

**Raven ISO AutoBoom®  
for John Deere Sprayers  
TerrainCommand®**

**English**

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# CHAPTER

# 1

# IMPORTANT SAFETY INFORMATION

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## NOTICE

Read this manual and the operation and safety instructions included with your implement and/or controller carefully before installing and using the John Deere TerrainCommand (John Deere Horst AutoBoom®) system.

- Follow all safety information presented within this manual.
- If you require assistance with any portion of the installation or service of your equipment, contact your local 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 or a safe working distance away from the booms 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

AutoBoom is fully integrated into the John Deere system. The correct software versions must be installed on the sprayer (self-propelled and Trailed) and the AutoBoom controllers in order for the AutoBoom system to function properly. Incorrect values will allow the AutoBoom system to operate in the standard Raven AutoBoom mode as long as the correct sensors and wiring are installed in the system.

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## HYDRAULIC

### GENERAL

- John Deere 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.

### INSTRUCTIONS FOR HOSE ROUTING

The word "hose" is used to mean all flexible fluid carrying components. Follow existing hoses as much as possible and use these guidelines:

Hoses should not contact or be attached to:

- Components with high vibration forces
- Components carrying hot fluids beyond component specifications

Avoid contact with any sharp edge or abrading surfaces such as, but not limited to:

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads
- Ends of adjustable hose clamps

Routing should not allow hoses to:

- Hang below the unit
- Have the potential to become damaged due to exposure to the exterior environment. (i.e. tree limbs, debris, attachments)
- Be placed in areas of or in contact with machine components which develop temperatures higher than the temperature rating of hose components
- Hoses should be protected or shielded if it needs to route near hot temperatures beyond hose component specifications

Hoses should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

- Drive shafts, universal joints and hitches (i.e. 3-point hitch)
- Pulleys, gears, sprockets
- Deflection and backlash of belts and chains
- Adjustment zones of adjustable brackets
- Changes of position in steering and suspension systems
- Moving linkages, cylinders, articulation joints, attachments
- Ground engaging components

For hose sections that move during machine operation:

- Allow sufficient length for free movement without interference to prevent: pulling, pinching, catching or rubbing, especially in articulation and pivot points
- Clamp hoses securely to force controlled movement to occur in the desired hose section
- Avoid sharp twisting or flexing of hoses in short distances

Protect hoses from:

- Foreign objects such as rocks that may fall or be thrown by the unit
- Buildup of dirt, mud, snow, ice, submersion in water and oil
- Tree limbs, brush and debris
- Damage where service personnel or operators might step or use as a grab bar
- Damage when passing through metal structures
- High pressure wash

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## ELECTRICAL

### GENERAL

- 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.
- A minimum of 12 VDC is required for system operation with a maximum of 15 VDC.

### INSTRUCTIONS FOR WIRE ROUTING

The word "harness" is used to mean all electrical leads and cables, bundled and unbundled. When installing harness, secure it at least every 30 cm (12in) to the frame. Follow existing harness as much as possible and use these guidelines:

Harness should not contact or be attached to:

- Lines and hoses with high vibration forces or pressure spikes
- Lines and hoses carrying hot fluids beyond harness component specifications

Avoid contact with any sharp edge or abrading surfaces such as, but not limited to:

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads

- Ends of adjustable hose clamps
- Wire exiting conduit without protection, either ends or side of conduit
- Hose and tube fittings

Routing should not allow harnesses to:

- Hang below the unit
- Have the potential to become damaged due to exposure to the exterior environment. (i.e. tree limbs, debris, attachments)
- Be placed in areas of or in contact with machine components which develop temperatures higher than the temperature rating of harness components
- Wiring should be protected or shielded if it needs to route near hot temperatures beyond harness component specifications

Harnessing should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

- Drive shafts, universal joints and hitches (i.e. 3-point hitch)
- Pulleys, gears, sprockets
- Deflection and backlash of belts and chains
- Adjustment zones of adjustable brackets
- Changes of position in steering and suspension systems
- Moving linkages, cylinders, articulation joints, attachments
- Ground engaging components

For harness sections that move during machine operation:

- Allow sufficient length for free movement without interference to prevent: pulling, pinching, catching or rubbing, especially in articulation and pivot points
- Clamp harnesses securely to force controlled movement to occur in the desired harness section
- Avoid sharp twisting or flexing of harnesses in short distances
- Connectors and splices should not be located in harness sections that move

Protect harnesses from:

- Foreign objects such as rocks that may fall or be thrown by the unit
- Buildup of dirt, mud, snow, ice, submersion in water and oil
- Tree limbs, brush and debris
- Damage where service personnel or operators might step or use as a grab bar
- Damage when passing through metal structures

### **IMPORTANT:**

- Avoid directly spraying electrical components and connections with high pressure water. High pressure water sprays can penetrate seals and cause electrical components to corrode or otherwise become damaged. When performing maintenance:
- Inspect all electrical components and connections for damage or corrosion. Repair or replace components, connections, or cable as necessary.
- Ensure connections are clean, dry, and not damaged. Repair or replace components, connections, or cable as necessary.
- Clean components or connections using low pressure water, pressurized air, or an aerosol electrical component cleaning agent.



- Remove visible surface water from components, connections, or seals using pressurized air or an aerosol electrical component cleaning agent. allow components to dry completely before reconnecting cables.



### INTRODUCTION

Congratulations on your purchase of the AutoBoom™ system! The AutoBoom system, used in conjunction with a Virtual Terminal (VT) Display, is designed to provide automated boom height adjustment for agricultural equipment. Using the machine's existing hydraulics, AutoBoom's parallel hydraulic system keeps the machine's hydraulic system open, using only the hydraulic fluid needed to balance the hydraulic cylinders to allow the booms to raise or lower effortlessly. The Raven software and system controls are integrated into the John Deere interface.

### UPDATES

Software updates are available via the John Deere support systems and can be programmed using John Deere Service Advisor.

### THEORY OF OPERATION

The UltraGlide AutoBoom system uses the following system components to maintain constant hydraulic pressure to the Variable Geometry (VG) cylinders:

- Ultrasonic sensors installed along the boom width used to measure the boom's height above ground and provide height feedback to the controller.
- State-of-the-art hydraulic system that uses proportional valves to monitor hydraulic pressure that actuates boom VG cylinders. Hydraulic blocker valves are used to stop the flow of hydraulic fluid when the proportional valves are not actuated, separating the AutoBoom valve from the machine's hydraulic valve control of the tilt cylinders.
  - On Trailed sprayers, the center frame height is controlled by John Deere hydraulics.
  - On self-propelled sprayers, the center frame height is controlled by Raven hydraulics..
  - Boom height is controlled by AutoBoom hydraulics, automatically adjusting the control duty cycle above or below the dynamic base duty cycle, causing movement of the booms based on the ultrasonic sensor feedback.

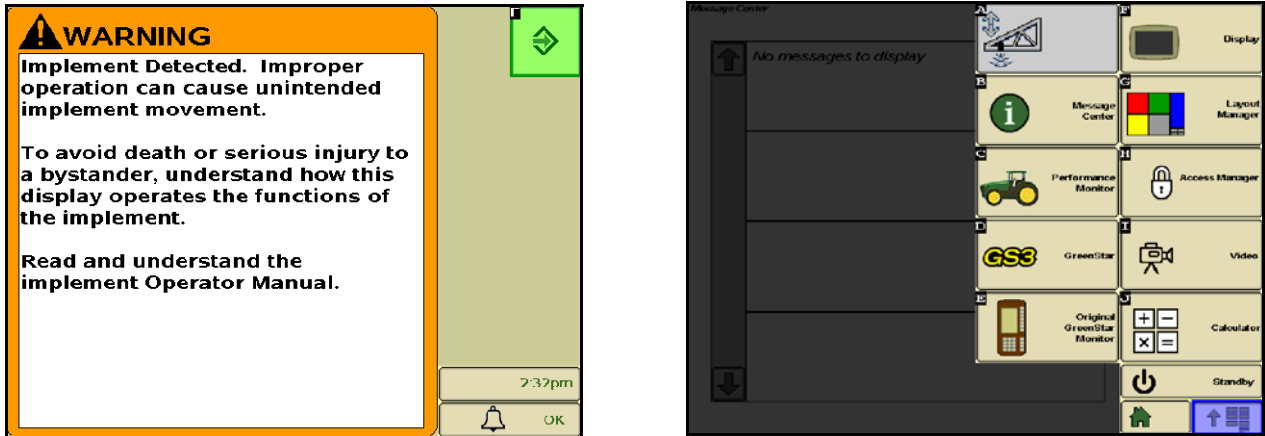
**NOTE:** Booms (VG) in automatic mode are controlled by Raven hydraulics. Booms (VG) in manual mode are controlled by John Deere hydraulics.

**NOTE:** Terrain conditions and the machine's hydraulic system dictate the actual speeds that can be achieved during application with an engaged AutoBoom system. Typically, rougher and varied field terrain require slower speeds while AutoBoom is enabled. Other system adjustments may be necessary to ensure optimal performance.

## AUTOBOOM ICONS

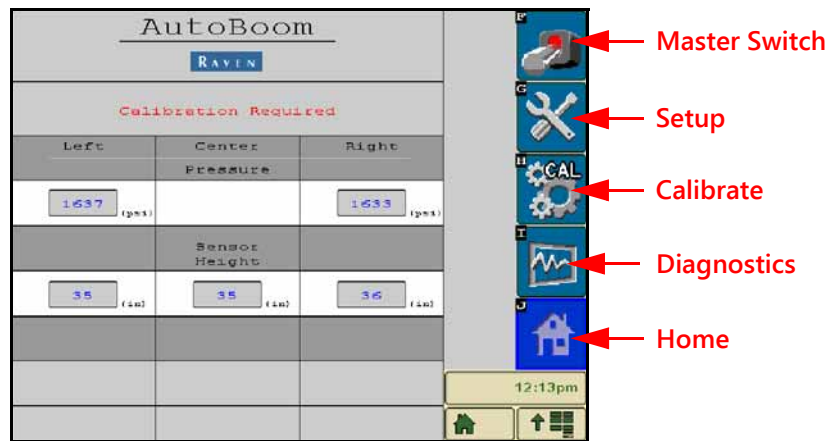
Once the AutoBoom node has been installed, the AutoBoom icons will be displayed on the Start-up screen, indicating the AutoBoom node has been detected.

FIGURE 1. Implement Detected



Refer to the icon definitions below when configuring the AutoBoom feature on the ISO terminal.

FIGURE 2. AutoBoom Home Screen



- Select the **Master Switch** icon to enable calibration.

**NOTE:** The Master Switch icon will appear only if calibration is necessary or available. Once the system is in automatic mode, this icon will not be visible.

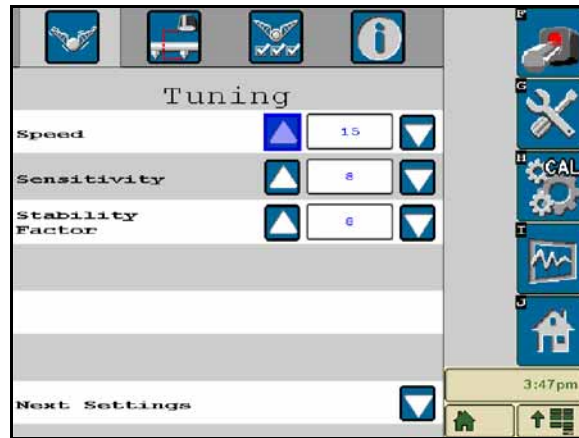
- Select the **Setup** icon to access the setup tools.
- Select the **CAL** icon to access the Calibration screen.
- Select the **Diagnostics** button to run the system diagnostic tools.
- Select the **Home** button to return to the AutoBoom main menu.

## SETUP TOOLS

The setup tools allow fine-tuning of stability control, minimum boom pressure, and sensor height offset parameters in the AutoBoom system. To access these tools, select the Setup icon. To adjust any of the ISO AutoBoom setup values, highlight the value and use the up and down arrows. To return to the AutoBoom home screen, select the Home icon.

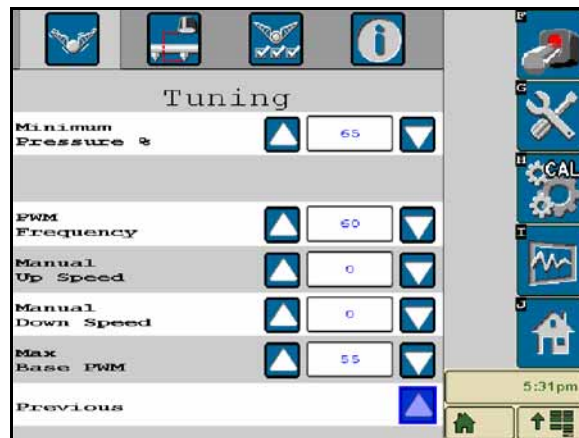
**NOTE:** The values shown in the screens below are merely examples of system settings that may be present in the AutoBoom system.

FIGURE 3. Tuning 1 Screen



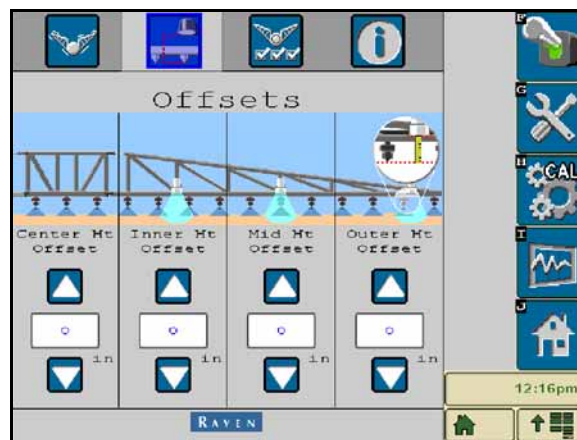
- **Speed** - Controls how fast the boom will move away from an obstacle, and how much the boom over-shoots the target height. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. Adjust the Speed setting as needed so that boom raise rates match hand movement rates, but so that the booms don't overreact and become unstable.
- **Sensitivity** - 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** - Allows fine-tuning of the reaction of the machine's center section. Adjust this value as needed to prevent boom oscillation.

FIGURE 4. Tuning 2 Screen



- **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 the booms from resting on the stops for travel-limited booms. The default value is 65%.
- **PWM Frequency** - Sets the frequency of the PWM signal to the proportional control valve. The default valve value of 60 Hz is recommended with AutoBoom valves with square coils and 250 Hz for valves with round coils.
- **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.
- **Max Base PWM %** - Sets a maximum limit on the Base PWM % (the calculated static duty cycle to maintain the set height). The Base PWM % will slowly change by 0-5 points during routine operation, but hilly terrain may cause the system to adjust the value too high. Set the Max Base PWM % to a value above the Base PWM % that was calculated during calibration. This allows the Base PWM % to adjust during routine operation, but will limit it from adjusting too high when the machine is on a hillside. The default Max Base PWM % is 100.

FIGURE 5. Offsets Screen



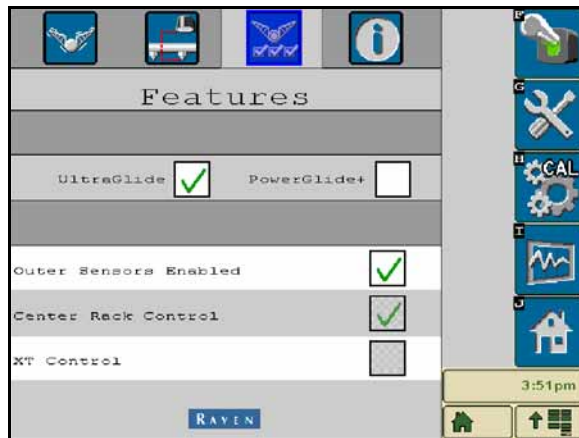
- **Height Offsets (Center, Inner, Mid, and Outer)** - Allows sensor heights to be adjusted according to the sensor mounting location. Enter a positive value if the sensors are mounted above the sprayer tips, and a negative value if the sensors are mounted below.

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.

**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.

**NOTE:** The Mid Ht Offset is not used in the AutoBoom system.

FIGURE 6. Features

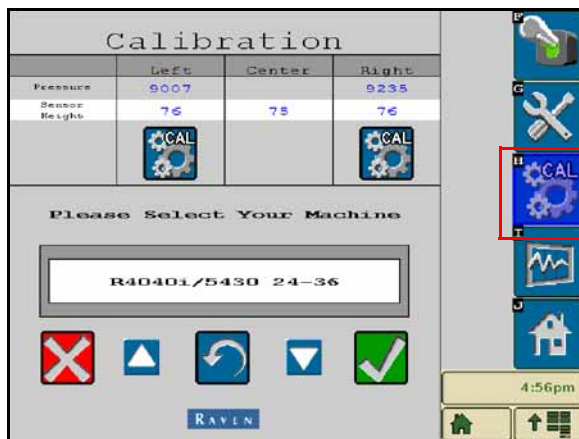


- **Outer Sensors** - Allows the operator to disable outer boom sensors if the machine is equipped with optional inside boom sensors. This feature is useful when the outer boom tips are folded in, and only the inside boom sensors are needed for control.

**NOTE:** The system may need to be re-calibrated if the outer sensors option is disabled, then re-enabled.

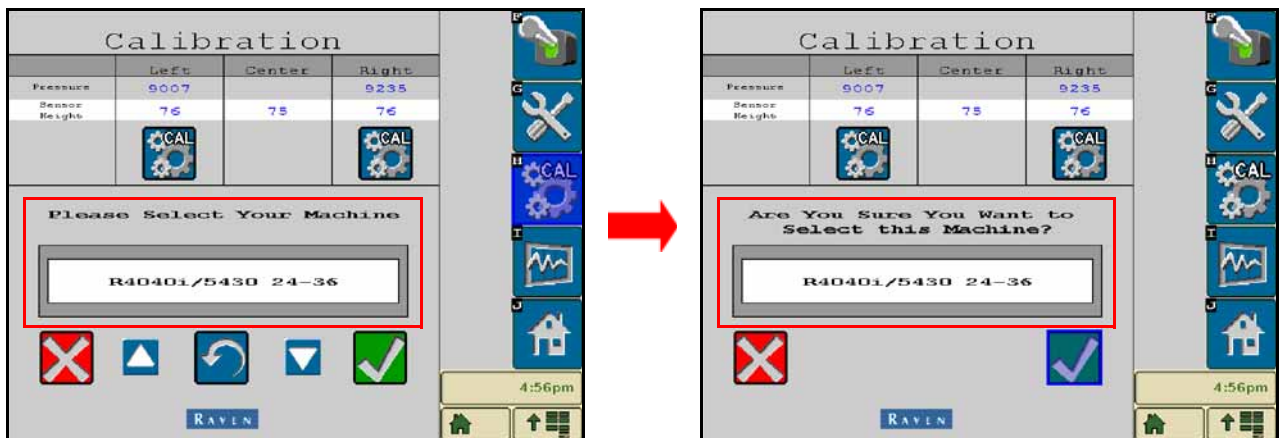
**NOTE:** Do not run the AutoBoom system while the outer boom tips are folded as the sensors reflect on the boom structure, causing inaccurate readings.

FIGURE 7. Calibration Screen



- **Machine Selection Database** - The machine type can be chosen by selecting the CAL button on the right side of the screen. The machine selection database contains a list of machines that, when selected, automatically populates the ideal settings for that specific machine.

FIGURE 8. Machine Selection Screen



If the specific machine is not listed, choose the profile that best fits the machine:

- **Standard0** - Generic profile suitable for most machines. Use this setting for John Deere sprayers.
- **Standard100** - Generic profile for machines with heavy booms that require more pressure to lift the booms quickly. Select this profile if the static pressure required to hold the booms level is 1800 psi [12,411 kPa] or greater.
- **Standard200** - Generic profile for machines with lighter booms that require less pressure to lower the booms at a faster rate. Select this profile if the static pressure required to hold the booms level is 900 psi [6205 kPa] or lower.

## DIAGNOSTIC TOOLS

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

AutoBoom Diagnostics			
	Left	Center	Right
Pressure	12169		12271
Sensor Height	59	55	56
Mid Ht.	0		0
Inner Ht.	131		137
Raise	OFF	OFF	OFF
Lower	OFF	OFF	OFF
Unfold	OFF		OFF
Blocker	OFF	LS OFF	OFF
PWM	0.00		0.00
Base PWM	50.58		54.40
State	0		0


- **Pressure, Sensor Ht, Mid Ht, and Inner Ht** - Indicate the status of the corresponding sensors.

**NOTE:** The Mid Ht Offset is not used in the AutoBoom system.

- **Raise and Lower Buttons** - Indicate the status of the boom switches. When using the machine's manual control functions, the corresponding boom switch will indicate On. These buttons can also be used to troubleshoot wiring or hydraulic issues by using the AutoBoom valve for raise/lower functions and by using the



machine's hydraulic valve for center section functions (if the machine is equipped with center section control cabling).

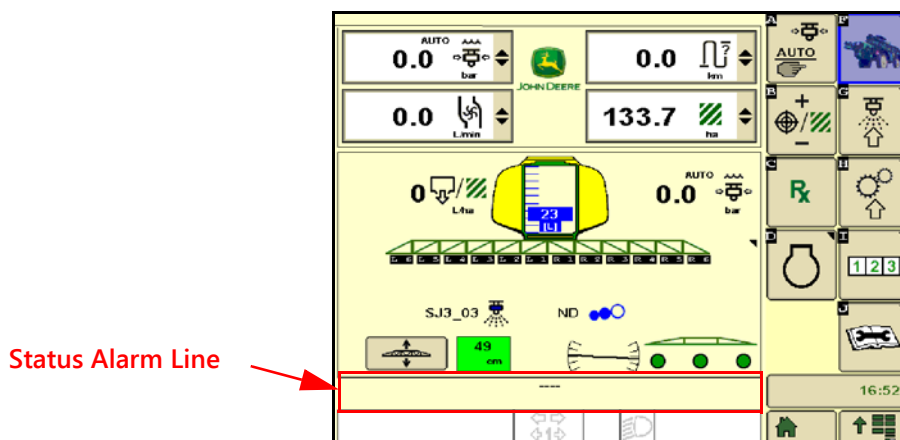
- **Unfold** - If the machine is equipped with a proximity sensor or AutoFold, Unfold communicates the status of the booms. OFF indicates that the booms are unfolded, and ON indicates that the booms are folded. If the machine is not equipped with a proximity sensor or AutoFold, Unfold will always indicate OFF.
- **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 by 0 - 5 points during routine operation.
- **Stats** - Reflects the boom performance. This value is for internal use only.
- **Manual Control Buttons**  - Used to actuate the corresponding boom functions. They can be used to troubleshoot wiring or hydraulic issues.

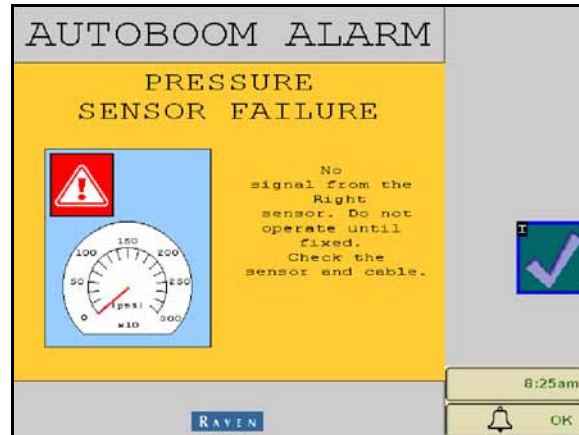
## ALARMS

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.

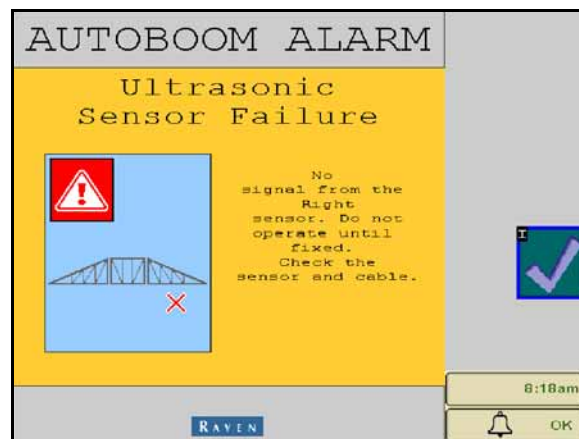
**NOTE:** On integrated systems, the warning will be displayed differently than shown. On John Deere sprayers, a status alarm line is displayed on the Machine's Home screen.

FIGURE 9. Machine's Home Screen



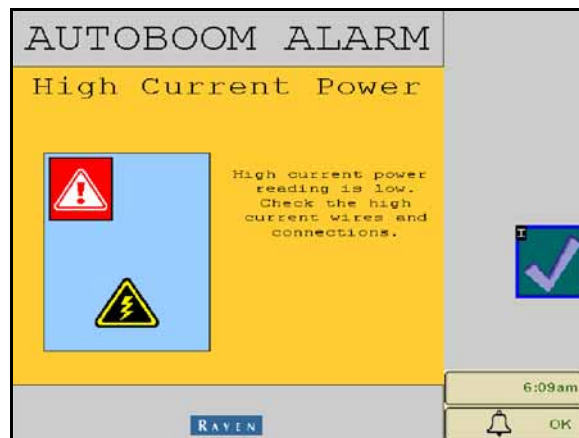


- **Low pressure alarms** - When the pressure in the left or right tilt cylinders is low, the low pressure alarm will sound. The alarm is a steady tone, and will stop immediately after pressure is restored to the system. The status alarm line will display "BOOMTRAC PRESSURE SENSOR VALVE LOW. CHECK APPLICATION."
- **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 or too high alarm** - This alarm occurs if the ultrasonic sensor is closer than five inches [13 cm] to the target for 1/2 a second or higher than 65 inches [165 cm] for five seconds. The status alarm line will display "CENTER FRAME ULTRASONIC SENSOR BOOMTRAC OUT OF RANGE" or "(LEFT/RIGHT) BOOM ULTRASONIC SENSOR OUT OF RANGE".



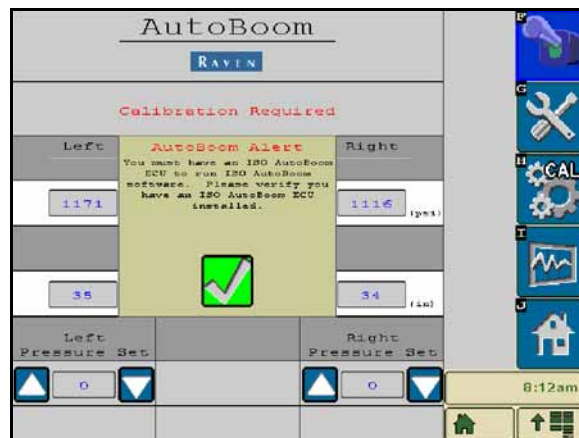
- **Ultrasonic sensor - failure alarm** - This alarm occurs immediately when an ultrasonic sensor is not detected. The alarm is a steady tone, and will stop immediately after the sensor is located.

FIGURE 10. Low HC Power



- **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. The status alarm line will display "POWER SUPPLY ISSUE ON BOOMTRAC CONTROLLER".

FIGURE 11. Incorrect Node Prompt

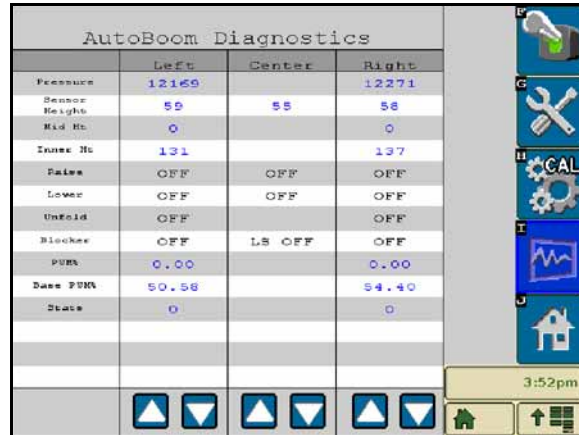


- **Incorrect Node Prompt** - This prompt appears if an incorrect ECU is connected to the system. Ensure the ISO AutoBoom ECU is installed.
- **Other tones** - When enabling the AutoBoom system in automatic mode via the machine's boom control functions or switches, a single beep will occur. When disabling AutoBoom, a double beep will sound.

## 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:



- Verify that the following components on the ISO terminal 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
  - Manual raise and lower buttons

## CALIBRATION

**NOTE:** Before performing the AutoBoom system calibration, ensure that the hydraulic fluid is warmed to the normal operating temperature, the cycle the booms up and down a minimum of five times to ensure that the hydraulic fluid within the VG cylinders is warmed to the normal operating temperature.

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 ten inches [25 cm] 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.

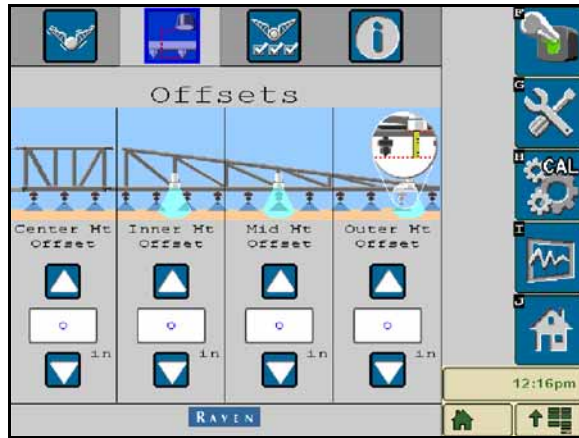
**NOTE:** If the machine has an open center hydraulic system, or the type of hydraulic system is unknown, all calibration procedures should be performed with the machine operating at the normal operating engine RPM.

**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.

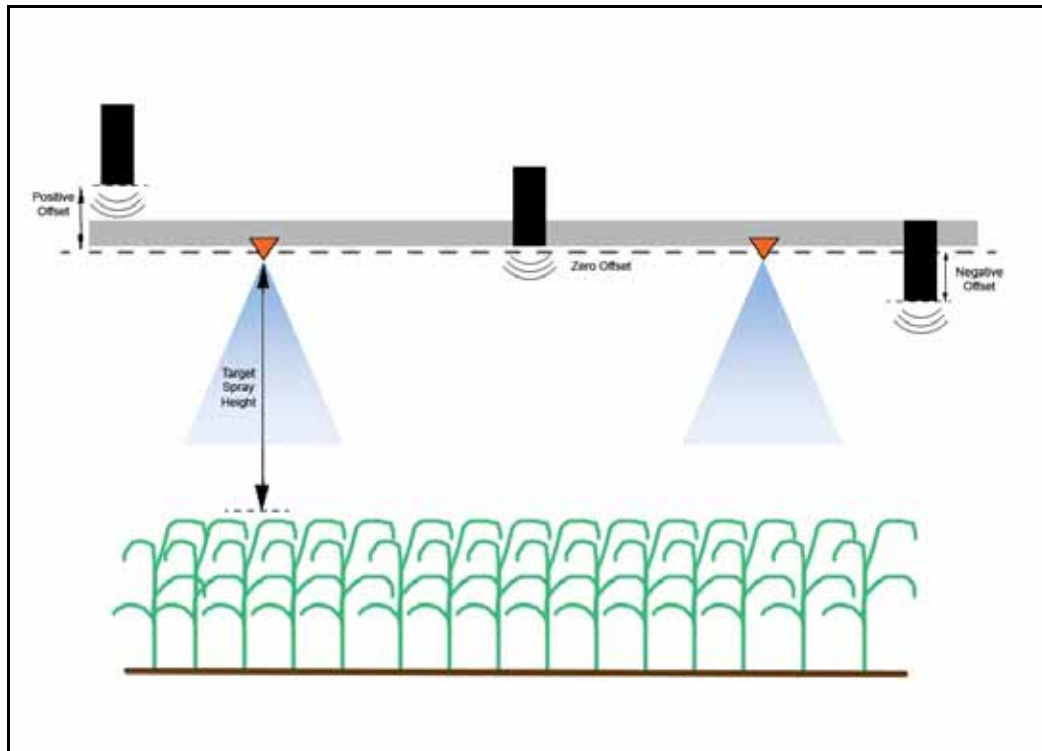
3. Verify that the booms are unfolded, and lower the center frame.

**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 [25 cm] above the horizontal position and lower the center section to approximately 20 inches [50 cm].



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.

**FIGURE 12. Sensor Height Offset Illustration**



6. Adjust the vertical sensor height offset settings in the Offsets screen as measured in step 4.

**NOTE:** The maximum offset height value is 30 inches [76 cm].

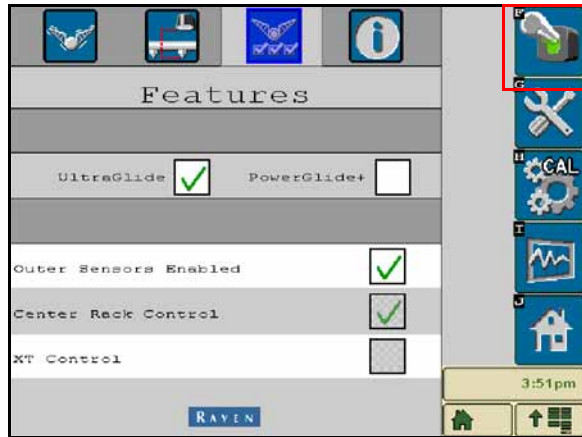
- Positive offsets indicate the sensor surface is located above the nearest spray tips.
- Negative offsets indicate the sensor surface is located below the nearest spray tips.

- Inner, 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. Raise the boom tips to approximately the target height.

**NOTE:** The default target height is 30 inches [76 cm]. 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 [100-115 cm] to prevent the wheels from touching the ground during the system calibration.

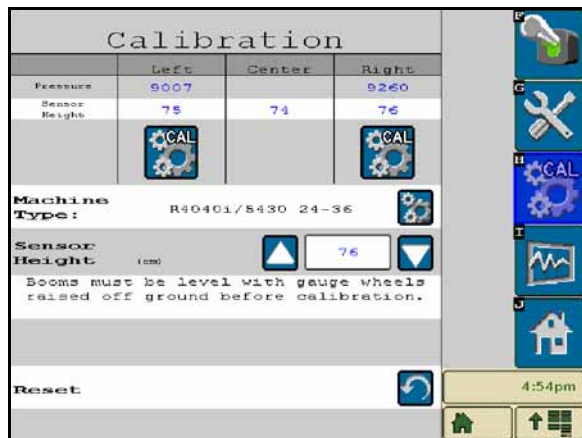
8. Select the **Features** page in the Setup menu..



9. Select **UltraGlide** from the Mode section and turn AutoBoom on in the upper-right corner.

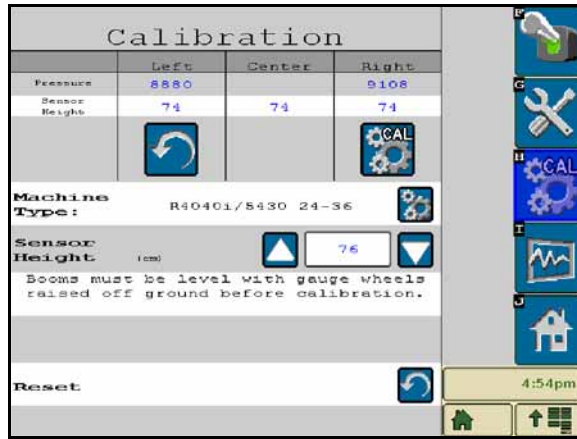
**NOTE:** The master switch icon is visible on the John Deere display when the AutoBoom system is in manual mode, allowing the system to be calibrated or recalibrated when necessary.

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:



12. Repeat steps 9 - 10 above to calibrate the right boom.



13. Press the center section calibration icon to begin calibration. Follow the on-screen instructions to complete the calibration process. Once the center section calibration process is complete, the following screen will appear:



## ROUTINE OPERATION

### MULTI-FUNCTION CONTROL

- When AutoBoom control is on, control of left and right booms can be enabled or disabled via the ISO terminal or by tapping the sprayer’s multi-function control (if equipped). When the boom up or down function is activated on the multi-function control, AutoBoom control will switch to manual mode.

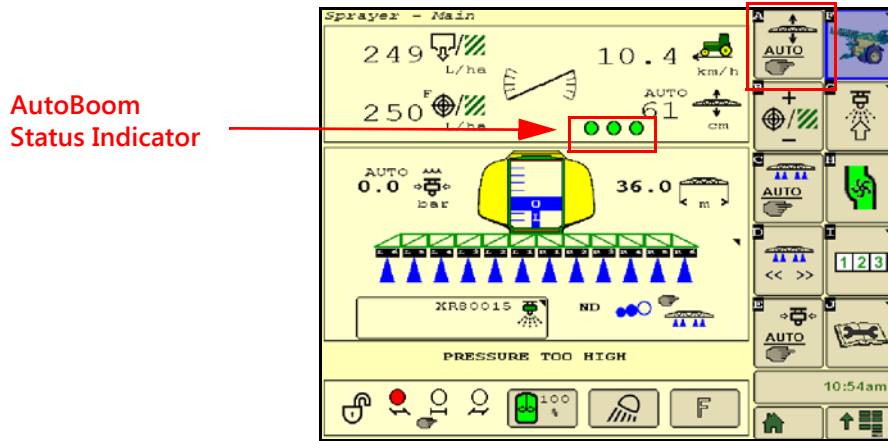
**NOTE:** Pressing the down function for longer than 1/2 a second will switch the function to manual control. The operator must tap the down function to enable AutoBoom.

- 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.

### JOHN DEERE INTERFACE NAVIGATION

#### TRAILED SPRAYERS

**FIGURE 13. John Deere Interface Main Screen**

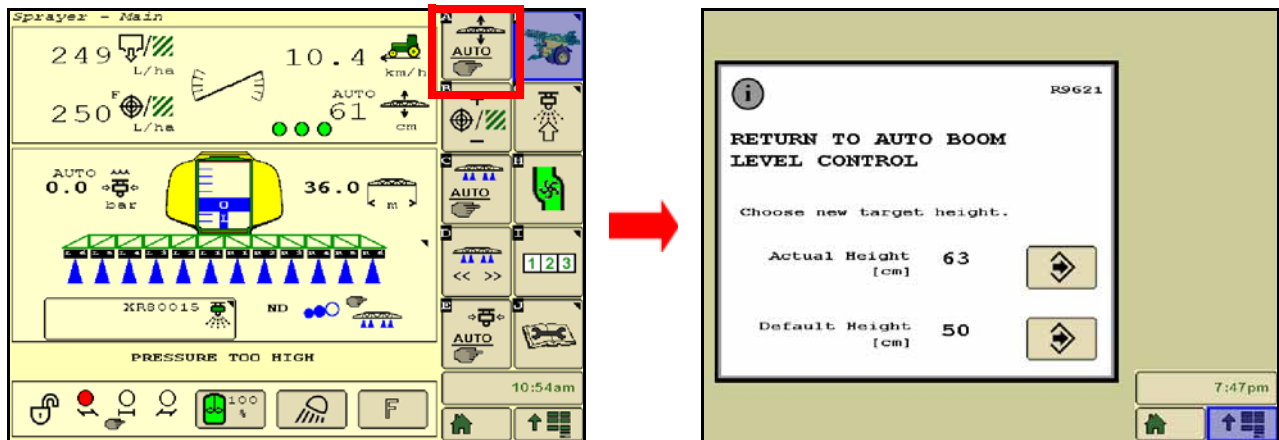


AutoBoom status indicators display the current state of the AutoBoom system.

- Green indicates that the system is active.
- Red indicates the system is disabled.
- The number next to the status indicators display the current boom height as indicated by the center frame sensor.



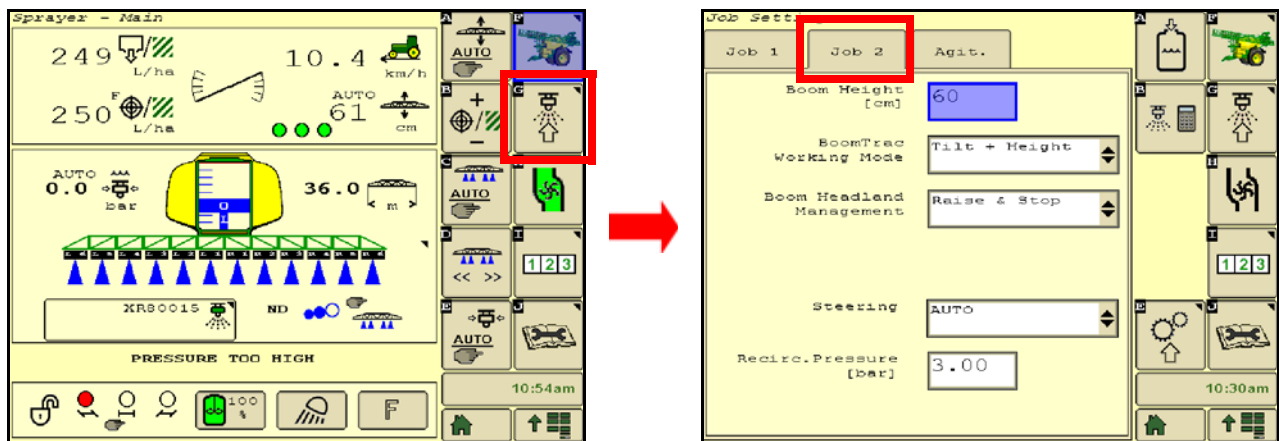
FIGURE 14. Boom Level Control



**NOTE:** The picture on the right in Figure 13 is visible only when "Tilt + Height" is selected in working mode. If the system is operating in "Tilt" mode, the screen will not be displayed as center frame height is not being controlled.

Selecting soft key A enables and disables the AutoBoom system and allows the user to select the new target height. Only the current actual height or the previously entered default height can be selected.

FIGURE 15. BoomTrac Mode Job Settings

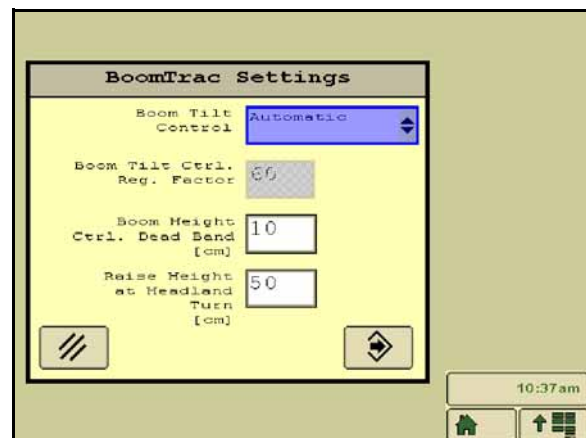
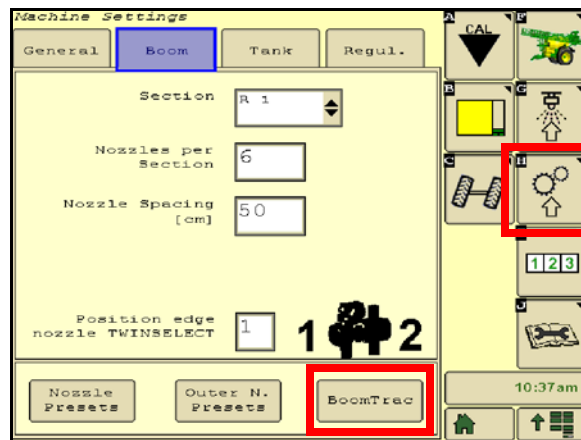
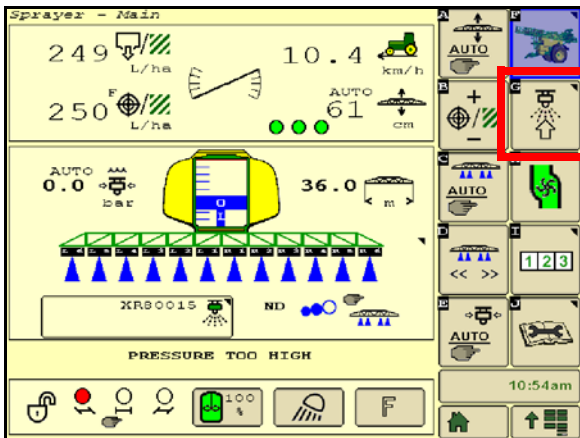


Select the Job 2 tab in the BoomTrac mode screen to select the desired mode.

- Working mode options
  - Tilt - The boom tips are controlled automatically and the center frame height is controlled manually.
  - Tilt + Height - The boom tips and center frame height are controlled automatically to the target height.
- Headland management options
  - Off - AutoBoom will continue to actively control the default target height.
  - Raise & Stop - The booms are raised to the assigned vertical offset from the target height and will stop automatic control until the headland mode is deactivated via the master spray switch.
  - Raise & Tilt - The booms are raised to the assigned vertical offset from the target height and will continue automatic control of the boom tips until the headland mode is deactivated via the master spray switch.

**NOTE:** If the tilt system is active at the headland, ensure that there is headland crop present. If no crop is present, the booms can drop below the center frame height.

FIGURE 16. BoomTrac Settings

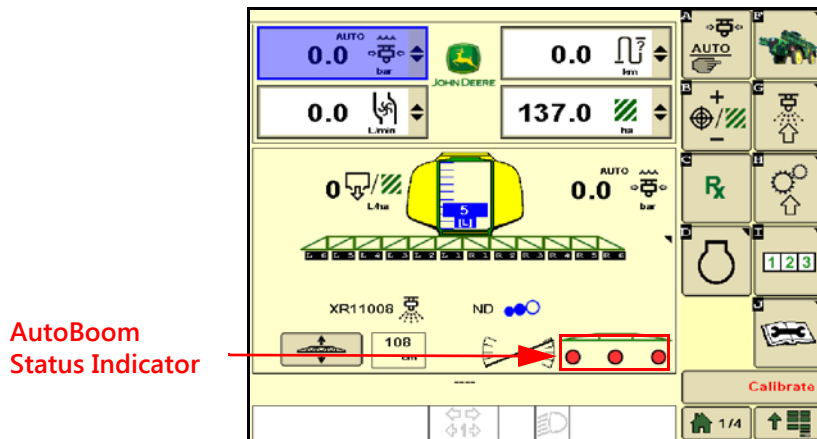


Access the BoomTrac screen as shown in Figure 14 above. In the BoomTrac settings screen the Boom Height Ctrl Dead Band and Raise Height at Headland Turn settings may be entered and the Boom Tilt Control mode may be selected.

**NOTE:** The softkey access to the BoomTrac settings may be located in different positions, depending on the machine's configuration.

SELF-PROPELLED SPRAYERS

FIGURE 17. Main Screen



AutoBoom status indicators display the current state of the AutoBoom system.

- Green indicates that the system is active.
- Red indicates the system is disabled.
- The number to the left of the status indicators display the current boom height as indicated by the center frame sensor.

FIGURE 18. Boom Level Control

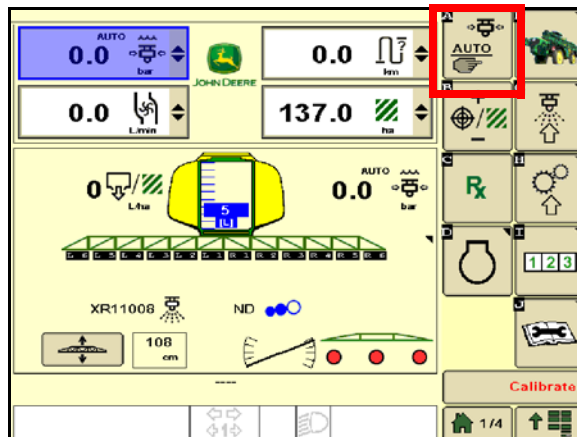
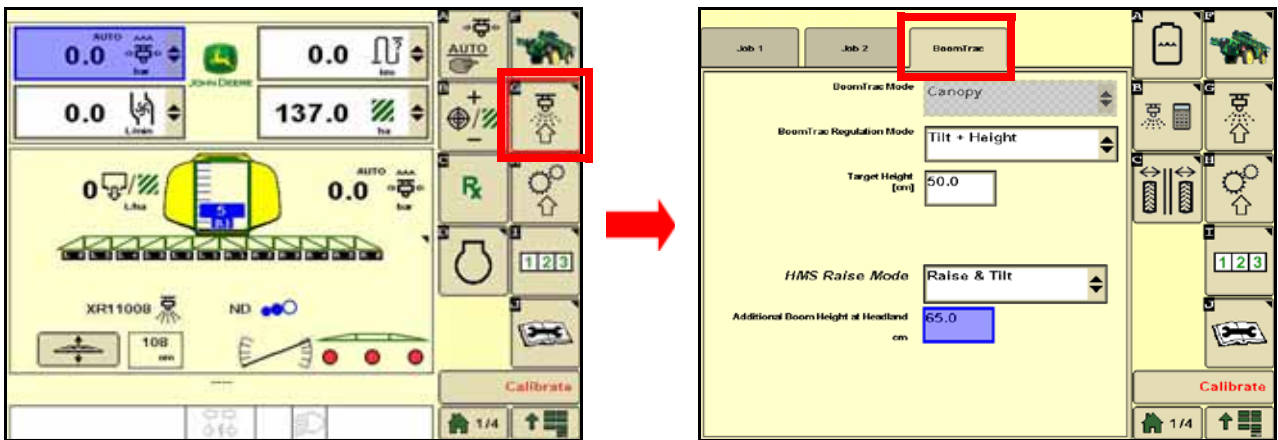


FIGURE 19. Multi-Function Lever



Use the button indicated in Figure 19 to enable boom level control.

FIGURE 20. BoomTrac Mode Job Settings



Select the BoomTrac tab in the BoomTrac mode screen to select the desired mode.

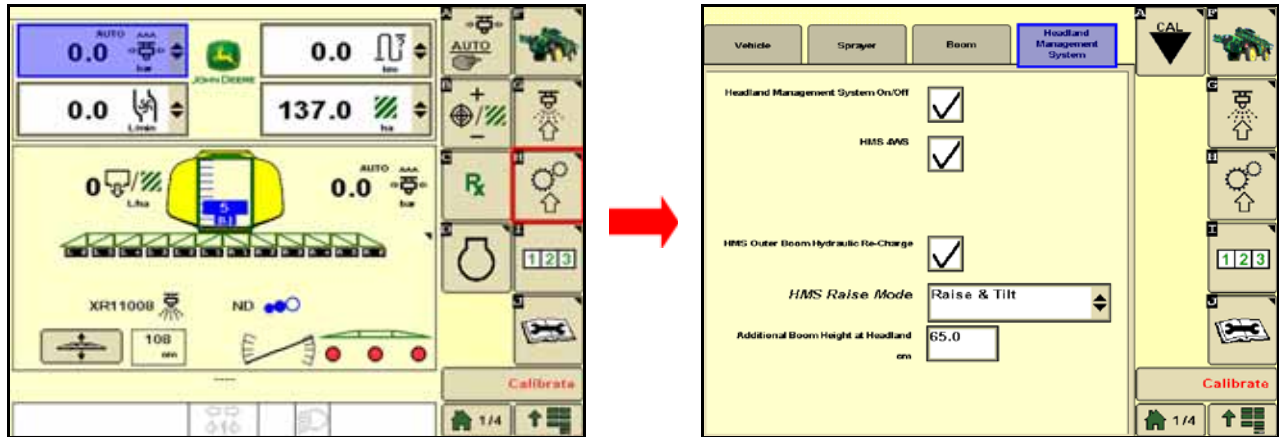
- BoomTrac Regulation Mode options
  - Tilt - The boom tips are controlled automatically and the center frame height is controlled manually.
  - Tilt + Height - The boom tips and center frame height are controlled automatically to the target height.
  - Target Height - The desired height of the boom.
- HMS Raise Mode options
  - Off - AutoBoom will continue to actively control the default target height.
  - Raise & Stop - The booms are raised to the assigned vertical offset from the target height and will stop automatic control until the headland mode is deactivated via the master spray switch.
  - Raise & Tilt - The booms are raised to the assigned vertical offset from the target height and will continue automatic control of the boom tips until the headland mode is deactivated via the master spray switch.

**NOTE:** If the tilt system is active at the headland, ensure that there is headland crop present. If no crop is present, the booms can drop below the center frame height.

Access the Headland Management System screen as shown in Figure 19 above. In the Headland Management System screen the Headland Raise Mode and Additional Boom Height at Headland settings may be entered and the Boom Tilt Control mode may be selected.

**NOTE:** The softkey access to the BoomTrac settings may be located in different positions, depending on the machine's configuration.

**FIGURE 21. Headland Management System Screen**



The Headland mode, HMS Raise mode, and Additional Boom Height at Headland setting can be enabled and disabled via the Headland Management System tab. This information will match what is shown in the BoomTrac tab under the Job settings.

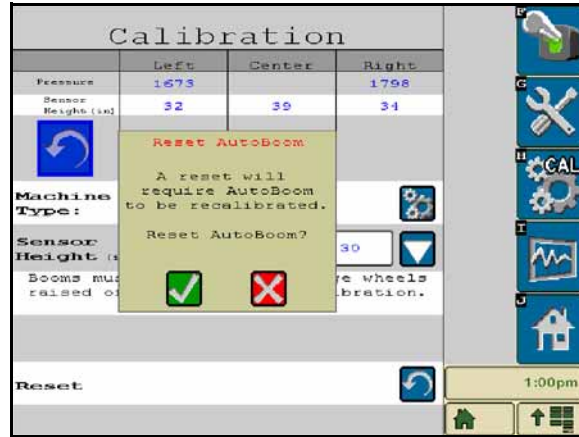
## RESETTING DEFAULTS

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 ISO terminal screen. The following screen will be displayed:

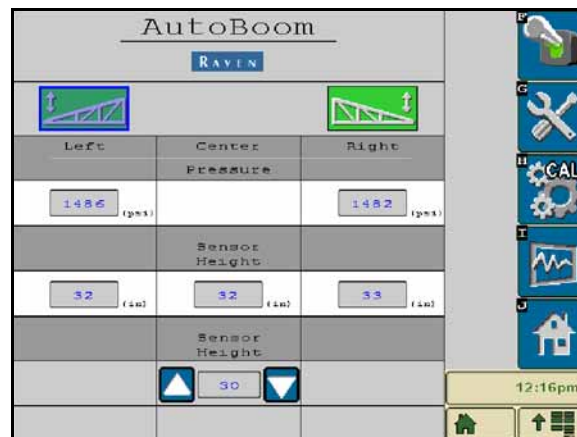


2. Select the **Reset** icon. The following screen will appear:



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

**IMPORTANT:** When performing system adjustments, it is important to make adjustments in the sequence as outlined in this chapter, as different system parameters can impact other parameters already set.



## SENSITIVITY

1. Place one hand at ground level below one boom sensor and raise it slowly (about one foot [30 cm] per second) to within 12 inches [30 cm] of the sensor surface.

**NOTE:** The boom should react immediately and raise at approximately the same speed as your hand.

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

**NOTE:** If the Sensitivity is too high, the boom will appear unstable and jittery, reacting to slight changes in target height or crop movement. The typical Sensitivity setting that works best for most machines is 8 - 15. During routine operation, AutoBoom should be unresponsive to changes in height of 2" - 3" [5-8 cm], but should react quickly to changes of 5" [12 cm] or more.

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 2 feet [60 cm] per second) to within 12 inches [30 cm] 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 [30 cm] or less.

2. Adjust the Speed setting as needed.

**NOTE:** 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 10 - 30, but can be much higher depending on the static pressures of the boom, boom geometry, and the Sensitivity settings.

---

## STABILITY

- Allows fine-tuning of the reaction of the machine's center frame.
  - 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 frame.
  - Stability settings of 1 - 99 will adjust the stability of the center frame. 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 frame 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
- 1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet [60 cm] per second) to within 12 inches [30 cm] 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 [15 cm]) simultaneously.

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

**NOTE:** A value of 15 - 20 is recommended for machines with a rigid center section. A value of 5 - 14 is recommended for machines with center sections that flow freely. Adjust this setting as needed to prevent boom oscillation.



---

## ELECTRONIC CONTROL UNIT (ECU)

The AutoBoom CAN control ECU 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. AutoBoom CAN Control Node LEDs**



## AUTOBOOM PRE-CALIBRATION DIAGNOSTICS

Problem	Possible Cause	Corrective Action
AutoBoom icon does not appear on the VT display.	The AutoBoom node is not being detected.	Check the electrical connections to the node including the power and CAN communication circuits.
	Power circuits are not properly connected.	<ul style="list-style-type: none"> <li>• Check power circuits.</li> <li>• Verify high current, logic, and CAN power systems are connected to the battery and switched properly.</li> </ul>
	Malfunctioning/improperly connected CAN system.	<ul style="list-style-type: none"> <li>• Verify the CAN system is installed correctly.</li> <li>• Verify terminators, cables, and connections are functioning.</li> </ul>
Pressures/heights are not being displayed in the correct units of measure.	System startup performed incorrectly.	Turn the power to the CAN system off, then on.
	Units of measure programmed incorrectly.	Reprogram the VT display to display the correct units of measure.
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 ultrasonic 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 coils.
Center section will not raise/lower manually with the machine's functions.	The center section 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.

## 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 harness 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 section to ensure pressure is sufficient in the booms for calibration.
	The 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 AutoBoom node.
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.	<ul style="list-style-type: none"> <li>• Check the cabling to the sensors.</li> <li>• Verify the sensor surface is clean.</li> <li>• Verify no obstructions or boom components are interfering with sensor readings.</li> </ul>
	The hydraulic connections are improperly connected.	<ul style="list-style-type: none"> <li>• Check the hydraulic connections.</li> <li>• Reverse the direction of the hydraulic lever on Trailed sprayers.</li> </ul>
	The electrical connections to the AutoBoom valve are reversed.	Check the connections to the proportional and blocker valves and reverse if necessary.
	The Speed setting is too high.	Decrease the Speed setting.
	The Sensitivity setting is too high.	Decrease the Sensitivity setting.
	The hydraulic flow is too high (Trailed sprayers only).	Decrease the hydraulic flow on the AutoBoom circuit remote. The flow should be 3 - 5 gpm [11-19 lpm] or 20 - 30%.

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.	<ul style="list-style-type: none"> <li>• Check the hydraulic connections.</li> <li>• Reverse the direction of the hydraulic lever on Trailed sprayers.</li> </ul>
	Malfunctioning proportional valve.	Turn the set screws in on the proportional valve to verify the booms raise during calibration. <ul style="list-style-type: none"> <li>• If the booms raise, troubleshoot the electrical system and/or AutoBoom node.</li> <li>• If the booms do not raise, troubleshoot the hydraulic system and/or AutoBoom node.</li> </ul>
	The hydraulics are not activated (Trailed sprayers only).	<ul style="list-style-type: none"> <li>• Verify the hydraulics are activated.</li> <li>• Ensure hydraulic flow going to the AutoBoom valve.</li> </ul>
Booms over-react 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 set too high.	Decrease the Speed setting.
	The Sensitivity setting is too high.	Decrease the Sensitivity setting.
	The hydraulic flow is too high (Trailed sprayers only).	Decrease the hydraulic flow to the AutoBoom circuit remote.

## AUTOBOOM OPERATION

Problem	Possible Causes	Corrective Action
The booms will not enable	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 AutoBoom harness cable is damaged.	Inspect the cable for damage and repair or replace as needed.
	The AutoBoom node is faulty.	Replace the AutoBoom node.
The pressure alarm is always on.	The pressure and tank hoses are reversed.	Check the hoses and reverse if necessary.
	The pressure transducer is faulty.	<ul style="list-style-type: none"> <li>• Inspect the transducer and verify the pressure reading on the Diagnostic screen.</li> <li>• Replace the pressure transducer if necessary.</li> </ul>
	The pressure transducers are not connected to the AutoBoom harness cable.	Connect the pressure transducers to the AutoBoom harness cable.
	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.
Objects under one boom makes the opposite side react.	The left and right sensor connections are reversed.	Check the left and right 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.	<ul style="list-style-type: none"> <li>• Inspect the proportional valve.</li> <li>• Clean and/or replace if necessary.</li> </ul>

Problem	Possible Causes	Corrective Action
The booms oscillate or overreact when the machine is stationary.	The Sensitivity setting is too high.	Decrease the Sensitivity setting by one increment until the boom oscillation stops.
	The wind is affecting the sensor readings.	Decrease the Sensitivity setting by one increment until the boom oscillation stops.
	The Speed setting is too high.	Decrease the Speed setting by one increment 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 increment 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.
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.

Problem	Possible Causes	Corrective Action
Booms raise but will not lower when starting the machine or engaging the hydraulics (Trailed sprayers) with AutoBoom engaged.	The PWM base is too high.	Engage the AutoBoom hydraulics and allow the PWM base to decrease and the booms to lower automatically.
	The system is out of calibration.	Re-calibrate the AutoBoom system.

## ULTRASONIC SENSORS

The first step in troubleshooting sensor function should be to verify that the ECU is powered up and the LOGIC POWER and HC POWER lights are lit and the MICRO 1 HZ, CAN RX, and CAN TX lights are flashing. Refer to "Electronic Control Unit (ECU)" on page 29 for more information on troubleshooting the ECU functions.

If the ECU is functioning properly, refer to the tables below to troubleshoot sensor function. The sensor power lights are located on top of the sensor body.

Pin	Color	Function
A	Red	Power
B	Black	Ground
C	Green or White	Signal

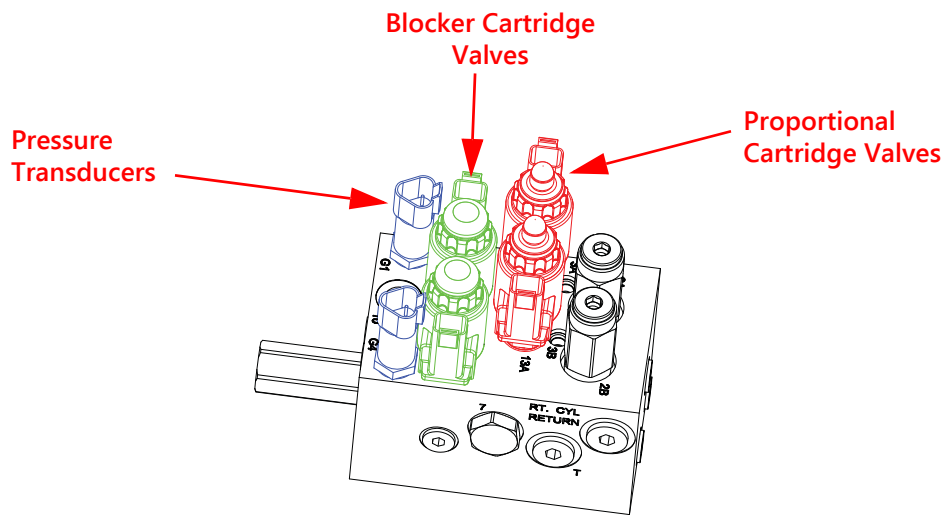
- When the sensor is disconnected, voltage between pin A and pin B should measure close to the battery voltage.
- With the sensor connected, probing between pin B and C should measure 0-5 V and change proportionally to the height the sensor is measuring.

Sensor Height Reading Change	Sensor Power Light Lit (Yellow, Green, Yellow)	Sensor Clicking	Corrective Action
Yes	Yes	Yes	None - the sensors are functioning properly.
No	Yes	Yes	<ol style="list-style-type: none"> <li>1. Disconnect the sensor from the sensor extension cable.</li> <li>2. Connect the sensor directly to the AutoBoom harness cable and repeat the sensor function test. <ul style="list-style-type: none"> <li>• If the sensor readings change, the sensor extension cable is defective and must be repaired or replaced.</li> <li>• If the sensor readings do not change, troubleshoot the cable voltage and continuity. <ul style="list-style-type: none"> <li>◦ If the voltage and continuity of the harness cable are good, replace the node.</li> <li>◦ If the voltage and continuity of the harness are bad, replace the harness cable.</li> </ul> </li> </ul> </li> </ol>

Sensor Height Reading Change	Sensor Power Light Lit (Yellow, Green, Yellow)	Sensor Clicking	Corrective Action
No	No	No	1. Swap the sensor with a sensor known to function with no issues. <ul style="list-style-type: none"> <li>If the sensor readings change, the sensor is defective and must be replaced.</li> <li>If the readings do not change, proceed to step 2.</li> </ul> 2. Disconnect the sensor from the installed sensor extension cable.                     3. Connect the sensor directly to the AutoBoom harness sensor connector and repeat the sensor function test. <ul style="list-style-type: none"> <li>If the sensor readings change, the sensor extension cable is defective and must be replaced.</li> <li>If the reading does not change, check voltage and continuity on the harness cable.                             <ul style="list-style-type: none"> <li>If the voltage and continuity of the harness cable are good, replace the node.</li> <li>If the voltage and continuity of the harness are bad, replace the harness cable.</li> </ul> </li> </ul>
No	No	Yes	
No	Yes	No	

## HYDRAULIC VALVE

### HYDRAULIC COMPONENTS



- Verify that the hydraulic are connected and working correctly. This can be performed directly from the AutoBoom hydraulic valve. With the machine running and the booms extended:
  - Press on the top of the blocker cartridge. The corresponding boom should lower.
  - Remove the cap from the proportional cartridge and use a hex wrench to turn the adjustment clockwise screw until it does not move.
  - Press on the top of the blocker cartridge. The corresponding boom should raise.
  - Once proper boom function is verified, back out the adjustment screw all the way and reinstall the proportional cartridge cap.



- Inspect and clean hydraulic fluid filters to ensure that the hydraulic fluid is clear and free of debris. Debris in the hydraulic fluid can get caught in the proportional valves and cause them to stick.

## ELECTRICAL COMPONENTS

- Verify that the electrical connections are connected correctly.
  - The 2-pin Deutsch SOLENOID connectors are connected to the blocker cartridge valves.
  - The 2-pin Deutsch LEFT PROP and RIGHT PROP connectors are connected to the proportional cartridge valves.
- Check voltage at the valve connectors when performing an up or down function from the Diagnostics screen.
  - The 2-pin Deutsch SOLENOID connectors should output battery voltages.
  - The 2-pin Deutsch LEFT PROP and RIGHT PROP connectors should output varying voltages.

**FOR EXAMPLE:** If the raise command drives the valve at 60% duty cycle as shown on the Diagnostics screen, battery voltage (assume 13 volts) x 60% = 7.8 volts.

- The pressure transducer (LEFT PRESS and RIGHT PRESS) connections should output battery voltage.

## CARTRIDGE VALVE

If no fault in the hydraulic or electrical components is found, swap the left and right cartridge valves.

**IMPORTANT:** Swap valves with valves of the same type. Do not swap a proportional cartridge with a blocker cartridge.

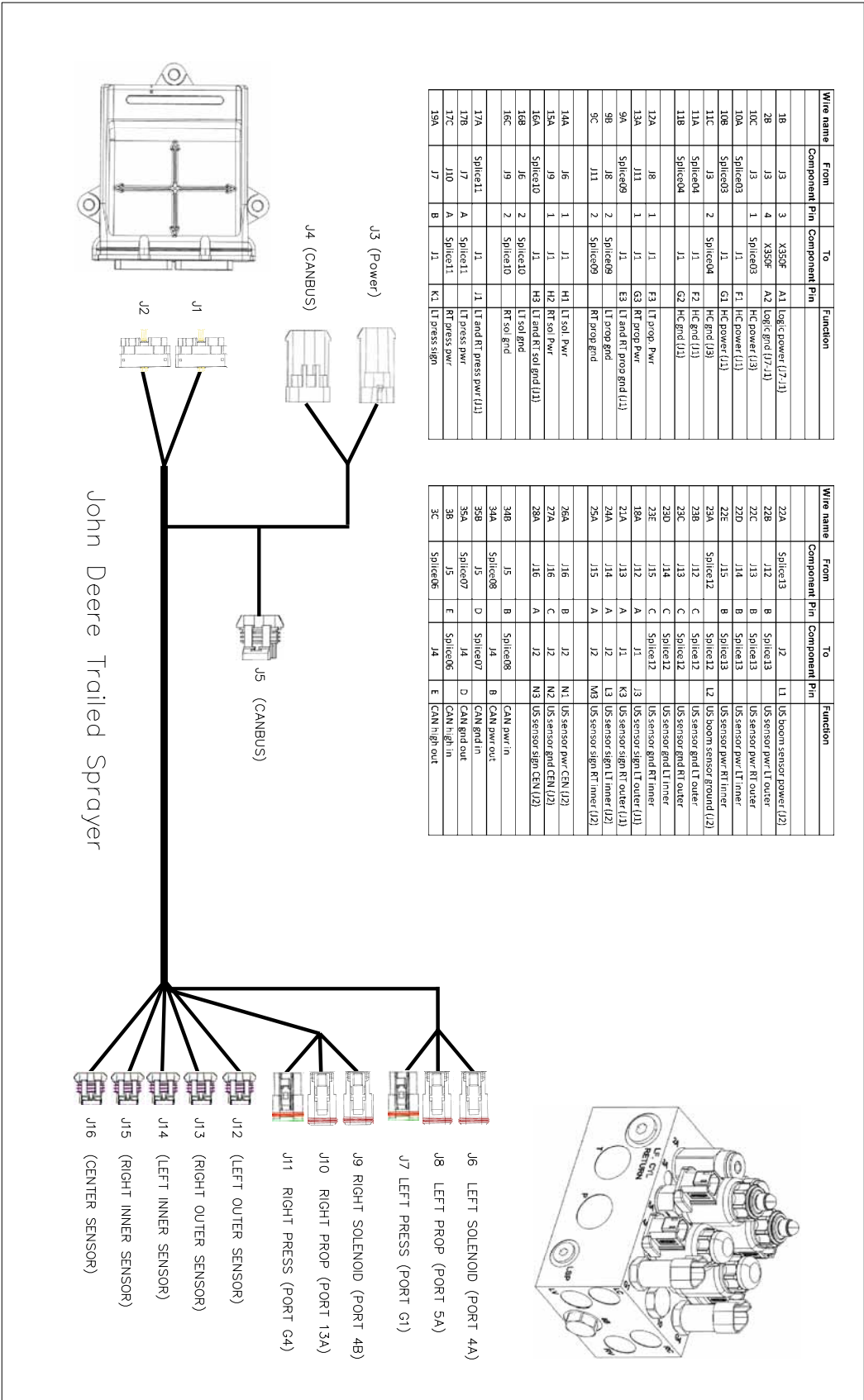
- If the problem follows the cartridge valve, the cartridge valve is defective.
- If the problem stays with the affected boom, the problem resides in either the AutoBoom valve or the machine's hydraulic system.



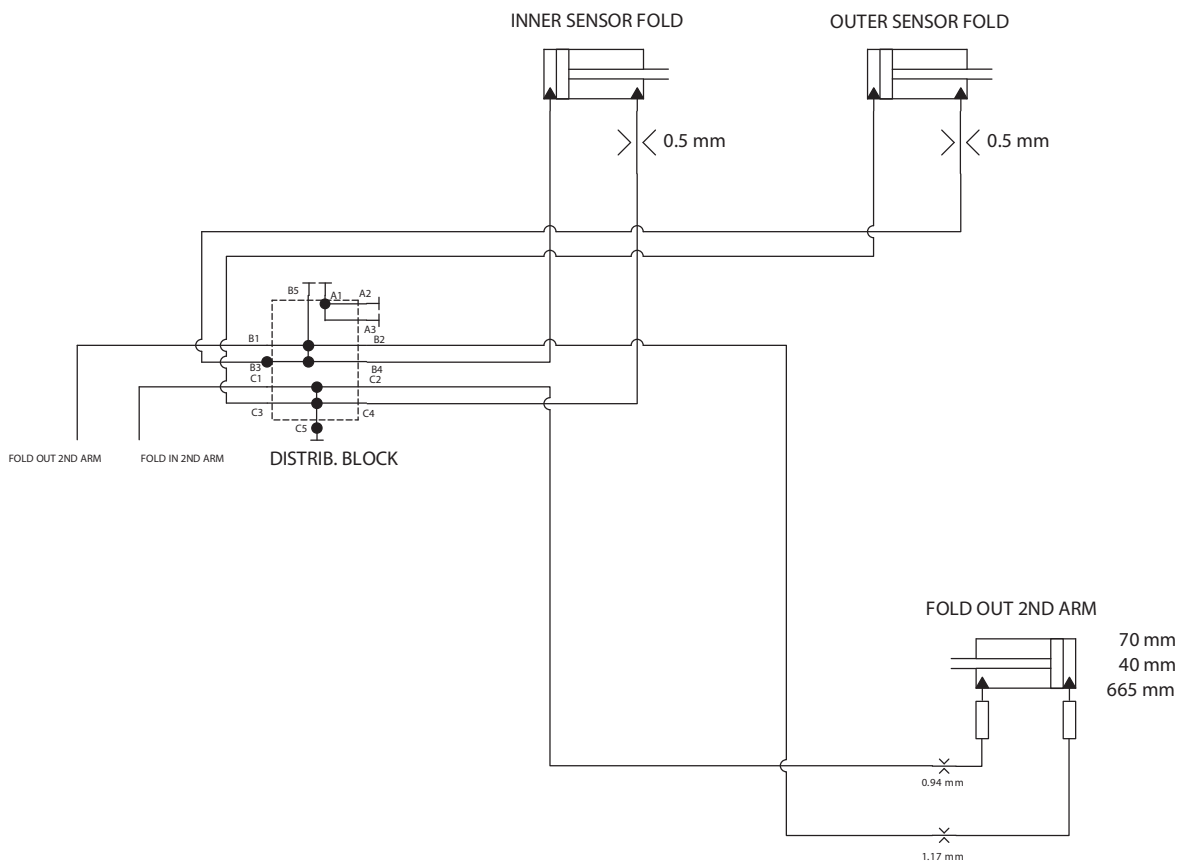
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This section contains system diagrams for machine-specific ISO AutoBoom machine configurations. Identify the appropriate schematic for the type of machine on which the ISO AutoBoom system is being installed.

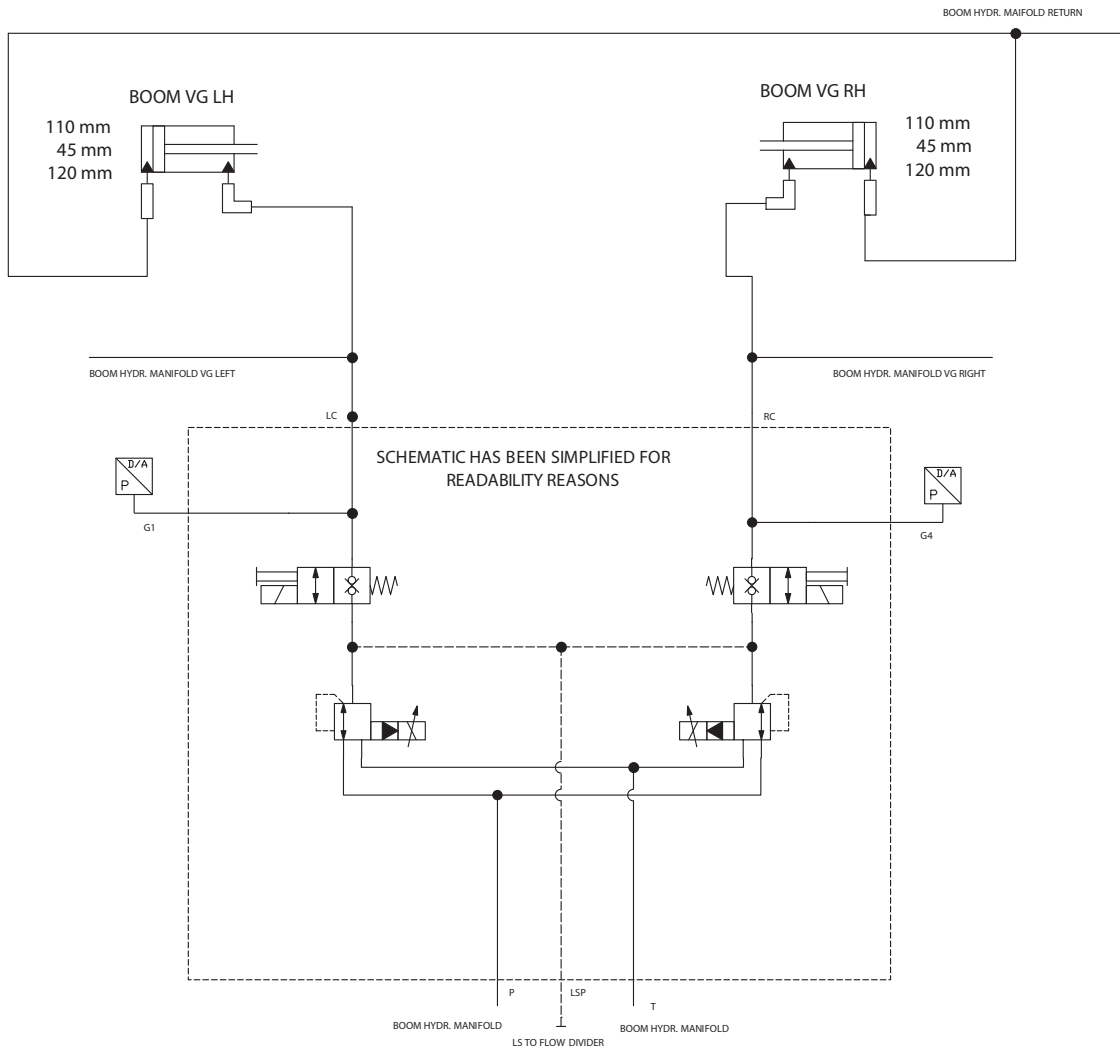
SELF-PROPELLED SPRAYERS



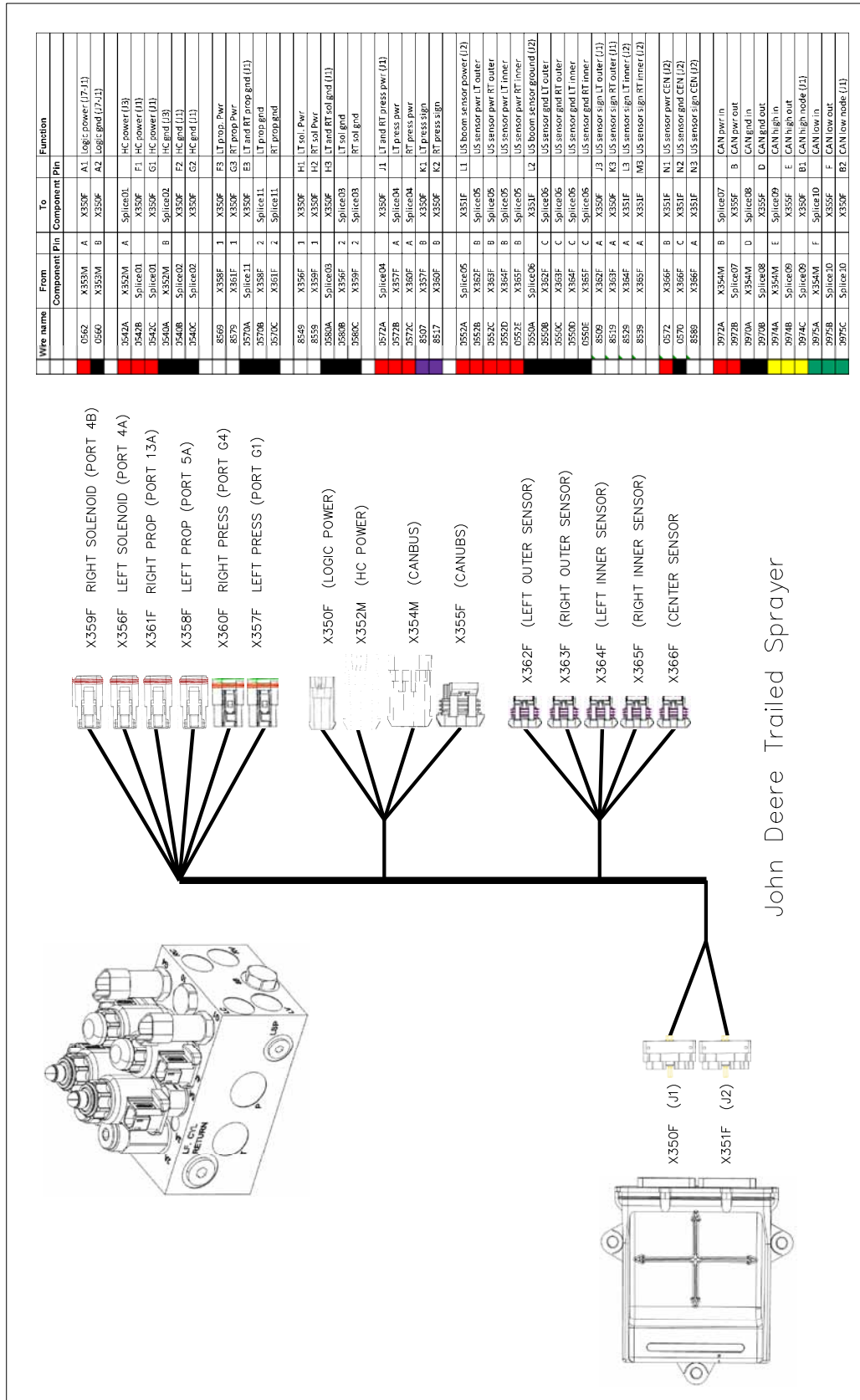
SPS BOOM HYDRAULIC TERRAIN COMMAND



SPS TERRAIN COMMAND

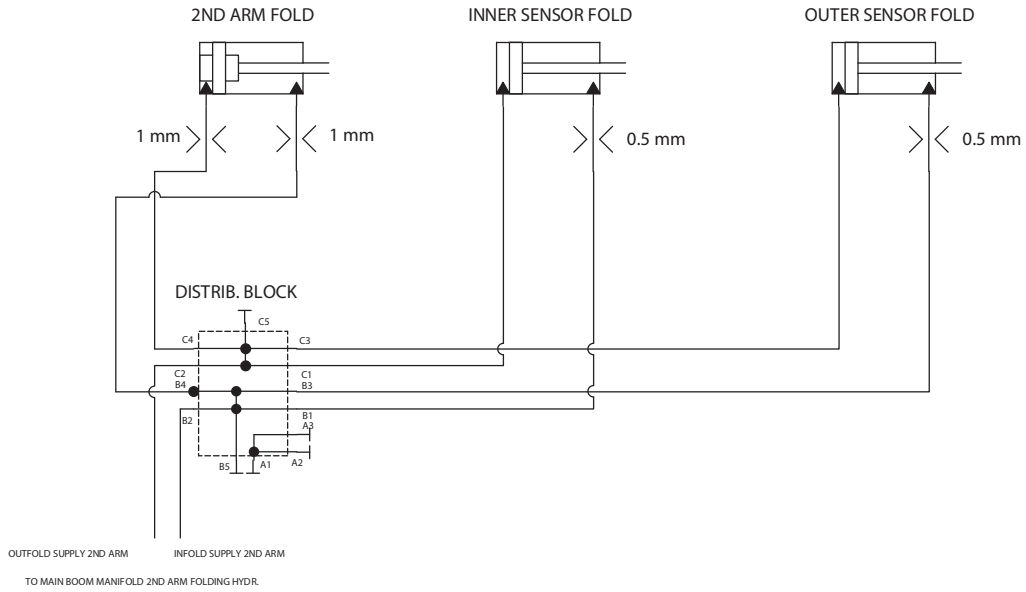


TRAILED SPRAYERS

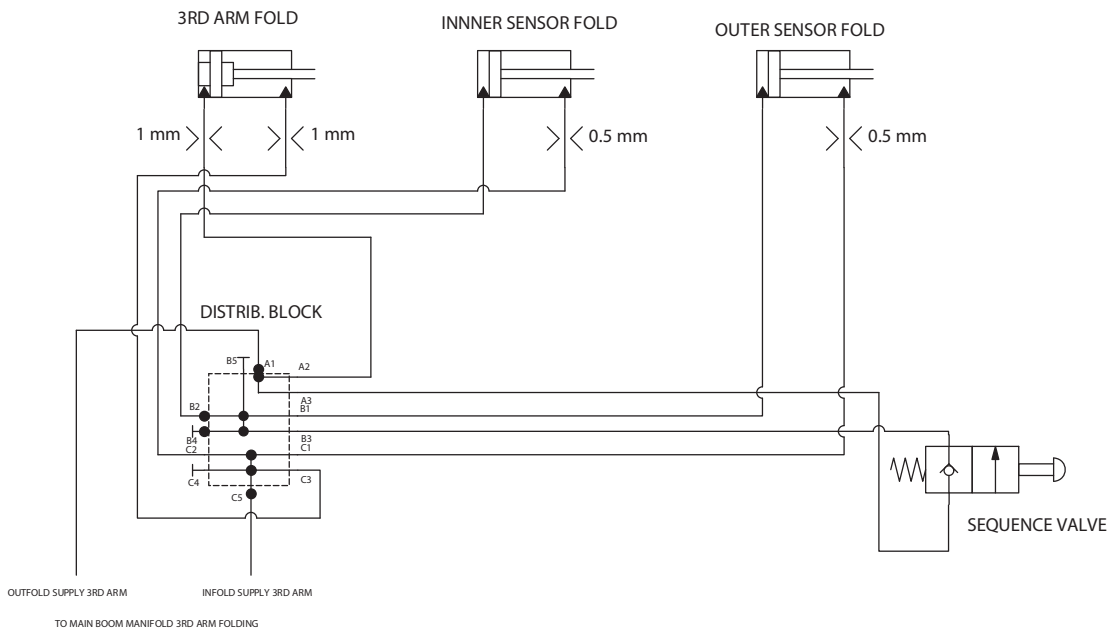


TERRAIN COMMAND SENSOR FOLDING TRAILED SPRAYER

2 PART FOLDING BOOM

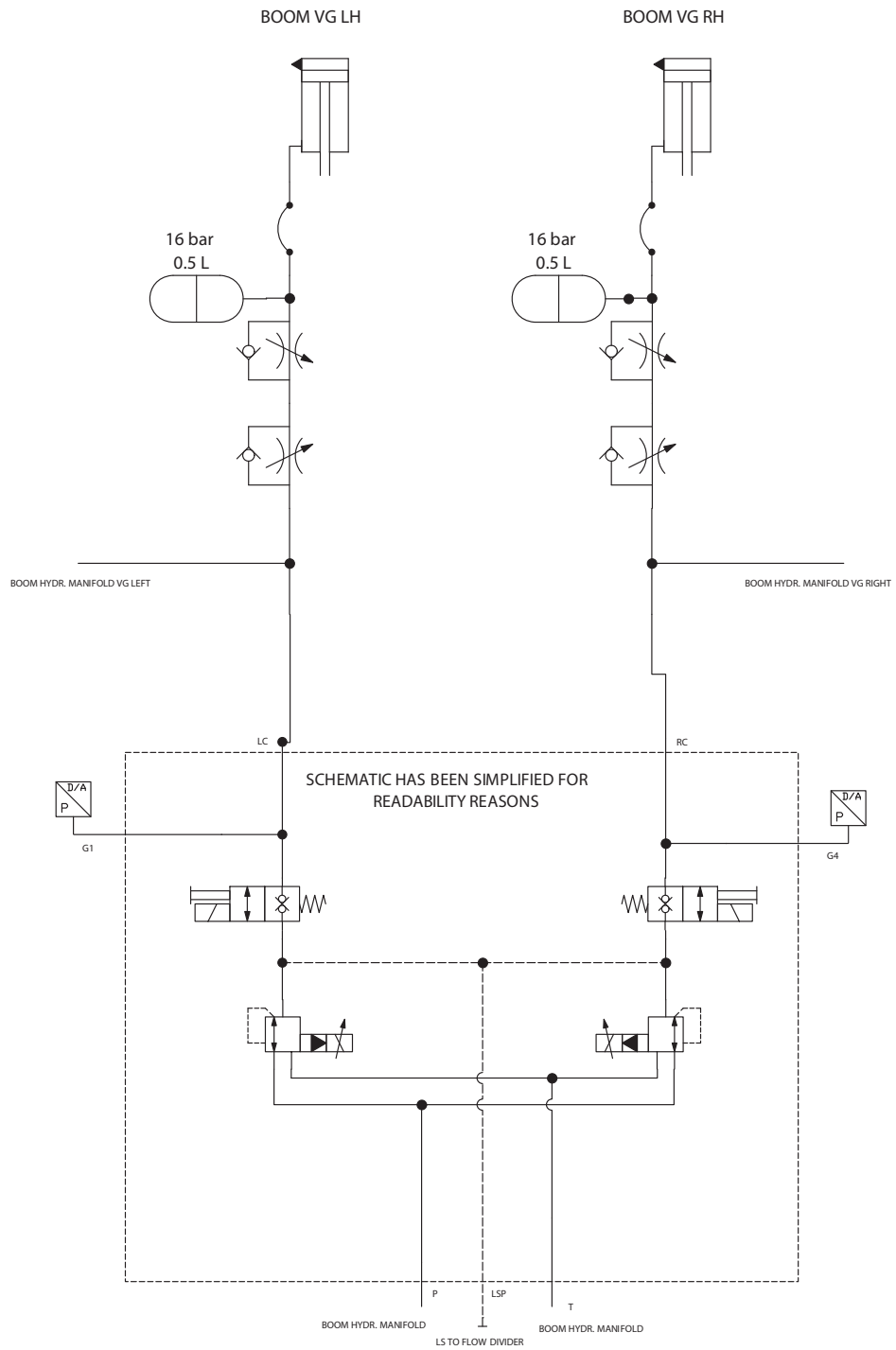


3 PART FOLDING BOOM





VG OPERATION TRAILED SPRAYER





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