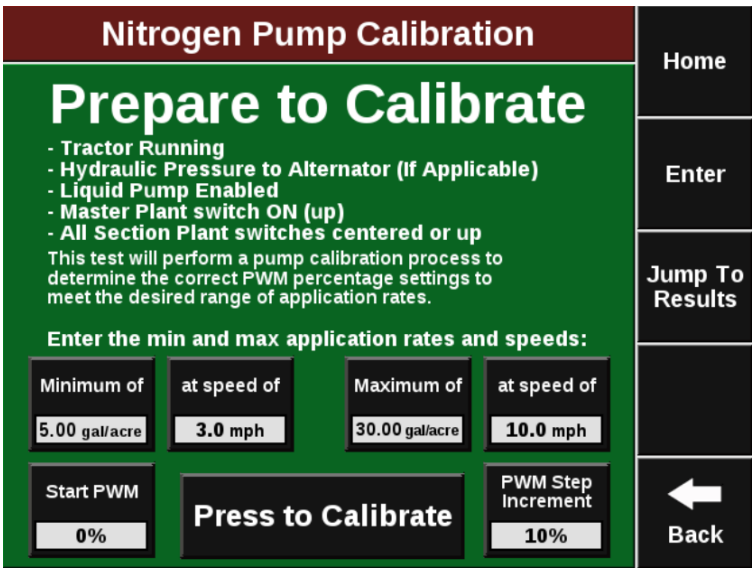
SeedSense can only control electric or hydraulically driven pumps that have a PWM controller. Ground driven or constant PWM pumps will not be able to take advantage of vApply pump control.



Prepare to Calibrate

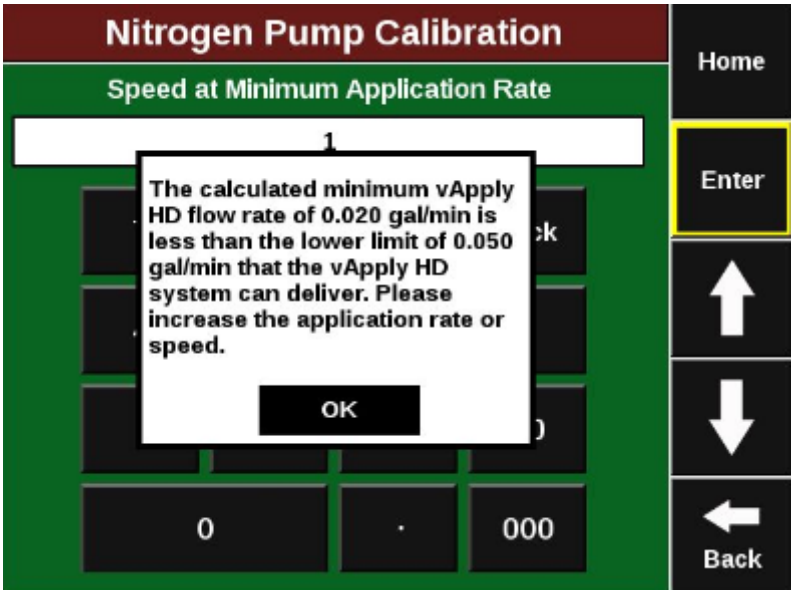
In order to run the calibration you will need:

- Water in the tanks
- Tractor running
- Hydraulic Pressure to Alternator (if applicable)
- Liquid pump enabled
- Master Plant switch on
- All section plant switches centered or up



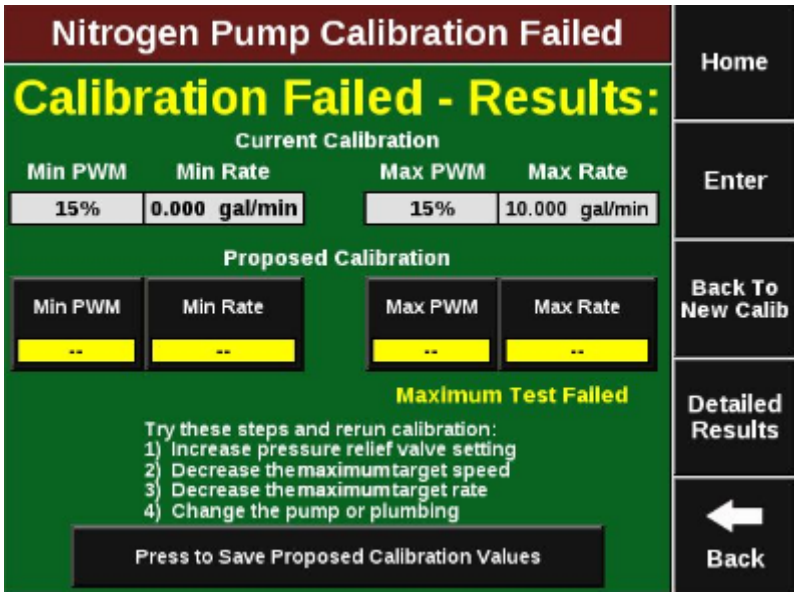
On the preparation screen, enter the lowest rate you may ask the vApplyHD to command as well as the lowest speed you plant at. Next, enter the highest rate and maximum speed you may encounter. The **Start PWM** and **PWM Step Increment** tell the 2020 where to start the motor speed at and how much to increase the PWM during each test increment. We recommend setting the **Start PWM** at 0% and using 10 as the **Step Increment**.*(SFA note:Consider PWM Step Increment at 5%. Our pump responds quickly to PWM changes.)*

Note: vApplyHD is capable of .05-3.0GPM. If the entered rate and speed falls outside of these parameters, a popup will result indicating how to adjust the rate or speed to a functional range.



Run the Pump Calibration

Press “Run Calibration” to start the calibration process. This process will begin calibrating for the highest rate and speed entered on the previous screen. The SeedSense software will begin stepping the PWM percentage up until the rate is achieved or the test fails. In the event of failure, a list will be displayed with the most appropriate courses of action needed in to successfully pass the test.

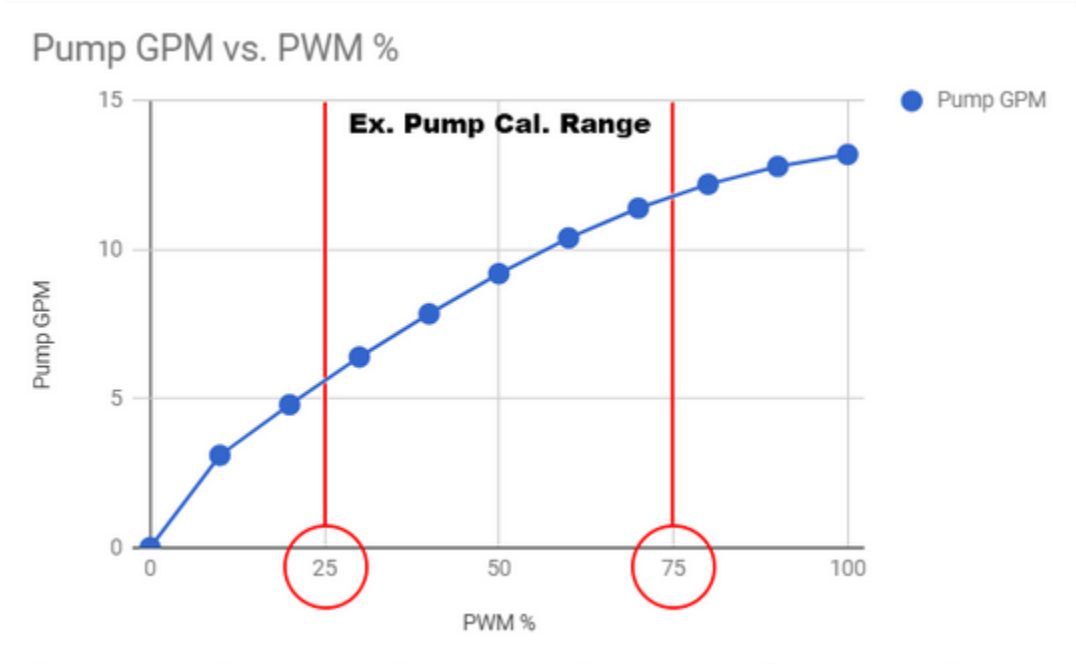


This Calibration process will typically fail the first time and requires adjustments to be made to the system prior to a successful calibration. Three or more attempts maybe be necessary to set up a vApplyHD system.

Understanding the Pump Calibration

The pump cal. is a process that the 2020 uses to learn about the rate capability of your system. The test starts in the "Off" position with a PWM command of 0%. This establishes a baseline for the 2020 to understand (0% PWM = 0 gpm). The 2020 will then begin to run through a series of PWM commands and checks in order to understand how many gallons per minute the pump is capable of supplying at a given PWM command. After each 10% PWM increase there is a short period of 0% to reestablish the baseline.

The pump cal. process will run through the maximum rate and speed test first. This segment will create the full PWM curve of the pump and trains the 2020 to understand the maximum PWM command needed in order to hit the maximum rate and speed entered at the beginning of the test. The second part of the test checks for the lowest rate and speed and gives the 2020 an understanding of how low the PWM command may need to go.



A successful Pump Calibration will set a Min and Max PWM percentage based on the total pump GPM achievable at those commands. This is the operation window that vApply expects to run within but does NOT keep vApply from operating outside of this window. In the event that the current speed and rate combination is outside of this window, vApply will use the pump curve to command the needed PWM.

Note: The pump calibration WILL NOT pass successfully if ANY vApplyHD is not 100% healthy (i.e. Low or High sensor failed/jammed, Motor or valve issues, PSI sensor failed). Resolve vApplyHD issue prior to running a calibration.

Maximum Test Failed

Try these steps and rerun calibration:

1) **Increase pressure relief valve setting.**

a) Screw the relief valve in half a turn to reduce the amount of product returning back to the tank. This will allow more product from the pump to reach the vApplyHDs. Repeat this step at least three times if necessary but do not run with the relief valve all the way closed.

2) Decrease the maximum target speed

a) Reducing speed allows more time to apply product and increases the GPA rate achievable at the supplied GPM.

3)Decrease the maximum target rate

a) Reducing the rate will reduce the needed GPM and allow the desired speed to be achieved.

4) Change the pump or plumbing

a) Pump is too large

i) too much supplied product causes excess pressure and can be the result of a failed health check.

ii) Adjust pump stroke if available.

b) Pump is too small

i) Total pump supply is not enough to achieve the desired rate commanded at the vApplyHD

ii) See GPM requirement on the preparation screen and double check pumps GPM capabilities.

iii) Adjust pump stroke if available.

c) Plumbing restrictions

i) A pressure drop of more than 15PSI between the pump and the vApplyHD's indicates excessive restriction in the plumbing.

ii) Identify points of restriction or increase plumbing sizes to allow for more efficient delivery of product from the pump to the row.

Minimum Test Failed

Try these steps and rerun calibration:

1) Decrease pressure relief valve setting

a) Unscrew the relief valve half a turn to increase the amount of product returning back to the tank. This will allow less product from the pump to reach the vApplyHDs. Repeat this step at least three times if necessary.

b) If this step causes the Maximum Test to fail, return the relief valve to a position that passes the Maximum test and move to the next step.

2) Increase the minimum target rate

a) Increasing speed allows product to be applied over a greater area and will allow for the desired low GPA to be achieved.

3) Increase the minimum target rate

a) Increasing the rate will increase the needed GPM and allow the desired speed to be achieved and the requested GPA.

4) Change the pump or plumbing

a) Pump is too large

i) Too much supplied product causes excess pressure and can be the result of a failed health check.

Save the Pump Calibration

After a successful Calibration, a proposed calibration value for minimum and maximum will be displayed. Press the button at the bottom of the screen to save the calibration values. These values will be what SeedSense uses to quickly adjust product flow during swath, rate, or speed changes.

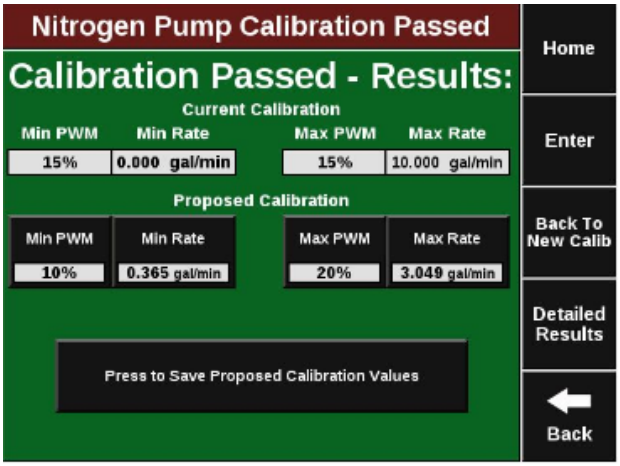


Image prior to saving calibration

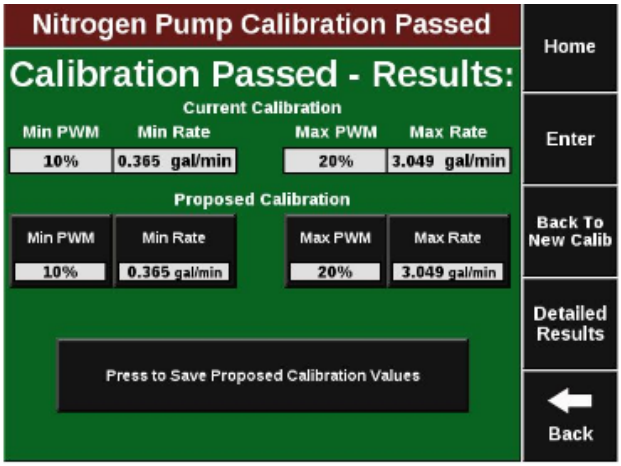


Image after saving calibration

Proceed to the Quick Test to finalize vApply set up before heading to the field. Details on the Quick Test can be found in the Health Checks section of this manual.

Health Checks

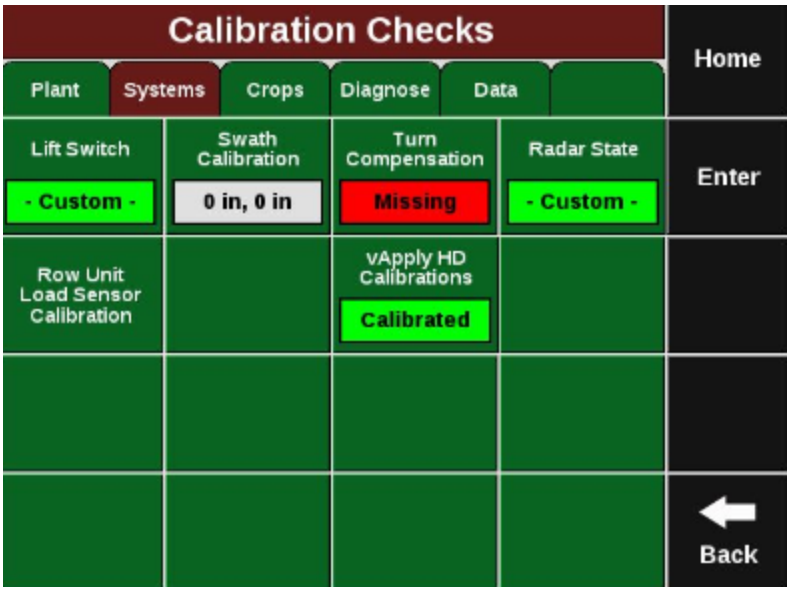
Manual Test

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.

Note: A pump calibration is needed in order to run the Manual Test.

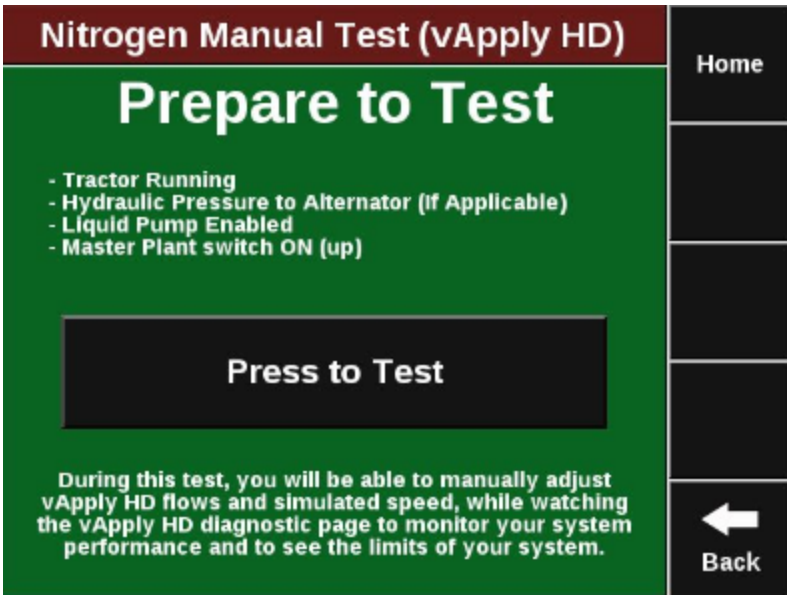
Setup > Systems > Health Checks

Setup > Diagnose > vApplyHD > HealthChecks



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



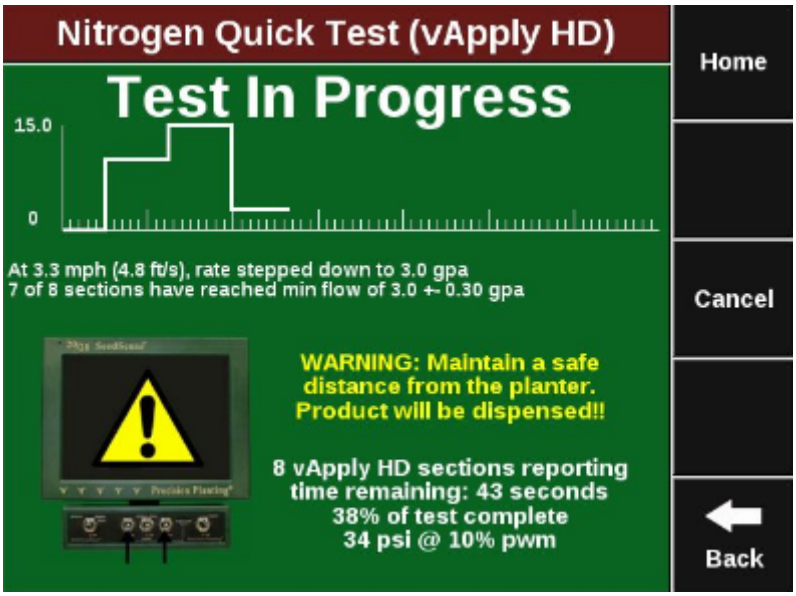
Select “Press to Test” to begin the test. This test will allow the user to enter simulated speed and product rates they may encounter when using vApplyHD. Use this mode to check for plumbing leaks after initial vApplyHD installation.

See the Diagnostics section below to help troubleshoot performance issues.

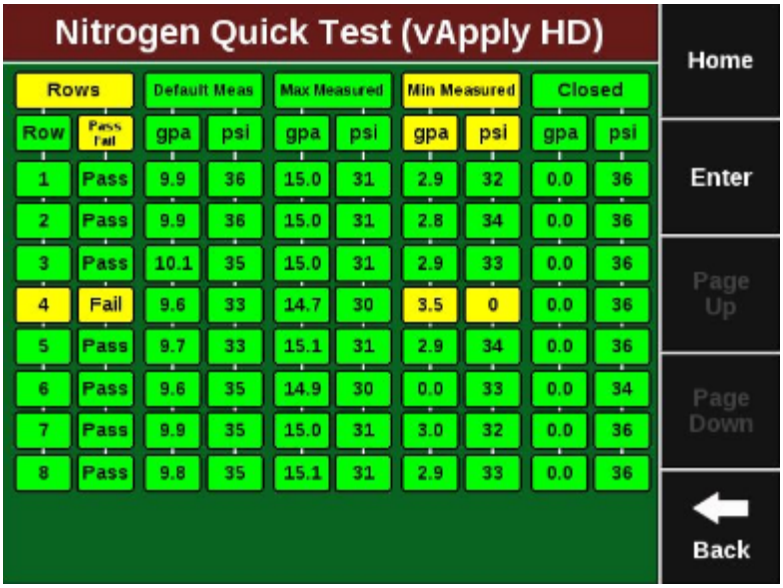
Quick Test

The Quick Test is designed to be performed as the last step prior to heading to the field with vApplyHD. Use this test after you have run the Calibration process.

The Quick Test will use the saved calibration values to quickly run through your application rates to validate that SeedSense can accurately execute all functions.



Once the test is complete, a 'scorecard' will be displayed. Any performance issues will be highlighted like the image below. Use the Manual Test to troubleshoot individual row issues.

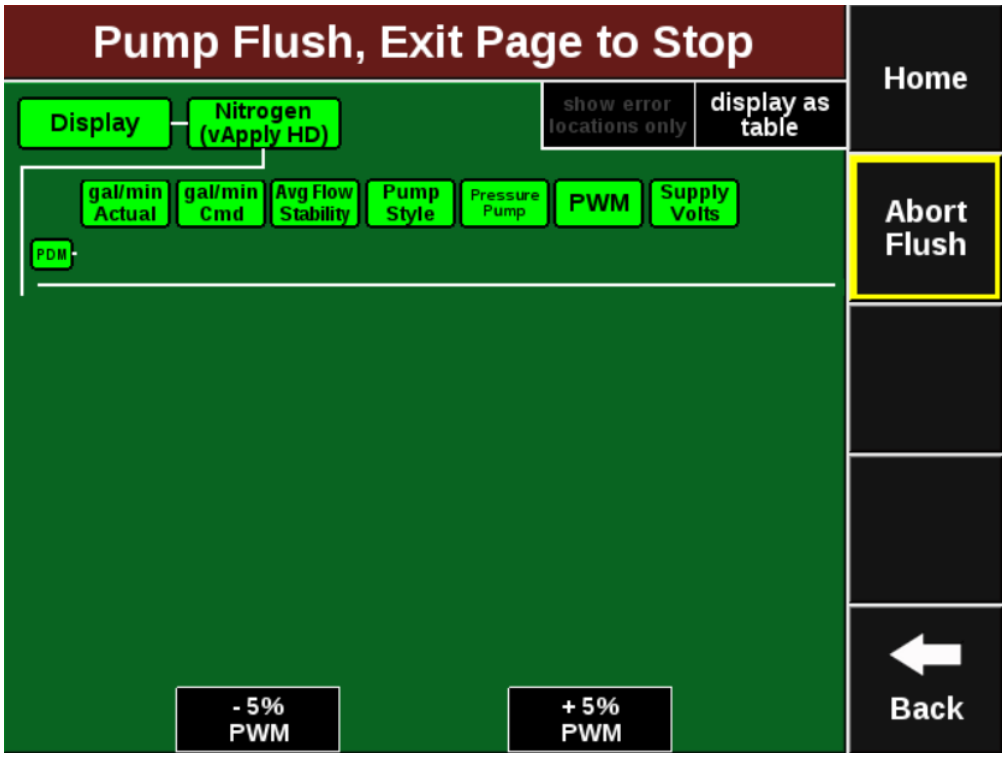


Pump Flush Health Check

The Pump Flush health check allows users to manually run the pump in order to flush the system out. This can only be used on systems that have a pump controlled by the vApply module. This test allows manual PWM values to be commanded in order to spin the pump with commands from the 2020.

We recommend removing the tubing from the inlet of your vApplyHD modules so that this test can flush product through the system WITHOUT pushing product through the vApplyHD modules.

Note: Many hydraulic pumps will need a command of 30% or more before there is enough hydraulic force to spin the pump.

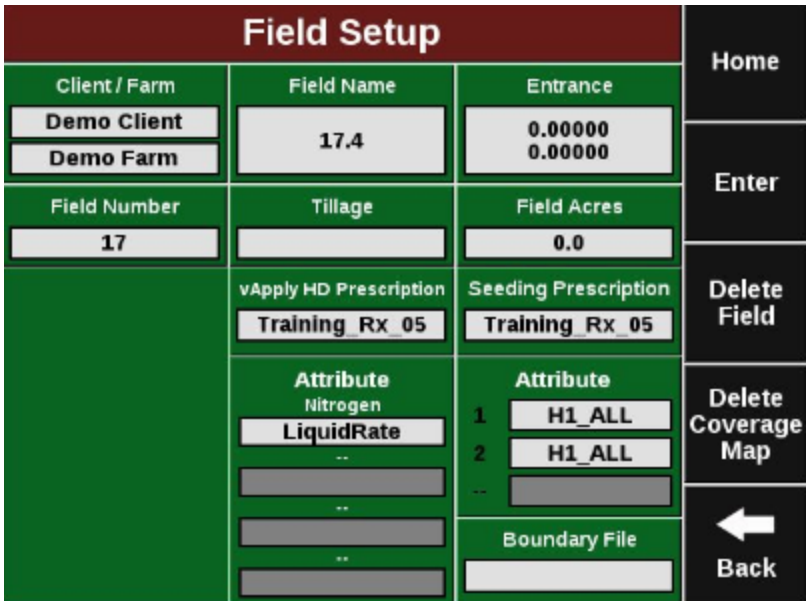


Loading a Liquid Prescription

Variable rate liquid prescriptions can be implemented by the vApplyHD system on a planter as long as the prescription is in the form of generic shapefile and written in terms of gallons per acre or liters per hectare. If BOTH the seeding and vApplyHD systems will be running variable rate prescriptions then there MUST be a single prescription assigned to the field that has both a seeding and liquid attribute. Separate liquid and seeding prescriptions will not be able to be ran simultaneously. Prescriptions can be loaded using FieldView or through a USB drive.

To import prescription files into the 20/20 SeedSense display unit, load the files (unzipped files only) onto the root drive of a USB drive and insert the drive into the display unit. From the dashboard screen select “Setup,” “Data,” “Import,” and “Prescription/Boundary”.

To assign a variable rate liquid prescription to a field vApplyHD must first be setup and configured on the display (See Setup Section). Prescriptions can be assigned to fields on the Field Setup screen (“Setup,” “Field,” and then select the appropriate field name). To assign a liquid prescription press on the button called “vApplyHD Prescription”. Next, select the prescription name and finally, the appropriate attribute. If a seeding prescription is being used, the same prescription name MUST be selected for both the seeding prescription and vApplyHD prescription.



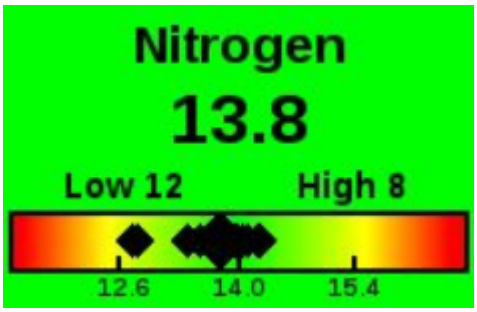
Home Screen

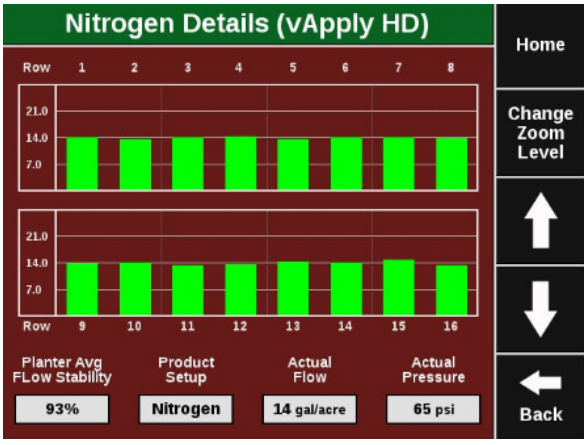
Control Button

The vApplyHD control button (named by the assigned product nickname) displays the status of vApplyHD. A green box indicates the system is detected and configured while a grey box indicates that the system is not detected. The top box indicates the commanded rate (this will be yellow if a prescription is assigned, but is in manual mode & will be red if the master plant switch is off). The bottom box is the planter wide average rate being applied.

Product Information

The product dashboard information box on the right hand side of the screen will be labeled with the product nickname selected during the vApplyHD setup. The number displayed is the planter wide average rate being applied. The large diamond on the chart represents the planter wide average, while each smaller diamond represents each individual row. Also the high and low rows are listed. Pressing on this button will display the rate being applied on each individual row.





Definitions

Planter Wide Stability - Planter wide average of the stability of the liquid flowing out of the vApplyHD modules. The lower the percent, the lower the consistency of the flow of liquid out of the vApply HD modules Actual Flow - Average flow of all vApplyHD modules. Actual Pressure - Planter wide average of the pressure in the vApplyHD modules.

Gallons Remaining

The Gallons Remaining button displays the number of gallons that are remaining for the tank volume specified in the vApplyHD setup pages. The product nickname will be displayed on this button. Pressing on this button will take the user to the vApplyHD control page where a new tank volume can be set .

Diagnostics

SRM and vApplyHD Light Status

Erratic Blink (.. — —.. — — .. — —..)

Device has power but has never communicated to 20/20

Solid Light (_____)

Device is being updated.

Steady 1Hz Blink (— — — — — —)

Device is powered and communicating to 20/20

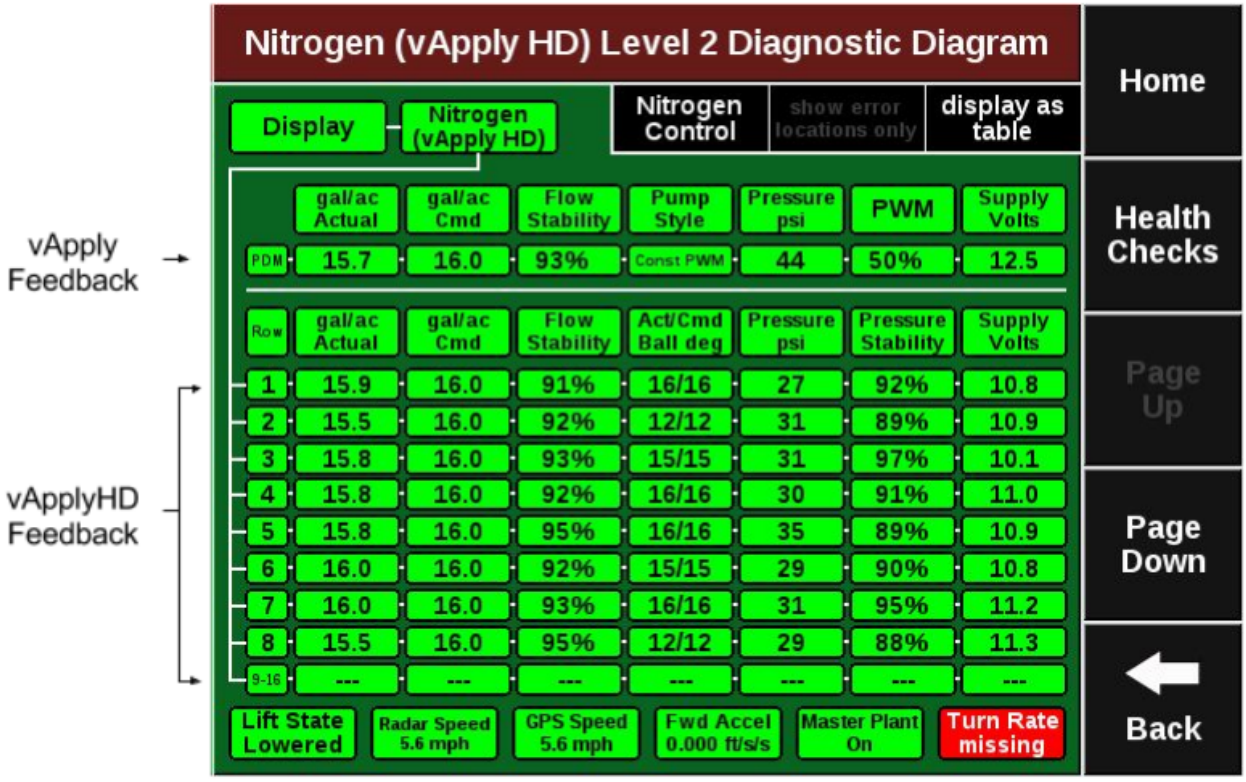
Fast 5Hz Blink (. . . . .)

Device is powered but lost communication to 20/20

No Light ( )

Device is not powered.

Level 2 Diagnostic Diagram will show the necessary values needed to pinpoint an issue on your fertility system. Review the image below to become familiar with what each metric represents.



PDM (vApply Module)

These are values are reported by the vApply module and reported through the PDM.

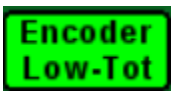
System wide average measured GPA

System wide average commanded GPA

Calculated by finding the planter wide average and then measuring the deviation of max and min actual GPA.

Anything below 80% is considered poor (visual pulses in product output).

Above 85% is the goal.

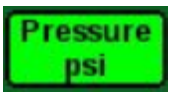


Low and Total flow sensor reading will be displayed.

Low flow encoder: Hz Values between 1 and 900.

Total FLow encoder: Hz values between 10 and 200.

Displays the selected Pump Style from the product setup page



Pressure measured by the vApply module at the plumbing essentials kit.

Current PWM percentage commanded by the 2020.

Voltage supplied to the vApply module.

Normal values are reported by each vApplyHD module on a row by row basis.

vApplyHD

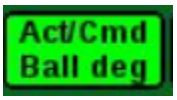
These values are reported by each vApplyHD module on a row by row basis.

Measured GPA for row.

Commanded GPA for row.

How much individual row flow variation is measured.

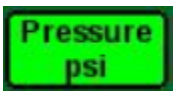
Acceptable performance is above 85%



Actual/Commanded ball position of the vApplyHD

Should always match

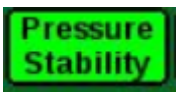
A stuck valve popup is triggered in the event that these fail to match



Pressure reading at the vApplyHD module

Should not be less than 15 PSI less than vApply Module pressure reading

Tapping on this icon also displays temperature. This is for future diagnostics.



Derived by calculating an average PSI and then measuring the percentage of deviation of the max or min PSI readings.

Above 85% is healthy

Voltage reading of each vApplyHD

Normal is 12–15v. HD will shutdown below 9.5V.

Issue Troubleshooting

1. Unable to hit desired rate (system wide)

a. Actual rates are low on most or all rows

b. Commanded rates are correct

c. Ball positions are wide open (act/cmd 75/75)

d. Pressure drop between pump and vApplyHDs is less than 15psi

e. check pressure relief

i. If relief is completely closed pump is too small for speed.

f. Slow down until HD's reach target rate to validate pump is the limiting factor.

2. Unable to hit desired rate (system wide)

a. Actual rates are low on most or all rows

b. Commanded rates are correct

c. Ball positions are wide open (act/cmd 75/75)

d. Pressure drop between pump and vApplyHDs is greater than 15psi

e. plumbing restrictions preventing efficient delivery of product from pump to row

i. Need to increase flow by reducing plumbing constraints (larger plumbing)

3. Single Row Failure

a. Potential Cause #1

i. Actual Rate is low

ii. Commanded rate is correct

iii. Ball Position is wide open

iv. Pressure drop between pump and HD's is less

v. Restriction in the line AFTER the HD.

1. Check plumbing after the HD to find plugging

b. Potential Cause #2

i. Actual rate is low

ii. Commanded rate is correct

iii. Ball position is wide open

iv. Pressure drop between pump and HD's is more than 15PSI

v. Restriction in the line BEFORE the HD

1. Check pluming prior to the HD to find plugging

c. Potential Cause #3

i. Actual rate is low

ii. Commanded rate is correct

iii. Ball position is restricted to 22 Deg

iv. Pressure drop between pump and HDs is less than 15 PSI

1. Pressure may be higher than other rows due to restricted ball position

v. Toggle flow stability to show sensor readings

1. TOT sensor shows 0

vi. Plugged total flow sensor

1. Remove total flow sensor and clean debris off

2. Replace sensor if necessary

Potential Cause #4

i. Actual rate is correct/close at higher rate/speed but erratic or zero at lower rate/speed

ii. Commanded is correct

iii. Will most likely notice issues in applied rate at the start of each pass

1. Ball position is correct/close

a. May be commanded off

iv. Pressure is within 15PSI of pump

v. Toggle flow stability to show sensor readings

1. low flow sensor shows 0

2. Cannot command rates off of total flow sensor at low rate/speed

vi. Pugged low flow sensor

1. Remove low flow sensor and clean debris out with warm soapy water

a. DO NOT USE COMPRESSED AIR

2. Replace sensor if necessary