

Calibration and Operation Manual: SmarTrax™

P/N 016-0171-532 Rev B

05/15

E21241

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CHAPTER

1

Important Safety Information

NOTICE

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

- Follow all safety information presented within this manual.
- If you require assistance with any portion of the installation or service of your Raven equipment, contact your local Raven dealer for support.
- Follow all safety labels affixed to the SmarTrax 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 SmarTrax, observe the following safety measures:

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



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.
- When starting the machine for the first time after installing SmarTrax, be sure that all persons stand clear in case a hose has not been properly tightened.

- The machine must remain stationary and switched off during SmarTrax installation or maintenance.



Hydraulic Safety

- Raven Industries recommends that appropriate protective equipment be worn at all times when working on the hydraulic system.
- Never attempt to open or work on a hydraulic system with the equipment running. Care should always be taken when opening a system that has been previously pressurized.
- When disconnecting the hydraulic hoses or purging is required, be aware that the hydraulic fluid may be extremely hot and under high pressure. Caution must be exercised.
- Any work performed on the hydraulic system must be done in accordance with the machine manufacturer's approved maintenance instructions.
- When installing SmarTrax 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 SmarTrax valve.

Electrical Safety

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

CHAPTER

2

Introduction

Congratulations on your purchase of the Raven SmarTrax system! This system is designed to provide cutting-edge, hands-free steering of the machine via Global Positioning System (GPS) coordinates.

The instructions in this manual are designed to assist in the proper calibration and operation of the SmarTrax, system when used with the Viper Pro, Envizio Pro or Envizio Pro II, and Cruizer series field computers.

Important: *Installation of the SmarTrax system must be completed before calibrating the system. If you have questions regarding the installation of the SmarTrax system, refer to the machine-specific SmarTrax Installation Manual provided with the installation kit.*

Important: *The Raven field computer/controller must be calibrated specifically for the vehicle before being used to operate the SmarTrax system. For questions about the field computer, refer to the Installation & Operation Manual provided with the field computer.*

Installation



WARNING

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

Recommendations

Before installing the SmarTrax system, park the machine where the ground is level, clean, and dry. Bleed pressure from the hydraulic system and leave the machine turned off for the duration of the installation process.

During the installation process, follow good safety practices. Be sure to carefully read the instructions in this manual as you complete the installation process.

Raven Industries recommends the following best practices when installing or operating the SmarTrax system for the first time, at the start of the season, or when moving the SmarTrax system to another machine:

- Ensure the machine's hydraulic filters have been recently changed and there are no issues with the machine's hydraulic system (e.g., pump issues, faulty hydraulic motors, fine metal deposits in the hydraulic hoses, etc.).
- Ensure the machine's hydraulic system is using fresh oil and debris is flushed from the hydraulic hoses, valves, and filters.

Antenna Installation

The machine presets loaded into the SmarTrax system software are based on the location of the antenna at the time the SmarTrax system was developed for your particular machine. If the antenna is not positioned exactly in the position configured in the software, the system will not acquire and remain on the desired path and/or system performance may degrade over time.

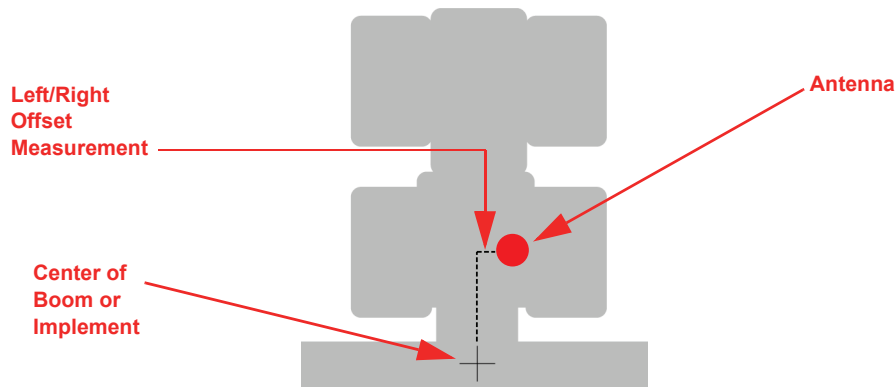
Refer to the Table 1 on page 5 to determine the correct antenna mounting position for your machine.

Important: *If your machine is not listed and/or a generic machine preset is selected, it will be necessary to physically measure the antenna location and manually adjust the value in the SmarTrax system.*

Antenna Left/Right Offset (Antenna X Position)

The antenna left/right offset position (represented in the following table as Antenna X Position, if applicable) is the distance from the antenna to the center of the boom or implement. The antenna left/right offset position is measured parallel to the boom or implement. Refer to Figure 1 below.

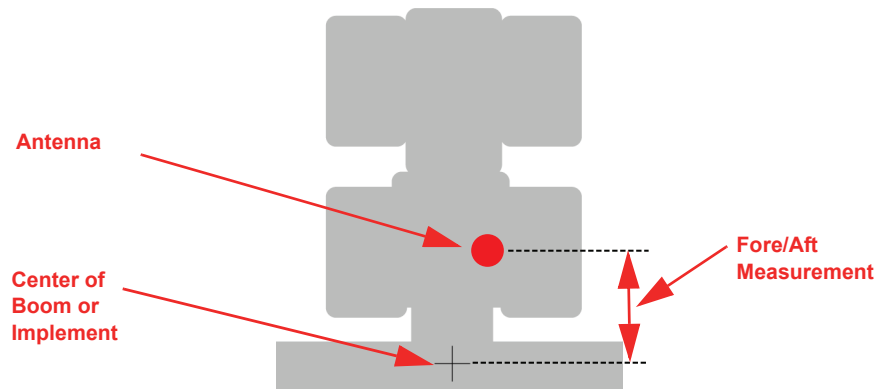
FIGURE 1. Antenna Left/Right Offset Measurement



Antenna Fore/Aft Offset (Antenna Y Position)

The antenna fore/aft offset position (represented in the following table as Antenna Y Position) is the distance from the GPS antenna to the boom or implement in front of or behind the machine. The antenna fore/aft offset position is measured perpendicularly from the antenna to the boom or implement. Refer to Figure 2 below.

FIGURE 2. Antenna Fore/Aft Offset Measurement



Antenna Height (Antenna Z Position)

The antenna height value is the measurement from the ground to 4" above the base of the antenna.

TABLE 1. Machine Presets

Machine Preset	Antenna X Position (left to right)	Antenna Y Position (fore/aft offset)	Antenna Z Position (ground to bottom of antenna)
Versatile 2300+	Centered	11.25 ft./3.43 m	11.92 ft./3.63 m
Versatile 2x0 Std	Centered	5 ft./1.524 m	9 ft. 11 in./3.029 m
Versatile 2xx/305 Ultra	Centered	5 ft./1.524 m	9 ft. 11 in./3.029 m
Versatile 300-400 HHT	Centered	10 ft. 7 in./3.239 m	11 ft. 7 in./3.531 m
Versatile 435-575 HHT	Centered	11 ft. 3 in./3.429 m	13 ft. 7 in./4.092 m
Versatile 490 Combine	Centered	6 ft./1.829 m	13 ft. 0 in./3.962 m
Versatile SX275 Sprayer	Centered	12 ft. 2 in./3.708 m	12 ft. 6 in./3.810 m

Point of Reference

The instructions in this manual assume that you are standing behind the machine, looking toward the cab.

Updates

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

<http://www.ravenhelp.com>

Sign up for email alerts, and you will be automatically notified when updates for your Raven products are available on the website!

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

-Buhler Versatile SmarTrax™ Calibration & Operation Manual

-Manual No. 016-0171-532 Rev. B

-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.

CHAPTER 3

Viper Pro Calibration and Operation






Introduction



Software Compatibility

The instructions in this manual apply to Viper Pro software version 3.7 or higher. The SmarTrax node software version must be running software version 6.0 or higher. If the Viper Pro or node is running with an older version of software, refer to the Viper Pro Installation & Operation Manual (P/N 016-0171-122) for instructions on updating the field computer and node software versions.

SmarTrax Status Display

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

Display	Message
	The SmarTrax node is detected, but the operator must accept responsibility for the operation of the SmarTrax system.
	SmarTrax is detected but not calibrated. The system must be calibrated before it can be used.
	SmarTrax is detected, turned on, and calibrated.
	SmarTrax is detected and in operation in the Online Sensitivity adjustment mode.
	SmarTrax is detected and in operation in the Line Acquisition Aggressiveness adjustment mode.

Display	Message
	SmarTrax is detected and turned on, but is not enabled. Tap the foot switch or touch the steering wheel icon to enable the SmarTrax system.
	SmarTrax is detected and in operation, with no errors detected.

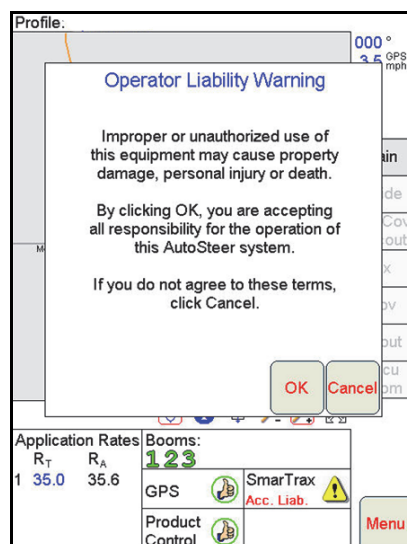
Initial Startup

Note: During the initial startup of the SmarTrax system, language data must be transferred from the SmarTrax node to the Viper Pro. Allow the data transfer several minutes to occur before calibrating the SmarTrax system.

SmarTrax Terms of Use

The following Operator Liability Warning will be displayed on the Viper Pro screen when the SmarTrax system is detected:

FIGURE 1. Operator Liability Warning Screen



The operator must select **OK** before the SmarTrax system may be enabled or calibrated. The Liability Waiver screen will appear each time the Viper Pro is turned on or rebooted.

GPS Configuration

1. From the Home screen, select **Menu**.
2. Select **Setup**.

3. Select **Comm Port**. The following screen will appear:

FIGURE 2. GPS Comm Port Setup Screen

GPS Comm Port Setup

Baud	Data Bits	Parity
<input type="radio"/> 4800	<input checked="" type="radio"/> 8	<input type="radio"/> Odd
<input type="radio"/> 9600	<input type="radio"/> 7	<input type="radio"/> Even
<input type="radio"/> 19200	Stop Bits	<input checked="" type="radio"/> None
<input type="radio"/> 38400	<input checked="" type="radio"/> 1	
<input type="radio"/> 57600	<input type="radio"/> 2	
<input checked="" type="radio"/> 115200		

☒ Generic GPS
☐ Raven GPS

←	→	*	/	+	-	=	.	←	→
1	2	3	4	5	6	7	8	9	0
q	w	e	r	t	y	u	i	o	p
Cap	a	s	d	f	g	h	j	k	l
Shift	z	x	c	v	b	n	m	End	
\$	%	@	\	,	:	Space	Enter		

4. Adjust the GPS settings to match the settings shown in Figure 1 above.
5. Select **OK**.

Machine Configuration

Before the SmarTrax system may be enabled, the Viper Pro and SmarTrax system must be calibrated for the specific vehicle being used. Complete the following steps to configure the machine specifications in the Viper Pro and the SmarTrax system.

FIGURE 3. SmarTrax Access Button

Profile: Viper Demo

000 °
6.9 GPS mph

Main

Guide
Rx+Cov
+Scout
Rx
Cov
Scout
Accu
Boom

500 ft

Application Rates: R_T R_A
1 35.0 34.5

Booms: 123

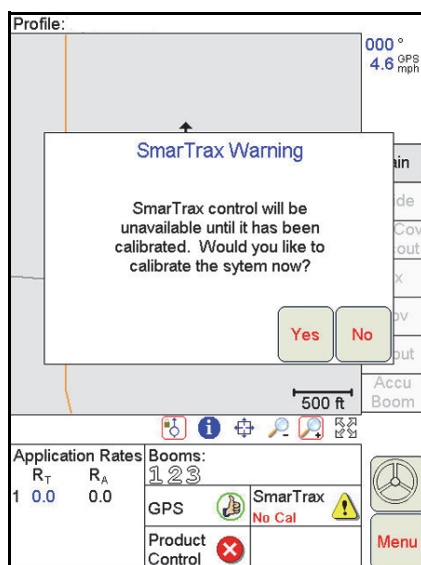
GPS ☒ No Cal ☒

Product Control ☒

Menu

1. Touch the SmarTrax area on the main Viper Pro screen. The following screen will appear:

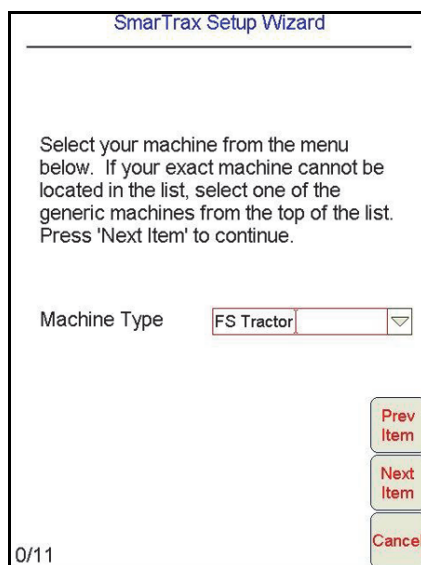
FIGURE 4. SmarTrax Warning Screen



Note: The screen above should only appear the first time SmarTrax is accessed or if default settings have been restored. If this prompt reappears, contact your local Raven dealer for assistance.

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

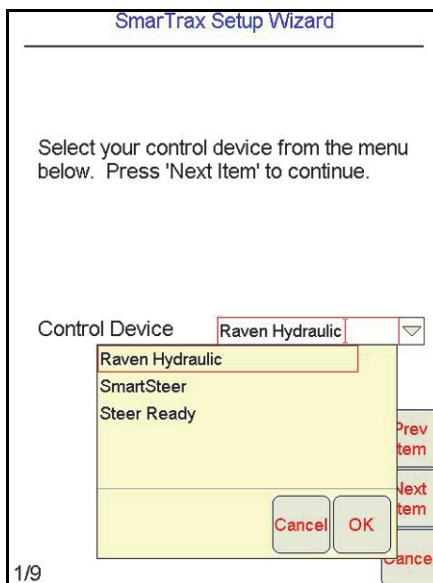
FIGURE 5. Machine Configuration Menu



3. Select the specific machine type from the **Machine Type** list. If the specific machine is not listed, choose the profile that best fits the machine:
 - FS Tractor - Front-steered tractor
 - SP Sprayer RBoom - Self-propelled sprayer with a rear boom
 - Articulated
 - SP Sprayer FBoom - Self-propelled sprayer with a front boom
 - Rear Steered - Rear-steered machine

4. Select **OK**.
5. Select **Next Item**. The following screen will appear

FIGURE 6. Steering Control Device Selection Screen



Note: The steering control device selection screen will be displayed only when a SmarTrax or SmarTrax 3D node is detected in the system.

6. SmarTrax Node Control Systems Only - Select the steering control device:
 - Raven Hydraulic - SmarTrax hydraulic valve is controlling the vehicle steering.
 - Steer Ready - An optional steering control system was installed at the factory - available on select machines only.
7. Select **OK**.
8. Refer to the appropriate System Disengage Calibration section on the following pages for the machine's specific system configuration.

Calibrate the SmarTrax System

Important: If the system contains a roading switch, the switch must be turned on before calibrating the steering system.

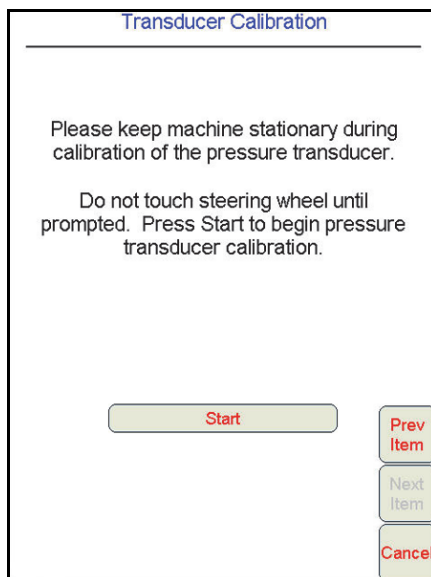
System Disengage Calibration - SmarTrax Only

SmarTrax Systems with a Pressure Transducer Installed

Important: This section applies only to SmarTrax systems utilizing a pressure transducer to disengage the SmarTrax system when the steering wheel is turned. If a flow or pressure switch is installed in the SmarTrax system, refer to the SmarTrax Systems with a Flow Switch or Pressure Switch Installed section on page 13 to calibrate the SmarTrax system..

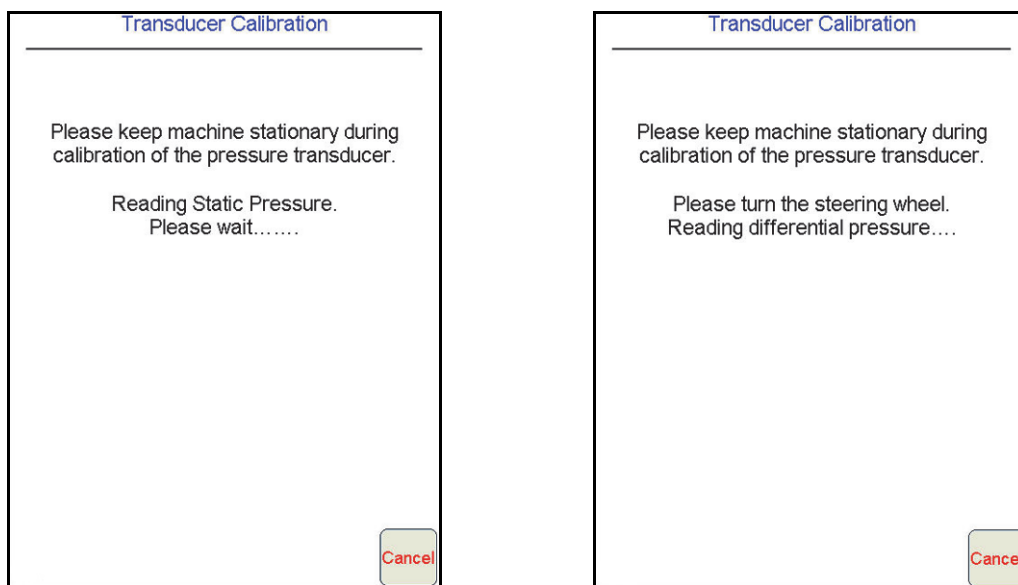
1. Select **Next Item** in the SmarTrax Setup Wizard. The following screen will appear:

FIGURE 7. Transducer Calibration Screen



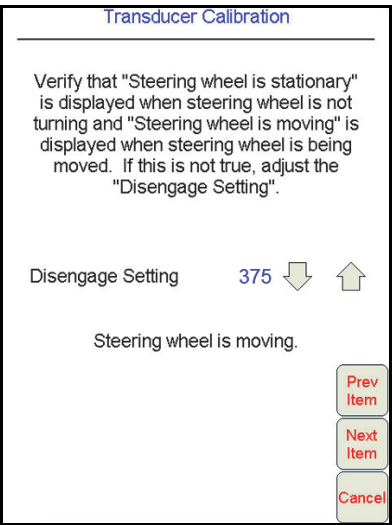
2. Select **Start**. The following screen will appear:

FIGURE 8. Transducer Calibrating Screen



3. When prompted, turn the steering wheel to allow the SmarTrax system to detect the hydraulic pressure increase. Once the system has detected the static and differential pressures, the following screen will be displayed:

FIGURE 9. Transducer Calibration Verification



4. Verify the Viper Pro displays the correct steering operation message as indicated in Figure 7 above.

Note: *It may be necessary to increase the disengage setting to require more steering input to disengage SmarTrax and to decrease the disengage setting to require less steering input.*

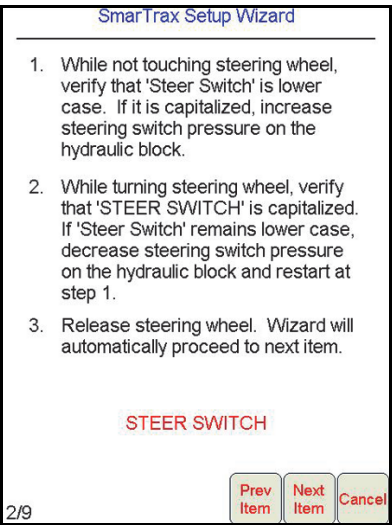
5. If the system setting is correct, select **Next Item**.
6. Proceed *Engage Switch Calibration and Node Orientation* section on page 14 to continue with the SmarTrax system calibration.

SmarTrax Systems with a Flow Switch or Pressure Switch Installed

Important: *This section applies only to SmarTrax systems utilizing a flow switch or pressure switch to disengage the SmarTrax system when the steering wheel is turned. If a pressure transducer is installed in the SmarTrax system, refer to the System Disengage Calibration - SmarTrax Only section on page 11 to calibrate the SmarTrax system.*

1. Select **Next Item** in the SmarTrax Setup Wizard. The following screen will appear:

FIGURE 10. Steering Switch Calibration Screen



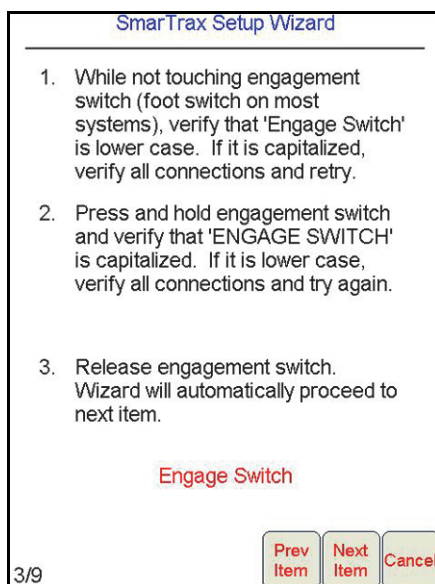
2. Review the on-screen instructions and turn the steering wheel to verify proper operation.

Note: *The SmarTrax Setup Wizard will automatically advance to the next step in the calibration process when the steering wheel is turned. If it does not, refer to Chapter 5, Troubleshooting for troubleshooting information. If the problem persists, contact your local Raven dealer for further information.*

3. Proceed to *Engage Switch Calibration and Node Orientation* section on page 14 to continue with the SmarTrax system calibration.

Engage Switch Calibration and Node Orientation

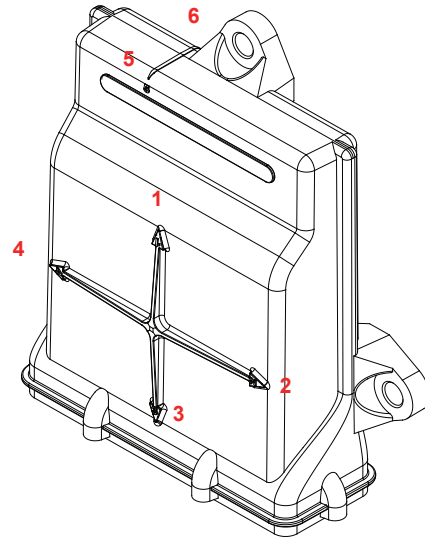
FIGURE 11. Engage Switch Calibration Screen



1. Review the on-screen instructions.
2. Press and release the foot switch or engage switch.

Note: *The SmarTrax Setup Wizard will automatically advance to the next step in the calibration process when the engage switch is detected.*

FIGURE 12. TC Orientation Screen



3. Park the machine on a level surface.
4. Select the number that corresponds with the node arrow number pointing toward the front of the machine.

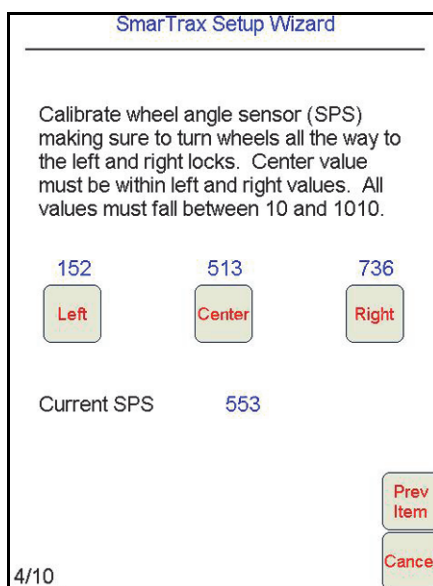
Note: The SmarTrax node will calibrate the internal sensors automatically. The SmarTrax Setup Wizard will automatically advance to the next step in the calibration process once the node calibration is complete.

Steering Position Sensor (SPS)/Wheel Angle Sensor (WAS) Calibration - SmarTrax Only (If Applicable)

Important: The range of the SPSWAS values is limited to 10 - 1010 to prevent damage to certain types of sensors. Ensure the sensor is mounted to prevent damage during operation. The difference between the Left and Center values and Center and Right values must exceed 100.

The SPS/WAS calibration is required only if a SPS/WAS is installed in the SmarTrax system. If a SPS/WAS is installed, the following screen will be displayed:

FIGURE 13. SPS/WAS Calibration Screen



SmarTrax Setup Wizard

Calibrate wheel angle sensor (SPS) making sure to turn wheels all the way to the left and right locks. Center value must be within left and right values. All values must fall between 10 and 1010.

152 513 736

Left Center Right

Current SPS 553

4/10

Prev Item


Cancel

1. While driving slowly, turn the steering wheel fully to the left wheel lock.
2. Select **Left**.
3. Continue driving slowly and straighten the wheel until the machine is driving straight forward.
4. Select **Center**.
5. Turn the steering wheel fully to the right wheel lock.
6. Select **Right**.
7. Select **Next Item**.

Configuring Wheel Base and Antenna Offsets

If a generic machine profile was selected during the machine configuration process, the Wheel Base, Antenna Position, and Antenna Height values must be entered into the SmarTrax system.

Important: *If a specific machine profile was selected during the machine configuration process, the Wheel base, Antenna Position, and Antenna Height measurements will be automatically populated in the screen. However, the antenna mounting position may vary on the machine, so it is important to re-measure the Antenna Position and Antenna Height to verify that the setting in the Viper Pro is correct. The Wheel Base value cannot be changed.*



NOTICE

The Wheel Base, Antenna Position, and Antenna Height values are critical to the operation of the SmarTrax system. Measure these dimensions accurately to ensure optimal SmarTrax system performance!

1. To figure the machine's wheel base, measure the distance from the center of the machine's front axle to the center of the rear axle.

Note: For articulated machines, measure from the center of the front tire to the center of the rear tire on both sides of the machine. Add the values together and divide the number by two to find the average.

FIGURE 14. Wheel Base Configuration Screen

SmartTrax Setup Wizard

Enter distance measured from rear axle to front axle. Wheels must be straight when taking this measurement.

Wheel Base

Units to be entered in Feet.

5/10

←	→	*	/	+	-	=	.	←←	→→
1	2	3	4	5	6	7	8	9	0
Q	W	E	R	T	Y	U	I	O	P
Cap	A	S	D	F	G	H	J	K	L
Shift	Z	X	C	V	B	N	M	End	
\$	%	@	\	,	:	Space	Enter		

Prev Item
Next Item
Cancel

2. Enter the Wheel Base measurement using the on-screen keypad.
3. Select **Next Item**.
4. To figure the GPS Antenna Position, measure the distance from the antenna to the center of the rear axle.

FIGURE 15. Antenna Position Configuration Screen

SmartTrax Setup Wizard

Enter horizontal distance measured from rear axle to antenna. If antenna is behind rear axle, enter a negative number.

Antenna Position (fore/aft)

Units to be entered in Feet.

6/10

←	→	*	/	+	-	=	.	←←	→→
1	2	3	4	5	6	7	8	9	0
Q	W	E	R	T	Y	U	I	O	P
Cap	A	S	D	F	G	H	J	K	L
Shift	Z	X	C	V	B	N	M	End	
\$	%	@	\	,	:	Space	Enter		

Prev Item
Next Item
Cancel

5. Enter the Antenna Position measurement.

Important: If the antenna is in front of the rear axle, the number entered must be positive. If the antenna is behind the rear axle, the number must be entered as negative using a “-” before the number. For example, if the antenna is located 3 feet behind the rear axle, the value would be entered as -3.

6. Select **Next Item**.
7. To figure the Antenna Height, measure the distance from the ground to the antenna base mounting plate.

FIGURE 16. Antenna Height Configuration Screen

The screenshot shows the 'SmarTrax Setup Wizard' interface. At the top, it says 'Enter distance measured from ground to mounting base plate of antenna.' Below this, there is a label 'Antenna Height' followed by a text input field containing the value '12.2'. To the right of the input field are three buttons: 'Prev Item', 'Next Item', and 'Cancel'. Below the input field, it says 'Units to be entered in Feet.' At the bottom of the screen, there is a numeric keypad with a grid of buttons for digits 0-9, symbols like \$, %, @, \, and a 'Space' button. Above the keypad, there are navigation buttons for left and right arrows, and a '7/10' indicator.

8. Enter the Antenna Height measurement.
9. Select **Next Item**.

Enhanced Tilt Calibration

For RTK steering systems, it is recommended that an enhanced tilt calibration be performed to accurately zero out the tilt sensor.

FIGURE 17. Enhanced Tilt Calibration Wizard

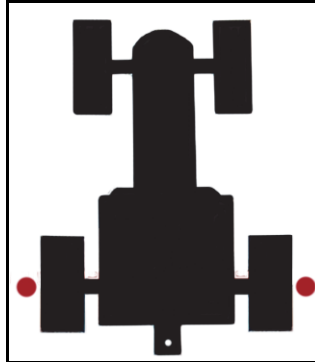
The screenshot shows the 'Tilt Calibration Wizard' interface. It displays a list of instructions for calibration:

1. Stop on flat surface
2. Flag your rear tires
3. Press Start calibration
4. Turn machine around and park with rear axle in the same position as before
5. Press Finish calibrate

 At the bottom right of the screen, there are two buttons: 'Next' and 'Cancel'.

1. Park the machine on a flat surface.

FIGURE 18. Machine's Rear Axle Marked Before Enhanced Tilt Calibration



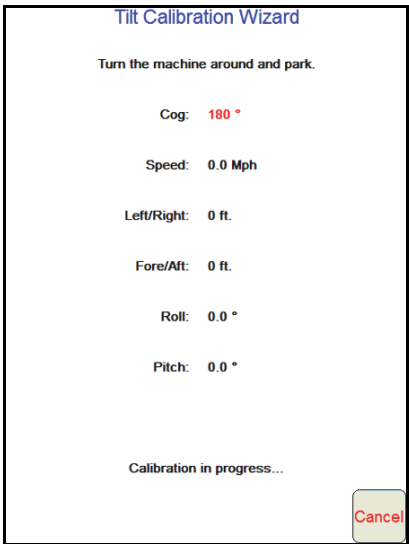
2. Place flags or markers on the outside of each rear wheel aligned with the axle.
3. Select **Next**.

FIGURE 19. Tilt Calibration Screen

A screenshot of the 'Tilt Calibration Wizard' screen. The title 'Tilt Calibration Wizard' is at the top in blue. Below it, the instruction 'Stop on flat surface and flag your rear tires.' is displayed. A series of status indicators are listed: 'Cog: 0 °', 'Speed: 0.0 Mph', 'Left/Right: 0 ft.', 'Fore/Aft: 0 ft.', 'Roll: 0.0 °', and 'Pitch: 0.0 °'. At the bottom, there are two buttons: 'Start Calibration' (highlighted with a red oval) and 'Cancel'.

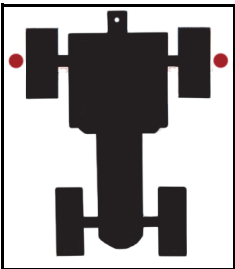
4. Select **Start Calibration**. The following screen will appear:

FIGURE 20. Calibration in Progress Screen



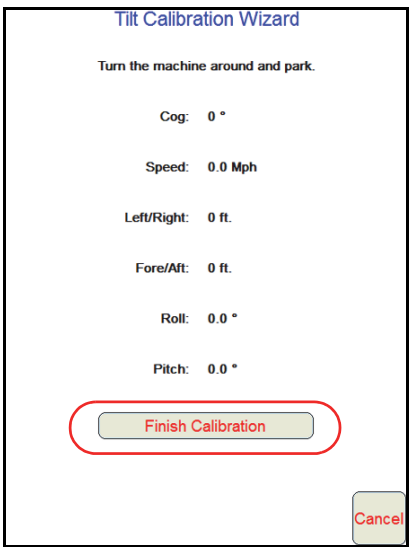
Note: The calibration may take a few minutes to complete.

FIGURE 21. Machine Orientation After Tilt Calibration



5. Turn the machine around 180° and park with the machine facing the opposite direction and the rear axle in between the markers.

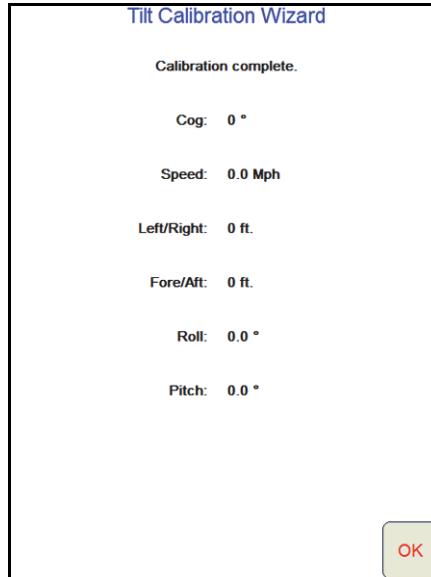
FIGURE 22. Finish Calibration



6. After the calibration is complete and the values on the screen have turned black, select **Finish Calibration**.

Note: In order for the values to turn black, the COG value must be less than 10°, the Left/Right must be less than 3 ft, and the Fore/Aft must be less than 3 ft.

FIGURE 23. Calibration Complete



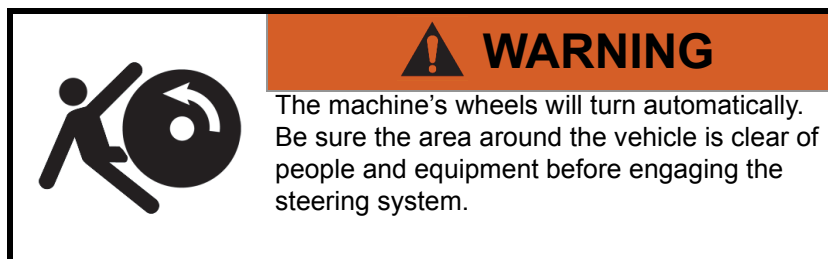
7. Select **OK**.


Calibrate the Machine's Steering System

After the initial calibration of the SmarTrax system is complete, it is necessary to calibrate the machine's steering system. This allows the Viper Pro to learn the hydraulic capabilities of the machine to allow SmarTrax to properly steer it in the field.

Before beginning the machine's steering system calibration, ensure:

- The implement sections are folded in and the booms are racked.
- The machine's engine is running at the normal operating RPM.
- The machine's measurements are correctly entered into the Viper Pro.





NOTICE

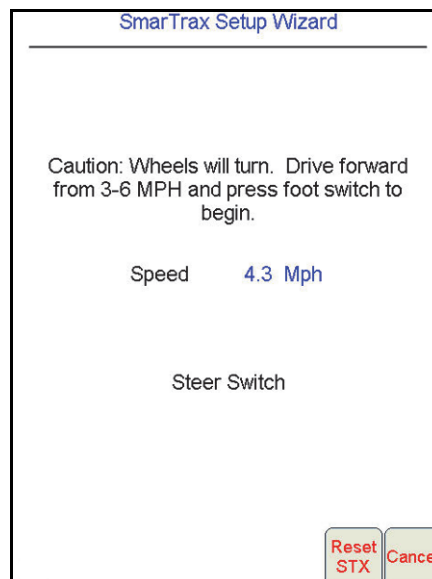
The calibration of the machine's steering system should be performed in a field or other large, open space and during conditions similar to normal vehicle operation.

If the ground or surface is slippery, muddy, or freshly tilled, the SmarTrax system may learn incorrect steering responses for normal operating conditions.

Ensure the machine's hydraulics are operating properly and there are no other mechanical issues that may affect the performance of the SmarTrax system.

Note: *To ensure the calibration is successful, the number of starts and stops during the calibration process should be limited. If it is necessary to pause the calibration process, turn the steering wheel or tap the foot/enable switch. Tap the foot/enable switch again to resume calibration.*

FIGURE 24. Steering Calibration Screen




1. Position the machine in an open space with several acres of smooth ground available to perform the machine's steering calibration.
2. Press the foot/engage switch to begin calibration.

Note: *During calibration, the machine will turn hard to the left or right and progressively turn in the opposite direction, then turn hard in that direction and progressively turn back in the opposite direction. Adjust the speed and vehicle location as necessary.*

Note: *After calibration is complete, the SmarTrax menu will be displayed.*

Complete the SmarTrax Calibration Process



NOTICE

The calibration of the machine's steering system should be performed in a field or other large, open space and during conditions similar to normal vehicle operation.

If the ground or surface is slippery, muddy, or freshly tilled, the SmarTrax system may learn incorrect steering responses for normal operating conditions.

Ensure the machine's hydraulics are operating properly and there are no other mechanical issues that may affect the performance of the SmarTrax system.

Note: The SmarTrax system will take a few minutes to fine-tune the machine's steering response the first time the SmarTrax system is enabled in field conditions.

Note: After at least ten minutes of the initial drive with the SmarTrax system engaged, the Line Acquire Aggressiveness and On-Line Sensitivity values may be adjusted to further tune the system or to adjust for operating conditions. Refer Advanced Setup Tools section on page 24 further information on system adjustments.

1. Start a job and set a straight A-B guidance line.

Note: Refer to the Viper Pro Installation and Operation Manual (P/N 016-0171-122) for information on starting a job.

2. With the engine running at the operating RPM, drive forward at a speed of 5-7 mph [8-11 km/h].

FIGURE 25. SmarTrax Enable Icon



3. Enable SmarTrax by pressing the steering wheel icon on the Viper Pro display or by tapping the foot/enable switch.

Note: When SmarTrax is enabled, the steering wheel icon will turn green.

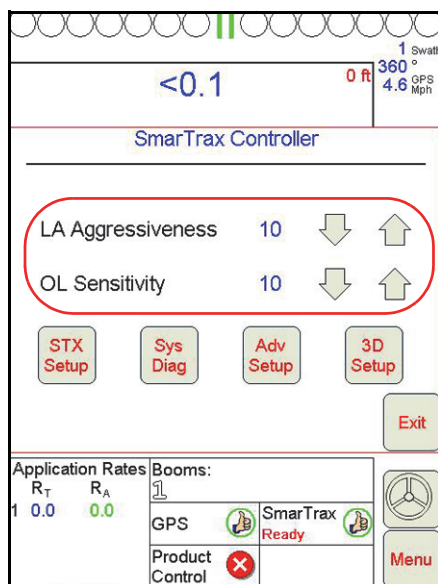
4. Increase speed every few minutes until the normal operating speed is reached.
5. Allow SmarTrax to run for ten minutes while driving back and forth along the A-B guidance line.

Note: If the machine is not operating to specifications after ten minutes, manual adjustment of the SmarTrax system may be necessary. Refer to the Advanced Setup Tools section below information on adjusting the SmarTrax system.

Advanced Setup Tools

Advanced setup tools allow fine-tuning of the system to adjust for operating conditions and improve steering accuracy. To adjust the steering response on the Viper Pro, touch the SmarTrax area on the Viper Pro main menu. The following screen will appear:

FIGURE 26. SmarTrax Information Screen



Line Acquisition (LA) Mode and Aggressiveness

Note: The speed of the LA mode is often limited by the speed of the machine's hydraulic and steering system. Increasing the LA value at the maximum vehicle speed may degrade performance of the SmarTrax system.

FIGURE 27. LA Mode Indicator



The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is travelling further than 24 inches [60 cm] from the desired path. If the machine does not approach the guidance line as quickly as desired, increase the LA Aggressiveness value one increment at a time, allowing SmarTrax at least 30 seconds between adjustments to adjust to the change in the value.

Setting the LA Aggressiveness value too high may cause the machine to steer into the guidance line too quickly and weave around the guidance line. Lowering the value in these situations will allow the machine to steer back to the line.

On-Line (OL) Mode and Sensitivity

FIGURE 28. OL Mode Indicator

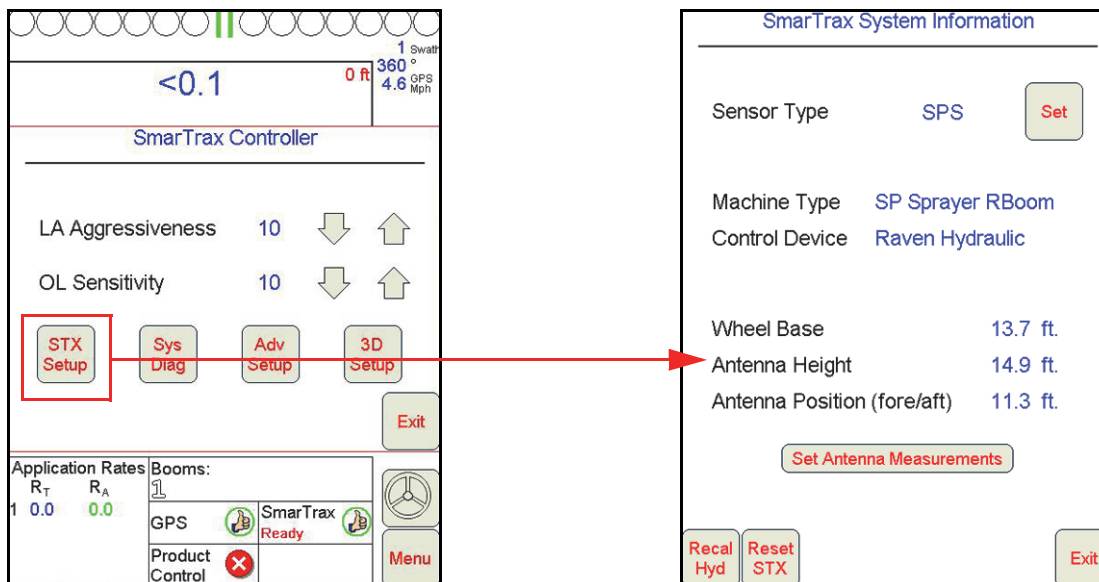


The OL Sensitivity value affects the response of the machine while steering within 24 inches [60 cm] of the displayed guidance line. If the machine tends to slowly weave across the guidance line and does not remain within 24 inches [60 cm] of the desired path, increase the OL Sensitivity value one increment at a time, allowing SmarTrax at least 30 seconds between adjustment to adjust to the change in the value.

Setting the OL Sensitivity value too high may cause the machine to over-correct or become jittery while on the line. Lowering the value in these situations will allow the vehicle to remain on the desired path.

STX Setup Screen

FIGURE 29. SmarTrax Setup Screen



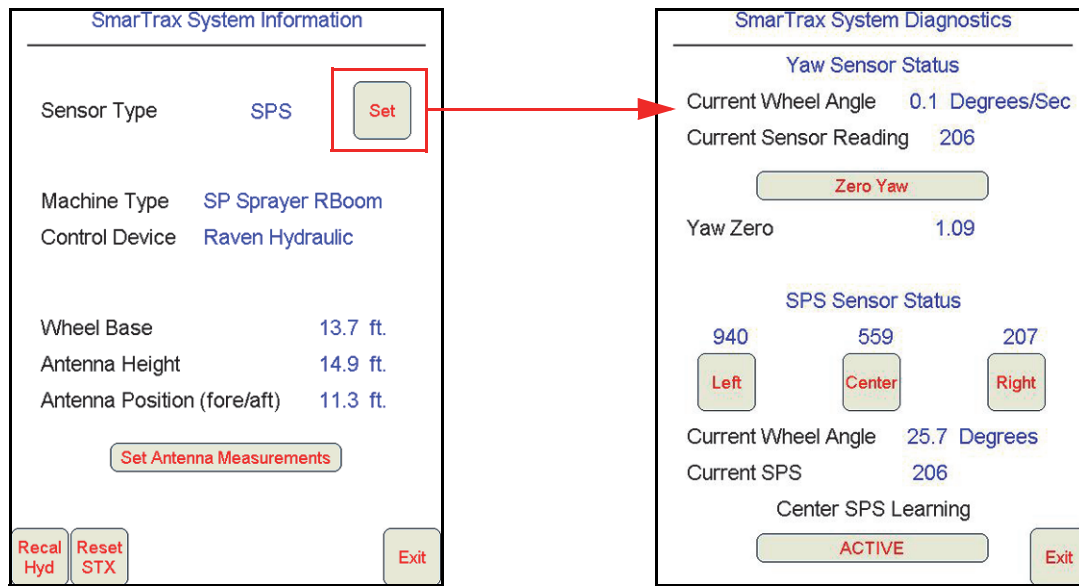
Note: To change the Sensor Type, Machine Type, Control Device, or Wheel Base settings, the SmarTrax system must be reset and recalibrated.

- **Set Antenna Measurements** - Allows the Antenna Height and Antenna Position measurements to be changed.
- **Recal Hyd** - Restarts the machine's steering calibration process. Refer to *Calibrate the Machine's Steering System* section on page 21 for information on completing the machine's steering calibration.
- **Reset STX** - Resets the SmarTrax system to the default values.

Important: If Reset STX is selected, the SmarTrax system must be recalibrated before the system can be enabled. Refer to *Calibrate the SmarTrax System* section on page 11 for information on completing the SmarTrax system calibration.

- **Set** - Displays the Sensor Status screen.

FIGURE 30. Sensor Status Screen



- The Yaw Sensor Status area of the screen displays the yaw sensor diagnostic information:
 - Current Wheel Angle** - An approximation of the steering inputs detected by the yaw sensor.
 - Current Sensor Reading** - The total yaw detected by the sensor.
 - Zero Yaw Button** - Recalibrates the yaw sensor to zero. The machine must be at a full stop before recalibrating the yaw sensor.
 - Yaw Zero** - The yaw sensor reading while the machine is stationary. Due to variations in the yaw sensors, this value may not be exactly zero.
- If the SmarTrax system contains a SPS/WAS, the SPS Sensor Status area of the screen displays the SPS/WAS sensor status information.

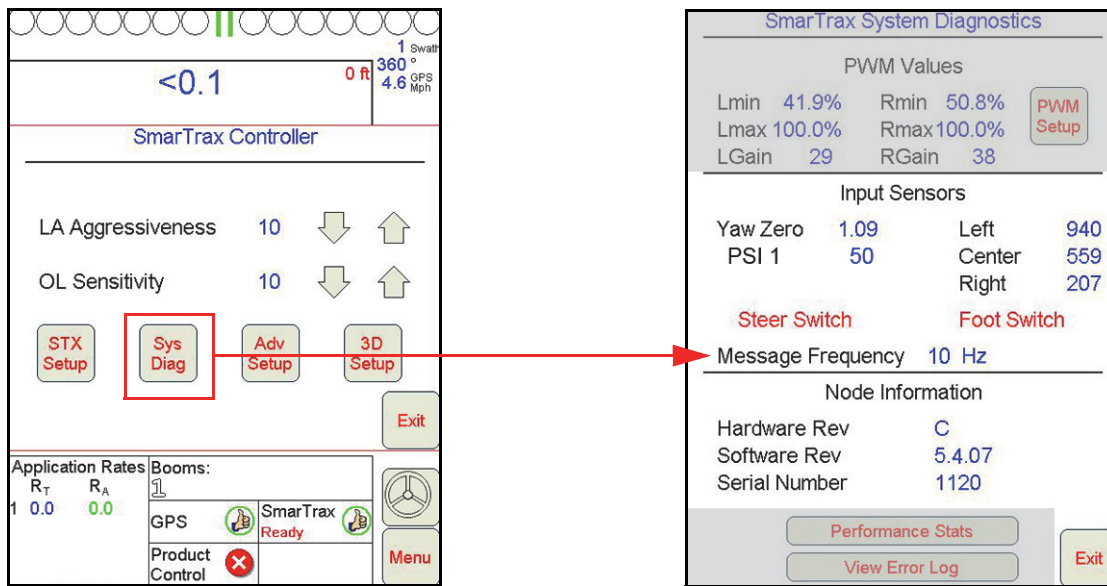
Note: *SmarTrax nodes 016-0173-031 and 016-0173-042 only - The SmarTrax node must be hardware version C or higher to utilize the SPS/WAS.*

- Left, Center, and Right** - Displays sensor readings. If the sensor is repositioned or replaced, these values should be recalibrated before operating the SmarTrax system.
- Current Wheel Angle** - The current wheel angle detected by the SPS/WAS.
- Current SPS** - Current value registered by the sensor.
- Center SPS Learning** (SmarTrax Systems Only) - When set to Active, the SmarTrax system automatically adjusts the SPS/WAS center position during operation. Bypassing this feature leaves the SPS/WAS position at its current value.

Sys Diag Screen

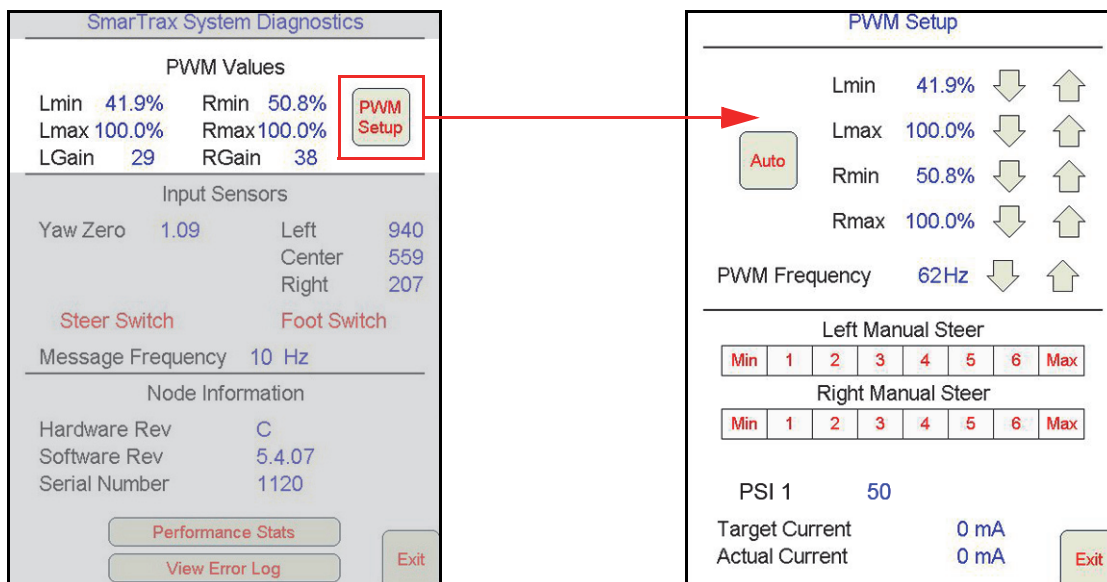
The System Diagnostics screen contains the PWM values and system input diagnostic tools.

FIGURE 31. SmarTrax Controller and System Diagnostics Screens



- **Input Sensors** - Displays yaw and SPS/WAS calibration values.
- **Steer Switch and Foot Switch** - Displays steering and foot/engage switches install in the system.
- **Message Frequency** - Displays GGA input message rate.
- **Node Information** - Displays node hardware version, software version, and serial number.
- **Exit** - Returns to the SmarTrax Controller screen.

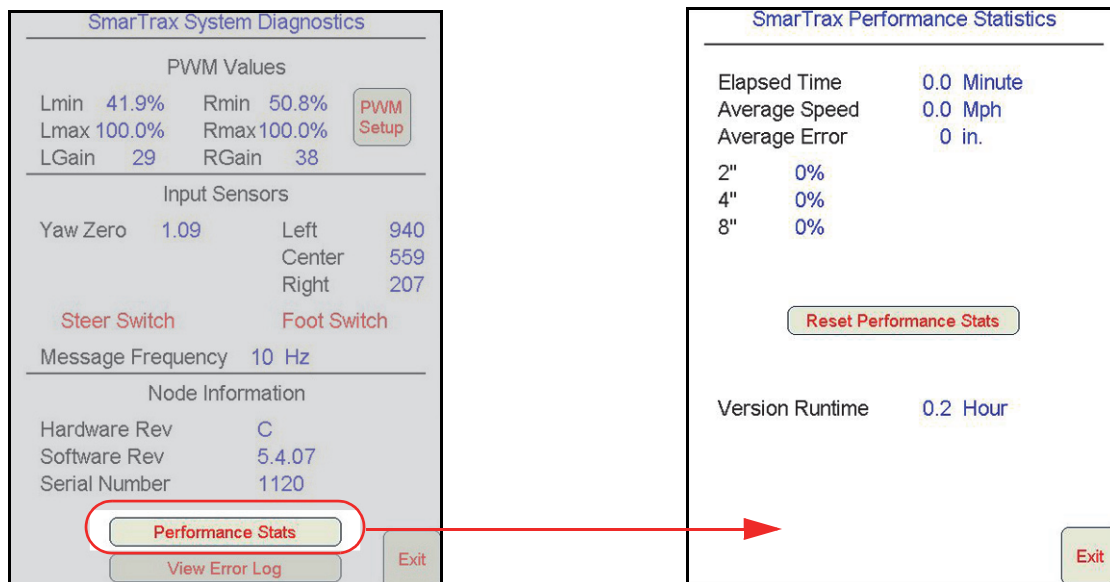
FIGURE 32. System Diagnostics and PWM Setup Screens



- **PWM Values** - Displays SmarTrax valve PWM minimum, maximum, and gain values. Adjustment of these values is not typically necessary. Raven Industries recommends leaving these values as configured by the SmarTrax system unless a technician instructs you to modify the settings. If the PWM values are adjusted, the SmarTrax system will no longer automatically adjust the PWM minimum values unless the Manual button is pressed, changing the system back to Auto. Pressing **Modify PWM Settings** displays the PWM Status screen to allow manual adjustments of the PWM values.

- **Auto or Manual** - Toggles between automatic and manual control of the PWM valves. If “Manual” is displayed in the icon, the system is in manual mode and is no longer learning the PWM minimum values. Pressing the button will switch SmarTrax to automatic mode. If “Auto” is displayed, the system is in automatic mode and is learning the PWM minimum values. Adjusting a PWM Minimum value will switch SmarTrax to manual mode.
- **Left and Right Manual Steer** - Used to manually test the SmarTrax system. Select one of the values or the Min or Max button to steer the machine. If it does not respond as expected, the PWM values may need to be adjusted.
- **Target Current and Actual Current** - Current readings performed on SmarTrax systems containing hydraulic valves with kit part numbers 117-0295-xxx and 117-4001-xxx. Target Current is what the system expects to read. Actual Current displays the amount of current the system is using to steer the machine. These values are used to adjust system performance.
- **Exit** - Returns to the System Diagnostic screen.

FIGURE 33. System Diagnostics and SmarTrax Performance Statistics Screens

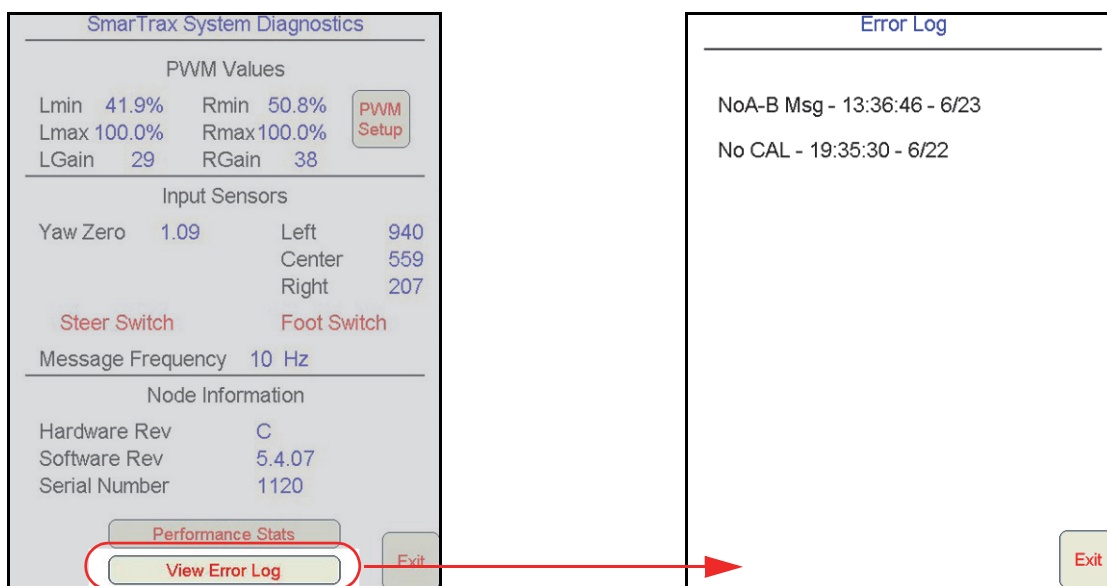


- **Performance Stats** - Displays the SmarTrax system performance statistics.
 - **Elapsed Time** - Length of time the SmarTrax system has been running.
 - **Average Speed** - Average vehicle speed over the last hour while SmarTrax has been running.
 - **Average Error** - Average distance from the desired guidance path or line during the last hour while SmarTrax has been running.
 - **2\", 4\", and 8\"** - The percentage of time the machine has been within the distance of the guide line during the last hour. Press **Reset Performance Stats** to set the fields to zero.

Note: The error percentages are always displayed in inches, regardless of the Display Unit selection. The equivalent metric values are 5 cm, 10 cm, and 20 cm. On RTK systems, the values are 1\", 2\", and 4\".

- **Version Runtime** - The runtime of the current SmarTrax node software version.
- **Exit** - Returns to the System Diagnostics screen.

FIGURE 34. SmarTrax Diagnostics and Error Log Screens

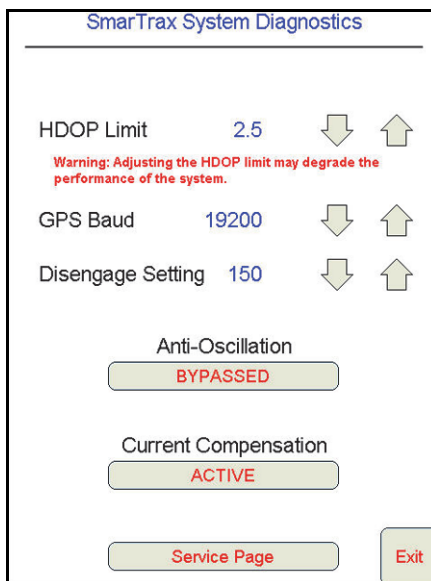


- **View Error Log** - Displays the Error Log screen, which contains the last 10 errors that have appeared in the SmarTrax status area of the Viper Pro and the time they occurred.
- **Exit** - Returns to the System Diagnostics screen.

Adv Setup Screen

The Advanced Setup screen contains advanced diagnostic information used to fine-tune the SmarTrax system and improve steering accuracy.

FIGURE 35. Advanced Setup Screen



- **HDOP Limit** - Horizontal Dilution of Precision (HDOP) is an indicator of the quality of the GPS signal. A high HDOP indicates that not enough satellites are distributed evenly throughout the sky, diminishing the

accuracy of the guidance system. The number displayed is the maximum number SmarTrax will allow to run. Raising this number may degrade system performance.

- **GPS Baud** - The rate the system uses to communicate with the GPS receiver. This value is typically set to 19200.
- **Anti-Oscillation** - This feature is only used with articulated machines and should not be enabled with any other type of machine. Anti-Oscillation automatically turns on when an articulated machine is selected during the machine configuration stage of the SmarTrax setup. Enabling this feature with any machine that is not articulated may degrade the system performance.
- **Current Compensation** - Used only with certain non-steering ready machines. This feature is automatically enabled or disabled during the calibration process and cannot be modified.
- **Service Page** - Used only for software programming purposes and is not accessible without a code.
- **Exit** - Returns to the SmarTrax Controller screen.

3D Setup Screen

The SmarTrax 3D terrain compensation feature adjusts incoming GPS messages, compensating for roll (side-to-side tilting), pitch (front-to-rear tilting), and yaw (twisting or turning) of the machine.

FIGURE 36. Terrain Compensation Information Screen

The screenshot shows the 'SmarTrax 3D Compensation' screen with the following data and controls:

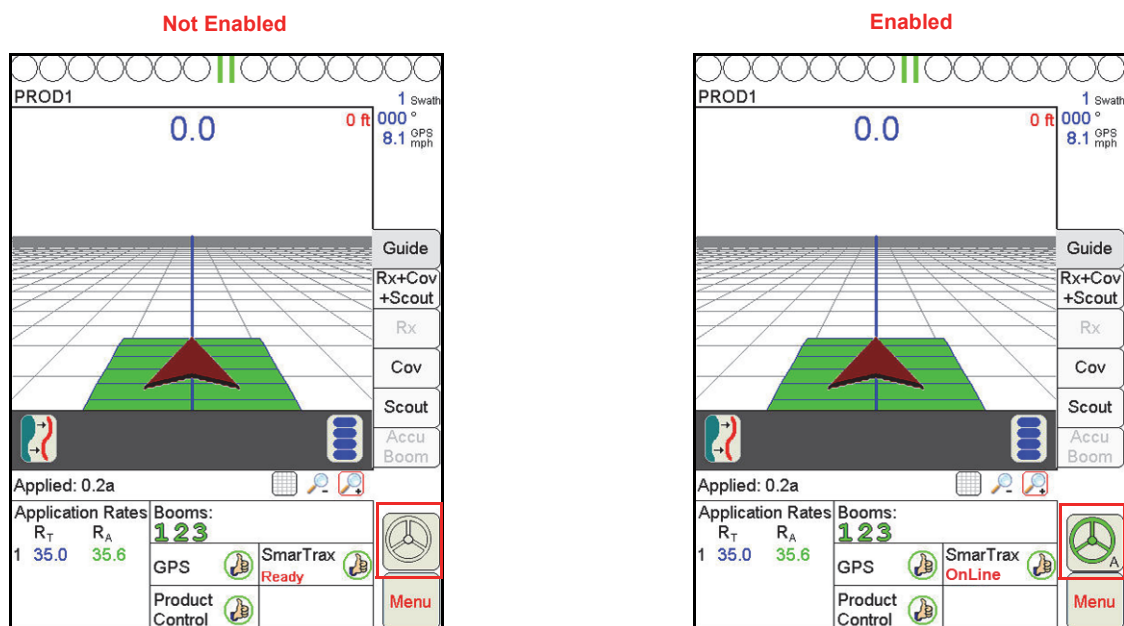
SmarTrax 3D Compensation	
Roll	0.1 Degrees
Pitch	0.0 Degrees
Yaw	0.0 Degrees
Yaw Rate	0.0 Degrees/Sec
Direction of Travel	UNKNOWN
Forward:	1
Downward:	6
<div>Calibrate TC</div> <div>ACTIVE</div> <div>Exit</div>	

- **Roll, Pitch, Yaw, and Yaw Rate** - Real-time measurement data used by the 3D terrain compensation feature.
- **Direction of Travel** - Indicates the direction in which the machine is travelling. If the direction is incorrect, drive forward and press the **Send Forward Command** button. Verify the direction of travel is displayed correctly when the machine is being driven in both forward and reverse.
- **Forward and Downward** - Indicate the orientation of the node programmed during calibration of the SmarTrax system.
- **Calibrate TC** - Used to calibrate the 3D terrain compensation feature. Refer to the *Enhanced Tilt Calibration* section on page 18 for the calibration procedure.
- **ACTIVE/BYPASSED** - Used to toggle the 3D terrain compensation feature on and off.

Routine Operation

Engaging SmarTrax

FIGURE 37. SmarTrax System Engaged



The steering wheel icon in the lower right corner of the Viper Pro screen indicates whether the SmarTrax system is engaged or disengaged. The steering wheel is green when the system is enabled and gray when it is not. SmarTrax can be engaged in two ways:

- Via the Viper Pro by pressing the steering wheel icon in the lower right corner of the display.
- By tapping the foot/enable switch.

Updating the Node

Refer to the Viper Pro Installation & Operation Manual (P/N 016-0171-122) for instructions on updating the node software.

System Settings

System Setting	Average Setting	Suggested Range	Function
Line Aggressiveness (LA) Acquisition	10	5 to 13	The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is travelling further than 24 inches [60 cm] from the desired path.
OnLine (OL) Sensitivity	10	4 to 13	The OL Sensitivity value affects the response of the machine while steering within 24 inches [60 cm] of the displayed guidance line.

System Setting	Average Setting	Acceptable Range	Function
Zero Yaw	0	-2 to 2	Indicates amount error in the internal yaw sensor while no yaw motion is present.
Message Frequency - GGA and VTG	10 Hz	N/A	Displays the frequency of GGA messages from the GPS receiver.
Message Frequency - ZDA	.3 Hz	N/A	Displays the frequency of GGA messages from the GPS receiver.
HDOP	2.5	N/A	Indicates the quality of the GPS signal.



CHAPTER 4

Envizio Pro and Cruizer Series Consoles Calibration and Operation

Introduction

Software Compatibility

The instructions in this manual apply to Envizio Pro consoles with software version 3.4 or higher and Cruizer II consoles with software version 3.0.1 or higher. The SmarTrax node must be running software version 6.0 or higher. If the field computer or node is running with an older version of software, refer to the Installation & Operation Manual included with the field computer for instructions software versions.










SmarTrax Status Display

FIGURE 1. Main Menu



Note: The images contained in this chapter are taken from the Envizio Pro display. If a Cruizer is being used, the images may vary slightly from the those referenced in this chapter.

The current status of the SmarTrax system can be determined by the icons displayed on the field computer screen.

Display	Message
	The SmarTrax node is detected, but no guidance line has been set or there is an error in the system.
	The SmarTrax node is detected and turned on, but the current speed is outside of the acceptable operating range.
	SmarTrax is detected and turned on, with no errors detected.
	SmarTrax is detected and turned on, but is not enabled. Tap the foot switch or touch the steering wheel icon to enable the SmarTrax system.
	SmarTrax is detected and in engaged, with no errors detected.
	Previous - Returns the Envizio Pro or Cruiser display to the previous screen in the setup process.
	Next - Saves the changes made to the SmarTrax system and proceeds to the next step in the setup process.
	Accept - Saves the changes made to the SmarTrax system at the end of the setup process and returns the to the Tools Menu.
	Exit - Exits from the current screen without saving any changes made to the system.

Initial Startup

Cruizer or Cruizer II not Connected to SmarTrax via CAN Communication (If Applicable)

1. Remove the thumb screws from the GPS INPUT TO CRUIZER end of the SmarTrax interface cable (P/N 115-0171-794).
2. Install the nuts in the supplied alternative hardware envelope into the holes.

3. Connect the DISPLAY connector of the SmarTrax node harness to Port A (located below the antenna plug) of the Cruiser.
4. Connect the single plug end of the SmarTrax interface cable to Port B (located below the part number tag) of the Cruiser.
5. Connect the GPS IN connector of the interface cable to the DGPS OUT connector of the node harness.
6. Connect the DGPS connector of the node harness into the GPS OUT connector of the interface cable.
7. Select the **Tools Menu** icon on the main menu.
8. Select the **Show All** icon in the upper-right corner of the screen.
9. Change Port A and Port B baud rates to 115,200.

Note: Press the down arrow until 115,200 is highlighted in blue.

10. Ensure all message sliders are turned off.
11. Select the green **Home** button in the lower-right corner of the screen.
12. Shut down and restart the Cruiser.
13. Select the **Tools Menu** icon on the main menu.
14. Select the **Show All** icon.

Note: The light blue Steering icon should appear in the System row of the menu.

15. Inspect the SmarTrax node to ensure the data transfer is taking place.

Important: Allow the data transfer to complete before entering the steering menu. Failure to allow the data transfer to complete may require a restart of the entire Smartrax system. If the Rx and Tx lights on the SmarTrax node are flashing rapidly, the data transfer is in progress. **The Rx and Tx lights will flash slowly or turn off when the data transfer is complete.**

16. Proceed to "SmarTrax Terms of Use" section on page 40.

Cruizer II Connecting to SmarTrax via CAN Communication (If Applicable)

1. Select the **Tools Menu** icon on the main menu.
2. Select the **Show All** icon in the upper-right corner of the screen.
3. Change the Port B baud rate to 115,200.

Note: Press the down arrow until 152,000 is highlighted in blue.

4. Ensure all message sliders are turned off.
5. Select the green **Home** button in the lower-right corner of the screen.
6. Shut down and restart the Cruiser.
7. Select the **Tools Menu** icon on the main menu.
8. Select the **Show All** icon.

Note: The light blue Steering icon should appear in the System row of the menu.

9. Inspect the SmarTrax node to ensure the data transfer is taking place.

Important: Allow the data transfer to complete before entering the steering menu in the. Failure to allow the data transfer to complete may require a restart of the entire Smartrax system. If the Rx and Tx lights on the SmarTrax node are flashing rapidly, the data transfer is in progress. **The Rx and Tx lights will flash slowly or turn off when the data transfer is complete. This process can take up to 20 minutes.**

10. Proceed to SmarTrax Terms of Use section on page 40.



Envizio Pro (If Applicable)

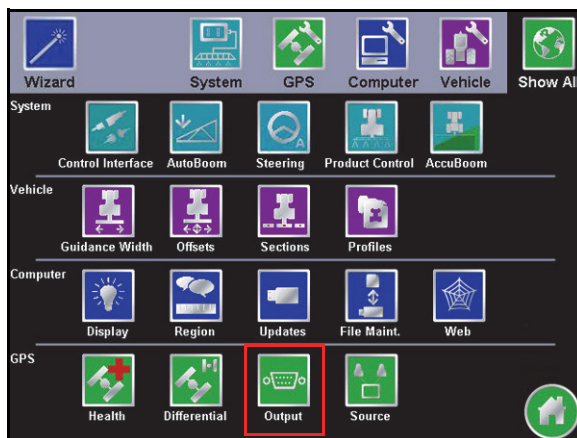
Note: During the initial startup of the SmarTrax system, language data must be transferred from the SmarTrax node to the Envizio Pro. Allow the data transfer several minutes to occur before calibrating the SmarTrax system. If the Rx and Tx lights on the SmarTrax node are flashing rapidly, the data transfer is in progress. **The Rx and Tx lights will flash slowly or turn off when the data transfer is complete.**

FIGURE 2. Tools Menu



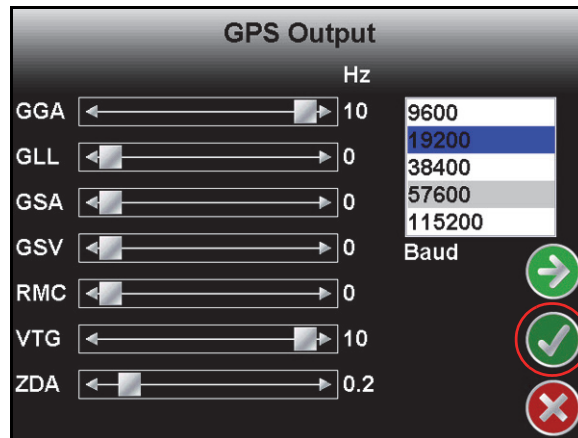
1. Select the **Tools Menu** icon on the Envizio Pro Home screen.

FIGURE 3. Output Icon



2. Select the **Output** icon.

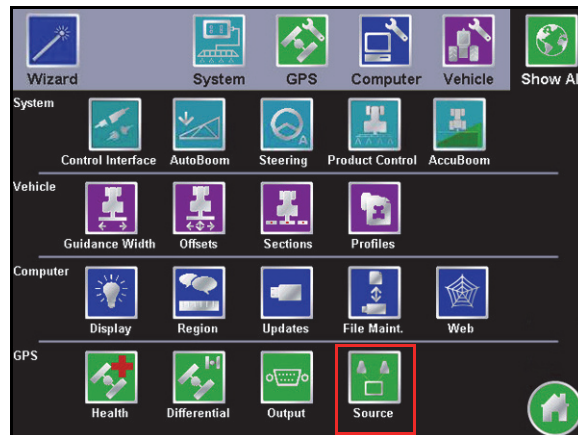
FIGURE 4. GPS Configuration Screen



3. Adjust the GPS settings to match the settings shown in Figure 4 above.
4. Select **Accept**.

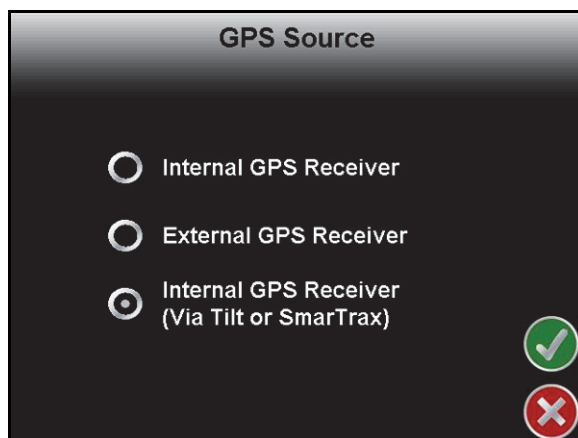
Note: The following steps apply only if the Envizio Pro contains internal GPS. If it doesn't, the Source icon will not appear in the Tools menu. Proceed to SmarTrax Terms of Use section on page 40.

FIGURE 5. Source Icon



5. Select the **Source** icon.

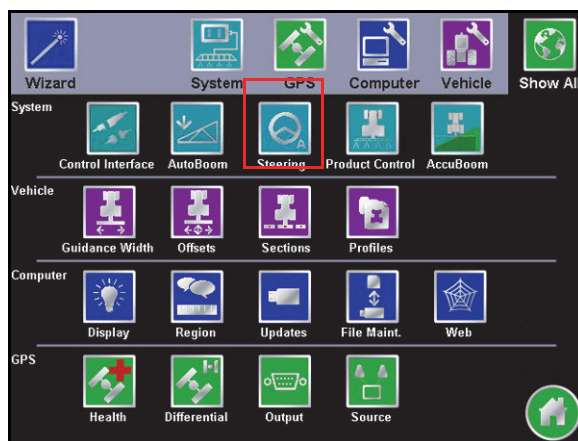
FIGURE 6. GPS Source Selection Screen



6. Select **Internal GPS Receiver (Via Tilt or SmarTrax)**.
7. Select **Accept**.
8. Proceed to the *SmarTrax Terms of Use* section below.

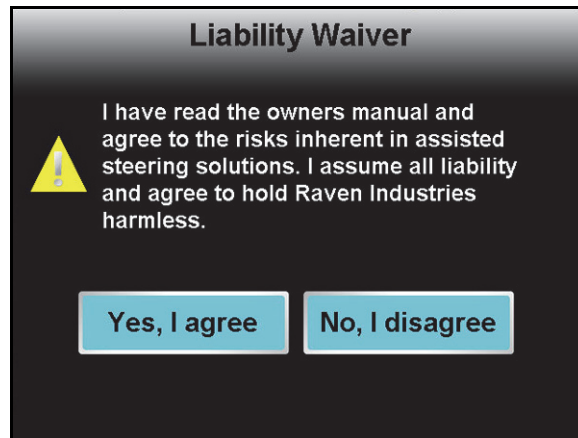
SmarTrax Terms of Use

FIGURE 7. Steering Icon



9. Select the **Steering** icon.

FIGURE 8. Terms of Use



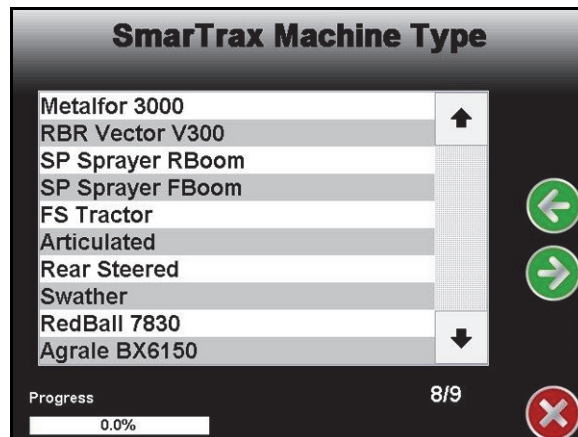
10. Review the Liability Waiver and select **Yes, I agree**.

Note: The operator must agree to the terms of use before the SmarTrax system may be enabled or calibrated. The Liability Waiver screen will appear each time the field computer is turned on or rebooted.

Machine Configuration

Before the SmarTrax system may be enabled, the field computer and SmarTrax system must be calibrated for the specific vehicle being used. Complete the following steps to configure the machine specifications in the field computer and the SmarTrax system.

FIGURE 9. Machine Type Screen



11. Select the specific machine type from the **Machine Type** list. If the specific machine is not listed, choose the profile that best fits the machine:

Note: Cruiser only - If the Machine Type list is not populated fully or at all, press the **Previous** (left) arrow to reload the screen.

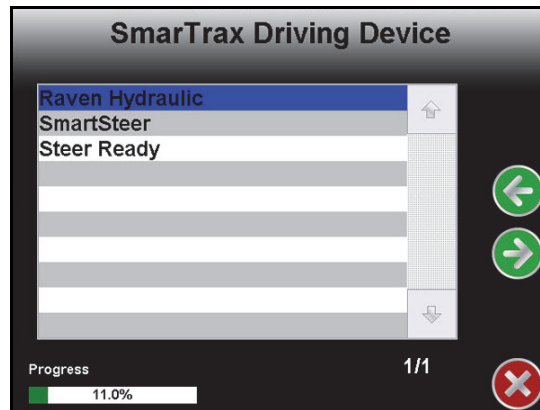
- FS Tractor - Front-steered tractor
- SP Sprayer RBoom - Self-propelled sprayer with a rear boom
- Articulated

- SP Sprayer FBoom - Self-propelled sprayer with a front boom
- Rear Steered - Rear-steered machine

Note: *The Machine Test option should only be selected if calibration problems are encountered. Contact your local Raven dealer for assistance with using the Machine Test option.*

12. Select **Next**.

FIGURE 10. Driving Device Selection Screen



Note: *The Driving Device selection screen will be displayed only when a SmarTrax or SmarTrax 3D node is detected in the system.*

13. SmarTrax Node Control Systems Only - Select the steering control device:

- Raven Hydraulic - SmarTrax hydraulic valve is controlling the vehicle steering.
- Steer Ready - An optional steering control system was installed at the factory - available on select machines only.

14. Select **Next**.

Calibrate the SmarTrax System

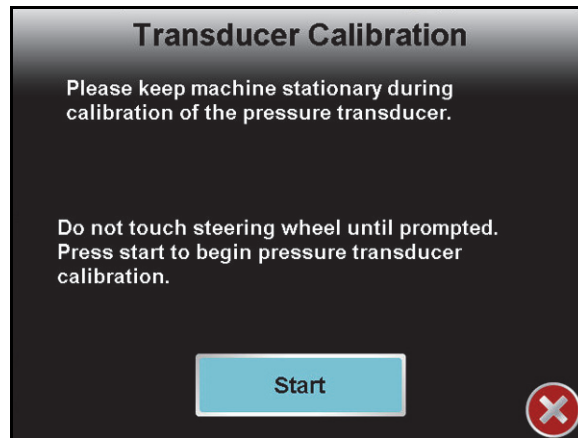
Important: *If the system contains a roading switch, the switch must be turned on before calibrating the steering system.*

System Disengage Calibration - SmarTrax Only

SmarTrax Systems with a Pressure Transducer Installed

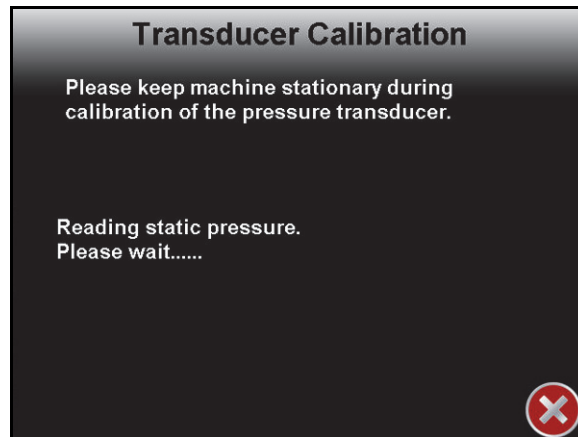
Important: *This section applies only to SmarTrax systems utilizing a pressure transducer to disengage the SmarTrax system when the steering wheel is turned. If a flow or pressure switch is installed in the SmarTrax system, refer to the SmarTrax Systems with a Flow Switch or Pressure Switch Installed section on page 44 to calibrate the SmarTrax system.*

FIGURE 11. Transducer Calibration Screen



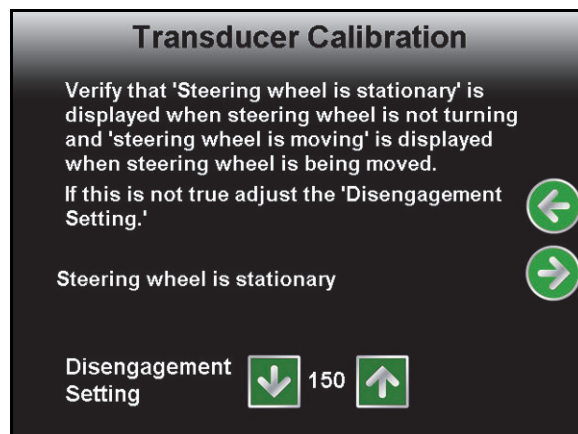
15. Press **Start**. The following screen will appear:

FIGURE 12. Transducer Calibrating Screen



16. When prompted, turn the steering wheel to allow the SmarTrax system to detect the hydraulic pressure increase. Once the system has detected the static and differential pressures, the following screen will be displayed:

FIGURE 13. Transducer Calibration Verification



17. Verify the field computer displays the correct steering operation message as indicated in Figure 8 above.

Note: It may be necessary to increase the disengage setting to require more steering input to disengage SmarTrax and to decrease the disengage setting to require less steering input.

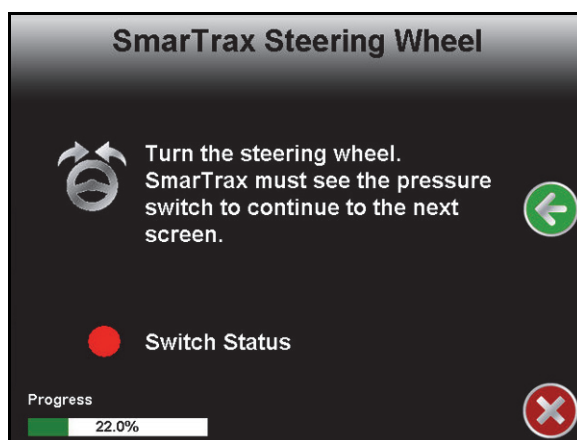
18. If the system setting is correct, select **Next**.

19. Proceed to the *Engage Switch Calibration and Node Orientation* section on page 45 continue with the SmarTrax system calibration.

SmarTrax Systems with a Flow Switch or Pressure Switch Installed

Important: This section applies only to SmarTrax systems utilizing a flow switch or pressure switch to disengage the SmarTrax system when the steering wheel is turned. If a pressure transducer is installed in the SmarTrax system, refer to the *SmarTrax Systems with a Pressure Transducer Installed* section on page 42 to calibrate the SmarTrax system.

FIGURE 14. Steering Pressure Switch Calibration Screen



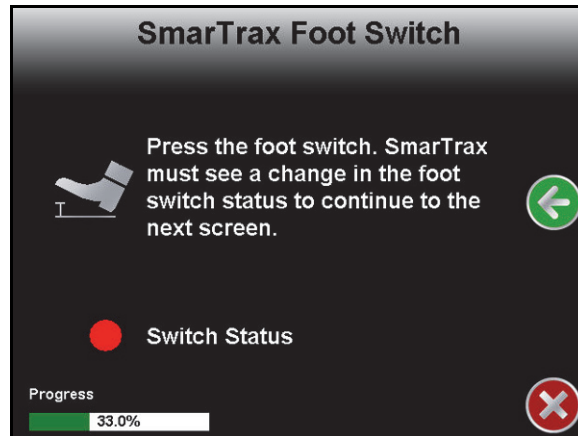
1. Review the on-screen instructions and turn the steering wheel to verify proper operation.

Note: The SmarTrax Setup Wizard will automatically advance to the next step in the calibration process when the steering wheel is turned. If it does not, refer to Chapter 5, *Troubleshooting* for troubleshooting information. If the problem persists, contact your local Raven dealer for further information.

2. Proceed to the *Engage Switch Calibration and Node Orientation* section on page 45 to continue with the SmarTrax system calibration.

Engage Switch Calibration and Node Orientation

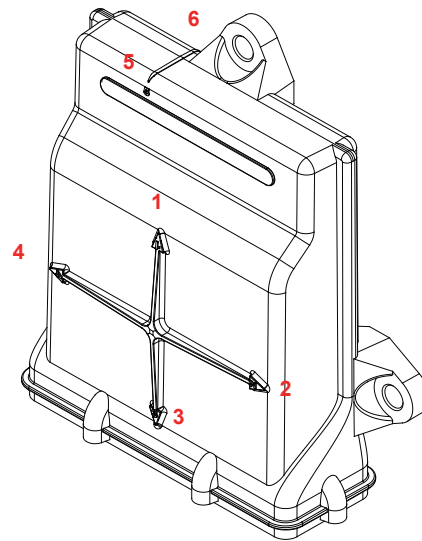
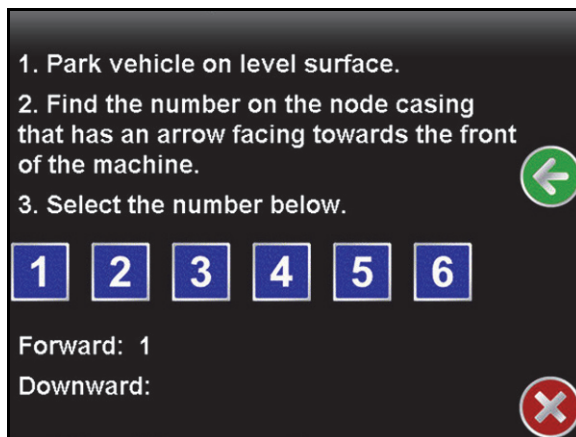
FIGURE 15. Engage Switch Calibration Screen



1. Review the on-screen instructions.
2. Press and release the foot switch or engage switch.

Note: The SmarTrax Setup Wizard will automatically advance to the next step in the calibration process when the engage switch is detected.

FIGURE 16. Node Orientation Screen



3. Park the machine on a level surface.
4. Select the number that corresponds with the node arrow number pointing forward on the machine.
5. Allow the SmarTrax node to calibrate the internal sensors.

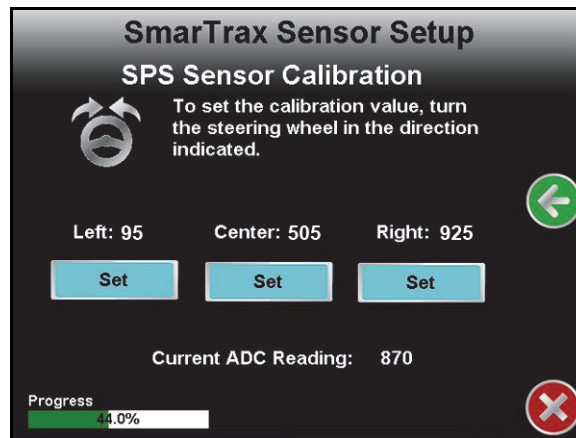
Note: The SmarTrax Setup Wizard will automatically advance to the next step in the calibration process once the node calibration is complete.

Steering Position Sensor (SPS) Wheel Angle Sensor (WAS) Calibration - SmarTrax Only (If Applicable)

Important: The range of the SPS/WAS values is limited to 10 - 1010 to prevent damage to certain types of sensors. Ensure the sensor is mounted to prevent damage during operation. The difference between the Left and Center values and Center and Right values must exceed 100.

The SPS/WAS calibration is required only if a SPS/WAS is installed in the SmarTrax system. If installed, the following screen will be displayed:

FIGURE 17. Sensor Setup Calibration Screen




1. While driving slowly, turn the steering wheel fully to the left wheel lock.
2. Select **Set** displayed below the left wheel value.
3. Continue driving slowly and straighten the wheel until the machine is driving straight forward.
4. Select **Set** displayed below the center wheel value.
5. Turn the steering wheel fully to the right wheel lock.
6. Select **Set** displayed below the right wheel value.
7. Select **Next**.

Configuring Wheel Base and Antenna Offsets

If a generic machine profile was selected during the machine configuration process, the Wheel Base, Antenna Position, and Antenna Height values must be entered into the SmarTrax system.

Important: If a specific machine profile was selected during the machine configuration process, the Wheel Base, Antenna Position, and Antenna Height measurements will be automatically populated in the screen. However, the antenna mounting position may vary on the machine, so it is important to re-measure the Antenna Position and Antenna Height to verify that the setting in the field computer is correct. The Wheel Base value cannot be changed.



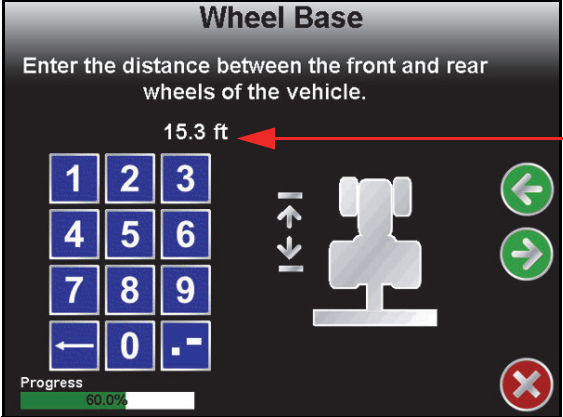
NOTICE

The Wheel Base, Antenna Position, and Antenna Height values are critical to the operation of the SmarTrax system. Measure these dimensions accurately to ensure optimal SmarTrax system performance!

1. To figure the machine's wheel base, measure the distance from the center of the machine's front axle to the center of the rear axle.

Note: For articulated machines, measure from the center of the front tire to the center of the rear tire on both sides of the machine. Add the values together and divide the number by two to find the average.

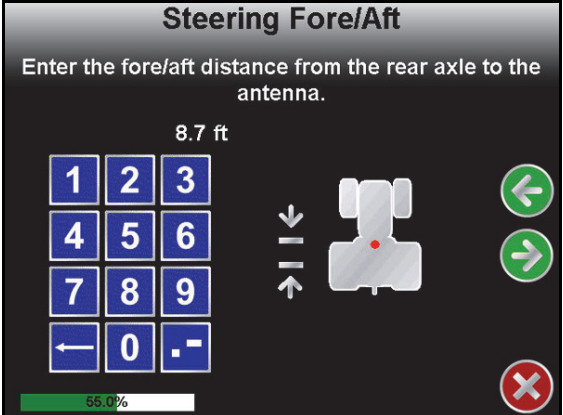
FIGURE 18. Wheel Base Configuration Screen



The screen displays the title "Wheel Base" and the instruction "Enter the distance between the front and rear wheels of the vehicle." The current input is "15.3 ft". A red arrow points from the text "Units of Measure" to the "ft" unit. Below the input is a numeric keypad with buttons for digits 1-9, 0, a decimal point, and a left arrow. To the right of the keypad is a diagram of a vehicle chassis with a vertical double-headed arrow indicating wheel base measurement. Further right are two green circular buttons with left and right arrows, and a red circular button with a white 'X' at the bottom right. A progress bar at the bottom left shows "60.0%".

2. Enter the Wheel Base measurement using the on-screen keypad.
3. Select **Next**.
4. To figure the GPS Antenna Position, measure the distance from the antenna to the center of the rear axle.

FIGURE 19. Antenna Position Configuration Screen



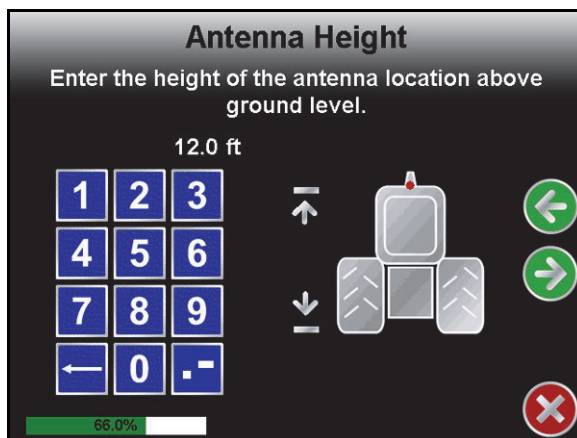
The screen displays the title "Steering Fore/Aft" and the instruction "Enter the fore/aft distance from the rear axle to the antenna." The current input is "8.7 ft". Below the input is a numeric keypad with buttons for digits 1-9, 0, a decimal point, and a left arrow. To the right of the keypad is a diagram of a vehicle chassis with a vertical double-headed arrow indicating antenna position measurement. Further right are two green circular buttons with left and right arrows, and a red circular button with a white 'X' at the bottom right. A progress bar at the bottom left shows "55.0%".

5. Enter the Antenna Position measurement.

Important: If the antenna is in front of the rear axle, the number entered must be positive. If the antenna is behind the rear axle, the number must be entered as negative using a “-” before the number. For example, if the antenna is located 3 feet behind the rear axle, the value would be entered as -3.

6. Select **Next**.
7. To figure the Antenna Height, measure the distance from the ground to the antenna base mounting plate.

FIGURE 20. Antenna Height Configuration Screen

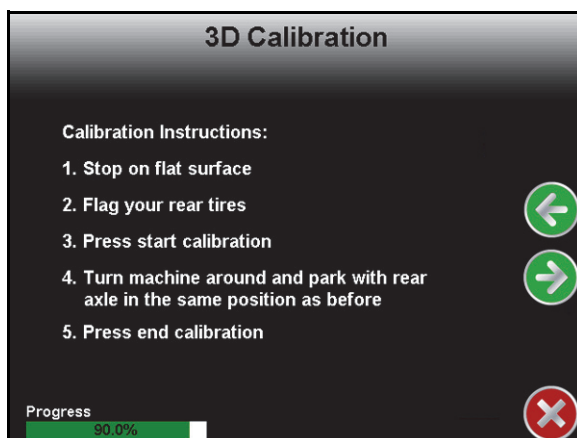


8. Enter the Antenna Height measurement.
9. Select **Next**.

Enhanced Tilt Calibration - Cruiser II and Envizio Pro Only

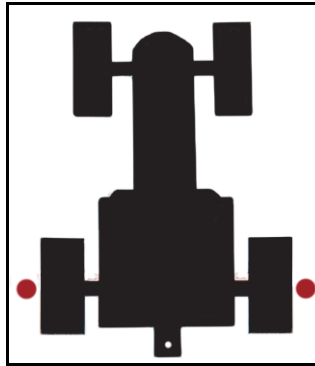
For RTK steering systems, it is recommended that an enhanced tilt calibration be performed to accurately zero out the tilt sensor.

FIGURE 21. Enhanced Tilt Calibration Wizard



1. Park the machine on a flat surface.

FIGURE 22. Machine's Rear Axle Marked Before Enhanced Tilt Calibration



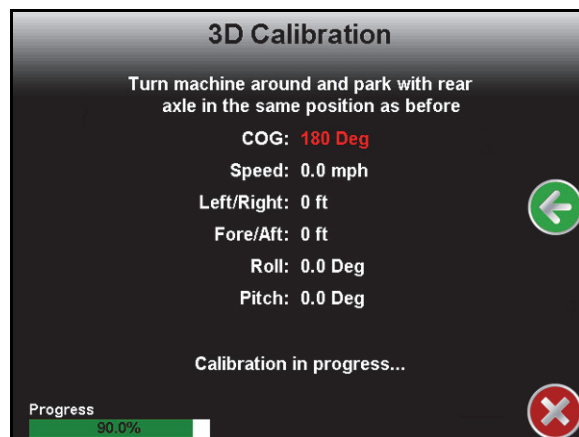
2. Place flags or markers on the outside of each rear wheel aligned with the axle.
3. Select **Next**.

FIGURE 23. Tilt Calibration Screen



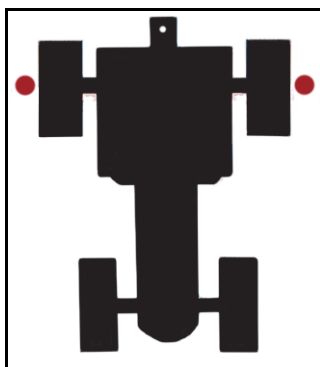
4. Select **Start Calibration**. The following screen will appear:

FIGURE 24. Calibration in Progress Screen



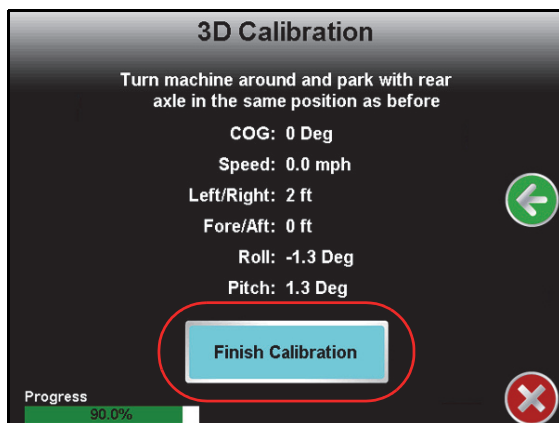
Note: The calibration may take a few minutes to complete.

FIGURE 25. Machine Orientation After Tilt Calibration



5. Turn the machine around 180° and park with the machine facing the opposite direction and the rear axle in between the markers.

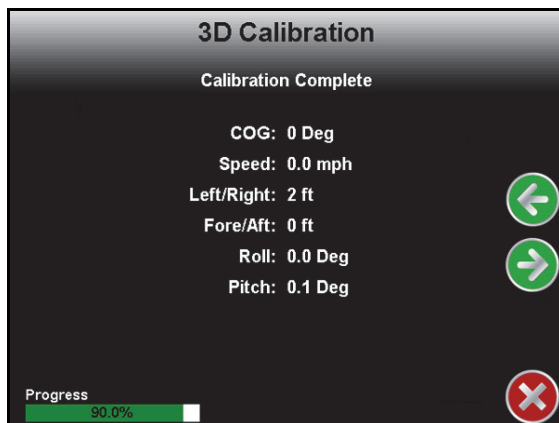
FIGURE 26. Finish Calibration



6. After the calibration is complete and the values on the screen have turned white, select **Finish Calibration**.

Note: In order for the values to turn white, the COG value must be less than 10°, the Left/Right must be less than 3 ft, and the Fore/Aft must be less than 3 ft.

FIGURE 27. Calibration Complete



7. Select **Next**.

Calibrate the Machine's Steering System

After the initial calibration of the SmarTrax system is complete, it is necessary to calibrate the machine's steering system. This allows the field computer to learn the hydraulic capabilities of the machine to allow SmarTrax to properly steer it in the field.

Before beginning the machine's steering system calibration, ensure:

- The implement sections are folded in and the booms are racked.
- The machine's engine is running at the normal operating RPM.
- The machine's measurements are correctly entered into the field computer.



WARNING

The machine's wheels will turn automatically. Be sure the area around the vehicle is clear of people and equipment before engaging the steering system.



NOTICE

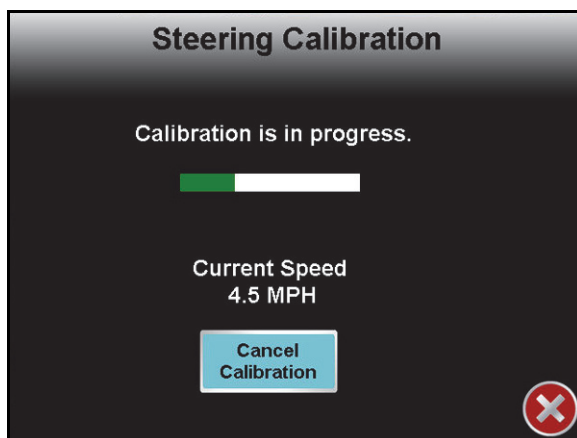
The calibration of the machine's steering system should be performed in a field or other large, open space and during conditions similar to normal vehicle operation.

If the ground or surface is slippery, muddy, or freshly tilled, the SmarTrax system may learn incorrect steering responses for normal operating conditions.

Ensure the machine's hydraulics are operating properly and there are no other mechanical issues that may affect the performance of the SmarTrax system.

Note: *To ensure the calibration is successful, the number of starts and stops during the calibration process should be limited. If it is necessary to pause the calibration process, turn the steering wheel or tap the foot/enable switch. Tap the foot/enable switch again to resume calibration.*

FIGURE 28. Steering Calibration Screen



1. Position the machine in an open space with several acres of smooth ground available to perform the machine's steering calibration.
2. Press the foot/engage switch to begin calibration.

Note: *During calibration, the machine will turn hard to the left or right and progressively turn in the opposite direction, then turn hard in that direction and progressively turn back in the opposite direction. Adjust the speed and vehicle location as necessary.*

Note: *After calibration is complete, the SmarTrax menu will be displayed.*

Complete the SmarTrax Calibration Process

	NOTICE
	<p>The calibration of the machine's steering system should be performed in a field or other large, open space and during conditions similar to normal vehicle operation.</p>
	<p>If the ground or surface is slippery, muddy, or freshly tilled, the SmarTrax system may learn incorrect steering responses for normal operating conditions.</p>
<p>Ensure the machine's hydraulics are operating properly and there are no other mechanical issues that may affect the performance of the SmarTrax system.</p>	

Note: The SmarTrax system will take a few minutes to fine-tune the machine's steering response the first time the SmarTrax system is enabled in field conditions.

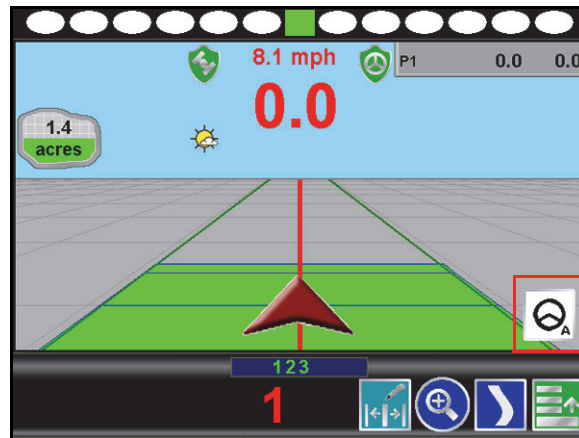
Note: The Line Acquire Aggressiveness and On-Line Sensitivity values may be adjusted to further tune the system or to adjust for operating conditions. Refer to the System Adjustments section below for further information on system adjustments.

1. Start a job and set a straight A-B guidance line.

Note: Refer to the Envizio Pro Installation and Operation Manual (P/N 016-0171-148) or the appropriate Cruiser manual for information on starting a job.

2. With the engine running at the operating RPM, drive forward at a speed of 5-7 mph [8-11 km/h].

FIGURE 29. SmarTrax Enable Icon



3. Enable SmarTrax by pressing the steering wheel icon on the display or by tapping the foot/enable switch.

Note: When SmarTrax is enabled, the steering wheel icon will turn green.

4. Increase speed every few minutes until the normal operating speed is reached.

Note: When SmarTrax is enabled, the steering wheel icon will turn green.

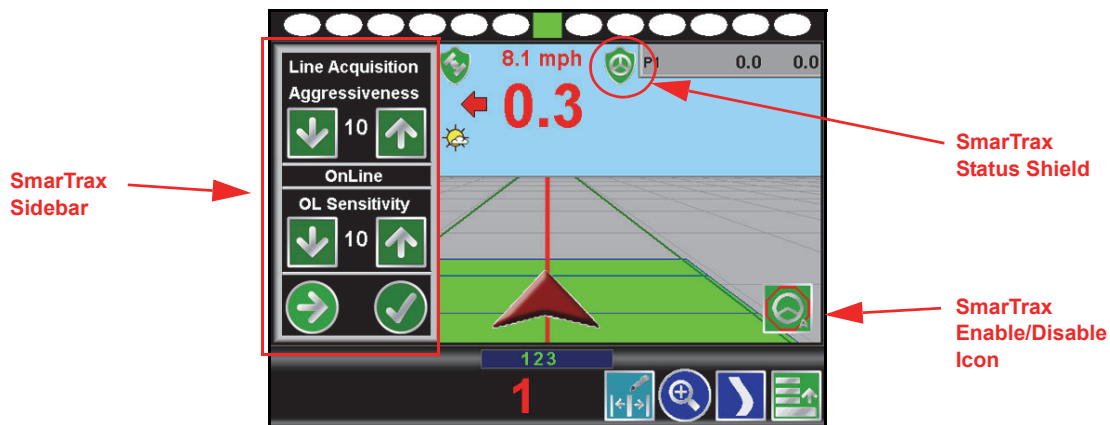
5. Allow SmarTrax to run for ten minutes while driving back and forth along the A-B guidance line.

Note: If the machine is not operating to specifications after ten minutes, manual adjustment of the SmarTrax system may be necessary. Refer to the System Adjustments section below information on adjusting the SmarTrax system.

System Adjustments

System tools allow fine-tuning of the system to adjust for operating conditions and improve steering accuracy. To adjust the steering response in the field computer, touch the SmarTrax icon on the main menu. The following screen will appear:

FIGURE 30. SmarTrax Adjustments Screen



Line Acquisition (LA) Mode and Aggressiveness

Note: The speed of the LA mode is often limited by the speed of the machine's hydraulic and steering system. Increasing the LA value at the maximum vehicle speed may degrade performance of the SmarTrax system.

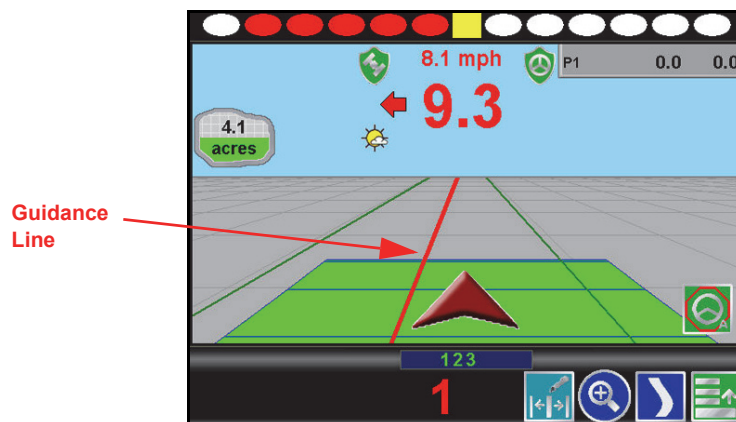
FIGURE 31. LA Adjustment Panel



The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is travelling further than 24 inches [60 cm] from the desired path. If the machine does not approach the guidance line as quickly as desired, increase the LA Aggressiveness value one increment at a time, allowing SmarTrax at least 30 seconds between adjustments to adjust to the change in the value.

Setting the LA Aggressiveness value too high may cause the machine to steer into the guidance line too quickly and weave around the guidance line. Lowering the value in these situations will allow the machine to steer back to the line.

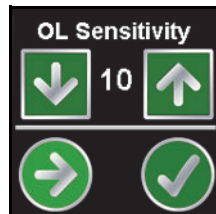
FIGURE 32. LA Mode



Note: The screen in Figure 27 illustrates an example of a situation in which SmarTrax is operating in LA mode. This mode will remain active until the machine steers within 24 inches [60 cm] of the displayed guidance line.

On-Line (OL) Mode and Sensitivity

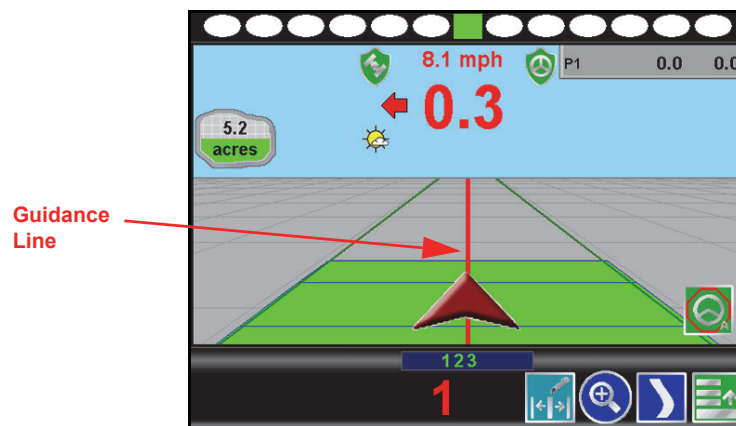
FIGURE 33. OL Mode Indicator



The OL Sensitivity value affects the response of the machine while steering within 24 inches [60 cm] of the displayed guidance line. If the machine tends to slowly weave across the guidance line and does not remain within 24 inches [60 cm] of the desired path, increase the OL Sensitivity value one increment at a time, allowing SmarTrax at least 30 seconds between adjustment to adjust to the change in the value.

Setting the OL Sensitivity value too high may cause the machine to over-correct or become jittery while on the line. Lowering the value in these situations will allow the vehicle to remain on the desired path.

FIGURE 34. OL Mode



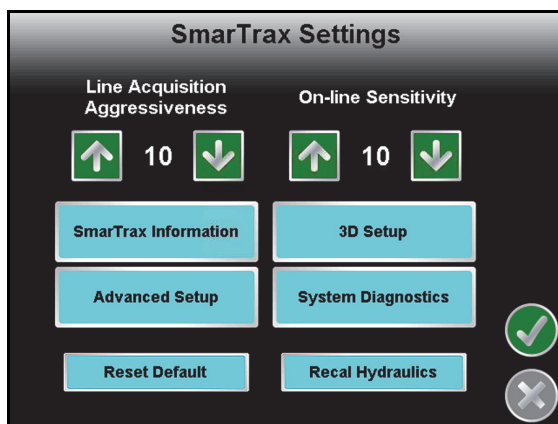
Note: The screen in Figure 29 illustrates an example of a situation in which SmarTrax is operating in OL mode. This mode will remain active as long as the machine steers within 24 inches [60 cm] of the displayed guidance line.

Advanced Setup and Diagnostics

This section provides detailed information on the various settings and options available in the SmarTrax screens. The SmarTrax Settings screen may be accessed in two ways:

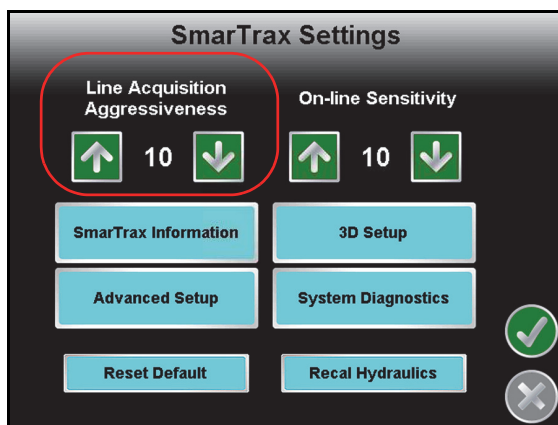
- From the Home screen, select the Tools Menu icon, then the Steering icon.
- In an active job, select **Next** in the SmarTrax sidebar.

FIGURE 35. SmarTrax Settings Screen



Line Acquisition Aggressiveness

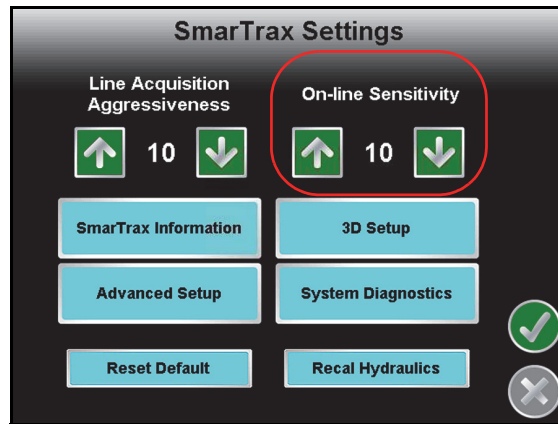
FIGURE 36. SmarTrax Settings Screen



The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is travelling further than 24 inches [60 cm] from the desired path. Refer to the *Line Acquisition (LA) Mode and Aggressiveness* section on page 54 for more information.

On-line Sensitivity

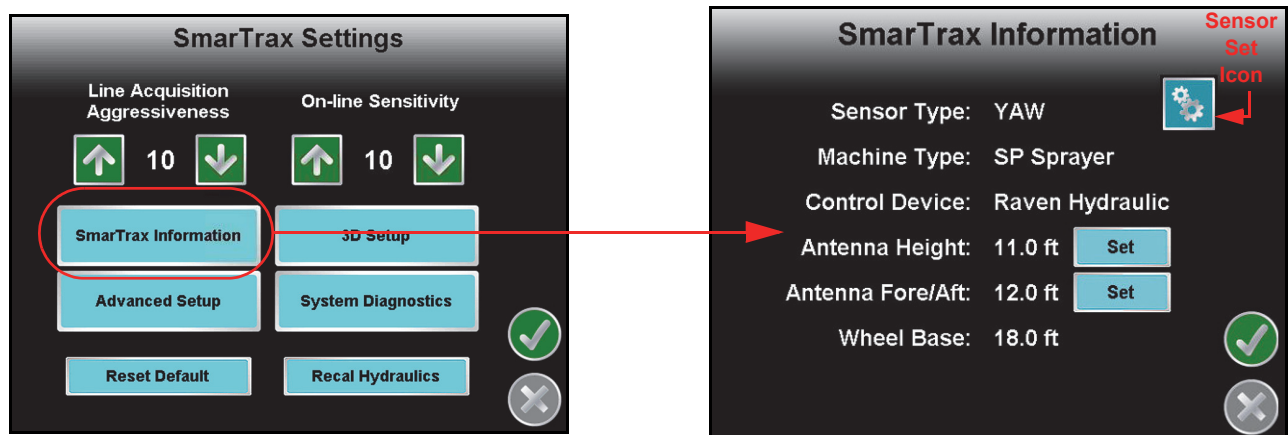
FIGURE 37. SmarTrax Settings Screen



The OL Sensitivity value affects the response of the machine while steering within 24 inches [60 cm] of the displayed guidance line. Refer to the *On-Line (OL) Mode and Sensitivity* section on page 55 for more information.

SmarTrax Information Screen

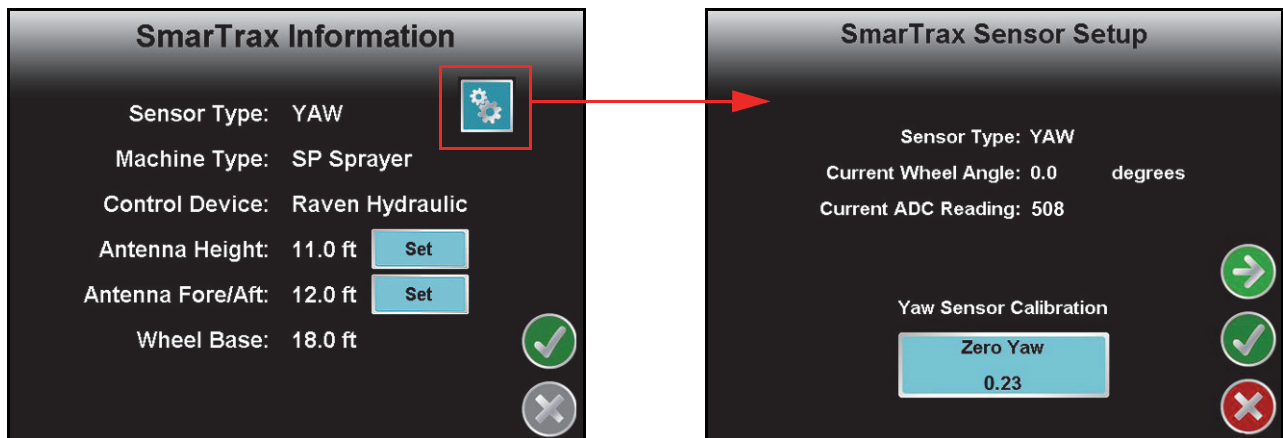
FIGURE 38. SmarTrax Settings and SmarTrax Information Screens



Note: To change the Sensor Type, Machine Type, Control Device, or Wheel Base settings, the SmarTrax system must be reset and recalibrated.

- **Antenna Height** - Selecting the Set icon next to the Antenna Height setting allows the Antenna Height measurement to be changed.
- **Antenna Fore/Aft** - Selecting the Set icon next to the Antenna Fore/Aft setting allows the Antenna Fore/Aft position measurement to be changed.
- **Sensor Type** - Selecting the sensor set icon next to the sensor type setting displays the Sensor Status screen.

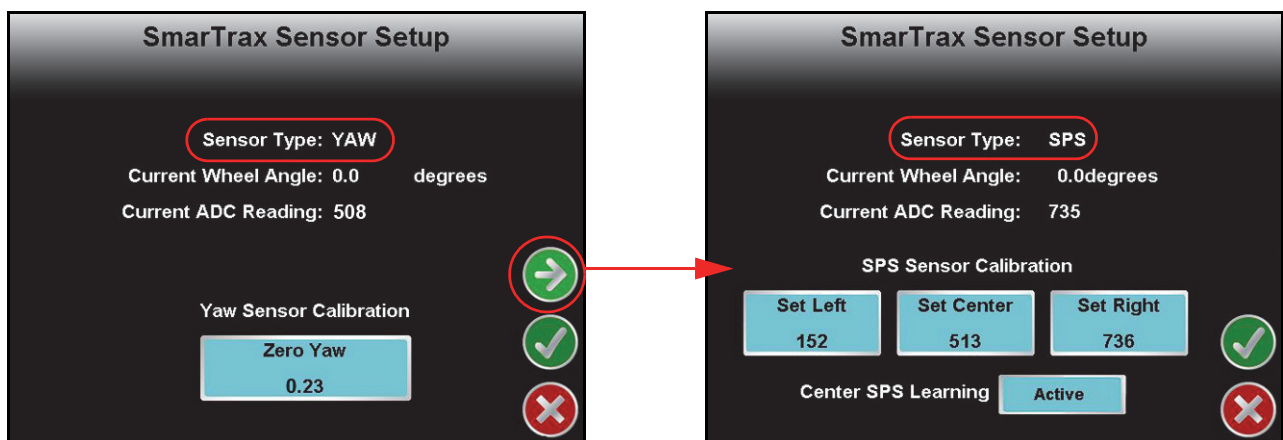
FIGURE 39. SmarTrax Information and Yaw Sensor Setup Screen



- The **Yaw Sensor Setup** screen displays the yaw sensor status information:
 - **Current Wheel Angle** - An approximation of the steering inputs detected by the yaw sensor.
 - **Current ADC Reading** - The total yaw detected by the sensor.
 - **Zero Yaw Button** - Recalibrates the yaw sensor to zero. The machine must be at a full stop before recalibrating the yaw sensor.

Note: Select **Accept** to save changes to the YAW Sensor Setup screen and return to the SmarTrax Information screen. Select **Exit** to exit the YAW Sensor Setup screen without saving any changes and return to the SmarTrax Information screen.

FIGURE 40. Sensor Status Screens



- If the SmarTrax system contains a SPS/WAS, the SPS Sensor Setup screen displays the SPS/WAS sensor status information.
 - **Current Wheel Angle** - The current wheel angle detected by the SPS/WAS.
 - **Current ADC Reading** - Current value registered by the sensor.
 - **Left, Center, and Right** - Displays sensor readings. If the sensor is damaged or replaced, these values should be recalibrated before operating the SmarTrax system.
 - **Center SPS Learning** (SmarTrax Systems Only) - When set to Active, the SmarTrax system automatically adjusts the SPS/WAS center position during operation. Bypassing this feature leaves the SPS/WAS position at its current value.

Note: *SmarTrax nodes 016-0173-031 and 016-0173-042 only - The SmarTrax node must be hardware version C or higher to utilize the SPS/WAS.*

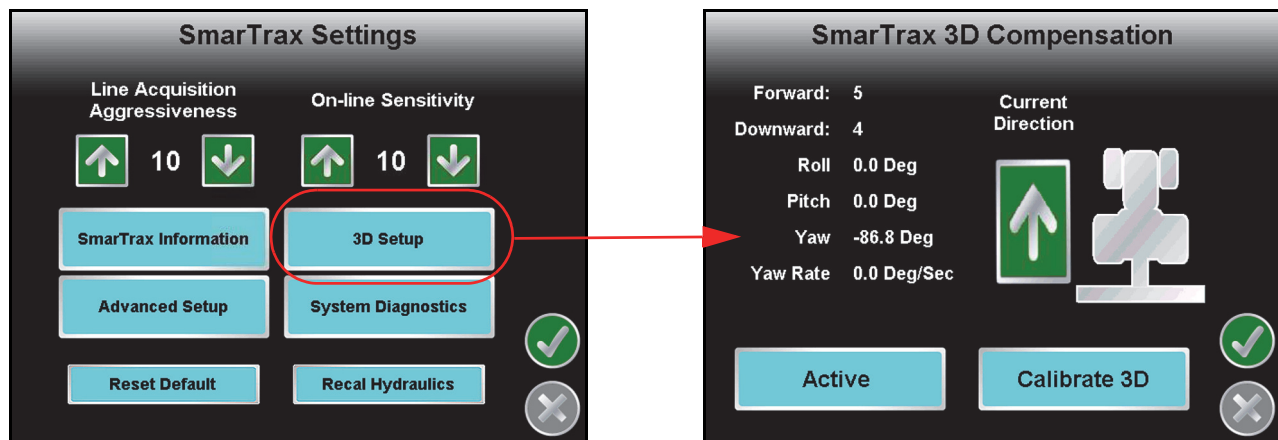
Note: *Refer to the Steering Position Sensor (SPS) Wheel Angle Sensor (WAS) Calibration - SmarTrax Only (If Applicable) section on page 46 for sensor calibration information.*

Note: *Select **Accept** twice to save changes to the SPS Sensor Setup screen and return to the SmarTrax Information screen. Select **Exit** twice to exit the SPS Sensor setup screen without saving any changes and return to the SmarTrax Information screen.*

3D Setup Screen

The SmarTrax 3D terrain compensation feature adjusts incoming GPS messages, compensating for roll (side-to-side tilting), pitch (front-to-rear tilting), and yaw (twisting or turning) of the machine.

FIGURE 41. SmarTrax Settings and 3D Terrain Compensation Screens



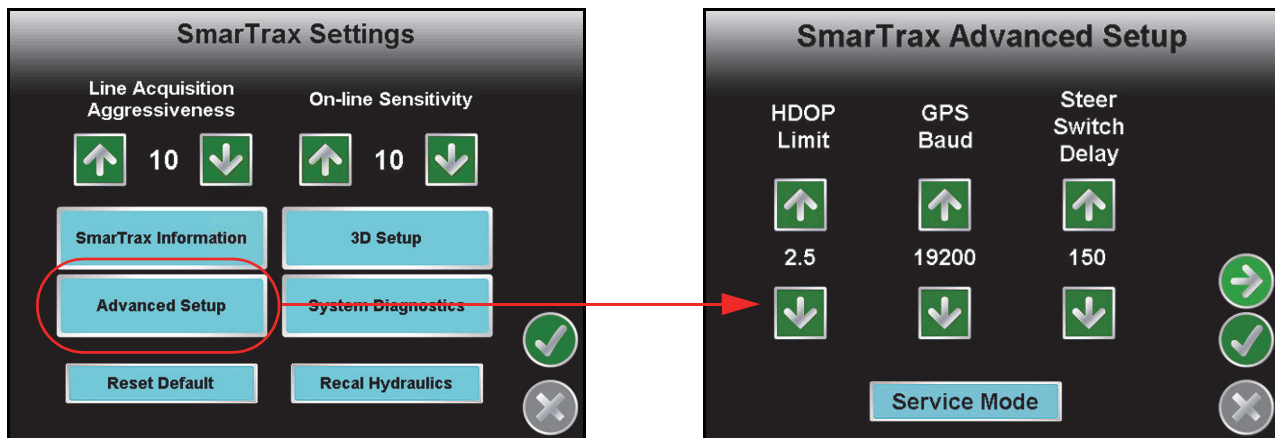
- **Forward and Downward** - Indicate the orientation of the SmarTrax node.
- **Roll, Pitch, Yaw, and Yaw Rate** - Real-time measurement data used by the 3D terrain compensation feature.
- **Current Direction** - Indicates the direction in which the machine is travelling. If the direction is incorrect, drive forward and press the **Current Direction** arrow icon to toggle the direction of the machine. Verify the direction of travel is displayed correctly when the machine is being driven in both forward and reverse.
- **Active/Bypassed** - Used to toggle the 3D terrain compensation feature on and off.
- **Calibrate TC** - Used to calibrate the 3D terrain compensation feature. Refer to the *Enhanced Tilt Calibration - Cruiser II and Envizio Pro Only* section on page 48 for the calibration procedure.

Note: *Select **Accept** to save changes to the 3D Terrain Compensation screen and return to the SmarTrax Information screen. Select **Exit** to exit the 3D Terrain Compensation setup screen without saving any changes and return to the SmarTrax Information screen.*

Advanced Setup Screen

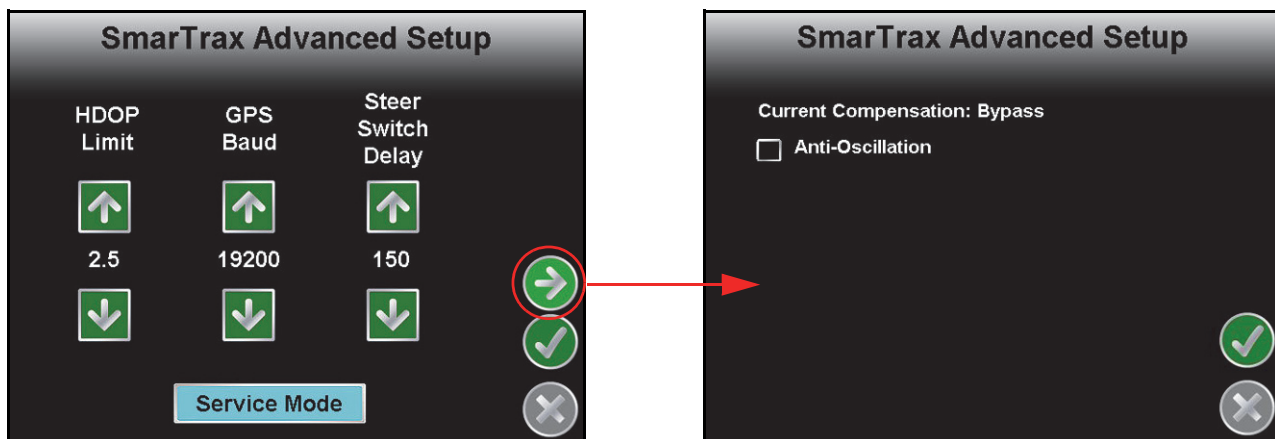
The Advanced Setup screen contains advanced diagnostic information used to fine-tune the SmarTrax system and improve steering accuracy.

FIGURE 42. SmarTrax Settings and Advanced Setup Screen #1



- **HDOP Limit** - Horizontal Dilution of Precision (HDOP) is an indicator of the quality of the GPS signal. A high HDOP indicates that not enough satellites are distributed evenly throughout the sky, diminishing the accuracy of the guidance system. The number displayed is the maximum number SmarTrax will allow to run. Raising this number may degrade system performance.
- **GPS Baud** - The rate the system uses to communicate with the GPS receiver. This value is typically set to 19200.
- **Steer Switch Delay** - Controls the amount of steering input required to disengage the SmarTrax system. Higher values require more input.
- **Service Mode** - Used only for software programming purposes and is not accessible without a code.
- **Exit** - Returns to the SmarTrax Controller screen.

FIGURE 43. Advanced Setup #1 and Advanced Setup #2 Screens

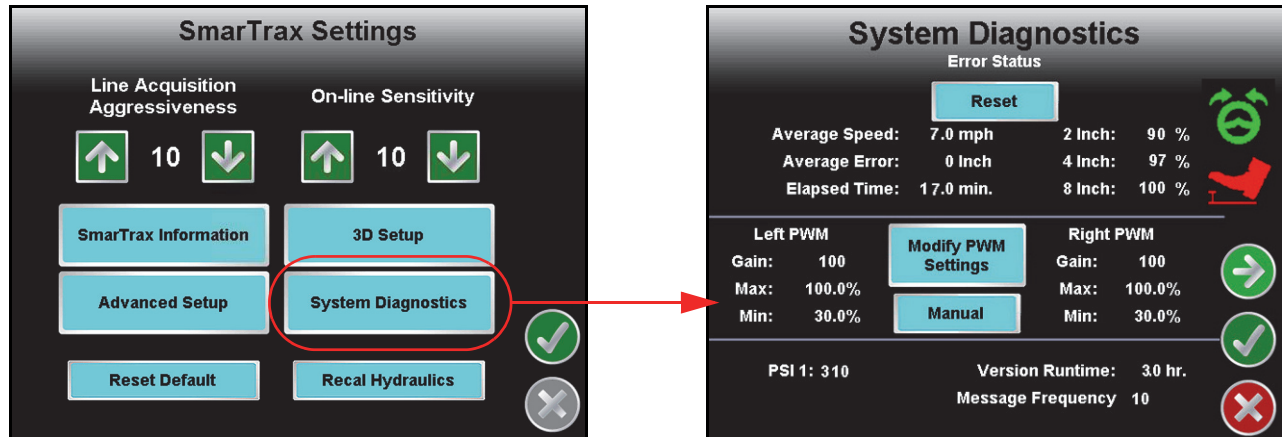


- **Current Compensation** - Used only with certain non-steering ready machines. This feature is automatically enabled or disabled during the calibration process and cannot be modified.
- **Anti-Oscillation** - This feature is only used with articulated machines and should not be enabled with any other type of machine. Anti-Oscillation automatically turns on when an articulated machine is selected during the machine configuration stage of the SmarTrax setup. Enabling this feature with any machine that is not articulated may degrade the system performance.

System Diagnostics Screen

The System Diagnostics screen contains the PWM values and system input diagnostic tools.

FIGURE 44. SmarTrax Settings and System Diagnostics Screen

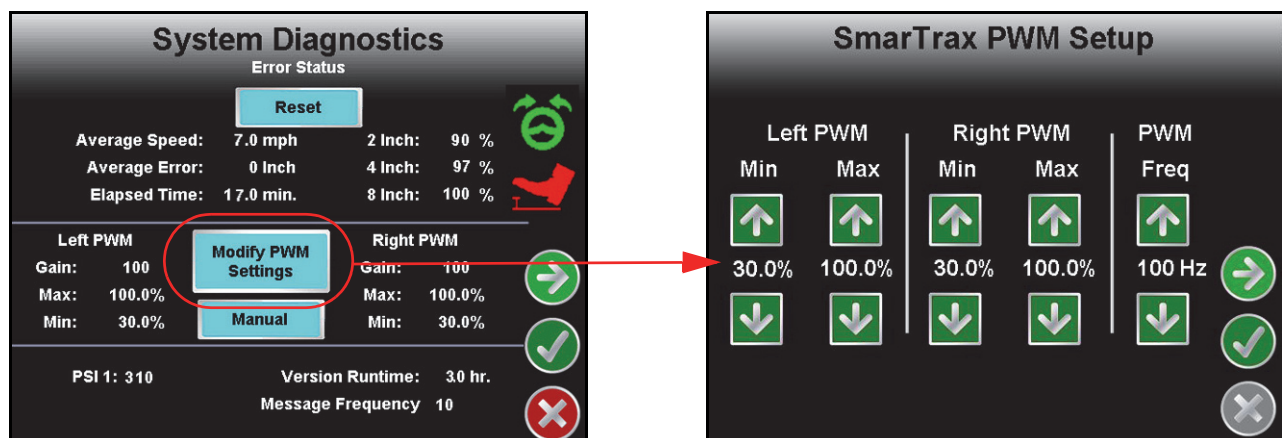


- **Average Speed** - Average vehicle speed over the last hour while SmarTrax has been running.
- **Average** - Average distance from the desired guidance path or line during the last hour while SmarTrax has been running.
- **2 Inch, 4 Inch, and 8 Inch** - The percentage of time the machine has been within the distance of the guide line during the last hour. Press **Reset** to set the fields to zero.

Note: The error percentages are always displayed in inches, regardless of the Display Unit selection. The equivalent metric values are 5 cm, 10 cm, and 20 cm. On RTK systems, the values are 1", 2", and 4".

- **Message Frequency** - Displays GGA input message rate.

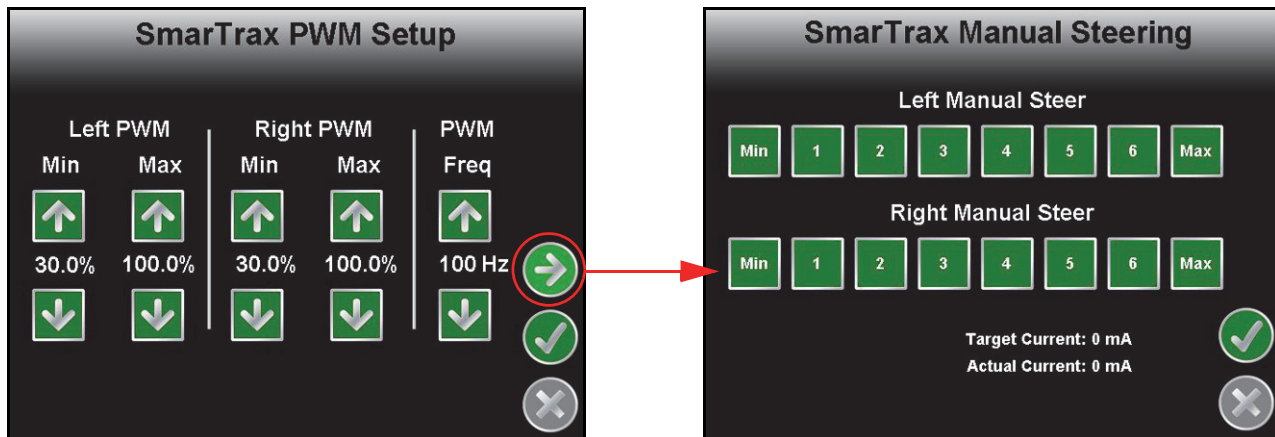
FIGURE 45. System Diagnostics and PWM Setup Screens



- **PWM Values** - Displays SmarTrax valve PWM minimum, maximum, and gain values. Adjustment of these values is not typically necessary. Raven Industries recommends leaving these values as configured by the SmarTrax system unless a technician instructs you to modify the settings. If the PWM values are adjusted, the SmarTrax system will no longer automatically adjust the PWM minimum values unless the Manual button is pressed, changing the system back to Auto.

- **Modify PWM Settings** - Displays the PWM Status screen to allow manual adjustments of the PWM values.
- **Auto or Manual** - Toggles between automatic and manual control of the PWM valves. If “Manual” is displayed in the icon, the system is in manual mode and is no longer learning the PWM minimum values. Pressing the button will switch SmarTrax to automatic mode. If “Auto” is displayed, the system is in automatic mode and is learning the PWM minimum values. Pressing the button will switch SmarTrax to manual mode.

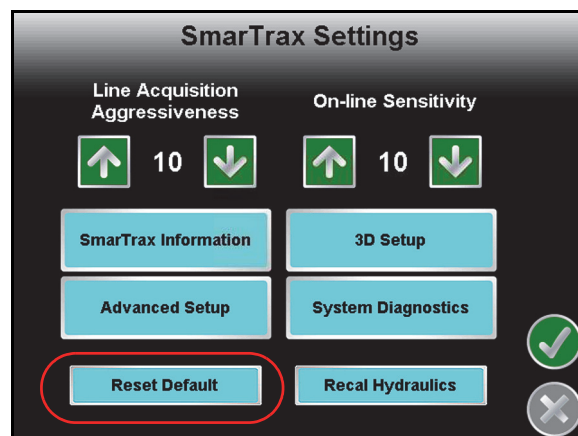
FIGURE 46. PWM Setup and Manual Steering Screens



- **Left and Right Manual Steer** - Used to manually test the SmarTrax system. Select one of the values or the Min or Max button to steer the machine. If it does not respond as expected, the PWM values may need to be adjusted.
- **Target Current and Actual Current** - Current readings performed on SmarTrax systems containing hydraulic valves with kit part numbers 117-0295-xxx and 117-4001-xxx. Target Current is what the system expects to read. Actual Current displays the amount of current the system is using to steer the machine. These values are used to adjust system performance.

Reset Default

FIGURE 47. SmarTrax Settings Screen

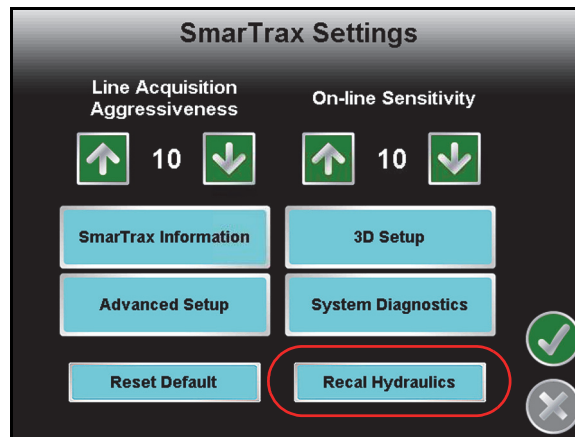


Selecting the Reset Defaults resets the SmarTrax system settings to the default values.

Important: If Reset Defaults is selected, the SmarTrax system must be recalibrated before the system can be enabled. Refer to Calibrate the SmarTrax System section on page 42 for information on completing the SmarTrax system calibration.

Recalibrating Hydraulics

FIGURE 48. SmarTrax Settings Screen

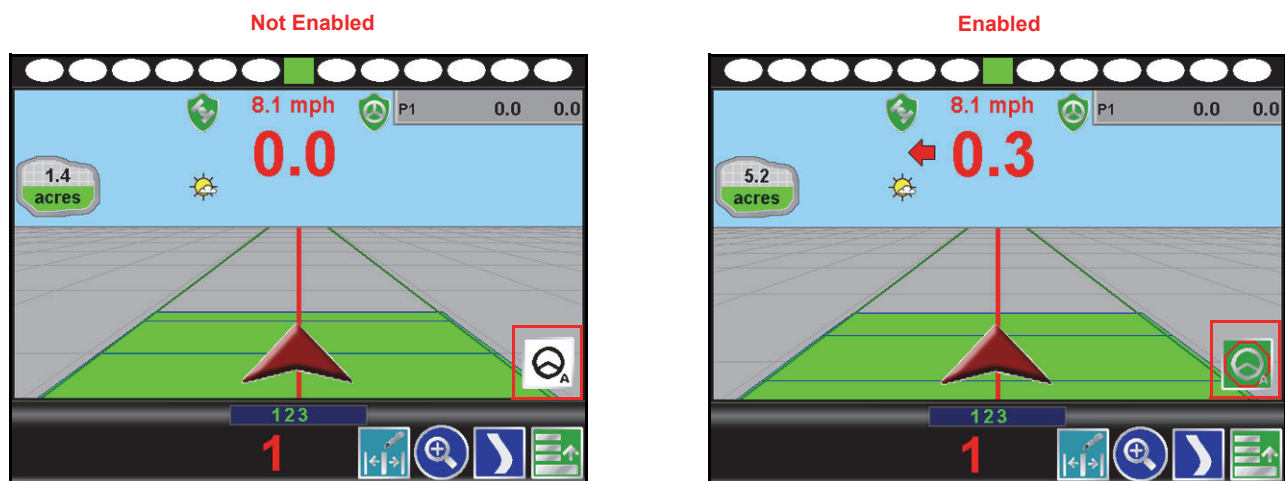


Selecting Recal Hydraulics restarts the machine's steering calibration process. Refer to *Calibrate the Machine's Steering System* section on page 51 for information on completing the machine's steering calibration.

Routine Operation

Engaging SmarTrax

FIGURE 49. SmarTrax System Engaged



The steering wheel icon in the lower right corner of the screen indicates whether the SmarTrax system is engaged or disengaged. The icon is green when the system is enabled and white when it is not. SmarTrax can be engaged in two ways:

- Via the field computer by pressing the steering wheel icon in the lower right corner of the display.
- By tapping the foot/enable switch.

Updating the Node

Refer to the Installation & Operation Manual for the specific field computer being used for instructions on updating the node software.

System Settings

System Setting	Average Setting	Suggested Range	Function
Line Aggressiveness (LA) Acquisition	10	5 to 13	The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is travelling further than 24 inches [60 cm] from the desired path.
OnLine (OL) Sensitivity	10	4 to 13	The OL Sensitivity value affects the response of the machine while steering within 24 inches [60 cm] of the displayed guidance line.

System Setting	Average Setting	Acceptable Range	Function
Zero Yaw	0	-2 to 2	Indicates amount error in the internal yaw sensor while no yaw motion is present.
Message Frequency - GGA and VTG	10 Hz	N/A	Displays the frequency of GGA messages from the GPS receiver.
Message Frequency - ZDA	.3 Hz	N/A	Displays the frequency of GGA messages from the GPS receiver.
HDOP	2.5	N/A	Indicates the quality of the GPS signal.



CHAPTER

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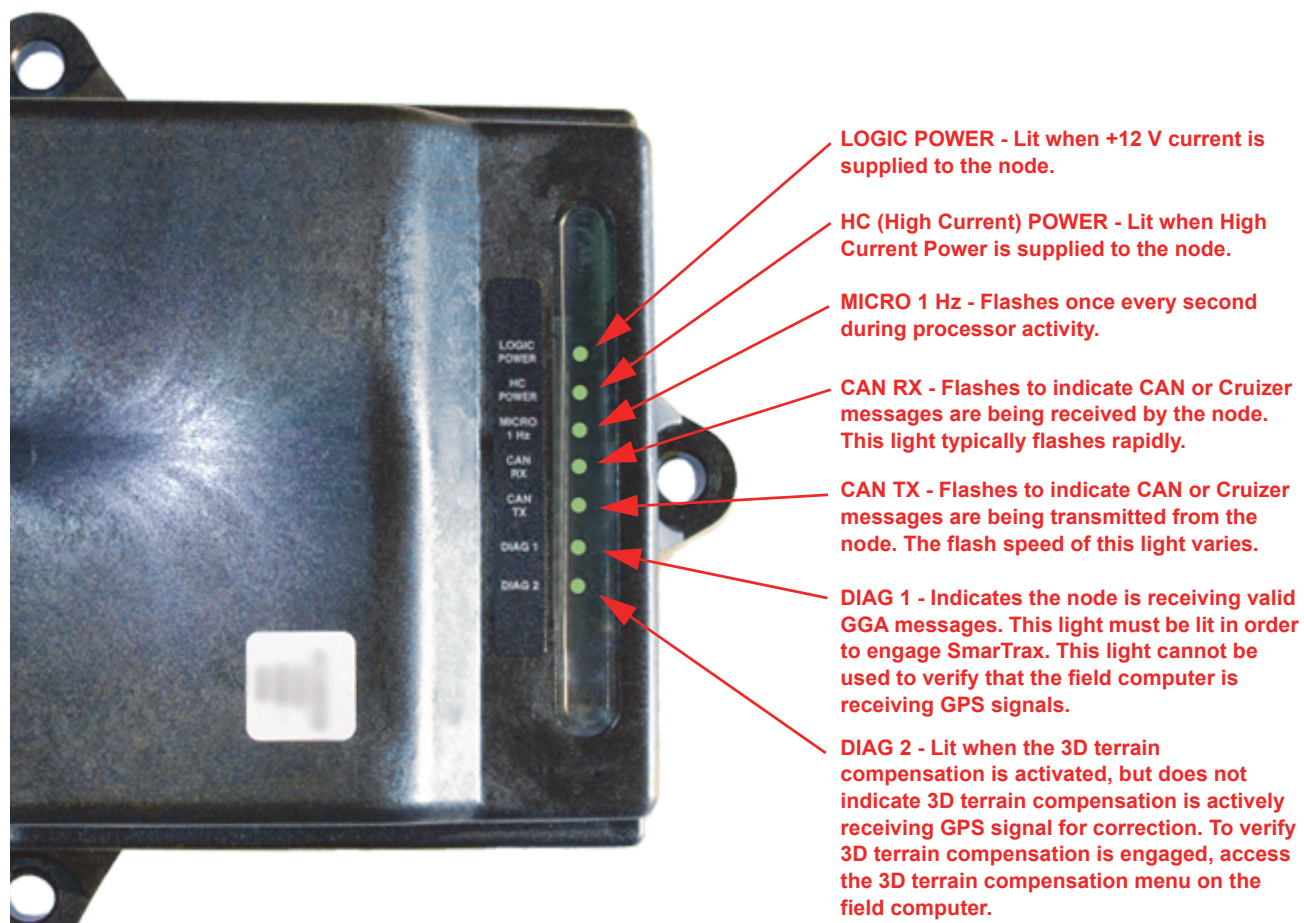
Troubleshooting

Node

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



Error Messages

Message	Possible Cause	Corrective Action
Cal SPS	The SPS/WAS has been detected but not calibrated.	Calibrate the SPS/WAS.
Guide Com	Guidance points are no longer received by SmarTrax.	Verify connections between SmarTrax and the field computer.
		Viper Pro Only - Verify that the "Send Guidance Message" option is on the Lightbar Setup screen.
HDW FailH/HDW FailL	Improper valve voltage output from the node	Check for a short in the valve harness
		Cycle power to the node to clear the failure.
		Replace the node.
High HDOP	Insufficient GPS signal is being received.	Wait a few minutes to see if signal improves.
Hyd Stuck	No wheel movement is detected by the field computer.	Check all valve hydraulic connections.
		Check all valve electrical connections.
		Check the SPS/WAS sensor and connections.
		Replace the node.
Low Stats	The GPS receiver is not receiving signal from enough satellites.	Wait a few minutes to see if more satellites are found.
No A-B Msg	The A-B line has not been set on the field computer.	Set the A-B line in the field computer.
	No communication from the field computer.	Verify cabling is correct and secure.
		Ensure the "Send Guidance" message is selected.
No Cal	SmarTrax has not been calibrated.	Calibrate the SmarTrax system using the calibration wizard.
No Diff	The GPS differential signal has not been found.	Wait a few minutes to see if the GPS differential signal is found.
		Check the receiver differential settings.
No GGA	No GGA messages are being received.	Check the receiver settings. The recommended setting is 10Hz.
No GPS	No GPS information is being received.	Verify the GPS receiver is properly installed and configured.
No HC Pwr	High current power is not being detected.	Check the high current cable connections.
		Check the fuse.
No VTG	No GGA messages are being received.	Check the receiver settings. The recommended setting is 10Hz.
Road Mode	The roading switch is in the off position.	Switch the roading switch to the on position.
Swath Jump	The guidance points being sent from the field computer has jumped swaths, causing the system to disengage.	Verify the guidance line on the field computer is not switching between lines.
TC Error	3D terrain compensation has been disabled because a gyro has failed but SmarTrax may still be used.	Contact your local Raven dealer.

Message	Possible Cause	Corrective Action
Too Fast	The vehicle speed is above 27 mph [45 km/h] and SmarTrax will be disengaged in five seconds.	Decrease the vehicle speed.
Too FAST	The vehicle speed is above 29 mph [45 km/h] or has been above 27 mph for more than 5 seconds and SmarTrax has been disengaged.	Decrease the vehicle speed and re-engage the SmarTrax system.
Too Slow	The vehicle speed is too slow and SmarTrax has been disengaged.	Increase the vehicle speed and re-engage the SmarTrax system.
Vlve Fit	Communication could not be established with the Steering Ready ISO valve.	Verify the proper software version is installed on the machine's ISO CANbus. Verify that the system is connected to a Raven-supported, ISO-compatible valve.
Wrong HDW	The software and hardware versions of the node are not compatible.	Update the node software to the proper version.
XDucer Er	A problem with the pressure transducer or cabling has been detected.	Verify the PSI values on the System Diagnostics screen. Verify pressure transducer connection and cabling. Replace the transducer(s).
Yaw Error	Yaw rate sensor values are out of range.	Replace the SmarTrax node.

SmarTrax Operation

Problem	Possible Cause	Corrective Action
SmarTrax will not power up.	The power connections are loose or not properly connected.	Check the power connections to ensure they are secure and properly connected.
	The fuse is blown.	Replace the fuse.
	The battery connections are loose, corroded, or not properly connected.	Check the battery connections to ensure they are secure and properly connected.
	The machine does not have proper voltage to run the system.	Test for +12VDC using a voltmeter.
	The field computer is defective.	Replace the field computer.
SmarTrax will not engage by pressing the foot/enable switch.	The node is not communicating properly.	Check the LEDs on the node to ensure proper communication.
	There is an error in the SmarTrax system.	Identify and correct system errors.
	The steer switch override is active.	Adjust the disengage settings and/or pressure switch knob. • Replace the pressure switch. • Replace the flow disengage switch. • Replace the transducer.
	The foot switch cable is not connected or is faulty.	Check the foot switch cable connection.



Problem	Possible Cause	Corrective Action
SmarTrax will not disengage when the steering wheel is turned.	The Disengage Setting is incorrect.	Adjust the Disengage Setting in the field computer.
	The knob on the pressure switch is turned in too far. (SmarTrax hydraulic valve part numbers 334-0003-056 through 334-0003-079 only)	Turn the knob on the pressure switch out.
	The pressure disengage switch has failed.	Replace the faulty pressure disengage switch.
SmarTrax will disengage only when the steering wheel is turned one way. (SmarTrax Only)	The flow disengage switch has failed on one side.	Replace the faulty flow disengage switch.
The wheels turn the wrong way when the steering wheel is turned. (SmarTrax Only)	The hydraulic hose connections are reversed.	Reverse the left and right steering hoses on the machine's steering orbital.
Valve makes noise in Stand-by mode. (SmarTrax Only)	The pressure relief adjustment on the SmarTrax valve is set incorrectly.	Adjust the relief valve on the SmarTrax valve until the noise stops.
Valve makes noise all of the time.	The load sense orifice in the valve is plugged.	Inspect the load sense orifice for blockage.
	The incorrect SmarTrax valve is installed.	Install the SmarTrax hydraulic valve recommended for the machine being used.
Cannot manually steer left or right from the System Diagnostics screen. (SmarTrax Only)	Hydraulic connections are plugged or not properly connected.	Check the hose connections.
	No high current power	<ul style="list-style-type: none"> • Check the node status lights for high current (HC) power. • Check the power/ground fuses and connections.
	Cable is improperly or not connected.	Check the solenoids on the SmarTrax valve for proper connection and voltage.
	There is a short or break in the cable.	Inspect the cable for shorts or breaks.
	The PWM Max settings are incorrect.	Verify PWM Max settings are set correctly in the field computer.
	Flow control valve is closed. (SmarTrax hydraulic valve part numbers 334-0003-056 through 334-0003-079 only)	Verify FC port is turned all the way out. (Command valves only)
System manually steers the wrong way from the System Diagnostics screen. (SmarTrax Only)	The left and right proportional solenoid connections are reversed.	Verify all solenoid connections are connected to the correct ports. Reverse if necessary.
	The hydraulic connections are reversed.	Verify all hydraulic connections are connected to the correct ports. Reverse if necessary.

Problem	Possible Cause	Corrective Action
The steering wheel turns by itself when the power is on and SmarTrax is not engaged. (SmarTrax Only)	There is an internal leak in the machine's steering orbital.	Check for and fix leaks in the steering orbital.
	The machine may have a reactive steering unit.	<ul style="list-style-type: none"> • Verify the steering unit type functions properly. • Verify the blocking valve is installed correctly.
	There is a failure in the dual counter-check valve (if applicable to the SmarTrax kit installed).	Replace the dual counter-balance valve or dual check valve.
SmarTrax will not find the guidance line.	SmarTrax is not engaged.	Engage the SmarTrax system.
	The GPS signal is hindered by the GL1DE speed filter.	Disable the GL1DE speed filter.
	The LA Aggressiveness setting is too low.	Increase the LA Aggressiveness setting.
	The OL Sensitivity setting is too low.	Increase the OL Sensitivity setting in increments of 1, allowing at least 40 seconds between adjustments.
Wheels are jittery while on-line.	The OL Sensitivity setting is too high.	Decrease the OL Sensitivity setting in increments of 1, allowing at least 40 seconds between adjustments.
System slowly oscillates while on-line.	The OL Sensitivity setting is too low.	Increase the OL Sensitivity setting in increments of 1, allowing at least 40 seconds between adjustments.
Machine consistently drives to the left or right of the guidance line.	The yaw or SPS/WAS sensor is out of calibration.	<ul style="list-style-type: none"> • Recalibrate the yaw sensor to zero while the machine is stationary. • Reset the SPS/WAS center calibration.
	The LA Aggressiveness setting is too low.	Increase the LA Aggressiveness setting.
	The OL Sensitivity setting is too low.	Increase the OL Sensitivity setting.
Machine consistently skips or overlaps in the field.	Antenna is position entered in the field computer does not correlate with the position on the roof.	Physically re-measure the antenna height and offset. Adjust the values in the field computer.
The system disengages when the auxiliary hydraulic functions (including boom and pump functions, raising and lowering an implement) are operated. (SmarTrax Only)	The knob on the pressure release switch is turned out too far.	Turn the knob on the pressure switch in.
	The Disengage setting is too low.	Increase the Disengage setting.
Wheels do not turn fast enough in LA mode.	The LA Aggressiveness setting is too low.	Increase the LA Aggressiveness setting.
Steering wheel is difficult to turn when attempting to disengage SmarTrax.	The pressure switch knob or disengage setting is set incorrectly.	Turn the knob out on the pressure switch and/or decrease the disengage setting.
Steering wheel is difficult to turn when attempting to turn the vehicle while SmarTrax is not engaged.	Load sense hose connections are installed incorrectly.	Verify the load sense hoses are installed correctly on the SmarTrax valve.



Problem	Possible Cause	Corrective Action
The hydraulic disengage switch or transducer is not detected during calibration.	The priority valve in the open center valve is stuck.	<ul style="list-style-type: none"> • Replace the cartridge. • Replace the open center valve.
	Cable connection(s) to the disengage switch is improperly connected or loose.	Verify disengage switch connections are correct and secure.
	The cable connection to the transducer is improperly connected or loose.	Verify the connection to the transducer is correct and secure.

CHAPTER

6

System Diagrams

The diagrams contained in this chapter may be helpful when installing or troubleshooting the SmarTrax system. Some of the diagrams may show optional features or components not required for SmarTrax operation and may not necessarily apply to the SmarTrax system installed on the machine.

Note: *Contact your local Raven dealer for ordering information on any optional features or components.*

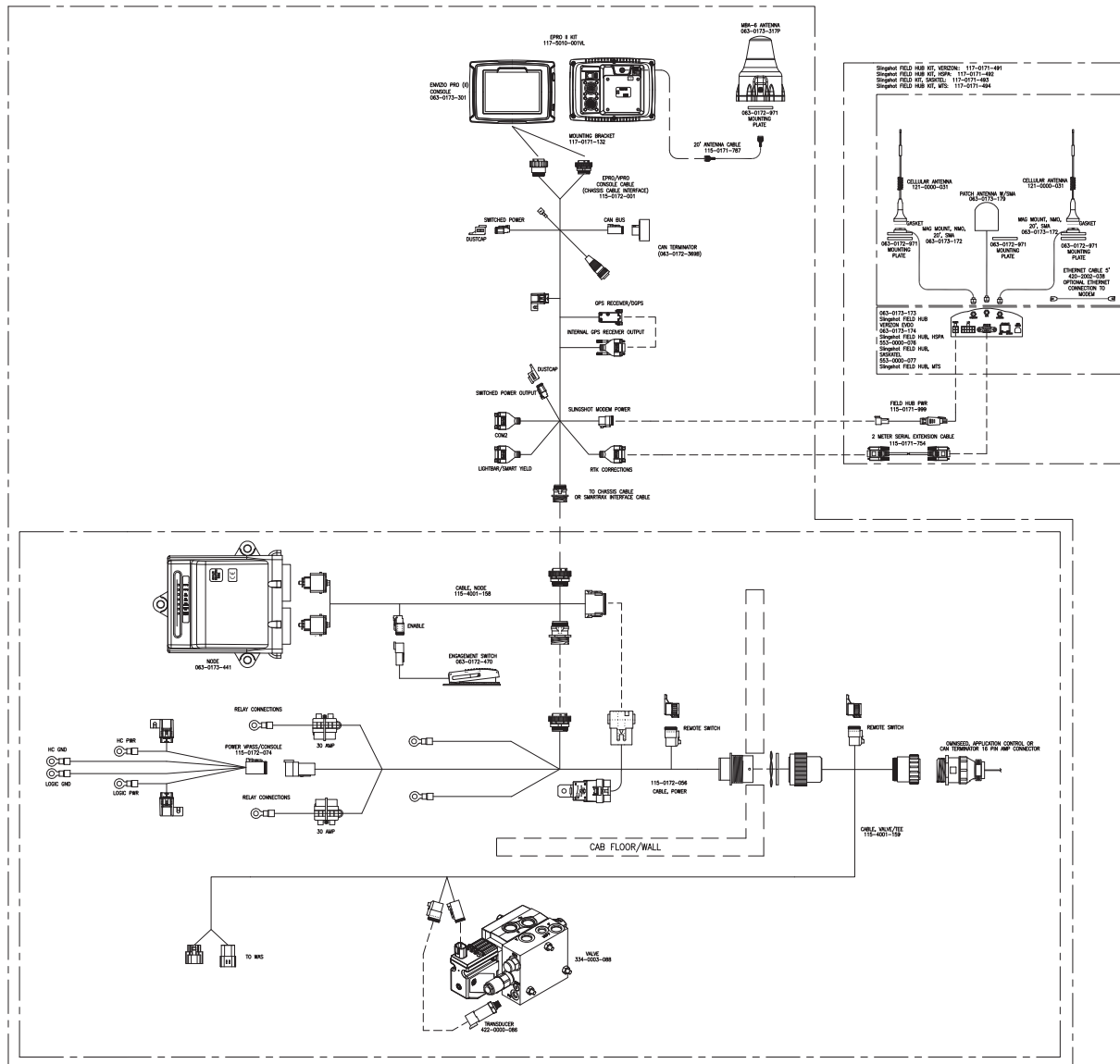
Buhler Versatile SmarTrax™ Calibration & Operation Manual

[illegible]

Manual No. 016-0171-532 Rev. B



FIGURE 3. Row Crop, Model Year 2012



Manual No. 016-0171-532 Rev. B

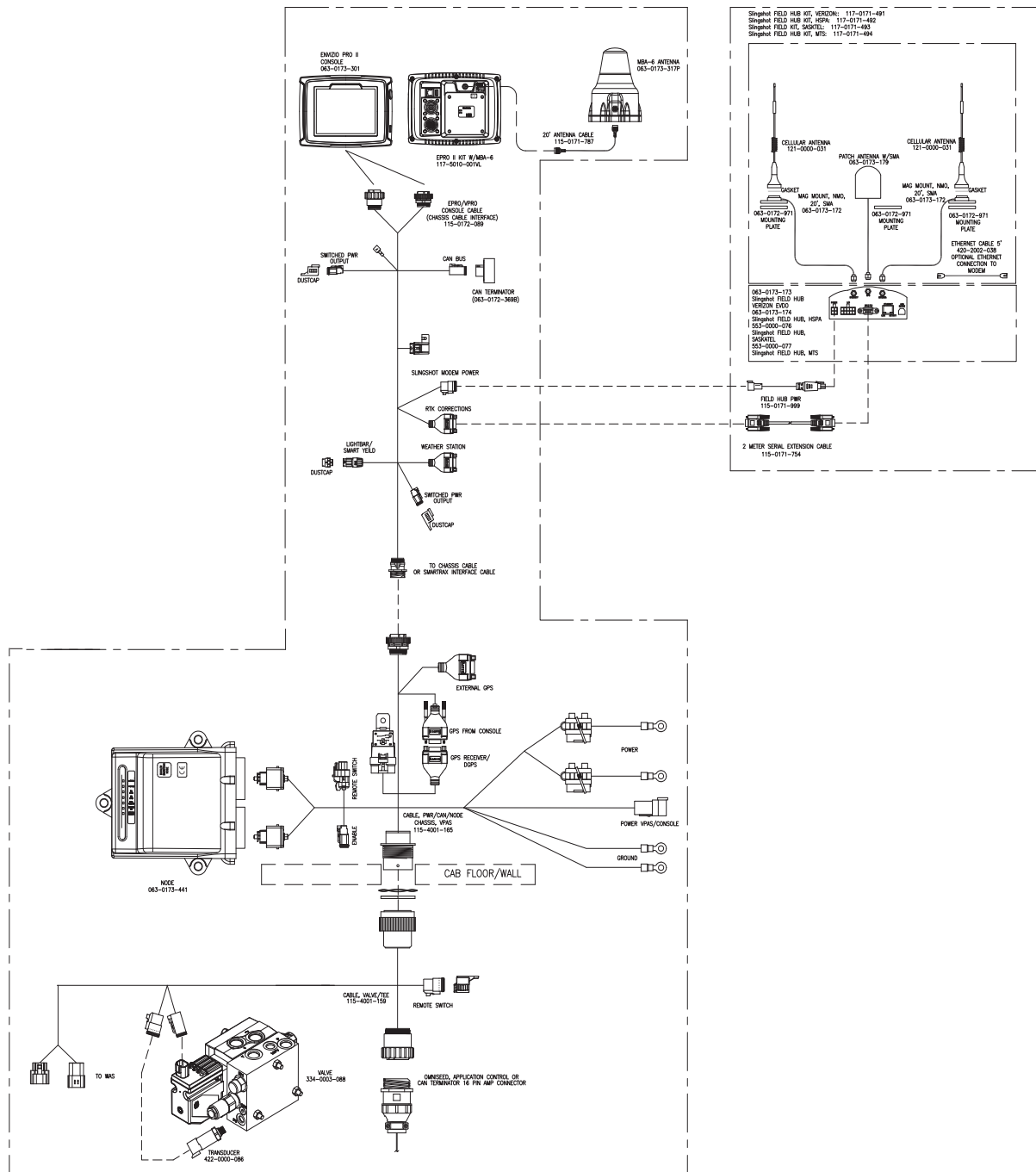
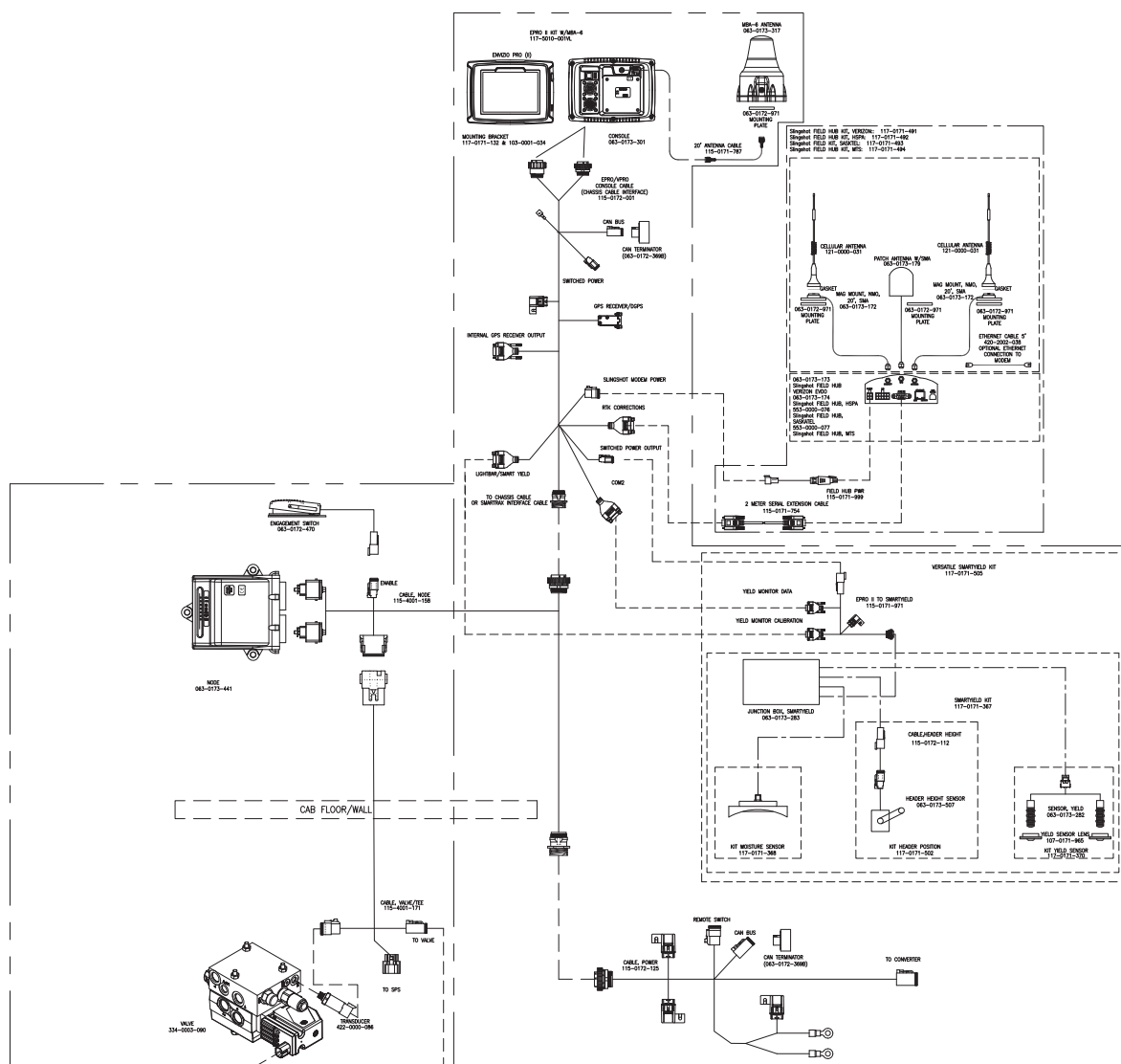


FIGURE 5. Combine, Model Year 2012







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Limited Warranty

What Does this Warranty Cover?

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

How Long is the Coverage Period?

Raven Applied Technology products are covered by this warranty for 12 months from the date of retail sale. In no case will the Limited Warranty period exceed 24 months from the date the product was issued by Raven Industries Applied Technology Division. This warranty coverage applies only to the original owner and is non-transferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries.

What Will Raven Industries Do?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

What is not Covered by this Warranty?

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

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



Extended Warranty

What Does this Warranty Cover?

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

Do I Need to Register My Product to Qualify for the Extended Warranty?

Yes. Products/systems must be registered within 30 days of retail sale to receive coverage under the Extended Warranty. If the component does not have a serial tag, the kit it came in must be registered instead.

Where Can I Register My Product for the Extended Warranty?

To register, go online to www.ravenhelp.com and select Product Registration.

How Long is the Extended Warranty Coverage Period?

Raven Applied Technology products that have been registered online are covered for an additional 12 months beyond the Limited Warranty for a total coverage period of 24 months from the date of retail sale. In no case will the Extended Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology Division. This Extended Warranty coverage applies only to the original owner and is non-transferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries. In addition, the words "Extended Warranty" must appear on the box and all documentation if the failure is between 12 and 24 months from the retail sale.

What Will Raven Industries Do?

Upon confirmation of the product's registration for the Extended Warranty and the claim itself, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

What is Not Covered by the Extended Warranty?

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. Cables, hoses, software enhancements, and remanufactured items are not covered by this Extended Warranty. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

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