RAVEN

Calibration & Operation Manual

AutoBoom™ UltraGlide XT

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CHAPTER 1

Important Safety Information

NOTICE

Read this manual and the operation and safety instructions included with your implement and/or controller carefully before installing the AutoBoom™ system.

- Follow all safety information presented within this manual.
- If you require assistance with any portion of the installation or service of your Raven equipment, contact your local Raven dealer for support.
- Follow all safety labels affixed to the AutoBoom system components. Be sure to keep safety labels in good condition and replace any missing or damaged labels. To obtain replacements for missing or damaged safety labels, contact your local Raven dealer.

When operating the machine after installing AutoBoom, observe the following safety measures:

- Be alert and aware of surroundings.
- Do not operate AutoBoom or any agricultural equipment while under the influence of alcohol or an illegal substance.
- Remain in the operator's position in the machine at all times when AutoBoom is engaged.
- Disable AutoBoom when exiting from the operator's seat and machine.
- Do not drive the machine with AutoBoom enabled on any public road.
- Determine and remain a safe working distance from other individuals. The operator is responsible for disabling AutoBoom when the safe working distance has diminished.
- Ensure AutoBoom is disabled prior to starting any maintenance work on AutoBoom or the machine.

⚠ WARNING

- When starting the machine for the first time after installing AutoBoom, be sure that all persons stand clear, in case a hose has not been properly tightened.
- The machine must remain stationary and switched off, with the booms unfolded and supported, during installation or maintenance.

⚠ CAUTION

Hydraulic Safety

- Raven Industries recommends that appropriate protective equipment be worn at all times when working on the hydraulic system.
- Never attempt to open or work on a hydraulic system with the equipment running. Care should always be taken when opening a system that has been previously pressurized.
- When disconnecting the hydraulic hoses or purging is required, be aware that the hydraulic fluid may be extremely hot and under high pressure. Caution must be exercised.
- Any work performed on the hydraulic system must be done in accordance with the machine manufacturer's approved maintenance instructions.
- When installing AutoBoom hydraulics or performing diagnostics, maintenance, or routine service, ensure that precautions are taken to prevent any foreign material or contaminants from being introduced into the machine's hydraulic system. Objects or materials that are able to bypass the machine's hydraulic filtration system will reduce performance and possibly damage the AutoBoom hydraulic valve.

Electrical Safety

- Always verify that the power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the equipment.
- Ensure that the power cable is the last cable to be connected.

CHAPTER 2

Introduction

Congratulations on your purchase of the AutoBoom™ UltraGlide XT system! The UltraGlide XT system is designed to provide automated boom height adjustment for agricultural equipment using ultrasonic sensors along with advanced boom positioning capabilities built into the node to determine boom position. The state-of-the-art hydraulic system adjusts pressures in the tilt and slant cylinders to keep the boom as close as possible to the target height while adjusting for chassis movement. The UltraGlide XT system is ideal for pre-emergence and post-emergence applications in challenging terrain.

Note: *Terrain conditions and the machine's hydraulic system dictate the actual speeds that can be achieve during application with an engaged AutoBoom system.*

The instructions in this manual are designed to assist in the proper calibration and operation of the UltraGlide XT system when used with a Raven or VT display.

Important: *Installation of the UltraGlide XT system must be completed before calibrating the system. If you have questions regarding the installation of the UltraGlide XT system, refer to the machine-specific UltraGlide XT Installation Manual provided with the installation kit. For questions about the field computer/controller, refer to the Installation & Operation Manual provided with the field computer/controller.*

Updates

Software and manual updates are available on the Raven Applied Technology website:

www.ravenhelp.com

Pre-Installation

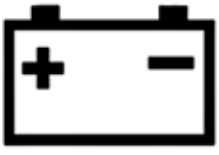
WARNING

Carefully read and follow all safety requirements and precautions contained in this manual and the machine-specific installation manual. Failure to follow safety instructions may lead to equipment damage, personal injury, or death.

Before any components of the UltraGlide XT system are installed, activated, or operated and at the beginning of each season Raven Industries recommends performing the following steps to ensure the machine will function with the UltraGlide XT system.

1. Ensure the machine's hydraulic filters have been changed and there are no problems with any components of the machine's hydraulics system:
   - Hydraulic pump issues
   - Faulty hydraulic motors
- Other issues that may leave fine metal deposits in the circuits
2. Operate each of the machine's boom hydraulic functions three times to ensure the machine's valve has fresh oil and any debris has been flushed from the system's hoses, valves, and filters.
   - Tilt
   - Fold
   - Center rack control
   - Tongue extension
   - Any other functions operated by the machine's hydraulic valves

Wiring Connections



CAUTION

Always connect the power cable as the last step in the wiring process and verify that the power leads are connected with the correct polarity. Reversing power leads can cause severe damage to the equipment.

For wiring connections made outside the cab, apply dielectric silicone grease (P/N 222-0000-006) generously on both the male and female ends of the connectors. Application of the grease will prevent corrosion to the pins and wires.

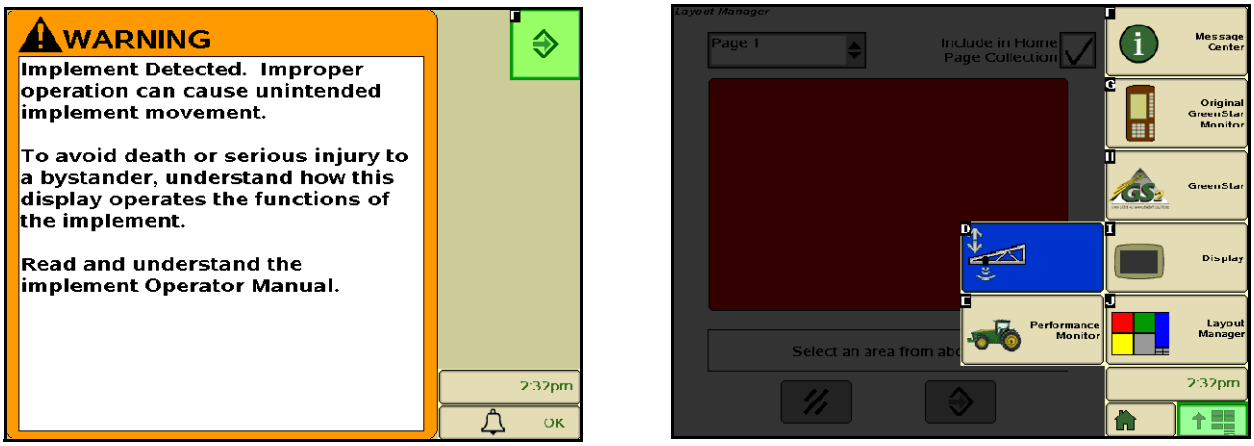
CHAPTER 3

VT Display Routine Operation

AutoBoom Icons

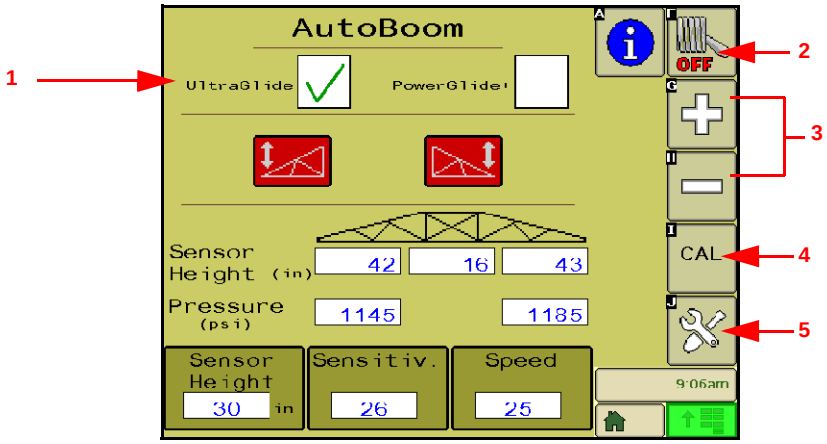
Once the AutoBoom node has been installed, the AutoBoom icons will be displayed on the Start-up screen, indicating the AutoBoom node has been detected.

FIGURE 1. Implement Detected



Refer to the icon definitions below when configuring the AutoBoom feature on the VT Display.

FIGURE 2. AutoBoom Home Screen

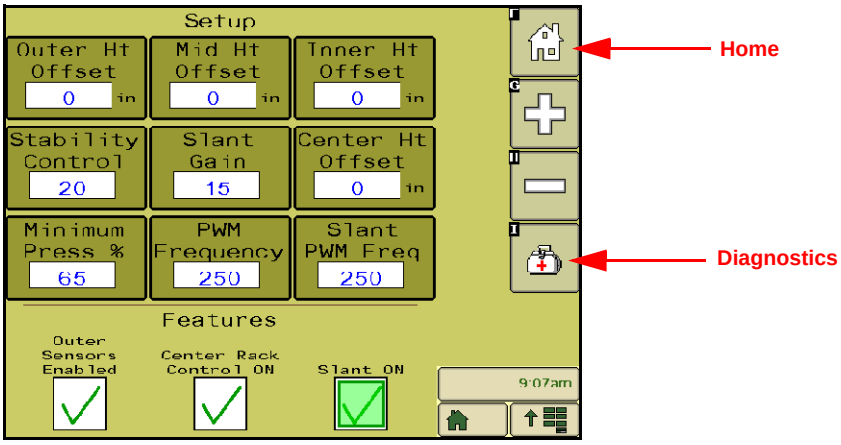


1. When the UltraGlide field is checked, the AutoBoom system is in UltraGlide mode.
2. The Master Switch icon is used to turn the AutoBoom system off and on.
3. Use the + and - icons to increase or decrease the displayed value.
4. Select the CAL icon to access the Calibration screen.
5. Select the Setup icon to access the setup tools and diagnostics.

System Tools

Setup Tools

The setup tools allow fine-tuning of stability control, slant gain, PWM frequency, slant PWM frequency, minimum boom pressure, and sensor height offset parameters in the AutoBoom system. To access these tools, select the Setup icon. The following screen will appear:



To adjust any of the ISO AutoBoom setup values, highlight the value and use the + and - icons. To return to the AutoBoom home screen, select the Home icon.

- **Height Offsets (Outer, Mid, Inner, and Center)** - Allows sensor heights to be adjusted according to the sensor mounting location. Enter a positive value if the sensors are mounted above the sprayer tips, and a negative value if the sensors are mounted below. Refer to the Sensor Height Offsets section on page 22 for more information.
- **Stability Control** - Allows fine-tuning of the rigidity of the machine's center rack. The default value of 20 is recommended for machines with a rigid center rack. A value of 5 - 14 is recommended for machines with center suspension that floats freely. Adjust this value as needed to prevent boom oscillation.
  - Stability settings of 0 disable the stability control completely, making the left and right booms completely independent of each other. When above target, the control of both booms is accelerated to increase the down speed. This setting is useful for machines that have a rigid center rack.
  - Stability settings of 1 - 99 will adjust the stability of the center section. Lower numbers cause the opposing boom that is not being controlled to counteract the movement of the controlled boom by raising to balance or stabilize the center section and to prevent undesired rotation or movement. While lower numbers allow the booms to react at the same rate and time, low settings may prevent the booms from lowering. Higher stability settings allow the booms to react independently from each other, but may cause the center section to oscillate, diminishing performance.

- **Slant Gain** (If equipped with slant feature enabled) - Allows fine-turning of the allowable rotation of the center section suspension. The default value is 15. A higher number will apply more pressure to the slant control cylinders when the chassis is maneuvering over challenging terrain.
- **Min Press %** - Sets a low limit pressure, preventing the boom pressure from falling below a percentage of static pressure, overriding the control when necessary to maintain a low limit of pressure on each boom. Minimum Pressure% also prevents the booms from resting on the stops for travel-limited booms.
- **PWM Frequency** - Sets the frequency of the PWM signal to the proportional control valve. The default value of is 250 Hz.This value is automatically detecting during calibration and should not be adjusted.
- **Slant PWM Freq** - Sets the frequency of the PWM signal to the slant proportional control valve. The default value of is 250 Hz.This value is automatically detecting during calibration and should not be adjusted.
- **Outer Sensors** - Allows the operator to disable the outer-most boom sensors if the machine is equipped with optional mid or inner boom sensors. This feature is useful when the outer boom tips are folded in and not able to control.

Note: *The system must be re-calibrated if the outer sensors option is disabled, then re-enabled.*

- **Center Rack Control** - Turns the center rack control on and off. Selecting Center Rack Control ON allows center rack control raise and lower feature to be enabled on the field computer/console or the machine's switch. If Center Rack Control OFF is selected, the center rack control raise and lower feature cannot be used.

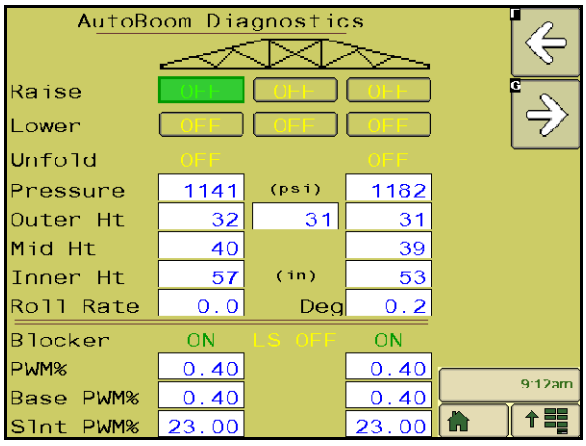
Note: *Center rack control should only be turned on of the machine is equipped with a center rack sensor and the appropriate cabling that allow center rack control.*

- **Slant Control** - Turns the slant control feature on and off. Selecting Slant Control ON allows slant control to be enabled when both booms are enabled on the field computer/console or the machine's switch.

Note: *The slant control feature can only be turned on when the system is in UltraGlide mode and the center rotation sensor is detected.*

Diagnostic Tools

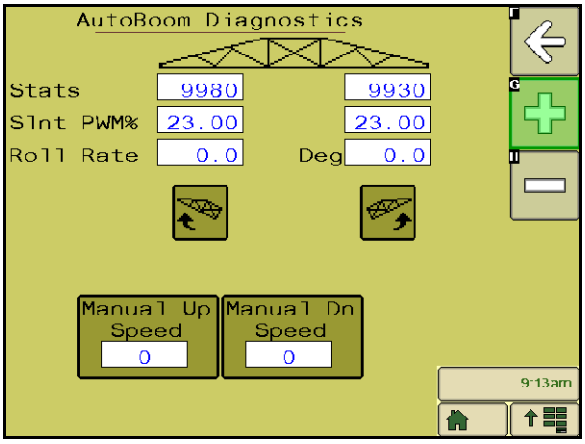
Integrated diagnostic tools allow the status of all AutoBoom inputs and outputs to be viewed on the VT Display display. To access the diagnostic tools, select the Diagnostics icon. The following screen will appear:



- **Raise and Lower** - Indicate the status of the boom switches. When using the machine's manual control functions, the corresponding boom switch will indicate On.
- **Pressure, Outer Ht, Mid Ht, Inner Ht, and Center Ht** - Indicate the status of the corresponding sensors.

- **Roll Rate** - Indicates the measured chassis roll rate. This value will change when the machine chassis is rolling left or right.
- **Deg** - Indicates the degrees of detected rotation of the machine's boom relative to the chassis. This value will be nearly zero when the boom suspension is centered, and will change when the boom is rotated relative to the machine's chassis.
- **Blocker** - Indicates the status of the double-blocker output. Blocker will indicate On when individual booms are engaged or calibrating.
- **PWM%** - Indicates the duty cycle to the proportional valves. This value will be 0 if the individual booms are disengaged, and will vary in output up to 100 when AutoBoom is engaged and the system is operating.
- **Base PWM%** - Indicates the system's calculated static duty cycle to maintain the set height or pressure. This number will typically change slowly from 0 - 5 points during routine operation.
- **Slnt PWM%** - Indicates the duty cycle of the slant control proportional valves. This value will be 0 if the slant control is not enabled, and can vary in output up to 100 when slant control is engaged and operating. A minimum value will be maintained when the slant control system is enabled, and move slightly when the boom is re-centering.

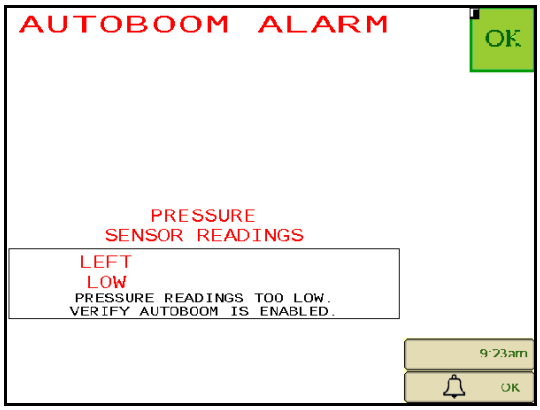
To access page two of the Diagnostic tools, select the right arrow button. The following screen will appear:

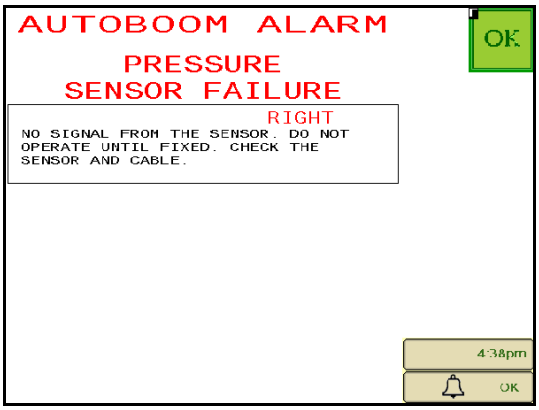


- **Stats** - Reflects the boom performance. This value is for Raven use only.
- **Slnt PWM%** - Allows the operator to see the duty cycle value of the slant control proportional valves while rotating the boom with the Manual Slant Control icons.
- **Roll Rate** - Allows the operator to see the roll rate value when using the Manual Slant Control icons.
- **Deg** - Allows the operator to see the degrees of rotation while operating the manual slant control.
- **Manual Slant Control Icons** - Used to manually rotate the boom clockwise or counterclockwise relative to the machine's chassis and can be used to troubleshoot wiring or hydraulic issues.

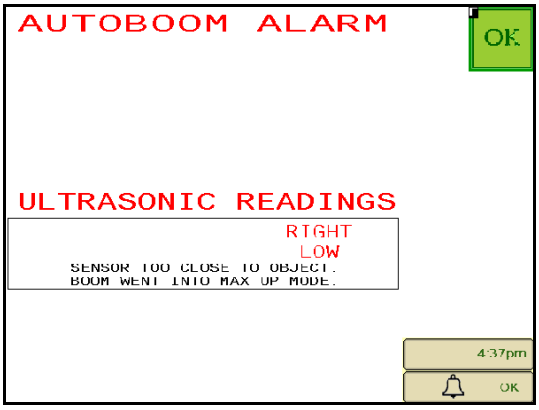
Alarms

Alarm tones will not sound if the operator is navigating through any of the configuration menus. However, the enable/disable alarms will always sound when appropriate.

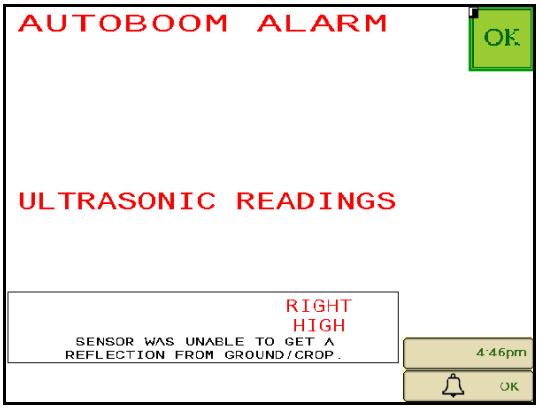




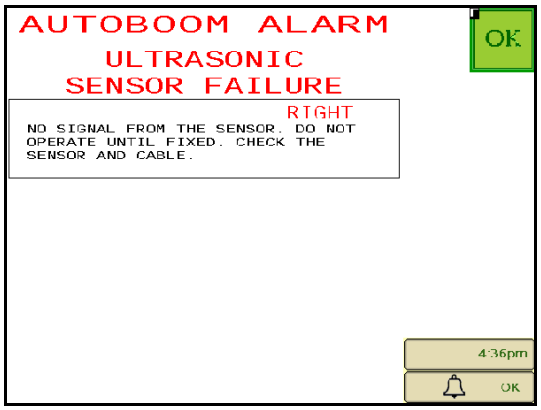
- **Low pressure alarms** - When the pressure in the left or right tilt cylinders is low, the low pressure alarm will sound. The alarm is a steady tone, and will stop immediately after pressure is restored to the system.
- **Pressure sensor failure alarms** - The pressure sensor failure alarm occurs immediately when a pressure sensor is not detected. The alarm is a steady tone, and will stop immediately after the sensor is located.



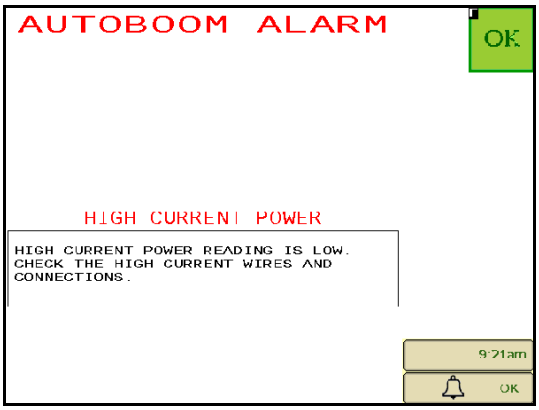
- **Ultrasonic sensor - too low alarm** - This alarm occurs if the ultrasonic sensor is closer than ten inches to the ground for 1/2 a second.



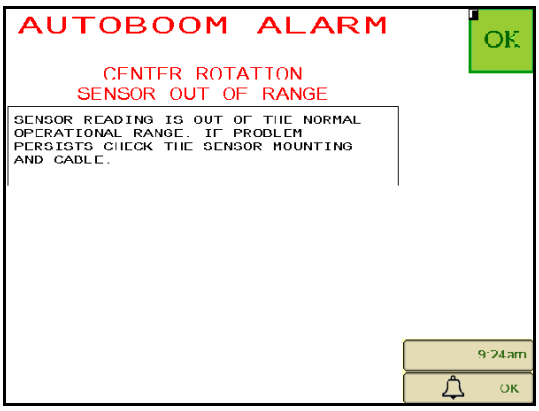
- **Ultrasonic sensor - too high alarm** - This alarm occurs when the ultrasonic sensor is higher than 65 inches from the ground for five seconds.



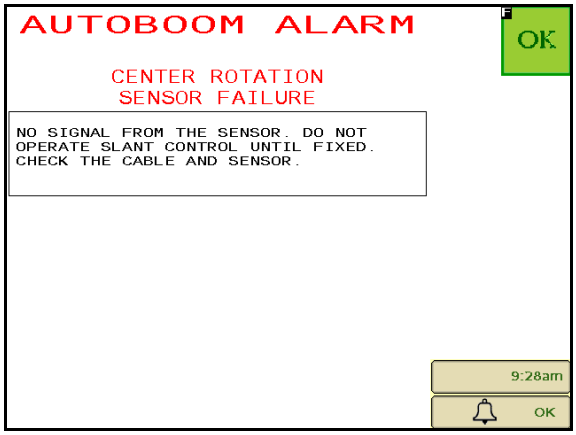
- **Ultrasonic sensor - failure alarm** - This alarm occurs immediately when an ultrasonic sensor is not detected. The alarm is a steady tone, and will stop immediately after the sensor is located.



- **Low HC Power** - This alarm occurs when the voltage to the node drops below 12 volts. This alarm is a steady tone, and stops immediately when proper voltage is restored to the node.



- **Center Rotation Sensor out of Range** - This alarm occurs when the center rotation sensor is out of the calibrated range. This alarm is a steady tone, and will stop immediately when the sensor is in the calibrated range.



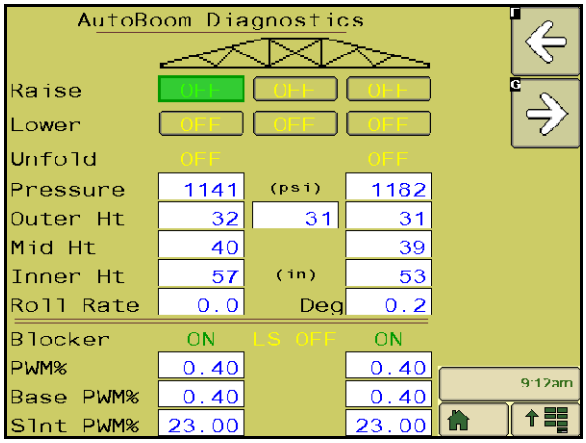
- **Center Rotation Sensor Failure** - Occurs when there is no signal from the rotation sensor when slant control is enabled. This alarm is a steady tone, and will stop immediately when the center rotation sensor signal is detected.
- **Other tones** - When enabling the AutoBoom system in automatic mode via the machine's boom control functions or switches, a single beep will occur. When disabling AutoBoom, a double beep will sound.

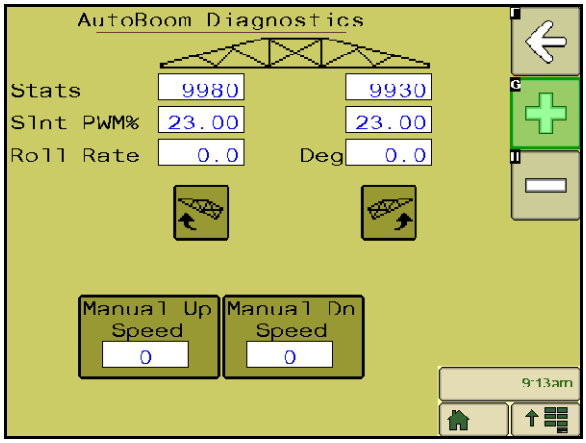
System Calibration

AutoBoom Pre-Calibration Diagnostics

While every effort has been made to properly label and document connections for the hydraulic and electrical components of the AutoBoom system, boom function connections may not be identified due to changes in the make and model of the machine. This makes it especially important to trace the hoses from the connection points and verify the electrical connections are correct to ensure proper AutoBoom system operation. In order to verify connections, it is necessary to perform a pre-calibration diagnostic test.

1. Select Setup icon.
2. Select Diagnostics icon. The following screen will appear:





3. Verify that the following components on the VT Display screen are displayed correctly and change when raising and lowering the booms via the machine's controls and the AutoBoom manual functions:
   - Pressures
   - Sensor heights
   - Right and left raise/lower functions
   - Center raise/lower functions
   - Fold/unfold functions
   - Slant rotation clockwise/counterclockwise

Calibration

After the AutoBoom installation is complete, it is necessary to calibrate the AutoBoom system before use. AutoBoom calibration requires pressure in the machine's cylinders and enough boom travel to allow the system to find the system base duty cycles for operation. Booms must be free to travel 10" up or down without reaching the tops or bottoms of the cylinder stops.

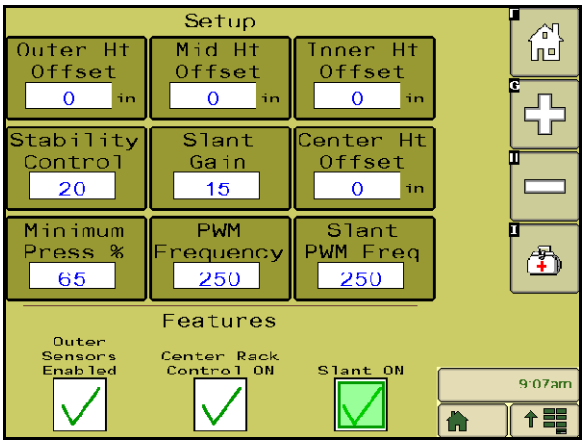
During calibration and operation, it is important to keep the machine running at a sufficient engine RPM so that the hydraulic pump is able to supply a full flow to the hydraulic system.

Note: *If the machine has an open center hydraulic system, or the type of hydraulic system is unknown, all calibration procedures should be performed with the machine operating at the normal operating engine RPM.*

Important: *Be sure that the area is clear of people and obstructions before beginning the calibration process.*

1. Move the machine to a flat area.
2. Verify that AutoBoom is turned on.
3. Verify that the booms are unfolded, and lower the center rack.

Note: *If the booms do not go over center or are travel limited, raise the booms so that the boom tips are approximately ten inches above the horizontal position and lower the center section to approximately 20 inches.*



4. Using a tape measure, measure the distance from the bottom of the sensor to the spray nozzle tip.
5. Access the AutoBoom Setup screen.
6. Adjust the vertical sensor height offset settings in the VT Display to sensor position as measured in step 4.

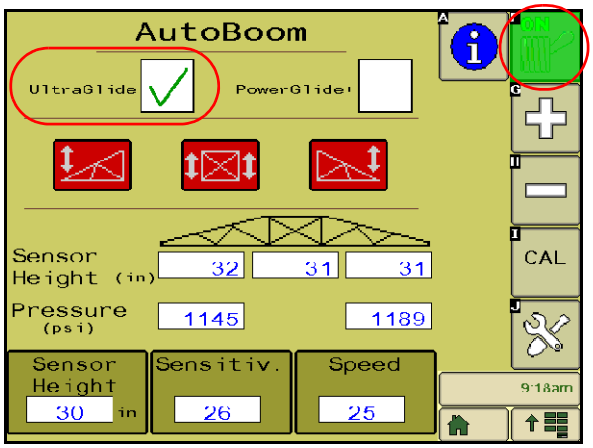
- Positive offsets indicate the sensor surface is located above the nearest spray tips.
- Negative offsets indicate the sensor surface is located below the nearest spray tips.
- Inner, mid, outer, and center offsets are not required to be the same across the width of the machine, but they must be correctly measured relative to the spray tips.

Note: *If the machine is equipped with a center sensor, the center rack height can be verified through the main menu or diagnostics screen in AutoBoom section of the VT Display.*

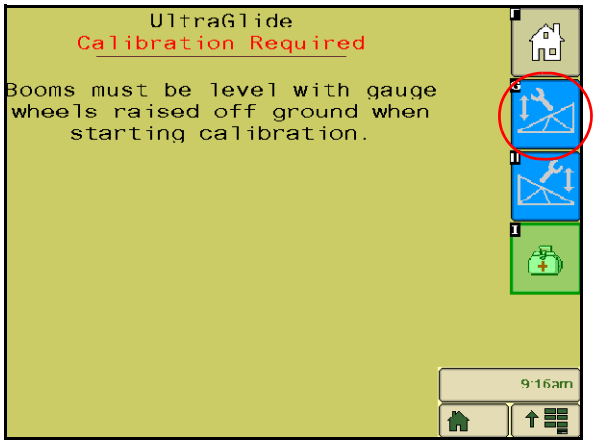
7. Raise the boom tips to approximately the target height.

Note: *The default target height is 30 inches. Verify that the booms are not fully raised to the boom stops. If gauge wheels are installed, the setting must be adjusted to 40 - 45 inches to prevent the wheels from touching the ground during the system calibration.*

8. Touch the Home icon on the screen to display the AutoBoom home screen.

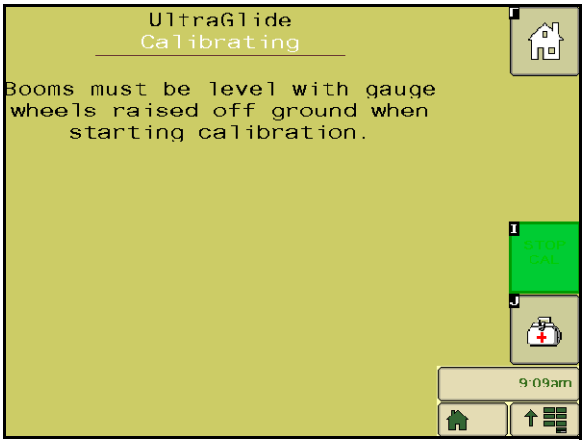


9. Select **UltraGlide** from the Mode section in the upper-left corner of the screen and turn AutoBoom on in the upper-right corner.
10. Select **CAL**. The following screen will appear:



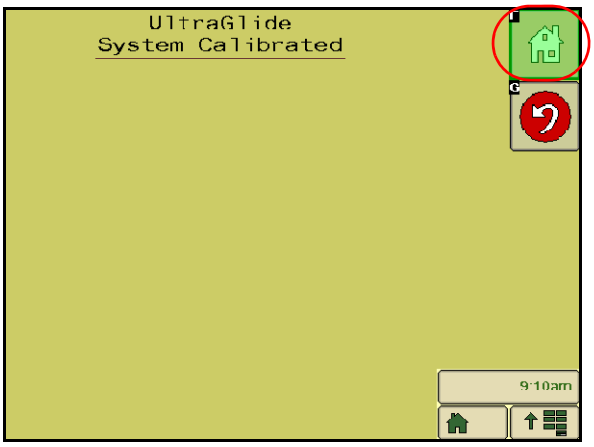
11. Select the left boom calibration icon to begin the calibration of the left boom.

Note: *The left boom will raise and then lower. This is a normal part of the calibration process. During the calibration process, the following screen will be displayed:*



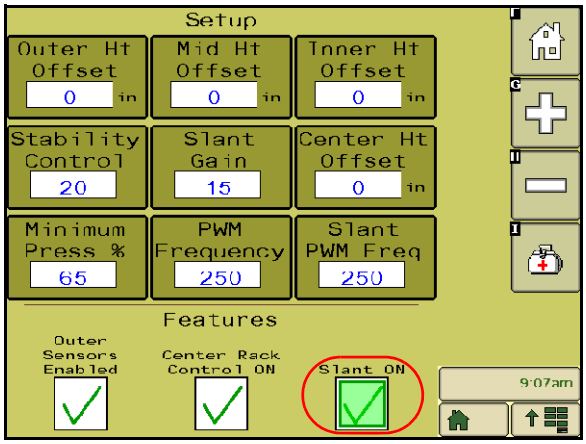
Note: *The calibration process may take several seconds to complete. "Calibrating" will flash, indicating that calibration is in progress.*

12. Repeat steps 9 - 10 above to calibrate the right boom. Once the right boom calibration process is complete, the following screen will appear:

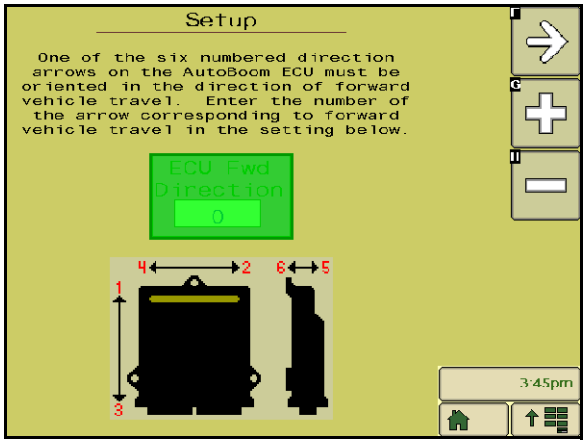


13. Select the **Home** icon.

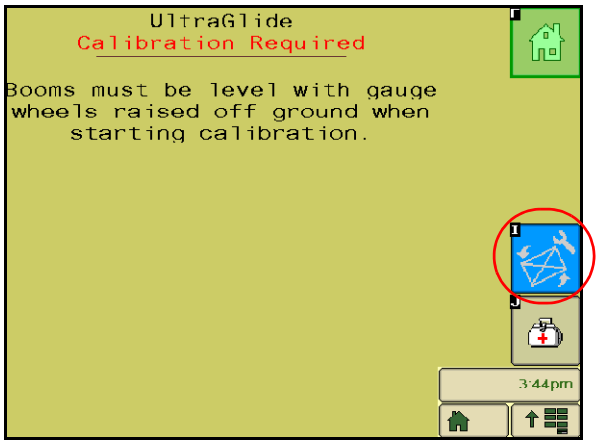
Slant Control Calibration



1. Verify the Slant Control feature is turned on in the Setup screen.
2. Select the CAL icon on the Home screen.



3. Enter the number of the direction arrow on the node that is pointing forward.
4. Select the right arrow icon to access the Calibration screen.



5. Select the Slant Calibration icon on the Calibration screen.

Note: *The boom tips may raise automatically to allow for full rotation of the center section. Pressure in one slant cylinder will increase until the center section begins to rotate slightly. The center section*

will then rotate fully clockwise then counterclockwise to calibrate the center rotation sensor position.

Note: *The center rotation sensor may be re-centered by recalibrating the slant control or by manual adjustment of the centering bolt while the center section is confirmed to be in the center position.*

Center Rack Raise/Lower Calibration

There are many different valve configurations used to control the machine's center rack functions. The AutoBoom system must "learn" which of the machine's solenoids are used to raise and lower the booms. Complete the following steps to calibrate the center rack control feature after the individual booms have been calibrated.

1. Press and hold the center rack raise button on the machine's control panel or joystick for six seconds so that the center rack raises.

Note: *The center rack may reach the upper limit of travel during this time, but continue holding the button until the full six seconds has passed.*

2. Press and hold the center rack lower button on the machine's control panel or joystick for six seconds so that the center rack lowers.

Note: *The center rack may reach the lower limit of travel during this time, but continue holding the button until the full six seconds has passed.*

Routine Operation

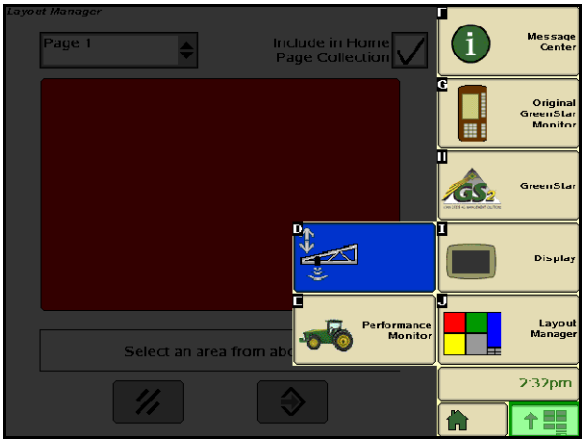
Joystick Functions

When AutoBoom control is on, control of each boom can be enabled or disabled via the VT display or by tapping the sprayer's switch functions (if equipped).

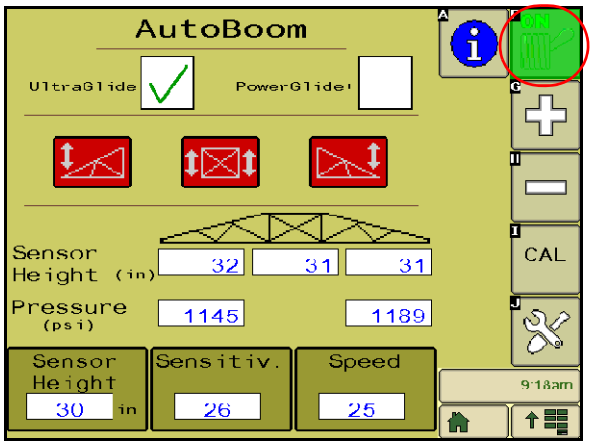
Note: *Pressing the down function for longer than 1/2 a second will switch the function to manual control. The operator must tap the down function to enable Autoboom.*

- A single up-tap on the sprayer's switch functions disables AutoBoom on that boom.
- A single down-tap on the sprayer's switch functions enables AutoBoom on that boom.

Enabling AutoBoom via the VT Display

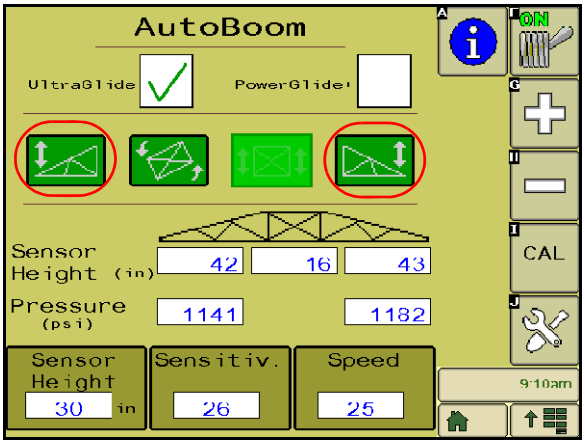


1. Touch **AutoBoom** icon on the VT display.



2. Select **On** in the upper-right corner of the screen.

Note: *The AutoBoom system is now powered on, but is not yet enabled.*



3. Select the **Left** and **Right** icons to enable the booms.

Note: *The booms can be disabled by deselecting the Left and Right icons, selecting the toggle switch icon in the upper right corner, or by performing a machine tilt up function.*

Boom Adjustments When Approaching Headlands (If Equipped with Gauge Wheels)

When approaching the headlands to make a turn, the inner gauge wheel must be raised approximately six inches from the ground to prevent it from sliding sideways or backward, causing damage to the inner gauge wheel assembly.

Center Rack Control

AutoBoom Enabled, Slant Control On, and Center Rack Control On

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

Note: *Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.*

Note: *Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.*

- **Center Down Switch** - A single down-tap will lower the center rack to the desired spray height, enable the center rack, slant control, and both booms.
- **Center Up Switch** - A single up-tap will disable the center rack, slant control, and both booms. Two consecutive up-taps will raise the center rack to the desired transport height. Four consecutive up-taps will raise the center rack to the maximum height, turn AutoBoom off, and preserve the new transport height as the maximum height.
  - Set a lower transport height - While the center rack is returning to transport, down- tap once on the center switch when the new transport height is reached.
  - Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

AutoBoom Enabled, Slant Control On, and Center Rack Control Off

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

Note: *Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.*

Note: *Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.*

- **Center Down Switch** - Two consecutive down-taps will lower the center rack to the desired spray height and enable slant control and both booms.

Note: *Center rack control will not be enabled since center rack control is off.*

- **Center Up Switch** - Two consecutive up-taps will disable slant control and both booms, and will raise the center rack to the desired transport height. Four consecutive up-taps will raise the center rack to the maximum height and turn AutoBoom off, preserving the new transport position as the maximum height.
  - Set a lower transport height - While the center rack is returning to transport, down-tap once on the center switch when the new transport height is reached.
  - Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with the AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

Operating the UltraGlide XT AutoBoom System in PowerGlide Plus Mode

Before populating the hydraulic fittings on the AutoBoom valve, it is necessary to remove orifice fittings from the valve in the PowerGlide Plus system. Failure to remove these fittings from the valve will restrict the down speed of the booms when the system is enabled.

FIGURE 3. Port 3A and 3B Location

1. Locate Ports 3A and 3B on the AutoBoom valve.

FIGURE 4. Coil Removed from the AutoBoom Valve

2. Remove the coils from the solenoids near Ports 3A and 3B to gain easy access to those ports.

FIGURE 5. **Port Plugs Removed from the AutoBoom Valve**

3. Use an Allen wrench to remove the plugs from Ports 3A and 3B.

FIGURE 6. **Orifice Fitting Removed from the AutoBoom Valve**

4. Remove the orifice fittings from Ports 3A and 3B.

Important: *Tip the AutoBoom valve on its side and use the Allen wrench to remove the orifice from the cavity, taking care not to let the fitting fall into the valve.*

FIGURE 7. **Port Plug Reinstalled on the AutoBoom Valve**

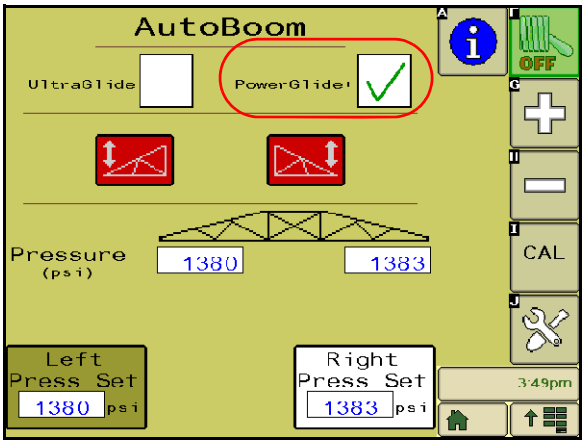
5. Use the Allen wrench to reinstall the port plugs on Ports 3A and 3B of the AutoBoom valve.

FIGURE 8. Coil Reinstalled on the AutoBoom Valve

6. Reinstall the coils on the solenoids of the AutoBoom valve.

Note: *When converting the AutoBoom system back to UltraGlide XT, the orifice fittings must be reinstalled.*

FIGURE 9. VT Display Programmed to Run in PowerGlide Plus Mode

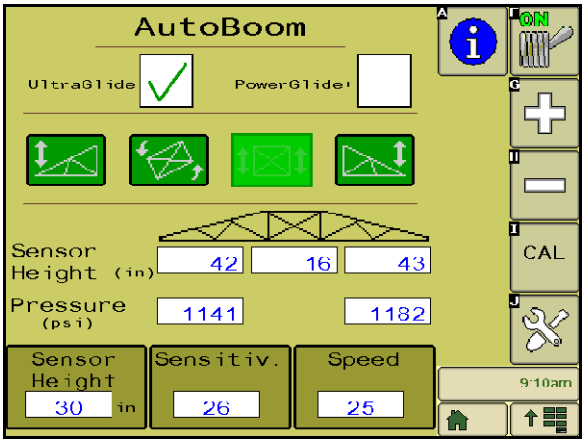


7. Program the VT Display to run in PowerGlide Plus mode.

Note: *When converting the AutoBoom system back to UltraGlide XT, the VT Display display must show the UltraGlide XT mode selected.*

System Adjustments

Note: *AutoBoom must be enabled after both booms have been calibrated in order to make system adjustments.*

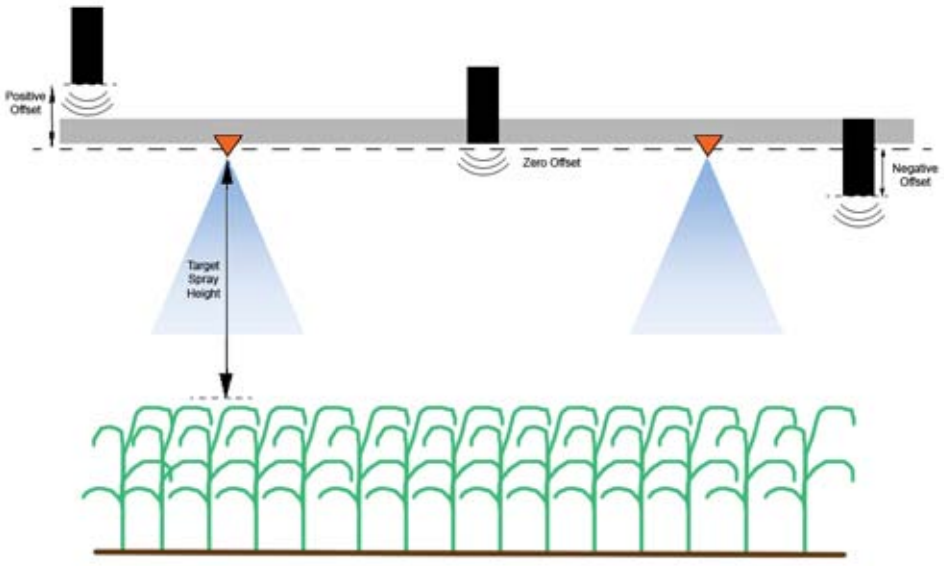


Ultrasonic Sensor Height Offsets

Ultrasonic sensor height offset adjustments are used to compensate for the difference between the height of the sensor surface and the height of the spray tip. The offset height is calculated by measuring the distance from the bottom of the sensor to the height of the crop, measuring the distance between the spray tip to the height of the crop, and then subtracting the spray tip distance from the sensor distance. Refer to the diagram below to determine whether the offset value should be positive or negative.

Note: *The maximum offset height value is 20 inches.*

Note: *Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop. For row-crop situations, it may be beneficial to adjust the sensor positions to directly over a row, or add additional boom sensors.*



- Touch the up arrow in the Sensor Height section to increase the value representing the distance between the sensor and the ground.
- Touch the down arrow in the Sensor Height section to decrease the value representing the distance between the sensor and the ground.

Note: *On machines with travel-limited booms, center sensor height offsets may need to be entered as less than the measured value from the sensor to the ground to ensure the boom cylinders have sufficient pressure during operation.*

Sensitivity

1. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface.

Note: *The boom should react immediately when your hand is approximately 6” from the ground.*

2. Adjust the Sensitivity setting as needed to make the boom more or less reactive to hand motions.

Note: *The default setting is 15. If the Sensitivity is too high, the boom will appear unstable and jittery, reacting to slight changes in target height or crop movement. During routine operation, AutoBoom should be unresponsive to changes in height of 2” - 3”, but should react quickly to changes of 5” or more.*

The typical Sensitivity setting for most machines with a 30” target spray height is 13 - 17. For target spray heights less than 25”, lower the sensitivity setting and for target heights greater than 40”, raise it.

For row-crop situations, or when crop conditions are sparse and not fully covering the ground, it may be beneficial to decrease the sensitivity so the boom is less reactive to sudden changes in crop height, and less likely to cause sudden movements that diminish performance.

Speed

The Speed setting controls how fast the boom will move away from an obstacle, and how much the boom overshoots the target height. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. Adjust the Speed setting as needed so that boom raise rates match hand movement rates, but so that the booms don’t overreact and become unstable.

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12” of the sensor surface.

Note: *The boom should react immediately and adjust at a raise speed matching the hand movement, overshooting the new target height by one foot or less.*

2. Adjust the Speed setting as needed.

Note: *The default setting is 25. The typical Speed setting that works best for most machines is 22 - 27, but can vary depending on the static pressures of the boom, boom geometry, and the Sensitivity settings.*

Stability

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12 inches of the sensor surface, while observing the movement of the opposite boom.

Note: *The opposite boom should raise slightly (usually no more than six inches) simultaneously.*

2. Adjust the Stability setting to minimize movement of the opposite boom.

Note: *Lower the Stability value to make the opposite boom more rigid, but keep the number high enough to allow for natural movement of the boom without affecting the chassis roll.*

Slant Gain

Allows fine-turning of the allowable rotation of the center section suspension. Higher Slant Gain values cause the slant control to react more aggressively when chassis roll is sensed by the node and can cause the boom to be excessively rigid, possibly causing damage to the center rack. Lower Slant Gain values cause the slant control to be less aggressive and can cause the system to be unreactive, not controlling the suspension based on the chassis roll.

1. Take the machine to the field and observe the rotation of the center section suspension with the AutoBoom system on and left, right, and slant enabled.
2. Adjust the Slant Gain setting to cause the slant control to be more or less reactive.

Note: *The default setting is 15.*

Min Press%

Note: *On machines with travel-limited booms, operate the AutoBoom system with center rack control enabled, or with the center sensor at or slightly below the target height to prevent the booms from continuously entering the Min Press% mode. This mode is for boom emergency protection only, and AutoBoom system should not be run in this mode during routine operation.*

1. Raise the center rack section to the target height, so that the booms and center rack are horizontal.
2. Enable the AutoBoom system.
3. Locate the Min Press% setting in the AutoBoom control menus.

Note: *The default setting is 65.*

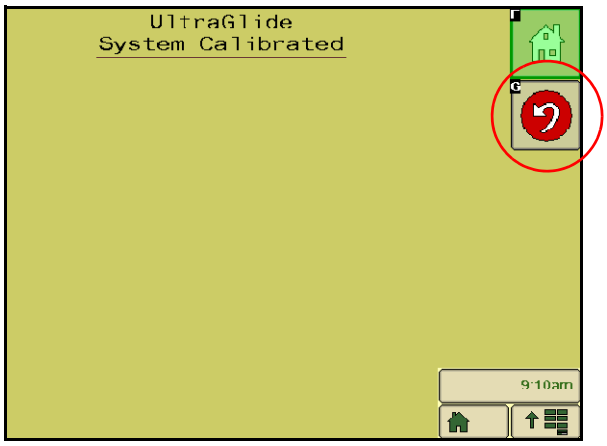
4. Increase the Min Press% value to approximately 80.
5. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface, or until the boom travels up approximately three feet higher than the original target.
6. Pull hand away, and verify that the booms lower slowly after a slight delay.

Note: *If the booms do not lower, decrease the Min Press% setting value by one and repeat the steps above. Continue performing the Min Press% test until the booms begin to lower.*

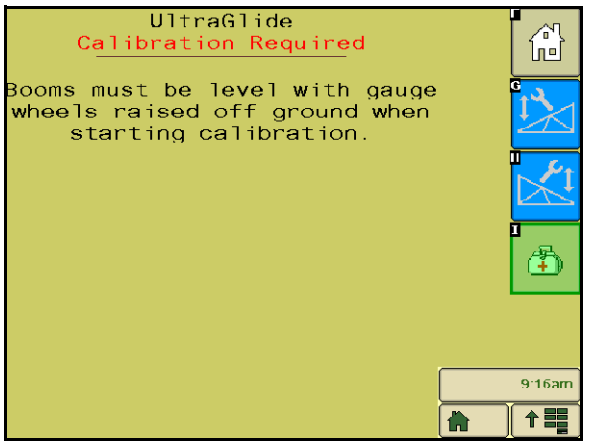
Resetting Defaults

Although it is not normally necessary, there may be circumstances under which it may be necessary to reset the system defaults. Resetting the defaults erases all AutoBoom system settings and adjustments that have been performed. System calibration will be required after the defaults have been reset.

1. Touch **CAL** on the VT Display screen. The following screen will be displayed:



2. Select the reset icon. The following screen will appear:



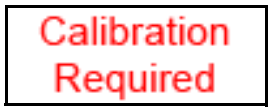
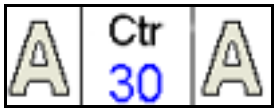
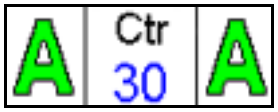
3. Select the left boom calibration icon to calibrate the left boom.
4. Select the right boom calibration icon to calibrate the right boom.
5. Return to the Setup screen to verify the Slant feature is turned on.
6. Select the Slant Calibration icon to calibrate the Slant feature.

CHAPTER 4

Viper Pro Routine Operation

AutoBoom Status Display

The current status of the AutoBoom system can be determined by the message displayed in the AutoBoom section of the Viper Pro screen.

	AutoBoom is detected and calibrated, but is currently turned off. The system must be turned on to be used.
	AutoBoom is detected but not calibrated. The system must be calibrated before it can be used.
	AutoBoom was detected but communication has been lost. Refer to Chapter 7, *Troubleshooting* to troubleshoot the issue.
	AutoBoom is detected and turned on, but is not enabled. Press both A buttons to enable the AutoBoom system.
	AutoBoom is detected and in operation, with no errors detected.
	AutoBoom is detected and turned on, but is not enabled and alarm conditions have occurred on both booms. Refer to Chapter 7, *Troubleshooting* to troubleshoot the issue.
	AutoBoom is detected, turned on, and enabled, but alarm conditions have occurred on both booms. Refer to Chapter 7, *Troubleshooting* to troubleshoot the issue.

Note: *If a center rack sensor is installed, Ctr Ht is displayed in place of the set height.*

System Tools

Setup Tools

Setup tools allow fine-tuning of stability control, slant gain, PWM frequency, slant PWM frequency, minimum boom pressure, and sensor height offset parameters in the AutoBoom system. To access these tools, select **Setup**. The following screen will appear:

- **Min Pressure% -** Sets a low limit pressure, preventing the boom pressure from falling below a percentage of static pressure, overriding the control when necessary to maintain a low limit of pressure on each boom. Minimum Pressure% also prevents the booms from resting on the stops for travel-limited booms.
- **Height Offsets (Outer, Mid, Inner, and Center)** - Allows sensor heights to be adjusted according to the sensor mounting location. Enter a positive value if the sensors are mounted above the sprayer tips, and a negative value if the sensors are mounted below. Refer to the Sensor Height Offsets section on page 42 for more information.
- **Slant Gain** (if equipped with slant feature enabled) - Allows fine-tuning of the allowable rotation of the center section suspension. The default value is 15. A higher number will apply more pressure to the slant control cylinders when the chassis is maneuvering over challenging terrain.
- **Manual Dn Speed and Manual Up Speed** - Allows the speed at which the AutoBoom hydraulic valve manually raises and lowers the booms to be adjusted on machines that do not have their own hydraulic control. **Leave the setting at the default of 0 if the machine is equipped to hydraulically control boom functions.**
- **Stability Factor** - Allows fine-tuning of the rigidity of the machine's center rack. The default value of 20 is recommended for machines with a rigid center rack. A value of 5 - 14 is recommended for machines with center suspension that floats freely. Adjust this value as needed to prevent boom oscillation.
  - Stability settings of 0 disable the stability control completely, making the left and right booms completely independent of each other. When above target, the control of both booms is accelerated to increase the down speed. This setting is useful for machines that have a rigid center rack.
  - Stability settings of 1 - 99 will adjust the stability of the center section. Lower numbers cause the opposing boom that is not being controlled to counteract the movement of the controlled boom by raising to balance or stabilize the center section and to prevent undesired rotation or movement. While

lower numbers allow the booms to react at the same rate and time, low settings may prevent the booms from lowering. Higher stability settings allow the booms to react independently from each other, but may cause the center section to oscillate, diminishing performance.

- **Outer Sensors** - Allows the operator to disable the outer-most boom sensors if the machine is equipped with optional inside boom sensors. This feature is useful when the outer boom tips are folded in and not able to control.

Note: *The system must be re-calibrated if the outer sensors option is disabled, then re-enabled.*

- **Units** - Allows the operator to select the desired units of measure.
- **Center Rack Control** - Turns the center rack control on and off. Selecting Center Rack Control ON allows center rack control raise and lower feature to be enabled on the field computer/console or the machine's switch. If Center Rack Control OFF is selected, the center rack control raise and lower feature cannot be used.

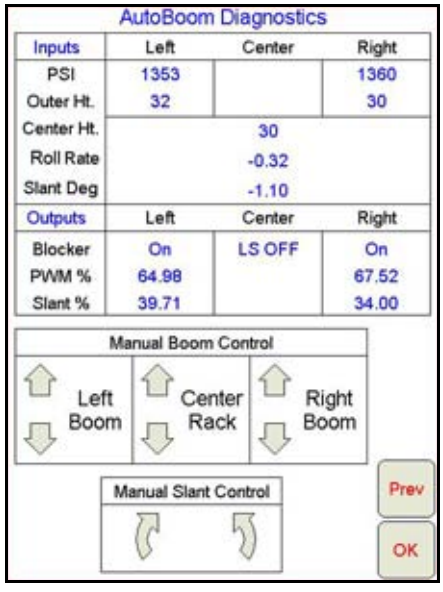
Note: *Center rack control should only be turned on of the machine is equipped with a center rack sensor and the appropriate cabling that allow center rack control.*

- **Slant Control** - Turns the slant control feature on and off. Selecting Slant Control ON allows slant control to be enabled when both booms are enabled on the field computer or the machine's switch.

Note: *The slant control feature can only be turned on when the system is in UltraGlide XT mode and the center rotation sensor is detected.*

Diagnostic Tools

Integrated diagnostic tools allow the status of all AutoBoom inputs and outputs to be viewed on the Viper Pro display. To access the diagnostic tools, select **Diag**. The following screen will appear:



- **Raise and Lower** - Indicate the status of the boom switches. When using the machine's manual control functions, the corresponding boom switch will indicate On.
- **Unfold** - Indicates the status of the unfold proximity switch (if equipped). The booms will not be enabled until the proximity switch is activated.
- **PSI, Outer Ht., Mid Ht., Inner Ht, and Center Ht.** - Indicate the status of the corresponding sensors.

- **Roll Rate** - Indicates the measured chassis roll rate. This value will change when the machine chassis is rolling left or right.
- **Deg** - Indicates the degrees of detected rotation of the machine's boom relative to the chassis. This value will be nearly zero when the boom suspension is centered, and will change when the boom is rotated relative to the machine's chassis.
- **Blocker** - Indicates the status of the double-blocker output. Blocker will indicate On when individual booms are engaged or calibrating
- **PWM %** - Indicates the duty cycle to the proportional valves. This value will be 0 if the individual booms are disengaged, and will vary in output up to 100 when AutoBoom is engaged and the system is operating.
- **Base PWM %** - Indicates the system's calculated static duty cycle to maintain the set height or pressure. This number will typically change slowly from 0 - 5 points during routine operation.
- **Slant %** - Indicates the duty cycle of the slant control proportional valves. This value will be 0 if the slant control is not enabled, and can vary in output up to 100 when slant control is engaged and operating. A minimum value will be maintained when the slant control system is enabled, and move slightly when the boom is re-centering. It also allows the operator to see the duty cycle value of the slant control proportional valves while rotating the boom with the Manual Slant Control icons.
- **Stats** - Reflects the boom performance. This value is for Raven use only.
- **Manual Boom Control** - This can be used to troubleshoot wiring or hydraulic issues by using the AutoBoom valve for raising and lowering functions, and the machine's valve for center rack functionality (if the machine is equipped with center rack control cabling).
- **Manual Slant Control** - Used to manually rotate the boom clockwise or counterclockwise relative to the machine's chassis. This can be used to troubleshoot wiring or hydraulic issues by using the AutoBoom valves for raising, lowering, and boom rotation functions, and the machine's valve for center rack functionality (if the machine is equipped with center rack control cabling).

Alarms

Alarm tones will not sound if the operator is navigating through any of the configuration menus. However, the enable/disable alarms will always sound when appropriate.

- **Pressure alarms (PowerGlide Plus mode only)** - The pressure alarm occurs if the pressure is detected at a level lower than the alarm set point. The pressure alarm is a steady tone, and will continue to sound for one second after the pressure rises above the set point.
- **Proximity alarm (if equipped)** - The proximity alarm occurs if a boom is not completely folded but is enabled. The boom will be disabled after five seconds.
- **Check AutoBoom high current voltage alarm** - This alarm occurs if the node senses a low voltage supply to the node. Check the power and ground wiring to the node.
- **Low pressure alarms** - When the pressure in the left or right tilt cylinders is low, the low pressure alarm will sound. The alarm is a steady tone, and will stop immediately after pressure is restored to the system.
- **Pressure sensor failure alarms** - The pressure sensor failure alarm occurs immediately when a pressure sensor is not detected. The alarm is a steady tone, and will stop immediately after the sensor is located.
- **Ultrasonic sensor - too low alarm** - This alarm occurs if the ultrasonic sensor is closer than ten inches to the ground for 1/2 a second. The alarm will continue to sound for three seconds.
- **Ultrasonic sensor - too high alarm** - This alarm occurs when the ultrasonic sensor is higher than 65 inches from the ground for five seconds. The alarm will continue to sound for one second.
- **Ultrasonic sensor - failure alarm** - This alarm occurs immediately when an ultrasonic sensor is not detected. The alarm is a steady tone, and will stop immediately after the sensor is located.

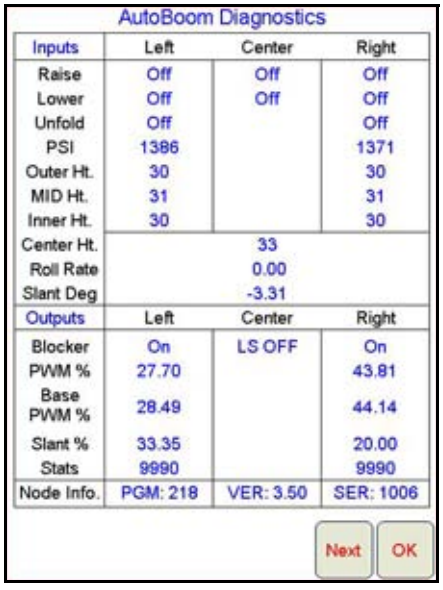
- **Boom unfold alarm** - This alarm applies only to machines that are equipped with proximity sensors. The alarm will occur if the operator tries to enable AutoBoom with the booms folded. It may also occur if the center sensor is greater than 60 inches off the ground, or it does not receive an echo from the ground.
- **Low HC Power** - This alarm occurs when the voltage to the node drops below 12 volts. This alarms is a steady tone, and stops immediately when proper voltage is restored to the node.
- **Center Rotation Sensor Out of Range** - This alarm occurs when the center rotation sensor is out of the calibrated range. This alarm is a steady tone, and will stop immediately when the sensor is in the calibrated range.
- **Center Rotation Sensor Failure** - Occurs when there is no signal from the rotation sensor when slant control is enabled. This alarm is a steady tone, and will stop immediately when the center rotation sensor signal is detected.
- **Other tones** - When enabling the AutoBoom system in automatic mode via the machine's boom control functions or switches, a single beep will occur. When disabling AutoBoom, a double beep will sound.

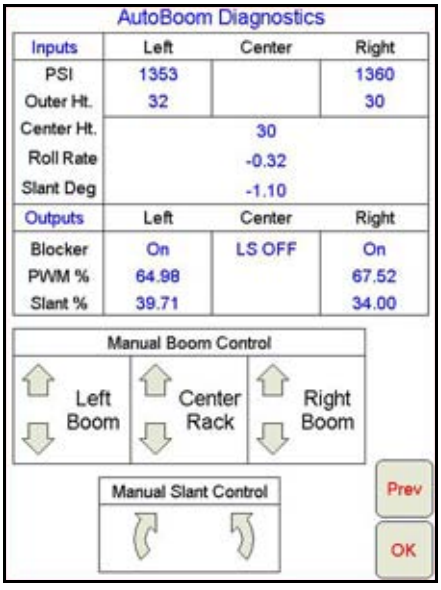
System Calibration

AutoBoom Pre-Calibration Diagnostics

While every effort has been made to properly label and document connections for the hydraulic and electrical components of the AutoBoom system, boom function connections may not be identified due to changes in the make and model of the machine. This makes it especially important to trace the hoses from the connection points and verify the electrical connections are correct to ensure proper AutoBoom system operation. In order to verify connections, it is necessary to perform a pre-calibration diagnostic test.

1. Select **Setup**.
2. Select **Diag**. The following screen will appear:





3. Verify that the following components on the Viper Pro screen are displayed correctly and change when raising and lowering the booms via the machine's controls and the AutoBoom manual functions:
   - Pressures
   - Sensor heights

- Right and left raise/lower functions
- Center raise/lower functions
- Fold/unfold functions
- Slant rotation clockwise/counterclockwise

Calibration

After the AutoBoom installation is complete, it is necessary to calibrate the AutoBoom system before use. AutoBoom calibration requires pressure in the machine's cylinders and enough boom travel to allow the system to find the system base duty cycles for operation. Booms must be free to travel 10" up or down without reaching the tops or bottoms of the cylinder stops.

During calibration and operation, it is important to keep the machine running at a sufficient engine RPM so that the hydraulic pump is able to supply a full flow to the hydraulic system.

Note: *If the machine has an open center hydraulic system, or the type of hydraulic system is unknown, all calibration procedures should be performed with the machine operating at the normal operating engine RPM.*

Important: *Be sure that the area is clear of people and obstructions before beginning the calibration process.*

1. Move the machine to a flat area.
2. Verify that AutoBoom is turned on.
3. Verify that the booms are unfolded, and lower the center rack.

Note: *If the booms do not go over center or are travel limited, raise the booms so that the boom tips are approximately ten inches above the horizontal position and lower the center section to approximately 20 inches.*

4. Using a tape measure, measure the distance from the bottom of the sensor to the spray nozzle tip.
5. Access the AutoBoom Setup screen.
6. Adjust the vertical sensor height offset settings in the Viper Pro to sensor position as measured in step 4.
   - Positive offsets indicate the sensor surface is located above the nearest spray tips.

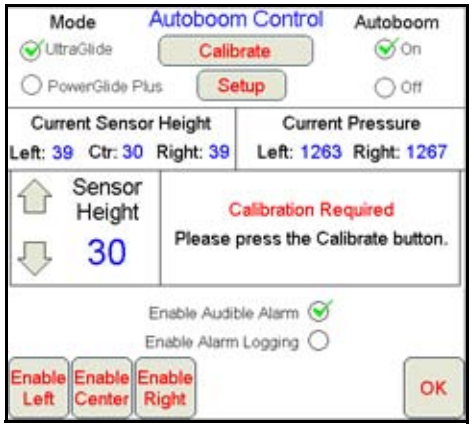
- Negative offsets indicate the sensor surface is located below the nearest spray tips.
- Inner, mid, outer, and center offsets are not required to be the same across the width of the machine, but they must be correctly measured relative to the spray tips.

Note: *If the machine is equipped with a center sensor, the center rack height can be verified through the main menu or diagnostics screen in AutoBoom section of the Viper Pro.*

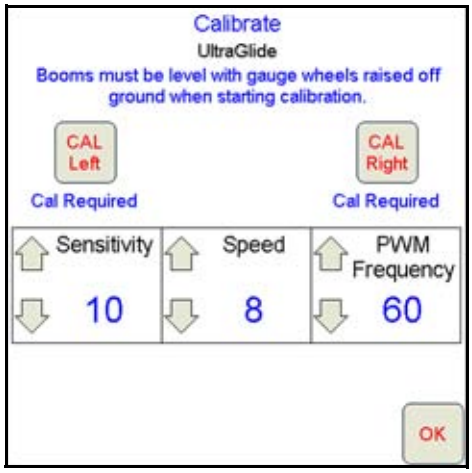
7. Raise the boom tips to approximately the target height.

Note: *The default target height is 30 inches. Verify that the booms are not fully raised to the boom stops. If gauge wheels are installed, the setting must be adjusted to 40 - 45 inches to prevent the wheels from touching the ground during the system calibration.*

8. Touch inside the AutoBoom section on the screen to display the AutoBoom Control screen.

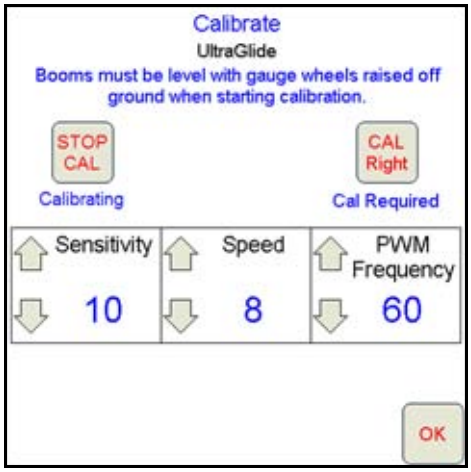


9. Select **UltraGlide** from the Mode section in the upper-left corner of the screen and turn AutoBoom on in the upper-left corner.
10. Select **Calibrate**. The following screen will appear:

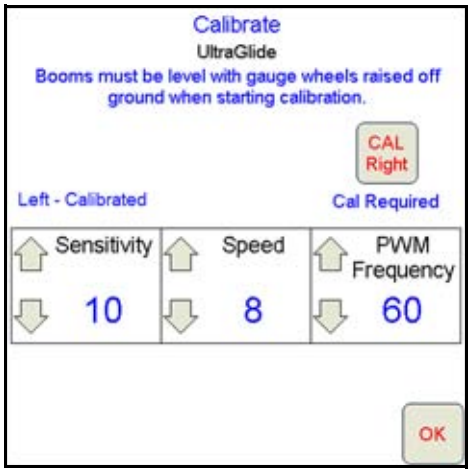


11. Select **CAL Left** to calibrate of the left boom.

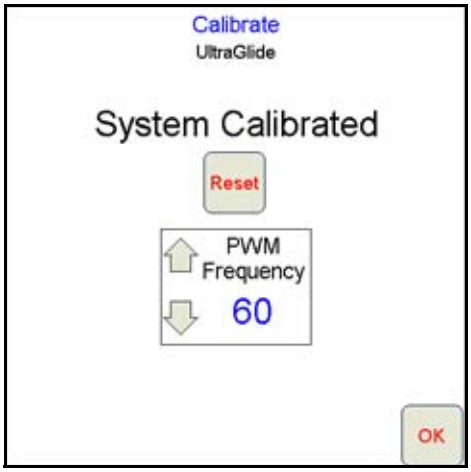
Note: *The left boom will raise and then lower. This is a normal part of the calibration process. During the calibration process, the following screen will be displayed:*



Note: *The calibration process may take several seconds to complete. "Calibrating" will flash, indicating that calibration is in progress. If the boom fails to calibrate, touch* ***STOP CAL*** *and refer to Chapter 7, Troubleshooting on page 103. Once the left boom calibration is complete, the following screen will appear:*



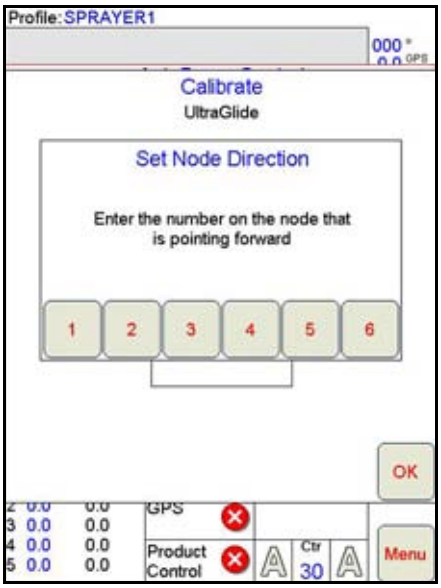
12. Repeat steps 9 - 10 above to calibrate the right boom. Once the right boom calibration process is complete, the following screen will appear:



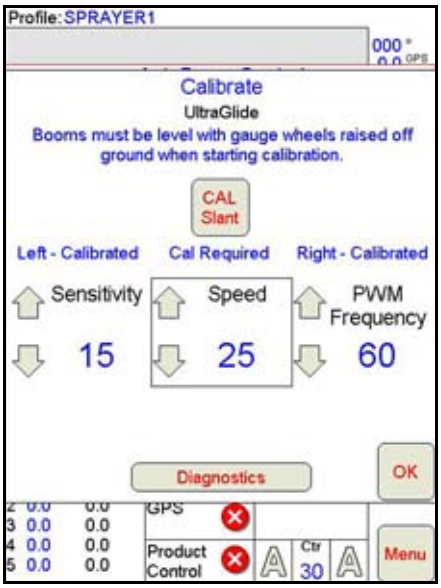
13. Select **OK** to return to the AutoBoom Control screen.

Slant Control Calibration

1. Verify the Slant Control feature is turned on in the Setup screen.
2. Select the **CAL** icon on the Home screen. The following screen will appear:



3. Enter the number of the direction arrow on the node that is pointing forward, then select **OK**. The following screen will appear:



4. Select the **CAL Slant** icon on the Calibration screen.

Note: *The boom tips may raise automatically to allow for full rotation of the center section. Pressure in one slant cylinder will increase until the center section begins to rotate slightly. The center section will then rotate fully clockwise then counterclockwise to calibrate the center rotation sensor position.*

Note: *The center rotation sensor may be re-centered by recalibrating the slant control or by manual adjustment of the centering bolt while the center section is confirmed to be in the center position.*

Center Rack Raise/Lower Calibration

There are many different valve configurations used to control the machine's center rack functions. The AutoBoom system must "learn" which of the machine's solenoids are used to raise and lower the booms. Complete the following steps to calibrate the center rack control feature after the individual booms have been calibrated.

1. Press and hold the center rack raise button on the machine's control panel or joystick for six seconds so that the center rack raises.

Note: *The center rack may reach the upper limit of travel during this time, but continue holding the button until the full six seconds has passed.*

2. Press and hold the center rack lower button on the machine's control panel or joystick for six seconds so that the center rack lowers.

Note: *The center rack may reach the lower limit of travel during this time, but continue holding the button until the full six seconds has passed.*

Routine Operation

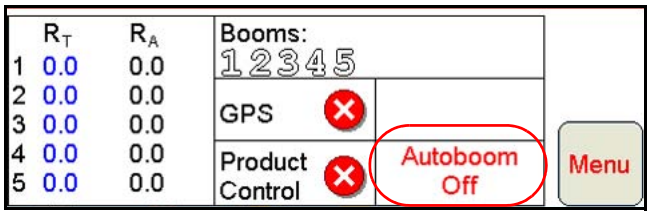
Joystick Functions

When AutoBoom control is on, control of each boom can be enabled or disabled via the Viper Pro console or by tapping the sprayer's switch functions (if equipped).

Note: *Pressing the down function for longer than 1/2 a second will switch the function to manual control. The operator must tap the down function to enable Autoboom.*

- A single up-tap on the sprayer's switch functions disables AutoBoom on that boom.
- A single down-tap on the sprayer's switch functions enables AutoBoom on that boom.

Enabling AutoBoom via the Viper Pro

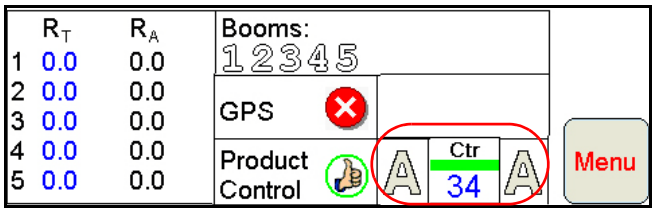


1. Touch **AutoBoom Off** on the Viper Pro screen.

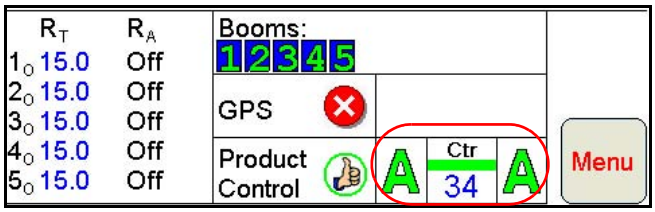
2. Select **On** in the upper-right corner of the screen.

Note: *The AutoBoom system is now powered on, but is not yet enabled.*

3. Select **OK** to return to the Viper Pro main screen. The AutoBoom section should appear similar to the screen shown below:



4. Press the gray **A** buttons. Once the buttons turn green as shown below, AutoBoom is enabled and ready to operate.



Note: *AutoBoom can be disabled by pressing the green A buttons. Once the buttons turn gray, AutoBoom is disabled.*

Boom Adjustments When Approaching Headlands (If Equipped with Gauge Wheels)

When approaching the headlands to make a turn, the gauge wheel must be raised approximately six inches from the ground to prevent it from sliding sideways or backward, causing damage to the gauge wheel assembly.

Center Rack Control

AutoBoom Enabled, Slant Control On, and Center Rack Control On

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

Note: *Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.*

Note: *Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.*

- **Center Down Switch** - A single down-tap will lower the center rack to the desired spray height, enable the center rack, slant control, and both booms.
- **Center Up Switch** - A single up-tap will disable the center rack, slant control, and both booms. Two consecutive up-taps will raise the center rack to the desired transport height. Four consecutive up-taps will raise the center rack to the maximum height, turn AutoBoom off, and preserve the new transport height as the maximum height.
    - Set a lower transport height - While the center rack is returning to transport, down-tap once on the center switch when the new transport height is reached.

- Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

AutoBoom Enabled, Slant Control On, and Center Rack Control Off

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

Note: *Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.*

Note: *Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.*

- **Center Down Switch** - Two consecutive down-taps will lower the center rack to the desired spray height and enable slant control and both booms.

Note: *Center rack control will not be enabled since center rack control is off.*

- **Center Up Switch** - Two consecutive up-taps will disable slant control and both booms, and raise the center rack to the desired transport height. Four consecutive up-taps will raise the center rack to the maximum height and turn AutoBoom off, preserving the new transport position as the maximum height.
  - Set a lower transport height - While the center rack is returning to transport, down-tap once on the center switch when the new transport height is reached.
  - Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with the AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

Operating the UltraGlide XT AutoBoom System in PowerGlide Plus Mode

Before populating the hydraulic fittings on the AutoBoom valve, it is necessary to remove orifice fittings from the valve in the PowerGlide Plus system. Failure to remove these fittings from the valve will restrict the down speed of the booms when the system is enabled.

FIGURE 1. Port 3A and 3B Location

1. Locate Ports 3A and 3B on the AutoBoom valve.

FIGURE 2. **Coil Removed from the AutoBoom Valve**

2. Remove the coils from the solenoids near Ports 3A and 3B to gain easy access to those ports.

FIGURE 3. **Port Plugs Removed from the AutoBoom Valve**

3. Use an Allen wrench to remove the plugs from Ports 3A and 3B.

FIGURE 4. **Orifice Fitting Removed from the AutoBoom Valve**

4. Remove the orifice fittings from Ports 3A and 3B.

Important: *Tip the AutoBoom valve on its side and use the Allen wrench to remove the orifice from the cavity, taking care not to let the fitting fall into the valve.*

FIGURE 5. Port Plug Reinstalled on the AutoBoom Valve

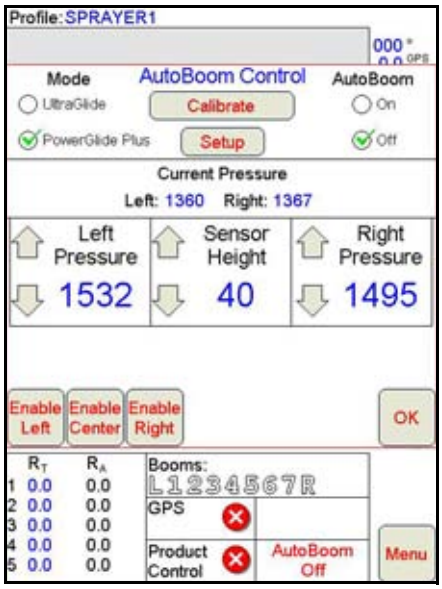
5. Use the Allen wrench to reinstall the port plugs on Ports 3A and 3B of the AutoBoom valve.

FIGURE 6. Coil Reinstalled on the AutoBoom Valve

6. Reinstall the coils on the solenoids of the AutoBoom valve.

Note: *When converting the AutoBoom system back to UltraGlide XT, the orifice fittings must be reinstalled.*

FIGURE 7. **Viper Pro Programmed to Run in PowerGlide Plus Mode**

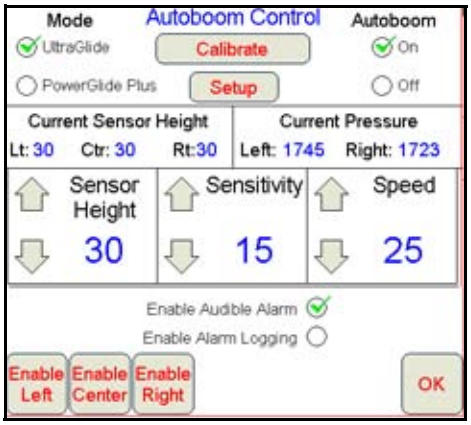


7. Program the Viper Pro to run in PowerGlide Plus mode.

Note: *When converting the AutoBoom system back to UltraGlide XT, the Viper Pro must be reprogrammed to run in the UltraGlide XT mode.*

System Adjustments

Note: *AutoBoom must be enabled after both booms have been calibrated in order to make system adjustments.*



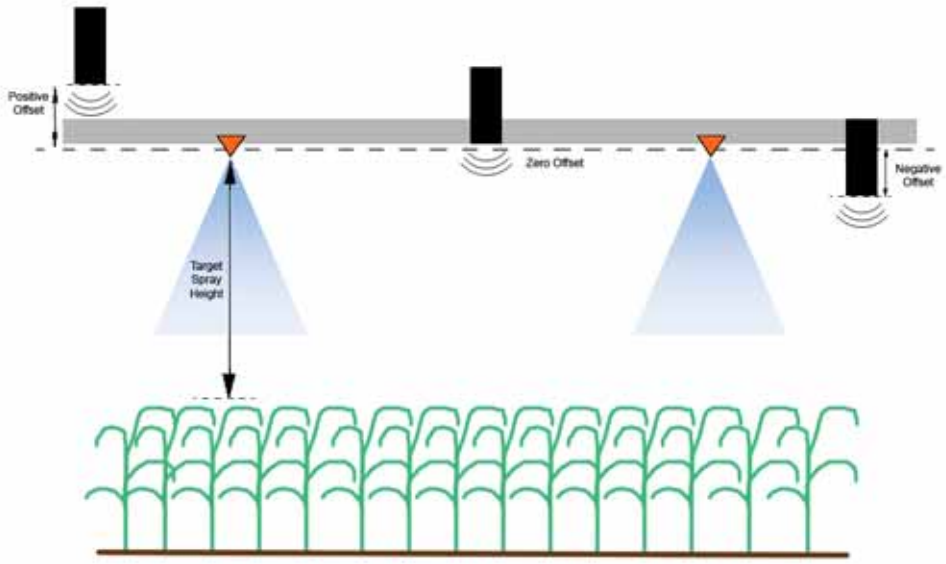
Ultrasonic Sensor Height Offsets

Ultrasonic sensor height offset adjustments are used to compensate for the difference between the height of the sensor surface and the height of the spray tip. The offset height is calculated by measuring the distance from the bottom of the sensor to the height of the crop, measuring the distance between the spray tip to the

height of the crop, and then subtracting the spray tip distance from the sensor distance. Refer to the diagram below to determine whether the offset value should be positive or negative.

Note: *The maximum offset height value is 20 inches.*

Note: *Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop. For row-crop situations, it may be beneficial to adjust the sensor positions to directly over a row, or add additional boom sensors.*



- Touch the up arrow in the Sensor Height section to increase the value representing the distance between the sensor and the ground.
- Touch the down arrow in the Sensor Height section to decrease the value representing the distance between the sensor and the ground.

Note: *On machines with travel-limited booms, center sensor height offsets may need to be entered as less than the measured value from the sensor to the ground to ensure the boom cylinders have sufficient pressure during operation.*

Sensitivity

1. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface.

Note: *The boom should react immediately when your hand is approximately 6” from the ground.*

2. Adjust the Sensitivity setting as needed to make the boom more or less reactive to hand motions.

Note: *The default setting is 15. If the Sensitivity is too high, the boom will appear unstable and jittery, reacting to slight changes in target height or crop movement. During routine operation, AutoBoom*

should be unresponsive to changes in height of 2” - 3”, but should react quickly to changes of 5” or more.

The typical Sensitivity setting for most machines with a 30” target spray height is 13 - 17. For target spray heights less than 25”, lower the sensitivity setting and for target heights greater than 40”, raise it.

For row-crop situations, or when crop conditions are sparse and not fully covering the ground, it may be beneficial to decrease the sensitivity so the boom is less reactive to sudden changes in crop height, and less likely to cause sudden movements that diminish performance.

Speed

The Speed setting controls how fast the boom will move away from an obstacle, and how much the boom overshoots the target height. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. Adjust the Speed setting as needed so that boom raise rates match hand movement rates, but so that the booms don’t overreact and become unstable.

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12” of the sensor surface.

Note: *The boom should react immediately and adjust at a raise speed matching the hand movement, overshooting the new target height by one foot or less.*

2. Adjust the Speed setting as needed.

Note: *The default setting is 25. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. The typical Speed setting that works best for most machines is 22 - 27, but can vary depending on the static pressures of the boom, boom geometry, and the Sensitivity settings.*

Stability

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12 inches of the sensor surface, while observing the movement of the opposite boom.

Note: *The opposite boom should raise slightly (usually no more than six inches) simultaneously.*

2. Adjust the Stability setting to minimize movement of the opposite boom.

Note: *Lower the Stability value to make the opposite boom more rigid, but keep the number high enough to allow for natural movement of the boom without affecting the chassis roll.*

Slant Gain

Allows fine-turning of the allowable rotation of the center section suspension. Higher Slant Gain values cause the slant control to react more aggressively when chassis roll is sensed by the node and can cause the boom to be excessively rigid, possibly causing damage to the center rack. Lower Slant Gain values cause the slant control to be less aggressive and can cause the system to be unreactive, not controlling the suspension based on the chassis roll.

1. Take the machine to the field and observe the rotation of the center section suspension with the AutoBoom system on and left, right, and slant enabled.

2. Adjust the Slant Gain setting to cause the slant control to be more or less reactive.

Note: *The default setting is 15.*

Min Press%

Note: *On machines with travel-limited booms, operate the AutoBoom system with center rack control enabled, or with the center sensor at or slightly below the target height to prevent the booms from continuously entering the Min Press % mode. This mode is for boom emergency protection only, and AutoBoom system should not be run in this mode during routine operation.*

1. Raise the center rack section to the target height, so that the booms and center rack are horizontal.
2. Enable the AutoBoom system.
3. Locate the Min Press% setting in the AutoBoom control menus.

Note: *The default setting is 65.*

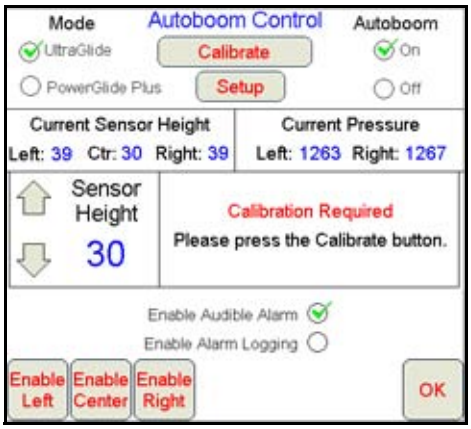
4. Increase the Min Press% value to approximately 80.
5. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface, or until the boom travels up approximately three feet higher than the original target.
6. Pull hand away, and verify that the booms lower slowly after a slight delay.

Note: *If the booms do not lower, decrease the Min Press % setting value by one and repeat the steps above. Continue performing the Min Press % test until the booms begin to lower.*

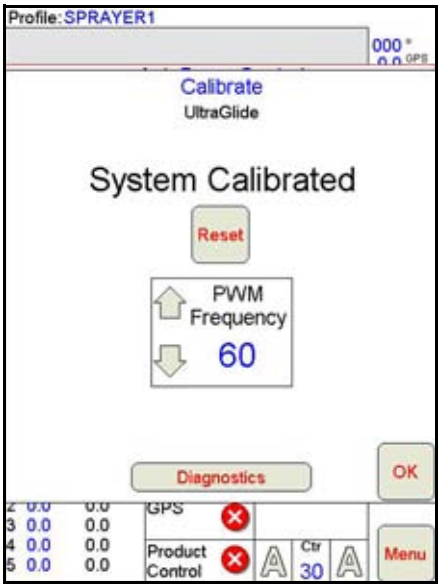
Resetting Defaults

Although it is not normally necessary, there may be circumstances under which it may be necessary to reset the system defaults. Resetting the defaults erases all AutoBoom system settings and adjustments that have been performed. System calibration will be required after the defaults have been reset.

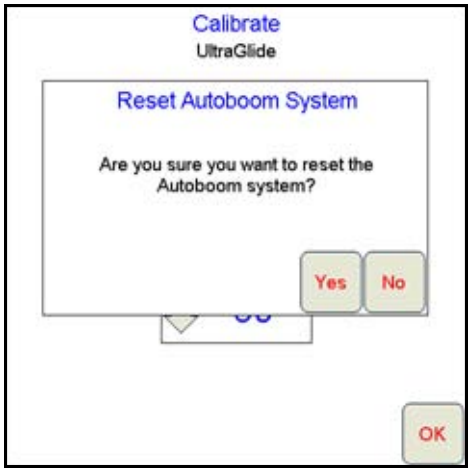
1. Touch anywhere in the AutoBoom section on the Viper Pro screen. The following screen will be displayed:



2. Select **Calibrate**. The following screen will appear:



3. Select **Reset**. The following screen will appear:



4. Select **Yes** to reset the AutoBoom system, or **No** to return to the calibrations screen.

CHAPTER 5

Envizio Pro Routine Operation

Introduction

Control and Navigation Icons

	AutoBoom is currently turned off. The system must be turned on to be used. Touch this icon to turn AutoBoom on.
	AutoBoom is currently turned on. Touch this icon to turn AutoBoom off.
	The Up icon increases displayed values in preset increments. Press this icon to increase the value until the desired value is displayed.
	The Down icon decreases displayed values in preset increments. Press this icon to increase the value until the desired value is displayed.
	The Next icon accepts changes and proceeds to the next page in the setup procedure.
	The Previous icon returns to the previous page in the setup procedure.
	The Accept icon confirms and saves any changes made to the point in the setup procedure in which it is displayed.
	The Cancel icon exits the page currently displayed without accepting or saving any changes.

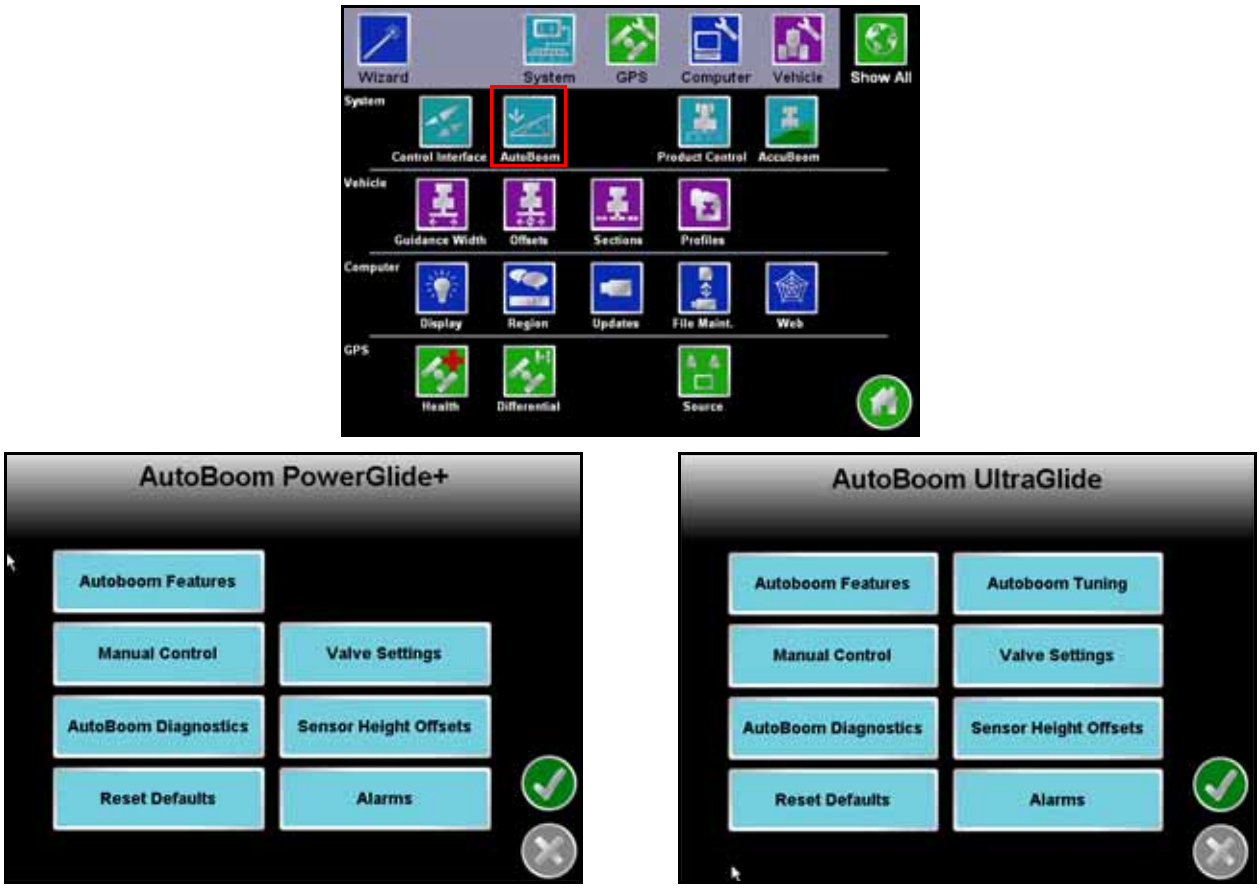
AutoBoom Status Display

The current status of the AutoBoom system can be determined by the message displayed in the guidance page of the Envizio Pro.

	AutoBoom is off and disabled.
	AutoBoom is on but disabled.
	AutoBoom is on and enabled
	The left boom is enabled, the center rack and right boom are disabled.
	The right boom is enabled, the center rack and left boom are disabled.
	The left boom and center rack are enabled, the right boom is disabled.
	The right boom and center rack are enabled, the left boom is disabled.
	The center rack is enabled, the left and right booms are disabled.

Envizio Pro Setup Pages

FIGURE 1. AutoBoom Main Menu



The AutoBoom setup pages allow adjustment of all of the parameters in the AutoBoom system. To access these tools, select the **AutoBoom** icon, then select the appropriate button on the AutoBoom main menu.

FIGURE 2. AutoBoom Features Page

- **AutoBoom Features** - Allows the operator to switch between the PowerGlide Plus and UltraGlide XT modes.

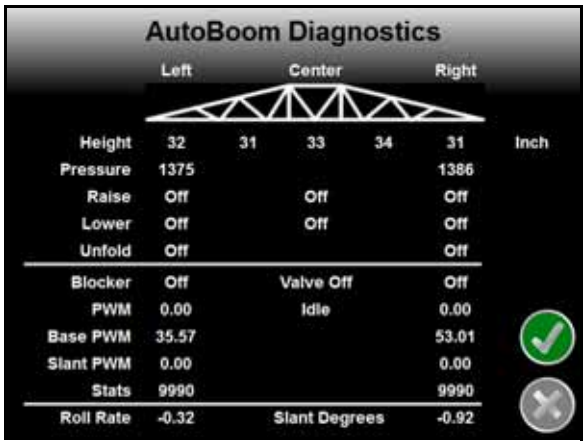
- Allows the operator to turn on Center Rack Control and Slant Control features.
- When in UltraGlide XT mode, the AutoBoom Features option also allows the operator to disable the outer-most boom sensors if the machine is equipped with optional inside boom sensors. This feature is useful when the outer boom tips are folded in and not able to control.

Note: *The system must be re-calibrated when the Outer Sensors option is disabled, then re-enabled.*

FIGURE 3. Manual Control Page

- **Manual Control Page -** The first Manual Control page allows the operator to manually raise and lower the boom functions using the AutoBoom valve for left and right functions, and the machine's hydraulic valve for center rack functions. The Manual Slant Control buttons allow the operator to manually rotate the boom clockwise or counterclockwise relative to the machine's chassis. The manual control buttons can be used to troubleshoot wiring or hydraulic issues. The second Manual Control page allows the speed at which the AutoBoom hydraulic valve manually raises and lowers the booms to be adjusted on machines that do not have their own hydraulic control. Since most machines are equipped to hydraulically control boom functions, the default setting is 0.

FIGURE 4. AutoBoom Diagnostics Page



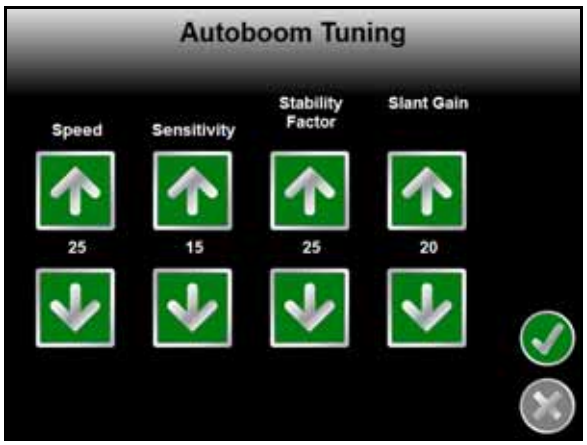
- **AutoBoom Diagnostics** - This page allows the status of all AutoBoom inputs and outputs to be viewed on the Envizio Pro display.
  - **Height** - Displays the individual sensor heights relative to the ground, adjusted for the values entered in the Sensor Height Offsets.
  - **Pressure** - Displays the actual pressure in the left and right boom cylinders at all times.

- **Raise and Lower** -Indicate the status of the boom switches. When using the machine's manual control functions, the corresponding boom switch will indicate On.
- **Unfold** - Indicates the status of the unfold proximity switch (if equipped). The boom will not be enabled until the proximity switch is activated.
- **Blocker** - Indicates the status of the double-blocker output.
- **PWM** - Indicates the duty cycle to the proportional valves. This value will be 0 if the individual booms are disengaged, and will vary in output up to 100 when AutoBoom is engaged and the system is operating.
- **Base PWM** - Indicates the system's calculated static duty cycle to maintain the set height or pressure. This number will typically change slowly from 0 - 5 points during routine operation.
- **Slant PWM** - Indicates the duty cycle of the slant control proportional valves. This value will be 0 if the slant control is not enabled, and can vary in output up to 100 when slant control is engaged and operating. A minimum value will be maintained when the slant control system is enabled, and move slightly when the boom is re-centering
- **Stats** - Reflects the boom performance. This value is for Raven use only.
- **Roll Rate** - Indicates the measured chassis roll rate. This value will change when the machine chassis is rolling left or right.
- **Slant Deg** - Indicates the degrees of detected rotation of the machine's boom relative to the chassis. This value will be nearly zero when the boom suspension is centered, and will change when the boom is rotated relative to the machine's chassis.

FIGURE 5. Reset Defaults Page

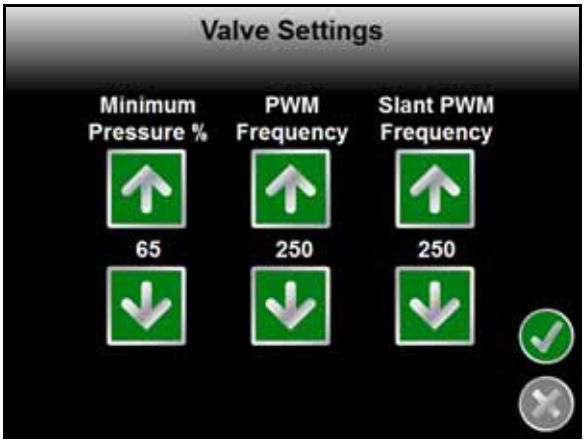
- **Reset Defaults Page** - Although it is not normally necessary, there may be circumstances under which it may be necessary to reset the system defaults. The Reset Defaults page allows the operator to reset the defaults, erasing all AutoBoom system settings and adjustments that have been performed. System calibration is required after the defaults have been reset.

FIGURE 6. **AutoBoom Tuning Page**



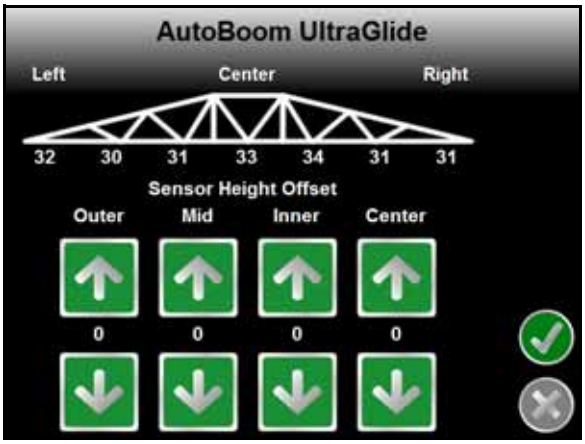
- **AutoBoom Tuning Page** - The AutoBoom tuning page is available in the UltraGlide XT system only.
  - **Speed** - The Speed setting allows the operator to adjust the rate at which the booms raise and lower. The Speed setting should be set so that the boom motion is smooth and does not oscillate.
  - **Sensitivity** - The Sensitivity setting allows the operator to adjust the sensitivity level of the sensors. If the Sensitivity setting is too high, the boom will appear unstable and jittery, reacting to slight changes in the target height or grass movement.
  - **Stability Factor** - The Stability Factor setting allows fine-turning of the rigidity of the machine's center rack. The default value of 20 is recommended for machines with a rigid center rack. A value of 5 - 14 is recommended for machines with center racks that float freely. Adjust this value as needed to prevent boom oscillation.
    - Stability settings of 0 disable the stability control completely, making the left and right booms completely independent of each other. When above target, the control of both booms is accelerated to increase the down speed. This setting is useful for machines that have a rigid center rack.
    - Stability settings of 1 - 99 will adjust the stability of the center section. Lower numbers cause the opposing boom that is not being controlled to counteract the movement of the controlled boom by raising to balance or stabilize the center section and to prevent undesired rotation or movement. While lower numbers allow the booms to react at the same rate and time, low settings may prevent the booms from lowering. Higher stability settings allow the booms to react independently from each other, but may cause the center section to oscillate, diminishing performance.
  - **Slant Gain** (if equipped with slant feature enabled) - Allows fine-tuning of the allowable rotation of the center section suspension. The default value is 15. A higher number will apply more pressure to the slant control cylinders when the chassis is maneuvering over challenging terrain.

FIGURE 7. **Valve Settings Page**



- **Valve Settings Page**
  - **Minimum Pressure %** - Sets a low limit pressure, preventing the boom pressure from falling below a percentage of static pressure, overriding the control when necessary to maintain a low limit of pressure on each boom. Minimum Pressure% also prevents booms from resting on the stops for travel-limited booms.
  - **PWM Frequency** - Sets the frequency of the PWM signal to the proportional control valve. The default value is 250 Hz.This value is automatically detected during calibration and should not be adjusted.
  - **Slant PWM Frequency** - Sets the frequency of the PWM signal to the slant proportional control valve. The default value is 250 Hz.This value is automatically detected during calibration and should not be adjusted.

FIGURE 8. **Sensor Height Offsets Page**



- **Sensor Height Offsets Page** - Allows sensor heights to be adjusted according the mounting location. Enter a positive value if the sensors are mounted above the sprayer tips, and a negative value if the sensors are mounted below. Refer to the Sensor Height Offsets section on page 63 for more information.

Alarms

FIGURE 9. **AutoBoom Alarms**

Alarm tones will not sound if the operator is navigating through any of the configuration menus. However, enable/disable alarms will always sound when appropriate.

Note: *The audible alarms can be disabled by deselecting the AutoBoom Audible Alarm box.*

- **Pressure alarms (PowerGlide Plus mode only)** - The pressure alarm occurs if the pressure is detected at a level lower than the alarm set point. The pressure alarm is a steady tone, and will continue to sound for one second after the pressure rises above the set point.
- **Proximity alarm (if equipped)** - The proximity alarm occurs if a boom is not completely folded but is enabled. The boom will be disabled after five seconds.
- **Check AutoBoom high current voltage alarm** - This alarm occurs if the node senses a low voltage supply to the node. Check the power and ground wiring to the node.
- **Low pressure alarms** - When the pressure in the left or right tilt cylinders is low, the low pressure alarm will sound. The alarm is a steady tone, and will stop immediately after pressure is restored to the system.
- **Pressure sensor failure alarms** - The pressure sensor failure alarm occurs immediately when a pressure sensor is not detected. The alarm is a steady tone, and will stop immediately after the sensor is located.
- **Ultrasonic sensor - too low alarm** - This alarm occurs if the ultrasonic sensor is closer than ten inches to the ground for 1/2 a second. The alarm will continue to sound for three seconds.
- **Ultrasonic sensor - too high alarm** - This alarm occurs when the ultrasonic sensor is higher than 65 inches from the ground for five seconds. The alarm will continue to sound for one second.
- **Ultrasonic sensor - failure alarm** - This alarm occurs immediately when an ultrasonic sensor is not detected. The alarm is a steady tone, and will stop immediately after the sensor is located.
- **Boom unfold alarm** - This alarm applies only to machines that are equipped with proximity sensors. The alarm will occur if the operator tries to enable AutoBoom with the booms folded. It may also occur if the center sensor is greater than 60 inches off the ground, or it does not receive an echo from the ground.
- **Low HC Power** - This alarm occurs when the voltage to the node drops below 12 volts. This alarms is a steady tone, and stops immediately when proper voltage is restored to the node.
- **Center Rotation Sensor Out of Range** - This alarm occurs when the center rotation is out of the calibrated range. This alarm is a steady tone, and will stop immediately when the sensor is in the calibrated range.
- **Center Rotation Sensor Failure** - Occurs when there is no signal from the rotation sensor when slant control is enabled. This alarm is a steady tone, and will stop immediately when the center rotation sensor signal is detected.

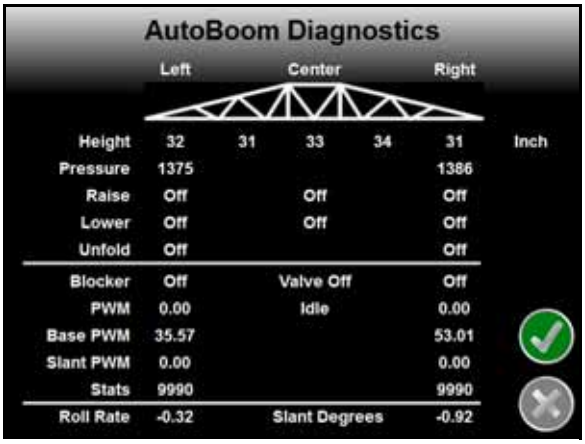
- **Other tones** - When enabling the AutoBoom system in automatic mode via the machine's boom control functions or switches, a single beep will occur. When disabling AutoBoom, a double beep will sound.

System Calibration

AutoBoom Pre-Calibration Diagnostics

While every effort has been made to properly label and document connections for the hydraulic and electrical components of the AutoBoom system, boom function connections may not be identified due to changes in the make and model of the machine. This makes it especially important to trace the hoses from the connection points and verify the electrical connections are correct to ensure proper AutoBoom system operation. In order to verify connections, it is necessary to perform a pre-calibration diagnostic test.

1. Select **AutoBoom Diagnostics**. The following page will appear:



2. Verify that the following components on the Envizio Pro page are displayed correctly and change when raising and lowering the booms via the machine's controls and the AutoBoom manual functions:
   - Pressures
   - Sensor heights
   - Right and left raise/lower functions
   - Center raise/lower functions
   - Fold/unfold functions
   - Slant rotation clockwise/counterclockwise

Calibration

After the AutoBoom installation is complete, it is necessary to calibrate the computer and vehicle before use. AutoBoom calibration requires pressure in the machine's cylinders and enough boom travel to allow the system to find the system base duty cycles for operation. Booms must be free to travel 10" up or down without reaching the tops or bottoms of the cylinder stops.

During calibration and operation, it is important to keep the machine running at a sufficient engine RPM so that the hydraulic pump is able to supply a full flow to the hydraulic system.

Note: *If the machine has an open center hydraulic system, or the type of hydraulic system is unknown, all calibration procedures should be performed with the machine operating at the normal operating engine RPM.*

Important: *Be sure that the area is clear of people and obstructions before beginning the calibration process.*

1. Move the machine to a flat area.
2. Verify that the booms are unfolded, and lower the center rack.

Note: *If the booms do not go over center or are travel limited, raise the booms so that the boom tips are approximately ten inches above the horizontal position and lower the center section to approximately 20 inches.*

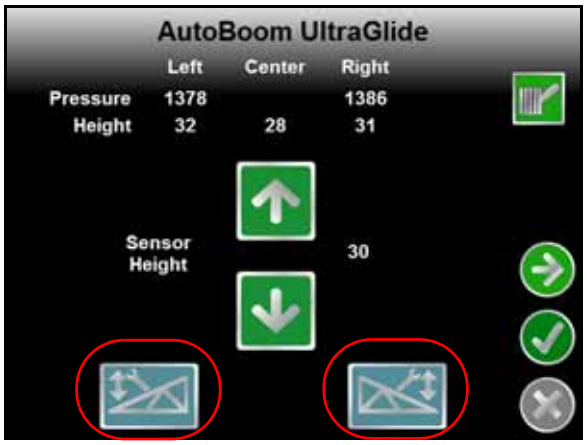
3. Using a tape measure, measure the distance from the bottom of the sensor to the spray nozzle tip.
4. Select the **Tools** icon on the main Envizio Pro screen.
5. Select the **AutoBoom** icon.

Note: *If the Function Disabled page appears when the AutoBoom icon is selected, troubleshoot problems with the AutoBoom node. Refer to the Envizio Pro Installation and Operation manual for troubleshooting information.*

6. Select **UltraGlide**.
7. Select the **Accept** icon.
8. Verify that Autoboom is turned on.
9. Adjust the vertical sensor height offset settings in the Envizio Pro to sensor position as measured in step 3.
   - Positive offsets indicate the sensor surface is located above the nearest spray tips.
   - Negative offsets indicate the sensor surface is located below the nearest spray tips.
   - Inner, mid, outer, and center offsets are not required to be the same across the width of the machine, but they must be correctly measured relative to the spray tips.
10. Raise the boom tips to approximately the target height.

Note: *The default target height is 30 inches. Verify that the booms are not fully raised to the stops. If gauge wheels are installed, the setting must be adjusted to 40 - 45 inches to prevent the wheels from touching the ground during system calibration.*

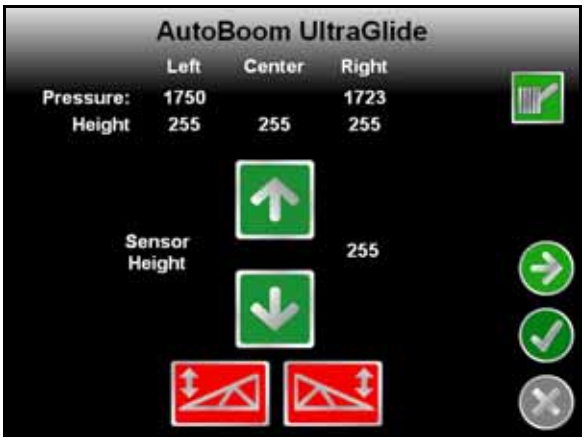
FIGURE 10. Calibrate Booms



11. Select the blue left boom icon to calibrate the left boom.

Note: *The message "Calibration in Process" will appear during the system calibration. The calibration process may take several seconds to complete. If the boom fails to calibrate, touch select* ***Cancel Calibration*** *and refer to Chapter 7, Troubleshooting on page 103.*

12. Select the blue right boom icon to calibrate the right boom. Once the right boom has calibrated, the following screen will appear:

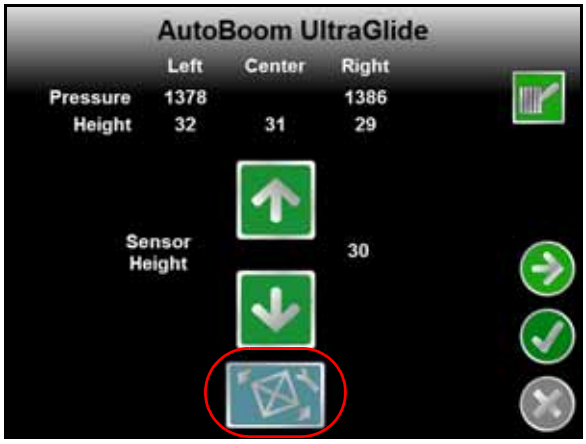


13. Select the **Next** button to return to the AutoBoom main menu.

Slant Control Calibration

1. Verify the Slant Control feature is turned on in the Features screen.

FIGURE 11. Main Screen



2. Return to the Main screen and select the slant calibration icon.
3. Enter the number of the direction arrow on the node that is pointing forward.
4. Select the Slant Calibration icon on the Calibration screen.

Note: *The boom tips may raise automatically to allow for full rotation of the center section. Pressure in one slant cylinder will increase until the center section begins to rotate slightly. The center section*

will then rotate fully clockwise then counterclockwise to calibrate the center rotation sensor position.

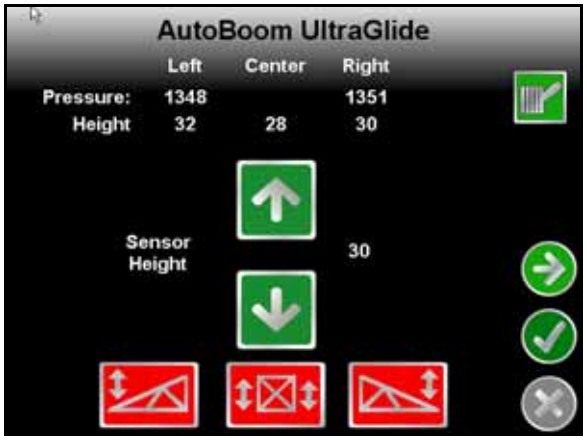
Note: *The center rotation sensor may be re-centered by recalibrating the slant control or by manual adjustment of the centering bolt while the center section is confirmed to be in the center position.*

Center Rack Raise/Lower Calibration

There are many different valve configurations used to control the machine's center rack functions. The AutoBoom system must "learn" which of the machine's solenoids are used to raise and lower the booms. Complete the following steps to calibrate the center rack control feature after the individuals booms have been calibrated.

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

1. From the AutoBoom Features page, ensure **Center Rack Control** is selected.
2. Select the **Accept** icon.



3. Press and hold the center rack raise button on the machine's joystick for six seconds so that the center rack raises.

Note: *The center rack may reach the upper limit of travel during this time, but continue holding the button until the full six seconds has passed.*

4. Press and hold the center rack lower button on the joystick for six seconds so that the center rack lowers.

Note: *The center rack may reach the upper limit of travel during this time, but continue holding the button until the full six seconds has passed.*

Routine Operation

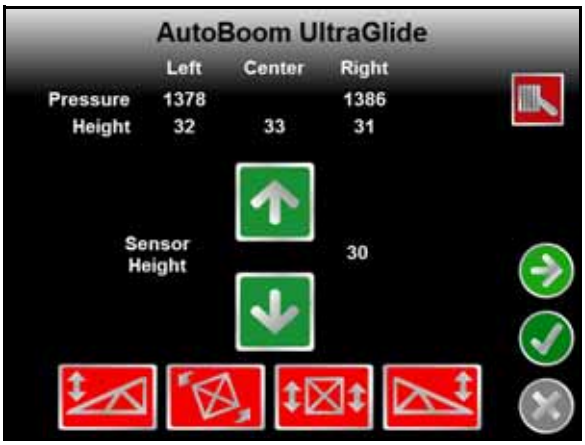
Joystick Functions

When AutoBoom control is on, control of each boom can be enabled or disabled via the Envizio Pro console or by tapping the sprayer's switch functions (if equipped).

Note: *Pressing the down function for longer than 1/2 a second will switch the function to manual control. The operator must tap the down function to enable Autoboom.*

- A single up-tap on the sprayer's switch functions disables AutoBoom on that boom.
- A single down-tap on the sprayer's switch functions enables AutoBoom on that boom.

Enabling AutoBoom via the Envizio Pro



1. Enable the left boom by selecting the red left boom icon on the bottom of the page.
2. Enable the right boom by selecting the red right boom icon on the bottom of the page.

Boom Adjustments When Approaching Headlands (If Equipped with Gauge Wheels)

When approaching the headlands to make a turn, the gauge wheel must be raised approximately six inches from the ground to prevent it from sliding sideways or backward, causing damage to the gauge wheel assembly.

Center Rack Control

AutoBoom Enabled, Slant Control On, and Center Rack Control On

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

Note: *Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.*

Note: *Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.*

- **Center Down Switch** - A single down-tap will lower the center rack to the desired spray height, enable the center rack, slant control, and both booms.
- **Center Up Switch** - A single up-tap will disable the center rack, slant control, and both booms. Two consecutive up-taps will raise the center rack to the desired transport height. Four consecutive up-taps will raise the center rack to the maximum height, turn AutoBoom off, and preserve the new transport height as the maximum height.
  - Set a lower transport height - While the center rack is returning to transport, down-tap once on the center switch when the new transport height is reached.
  - Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

AutoBoom Enabled, Slant Control On, and Center Rack Control Off

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

Note: *Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.*

Note: *Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.*

- **Center Down Switch** - Two consecutive down-taps will lower the center rack to the desired spray height and enable slant control and both booms.

Note: *Center rack control will not be enabled since center rack control is off.*

- **Center Up Switch** - Two consecutive up-taps will disable slant control and both booms, and raise the center rack to the desired transport height. Four consecutive up-taps will raise the center rack to the maximum height and turn AutoBoom off, preserving the new transport position as the maximum height.
  - Set a lower transport height - While the center rack is returning to transport, down-tap once on the center switch when the new transport height is reached.
  - Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with the AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

Operating the UltraGlide XT AutoBoom System in PowerGlide Plus Mode

Before populating the hydraulic fittings on the AutoBoom valve, it is necessary to remove orifice fittings from the valve in the PowerGlide Plus system. Failure to remove these fittings from the valve will restrict the down speed of the booms when the system is enabled.

FIGURE 12. Port 3A and 3B Location

1. Locate Ports 3A and 3B on the AutoBoom valve.

FIGURE 13. Coil Removed from the AutoBoom Valve

2. Remove the coils from the solenoids near Ports 3A and 3B to gain easy access to those ports.

FIGURE 14. **Port Plugs Removed from the AutoBoom Valve**

3. Use an Allen wrench to remove the plugs from Ports 3A and 3B.

FIGURE 15. **Orifice Fitting Removed from the AutoBoom Valve**

4. Remove the orifice fittings from Ports 3A and 3B.

Important: *Tip the AutoBoom valve on its side and use the Allen wrench to remove the orifice from the cavity, taking care not to let the fitting fall into the valve.*

FIGURE 16. **Port Plug Reinstalled on the AutoBoom Valve**

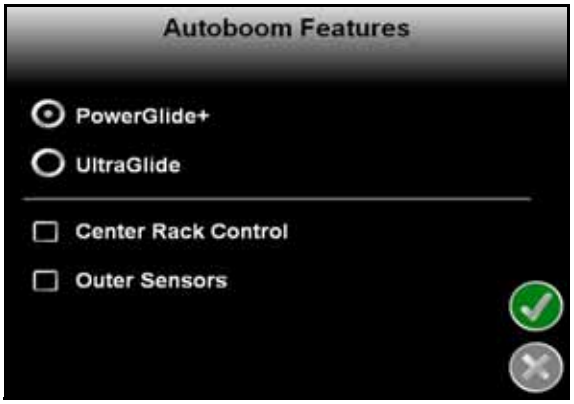
5. Use the Allen wrench to reinstall the port plugs on Ports 3A and 3B of the AutoBoom valve.

FIGURE 17. Coil Reinstalled on the AutoBoom Valve

6. Reinstall the coils on the solenoids of the AutoBoom valve.

Note: *When converting the AutoBoom system back to UltraGlide XT, the orifice fittings must be reinstalled.*

FIGURE 18. Envizio Pro Programmed to Run in PowerGlide Plus Mode



7. Program the Envizio Pro to run in PowerGlide Plus mode.

Note: *When converting the AutoBoom system back to UltraGlide XT, the Envizio Pro must be reprogrammed to run in UltraGlide XT mode.*

5

System Adjustments

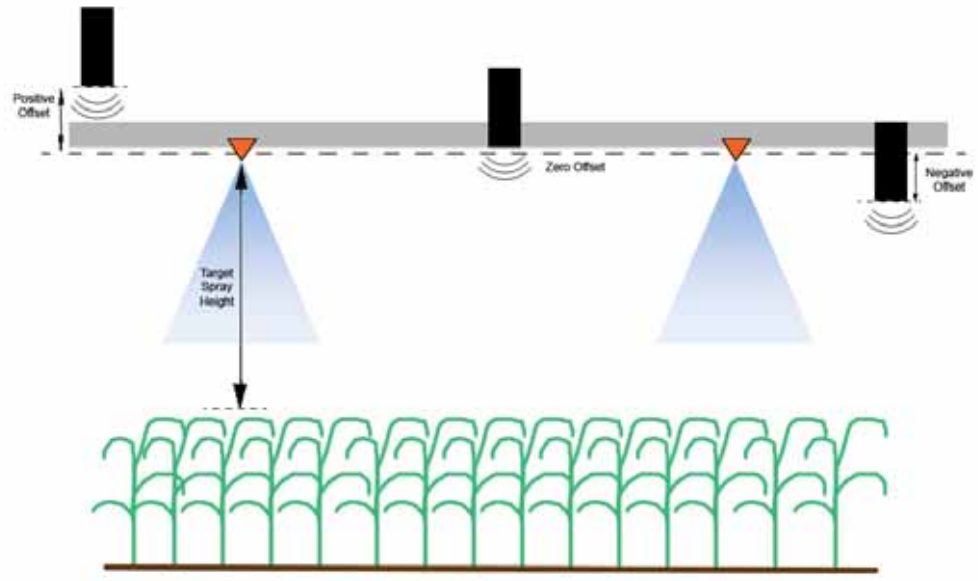
Ultrasonic Sensor Height Offsets

Ultrasonic sensor height offset adjustments are used to compensate for the difference between the height of the sensor surface and the height of the spray tip. The offset height is calculated by measuring the distance from the bottom of the sensor to the height of the crop, measuring the distance between the spray tip to the

height of the crop, and then subtracting the spray tip distance from the sensor distance. Refer to the diagram below to determine whether the offset value should be positive or negative.

Note: *The maximum offset height value is 20 inches.*

Note: *Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop. For row-crop situations, it may be beneficial to adjust the sensor positions to directly over a row, or add additional boom sensors.*



- Touch the up arrow in the Sensor Height section to increase the value representing the distance between the sensor and the ground.
- Touch the down arrow in the Sensor Height section to decrease the value representing the distance between the sensor and the ground.

Note: *On machines with travel-limited booms, center sensor height offsets may need to be entered as less than the measured value from the sensor to the ground to ensure the boom cylinders have sufficient pressure during operation.*

Sensitivity

1. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface.

Note: *The boom should react immediately when your hand is approximately 6” from the ground.*

2. Adjust the Sensitivity setting as needed to make the boom more or less reactive to hand motions.

Note: *The default setting is 15. If the Sensitivity is too high, the boom will appear unstable and jittery, reacting to slight changes in target height or crop movement. During routine operation, AutoBoom*

should be unresponsive to changes in height of 2” - 3”, but should react quickly to changes of 5” or more.

The typical Sensitivity setting for most machines with a 30” target spray height is 13 - 17. For target spray heights less than 25”, lower the sensitivity setting and for target heights greater than 40”, raise it.

For row-crop situations, or when crop conditions are sparse and not fully covering the ground, it may be beneficial to decrease the sensitivity so the boom is less reactive to sudden changes in crop height, and less likely to cause sudden movements that diminish performance.

Speed

The Speed setting controls how fast the boom will move away from an obstacle, and how much the boom overshoots the target height. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. Adjust the Speed setting as needed so that boom raise rates match hand movement rates, but so that the booms don’t overreact and become unstable.

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12” of the sensor surface.

Note: *The boom should react immediately and adjust at a raise speed matching the hand movement, and overshoot the new target height by one foot or less.*

2. Adjust the Speed setting as needed.

Note: *The default setting is 25. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. The typical Speed setting that works best for most machines is 22 - 27, but can vary depending on the static pressures of the boom, boom geometry, and the Sensitivity settings.*

Stability

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12 inches of the sensor surface, while observing the movement of the opposite boom.

Note: *The opposite boom should raise slightly (usually no more than six inches) simultaneously.*

2. Adjust the Stability setting to minimize movement of the opposite boom.

Note: *Lower the Stability value to make the opposite boom more rigid, but keep the number high enough to allow for natural movement of the boom without affecting the chassis roll.*

Slant Gain

Allows fine-turning of the allowable rotation of the center section suspension. Higher Slant Gain values cause the slant control to react more aggressively when chassis roll is sensed by the node and can cause the boom to be excessively rigid, possibly causing damage to the center rack. Lower Slant Gain values cause the slant control to be less aggressive and can cause the system to be unreactive, not controlling the suspension based on the chassis roll.

1. Take the machine to the field and observe the rotation of the center section suspension with the AutoBoom system on and left, right, and slant enabled.

2. Adjust the Slant Gain setting to cause the slant control to be more or less reactive.

Note: *The default setting is 15.*

Min Press%

Note: *On machines with travel-limited booms, operate the AutoBoom system with center rack control enabled, or with the center sensor at or slightly below the target height to prevent the booms from continuously entering the Min Press % mode. This mode is for boom emergency protection only, and AutoBoom system should not be run in this mode during routine operation.*

1. Raise the center rack section to the target height, so that the booms and center rack are horizontal.
2. Enable the AutoBoom system.
3. Locate the Min Press% setting in the AutoBoom control menus.

Note: *The default setting is 65.*

4. Increase the Min Press% value to approximately 80.
5. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface, or until the boom travels up approximately three feet higher than the original target.
6. Pull hand away, and verify that the booms lower slowly after a slight delay.

Note: *If the booms do not lower, decrease the Min Press % setting value by one and repeat the steps above. Continue performing the Min Press % test until the booms begin to lower.*

Resetting Defaults

Although it is not normally necessary, there may be circumstances under which it may be necessary to reset the system defaults. Resetting the defaults erases all AutoBoom system settings and adjustments that have been performed. System calibration will be required after the defaults have been reset.

1. From the AutoBoom main menu, select **Reset Defaults**. The following screen will appear:

2. Select the **Accept** icon.

CHAPTER 6

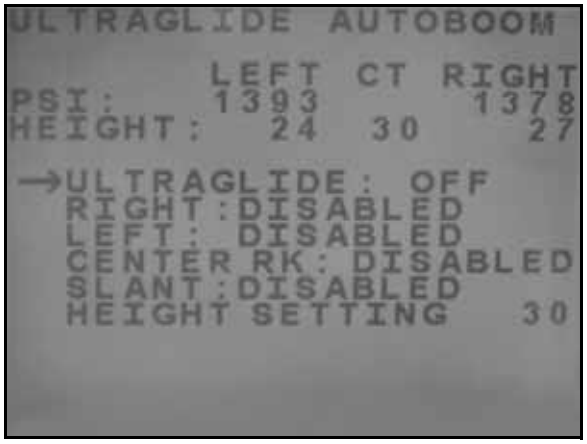
SCS Console

AutoBoom Status Display

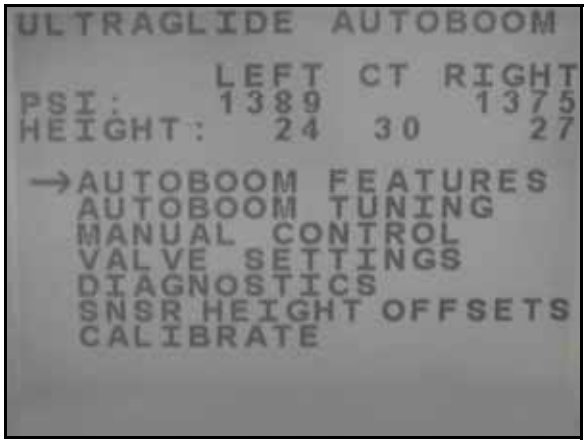
The current status of the AutoBoom system can be determined by the message displayed on the SCS console display. Advanced setup tools allow fine-tuning of stability control, minimum boom pressure, and sensor height offset parameters in the AutoBoom system. To access these tools, press the DATA MENU button until the AutoBoom Main Menu is displayed, then use the arrow keys to select the desired feature.

FIGURE 1. UltraGlide XT Main Menus

Page 1



Page 2



- **PowerGlide +** or **UltraGlide** - These settings are either ON or OFF. Toggle between these settings by selecting CE on the SCS console keypad.
- **Right** - Displays the status of the right boom. This setting is either DISABLED or ENABLED. Toggle between these settings by selecting CE on the SCS console keypad.
- **Left** - Displays the status of the left boom. This setting is either DISABLED or ENABLED. Toggle between these settings by selecting CE on the SCS console keypad.
- **Center Rk** - Displays the status of the center rack control. These settings are either ENABLED or DISABLED. Toggle between these settings by selecting CE on the SCS console keypad.

Note: *The machine must be equipped with the center rack ultrasonic sensor and center rack control cabling to enable this function.*

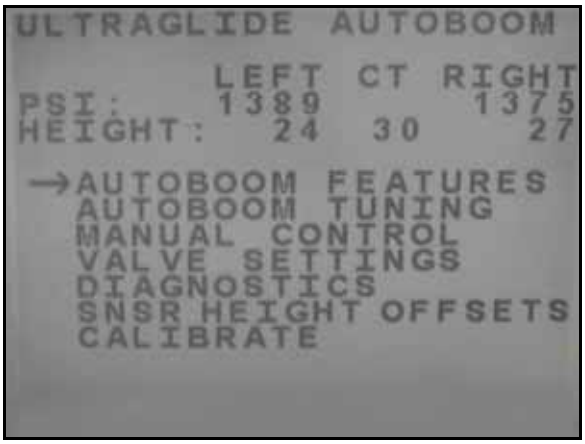
- **Slant** - Displays the status of slant control. These settings are either ENABLED or DISABLED. Toggle between these settings by selecting CE on the SCS console keypad.
- **Height Setting** - Displays the target center rack height that AutoBoom is going to maintain during operation. To adjust this setting, arrow down to this option and select ENTER. Use the up and down arrows on the SCS console keypad to change the value. When the desired value is displayed, select ENTER.

System Tools

Setup Tools

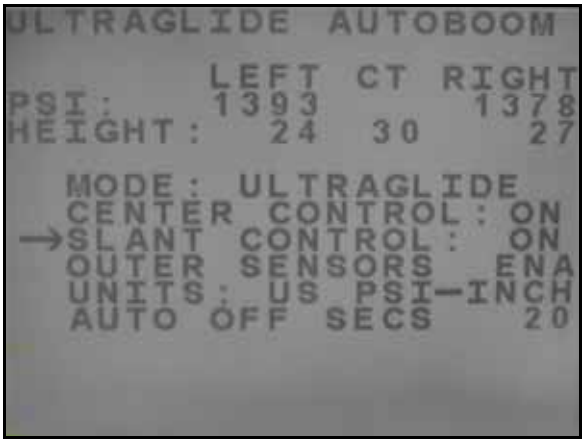
Note: *To access the AutoBoom Setup screen, press the down arrow button in the AutoBoom Main Menu screen until the AutoBoom Setup screen appears as shown in Figure 2 below.*

FIGURE 2. Setup Screen



Setup tools allow fine-tuning of stability control, slant gain, minimum boom pressure, and sensor height offset parameters in the AutoBoom system. To access these tools, press the DATA MENU button until the AutoBoom Main Menu is displayed, then use the arrow keys to select the desired feature.

FIGURE 3. AutoBoom Features Screen



- **AutoBoom Features**
  - **MODE** - Allows the operator to switch between the PowerGlide Plus and UltraGlide XT modes.
  - **CENTER CONTROL** - Allows the operator to enable center rack control. This setting is either ON or OFF. Toggle between these settings by selecting CE on the SCS console keypad.

Note: *The machine must be equipped with the center rack ultrasonic sensor and center rack control cabling to enable the center rack control function.*

  - **SLANT CONTROL** - Allows the operator to enable slant control. This setting is either ON or OFF. Toggle between these settings by selecting CE on the SCS console keypad.
  - **OUTER SENSORS** - Allows the operator to disable outer boom sensors if the machine is equipped with optional inside boom sensors. This feature is useful when the outer boom tips are folded in and not able to control.

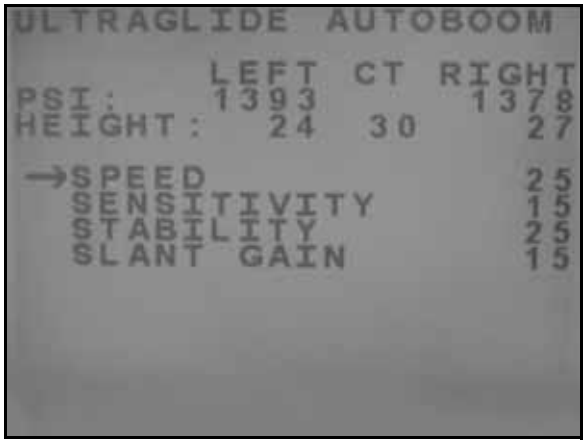
Note: *The system must be re-calibrated when the Outer Sensors option is disabled, then re-enabled.*

  - **UNITS** - Allows the operator to select the desired units of measure.

Note: *Units must be changed on the SCS console before changing the units of measure in the AutoBoom system. Refer to the SCS 4000/5000 Series Consoles Installation & Operation Manual for information on changing the console units of measure.*

  - **AUTO OFF SECS** - The setting is the amount of time (in seconds) in which the AutoBoom system will be automatically shut off when either the master switch or all boom sections are turned off. Upon turning the master switch or a boom switch back on, AutoBoom is automatically turned on with all booms disabled. This value can be set from 0 to 240 seconds. A setting of 0 disables the Auto Off Secs feature.

FIGURE 4. AutoBoom Tuning Screen

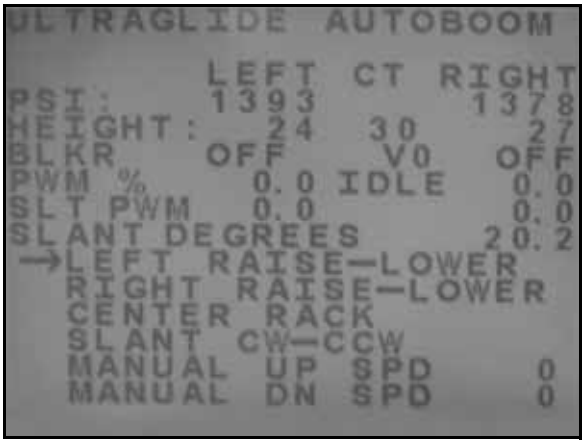


- **AutoBoom Tuning Screen** - The AutoBoom tuning screen is available in the UltraGlide XT system only.
  - **SPEED** - The Speed setting allows the operator to adjust the rate at which the booms raise and lower. The Speed setting should be set so that the boom motion is smooth and does not oscillate.
  - **SENSITIVTY** - The Sensitivity setting allows the operator to adjust the sensitivity level of the sensors. If the Sensitivity setting is too high, the boom will appear unstable and jittery, reacting to slight changes in the target height or grass movement.
  - **STABILITY** - The Stability setting allows fine-turning of the rigidity of the machine's center rack. The default value of 20 is recommended for machines with a rigid center rack. A value of 5 - 14 is recommended for machines with center racks that float freely. Adjust this value as needed to prevent boom oscillation.

- Stability settings of 0 disable the stability control completely, making the left and right booms completely independent of each other. When above target, the control of both booms is accelerated to increase the down speed. This setting is useful for machines that have a rigid center rack.
- Stability settings of 1 - 99 will adjust the stability of the center section. Lower numbers cause the opposing boom that is not being controlled to counteract the movement of the controlled boom by raising to balance or stabilize the center section and to prevent undesired rotation or movement. While lower numbers allow the booms to react at the same rate and time, low settings may prevent the booms from lowering. Higher stability settings allow the booms to react independently from each other, but may cause the center section to oscillate, diminishing performance.

◦ **SLANT GAIN** (if equipped with slant feature enabled) - Allows fine-tuning of the allowable rotation of the center section suspension. The default value is 15. A higher number will apply more pressure to the slant control cylinders when the chassis is maneuvering over challenging terrain.

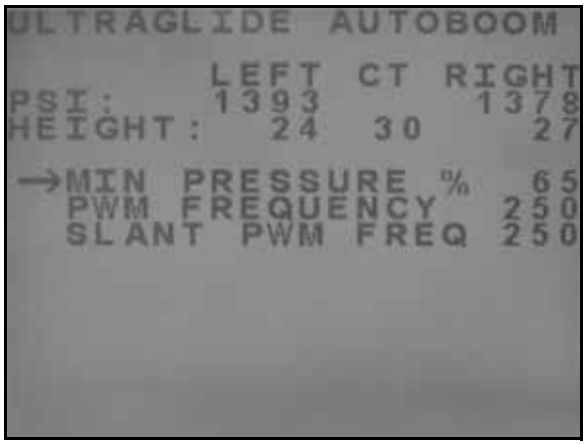
FIGURE 5. Manual Control Screen



- **Manual Control Screen** - This page allows the status of all AutoBoom inputs and outputs to be viewed on the SCS display.
  - **PSI** - Displays the actual pressure in the left and right boom cylinders at all times.
  - **HEIGHT** - Displays the individual sensor heights relative to the ground, adjusted for the values entered in the Sensor Height Offsets.
  - **BLKR** - Indicates the status of the double-blocker output.
  - **PWM %** - Indicates the duty cycle to the proportional valves. This value will be 0 if the individual booms are disengaged, and will vary in output up to 100 when Autoboom is engaged and the system is operating.
  - **SLT PWM** - Indicates the duty cycle of the slant control proportional valves. This value will be 0 if the slant control is not enabled, and can vary in output up to 100 when slant control is engaged and operating. A minimum value will be maintained when the slant control system is enabled, and move slightly when the boom is re-centering.
  - **SLANT DEGREES** - Indicates the degrees of detected rotation of the machine's boom relative to the chassis. This value will be nearly zero when the boom suspension is centered, and will change when the boom is rotated relative to the machine's chassis.
  - **LEFT** and **RIGHT RAISE-LOWER** - Allows the left and right booms to be raised and lowered via the SCS console.
  - **CENTER RACK SLANT CW-CCW** - Allows the operator to manually rotate the boom clockwise or counterclockwise relative to the machine's chassis using the machine's hydraulic valve. This function can be used to troubleshoot wiring or hydraulic issues.

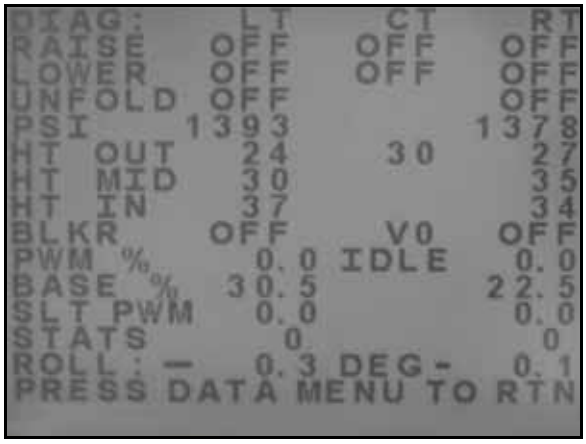
- **MANUAL UP** and **DN SPD** - Allows the speed at which the AutoBoom hydraulic valve raises and lowers the booms to be adjusted on machines that do not have their own hydraulic control. Since most machines are equipped to hydraulically control boom functions, the default setting is 0.

FIGURE 6. Valve Settings Screen



- **MIN PRESSURE %** - Sets a low limit pressure, preventing the boom pressure from falling below a percentage of static pressure, overriding the control when necessary to maintain a low limit of pressure on each boom. Minimum Pressure% also prevents the booms from resting on the stops for travel-limited booms.
- **PWM FREQUENCY** - Sets the frequency of the PWM signal to the proportional control valve. The default value is 250 Hz. This value is automatically detected during calibration and should not be adjusted.
- **SLANT PWM FREQUENCY** - Sets the frequency of the PWM signal to the slant proportional control valve. The default value is 250 Hz. This value is automatically detected during calibration and should not be adjusted.

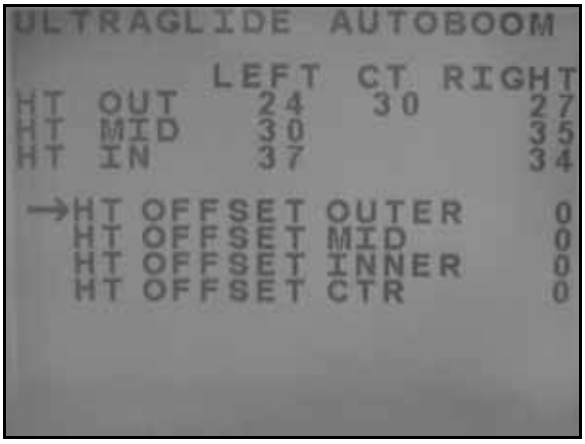
FIGURE 7. Diagnostics Screen



- **AutoBoom Diagnostics** - This page allows the status of all AutoBoom inputs and outputs to be viewed on the SCS display.
  - **RAISE** and **LOWER** - Indicate the status of the boom switches. When using the machine's manual control functions, the corresponding boom switch will indicate On.
  - **UNFOLD** - Indicates the status of the unfold proximity switch (if equipped).
  - **PSI** - Displays the actual pressure in the left and right boom cylinders at all times.

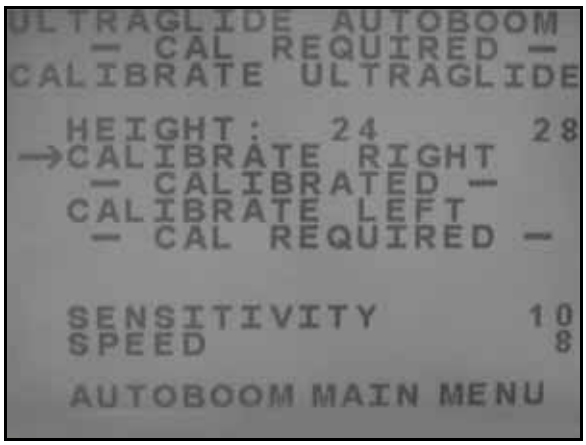
- **HT OUT, MIN,** and **IN** - Displays the individual sensor heights relative to the ground, adjusted for the values entered in the Sensor Height Offsets.
- **BLKR** - Indicates the status of the double-blocker output.
- **PWM %** - Indicates the duty cycle to the proportional valves. This value will be 0 if the individual booms are disengaged, and will vary in output up to 100 when AutoBoom is engaged and the system is operating.
- **BASE %** - Indicates the system's calculated duty cycle to maintain the set height or pressure. This number will typically change slowly from 0 - 5 points during routine operation.
- **SLT PWM** - Indicates the duty cycle of the slant control proportional valves. This value will be 0 if the slant control is not enabled, and can vary in output up to 100 when slant control is engaged and operating. A minimum value will be maintained when the slant control system is enabled, and move slightly when the boom is re-centering.
- **STATS** - Reflects the boom performance. This value is for Raven use only.
- **ROLL** - Indicates the measured chassis roll rate. This value will change when the machine chassis is rolling left or right.
- **DEG** - Indicates the degrees of detected rotation of the machine's boom relative to the chassis. This value will be nearly zero when the boom suspension is centered, and will change when the boom is rotated relative to the machine's chassis.

FIGURE 8. Sensor Height Offsets Screen



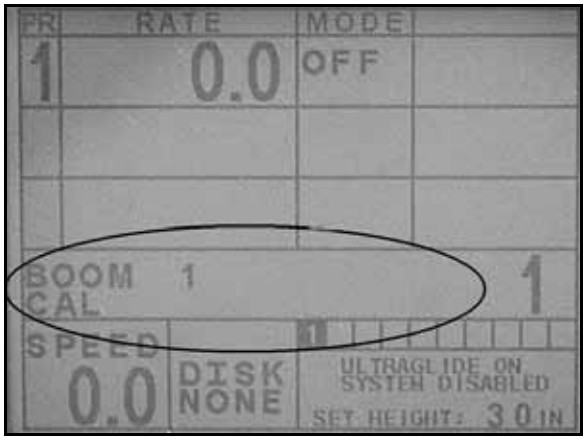
- **Sensor Height Offsets Screen** - Allows sensor heights to be adjusted according to the mounting location. Enter a positive value if the sensors are mounted above the sprayer tips, and a negative value if the sensors are mounted below. Refer to the *Ultrasonic Sensor Height Offsets* section on page 86 for more information.

FIGURE 9. **Calibration Screen**



- **Calibration Screen** - Used to calibrate the AutoBoom system. Refer to *Calibration* section on page 75 for more information.

Alarms



Alarm tones will not sound if the operator is navigating through any of the configuration menus. However, the enable/disable alarms will always sound when appropriate. The SCS console will display the following errors below the product control/above the speed section when an error exists.

Note: *Alarms can occur for left or right booms independently. The boom experiencing the error will be indicated by LT for the left boom and RT for the right boom.*

- **LOW PRESSURE ALARM (PowerGlide Plus mode only)** - The pressure alarm occurs if the pressure is detected at a level lower than the alarm set point. The pressure alarm is a steady tone, and will continue to sound for one second after the pressure rises above the set point.
- **LT/RT UNFOLD TO ENAB BOOM** - This alarm occurs if a boom is not completely folded but is enabled. The boom will be disabled after five seconds. The machine must be equipped with proximity sensors for this alarm to occur. It may also occur if the center sensor is greater than 60 inches off the ground, or it does not receive an echo from the ground.
- **CHK AUTOBM HC VOLTAGE** - This alarm occurs if the node senses a low voltage supply to the node. Check the power and ground wiring to the node.

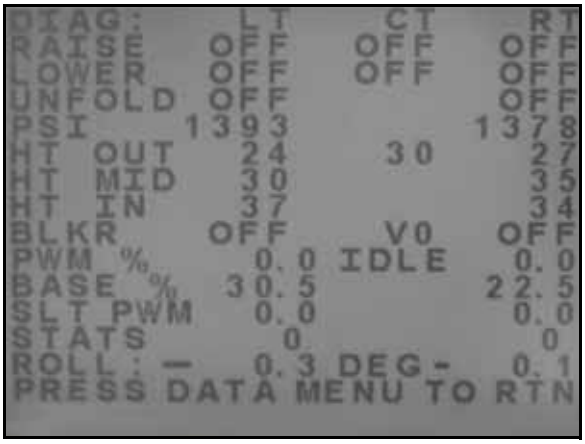
- **ULTRASONIC FAILURE** - The pressure sensor failure alarm occurs immediately when a pressure sensor is not detected. The alarm is a steady tone, and will stop immediately after the sensor is located.
- **LOW ULTRASONIC SEN** - This alarms occurs if the ultrasonic sensor is closer than ten inches to the ground for 1/2 a second. The alarm will continue to sound for three seconds.
- **HI ULTRASONIC SENS** - This alarm occurs when the ultrasonic sensor is higher then 65 inches from the ground for five seconds. The alarm will continue to sound for one second.
- **CENTER ROTATION SENSOR OUT OF RANGE** - This alarm occurs when the center rotation is out of the calibrated range. This alarm is a steady tone, and will stop immediately when the sensor is in the calibrated range.
- **CENTER ROTATION SENSOR FAILURE** - Occurs when there is no signal from the rotation sensor when slant control is enabled. This alarm is a steady tone, and will stop immediately when the center rotation sensor signal is detected.
- **Other tones** - When enabling the AutoBoom system in automatic mode via the machine's boom control functions or switches, a single beep will occur. When disabling AutoBoom, a double beep will sound.

System Calibration

AutoBoom Pre-Calibration Diagnostics

While every effort has been made to properly label and document connections for the hydraulic and electrical components of the AutoBoom system, boom function connections may not be identified due to changes in the make and model of the machine. This makes it especially important to trace the hoses from the connection points and verify the electrical connections are correct to ensure proper AutoBoom system operation. In order to verify connections, it is necessary to perform a pre-calibration diagnostic test.

FIGURE 10. Diagnostics Screen



1. Navigate to the **Diagnostics** screen on the SCS console as shown above.
2. Verify that the following components on the SCS console screen are displayed correctly and change when raising and lowering the booms via the machine's controls and the AutoBoom manual functions:
   - Pressures
   - Sensor heights
   - Right and left raise/lower functions

- Center raise/lower functions
- Fold/unfold functions
- Slant rotation clockwise/counterclockwise

Calibration

After the AutoBoom installation is complete, it is necessary to calibrate the computer and vehicle before use. AutoBoom calibration requires pressure in the machine's cylinders and enough boom travel to allow the system to find the system base duty cycles for operation. Booms must be free to travel 10" up or down without reaching the tops or bottoms of the cylinder stops.

During calibration and operation, it is important to keep the machine running at a sufficient engine RPM so that the hydraulic pump is able to supply a full flow to the hydraulic system.

Note: *If the machine has an open center hydraulic system, or the type of hydraulic system is unknown, all calibration procedures should be performed with the machine operating at the normal operating engine RPM.*

Important: *Be sure that the area is clear of people and obstructions before beginning the calibration process.*

1. Move the machine to a flat area.
2. Verify that AutoBoom is turned on.
3. Verify that the booms are unfolded, and lower the center rack.

Note: *If the booms do not go over center or are travel limited, raise the booms so that the boom tips are approximately ten inches above the horizontal position and lower the center section to approximately 20 inches.*

4. Using a tape measure, measure the distance from the bottom of the sensor to the spray nozzle tip.
5. Access the AutoBoom Setup screen.
6. Adjust the vertical sensor height offset settings in the SCS console to sensor position as measured in step 4.
   - Positive offsets indicate the sensor surface is located above the nearest spray tips.
   - Negative offsets indicate the sensor surface is located below the nearest spray tips.
   - Inner, mid, outer, and center offsets are not required to be the same across the width of the machine, but they must be correctly measured relative to the spray tips.
7. Lower the center rack section to approximately 20 inches.

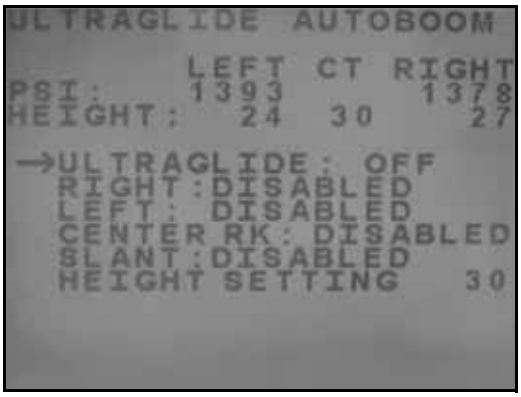
Note: *If the machine is equipped with a center sensor, the center rack height can be verified through the main menu or diagnostics screen in AutoBoom section of the SCS console.*

8. Raise the boom tips to approximately the target height.

Note: *The default target height is 30 inches. Verify that the booms are not fully raised to the boom stops. If gauge wheels are installed, the setting must be adjusted to 40 - 45 inches to prevent the wheels from touching the ground during system calibration.*

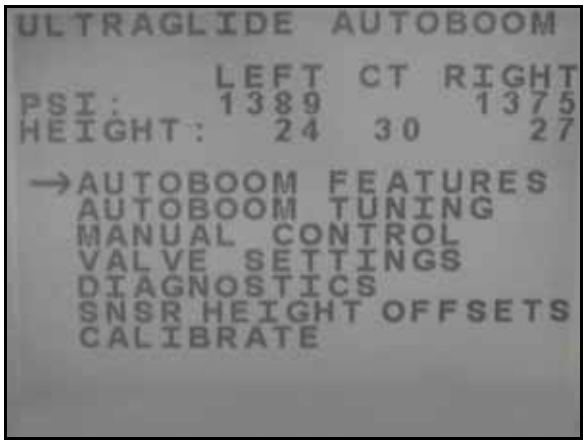
9. Press the **DATA MENU** button on the SCS console keypad until the AutoBoom Main Menu is displayed.

FIGURE 11. **AutoBoom Main Menu**



10. Press the **CE** button to toggle UltraGlide to ON.

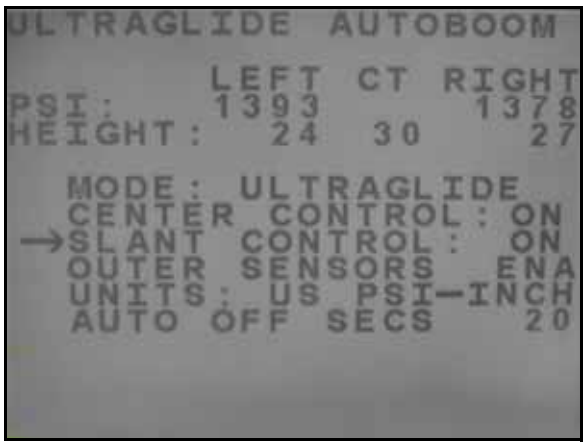
FIGURE 12. **AutoBoom Setup Screen**



11. Press the down arrow on the SCS console keypad to access the AutoBoom Setup screen.

12. Press **ENTER** on the AUTOBOOM FEATURES line.

FIGURE 13. **AutoBoom Features Screen**



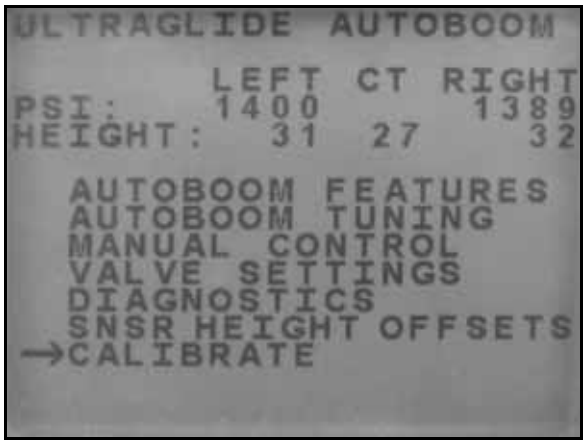
13. Verify that SLANT CONTROL is set to ON.

14. Verify that the booms are unfolded, and lower the center rack so that the wheels are approximately six inches from the ground.

Note: *If the booms do not go over center or are travel-limited, raise the booms so that the boom tips are approximately ten inches above the horizontal position and lower the center section slightly below the normal spraying height.*

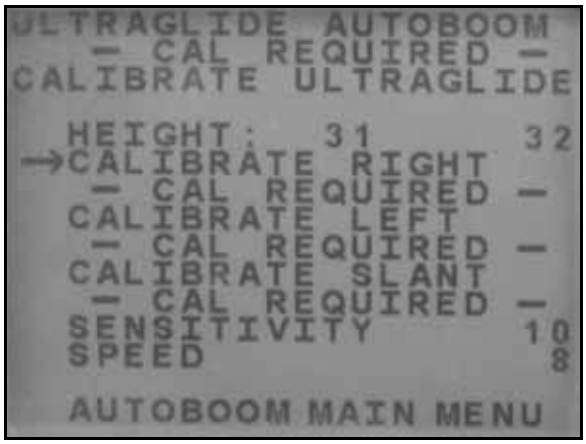
15. Press the up arrow on the SCS console keypad to access the AutoBoom Setup screen.

FIGURE 14. Calibration Screen



16. Press the arrow down button to move the cursor to CALIBRATE and press **ENTER**. The following screen will appear:

FIGURE 15. Calibration Screen



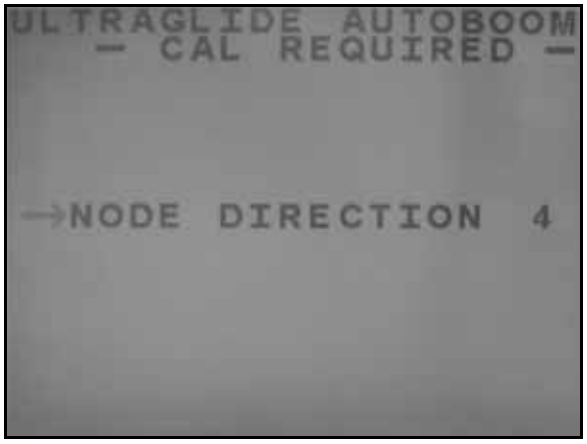
17. Press the arrow down button to move the cursor to CALIBRATE RIGHT.
18. Press the **ENTER** button on the SCS console to begin calibration.

Note: *The message "Calibrating" will appear during the system calibration. The calibration process may take several seconds to complete. If the boom fails to calibrate, press ENTER to stop the calibration process and refer to Chapter 7, Troubleshooting on page 91.*

19. Press the arrow down button to move the cursor to CALIBRATE LEFT.
20. Press the **ENTER** button on the SCS console to begin calibration.
21. Press the arrow down button to move the cursor to CALIBRATE SLANT.

22. Press **ENTER**.

FIGURE 16. Node Direction Screen



23. Enter the number of the direction arrow on the node that is pointing forward.
24. Press **ENTER**.

Note: *The boom tips may raise automatically to allow for full rotation of the center section. Pressure in one slant cylinder will increase until the center section begins to rotate slightly. The center section will then rotate fully clockwise then counterclockwise to calibrate the center rotation sensor position.*

Note: *The center rotation sensor may be re-centered by recalibrating the slant control or by manual adjustment of the centering bolt while the center section is confirmed to be in the center position.*

Center Rack Raise/Lower Calibration

There are many different valve configurations used to control the machine's center rack functions. The AutoBoom system must "learn" which of the machine's solenoids are used to raise and lower the booms. Complete the following steps to calibrate the center rack control feature after the individual booms have been calibrated.

1. Press and hold the center rack raise button on the machine's control panel or joystick for six seconds so that the center rack raises.

Note: *The center rack may reach the upper limit of travel during this time, but continue holding the button until the full six seconds has passed.*

2. Press and hold the center rack lower button on the machine's control panel or joystick for six seconds so that the center rack lowers.

Note: *The center rack may reach the lower limit of travel during this time, but continue holding the button until the full six seconds has passed.*

Routine Operation

Joystick Functions

When AutoBoom control is on, control of each boom can be enabled or disabled via the SCS console or by tapping the sprayer's switch functions (if equipped).

Note: *Pressing the down function for longer than 1/2 a second will switch the function to manual control. The operator must tap the down function to enable Autoboom.*

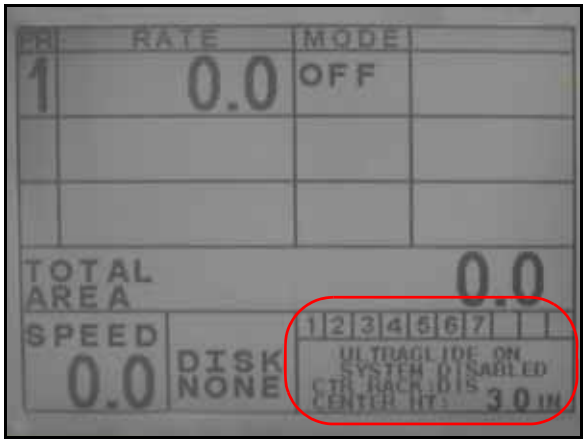
- A single up-tap on the sprayer's switch functions disables AutoBoom on that boom.
- A single down-tap on the sprayer's switch functions enables AutoBoom on that boom.

Enabling AutoBoom via the SCS Console

The status of the AutoBoom system is displayed in the lower-right corner of the SCS console display. The status details displayed are:

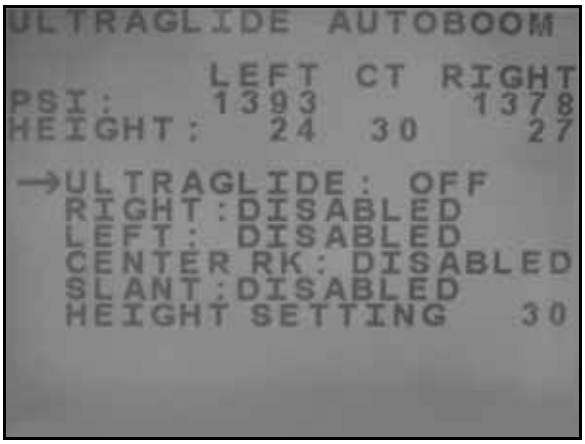
- The type of AutoBoom system installed and whether it is powered on or off.
- The status of the AutoBoom system (enabled or disabled).
- Center rack height (if equipped with center rack control).

FIGURE 17. AutoBoom Status Display



1. Press the DATA MENU button to navigate to the AutoBoom Main Menu.

FIGURE 18. **AutoBoom Main Menu**



2. Select ULTRAGLIDE and press the **CE** button to toggle the setting to ON.

Note: *The AutoBoom system is now powered on, but the booms are disabled.*

3. Press the down arrow to navigate to the RIGHT boom setting.
4. Press the **ENTER** button to select the RIGHT boom setting.
5. Press the down arrow to enable the RIGHT boom setting.
6. Repeat the steps above to enable the LEFT, RIGHT, CENTER RK, and SLANT settings.

Note: *AutoBoom can be disabled by selecting the boom settings and pressing the up arrow.*

Boom Adjustments When Approaching Headlands (If Equipped with Gauge Wheels)

When approaching the headlands to make a turn, the gauge wheel must be raised approximately six inches from the ground to prevent it from sliding sideways or backward, causing damage to the gauge wheel assembly.

Center Rack Control

AutoBoom Enabled, Slant Control On, and Center Rack Control On

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

Note: *Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.*

Note: *Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.*

- **Center Down Switch** - A single down-tap will lower the center rack to the desired spray height, enable the center rack, slant control, and both booms.
- **Center Up Switch** - A single up-tap will disable the center rack, slant control, and both booms. Two consecutive up-taps will raise the center rack to the desired transport height. Four consecutive up-taps will

raise the center rack to the maximum height, turn AutoBoom off, and preserve the new transport height as the maximum height.

- Set a lower transport height - While the center rack is returning to transport, down-tap once on the center switch when the new transport height is reached.
- Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

AutoBoom Enabled and Center Rack Control Off

Note: *The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.*

Note: *Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.*

Note: *Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.*

- **Center Down Switch** - Two consecutive down-taps will lower the center rack to the desired spray height and enable slant control and both booms.

Note: *Center rack control will not be enabled since center rack control is off.*

- **Center Up Switch** - Two consecutive up-taps will disable slant control and both booms, and raise the center rack to the desired transport height. four consecutive up-taps will raise the center rack to the maximum height and turn AutoBoom off, preserving the new transport position as the maximum height.
  - Set a lower transport height - While the center rack is returning to transport, down-tap once on the center switch when the new transport height is reached.
  - Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with the AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

Operating the UltraGlide XT AutoBoom System in PowerGlide Plus Mode

Before populating the hydraulic fittings on the AutoBoom valve, it is necessary to remove orifice fittings from the valve in the PowerGlide Plus system. Failure to remove these fittings from the valve will restrict the down speed of the booms when the system is enabled.

FIGURE 19. **Port 3A and 3B Location**

1. Locate Ports 3A and 3B on the AutoBoom valve.

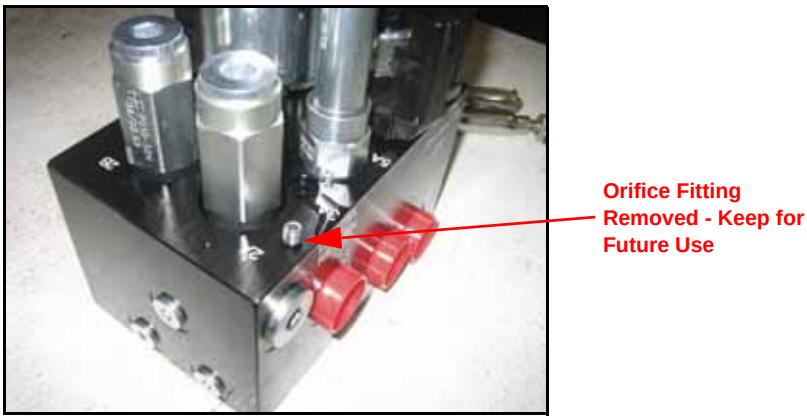
FIGURE 20. **Coil Removed from the AutoBoom Valve**

2. Remove the coils from the solenoids near Ports 3A and 3B to gain easy access to those ports.

FIGURE 21. **Port Plugs Removed from the AutoBoom Valve**

3. Use an Allen wrench to remove the plugs from Ports 3A and 3B.

FIGURE 22. **Orifice Fitting Removed from the AutoBoom Valve**



4. Remove the orifice fittings from Ports 3A and 3B.

Important: *Tip the AutoBoom valve on its side and use the Allen wrench to remove the orifice from the cavity, taking care not to let the fitting fall into the valve.*

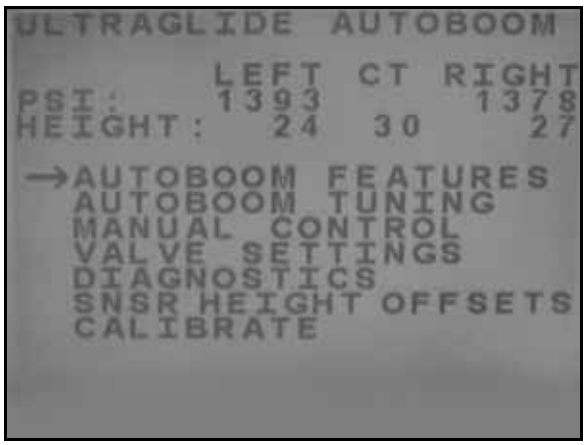
FIGURE 23. **Port Plug Reinstalled on the AutoBoom Valve**

5. Use the Allen wrench to reinstall the port plugs on Ports 3A and 3B of the AutoBoom valve.

FIGURE 24. **Coil Reinstalled on the AutoBoom Valve**

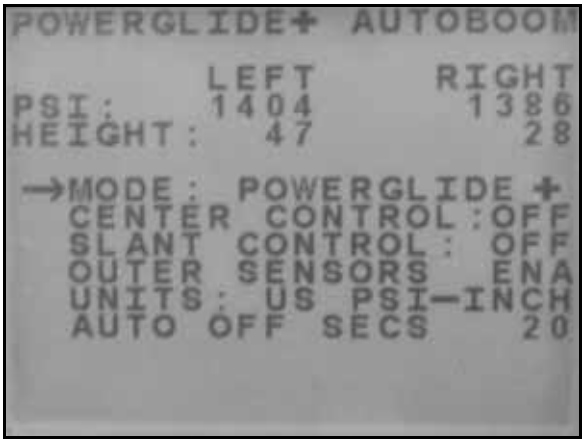
6. Reinstall the coils on the solenoids of the AutoBoom valve.

FIGURE 25. **AutoBoom Features Screen**

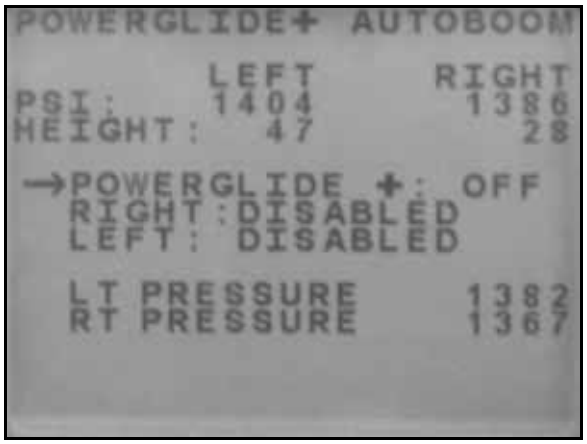


7. In the AutoBoom Main Menu, arrow down to AUTOBOOM FEATURES.

FIGURE 26. **PowerGlide Plus Mode Selected**



8. Arrow down to select MODE and press the **CE** button to toggle the setting to run in the PowerGlide + mode. The following screen will appear:



Note: *When converting the AutoBoom system back to UltraGlide XT, the SCS console must be reprogrammed to run in the UltraGlide XT mode.*

System Adjustments

Note: *AutoBoom must be enabled after both booms have been calibrated in order to make system adjustments.*

Speed

The Speed setting controls how fast the boom will move away from an obstacle, and how much the boom overshoots the target height. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. Adjust the Speed setting as needed so that boom raise rates match hand movement rates, but so that the booms don't overreact and become unstable.

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12" of the sensor surface.

Note: *The boom should react immediately and adjust at a raise speed matching the hand movement, overshooting the new target height by one foot or less.*

2. Adjust the Speed setting as needed.

Note: *The default setting is 25. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. The typical Speed setting that works best for most machines is 22 - 27, but can vary depending on the static pressures of the boom, boom geometry, and the Sensitivity settings.*

Sensitivity

1. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface.

Note: *The boom should react immediately when your hand is approximately 6" from the ground.*

2. Adjust the Sensitivity setting as needed to make the boom more or less reactive to hand motions.

Note: *The default setting is 15. If the Sensitivity is too high, the boom will appear unstable and jittery, reacting to slight changes in target height or crop movement. During routine operation, AutoBoom should be unresponsive to changes in height of 2" - 3", but should react quickly to changes of 5" or more.*

The typical Sensitivity setting for most machines with a 30" target spray height is 13 - 17. For target spray heights less than 25", lower the sensitivity setting and for target heights greater than 40", raise it.

For row-crop situations, or when crop conditions are sparse and not fully covering the ground, it may be beneficial to decrease the sensitivity so the boom is less reactive to sudden changes in crop height, and less likely to cause sudden movements that diminish performance.

Stability

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12 inches of the sensor surface, while observing the movement of the opposite boom.

Note: *The opposite boom should raise slightly (usually no more than six inches) simultaneously.*

2. Adjust the Stability setting to minimize movement of the opposite boom.

Note: *Lower the Stability value to make the opposite boom more rigid, but keep the number high enough to allow for natural movement of the boom without affecting the chassis roll.*

Slant Gain

Allows fine-turning of the allowable rotation of the center section suspension. Higher Slant Gain values cause the slant control to react more aggressively when chassis roll is sensed by the node and can cause the boom to be excessively rigid, possibly causing damage to the center rack. Lower Slant Gain values cause the slant control to be less aggressive and can cause the system to be unreactive, not controlling the suspension based on the chassis roll.

1. Take the machine to the field and observe the rotation of the center section suspension with the AutoBoom system on and left, right, and slant enabled.
2. Adjust the Slant Gain setting to cause the slant control to be more or less reactive.

Note: *The default setting is 15.*

Min Press%

Note: *On machines with travel-limited booms, operate the AutoBoom system with center rack control enabled, or with the center sensor at or slightly below the target height to prevent the booms from continuously entering the Min Press % mode. This mode is for boom emergency protection only, and AutoBoom system should not be run in this mode during routine operation.*

1. Raise the center rack section to the target height, so that the booms and center rack are horizontal.
2. Enable the AutoBoom system.
3. Locate the Min Press% setting in the AutoBoom control menus.

Note: *The default setting is 65.*

4. Increase the Min Press% value to approximately 80.
5. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface, or until the boom travels up approximately three feet higher than the original target.
6. Pull hand away, and verify that the booms lower slowly after a slight delay.

Note: *If the booms do not lower, decrease the Min Press % setting value by one and repeat the steps above. Continue performing the Min Press % test until the booms begin to lower.*

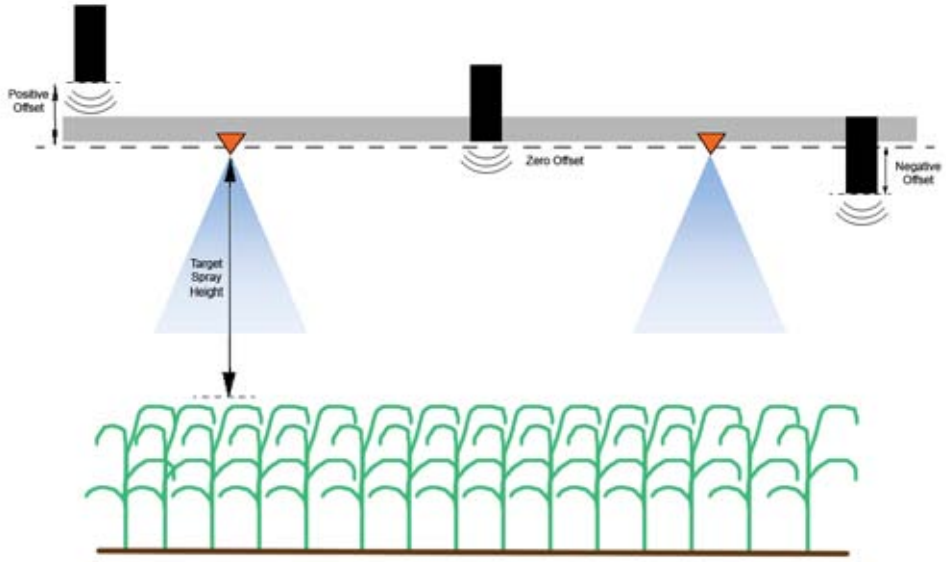
Ultrasonic Sensor Height Offsets

Ultrasonic sensor height offset adjustments are used to compensate for the difference between the height of the sensor surface and the height of the spray tip. The offset height is calculated by measuring the distance from the bottom of the sensor to the height of the crop, measuring the distance between the spray tip to the

height of the crop, and then subtracting the spray tip distance from the sensor distance. Refer to the diagram below to determine whether the offset value should be positive or negative.

Note: *The maximum offset height value is 20 inches.*

Note: *Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop. For row-crop situations, it may be beneficial to adjust the sensor positions to directly over a row, or add additional boom sensors.*



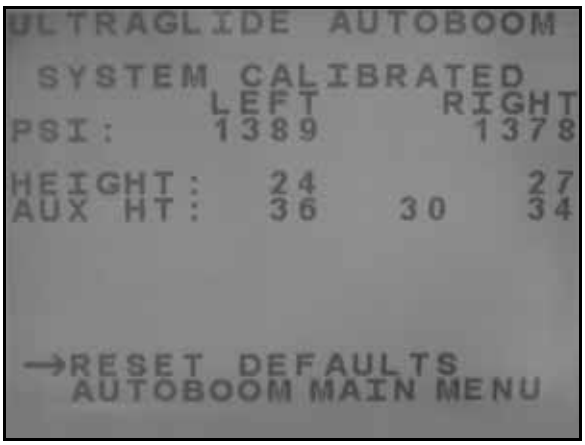
- Touch the up arrow in the Sensor Height section to increase the value representing the distance between the sensor and the ground.
- Touch the down arrow in the Sensor Height section to decrease the value representing the distance between the sensor and the ground.

Note: *On machines with travel-limited booms, center sensor height offsets may need to be entered as less than the measured value from the sensor to the ground to ensure the boom cylinders have sufficient pressure during operation.*

Resetting Defaults

Although it is not normally necessary, there may be circumstances under which it may be necessary to reset the system defaults. Resetting the defaults erases all AutoBoom system settings and adjustments that have been performed. System calibration will be required after the defaults have been reset.

FIGURE 27. **UltraGlide XT Calibration Screen**



1. From the Calibration menu, use the arrow buttons to navigate to RESET DEFAULTS.
2. Press the **ENTER** button on the SCS console to reset the AutoBoom settings.

CHAPTER 7

Troubleshooting

Node

The AutoBoom CAN control node features several green light-emitting diodes (LEDs) which may be used to diagnose issues within the AutoBoom system.

Note: *If the LEDs are not displayed as outlined in the figure below or are all on continuously, check the CAN connections and the control cable connections on the node. If the issue persists, contact your local Raven dealer for additional technical support.*

FIGURE 1. AccuBoom CAN Control Node LEDs

AutoBoom Pre-Calibration Diagnostics

Problem	Possible Cause	Corrective Action
Pressures/heights are not being displayed in the correct units of measure.	The units of measure are set incorrectly in the AutoBoom system.	Change the units of measure in the controller being used in the AutoBoom system.
Pressures for the left and right boom are not displayed on the correct side.	The left and right pressure transducer connections are reversed.	Reverse the left and right transducer connections.
	The left and right hose connections are reversed.	Reverse the left and right cylinder connections on the AutoBoom valve.
Ultrasonic sensor heights are displaying incorrect locations.	The left and right sensor connections are reversed.	Reverse the left and right outer sensor connections on the AutoBoom harness cable.
	The outer sensors are connected to the inner sensor connectors.	Disconnect the sensors from the AutoBoom harness cable and connect the outer sensor connectors to the sensors.
Left, right, and center raise/lower functions are not sensed correctly when the machine's functions are used.	The boom sense cables/connections are connected to the incorrect machine coils.	Check the connections to the machine's coils and trace the wiring to ensure the connections are made to the correct cylinders.
Center section will not raise/lower manually with the machine's functions.	The center rack boom sense cables are not connected to the correct center sense/control function.	Check the connections to the machine's coils and trace the wiring to ensure the connections are made to the correct coils.
Right, left, center, and slant will not operate properly though the Raven controller/field computer.	The proportional/blocker coil connections on the AutoBoom valve are incorrect.	Check the connections on the AutoBoom valve to ensure the cable connections are connected to the correct ports. NOTE: Proportional cartridges are taller than blocker cartridges.
	The hydraulic connections are reversed.	• Reverse the left and right hydraulic connections. • Verify pressure and tank connections are not reversed.
	The electrical connections are reversed.	Reverse the left and right electrical connections (proportional, blocker, slant control, and possibly pressure transducers).
	Improper high current voltage electrical connection or blown fuse.	Check the electrical connections and fuses.
	The center sense/control cables are improperly connected.	Check the center section control cabling (connections to center control valve(s), directional valve, load sense valve, and open center valve - if applicable).
Fold/unfold status does not change when booms are folded/unfolded (if equipped).	Fold/unfold sensors are not connected.	Check the electrical connections to the fold sensors.

AutoBoom Calibration

Problem	Possible Cause	Corrective Action
Booms do not move during calibration.	The proportional/blocker connections are reversed or improperly connected.	Check the connections on the AutoBoom valve to ensure the cable connections are connected to the correct ports.
	The hydraulic connections are improperly connected.	Check the hydraulic connections.
	Booms are resting on their stops or the cylinders are fully extended.	Raise the booms and lower the center rack to ensure the pressure is sufficient in the booms for calibration.
	Pressure transducer or connection is faulty.	Check the transducer connections to the AutoBoom harness cable.
	There is insufficient high current power.	Check the power and ground connections at the battery and the connections to the node.
The booms overreact or oscillate during calibration.	There are objects beneath the sensors causing faulty readings.	Attempt to calibrate the system over open ground or consistent crop canopy.
	The inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and reverse if necessary.
	Faulty ultrasonic sensor readings.	Check the sensors and cabling and replace if necessary.
	The Speed setting is too high.	Decrease the Speed setting.
	The Sensitivity setting is too high.	Decrease the Sensitivity setting.
	(Pull-Type only) The hydraulic flow is too high.	Decrease the hydraulic flow the AutoBoom circuit remote.
The booms fully raise during calibration and do not lower.	The inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and reverse them if necessary.
	The ultrasonic sensors are giving poor readings.	• Check the cabling to the sensors. • Verify the sensor surface is clean. • Verify no obstructions or boom components are interfering with sensor readings.
	The hydraulic connections are improperly connected.	• Check the hydraulic connections. • Reverse the direction of the hydraulic lever on pull-type sprayers.
	The electrical connections to the AutoBoom valve are reversed.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	The Speed setting is too high.	Decrease the Speed setting.
	The Sensitivity setting is too high.	Decrease the Sensitivity setting.
	(Pull-Type only) The hydraulic flow is too high.	Decrease the hydraulic flow the AutoBoom circuit remote.

Problem	Possible Cause	Corrective Action
The booms fall to the ground during calibration.	The proportional valve connections are reversed on the AutoBoom valve.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	The hydraulic connections are improperly connected.	• Check the hydraulic connections. • Reverse the direction of the hydraulic lever on pull-type sprayers.
	Malfunctioning proportional valve.	Turn the set screws in on the proportional valve to verify the booms raise during calibration. • If the booms raise, troubleshoot the electrical system and/or AutoBoom node. • If the booms do not raise, troubleshoot the hydraulic system and/or AutoBoom valve.
	(Pull-Type only) The hydraulics are not activated.	• Verify the hydraulics are activated. • Ensure hydraulic flow going to the AutoBoom valve.

AutoBoom Operation

Problem	Possible Cause	Corrective Action
The booms will not enable with the down-tap of the machine's functions.	The boom sense adapter cables are damaged or not connected.	• Check the cabling. • Use the Diagnostics menu to determine the proper wiring setup.
	There is inadequate voltage to the system.	Use a multi-meter to verify +12V is provided to the machine's coils when the function is activated.
	The AutoBoom system is not calibrated.	Calibrate the AutoBoom system.
	The harness cable is damaged.	Inspect the cable for damage and repair or replace as needed.
	The UltraGlide XT node is faulty.	Replace the AutoBoom node.
The pressure alarm is always on.	The pressure alarm setting in the PowerGlide Plus mode is set too low.	Increase the pressure alarm setting.
	The pressure and tank hoses are reversed.	Check the hoses and reverse if necessary.
	The pressure transducer is faulty.	• Inspect the transducer and verify the pressure reading on the Diagnostic screen. • Replace the pressure transducer if necessary.
	Pressure transducers are not connected to the harness.	Connect the pressure transducers to the harness.
	The AutoBoom harness cable is damaged.	Inspect the cable for damage and repair or replace as needed.
	Booms are resting on their stops or the cylinders are fully extended.	Raise the booms, lower the center section, and re-engage AutoBoom.

Problem	Possible Cause	Corrective Action
Objects under one boom makes the opposite side react.	The left and right sensor connections are reversed.	Check the inner and outer sensor connections and reverse them if necessary.
	The proportional valve connections are reversed or one side is not connected.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	The Stability setting is too low.	Increase the Stability setting incrementally until the opposite side barely raises.
	The proportional valve is faulty.	• Inspect the proportional valve. • Clean and/or replace if necessary.
The booms oscillate or overreact when the machine is stationary.	The Sensitivity setting is too high.	Decrease the Sensitivity setting by one increments until the boom oscillation stops.
	The wind is affecting the sensor readings.	Decrease the Sensitivity setting by one increments until the boom oscillation stops.
	The Speed setting is too high.	Decrease the Speed setting by one until the boom oscillation stops.
	The center section is unstable.	Decrease the Stability setting to balance the movement of the booms on both sides of the center section.
	Sporadic ultrasonic sensor readings.	Inspect the sensor cabling for damage and repair or replace as needed.
The booms raise but will not lower or lower too slowly during operation.	The incorrect PWM frequency was entered.	Verify the PWM frequency setting in the Raven console/field computer. (60 Hz for square coil valves, 250 Hz for round coil valves).
	The Speed setting is too low	Increase the Speed setting.
	The Minimum Pressure % setting is too high.	Decrease the minimum pressure % setting by one until the booms lower at the desired rate.
	(PowerGlide Plus only) The set pressure is too high.	Decrease the set pressure by 10 until the booms lower at the desired rate.
	The inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and reverse them if necessary.
	Faulty ultrasonic sensor readings.	Check the sensors and cabling and replace if necessary.
	The orifices or circuit restrictions are restricting the return flow from the tilt cylinders.	Inspect the AutoBoom hydraulics and remove orifices or restrictions in the circuit if necessary.

Problem	Possible Cause	Corrective Action
The booms are slow to raise or are unresponsive to height changes.	The Speed setting is too low.	Increase the Speed setting.
	The Sensitivity setting is too low.	Increase the Sensitivity setting.
	Excessive ground speed.	Decrease the ground speed.
	The incorrect sensor height offsets were entered.	Verify the proper height offset and adjust the settings as needed. Refer to the appropriate chapter in this manual for the Raven controller/field computer being used to determine the height offset settings calculation.
	The orifices or circuit restrictions are restricting the return flow from the tilt cylinders.	Inspect the AutoBoom hydraulics and remove orifices or restrictions in the circuit if necessary.
Center boom section does not float and appears to be rigid or rotates too aggressively.	Slant Gain setting is too high.	Decrease the Slant Gain setting.
Booms are unreactive to machine's chassis roll or react in incorrect direction.	The Slant Control is disabled.	Enable Slant Control.
	The Slang Gain setting is too low.	Increase the Slant Gain setting.
	The UltraGlide XT valve electrical connections are reversed or one side is not connected.	Check cabling and reverse connections if necessary.
	The UltraGlide XT node is mounted improperly.	Verify the node is mounted solidly to the machine's chassis and not part of the rotating boom components.
	The incorrect node direction value was entered during calibration.	Reset calibration and enter the correct direction arrow number.
	The UltraGlide XT valve is faulty.	• Inspect the valve. • Clean or replace the valve if necessary.
	The UltraGlide XT node is faulty.	Replace the UltraGlide XT node.
The booms raise but will not lower when first starting the machine or engaging hydraulics (pull-type sprayers) with AutoBoom engaged.	The PWM base is too high.	Engage AutoBoom and hydraulics and allow the PWM base value to decrease and boom to lower.
	The system is out of calibration.	Re-calibrate the AutoBoom system.
The system can not be switched from PowerGlide Plus to UltraGlide mode.	The ultrasonic sensors are not being detected.	• Connect the sensor cables from the harness cable to the sensors. • Check the node cable connections. • Repair or replace cables as necessary.
	The outer sensors are connected to the inner sensor connectors (non-dual sensor system).	Disconnect the sensors from the AutoBoom harness cable and connect the outer sensor connectors to the sensors.
	The UltraGlide XT node is not connected to the CAN system.	Verify the UltraGlide XT node is connected to the CAN system.

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Limited Warranty

What Does this Warranty Cover?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service.

How Long is the Coverage Period?

Raven Applied Technology Division products are covered by this warranty for 12 months after the date of purchase. This warranty coverage applies only to the original owner and is nontransferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If your dealer agrees with the warranty claim, the dealer will send the part and proof of purchase to their distributor or to Raven Industries for final approval.

What Will Raven Industries Do?

Upon confirmation of the warranty claim, Raven Industries will, at our discretion, repair or replace the defective part and pay for return freight.

What is not Covered by this Warranty?

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit or other special damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.

AutoBoom™ UltraGlide XT
Calibration & Operation Manual
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