

AutoBoom® Calibration & Operation Manual

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CHAPTER

1

*Important Safety
Information*

NOTICE

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

- Follow all safety information presented within this manual.
- Contact a local Raven dealer for additional assistance with any portion of the installation, service, or operation of Raven equipment or components.
- 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 replacement safety labels, contact a local Raven dealer.

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

- Be alert and aware of surroundings at all times during equipment operation.
- Do not operate AutoBoom or any agricultural equipment while under the influence of alcohol or an illegal substance.
- Remain in the operator position or a safe working distance away from the booms at all times when AutoBoom is engaged.
- Turn the AutoBoom system off when leaving the operator position or exiting the implement cabin.
- Do not drive the implement on any public road with the AutoBoom system on or enabled.
- Determine and maintain a safe working distance from bystanders and any hazards that may damage the booms or other equipment. The operator is responsible for disabling AutoBoom when the safe working distance has been diminished.
- Disable the AutoBoom system prior to starting any maintenance work on AutoBoom components or the machine.

WARNING

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

CAUTION

Hydraulic Safety

- Raven Industries recommends that appropriate protective equipment be worn at all times when installing or servicing 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.
- Hydraulic fluid may be extremely hot and under high pressure. Caution must be exercised when disconnecting or purging hydraulic components.
- Any work performed on the hydraulic system must be done in accordance with the machine manufacturer's approved maintenance procedures.
- Take precautions to prevent any foreign material or contaminants from being introduced into the hydraulic system when installing or maintaining the hydraulic components. Objects or materials that are able to bypass the hydraulic filtration system will adversely reduce performance and possibly damage the AutoBoom hydraulic valves.

Electrical Safety

- Disconnect the Raven OS device and all electrical components of the Raven system before jump-starting the vehicle or welding on any component of the implement.
- Always verify that power leads are connected to the correct polarity as marked or instructed. Reversing the power leads could cause severe damage to the equipment or components.
- Ensure that the power cable is the last cable to be connected.

Overview

Thank you for purchasing the Raven AutoBoom system. Raven AutoBoom systems are designed to provide automated height control features for many self-propelled and pull-type application implements. AutoBoom systems are designed to leave the existing implement hydraulic circuits open, or in a float condition, which provides a smooth and responsive solution for automated boom height control in agricultural applications.

The instructions in this manual are provided to assist the operator with proper calibration and operation of the AutoBoom system when used with the Raven OS device.



NOTICE

Installation of the AutoBoom hydraulic and electrical components must be completed before calibrating the system. Refer to the machine-specific AutoBoom Installation Manual provided with the installation kit for details or questions regarding installation of the AutoBoom system.

Review the Installation Manual provided with the field computer for details regarding the Raven OS device.

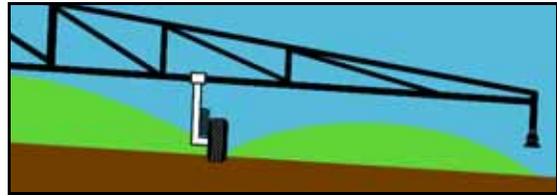
Note: *Terrain conditions and the machine hydraulic system will dictate the actual vehicle speeds which may be achieved during application with the AutoBoom system engaged. Typically, rougher and more varied field terrain will require slower speeds while AutoBoom is engaged.*

AutoBoom® Systems

The following AutoBoom systems are compatible with the Raven OS device:

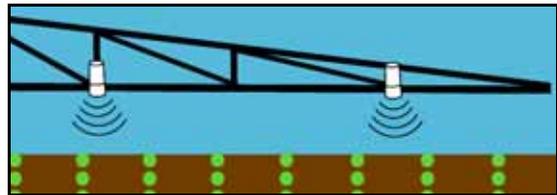
PowerGlide Plus

The AutoBoom PowerGlide Plus system uses gauge wheels to “feel” for the ground while the AutoBoom hydraulic control system maintains constant pressure in the boom tilt cylinders to maintain an optimum boom height. PowerGlide Plus systems are typically used in pre-emergence applications.



UltraGlide

The AutoBoom UltraGlide system uses ultrasonic sensors to “sense” or measure the boom height above ground. UltraGlide systems are ideal for either pre-emergence or post-emergence applications as the system does not require contact with the ground and will not damage the crop canopy.

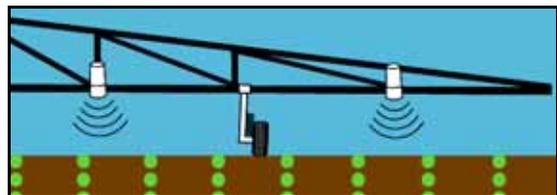


UltraGlide XT

AutoBoom UltraGlide XT systems use ultrasonic sensors for the boom wings as well as advanced boom position monitoring capabilities built into the control node to adjust the tilt and slant cylinders while adjusting for chassis roll to keep the boom as close as possible to the target application height. The UltraGlide XT system is ideal for pre-emergence or post-emergence applications where the system must adjust for rough or varied terrain in the field and to avoid damage to the booms or crop canopy.

Operating UltraGlide Systems in PowerGlide Plus Mode

AutoBoom UltraGlide and UltraGlide XT systems may be operated in PowerGlide Plus mode if desired without removing components of the UltraGlide system. In this mode, the system relies upon gauge wheels to “feel” for the ground and may provide preferred operation characteristics for pre-emergence and burn-down applications. While all ultrasonic sensors remain connected to the system, only the center rack sensor will be used for height control.



Recommendations and Best Practices

	⚠ 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.	

Raven Industries recommends performing the following steps to ensure the machine will function properly with the AutoBoom system before installing, activating, or operating any AutoBoom components and at the beginning of each season:

- Ensure that the hydraulic filters on the implement have been changed recently and that there are no issues with the function of the factory hydraulic system (e.g. pump issues, faulty hydraulic motors, fine metal deposits in the hydraulic system, etc.).
- Operate each of the following boom hydraulic functions (e.g. tilt, fold, center rack, tongue extension, etc.) at least three times to ensure the stack valve on the machine has been supplied fresh with oil and any debris has been flushed through the system hoses, valves, and filters.
- After installation of the AutoBoom system is complete, operate the boom and center rack raise/lower functions through the manual controls first before enabling AutoBoom to control these functions automatically to ensure that the hydraulic system is connected correctly and air is released from the system.

Updates

Product software and documentation updates may be made available periodically on the Raven Applied Technology web site:

www.ravenhelp.com

At Raven Industries, we strive to make your experience with our products as rewarding as possible. One way to improve this experience is to provide us with feedback on this manual.

Your feedback will help shape the future of our product documentation and the overall service we provide. We appreciate the opportunity to see ourselves as our customers see us and are eager to gather ideas on how we have been helping or how we can do better.

To serve you best, please send an email with the following information to

techwriting@ravenind.com

-AutoBoom® Calibration & Operation Manual

-Manual No. 016-0130-076 Rev. C

-Any comments or feedback (include chapter or page numbers if applicable).

-Let us know how long have you been using this or other Raven products.

We will not share your email or any information you provide with anyone else. Your feedback is valued and extremely important to us.

Thank you for your time.

AutoBoom[®] Calibration Overview

The Raven OS device and AutoBoom system must be calibrated specifically for each vehicle or implement before being used to provide automated boom height control. Calibration of the AutoBoom system requires hydraulic fluid pressure and sufficient boom travel to allow the system to detect the base duty cycles for boom operation.

During calibration and operation, the booms must be free to travel 10 inches [25 cm] up and down without reaching cylinder stops. It is also important to keep the machine running at 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 engine at the normal operating RPM.*

The following items must be completed to successfully test and calibrate the AutoBoom system:

1. Detect the AutoBoom system with the Raven OS and setup a machine configuration. See the *Raven Operating System (ROS) Basic Operation Manual* for additional assistance.
2. Test and verify AutoBoom installation on the implement. See the *Pre-Calibration Hydraulic Diagnostics* section on page 8.
3. Perform an automated calibration of the AutoBoom system:
 - PowerGlide Plus systems, see the *PowerGlide Plus Calibration* section on page 9.
 - UltraGlide and UltraGlide XT systems, see the *UltraGlide Calibration* section on page 11.

Pre-Calibration Hydraulic Diagnostics

While every effort has been made to properly label and document connections for the hydraulic and electrical components of the AutoBoom® system, some 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 electrical connections are correct to ensure proper AutoBoom system operation.

To test that the AutoBoom system will be able to operate as intended, perform the following procedure:



1. Touch the Edit icon in the equipment profile panel to expand the Machine Configuration panel and view available system devices.
2. Locate and select the AutoBoom button.

Note: If the AutoBoom button is not displayed or displays as unavailable, refer to Chapter 5, Troubleshooting, to diagnose and correct issues with the AutoBoom control node.

3. Select the Diagnostics tab.
4. Use the machine joystick or panel controls to operate the following boom functions and verify that the Raven OS displays and updates the status changes properly:

	 <p>Booms may raise or lower quickly or suddenly during the testing process. To avoid serious injury or death, keep the area around the implement clear of bystanders during the test process.</p>
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- Raise and lower functions for the left and right booms.
- Raise and lower functions for the center rack.
- Fold and unfold functions.
- Sensor heights (if installed).
- Hydraulic pressures.

Note: Refer to the Diagnostics Tab section on page 23 for details on reviewing AutoBoom status updates while checking the above functions.

Reset Calibration

Although it is not normally necessary, there may be circumstances under which it may be desired to reset the AutoBoom system calibration. The AutoBoom system must be recalibrated after the system is reset. To reset the AutoBoom system calibration:



1. Touch the Edit icon in the Machine Configuration panel to expand the panel.
2. Locate and select the AutoBoom button. The AutoBoom Features tab will be displayed.
3. Touch the Calibrate tab and select the Reset Defaults icon in the lower, left corner of the tab.
4. When prompted to accept the reset, touch 'Yes' to proceed.

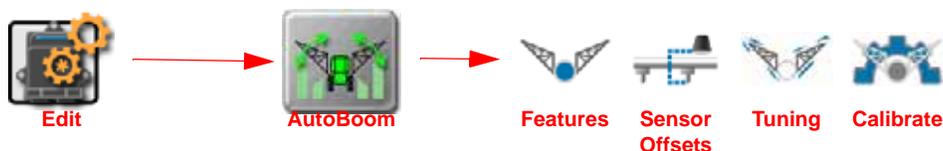
Note: *Resetting the AutoBoom system calibration will delete all system settings and adjustments that have been performed. Before resetting the AutoBoom calibration, refer to the Reset Defaults section on page 21.*

5. Refer to the *PowerGlide Plus Calibration* section on page 9 or the *UltraGlide Calibration* section on page 11 to recalibrate AutoBoom before engaging the system during a field operation.

PowerGlide Plus Calibration

Important: *Read and perform the process outlined in the Pre-Calibration Hydraulic Diagnostics section on page 8 before starting the calibration process.*

Boom Calibration



1. Touch the Edit icon in the Machine Configuration panel to expand the panel.
2. Locate and select the AutoBoom button. The AutoBoom Features tab will be displayed.

Note: *If the AutoBoom button is not displayed or displays as unavailable, refer to Chapter 5, Troubleshooting, to diagnose and correct issues with the AutoBoom control node.*

3. On the Features tab, select the options desired for operation of the AutoBoom system. Refer to the *AutoBoom® Features Tab* section on page 14 for additional information on the available features.
4. Touch the Sensor Offsets tab to access sensor height offset settings.
5. If ultrasonic sensors are installed, use the up and down arrows to set the vertical offset of the sensor body from the spray nozzle for each sensor location. Refer to the *Sensor Offsets Tab* section on page 15 for details on setting or adjusting the sensor offsets.
6. Select the Calibrate tab to access the AutoBoom calibration.

- Verify that the booms are unfolded and lower the center rack until the gauge wheels are approximately 6 inches [15 cm] above the ground.

Note: *If the booms do not go below horizontal or are travel-limited, raise the booms so that the boom tips are approximately 10 inches [25 cm] above the horizontal position and lower the center section slightly below the normal spray height.*

- If ultrasonic sensors are installed, use the up or down arrows to set the desired target height which the AutoBoom system should maintain when engaged.
- Touch the master power icon at the bottom of the Calibrate tab to toggle the AutoBoom system on.



WARNING

Booms will raise and lower automatically and may do so quickly or suddenly during the calibration process. To avoid serious injury or damage to the booms, check the area around the implement and keep bystanders and obstructions clear of boom travel during the AutoBoom calibration process.

- Touch the Start Calibration icon displayed above either the left or right boom.

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 engine at the normal operating RPM.*



To stop the calibration at any time, touch the stop calibration icon for the boom.

Note: *A calibration progress bar will display at the top of the tab. The calibration may take several seconds to complete. If the boom fails to calibrate, refer to Chapter 5, Troubleshooting, and troubleshoot the AutoBoom system.*



Center Rack Height Control Calibration (If Equipped)

Note: *Center rack calibration may take several minutes to complete. Before attempting to calibrate center rack height control with the PowerGlide Plus system, verify that an ultrasonic sensor is installed and connected to the AutoBoom control node. Contact a local Raven dealer for additional assistance with ordering and installing the center rack sensor.*

There are several different stack valve configurations used to control implement center rack functions. AutoBoom must “learn” which of the solenoids are used to raise and lower booms and center rack. Complete the following procedure to calibrate the center rack control feature:



- Complete the calibration procedure for the left and right booms. Refer to the *Boom Calibration* section on page 9 to complete the boom calibration process.
- Touch the Edit icon in the Machine Configuration panel to expand the panel.
- Locate and select the AutoBoom button. The AutoBoom Features tab will be displayed.

- Verify that the Center Rack Control option is selected.

Note: Be sure that the required components for center rack control are installed prior to enabling the center rack control feature.

- Select the Calibrate tab.
- Touch the master power icon at the bottom of the tab to toggle the AutoBoom system on.
- On the implement joystick or control panel, press and hold the center rack raise function for 6 seconds.



Note: Continue to hold the raise function for the full 6 seconds even if the center rack reaches the upper limit of travel during this time.

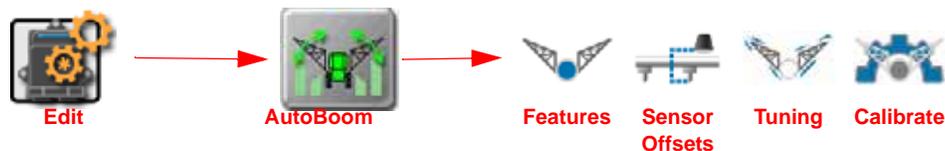
- On the implement joystick or control panel, press and hold the center rack lower function for 6 seconds.

Note: Continue to hold the lower function for the full 6 seconds even if the center rack reaches the lower limit of travel during this time.

UltraGlide Calibration

Important: Read and perform the process outlined in the Pre-Calibration Hydraulic Diagnostics section on page 8 before starting the calibration process.

Boom Calibration



- Touch the Edit icon in the Machine Configuration panel to expand the panel.
- Locate and select the AutoBoom button. The AutoBoom Features tab will be displayed.

Note: If the AutoBoom button is not displayed or displays as unavailable, refer to Chapter 5, Troubleshooting, to diagnose and correct issues with the AutoBoom control node.

- On the Features tab, select the options desired for operation of the AutoBoom system. Refer to the *AutoBoom® Features Tab* section on page 14 for additional information on any available features.
- Touch the Sensor Offsets tab to access sensor height offset settings. Refer to the *Sensor Offsets Tab* section on page 15 for details on setting or adjusting the sensor offsets.
- Select the Calibrate tab to access the AutoBoom calibration.
- Use the up or down arrows to set the desired target height which the AutoBoom system should maintain when engaged.

- Verify that the booms are unfolded and set the center rack and both booms within 10 inches [25 cm] of the set target height.

Note: The default target height is 30 inches [76 cm]. Verify that the booms are not fully raised to the cylinder stops. If gauge wheels are installed, the target height must be adjusted to 40-45 inches [101-114 cm] to prevent the wheels from touching the ground during the calibration process.

If boom travel will not go below horizontal or the booms are travel-limited, raise the booms so that the boom tips are approximately 10 inches [25 cm] above the horizontal position and lower the center section slightly below the normal spray height.

- Touch the master power icon at the bottom of the tab to toggle the AutoBoom system on.



! WARNING

Booms will raise and lower automatically and may do so quickly or suddenly during the calibration process. To avoid serious injury or damage to the booms, check the area around the implement and keep bystanders and obstructions clear of boom travel during the AutoBoom calibration process.



- Touch the Start Calibration icon displayed above either the left or right boom.

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 engine at the normal operating RPM.

To stop the calibration at any time, touch the stop calibration icon for the boom.

Note: A calibration progress bar will display at the top of the tab. The calibration may take several seconds to complete. If the boom fails to calibrate, refer to Chapter 5, Troubleshooting, and troubleshoot the system.



Center Rack Height Control Calibration (If Equipped)

There are several different stack valve configurations used to control implement center rack functions. AutoBoom must “learn” which of the solenoids are used to raise and lower booms and center rack. Complete the following procedure to calibrate the center rack control feature:



- Complete the calibration procedure for the left and right booms. Refer to the *Boom Calibration* section on page 9 to complete the boom calibration process.
- Touch the Edit icon in the Machine Configuration panel to expand the panel.
- Locate and select the AutoBoom button. The AutoBoom Features tab will be displayed.
- Verify that the Center Rack Control option is selected.

Note: Be sure that the required components for center rack control are installed prior to enabling the center rack control feature.

- Select the Calibrate tab.

6. Touch the master power icon at the bottom of the tab to toggle the AutoBoom system on.
7. On the implement joystick or control panel, press and hold the center rack raise function for 6 seconds.



Note: Continue to hold the raise function for the full 6 seconds even if the center rack reaches the upper limit of travel during this time.

8. On the implement joystick or control panel, press and hold the center rack lower function for 6 seconds.

Note: Continue to hold the lower function for the full 6 seconds even if the center rack reaches the lower limit of travel during this time.

XT Control Calibration (If Equipped)

Complete the following procedure to calibrate the center rack tilt control feature:



1. Complete the calibration procedure for the left and right booms. Refer to the *Boom Calibration* section on page 11 to complete the boom calibration process.
2. Touch the Edit icon in the Machine Configuration panel to expand the panel.
3. Locate and select the AutoBoom button. The AutoBoom Features tab will be displayed.
4. Verify that the XT Control option is selected.

Note: Be sure that the required components for XT Control are installed prior to enabling these additional features.

5. Select the Calibrate tab.
6. Select the Forward Pointing Arrow value and use the scroll menu to select the arrow number on the node enclosure which is pointing toward the front of the implement. Refer to the *Forward Pointing Number* section on page 21 for additional assistance with this setting.
7. Touch the master power icon at the bottom of the tab to toggle the AutoBoom system on.



	WARNING
<p>Booms will raise and lower automatically and may do so quickly or suddenly during the calibration process. To avoid serious injury or damage to the booms, check the area around the implement and keep bystanders and obstructions clear of boom travel during the AutoBoom calibration process.</p>	

8. Touch the Start Calibration icon displayed above the center section.

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 engine at the normal operating RPM.



To stop the calibration at any time, touch the stop calibration icon for the center section.



Note: A calibration progress bar will display at the top of the tab. The calibration of the XT Control feature may take up to a minute to complete. If the boom fails to calibrate, refer to Chapter 5, Troubleshooting, and troubleshoot the system.

Boom tips may raise automatically during calibration to allow for full rotation of the center rack. Pressure in slant cylinders will increase until the center section begins to rotate slightly. The center section will then rotate fully clockwise and then counterclockwise to calibrate the center rotation sensor position.

The center rotation sensor may be re-centered by recalibrating XT Control or by manual adjustment of the centering bolt while the center section is confirmed to be in the center position.

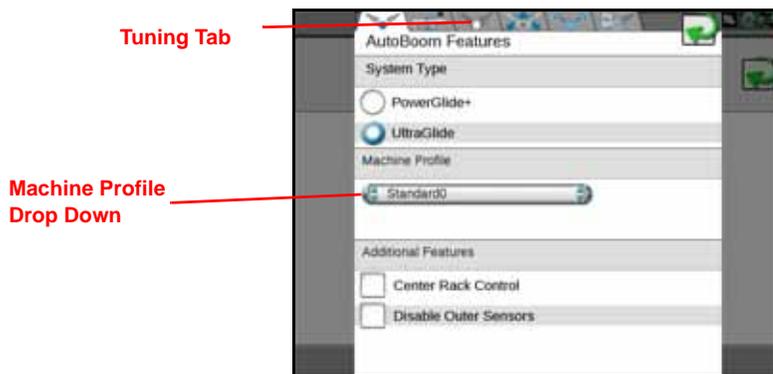
AutoBoom® Settings Definition

AutoBoom® Features Tab



1. Touch the Edit icon in the Machine Configuration panel to expand the panel.
2. Locate and select the AutoBoom button. The AutoBoom Features tab will be displayed.

UltraGlide Systems



Note: Most of the machine profile settings (boom size, spacing, etc) are completed during machine configuration. Refer to the Basic ROS Operation manual for additional information on machine configuration. Selecting a machine from the Machine Profile drop down will adjust some of the tuning settings such as speed, stability, and the stability factor based on the selected machine. These settings can be viewed in the Tuning tab.

System Type

(UltraGlide Systems) The system type selection allows the UltraGlide system to operate in PowerGlide Plus mode. This mode requires gauge wheels to be installed on the booms and orifices removed from the

AutoBoom hydraulic valve. In this mode, the AutoBoom system will not adjust the boom height based upon the ultrasonic sensor height.

Note: *PowerGlide Plus systems are locked to operate with gauge wheels, the system type cannot be modified.*

Additional Features

Center Rack Control. The center rack control feature allows the AutoBoom system to automatically adjust the height of the center rack during field operations. Additional hardware may be required to provide automated center rack control. Contact a local Raven dealer for more information or purchasing.

Disable Outer Sensors. (UltraGlide Systems) Allows the operator to disable outer boom sensors if the implement is equipped with optional inner or mid sensor pairs. This feature is useful during operation with the boom tips folded in to allow the AutoBoom system to be engaged and use only inner sensor pairs during field operations.

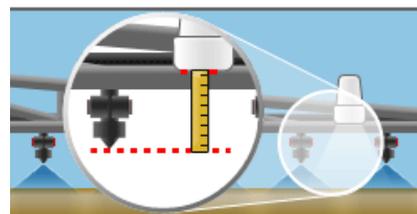
XT Control. (UltraGlide Systems) Select this option if a control node capable of XT Control is installed to allow the system to adjust for rough or challenging field terrain during applications.

Sensor Offsets Tab

Note: *The Sensor Offsets tab will not be used with PowerGlide Plus systems without the center rack control feature.*



1. Touch the Edit icon in the Machine Configuration panel to expand the panel.
2. Locate and select the AutoBoom button.
3. Touch the Sensor Offsets tab to display the height offset settings.



Sensor Height Offset

The sensor height offset values adjust for the vertical distance from the spray tip to the sensor. Adjusting for this distance allows the AutoBoom system to display the height of the spray tips and accurately control the height of the boom to ensure an even spray pattern.

To set the sensor height offset for each sensor location:

1. Measure the vertical distance from the bottom of the nearest spray tip to the bottom of the sensor surface for each sensor location.
2. Use the up or down arrows on the Sensor Offsets tab to set the offset value. If the sensor surface is below the spray tip, set the height offset to a negative value.

Note: The maximum height offset is 20 inches [50 cm]. On machines with travel-limited booms, the center sensor height offset 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.

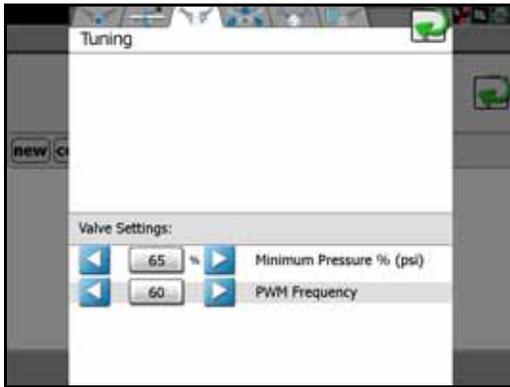
Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop canopy. For row-crop situations, it may be beneficial to adjust sensor positions to directly over a row or add additional boom sensors.

Tuning Tab

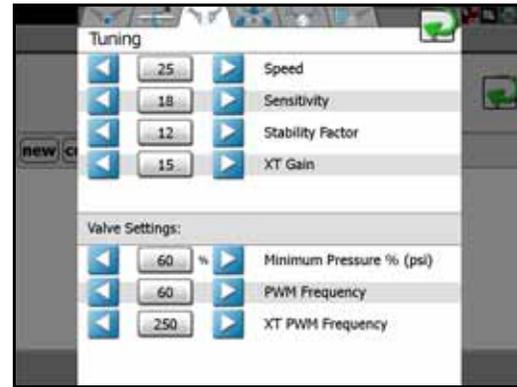


1. Touch the Edit icon in the Machine Configuration panel to expand the panel.
2. Locate and select the AutoBoom button.
3. Touch the Tuning tab to display the AutoBoom tune settings.

PowerGlide Plus Systems



UltraGlide XT Systems



Tune Settings

Note: The tune settings at the top of the Tuning tab are only available when operating with AutoBoom UltraGlide systems. Refer to the Valve Settings section on page 18 for valve tuning information for PowerGlide Plus systems.

Speed. The AutoBoom speed setting adjusts how quickly the boom will move away from an obstacle or obstruction in the sensor path, and how much the boom could overshoot the target height. The speed value should be set so that the boom motion is smooth and the machine does not oscillate when the booms react. The default speed value is 25. Typical speed range is between 22 and 27 for most implements but could be much higher depending upon the static pressure of the booms, boom geometry, and the AutoBoom sensitivity value.

To adjust the speed:

Note: It is recommended to set the AutoBoom sensitivity before adjusting the AutoBoom speed.

1. Place an obstacle (hand, note pad, etc.) at ground level below one boom sensor.

2. Raise the obstacle quickly toward the sensor body (approximately 2 feet per second [60 cm/s]) until the obstacle is within 12 inches [30 cm] of the sensor surface.

The boom should react immediately and raise at a speed matching the obstacle movement. When the obstacle stops, the boom should overshoot the new target height by 1 foot [30 cm] or less.

3. Adjust the AutoBoom speed value as necessary.

Sensitivity. The AutoBoom sensitivity setting adjusts how sensitive the system will be to changes in the height of the booms above the ground or crop canopy. During normal operation, it is recommended to set the AutoBoom sensitivity so that AutoBoom is unresponsive to height changes between 2 to 3 inches [5 to 8 cm], but should react quickly to changes of 5 inches [13 cm] or more.

The default sensitivity value is 15. Typical sensitivity range for most implements with a 30 inch [76 cm] spray height is between 13 to 17. If the AutoBoom sensitivity is set too high, the boom will appear unstable or jittery as the system reacts to slight changes in the target height such as the crop canopy swaying in the wind.

Note: *It is recommended to reduce the AutoBoom sensitivity factor for target heights less than 25 inches [63 cm] and to increase the sensitivity factor for target heights greater than 40 inches [101 cm].*

For row-crop operations, or when crop canopy is sparse or not fully covering the ground, it may be beneficial to decrease the AutoBoom sensitivity so the booms are less reactive to sudden changes in crop height and less likely to cause sudden movements which will diminish performance.

To adjust the AutoBoom sensitivity:

1. Place an obstacle (hand, note pad, etc.) at ground level below one boom sensor.
2. Raise the obstacle steadily toward the sensor body (approximately 1 foot per second [30 cm/s]) to within 12 inches [30 cm] of the sensor surface.

The boom should react immediately when the obstacle is 5 to 6 inches [12 to 15 cm] above the ground.

3. Adjust the sensitivity value as necessary.

Stability Factor. The stability factor allows the AutoBoom system to compensate for loose center racks by controlling the opposite boom. When one boom is raised to reach target height, AutoBoom will raise the opposite boom slightly to keep the implement stable and the opposing boom from dipping into crop canopy or the dirt and to minimize chassis roll. The AutoBoom stability factor may be adjusted to provide very slight compensation for highly stable or rigid center racks or adjusted to compensate more for looser or less stable center racks.

The default value of 20 is recommended for implements with a rigid center rack. A value of 5 - 14 is recommended for implements with center suspension that floats freely. Adjust this value as needed to prevent boom oscillation.

To adjust the AutoBoom stability factor:

Note: *Adjust the stability factor after the sensitivity and speed have been set.*

1. Place an obstacle (hand, note pad, etc.) at ground level below one boom sensor.
2. Raise the obstacle quickly toward the sensor body (approximately 2 feet per second [60 cm/s]) while observing movement of the opposite boom.

The opposite boom should raise slightly (usually no more than 6 inches [15 cm]) at the same time as the boom being manipulated.

3. Adjust the stability factor as necessary:
 - a. Lower the stability factor if the opposite boom does not raise enough.
 - b. Raise the stability factor to make the opposite boom less reactive, allow for natural movement of the boom, and avoid inducing chassis roll.

Note: *Too low of a stability factor (1-4) may prevent the booms from lowering. A stability factor of zero (0) will completely disable AutoBoom stability control, making the left and right boom responses*

completely independent of each other. When above the target height, control of each boom is accelerated. A stability factor of zero may be desirable for implements with a very rigid center rack.

XT Gain. (UltraGlide XT Systems Only) The XT gain value allows fine tuning of the allowable rotation of the center rack suspension.

The default gain value is 15. Higher XT gain values cause the XT control to react more aggressively when chassis roll is sensed by the node. Setting the XT gain too high may cause the center rack to be excessively rigid and possibly cause damage to the center rack. Lower XT gain values cause the XT control to be less aggressive when chassis roll is sensed. Setting the XT gain too low may cause the system to be unresponsive to chassis roll.

To adjust the XT gain:

1. Enable the left, right, and slant control in the field.
2. While driving over varying terrain, observe the rotation of the center section compared to chassis roll.
3. Raise or lower the XT gain value as necessary to cause the XT control to be more or less reactive.

Valve Settings

Minimum Pressure Percent (UltraGlide Systems). The minimum pressure percent sets the lowest pressure limit and will prevent the boom hydraulic pressure from falling below a percentage of static pressure, overriding AutoBoom control when necessary to maintain the lowest pressure limit for each boom. The minimum pressure percent setting also prevents travel-limited booms from resting on the boom stops during operation.

The default value for the minimum pressure percent is 65. The minimum pressure percent mode is intended for emergency boom protection only. The AutoBoom system should not be run with booms at this pressure during routine operation. 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 minimum pressure percent mode.

To adjust the minimum pressure percent:

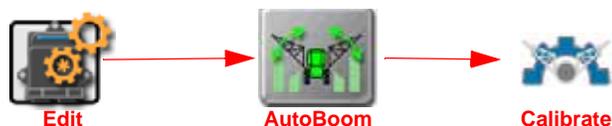
1. Raise the center rack section to the target height so that both booms and center rack are level and horizontal to the ground.
2. Set the minimum pressure percent value to 80.
3. Place an obstacle (hand, note pad, etc.) at ground level below one boom sensor.
4. Raise the obstacle steadily toward the sensor body (approximately 1 foot per second [30 cm/s]) to within 12 inches [30 cm] of the sensor surface, or until the boom raises approximately 3 feet [0.9 m] above the original height.
5. Remove obstacle from the sensor path and verify that the boom lowers slowly after a slight delay. If the boom does not lower, decrease the minimum pressure percent value by one and repeat the procedure. Repeat the procedure until the boom begins to lower.

PWM Frequency. The PWM frequency sets the frequency of the pulse width modulated signal to the proportional control valve. The following PWM Frequencies are automatically detected during the AutoBoom calibration process and should not be adjusted:

- 60 Hz with square coils installed on the hydraulic valve,
- 250 Hz with round coils installed on the hydraulic valve.

XT PWM Frequency. (UltraGlide XT Systems Only) The PWM frequency sets the frequency of the pulse width modulated signal to the proportional control valve for extreme terrain control. The default frequency for the XT system is 250 Hz. This value is automatically detected during the AutoBoom calibration process and should not be adjusted.

Calibrate Tab



1. Touch the Edit icon in the Machine Configuration panel to expand the panel.
2. Locate and select the AutoBoom button.
3. Touch the Calibrate tab to access the AutoBoom calibration options.

PowerGlide Plus Systems



UltraGlide XT Systems



Automated Calibration Icons

If the AutoBoom system has not been calibrated, or if the calibration settings have been reset, the start and stop calibration icons will be displayed for each boom. For implements with the XT Control feature enabled, a calibration icon will also be displayed for the center section.

Start Calibration



Stop Calibration



Touch the start icon to initiate the boom calibration process. Touch the stop icon to stop the calibration process at any time.

WARNING

Booms will raise and lower automatically and may do so quickly or suddenly during the calibration process. To avoid serious injury or damage to the booms, check the area around the implement and keep bystanders and obstructions clear of boom travel during the AutoBoom calibration process.

Note: XT Control may only be calibrated after the left and right booms are calibrated. The start calibration icon for the center rack will not be displayed until calibration is complete on each of the booms.

Boom Status Display

The current monitored height and hydraulic pressure for each implement section is displayed on the Calibrate tab. These displays may be useful to prepare the system for calibration or help to indicate issues with the system during the calibration process.

A more detailed display of sensor height and hydraulic pressure is available on the Diagnostics tab. Refer to the *Diagnostics Tab* section on page 23 for more information.

Target Height

(UltraGlide Systems) The target height sets the distance in inches [centimeters] above ground or the crop canopy to which AutoBoom should control boom heights while the system is engaged. Target height is only utilized with AutoBoom systems which utilize ultrasonic sensors to measure boom height during field operations.

Use the up and down arrows to raise or lower the target height as necessary.

Note: *Recall that the sensor height offsets adjust the distance measured by each sensor pair to the actual distance from the spray tips to the ground or crop canopy while the system is engaged. The height displayed on the Calibrate tab displays the adjusted height for the spray tips. Refer to the Sensor Offsets Tab section on page 15 for more information on setting or adjusting the sensor height offsets.*

Left and Right Pressure

(PowerGlide Plus Systems) During the calibration process, the AutoBoom system will calculate an initial pressure setting. Normally, the calculated value will be the pressure at which the machine should operate. However, an adjustment to the initial pressure levels may be necessary to further tune the AutoBoom system for the implement. The pressure value for the left and right booms allows the operator to manually tune the static pressure supplied to each boom during AutoBoom operation.

To adjust the left and right pressure values after the initial calibration sequence:

1. Verify that AutoBoom is set to PowerGlide Plus mode.
2. Enable AutoBoom control for the left and right booms.
3. Walk to the end of each boom and physically lift the boom while monitoring the responsiveness of the system. The boom should raise easily and the force required to lift the boom should never exceed 200 pounds [90 kg].
4. Adjust the pressure value for each boom as necessary to optimize performance.

Higher Static Pressures:	Lower Static Pressures will:
<ul style="list-style-type: none"> • will reduce “felt weight” of the boom, • will reduce the down speed, 	<ul style="list-style-type: none"> • will increase “felt weight” of the boom, • will increase down speed,
<ul style="list-style-type: none"> • may cause the boom to “hang” in the air during operation. 	<ul style="list-style-type: none"> • may cause excessive force on and damage the gauge wheels during operation.

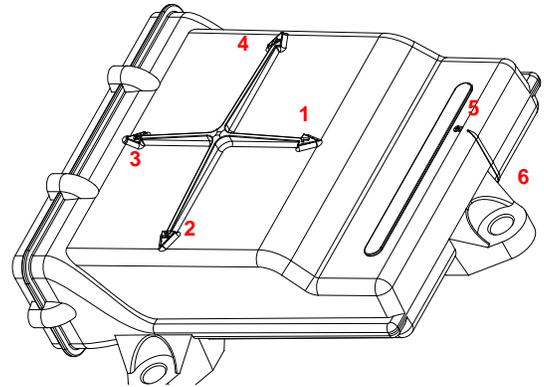
5. Continue to monitor the booms and gauge wheels during field operations.

Note: *During routine operation, the gauge wheels should touch down momentarily, raise slightly, then lower back to the target height. Wheels should not continuously ride on the ground.*

Forward Pointing Number

(UltraGlide XT Systems Only) If an UltraGlide XT control node is installed for automated boom height control in challenging terrain, the system will require the node orientation to be calibrated.

To configure the node orientation, touch and drag on the scroll list to select the arrow on the node enclosure which is pointed toward the front of the vehicle during normal implement operation.



Note: Once set during calibration, the orientation will not be displayed by the Raven OS. To change this setting if the node orientation is physically modified, reset the AutoBoom system calibration and recalibrate the UltraGlide XT system.

Reset Defaults

Touch the reset defaults icon in the lower, left corner of the Calibrate tab to reset the AutoBoom system settings. Although it is not normally necessary, there may be circumstances under which it may be desired to reset the calibration of the AutoBoom system. It is also recommended to reset system settings and recalibrate if any significant changes are made to the tractor or implement hydraulic system.

Note: Resetting the AutoBoom system calibration will delete all system settings and adjustments that have been performed.

Master Power

Touch the master power icon to toggle the AutoBoom system on or off. The system must be on before automated boom height features can be engaged during an application. Refer to the *Engaging AutoBoom®* section on page 26 for more information on enabling and engaging AutoBoom during field operations.

Manual Control Tab

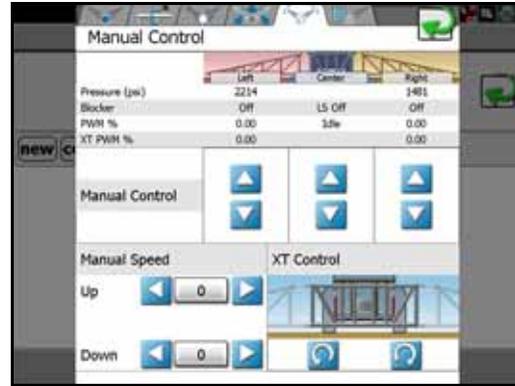


1. Touch the Edit icon in the Machine Configuration panel to expand the panel.
2. Locate and select the AutoBoom button.
3. Touch the Manual Control tab to access the on-screen manual controls.

PowerGlide Plus Systems



UltraGlide XT Systems



Boom Status Display

The current monitored height and hydraulic pressure for each implement section is displayed on the Manual Control tab. These displays may be useful to prepare the system for calibration or help to indicate issues with the system during the calibration process.

A more detailed display of sensor height and hydraulic pressure is available on the Diagnostics tab. Refer to the *Diagnostics Tab* section on page 23 for more information.

Manual Controls

The manual controls may be used to help troubleshoot wiring or hydraulic issues experienced with the AutoBoom system. The up and down manual controls for the left, center, and right sections allow the implement operator to manually raise and lower the booms via the AutoBoom system to verify function of the system without engaging AutoBoom.

Note: *The machine valve will be used to control center rack functionality if the machine is equipped with center rack control and required center rack control cabling has been installed.*

Manual Speed Adjustment

Use the left and right arrow buttons to adjust the speed at which the AutoBoom valve manually raises or lowers the booms on implements that do not have a remote or SVC hydraulic control. Since most implements are equipped to hydraulically control boom functions, the default up and down speeds are set to zero.

XT Control

(UltraGlide XT Systems Only) Allows the operator to rotate the center rack clockwise and counterclockwise relative to the implement chassis. These functions may be used to troubleshoot issues with the XT Control system and verify that the XT valve is connected correctly.

Diagnostics Tab



1. Touch the Edit icon in the Machine Configuration panel to expand the panel.
2. Locate and select the AutoBoom button.
3. Touch the Diagnostics tab to access the AutoBoom diagnostics display.

PowerGlide Plus Systems

UltraGlide XT Systems

	Left	Center	Right
Height (in)	35	30	34
Pressure (psi)	993		975
Raise	OFF	OFF	OFF
Lower	OFF	OFF	OFF
Unfold	OFF	OFF	OFF
Blocker	OFF	LS OFF	OFF
PWM %	0.00	Idle	0.00
Base PWM %	0.00	Idle	0.00
Stats	0		0

	Left	Center	Right
Height (in)	25	9	7
Pressure (psi)	2214		1461
Raise	OFF	OFF	OFF
Lower	OFF	OFF	OFF
Unfold	OFF	OFF	OFF
Blocker	OFF	LS OFF	OFF
PWM %	0.00	Idle	0.00
Base PWM %	57.30		47.61
XT PWM %	0.00		0.00
Roll Rate		0.00	
Center Rack Angle		-32.46	
Stats	0		0

Diagnostic Displays

The following information is available on the Diagnostics tab depending upon the type of AutoBoom system to which the Raven OS device is connected:

Height. The monitored sensor heights for each implement section are displayed at the top of the Diagnostics tab display. These values are the adjusted heights based upon the values set on the Sensor Offsets tab.

Pressure. Displays the current hydraulic pressure in the left and right boom cylinders.

Raise. Indicates the status of the implement manual boom control switches. When raise functions are operated, this status area will display ON for the section or sections being raised.

Lower. Indicates the status of the implement manual boom control switches. When raise functions are operated, this status area will display ON for the section or sections being raised.

Unfold. Displays the status of the boom unfold proximity switch (if equipped). AutoBoom system power cannot be toggled on until this switch is triggered to indicate that the booms are unfolded.

Blocker. Displays the status of the AutoBoom node output to the double-blocker valves. Blocker will indicate On when individual booms are engaged.

PWM Percent. Indicates the duty cycle of the proportional valves. This value will be 0 if the individual booms are disengaged. When AutoBoom is engaged and operating, the PWM percent will vary in output up to 100 percent when the booms are being operated.

Base PWM Percent. Indicates the calculated static duty cycle for the AutoBoom system to maintain the set height or pressure. This value will typically change slowly ± 5 percentage points during routine operations.

XT PWM Percent. (UltraGlide XT Systems Only) Indicates the duty cycle of slant control proportional valves when operating with an UltraGlide XT system. This value will be 0 if XT control is not enabled. When XT control is engaged and operating, this value may vary in output up to 100 percent as the system adjusts for varying terrain. A minimum value will be maintained when the XT control is enabled.



Roll Rate. (UltraGlide XT Systems Only) Indicates the measured chassis roll rate. This value will change when the machine chassis is rolling left or right.

Center Rack Angle. (UltraGlide XT Systems Only) Degrees of measured rotation of the implement boom relative to the chassis. This value should be nearly zero when the boom suspension is centered and will vary when the boom is rotated independently of the machine chassis.

Stats. Reflects the boom performance. This value is for Raven use only.

AutoBoom[®] Operation Overview

Note: *If the machine has an open center hydraulic system, or the type of hydraulic system is unknown, be sure to maintain sufficient RPM while the AutoBoom system is engaged. The AutoBoom system will not be able to raise booms at expected speeds if sufficient hydraulic flow is not supplied to the boom cylinders.*

The following items may be useful when operating the AutoBoom system during field operations:

1. AutoBoom status widget to toggle the AutoBoom system on and quickly view AutoBoom control status.
Review the Raven OS device Installation and Operation Manual for more information about customizing screen profiles and layouts. See the *AutoBoom[®] Widget and Control Prompt* section on page 27 for details about using the AutoBoom widget during field operations.
2. Review of the implement joystick functions to engage automated boom height control.
See the *Joystick Control Interface* section on page 28 for details on using the implement joystick boom control functions to engage and disengage the AutoBoom system during field operations.

Operational Notes

AutoBoom[®] Calibration

While calibration of some AutoBoom systems may be completed while in an active job, it is recommended to exit the job and calibrate the system via the Calibrate tab found within the AutoBoom module. Review Chapter 3, *Calibration*, for additional information and detailed procedures.

Note: *Calibration of the UltraGlide XT system cannot be completed during an active job if the forward pointing number value is not set prior to starting the job. Review the Forward Pointing Number section on page 21 for more information on this value for the XT Control feature.*

Boom Travel

During normal operations, the implement booms must be free to travel 10 inches [25 cm] up or down without reaching the tops or bottoms of the cylinder stops. When operating with a travel-limited boom, review the *Sensor Offsets Tab* section on page 15 and the *Minimum Pressure Percent (UltraGlide Systems)* section on page 18 for additional assistance with adjusting the AutoBoom system for these configurations.

Operating with Gauge Wheels

During routine operation, the gauge wheels should touch down momentarily, raise slightly, then lower back to the target height. Wheels should not continuously ride on the ground and booms should not be supported by the gauge wheels. The boom should raise easily and the force required to lift the boom should never exceed 200 pounds [90 kg].

When approaching headlands to make a turn, or when making quick course changes, the gauge wheels must be raised approximately 6 inches [15 cm] from the ground to prevent the wheels from sliding sideways or backward, causing damage to the gauge wheel assembly.

Note: *The implement joystick functions may be used to quickly re-engage AutoBoom and reset the booms to the target height. Refer to the Joystick Control Interface section on page 28 for additional information.*

Engaging AutoBoom®

The AutoBoom system may be engaged with either the joystick functions on the implement or via the Raven OS. Review the following sections for information on using both of these methods during field operations.

Note: *The AutoBoom widget will be required to turn the AutoBoom system power on or off during field operations.*

To engage the AutoBoom system:

1. Toggle the AutoBoom system power on. See the *AutoBoom® System Power* section on page 27 for details.
2. Enable automated height control features for boom sections as desired or available. See the *AutoBoom® Widget and Control Prompt* section on page 27 and the *Joystick Control Interface* section on page 28 for available options for enabling height control features.

Note: *On-screen controls are not available to engage the AutoBoom system without an active job on the Raven OS device.*

See the AutoBoom® System Power section on page 27 and refer to the Joystick Control Interface section on page 28 to use AutoBoom, automated boom height control, features without starting or resuming a job on the Raven OS device.

AutoBoom® Widget and Control Prompt

The AutoBoom widget allows the operator to engage and disengage boom sections quickly right from the guidance display. The widget also provides access to AutoBoom system power and operational adjustments.

Status Display and Interface



System Off Boom Disabled Boom Enabled

The AutoBoom widget displays the following system and boom status information:

Note: The center rack status will only be displayed if the Center Rack Control feature is selected. Review the AutoBoom® Features Tab section on page 14 for additional information regarding features available with the Raven AutoBoom system.

System Off. When the AutoBoom system power is off, all boom sections will display a red x as shown in the figure above. The system power must be toggled on before AutoBoom height control may be enabled for boom sections. See the AutoBoom® System Power section on page 27 for assistance with toggling the AutoBoom system power.

Boom Disabled. AutoBoom height control is not enabled for any sections displayed in red as shown in the figure above. Touch the status indicator to enable AutoBoom for that section.

Note: If XT Control is available, disabling height control for either the left or right boom section will automatically disable automated center rack XT control functions.

Boom Enabled. AutoBoom height control is enabled for any sections displayed in green as shown in the figure above. Touch the status indicator to disable AutoBoom for that section.

Note: Enabling height control for the center rack section will automatically enable the left and right boom sections.

Boom Calibrate. Any sections for which the automated calibration has not been completed will display the boom calibrate status.

While boom sections may be calibrated during a job in many circumstances, it is highly recommended to exit the job and calibrate the AutoBoom system from the Calibrate Tab within the AutoBoom module. Review Chapter 3, Calibration, for additional information and detailed procedures.



Calibration Required

AutoBoom® System Power



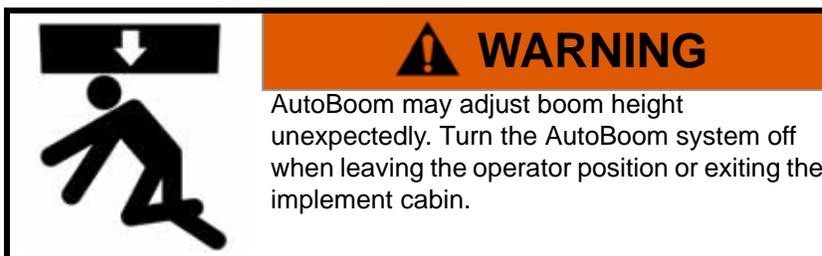
Widget



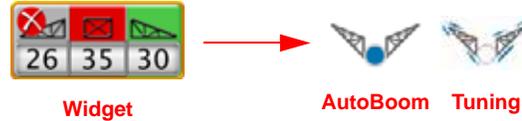
AutoBoom

To toggle the AutoBoom system power while in an active job:

1. Touch and hold the AutoBoom widget for approximately 2 seconds to access the AutoBoom in-job prompt.
2. Touch the Master Power icon to toggle the AutoBoom system on or off.



AutoBoom® In-Job Prompt



In addition to the AutoBoom system power, the AutoBoom in-job prompt provides the following displays and operator controls:

Section Status. The status indicators display the same status information and provide the same functionality as the AutoBoom on-screen widget. Touch each section to enable or disable AutoBoom height control features for the section.

Boom Pressures. Displays the current hydraulic pressure in the left and right boom cylinders.

Current Height. The monitored sensor heights for each implement section are displayed at the top of the Diagnostics tab display. These values are the adjusted heights based upon the values set on the Sensor Offsets tab.

Target Height. The target height sets the distance in inches [centimeters] above ground or the crop canopy to which AutoBoom should control boom heights while the system is engaged.

Tuning Tab. (UltraGlide Systems Only) Provides the operator with access to the speed, sensitivity, stability factor, and XT Gain values (if available) during an active job. Refer to the *Tuning Tab* section on page 16 for information on adjusting the AutoBoom tune settings available in the in-job prompt.

Joystick Control Interface

The AutoBoom system power must be turned on or off via the AutoBoom widget before the system may be enabled using the following joystick function controls. Review the *AutoBoom® System Power* section on page 27 for details. With the AutoBoom system power on, the implement operator may use the implement joystick functions in the following sections to quickly enable or disable automated boom height control for individual sections:

Note: *Holding the down function for longer than 1/2 of a second will disable AutoBoom height control and allow the operator to lower the boom manually. To enable AutoBoom height control, tap and immediately release the down function.*

Consecutive up-taps or down-taps must be performed within 1.5 seconds to engage the double tap joystick control functions.

PowerGlide Plus Joystick Interface Functions (Center Rack Control Feature Disabled)

The following joystick control interface functions are available when operating an AutoBoom PowerGlide Plus system with the center rack control feature disabled.

Note: *Implement may require the activation of a boom valve and/or master switch before the center rack control feature may be enabled.
Active center rack height control will not be enabled as this control feature is disabled.*

Boom Function Switch		Center Rack Function Switch	
Single Up-Tap	Single Down-Tap	Single Up-Tap	Single Down-Tap
<ul style="list-style-type: none"> • Disable AutoBoom control on the boom. 	<ul style="list-style-type: none"> • Enable AutoBoom control on the boom. 		
Double Up-Tap	Double Down-Tap	Double Up-Tap	Double Down-Tap
<ul style="list-style-type: none"> • Raise both booms slightly.^a 	<ul style="list-style-type: none"> • Lower both booms quickly.^a • Re-enable AutoBoom control to the set pressure setting.^a 	<ul style="list-style-type: none"> • Disable AutoBoom control for both booms. 	<ul style="list-style-type: none"> • Lower the center rack to the set target height.
<ul style="list-style-type: none"> • Raise boom slightly.^b 	<ul style="list-style-type: none"> • Lower the boom quickly.^b • Re-enable AutoBoom control to the set pressure setting.^b 	<ul style="list-style-type: none"> • Raise the center rack to the set transport height. 	<ul style="list-style-type: none"> • Enable AutoBoom control for both booms.
		Four Up-Taps	Four Down-Taps
		<ul style="list-style-type: none"> • Raise the center rack to the maximum height. • Turn AutoBoom system off. • Save the maximum height as the new transport height. 	

a. AutoBoom systems with a single proportional valve and square coils.

b. AutoBoom systems with two proportional valves and round coils.

Setting Transport Height. Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop canopy. Return to height and return to transport heights are sensor measurements relative to the first reflected signal (e.g. crop canopy), not necessarily ground level.

To set the transport height to maximum center rack height:

1. Raise the center rack above the current set transport height.
2. Double up-tap on the center rack function switch. AutoBoom will save the maximum height as the new transport height.

Note: *Four up-taps will also reset the transport height to the maximum center rack height as defined in the above joystick interface function tables.*

To set the transport height to a lower height than the current set transport height:

1. Engage the return to transport height feature.
2. Single down-tap on the center rack function switch at the desired transport height. AutoBoom will save the current height as the new transport height.

PowerGlide Plus Joystick Interface Functions (Center Rack Control Feature Enabled)

The following joystick control interface functions are available when operating an AutoBoom PowerGlide Plus system with the center rack control feature enabled.

Note: *Implement may require the activation of a boom valve and/or master switch before the center rack control feature may be enabled.*

Boom Function Switch		Center Rack Function Switch	
Single Up-Tap	Single Down-Tap	Single Up-Tap	Single Down-Tap
<ul style="list-style-type: none"> • Disable AutoBoom control on the boom. 	<ul style="list-style-type: none"> • Enable AutoBoom control on the boom. 	<ul style="list-style-type: none"> • Disable AutoBoom control for the center rack. • Disable AutoBoom control for both booms. 	<ul style="list-style-type: none"> • Lower the center rack to the set target height. • Enable AutoBoom control for the center rack. • Enable AutoBoom control for both booms.
Double Up-Tap	Double Down-Tap	Double Up-Tap	Double Down-Tap
<ul style="list-style-type: none"> • Raise both booms slightly.^a 	<ul style="list-style-type: none"> • Lower both booms quickly.^a • Re-enable AutoBoom control to the set pressure setting.^a 	<ul style="list-style-type: none"> • Disable AutoBoom height control for the center rack. • Disable AutoBoom control for both booms. • Raise the center rack to the set transport height. 	
<ul style="list-style-type: none"> • Raise boom slightly.^b 	<ul style="list-style-type: none"> • Lower the boom quickly.^b • Re-enable AutoBoom control to the set pressure setting.^b 		
		Four Up-Taps	Four Down-Taps
		<ul style="list-style-type: none"> • Raise the center rack to the maximum height. • Turn AutoBoom system off. • Save the maximum height as the new transport height. 	

a. AutoBoom systems with a single proportional valve and square coils.

b. AutoBoom systems with two proportional valves and round coils.

Setting Transport Height. Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop canopy. Return to height and return to transport heights are sensor measurements relative to the first reflected signal (e.g. crop canopy), not necessarily ground level.

To set the transport height to maximum center rack height:

1. Raise the center rack above the current set transport height.
2. Double up-tap on the center rack function switch. AutoBoom will save the maximum height as the new transport height.

Note: *Four up-taps will also reset the transport height to the maximum center rack height as defined in the above joystick interface function tables.*

To set the transport height to a lower height than the current set transport height:

1. Engage the return to transport height feature.
2. Single down-tap on the center rack function switch at the desired transport height. AutoBoom will save the current height as the new transport height.

UltraGlide and UltraGlide XT Joystick Interface Functions (Center Rack Control Feature Disabled)

The following joystick control interface functions are available when operating an AutoBoom UltraGlide system with the center rack control feature disabled.

Note: *Implement may require the activation of a boom valve and/or master switch before the center rack control feature may be enabled.
Active center rack height control will not be enabled as this control feature is disabled.*

Boom Function Switch		Center Rack Function Switch	
Single Up-Tap	Single Down-Tap	Single Up-Tap	Single Down-Tap
• Disable AutoBoom height control on the boom.	• Enable AutoBoom height control on the boom.		
Double Up-Tap	Double Down-Tap	Double Up-Tap	Double Down-Tap
		<ul style="list-style-type: none"> • Disable AutoBoom height control for both booms. • Raise the center rack to the set transport height. 	<ul style="list-style-type: none"> • Lower the center rack to the set target height. • Enable AutoBoom height control for both booms.
		Four Up-Taps	Four Down-Taps
		<ul style="list-style-type: none"> • Raise the center rack to the maximum height. • Turn AutoBoom system off. • Save the maximum height as the new transport height. 	

Setting Transport Height. Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop canopy. Return to height and return to transport heights are sensor measurements relative to the first reflected signal (e.g. crop canopy), not necessarily ground level.

To set the transport height to maximum center rack height:

1. Raise the center rack above the current set transport height.
2. Double up-tap on the center rack function switch. AutoBoom will save the maximum height as the new transport height.

Note: *Four up-taps will also reset the transport height to the maximum center rack height as defined in the above joystick interface function tables.*

To set the transport height to a lower height than the current set transport height:

1. Engage the return to transport height feature.
2. Single down-tap on the center rack function switch at the desired transport height. AutoBoom will save the current height as the new transport height.

UltraGlide and UltraGlide XT Joystick Interface Functions (Center Rack Control Feature Enabled)

The following joystick control interface functions are available when operating an AutoBoom UltraGlide system with the center rack control feature enabled.

Note: *Implement may require the activation of a boom valve and/or master switch before the center rack control feature may be enabled.*

Boom Function Switch		Center Rack Function Switch	
Single Up-Tap	Single Down-Tap	Single Up-Tap	Single Down-Tap
<ul style="list-style-type: none"> • Disable AutoBoom height control on the boom. 	<ul style="list-style-type: none"> • Enable AutoBoom height control on the boom. 	<ul style="list-style-type: none"> • Disable AutoBoom height control for the center rack. • Disable AutoBoom height control for both booms. 	<ul style="list-style-type: none"> • Lower the center rack and both booms to the set target height. • Enable AutoBoom height control for the center rack. • Enable AutoBoom height control for both booms.
Double Up-Tap	Double Down-Tap	Double Up-Tap	Double Down-Tap
		<ul style="list-style-type: none"> • Disable AutoBoom height control for the center rack. • Disable AutoBoom height control for both booms. • Raise the center rack to the set transport height. 	
		Four Up-Taps	Four Down-Taps
		<ul style="list-style-type: none"> • Raise the center rack to the maximum height. • Turn AutoBoom system off. • Save the maximum height as the new transport height. 	

Setting Transport Height. Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop canopy. Return to height and return to transport heights are sensor measurements relative to the first reflected signal (e.g. crop canopy), not necessarily ground level.

To set the transport height to maximum center rack height:

1. Raise the center rack above the current set transport height.
2. Double up-tap on the center rack function switch. AutoBoom will save the maximum height as the new transport height.

Note: *Four up-taps will also reset the transport height to the maximum center rack height as defined in the above joystick interface function tables.*

To set the transport height to a lower height than the current set transport height:

1. Engage the return to transport height feature.
2. Single down-tap on the center rack function switch at the desired transport height. AutoBoom will save the current height as the new transport height.

Alarms and Operation Tones

The tones for enabling and disabling AutoBoom will always be activated, however, alarm tones will not activate outside of an active job or application.

Audible alarms may be disabled by deselecting the Audible Alarm Enabled option within the User Profile Settings. Refer to the Raven OS device Installation and Operation Manual for additional information on setting up profiles or disabling the audible alarm features.

Node Diagnostics

The AutoBoom[®] control node features several light-emitting diodes (LEDs) which may be used to diagnose issues with the AutoBoom system.

Note: *If the LEDs are not illuminated as outlined in the figure below, or are all on continuously, check the CANbus connections and the AutoBoom harness connections to the node. If the issue persists, contact a local Raven dealer for additional technical support.*

FIGURE 1. AutoBoom[®] CAN Control LEDs



Pre-Calibration Diagnostics

TABLE 1. Pre-Calibration Diagnostic Issues

Issue	Possible Cause	Solution
Pressure or boom height are not displayed in the correct units of measure.	Raven OS units of measure setting is set incorrectly.	Refer to the Raven OS operation instructions to change the units of measure displayed.
Pressures for the left and right boom are not displayed on the correct side.	Left and right pressure transducer connections are reversed.	Switch the left and right transducer connections on the AutoBoom valve.
	Left and right hydraulic hose connections are reversed.	Switch the left cylinder (LC) and right cylinder (RC) hydraulic hoses connected to the AutoBoom valve.
Ultrasonic sensor heights are displaying incorrect sensor locations.	Left and right sensor connections are reversed.	Switch the left and right outer sensor connections on the AutoBoom harness cable.
	Outer sensors are connected to the inner sensor connections.	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 manual functions are used.	Boom sense cables/connections are connected to the incorrect machine coils.	Check the connections to the machine coils and trace the wiring to ensure the connections are made to the correct cylinders.
Center section will not raise/lower manually when the machine manual functions are used.	Center rack boom sense cables are not connected to the correct center sense/control function.	Check the connections to the machine coils and trace the wiring to ensure the connections are made to the correct coils.
	AutoBoom node hardware does not support the center rack control function.	Node must be revision 'B' or higher to support the center rack control function. Contact a local Raven dealer.
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/unfold sensors.

Issue	Possible Cause	Solution
Booms and center section will not raise/lower properly through the Raven OS manual controls.	Proportional/blocker coil connections from the AutoBoom harness cable are incorrect on the AutoBoom valve.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	Hydraulic connections to the AutoBoom hydraulic valve are reversed.	Trace the left cylinder (LC) and right cylinder (RC) hydraulic lines connected to the AutoBoom valve and switch the hose connections as necessary. Trace the left cylinder return (LF CYL RTN) and right cylinder return (RT CYL RTN) hydraulic lines connected to the AutoBoom valve and switch the hose connections as necessary.
	Electrical connections are reversed.	Check and switch the left and right electrical connections (e.g. proportional, blocker, and pressure transducer) connections as necessary.
	Improper high current voltage supplied to the AutoBoom node or blown fuse	Check the electrical connection and AutoBoom harness fuses.
	Center sense/control cables are improperly connected.	Check the center rack section control cabling (connections to center control valve(s), directional valve, load sense valve, and open center valve as applicable).

Calibration Diagnostics

TABLE 2. Calibration Diagnostic Issues

Issue	Possible Cause	Solution
Left and right booms do not move during calibration.	Proportional/blocker connections are reversed or improperly connected.	Check the connections on the AutoBoom valve to ensure the harness cable connectors are inserted in the correct ports.
	Hydraulic connections are improperly connected.	Trace the hydraulic lines connected to the AutoBoom valve and verify they are properly routed and tightened.
	Booms are resting on the stops or cylinders are fully extended.	Manually raise the booms and lower the center rack to ensure the pressure is sufficient in the hydraulic system for calibration.
	Pressure transducer or connection is faulty.	Check the transducer connections to the AutoBoom harness cable.
	Insufficient high current power supplied to the AutoBoom node.	Check the AutoBoom harness power and ground connections and the node connectors.



Issue	Possible Cause	Solution
Booms overreact or oscillate during calibration.	Ultrasonic sensors registering objects below the sensor causing faulty readings.	Retry calibration of the system over open ground or consistent crop canopy.
	Inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and switch if necessary.
	Faulty ultrasonic sensor readings.	Check the sensors and cabling and replace as necessary.
	Speed setting is too high.	Decrease the speed setting.
	Sensitivity setting is too high.	Decrease the sensitivity setting.
	Hydraulic flow is too high (pull-type sprayers only).	Decrease the hydraulic flow to the AutoBoom circuit remote.
	Orifices are missing from the AutoBoom valve.	Reinstall orifices into the AutoBoom valve.
Booms fully raise during calibration and do not lower.	Inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and switch if necessary.
	Ultrasonic sensors are giving poor readings.	<ul style="list-style-type: none"> • Check cabling to the sensors. • Verify the sensor surface is clean. • Verify no obstructions or boom components are interfering with sensor readings.
	Hydraulic connections are improperly connected.	<ul style="list-style-type: none"> • Check hydraulic connections. • Reverse the direction of the hydraulic lever (pull-type sprayers only).
	The electrical connections to the AutoBoom valve are reversed.	Check the connections to the AutoBoom valve to ensure the harness cable connections are inserted to the correct ports.
	Speed setting is too high.	Decrease the speed setting.
	Sensitivity setting is too high.	Decrease the sensitivity setting.
	Hydraulic flow is too high (pull-type sprayers only).	Decrease the hydraulic flow to the AutoBoom circuit remote.
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 inserted into the correct ports.
	Hydraulic connections are improperly connected.	<ul style="list-style-type: none"> • Check the hydraulic connections. • Reverse the direction of the hydraulic lever (pull-type sprayers).
	Malfunctioning proportional valve.	<p>Turn the set screws in the proportional valve to verify the booms raise during calibration.</p> <ul style="list-style-type: none"> • If booms raise, troubleshoot the electrical system and/or AutoBoom node. • If the booms do not raise, troubleshoot the hydraulic system and/or AutoBoom valve.
	Hydraulics are not activated (pull-type sprayers only).	<ul style="list-style-type: none"> • Verify the hydraulics are activated. • Ensure hydraulic flow going to the AutoBoom valve.

Operation Diagnostics

TABLE 3. Operation Diagnostic Issues

Issue	Possible Cause	Solution
Booms raise but will not lower when starting the machine or engaging the hydraulics (pull-type sprayers) with AutoBoom engaged.	PWM base is too high.	Engage the AutoBoom hydraulics and allow the PWM base to decrease and the booms to lower automatically.
	System is out of calibration.	Re-calibrate the AutoBoom system.
	(Pull-type only) Restriction in the tank line.	<ul style="list-style-type: none"> • Check the quick couplers on the sprayer. • If the sprayer is equipped with a case drain line (non-restricted), connect the tank line to this hose.
Booms will not enable with the down-tap of the machine functions.	The boom sense adapter cables are damaged or not connected.	<ul style="list-style-type: none"> • Check the cabling. • Use the Diagnostics screen to help determine the proper wiring set up.
	Inadequate voltage to the AutoBoom system.	Use a multi-meter to verify +12 V is provided to the machine coils when the function is activated.
	AutoBoom system is not calibrated.	Calibrate the AutoBoom system.
	AutoBoom harness cable is damaged.	Inspect the cable for damage and repair or replace as necessary.
	AutoBoom node is faulty.	Replace the AutoBoom node.
The pressure alarm is always on.	Pressure alarm setting for PowerGlide Plus mode is set too low.	Increase pressure alarm setting.
	Pressure and tank hoses are reversed.	Check pressure (P) and tank (T) lines connected to AutoBoom valve and switch if necessary.
	Pressure transducer is faulty.	<ul style="list-style-type: none"> • Inspect the transducer and verify the pressure reading on the Diagnostics screen. • Replace the pressure transducer if necessary.
	The AutoBoom harness cable is damaged.	Inspect the cable for damage and repair or replace as needed.
	Booms are resting on the stops or cylinders are fully extended.	Raise the booms, lower the center section, and re-engage AutoBoom.
Objects under one boom makes the opposite side react.	The inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and reverse if necessary.
	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 inserted into the correct ports.
	Stability setting is too low.	Gradually increase the stability setting until the opposite side barely reacts to boom movement.
	Proportional valve is faulty.	<ul style="list-style-type: none"> • Inspect the proportional valve. • Clean and/or replace if necessary.



Issue	Possible Cause	Solution
Booms oscillate or overreact when the machine is stationary.	Sensitivity is set too high.	Gradually decrease the sensitivity setting until the boom oscillation stops.
	Wind affecting the sensor readings.	Gradually decrease the sensitivity setting until the oscillation stops.
	Speed setting is too high.	Gradually decrease the speed setting until the oscillation stops.
	Center section is unstable.	Gradually decrease the stability setting to balance the motion 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.
Booms raise but will not lower or lower too slowly during operation.	Incorrect PWM frequency is entered.	Verify that the PWM frequency setting in the Raven OS (60 Hz for square coil valves, 250 Hz for round coil valves).
	Speed setting is too low.	Increase the speed setting.
	Minimum pressure percent setting is too high.	Gradually decrease the minimum pressure percent setting until the booms lower at the desired rate.
	The set pressure is too high (PowerGlide Plus only).	Gradually decrease the set pressure by 10 until the booms lower at the desired rate.
	Inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and switch if necessary.
	Faulty ultrasonic sensor readings.	Check the sensors and cabling and replace if necessary.
	Orifices or circuit restrictions are causing reduced return flow from the tilt cylinders.	Inspect the AutoBoom hydraulic lines and remove orifices or clear restrictions in the circuit if necessary.
Booms are slow to raise or are unresponsive to height changes	Speed setting is too low.	Increase the speed setting.
	Sensitivity setting is too low.	Increase the sensitivity setting.
	Excessive ground speed.	Decrease the ground speed.
	Incorrect sensor height offsets entered.	Verify the proper height offset and adjust the settings as needed. Refer to the <i>Sensor Offsets Tab</i> section on page 15 for assistance with the sensor height offset settings.
	The orifices or circuit restrictions are causing reduced return flow from the tilt cylinders.	Inspect the AutoBoom hydraulic lines and remove orifices or clear restrictions in the circuit if necessary.
The system cannot be switched from PowerGlide Plus to UltraGlide mode.	Ultrasonic sensors are not detected.	<ul style="list-style-type: none"> • 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.
	UltraGlide node is not connected to the CANbus system.	Verify an AutoBoom UltraGlide node is connected to the CANbus.

A

Overview

The AutoBoom UltraGlide and UltraGlide XT systems may be converted to operate in PowerGlide Plus mode if desired. PowerGlide Plus mode may provide preferred operation characteristics for pre-emergence and burn-down applications.

Requirements

In the PowerGlide Plus mode, gauge wheels must be installed to “feel” for the ground. The ultrasonic sensors may still be used to monitor the boom height, however, the system will not use the measured sensor heights to control boom height while the system is engaged in this mode. Contact a local Raven dealer for available kits and purchasing.

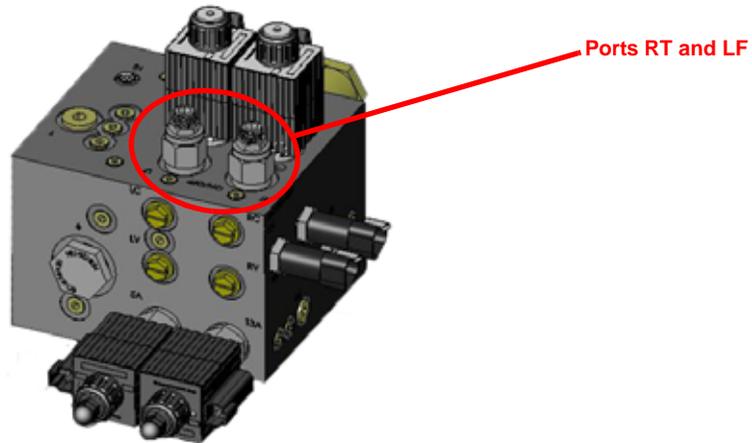
Converting the Hydraulic Control Valve

AutoBoom[®] Valves with Square Coils

Perform the following procedure to convert an AutoBoom hydraulic control valve with the square coils to operate in PowerGlide Plus mode:

1. Locate the needle valves installed in the ports labeled 'RT' and 'LF' on the AutoBoom control valve.

FIGURE 1. Needle Valve Location



2. Loosen the jam nuts on the needle valves.
3. Use an Allen wrench to turn the set screws counter-clockwise until the screw will not turn any further.
4. Re-tighten the jam nuts.
5. Set the Raven OS device to operate the AutoBoom feature in PowerGlide Plus mode. Review the *AutoBoom[®] Features Tab* section on page 14 to properly configure the Raven OS.

Note: *When converting the AutoBoom system back to UltraGlide mode, the set screws must be turned clockwise until the screw will not turn any further and the Raven OS must be reset to operate in UltraGlide mode.*

AutoBoom[®] Valves with Round Coils

To convert the system to operate in the PowerGlide Plus mode, it is necessary to remove the orifice fittings from the AutoBoom hydraulic control valve. Failure to remove these fittings from the valve will restrict the AutoBoom down speed capabilities to lower booms while the system is engaged.

Perform the following procedure to convert an AutoBoom hydraulic control valve with round coils:

1. Locate the ports labeled '3A' and '3B' in the AutoBoom hydraulic control valve.

FIGURE 2. Port 3A and 3B Orifice Location



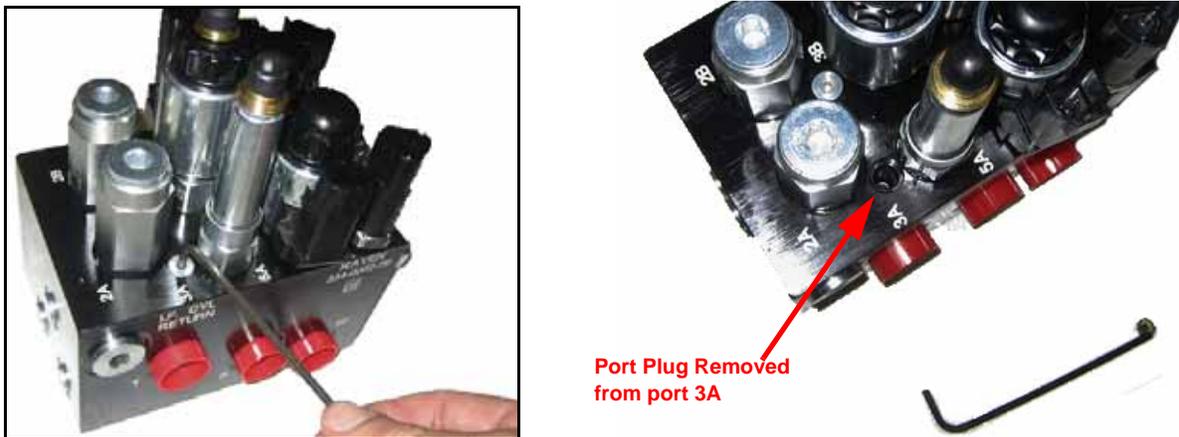
2. Locate the solenoids near ports 3A and 3B. Unscrew the large, black caps and remove the coils to make the orifice fittings more accessible.

FIGURE 3. Coil Removal from AutoBoom[®] Valve



3. Use an allen wrench to remove the plugs from both port 3A and 3B.

FIGURE 4. Port Plug Removal

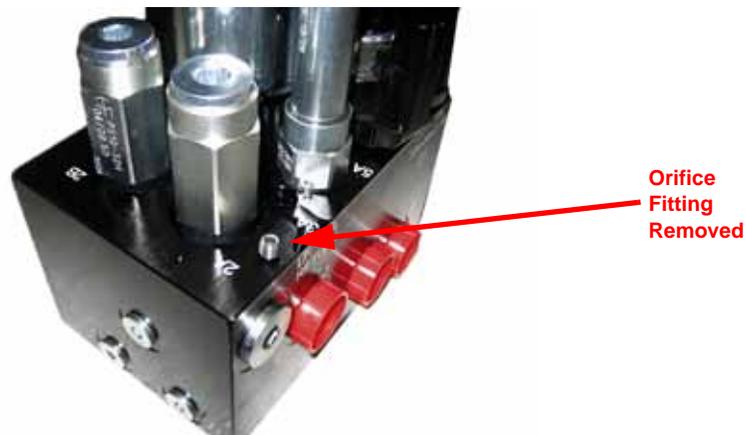


4. Place the AutoBoom valve on its side and use the Allen wrench to remove the orifice fittings from both ports 3A and 3B.

	WARNING
	Do not let the fitting fall into the hydraulic valve. Obstructions in the hydraulic valve will adversely affect system performance or damage the hydraulic valve.

Note: Keep the orifice fittings removed from ports 3A and 3B for future use. These fittings will be required to convert the AutoBoom hydraulic valve back to UltraGlide mode.

FIGURE 5. Orifice Fitting Removal



5. Use an Allen wrench to reinstall the port plugs into the cavities in ports 3A and 3B.
6. Replace the coils on the solenoids.

FIGURE 6. Plug and Solenoid Reinstallation



7. Set the Raven OS device to operate the AutoBoom feature in PowerGlide Plus mode. Review the *AutoBoom® Features Tab* section on page 14 to properly configure the Raven OS.

Note: *When converting the AutoBoom system back to UltraGlide mode, the orifice fittings must be re-installed and the Raven OS must be reset to operate in UltraGlide mode.*

