

SmarTrax™ MD Calibration & Operation Manual

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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 MD™ 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 MD 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 MD, observe the following safety measures:

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

CAUTION

GENERAL

- Always verify that the power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the equipment.
- Ensure that the power cable is the last cable to be connected.
- A minimum of 12 VDC is required for system operation with a maximum of 15 VDC.

INSTRUCTIONS FOR WIRE ROUTING

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

Harness should not contact or be attached to:

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

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

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads
- Ends of adjustable hose clamps
- Wire exiting conduit without protection, either ends or side of conduit
- Hose and tube fittings

Routing should not allow harnesses to:

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

Harnessing should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

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

For harness sections that move during machine operation:

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

Protect harnesses from:

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

IMPORTANT:

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

ROADWAY HOMOLOGATION

NOTE: This section applies only to European countries where compliance to Roadway Homologation Regulations are required.

- Roadway operation with this system installed may require additional machine inspection and testing from a local TÜV authority. Before operating on a roadway, please contact a local TÜV authority for more information.
- The mechanical drive unit must be removed before public roadway travel is attempted. Install the protective trim around the installed ring gear when the mechanical drive is removed.
- The field computer installation location must not obstruct the machine operator’s view in accordance with Directive 2008/2/EC.
- Refer to Chapter 8, Roadway Homologation Certification on page 111 for Roadway Homologation certificate information.

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

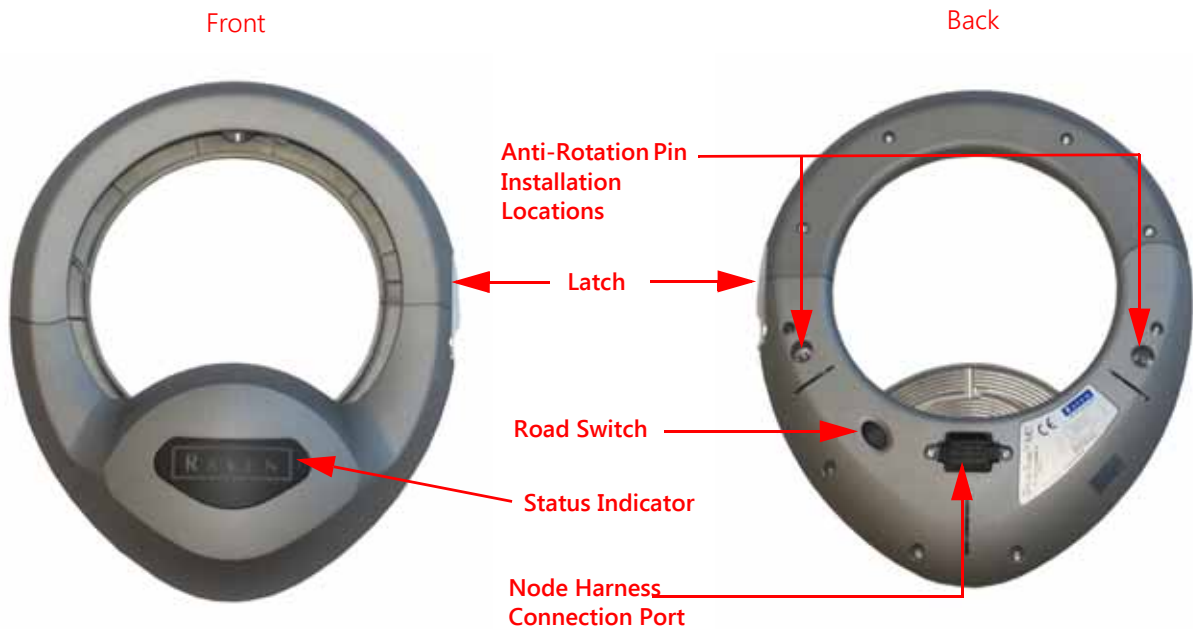
The instructions in this manual are designed to assist in the proper calibration and operation of the SmarTrax MD system when used with the Viper 4, Viper Pro, Envizio Pro or Envizio Pro II, and Cruiser II field computers.

IMPORTANT: Installation of the SmarTrax MD system must be completed before calibrating the system. If you have questions regarding the installation of the SmarTrax MD system, refer to the SmarTrax MD 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 MD system. For questions about the field computer, refer to the Installation & Operation Manual provided with the field computer.

NOTE: Machine-specific installation kits are not available for all machine makes and models.

SMARTRAX MD PART IDENTIFICATION



INSTALLATION

	<p>WARNING</p> <p>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.</p>
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RECOMMENDATIONS

Before installing the SmarTrax MD system, park the machine where the ground is level, clean, and dry. 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.

POINT OF REFERENCE

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

UPDATES

UPDATING THE NODE

The SmarTrax node may be updated in two ways:

- Via a USB drive loaded with the latest software and plugged into the field computer.
- Via the Raven Service Tool. Refer to the Raven Service Tool Installation & Operation Manual (P/N 016-5030-022) for instructions on updating the node software.

Refer to the appropriate field computer manual for instructions on updating the node software:

- Viper/Viper 4+ Installation & Operation Manual (P/N 016-0171-539)
- Viper Pro Installation and Operation Manual (P/N 016-0171-122)
- Envizio Pro & Envizio Pro II Installation and Operation Manual (P/N 016-0171-148)
- Cruiser II Operation Guide (P/N 016-0171-415)

UPDATING THE MECHANICAL DRIVE

Update the mechanical drive software using a Windows-based operating system computer and the instructions stored on the USB drive (P/N 063-0173-595) contained in the Raven Service Tool kit (P/N 117-0171-464).

When updating SmarTrax MD software, refer to the Raven Service Tool Installation Manual (P/N 016-5030-022) located on the flash drive supplied with the installation kit. 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








- SmarTrax™ MD Calibration & Operation Manual
- P/N 016-5030-020 Rev. D
- 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.

WIDGET AND BUTTON DEFINITIONS

The following are common status or mode and navigation icons which may be visible while the SmarTrax MD system is installed:

Display	Message
	<p>The SmarTrax node is detected, but the operator must accept responsibility for the operation of the SmarTrax MD system.</p>
	<p>The SmarTrax MD system cannot be engaged because the vehicle is traveling too fast or too slow or no A-B path or guidance line has been set.</p>
	<p>SmarTrax is detected, turned on, calibrated, and ready to be engaged.</p>
	<p>SmarTrax is detected and in operation in the Online Sensitivity or Line Acquisition Aggressiveness mode. Adjusting the OL Sensitivity or LA Aggressiveness will affect performance while in this mode. Press and hold to determine in which mode the system is operating.</p>
	<p>Vehicle speed is too fast or too slow for SmarTrax operation and the system will disengage.</p>
	<p>Previous - Returns the Viper 4 display to the previous screen in the setup process.</p>
	<p>Next - Saves the changes made to the SmarTrax system and proceeds to the next step in the setup process.</p>

Display	Message
	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.

NOTE: Refer to Error Messages section on page 100 for additional status conditions which may be displayed in the SmarTrax on-screen widget.

INITIAL STARTUP

DATA TRANSFER

During the initial startup of the SmarTrax MD system, language data must transfer from the SmarTrax node to the Viper 4. Allow several minutes for data transfer to complete before calibrating SmarTrax.

NOTE: The Rx and Tx diagnostic LEDs on the SmarTrax node will flash rapidly during the data transfer. The Rx and TX lights will flash slowly or turn off when the data transfer is complete. Attempting to access the SmartTrax MD configuration screen while language data is transferring will open a message asking the user to try again later.

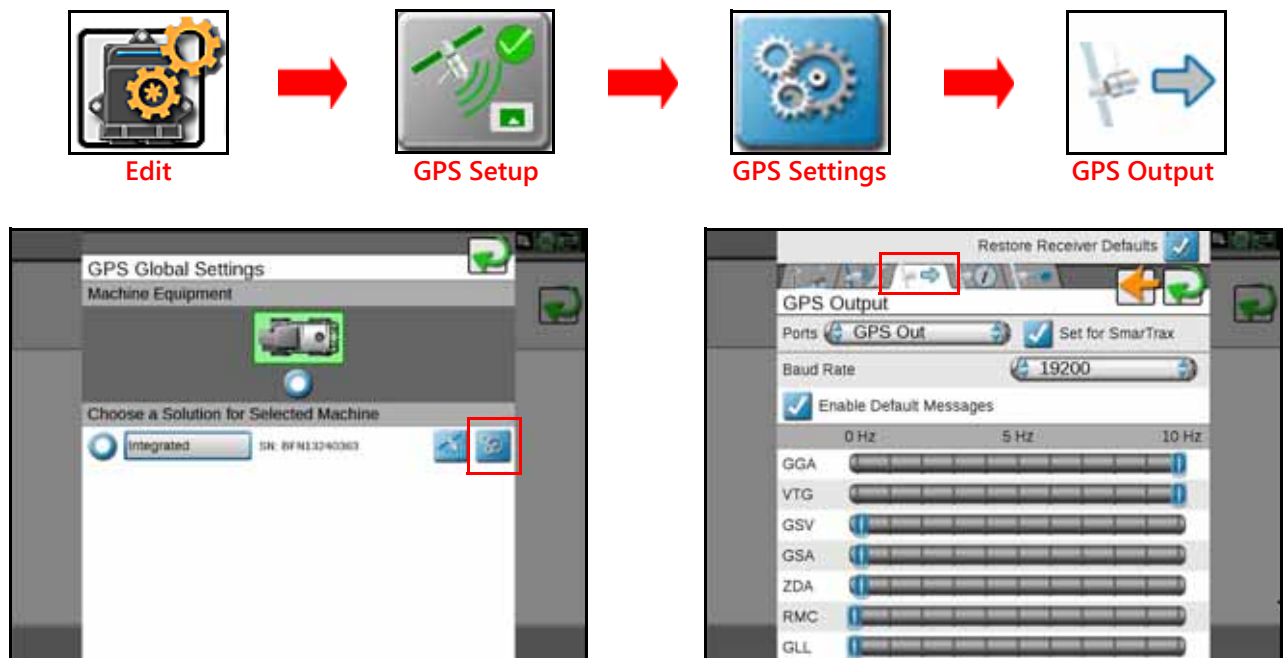
GPS CONFIGURATION

NOTE: The SmarTrax MD system will automatically attempt to detect GPS position information and will proceed with the calibration wizard if GPS is present. If GPS messages cannot be detected, a GPS error message will be displayed. Check any external receiver connections and verify settings in any external GPS equipment. Contact your local Raven dealer for additional assistance if the SmarTrax MD system still does not detect a GPS message.

INTERNAL GPS RECEIVER

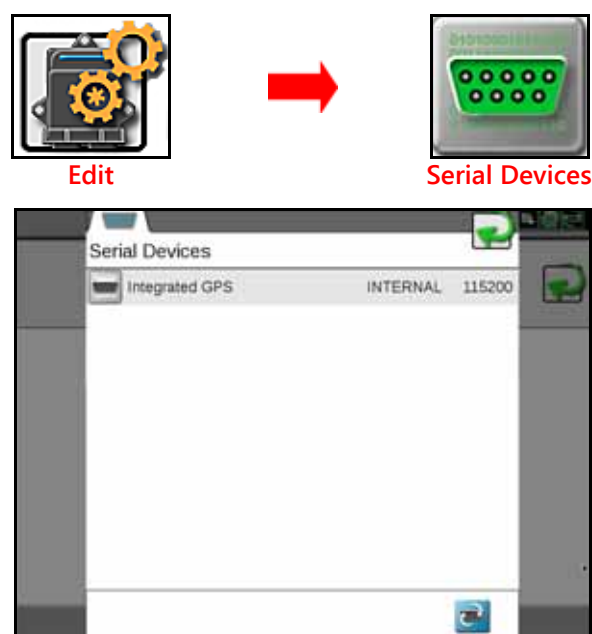
NOTE: The steps below apply only to Viper 4 computers with an internal GPS receiver that is being used as the primary GPS source.

FIGURE 1. GPS Setup Screen



1. Press **Edit**.
2. Press **GPS Setup**.
3. Select **GPS Settings**.
4. Select the **GPS Output** tab.
5. Select **GPS Out** from the Ports drop-down box.
6. Select the **Set for SmarTrax** box so that the blue check mark is present.
7. Verify that the GPS settings match the settings shown in the right picture in Figure 1 above.

FIGURE 2. Serial Device Setup Screen



8. Select **Edit**.
9. Select **Serial Devices**. The following screen will be displayed:

FIGURE 3. Serial Device Detection Screen




NOTE: If Integrated, SmarTrax, and SmarTrax GPS are not listed, press the Retry icon  on the bottom-right corner of the screen. If these devices still do not appear, inspect cable connections to ensure they are installed securely, then press the Retry icon again. If the devices still do not appear, refer to Chapter 6, Troubleshooting for further information.

FIGURE 4. GPS Global Settings Screen



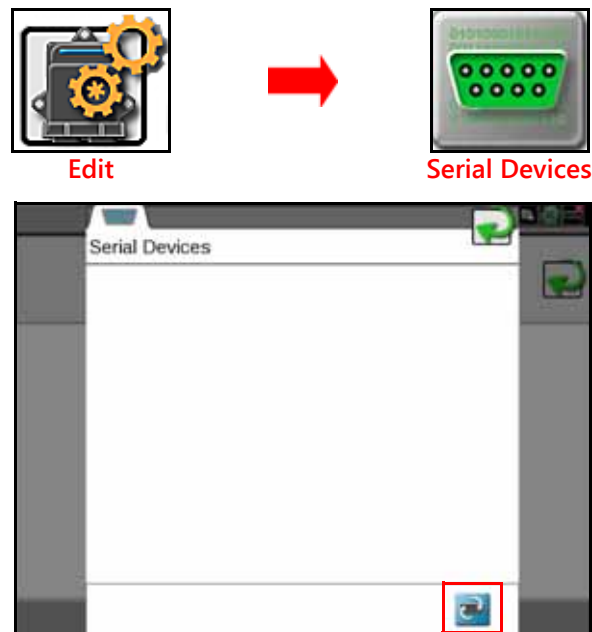
10. Verify that SmarTrax GPS on DGPS is displayed and selected as shown in Figure 4 above.

NOTE: If SmarTrax GPS on DGPS is not visible in the list, inspect cable connections to ensure they are installed securely, then press the Retry icon again. Refer to Chapter 6, Troubleshooting beginning on page 99 for further information.

EXTERNAL 600S GPS RECEIVER

The steps below apply only to Viper 4 computers utilizing an external 600S GPS receiver.

FIGURE 5. Serial Device Setup Screen



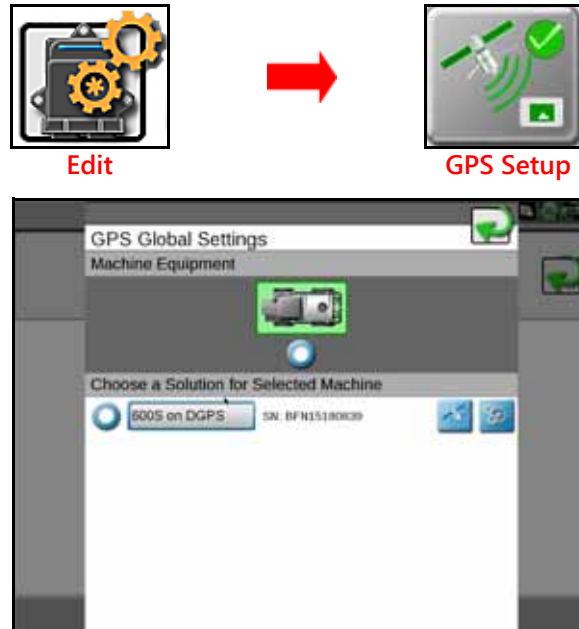
1. Select **Edit**.
2. Select **Serial Devices**.
3. Press the **Retry** button in the bottom-right corner of the screen. The following screen will appear:



4. Verify that the SmarTrax and 600S are listed in the Serial Device Setup screen.

NOTE: If SmarTrax and 600S are not visible in the list, inspect cable connections to ensure they are installed securely, then press the Retry icon again. Refer to Chapter 6, Troubleshooting beginning on page 99 for further information.

5. Press **Accept**.



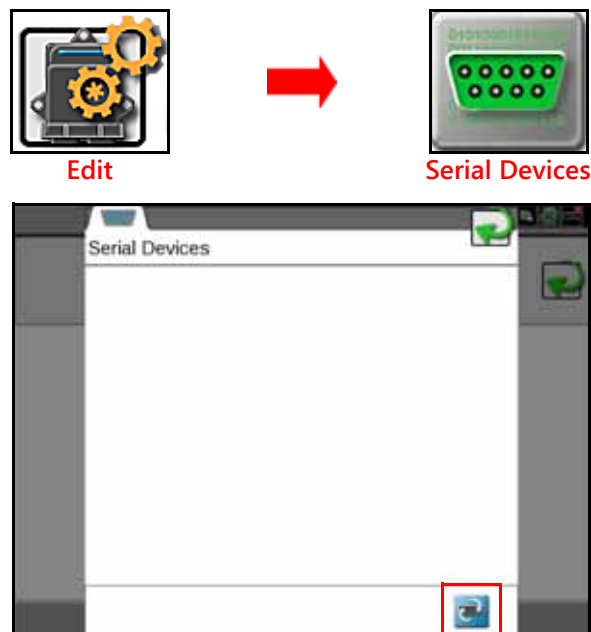
6. Select **GPS Setup**.
7. Verify that 600S on DGPS is visible and selected.

NOTE: If 600S on DGPS is not visible or selected in the list, inspect cable connections to ensure they are installed securely. Refer to Chapter 6, Troubleshooting beginning on page 99 for further information.

EXTERNAL GPS RECEIVER

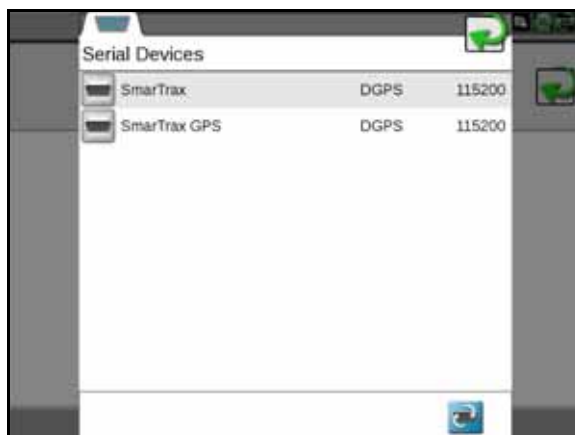
The steps below apply only to Viper 4 computers with an external GPS receiver other than model 600S.

FIGURE 6. Serial Device Setup Screen




1. Select **Edit**.

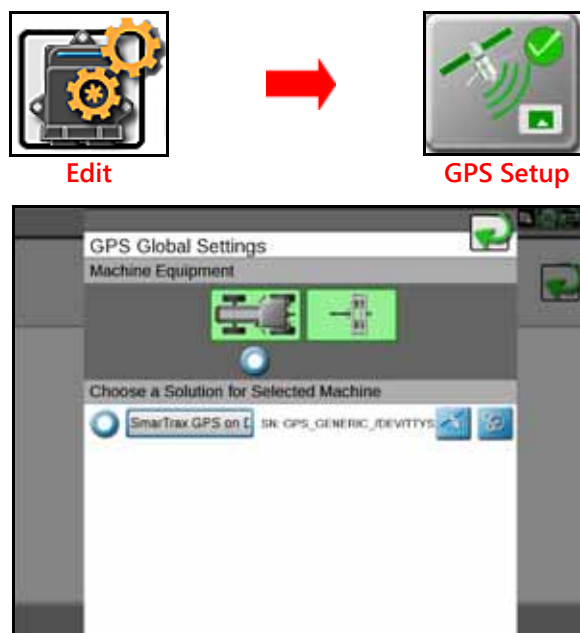
2. Select **Serial Devices**.



3. Verify that the SmarTrax and SmarTrax GPS are listed in the Serial Device Setup screen.

NOTE: If SmarTrax and SmarTrax GPS are not listed, press the Retry icon  on the bottom-right corner of the screen. If these devices still do not appear, inspect cable connections to ensure they are installed securely, then press the Retry icon again. If the devices still do not appear, refer to Chapter 6, Troubleshooting for further information.

4. Press **Accept**.

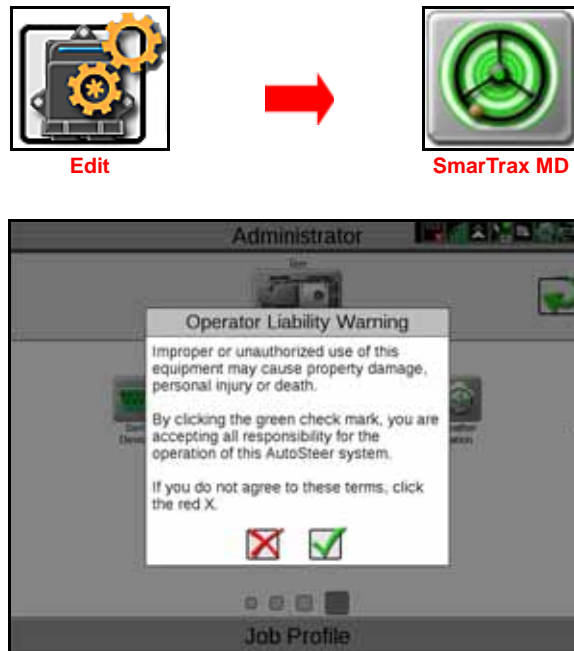


5. Select **GPS Setup**.
6. Verify that SmarTrax on DGPS is visible and selected.

NOTE: If SmarTrax GPS on DGPS is not visible and selected in the list, refer to Chapter 6, Troubleshooting beginning on page 99 for further information.

SMARTRAX MD TERMS OF USE

FIGURE 7. Operator Liability Warning Screen



Read and accept the Operator Liability Warning. If the operator does not accept liability, the SmarTrax MD system will disable and cannot be re-engaged until the liability warning is accepted. The Operator Liability Warning screen will appear each time the Viper 4 is turned on or rebooted.

MACHINE CONFIGURATION

SET UP MACHINE PROFILE(S) - OPTIONAL

FIGURE 8. Machine Configuration Menu



1. Select one of the **Profile** options from the bottom of the Machine Type list.
2. Select **Next**.
3. Select **New, Load,** or **Reset**.

- New creates a new machine profile. Once New is selected, the screen will return to the Machine Type list to allow the operator to select the appropriate tune set and continue with the calibration process. Once the calibration process is complete, the machine will be associated with the Profile number selected.
- Load allows the operator to select an existing profile. Load will not be displayed as an option until a machine calibration has been performed and a new profile has been set up.
 - If the profile chosen has previously been calibrated on the machine, the calibration process is complete.
 - If the profile chosen has not been calibrated on the machine, the calibration process must be completed as outlined in the following sections in this manual.
- Reset clears the previous profile settings. Once Reset is selected, the operator must select the machine from the Machine Type list and the calibration process must be completed as outlined in the following sections in this manual. Reset will not be displayed as an option until a machine calibration has been performed and a new profile has been set up.

4. Select **Next**.

MACHINE-SPECIFIC CONFIGURATION

NOTE: If machine measurements (guidance width, wheel base, etc.) have not already been entered into the field computer, it will be necessary to enter machine measurements before operating the SmarTrax MD system. Refer to the Viper/Viper 4+ Installation and Operation Manual (P/N 016-0171-539) for further information.

Before the SmarTrax MD system may be enabled, the SmarTrax MD system must be calibrated for the specific vehicle being used. Complete the following steps to configure the machine specifications in the Viper 4 and the SmarTrax MD system.

FIGURE 9. Vehicle Selection Screen



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

FIGURE 10. Steering Control Device Selection Screen



3. Select **SmarTrax MD** from the drop-down box.
4. Select **Next**.

CALIBRATE THE SMARTRAX MD SYSTEM

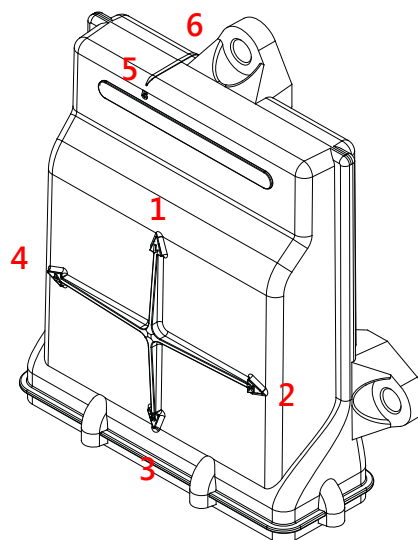
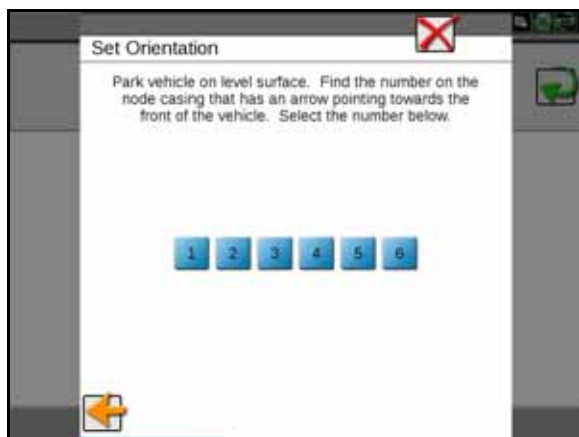
IMPORTANT: The switch on the bottom of the mechanical drive must be turned on before calibrating the SmarTrax MD system.

NOTE: The calibration wizard will be displayed the first time the SmarTrax module is accessed after installation or any time the Reset SmarTrax option is selected. Refer to Reset Calibration section on page 37 for additional information about resetting the SmarTrax MD system.

1. Park the machine on a level surface.
2. Locate and select the SmarTrax module. The calibration wizard will start automatically if the SmarTrax MD system requires calibration.

NODE ORIENTATION

FIGURE 11. Node Orientation Screen



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

IMPORTANT: Selecting the incorrect node arrow number may cause poor steering performance!

NOTE: The SmarTrax MD calibration wizard will perform an initial calibration on the SmarTrax MD tilt sensors. The wizard will automatically advance to the next step in the calibration process once the node calibration is complete.

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 4 is correct. The Wheel Base value cannot be changed.


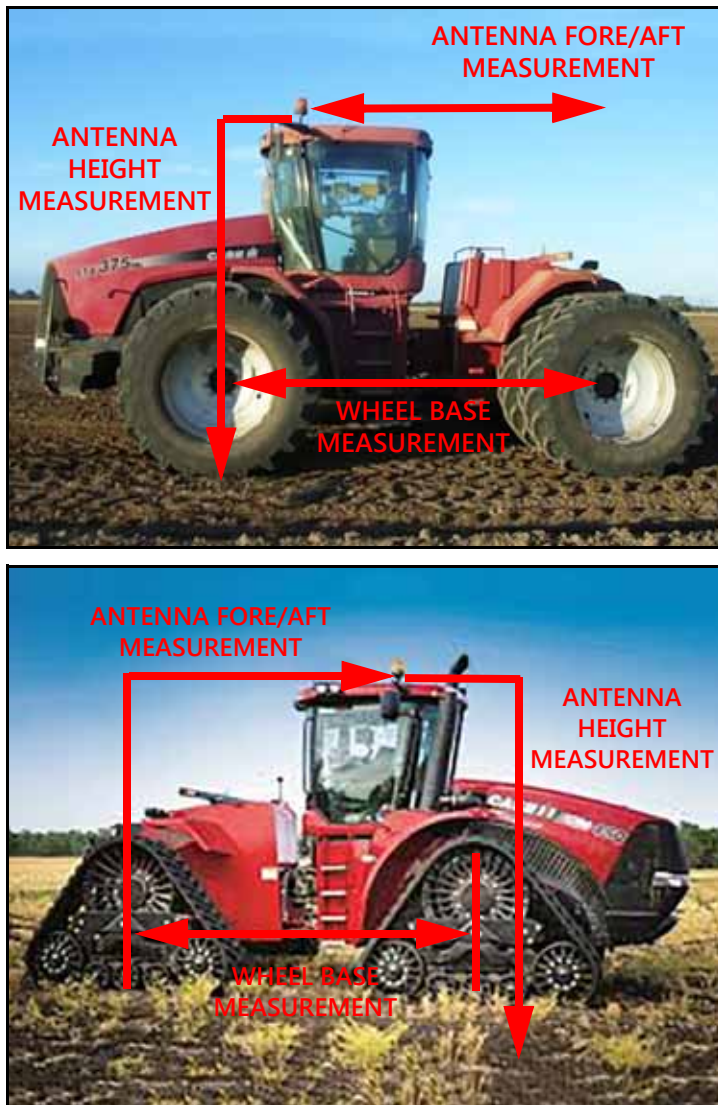
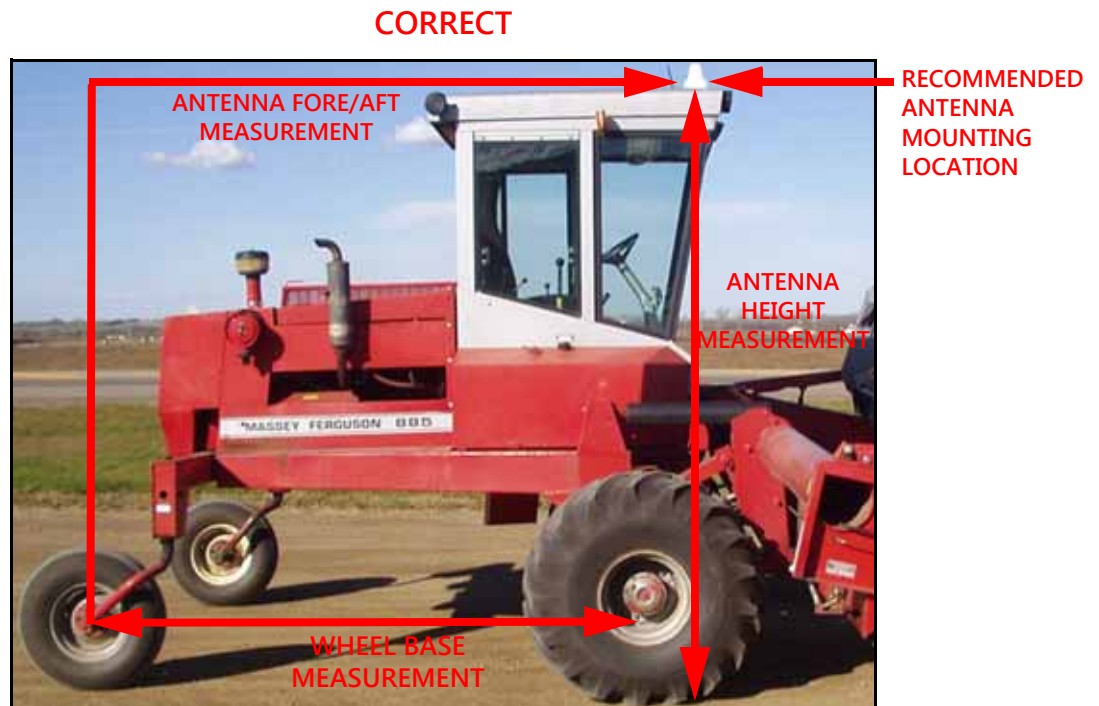
	NOTICE
<p>The Wheel Base, Antenna Position, and Antenna Height values are critical to the operation of the SmarTrax system. Measure these dimensions accurately to ensure optimal SmarTrax MD system performance!</p>	

FIGURE 12. Articulated Machine Measurements



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 13. Swather Machine Measurements



INCORRECT WHEEL BASE MEASUREMENT



Wheel base measurement taken from pivot point instead of the center of the front wheel.



Wheel base measurement taken with wheels reversed and not in the straight line operation position.

NOTE: For swather machines, the rear wheels MUST be positioned behind the pivot point and pointing forward to reflect the tire position during normal, straight line operation. To figure the wheelbase distance, measure from the center of the rear tire to the center of the front tire.

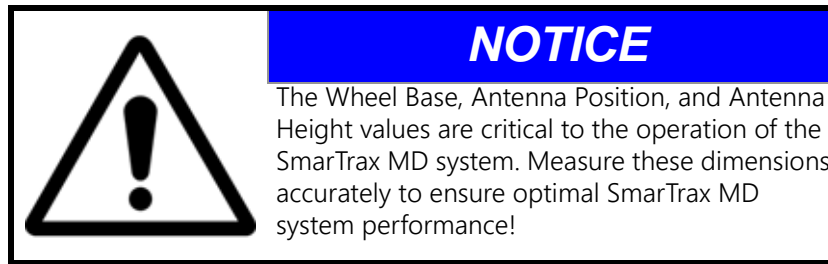
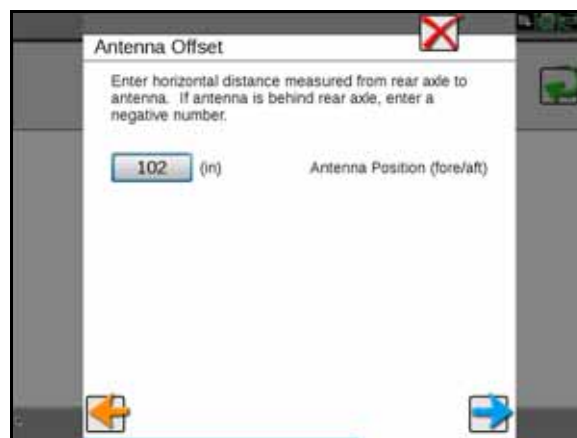


FIGURE 14. Wheel Base Configuration Screen



1. To determine the machine's wheel base, measure the distance from the center of the machine's front axle to the center of the rear axle.
2. Select the value box to enter the Wheel Base measurement using the on-screen keypad.
3. Select **Next**.
4. To determine the GPS Antenna Position, measure the distance from the antenna to the center of the rear axle.

FIGURE 15. Antenna Position Configuration Screen



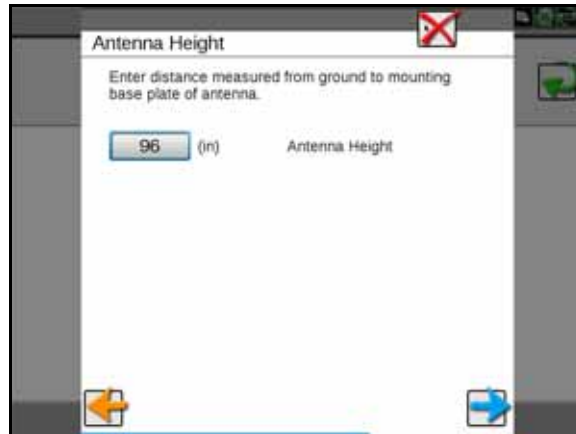
5. Select the value box to enter the Antenna Position measurement using the on-screen keypad.

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. Raven Industries recommends mounting the antenna in front or even with the rear axle.

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

FIGURE 16. Antenna Height Configuration Screen



8. Select the value box to enter the Antenna Height measurement using the on-screen keypad.
9. Select **Next**.

ENHANCED TILT CALIBRATION

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

FIGURE 17. Enhanced Tilt Calibration Wizard

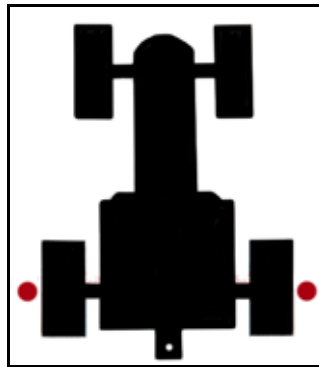


1. Drive the machine forward 33 feet and park on a flat surface.

NOTE: The machine must detect a forward motion prior to calibration to determine which direction it is facing.

2. Follow the on-screen instructions to begin the calibration process.

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



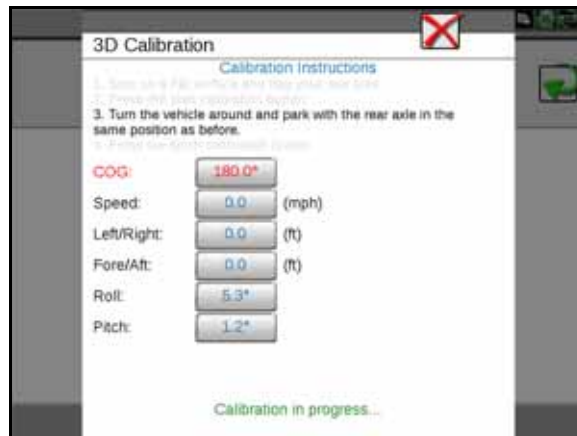
3. Place flags or markers on the outside of each rear wheel aligned with the axle.

FIGURE 19. Tilt Calibration Screen



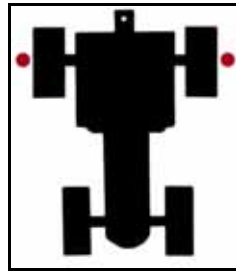
4. Select the arrow at the bottom of the screen to begin calibration. The following screen will appear:

FIGURE 20. Calibration in Progress Screen



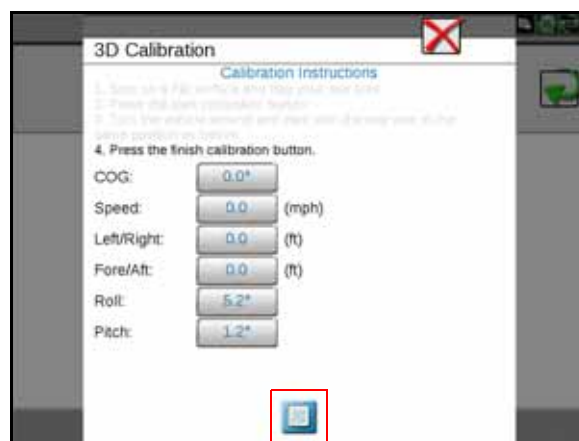
5. Wait for the calibration process to be completed.

FIGURE 21. Machine Orientation After Tilt Calibration



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

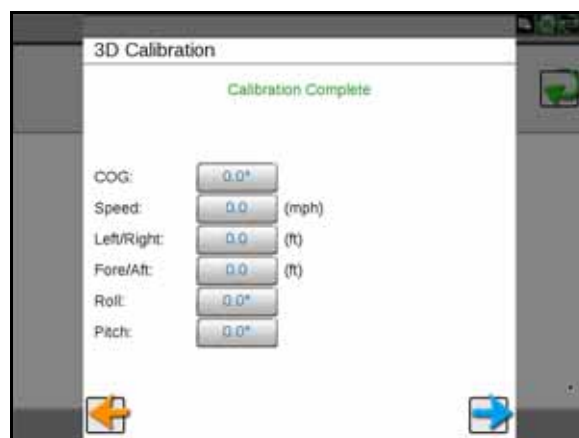
FIGURE 22. Finish Calibration



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

NOTE: In order for the values to turn blue, 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. The rear wheels will not necessarily end up aligned exactly with the markers to get the Fore/Aft number to turn black.

FIGURE 23. Calibration Complete

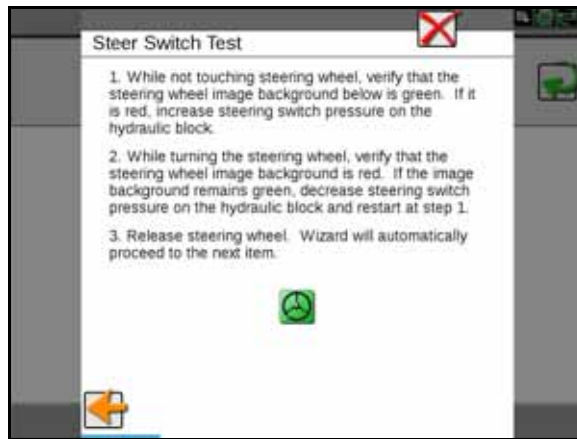


- Select **Next**.

SYSTEM DISENGAGE CALIBRATION

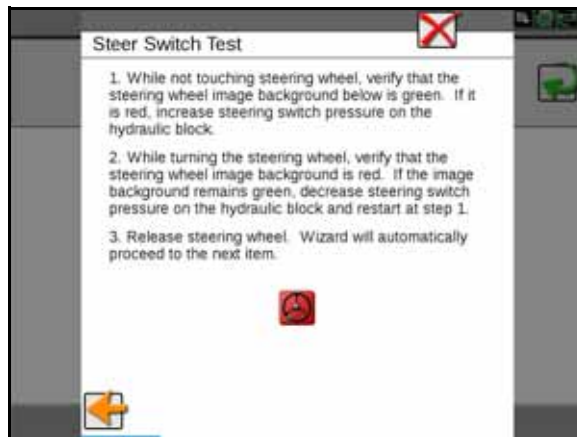
1. Select **Next** in the SmarTrax MD Setup Wizard. The following screen will appear:

FIGURE 24. Disengage Calibration Screen



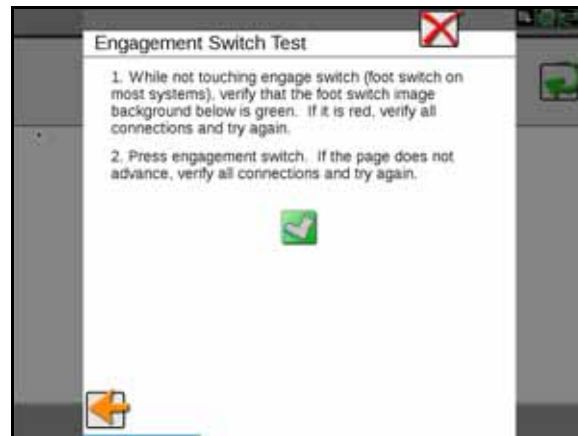
2. Turn the steering wheel. The following screen will appear:

FIGURE 25. Disengage Calibrating Screen



3. Proceed to the Engage Switch section on page 27 continue with the SmarTrax system calibration.

ENGAGE SWITCH



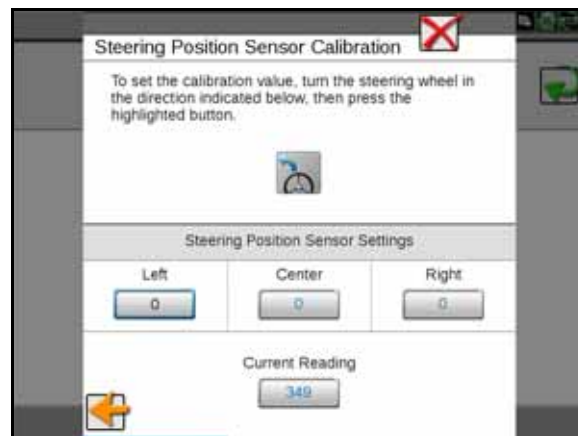
1. Review the on-screen instructions.
2. Press and release the foot switch or engage switch.

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

WHEEL ANGLE SENSOR (WAS) CALIBRATION

The WAS calibration is required on the SmarTrax MD system. Once the WAS is detected in the system, the following screen will be displayed:

FIGURE 26. WAS Calibration Screen



1. While driving slowly, turn the steering wheel fully to the left wheel lock.
2. Select **Left**.
3. Turn the steering wheel fully to the right wheel lock.
4. Select **Right**.
5. Select **Next**.


NOTE: If the steering wheel continues to turn when the wheels are turned fully to the left or right, be sure to stop turning the steering wheel when the machine's wheels stop moving.


CALIBRATE THE MACHINE'S STEERING SYSTEM

After the initial calibration of the SmarTrax MD system is complete, it is necessary to calibrate the machine's steering system. This allows the SmarTrax MD system to learn the hydraulic capabilities of the machine for optimal steering performance in the field.

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

- The booms are racked on self-propelled units.
- There are no implements connected to the hitch.
- The machine's engine is running at the normal operating RPM.
- The machine's measurements are correctly entered into the Viper 4.

	<p>WARNING</p> <p>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.</p>
---	--

	<p>NOTICE</p> <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 MD 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 MD system.</p>
---	---

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 27. 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: If an error message is displayed during calibration, refer to the "Error Messages" section on page 100 for possible causes and corrective action to complete the calibration process.

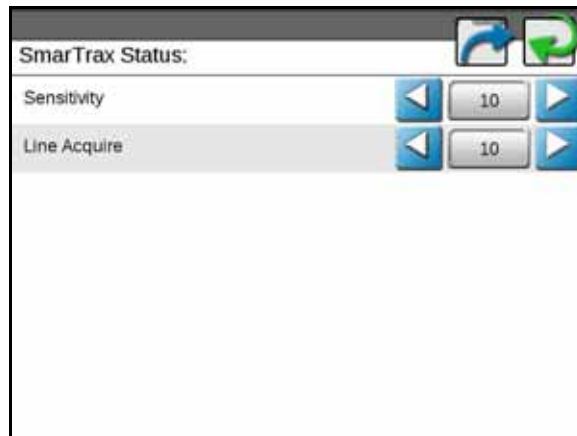
START A JOB

Refer to the ROS (Raven Operating System) Basic Operation Manual (P/N 016-0171-539) for instructions on starting a job and setting guidance lines.

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, press and hold the SmarTrax MD widget while within a job. The following screen will appear:

FIGURE 28. SmarTrax MD Adjustments Screen

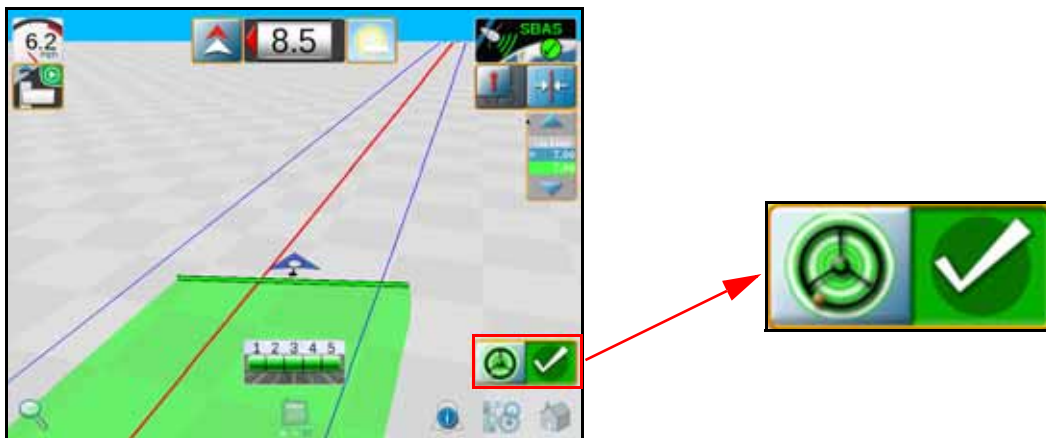


Is there a new screen?

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 29. LA Mode



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

The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is traveling 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 MD 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 settle on the line.

ON-LINE (OL) MODE AND SENSITIVITY

FIGURE 30. OL Mode Indicator



NOTE: The screen in the figure above illustrates an example of a situation in which SmarTrax MD 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.

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 MD 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.

ADVANCED SETUP TOOLS AND SYSTEM DIAGNOSTICS

Advanced setup tools allow fine-tuning of the system to adjust for operating conditions and improve steering accuracy.

NOTE: Some features or settings are not able to be adjusted unless SmarTrax MD is in an active job.

NOTE: Some features or settings are configured during the SmarTrax MD calibration wizard and cannot be modified or changed without resetting the SmarTrax MD system. Refer to Reset Calibration section on page 37 for additional assistance with resetting the SmarTrax MD system to default settings.

SYSTEM INFORMATION TAB

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



- **Machine Type** - Displays the machine type or model selected during the SmarTrax MD calibration wizard. This information cannot be changed without resetting the SmarTrax MD system. Generic machine types which may be displayed in this area include:
 - SP Sprayer RBoom - Self-propelled sprayer with a rear boom
 - SP Sprayer FBoom - Self-propelled sprayer with a front boom
 - FS Tractor - Front-steered tractor
 - Articulated
 - Track
 - Rear Steered - Rear-steered machine
 - Swather
- **Control Device** - Displays the steering control device (SmarTrax MD) selected during the calibration wizard. This setting cannot be changed without resetting the SmarTrax system.
- **Sensor Type** - Displays the primary sensor type that is providing machine feedback (wheel angle sensor). The sensor type is automatically detected by the system and cannot be changed.
- **Wheel Base** - The measured distance between the front and rear axles on the equipment.
- **Antenna Height** - The measured distance from the ground to the antenna base mounting plate.
- **Antenna Position** - Enter the measured fore/aft distance from the center of the wheel axle to the GPS antenna. The fore/aft offset distance must be measured parallel with the direction of travel.

NOTE: The antenna position measurement will normally be entered as a positive value. If the antenna is mounted behind the rear axle, enter a negative value for the antenna fore/aft position.

- **Recal Steering** - Restarts the machine's steering calibration process. Refer to Calibrate the Machine's Steering System section on page 28 for information on completing the machine's steering calibration.
- **Reset SmarTrax** - Resets the SmarTrax MD system to the default values. Resetting the SmarTrax MD system calibration will delete all system settings and adjustments that have been performed. Before resetting the

system, write down the current system settings for future reference. Recalibrate the SmarTrax MD system after it has been reset.

NOTE: If Reset SmarTrax is selected, the SmarTrax MD system must be recalibrated before the system can be enabled. Refer to the Calibrate the SmarTrax MD System section on page 18 for information on completing the SmarTrax MD system calibration.

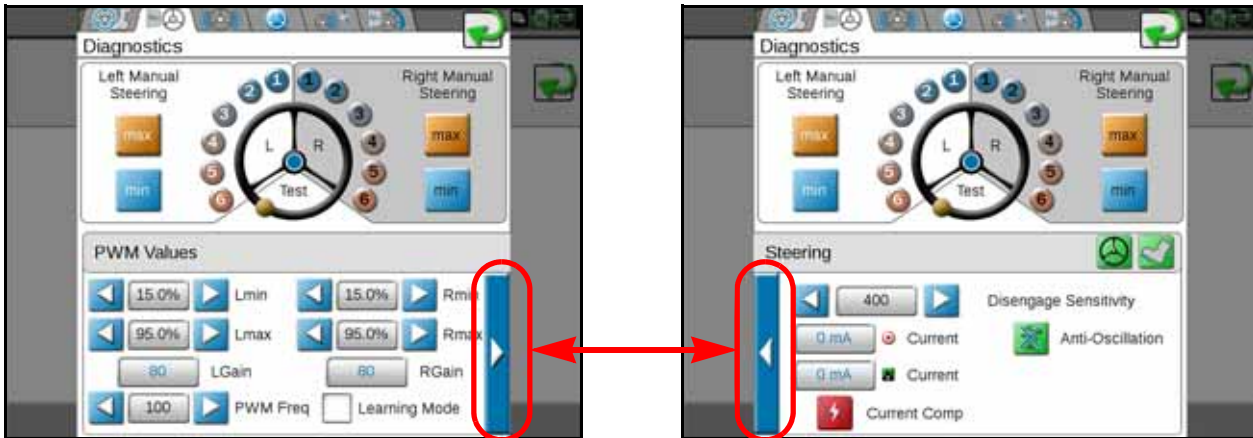
DIAGNOSTICS TAB



- **Left and Right Manual Steer** - Used to manually test the SmarTrax MD system. Select one of the numeric settings (1 being very low, 6 being very high) positioned around the steering wheel graphic 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.
- **PWM Values** - Displays SmarTrax MD 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 MD system unless a technician instructs you to modify the settings.
- **Learning Mode** - Enable the learning mode feature to allow the system to automatically adjust system response during operation. This feature allows the SmarTrax MD system to adjust the PWM minimum values during field operation to continuously tune the steering response for monitored field conditions. Disable learning mode to keep the system from automatically tuning the PWM minimum values and disable automatic system response adjustment. Raven Industries does not typically recommend enabling learning mode to avoid unexpected changes to PWM values.

NOTE: If the PWM values are adjusted, the SmarTrax MD system will no longer automatically adjust the PWM minimum values unless the Learning Mode function is enabled again.

Use the scroll button at the bottom of the Diagnostics prompt to toggle between the following PWM values and steering system settings and options:

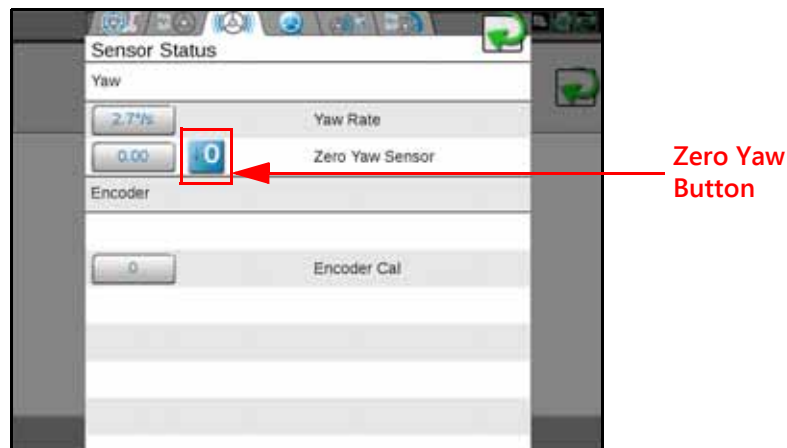


- **Disengage Sensitivity** - Proper tuning of the disengage sensitivity value allows the equipment operator to disengage SmarTrax MD by turning the steering wheel with minimal or moderate effort. Disengage sensitivity requires minimal adjustment.

NOTE: If the sensitivity value is too low, the steering system may disengage in rougher fields without any input from the operator. Raising the sensitivity value too high may make disengaging the SmarTrax MD system at the steering wheel difficult or impossible.

- **Target Current and Actual Current** - Current readings performed on SmarTrax systems MD. 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.
- **Current Compensation** - This feature is not used in SmarTrax MD systems.
- **Anti-Oscillation-Articulated Machines** - This feature is not used in SmarTrax MD systems.

SENSOR STATUS



- The Yaw Sensor Status area of the screen displays the yaw sensor diagnostic information:
 - **Yaw Rate** - Yaw sense detected by the SmarTrax node.
 - **Zero Yaw Sensor** - Displays the offset currently programmed into the system to compensate for imperfections in Yaw Rate readings.
 - **Zero Yaw Button** - Recalibrates the yaw sensor to zero. The machine must be at a full stop before recalibrating the yaw sensor. The example above shows the Zero Yaw Sensor as already been recalibrated to 0. During normal operation, the value will likely show a value other than 0.

SMARTRAX 3D COMPENSATION TAB



- **Forward and Downward** - Indicate the orientation of the node programmed during calibration of the SmarTrax MD system.
- **Yaw Rate, Roll, Pitch, and Yaw** - Real-time measurement data used by the 3D terrain compensation feature.
- **Current Direction** - Indicates the direction in which the machine is traveling. 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.
- **3D Compensation** - Touch the 3D Compensation status button to toggle the 3D compensation features on or off. When disabled, the SmarTrax MD system will not adjust the displayed guidance path for any machine tilt during field operations.
- **Calibrate** - Used to calibrate the 3D terrain compensation feature. Refer to the Enhanced Tilt Calibration section on page 23 for the calibration procedure.

GPS SETUP TAB



- **SmarTrax 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 MD will allow to run. Raising this number may degrade system performance.

NOTE: The default SmarTrax HDOP limit is 2.5. Increasing the HDOP limit may degrade SmarTrax performance. Decreasing the HDOP limit may cause SmarTrax MD to disengage more often.

- **SmarTrax GPS Baud** - The rate the system uses to communicate with the GPS receiver. This value is typically set to 19200, but it can be changed to match the baud rate of receivers that cannot be easily changed to 19200.

NOTE: With the 600S GPS Receiver and SmarTrax MD software version 7.6 and newer, the GPS baud will automatically change to 115200 to allow communication with the 600S for configuration or changing settings.

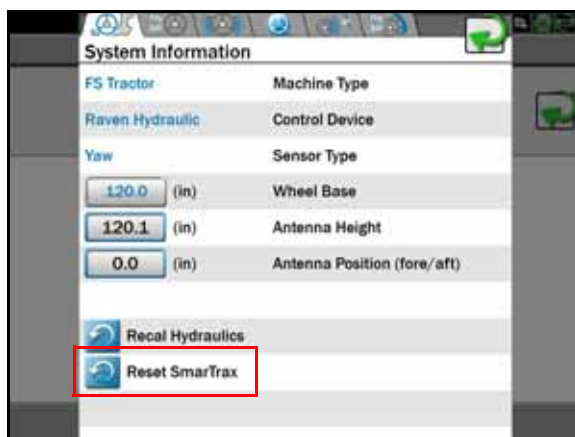
- **SmarTrax GPS Frequency** - The GGA message update frequency in hertz (Hz).
- **Minimum GPS Correction** - This setting is used to select the correction source providing the minimum accuracy allowable for SmarTrax operation. This selection may be used to prevent the SmarTrax system from sudden course changes if the desired correction source is lost. For example, selecting RTK for this feature will disengage SmarTrax if RTK corrections are lost.

ERROR LOG TAB



- **Error Log** - Displays the last ten errors or status messages that have appeared in the SmarTrax MD status area of the Viper 4 and the time they occurred.
- **Vehicle Database Version** - The vehicle database version currently installed on the SmarTrax MD control node. It contains the list of machine tune sets with their measurements.

RESET CALIBRATION

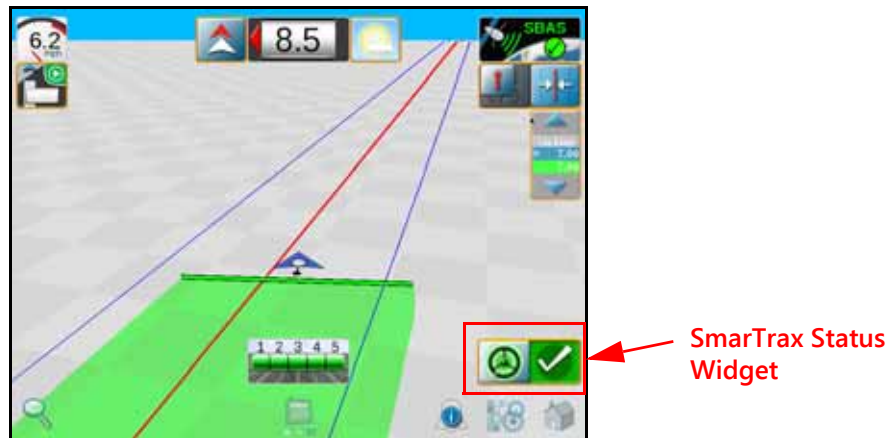


Resetting the SmarTrax system calibration will delete all system settings and adjustments that have been performed. Before resetting the SmarTrax calibration, write down the current system settings for reference later. Recalibrate the SmarTrax system after the system is reset.

ROUTINE OPERATION

ENGAGE SMARTRAX

FIGURE 31. SmarTrax Status Widget



NOTE: If the SmarTrax steering widget does not appear on the screen, refer to the Viper/Viper 4+ Installation and Operation manual (P/N 016-0171-539) for further information on adding widgets.

The SmarTrax MD system may be engaged using the following methods:

- Tap the foot switch or rocker switch to engage SmarTrax MD system without touching the Viper 4 display.
- Press the SmarTrax MD on-screen status widget to engage the system during field operation.

NOTE: The operator liability waiver must be accepted before the SmarTrax MD system can be enabled for operation.

SYSTEM SETTINGS

System Setting	Average Setting	Suggested Range	Function
Line Acquisition (LA) Aggressiveness	10	4 to 16	The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is traveling further than 24 inches [60 cm] from the desired path.
OnLine (OL) Sensitivity	10	4 to 20	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	10 Hz	Displays the frequency of GGA messages from the GPS receiver.
Message Frequency - ZDA	.3 Hz	.3 to 10 Hz	Displays the frequency of GGA messages from the GPS receiver.
HDOP	2.5	N/A	Indicates the quality of the GPS signal.

CHAPTER

4

VIPER PRO CALIBRATION AND OPERATION

INTRODUCTION






SOFTWARE COMPATIBILITY



The instructions in this manual apply to Viper Pro software version 3.9.0.8 or higher. The SmarTrax node software version must be running software version 6.1.90 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.

For SmarTrax MD swather operation, the SmarTrax MD unit must be running software version 1.3.60 or higher with the SmarTrax node MD software version 6.3.55 or higher. Together, these node software versions support SmarTrax MD swather control.

SMARTRAX MD STATUS DISPLAY

The current status of the SmarTrax MD system can be determined by the message displayed in the SmarTrax MD 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 MD system.
	SmarTrax MD is detected but not calibrated. The system must be calibrated before it can be used.
	SmarTrax MD is detected, turned on, and calibrated.
	SmarTrax MD is detected and in operation in the Online Sensitivity adjustment mode.
	SmarTrax MD is detected and in operation in the Line Acquisition Aggressiveness adjustment mode.

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

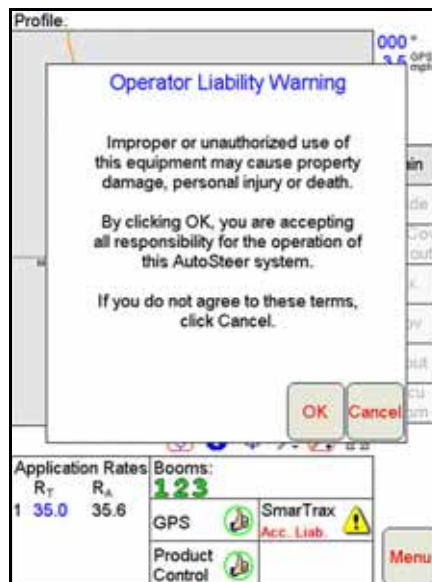
INITIAL STARTUP

NOTE: During the initial startup of the SmarTrax MD 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 MD system.

SMARTRAX MD TERMS OF USE

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

FIGURE 1. Operator Liability Warning Screens



The operator must select OK before the SmarTrax MD 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



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

MACHINE CONFIGURATION

CALIBRATION WARNING

FIGURE 3. SmarTrax Warning Screen



NOTE: The screen above should only appear the first time SmarTrax MD is accessed or if default settings have been restored. Select **Yes** to continue.

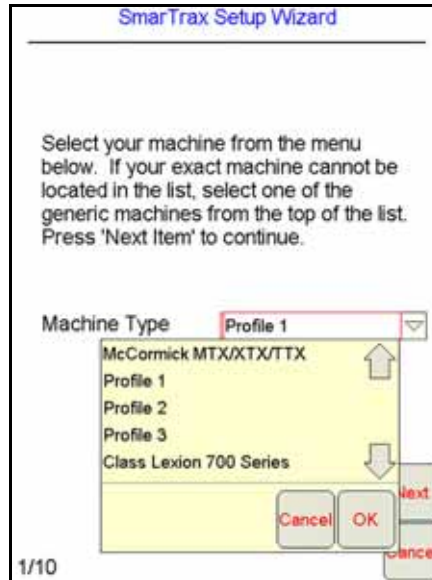
If this prompt continues to appear and the default settings have not been restored, contact your local Raven dealer for assistance.



SET UP MACHINE PROFILE(S) - OPTIONAL

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

FIGURE 4. Machine Configuration Menu

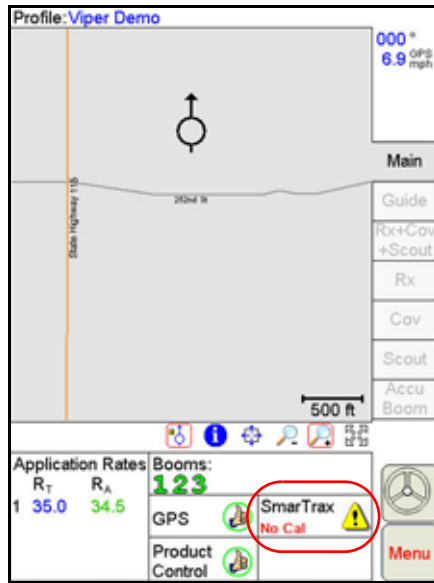


3. Select one of the profile options from the bottom of the Machine Type list.
4. Select **Next**.
5. Select **New**, **Load**, or **Reset**.
 - **New** creates a new machine profile. Once **New** is selected, the screen will return to the Machine Type list to allow the operator to select the appropriate tune set and continue with the calibration process. Once the calibration process is complete, the machine will be associated with the Profile number selected.
 - **Load** allows the operator to select an existing profile. **Load** will not be displayed as an option until the machine calibration has been performed and a new profile has been set up.
 - If the profile chosen has previously been calibrated on the machine, the calibration process is complete.
 - If the profile chosen has not been calibrated on the machine, the calibration process must be completed as outlined in the following sections in this manual.
 - **Reset** clears the previous profile settings. Once **Reset** is selected, the operator must select the machine from the Machine Type list and the calibration process must be completed as outlined in the following sections in this manual. **Reset** will not be displayed as an option the machine calibration has been performed and a new profile has been set up.
6. Select **Next**.

MACHINE-SPECIFIC CONFIGURATION

Before the SmarTrax MD system may be enabled, the Viper Pro and SmarTrax MD 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 MD system.

FIGURE 5. SmarTrax MD Access Button



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

FIGURE 6. SmarTrax MD Warning Screen

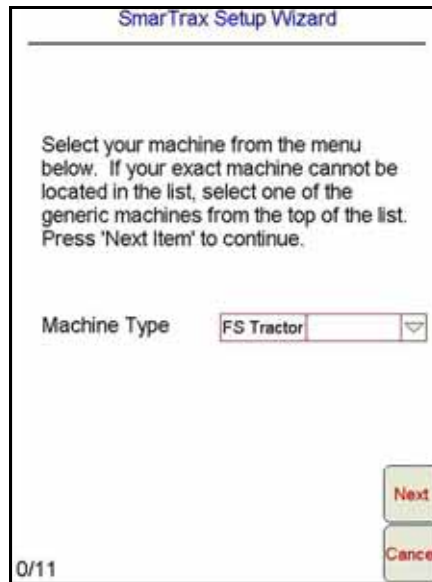


NOTE: The screen above should only appear the first time SmarTrax MD is accessed or if default settings have been restored. If this prompt reappears, contact your local Raven dealer for assistance.

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



FIGURE 7. 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:
 - SP Sprayer RBoom - Self-propelled sprayer with a rear boom
 - FS Tractor - Front-steered tractor
 - Articulated
 - Track
 - Rear Steered - Rear-steered machine
 - Swather
4. Select **OK**.
5. Select **Next Item**. The following screen will appear

FIGURE 8. Steering Control Device Selection Screen



6. Select **SmarTrax MD** in the Control Device drop-down field.

NOTE: The steering control device may need to be selected manually (even if SmarTrax MD is displayed in the Control Device field) before the system will proceed with the calibration process..

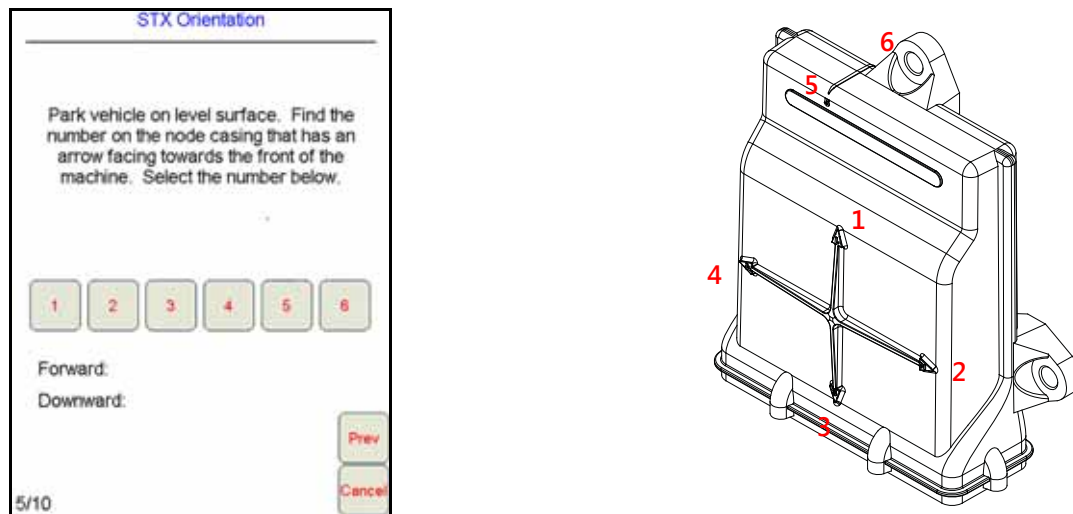
7. Select **Next Item**.

CALIBRATE THE SMARTRAX MD SYSTEM

IMPORTANT: The switch on the bottom of the MDU must be turned on before calibrating the steering system.

NODE ORIENTATION

FIGURE 9. Node Orientation Screen




1. Park the machine on a level surface.
2. 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 MD Setup Wizard will automatically advance to the next step in the calibration process once the node calibration is complete.

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 MD system.

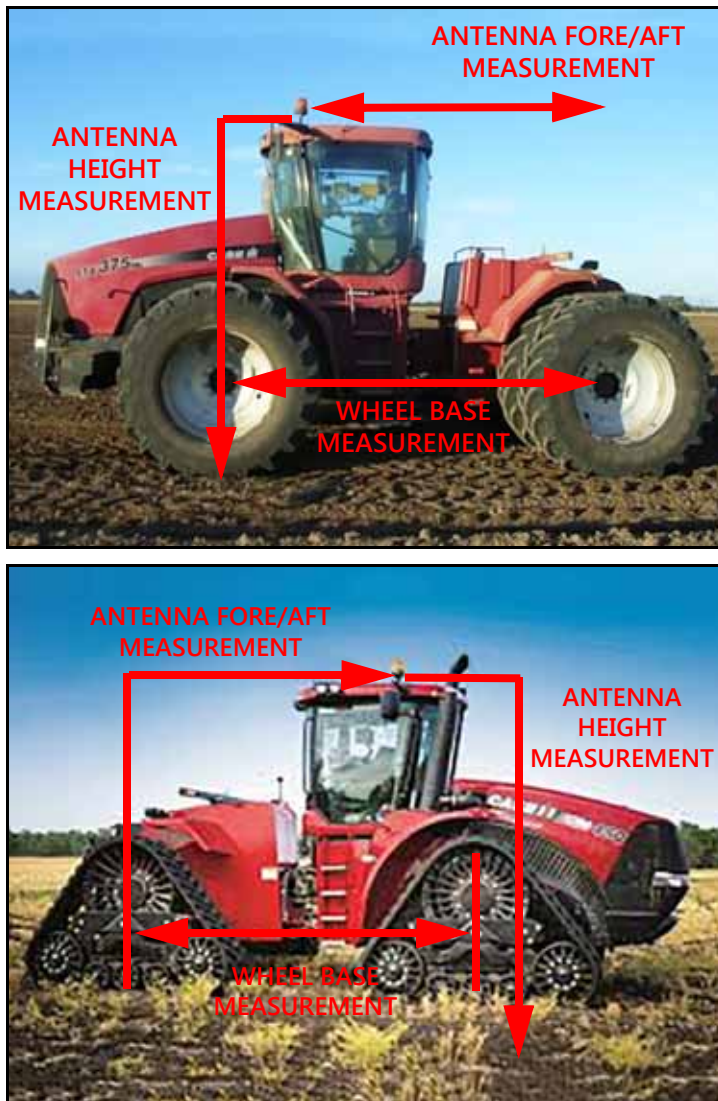
IMPORTANT: If a specific machine profile was selected during the machine configuration process, the Wheel base, Antenna Position, and Antenna Height measurements will be automatically populated in the screen. However, the antenna mounting position may vary on the machine, so it is important to re-measure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

	<h2 style="margin: 0;">NOTICE</h2>
<p>The Wheel Base, Antenna Position, and Antenna Height values are critical to the operation of the SmarTrax MD system. Measure these dimensions accurately to ensure optimal SmarTrax MD system performance!</p>	

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

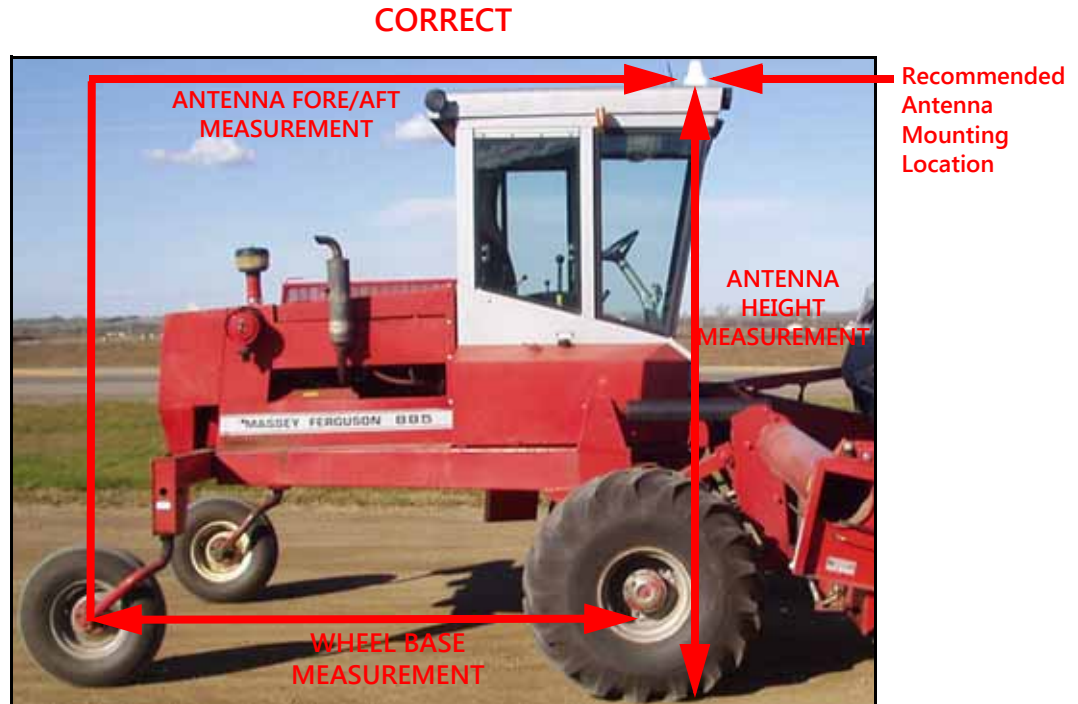
NOTE: For articulated machines, measure from the center of the front tire to the center of the rear tire on both sides of the machine. Add the values together and divide the number by two to find the average.

FIGURE 10. Articulated Machine Measurements



NOTE: For swather machines, the rear wheels **MUST** be positioned behind the pivot point and pointing forward to reflect the tire position during normal, straight line operation. To figure the wheelbase distance, measure from the center of the rear tire to the center of the front tire.

FIGURE 11. Swather Machine Measurements



INCORRECT WHEEL BASE MEASUREMENT



Wheel base measurement taken from pivot point instead of the center of the front wheel.



Wheel base measurement taken with wheels reversed and not in the straight line operation position.

FIGURE 12. Wheel Base Configuration Screen

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

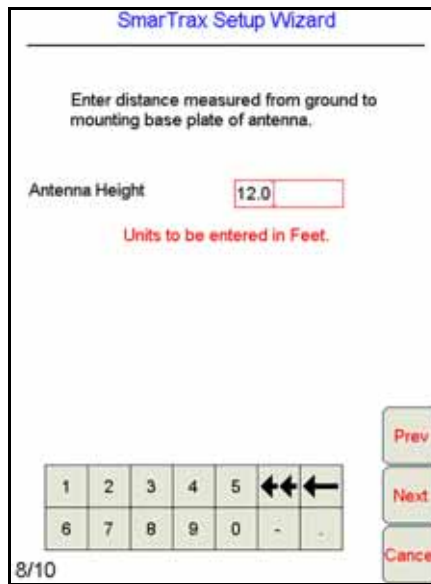
FIGURE 13. Antenna Position Configuration Screen

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. Raven Industries recommends mounting the antenna in front or even with the rear axle.

6. Select **Next**.
7. To determine the Antenna Height, measure the from the ground to 4" above the base of the antenna.

FIGURE 14. Antenna Height Configuration Screen



SmarTrax Setup Wizard

Enter distance measured from ground to mounting base plate of antenna.

Antenna Height

Units to be entered in Feet.

1	2	3	4	5	←	←
6	7	8	9	0	-	.

8/10

Prev
Next
Cancel

8. Enter the Antenna Height measurement.
9. Select **Next**. The following screen will appear:

FIGURE 15. Checking for GPS Screen



SmarTrax Setup Wizard

Please wait ...Checking for GPS.

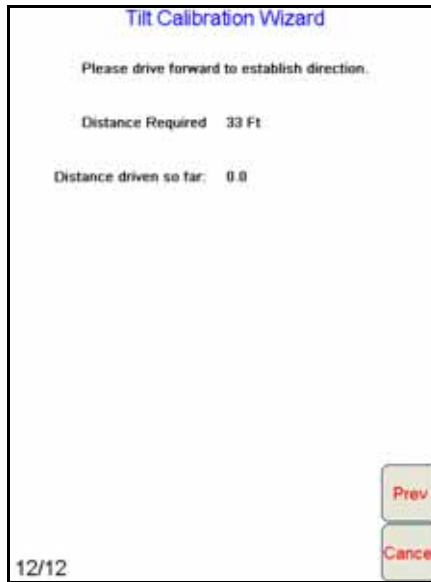
9/10

Prev
Cancel

10. Allow the system to detect the GPS installed in the system.

ENHANCED TILT CALIBRATION

FIGURE 16. Establishing Heading Screen



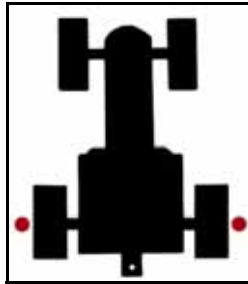
1. Drive straight ahead 33 feet to allow SmarTrax MD to acquire a heading.

FIGURE 17. Enhanced Tilt Calibration Wizard



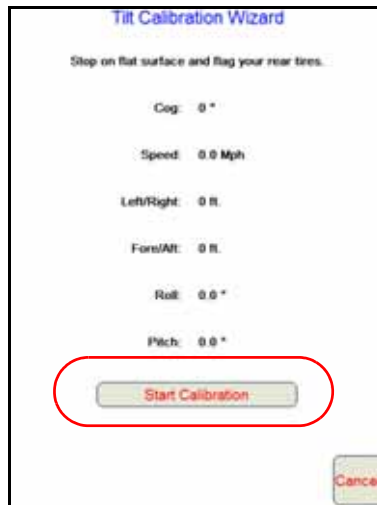
2. Park the machine on a flat surface.

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



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

FIGURE 19. Tilt Calibration Screen



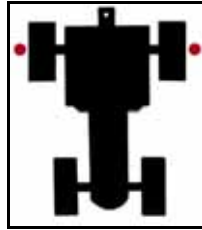
5. Select **Start Calibration**. The following screen will appear:

FIGURE 20. Calibration in Progress Screen



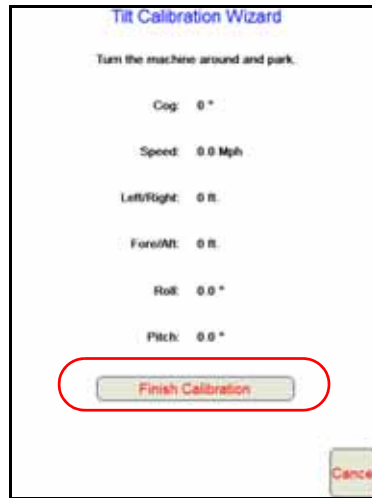
NOTE: The calibration may take a few minutes to complete.

FIGURE 21. Machine Orientation After Tilt Calibration



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

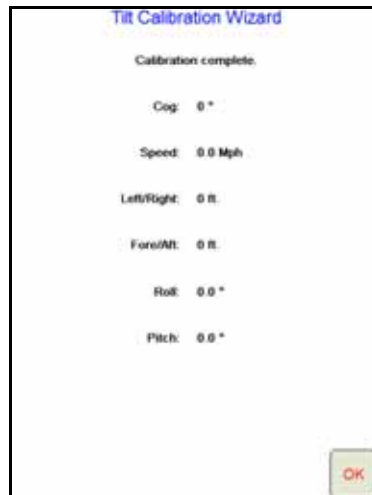
FIGURE 22. Finish Calibration



7. 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. The rear wheels will not necessarily end up aligned exactly with the markers to get the Fore/Aft number to turn black.

FIGURE 23. Calibration Complete



8. Select **OK**.

STEERING SWITCH CALIBRATION

IMPORTANT: The switch on the bottom of the mechanical drive must be turned on before calibrating the steering system.

FIGURE 24. Steering Switch Calibration Screen



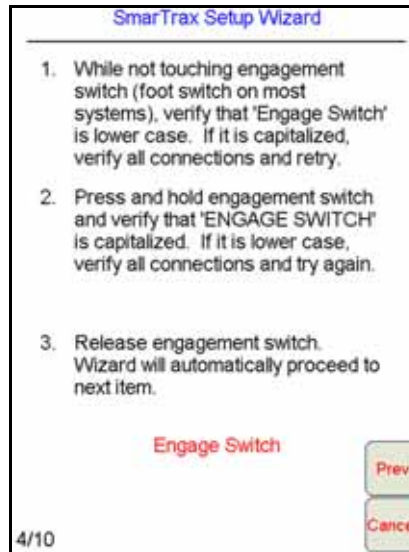
1. Review the on-screen instructions and turn the steering wheel to verify proper operation.

NOTE: The SmarTrax MD 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 6, Troubleshooting for troubleshooting information. If the problem persists, contact your local Raven dealer for further information.

2. Proceed to Engage Switch Calibration below to continue with the system calibration.

ENGAGE SWITCH CALIBRATION

FIGURE 25. Engage Switch Calibration Screen

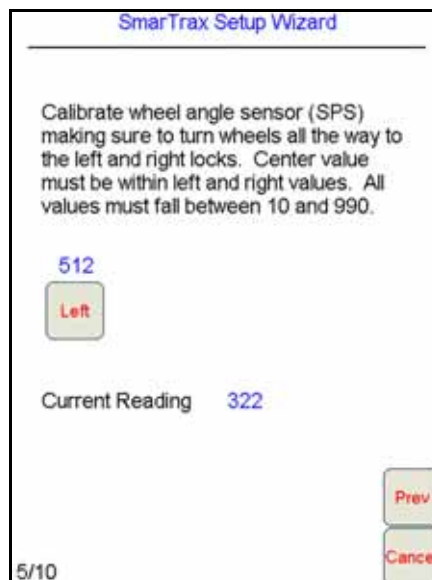


1. Review the on-screen instructions.
2. Press and release the foot switch or engage switch.

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

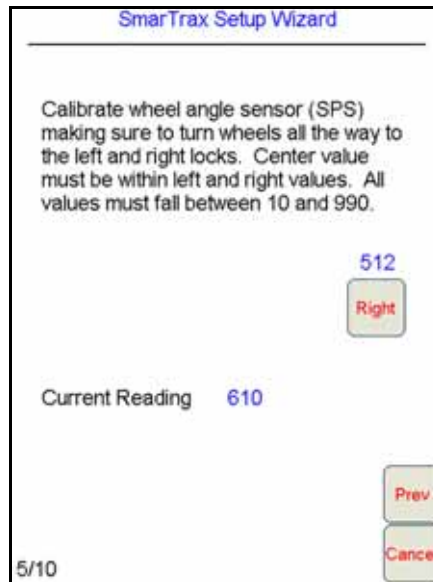
WHEEL ANGLE SENSOR (SPS) CALIBRATION

FIGURE 26. SPS Calibration Screen



1. While driving slowly, turn the steering wheel fully to the left wheel lock.
2. Select **Left**.

FIGURE 27. SPS Calibration Screen




3. Turn the steering wheel fully to the right wheel lock.
4. Select **Right**.
5. Select **Next**.

CALIBRATE THE MACHINE'S STEERING SYSTEM

After the initial calibration of the SmarTrax MD system is complete, it is necessary to calibrate the machine's steering system. This allows the SmarTrax MD system to learn the steering capabilities of the machine to allow SmarTrax MD 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.



⚠ 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.



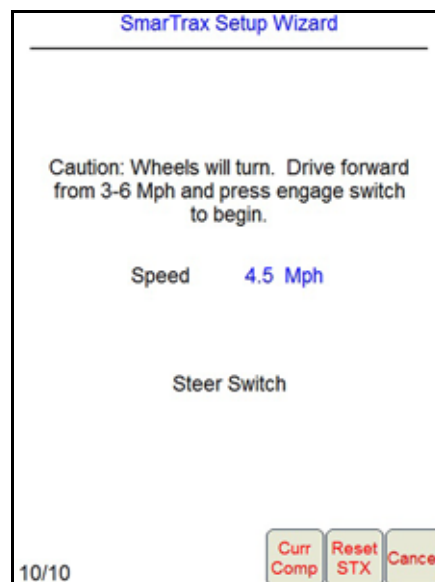
NOTICE

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 MD system may learn incorrect steering responses for normal operating conditions.

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

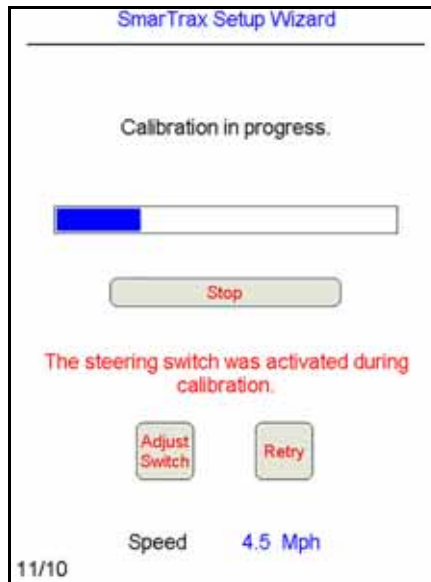


1. Position the machine in an open space with several acres of smooth ground available to perform the machine's steering calibration.
2. Press the foot/engage switch to begin calibration.

NOTE: During calibration, the machine will turn hard to the left and then to the right. Adjust the speed and vehicle location as necessary.

NOTE: After calibration is complete, the SmarTrax MD menu will be displayed.


FIGURE 29. Steering Calibration Resume Screen



If the wheels strike the stops at the end of travel or if a high degree of effort is required to turn the wheels during calibration, steering may be disengaged. If steering becomes disengaged during calibration:

- Press **Stop** to cancel the calibration. Adjust the amount of effort required to disengage the steering system by pressing the **Adjust Switch** button.
- Press **Retry** to return to the calibration process. Retry is most commonly used when the system is intentionally disengaged to avoid obstacles.

COMPLETE THE SMARTRAX MD 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 MD 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 MD system.

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 Advanced Setup Tools section below for 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 30. SmarTrax MD Enable Icon



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

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

4. Allow SmarTrax MD to run while driving back and forth along the A-B guidance line.

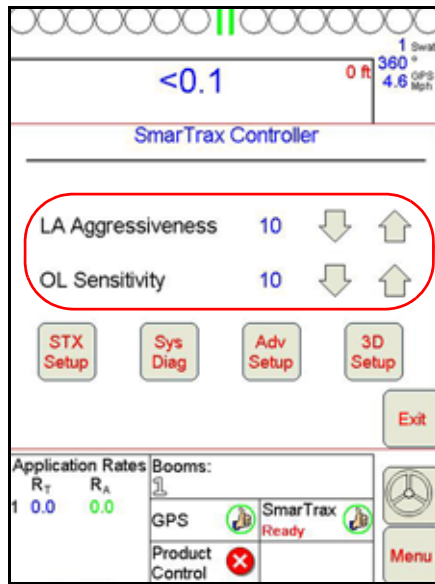
NOTE: If the machine is not operating to specifications, manual adjustment of the SmarTrax MD system may be necessary. Refer to the Advanced Setup Tools section below information on adjusting the SmarTrax MD system.

ADVANCED SETUP TOOLS

Are these necessary since they also appear in the Advanced Setup and Diagnostics section?

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 31. SmarTrax MD 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 steering system. Increasing the LA value at the maximum vehicle speed may degrade performance of the SmarTrax MD system.

FIGURE 32. LA Mode Indicator



The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is traveling further than 24 inches [60 cm] from the desired path. If the machine drives past the line and has to drive back to it, increase the LA Aggressiveness value one increment at a time, allowing SmarTrax MD 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 settle on the line.

ON-LINE (OL) MODE AND SENSITIVITY

FIGURE 33. OL Mode Indicator

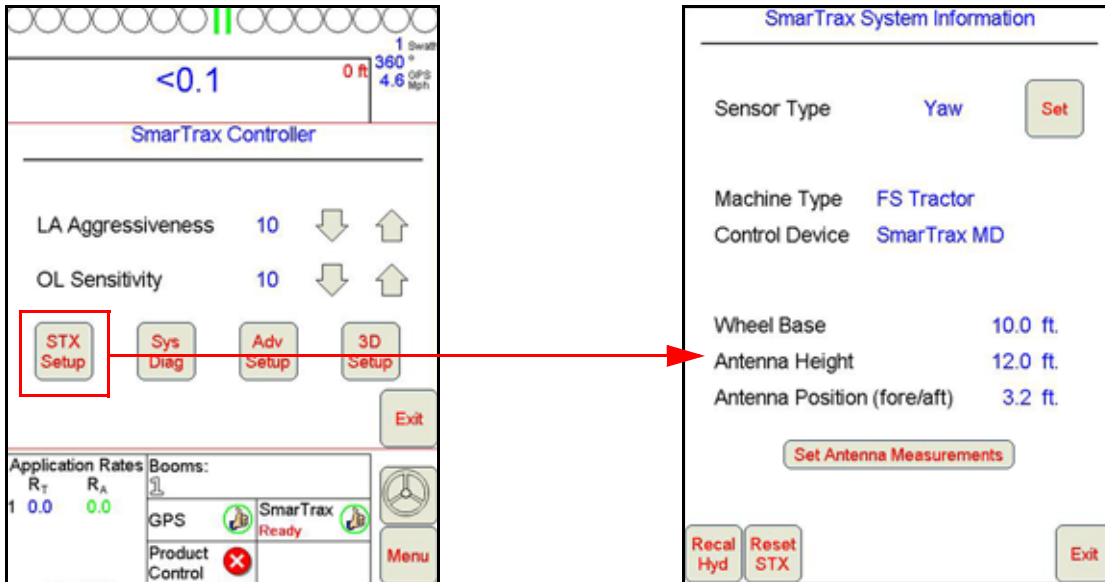


The OL Sensitivity value affects the response of the machine while steering within 24 inches [60 cm] of the displayed guidance line. If the machine tends to slowly weave across the guidance line and does not remain within 24 inches [60 cm] of the desired path, increase the OL Sensitivity value one increment at a time, allowing SmarTrax MD 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 34. SmarTrax MD Setup Screen



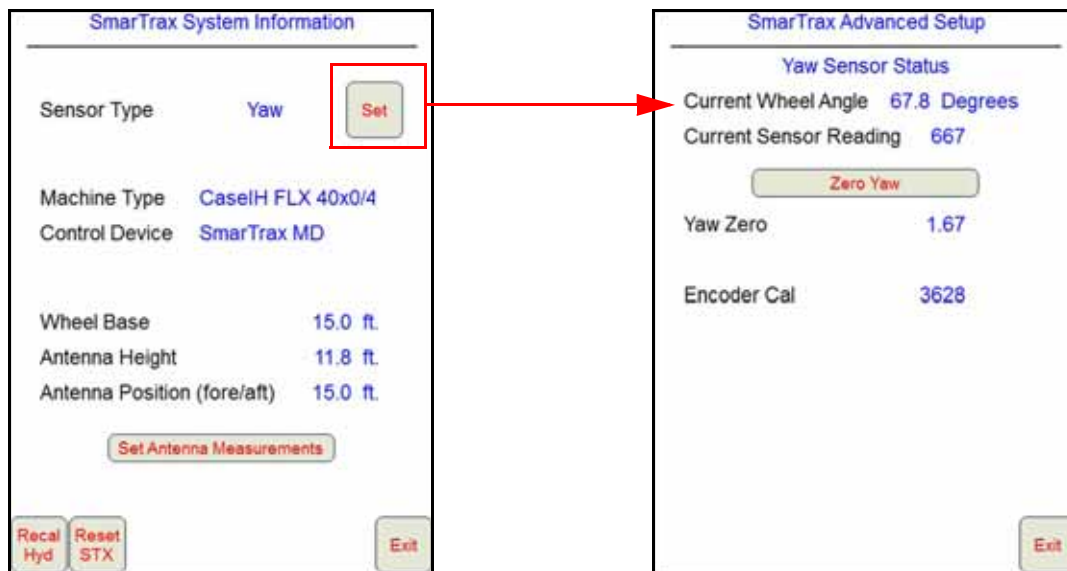
NOTE: To change the Machine Type, Control Device, or Wheel Base settings, the SmarTrax MD system must be reset and recalibrated.

- **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 57 for information on completing the machine’s steering calibration.
- **Reset STX** - Resets the SmarTrax MD system to the default values.

IMPORTANT: If Reset STX is selected, the SmarTrax MD system must be recalibrated before the system can be enabled. Refer to Calibrate the SmarTrax MD System section on page 47 for information on completing the SmarTrax MD system calibration.

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

FIGURE 35. Sensor Status Screen

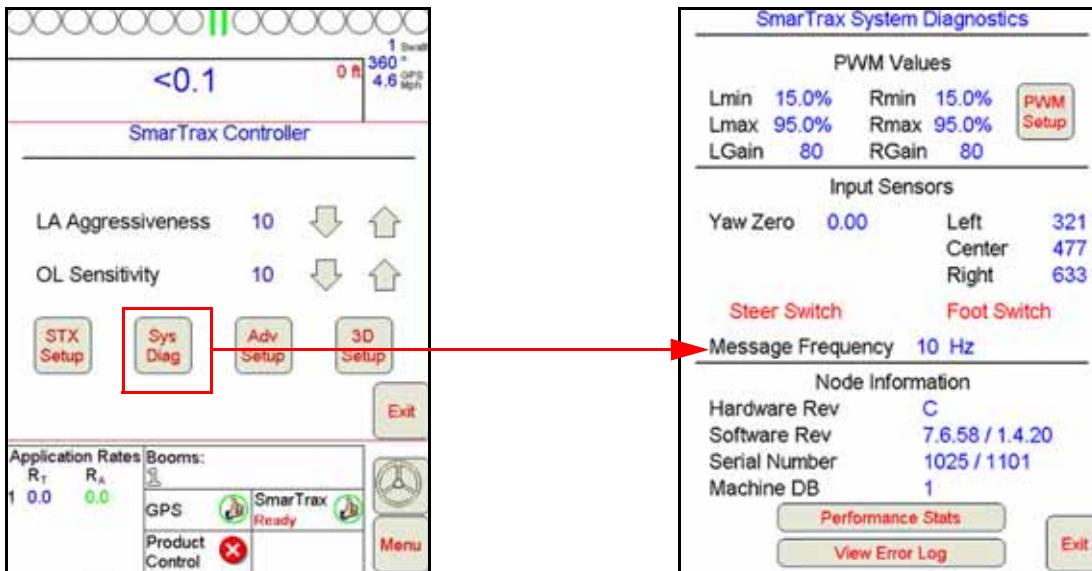


- The Yaw Sensor Status area of the screen displays the yaw sensor diagnostic information:
 - **Current Wheel Angle** - An approximation of the machine's wheel angle.
 - **Current Sensor Reading** - The current value of the encoder.
 - **Zero Yaw Button** - Recalibrates the yaw sensor to zero. The machine must be at a full stop before recalibrating the yaw sensor.
 - **Yaw Zero** - The yaw sensor reading while the machine is stationary. The acceptable operating range for the Yaw Zero measurement is -2.00 to 2.00. Readings outside this range indicate that a sensor within the node is operating outside of specifications and that the node must be repaired.
 - **Encoder Cal** - The ratio of the steering wheel movement to the machine's wheel movement.

SYS DIAG SCREEN

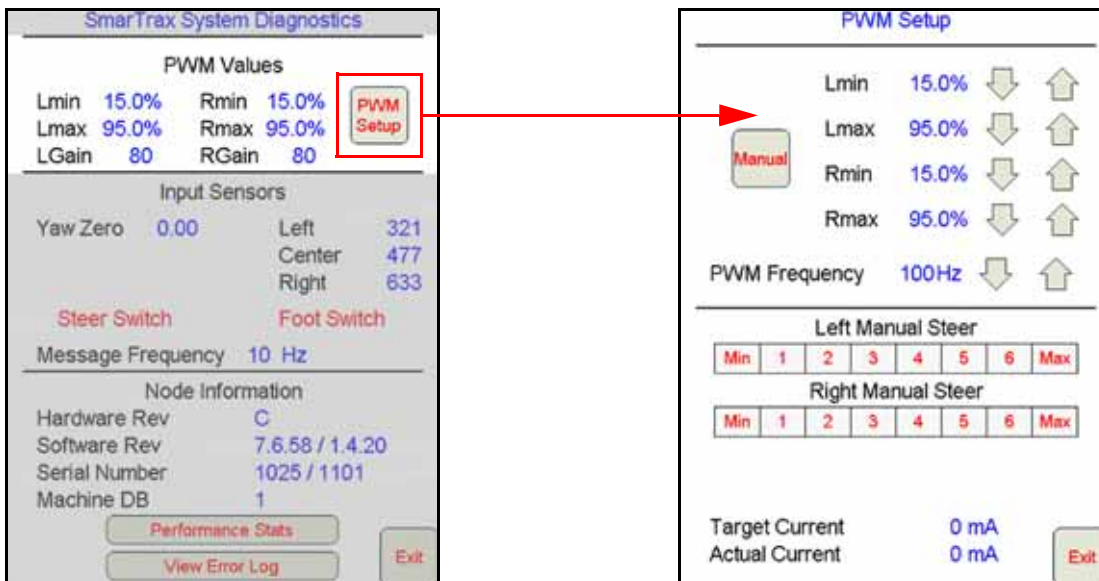
The System Diagnostics screen contains the PWM values and system input diagnostic tools.

FIGURE 36. SmarTrax MD Controller and System Diagnostics Screens



- **Input Sensors** - Displays sensor calibration values.
- **Steer Switch and Foot Switch** - Displays the state of the disengage switch/transducer and foot/engage switches. Lower-case letters indicate that there is no input from the switches. Upper-case letters indicate activation of the switches.
- **Message Frequency** - Displays GGA input message rate.
- **Node Information** - Displays node hardware version, software version, and serial number.
- **Exit** - Returns to the SmarTrax MD Controller screen.
- **Machine DB** - The database stores the information that was entered into the Viper Pro during initial startup. In the SmarTrax MD system, there is only one database version.

FIGURE 37. System Diagnostics and PWM Setup Screens

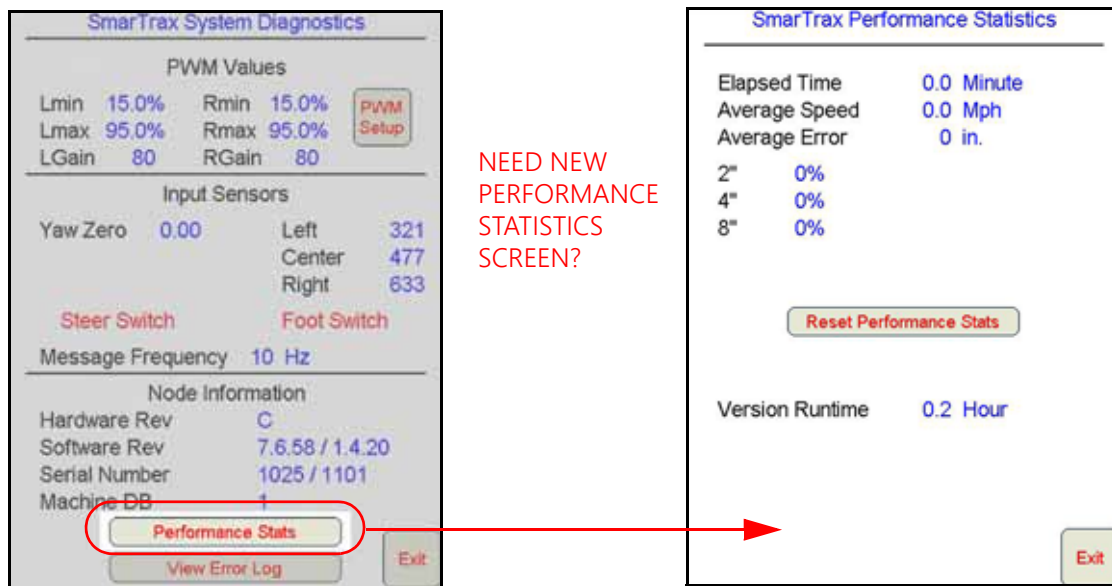


- **PWM Values** - Displays SmarTrax MD PWM minimum, maximum, and gain values. Adjustment of these values is not typically necessary. Raven Industries recommends leaving these values as configured by the

SmarTrax MD system unless a technician instructs you to modify the settings. Pressing Modify PWM Settings displays the PWM Setup screen to allow manual adjustments to the PWM values.

- **Auto or Manual** - Toggles between automatic and manual control of the PWM values. 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 MD 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 MD to manual mode. Raven Industries does not advise leaving the system in auto mode as the PWM minimum values may change unpredictably.
- **Left and Right Manual Steer** - Used to manually test the SmarTrax MD 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** - Displays the expected current level for the mechanical drive to turn the steering wheel.
- **Actual Current** - Displays the amount of current the system is using to steer the machine.
- **Exit** - Returns to the System Diagnostic screen.

FIGURE 38. System Diagnostics and SmarTrax MD Performance Statistics Screens

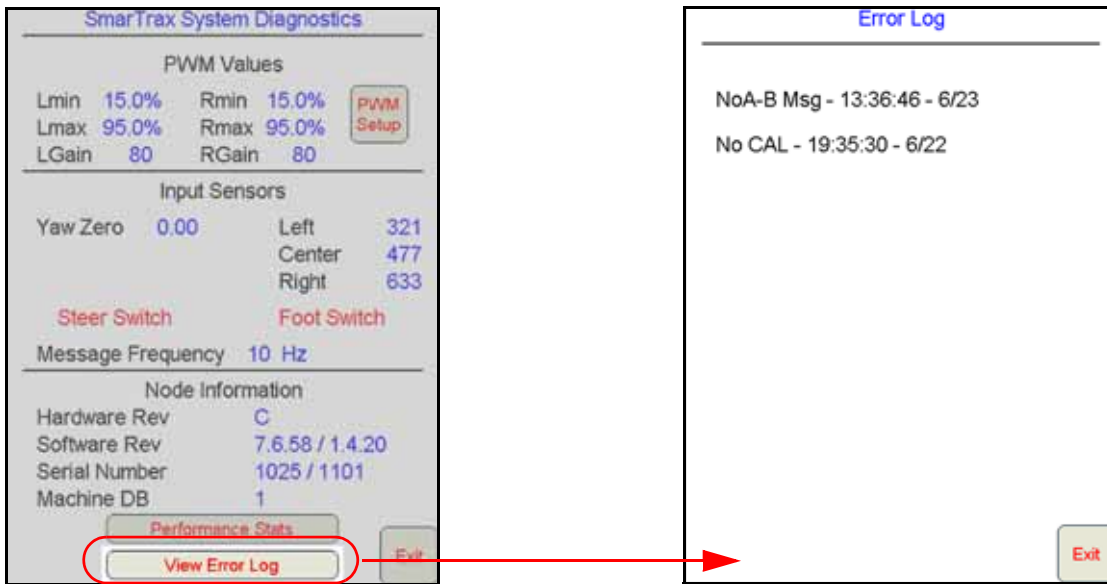


- **Performance Stats** - Displays the SmarTrax MD system performance statistics.
 - **Elapsed Time** - Length of time the SmarTrax MD system has been running.
 - **Average Speed** - Average vehicle speed over the last hour while SmarTrax MD has been running.
 - **Average Error** - Average distance from the desired guidance path or line during the last hour while SmarTrax MD has been running.
 - **1", 2", and 4"** - 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 non-RTK systems, the values are 2", 4", and 8".

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

FIGURE 39. SmarTrax MD Diagnostics and Error Log Screens

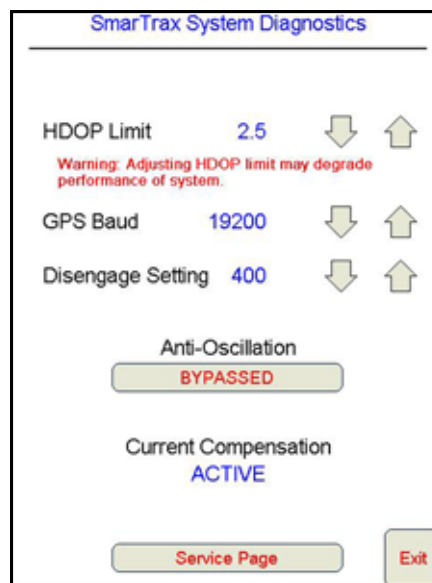


- **View Error Log** - Displays the Error Log screen, which contains the last 10 errors that have appeared in the SmarTrax MD status area of the Viper Pro and the time they occurred.
- **Exit** - Returns to the System Diagnostics screen.

ADV SETUP SCREEN

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

FIGURE 40. 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

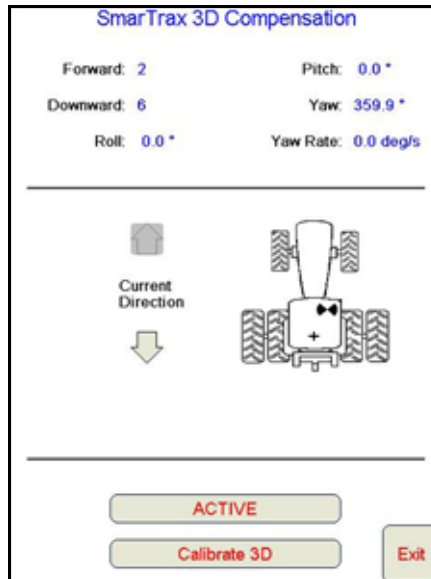
of the guidance system. The number displayed is the maximum number SmarTrax MD will allow to run. Raising this number may degrade system performance.

- **GPS Baud** - The rate the system uses to communicate with the GPS receiver. This value must match the value of the GPS receiver installed in the system.
- **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 MD setup. Enabling this feature with any machine that is not articulated may degrade the system performance.
- **Service Page** - Used only for software programming purposes and is not accessible without a code.
- **Exit** - Returns to the SmarTrax MD Controller screen.

ENHANCED TILT SETUP SCREEN

The SmarTrax MD 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. Terrain Compensation Information Screen

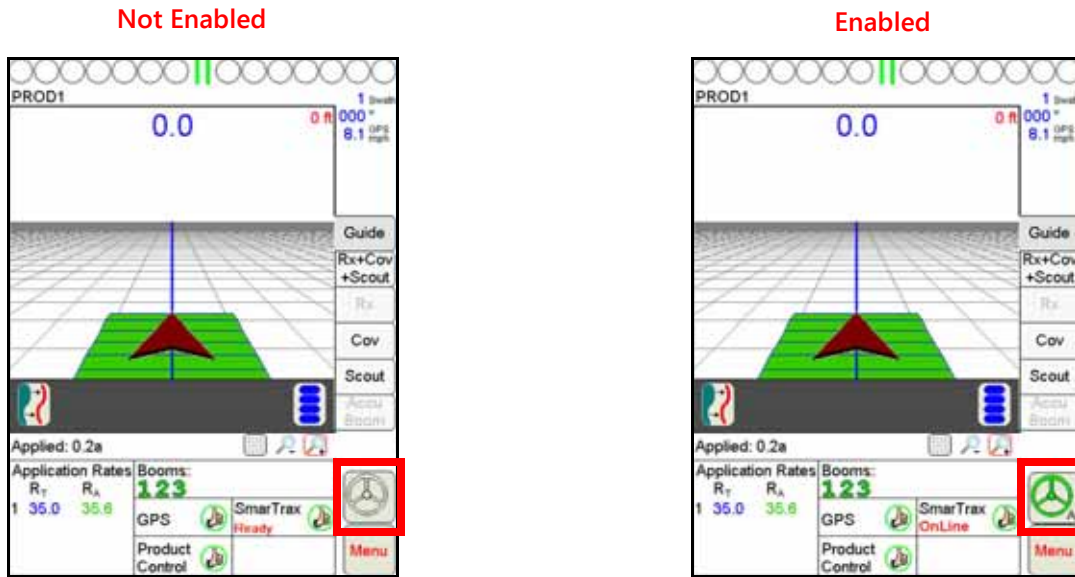


- **Roll, Pitch, Yaw, and Yaw Rate** - Real-time measurement data used by the 3D terrain compensation feature.
- **Direction of Travel** - Indicates the direction in which the machine is traveling. If the direction is incorrect, drive forward and press the Send Forward Command button. Verify the direction 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 MD system.
- **Calibrate 3D** - Used to calibrate the 3D terrain compensation feature. Refer to the Enhanced Tilt Calibration section on page 52 for the calibration procedure.
- **ACTIVE/BYPASSED** - Used to toggle the 3D terrain compensation feature on and off.

ROUTINE OPERATION

ENGAGING SMARTRAX MD

FIGURE 42. SmarTrax MD System Engaged



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

SYSTEM SETTINGS

System Setting	Average Setting	Suggested Range	Function
Line Acquisition (LA) Aggressiveness	10	5 to 13	The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is traveling 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	10 Hz	Displays the frequency of GGA messages from the GPS receiver.

System Setting	Average Setting	Acceptable Range	Function
Message Frequency - ZDA	.3 Hz	.3 Hz to 10 Hz	Displays the frequency of GGA messages from the GPS receiver.
HDOP	2.5	N/A	Indicates the quality of the GPS signal.

CHAPTER

5

ENVIZIO PRO AND CRUIZER II CONSOLES CALIBRATION AND OPERATION

INTRODUCTION

SOFTWARE COMPATIBILITY

The instructions in this manual apply to Envizio Pro consoles with software version 3.6.0.27 or higher and Cruizer II consoles with software version 3.1.2.29627 or higher. The SmarTrax node must be running software version 6.1.90 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.

For SmarTrax MD swather operation, the SmarTrax node must be running software version 1.3.60 or higher with the SmarTrax node software version 6.3.55 or higher. Together, these node software versions support SmarTrax MD swather control.










SMARTRAX MD STATUS DISPLAY

FIGURE 1. Main Menu



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

The current status of the SmarTrax MD 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 MD is detected and turned on, with no errors detected.
	SmarTrax MD is detected and turned on, but is not enabled. Tap the foot switch or touch the steering wheel icon to enable the SmarTrax MD system.
	SmarTrax MD is detected and in engaged, with no errors detected.
	Previous - Returns the Envizio Pro or Cruizer display to the previous screen in the setup process.
	Next - Saves the changes made to the SmarTrax MD system and proceeds to the next step in the setup process.
	Accept - Saves the changes made to the SmarTrax MD 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 II - CONNECTING TO SMARTRAX MD VIA CAN COMMUNICATION

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 115,200 is displayed, then tap it to highlight it 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. Failure to allow the data transfer to complete may require a restart of the entire SmarTrax MD 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 typically takes around two minutes, but can take up to 20 minutes.

10. Proceed to SmarTrax MD Terms of Use section on page 74.

ENVIZIO PRO

DATA TRANSFER

During the initial startup of the SmarTrax MD 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 MD system.

NOTE: The Rx and Tx lights on the SmarTrax node will flashing rapidly during the data transfer. The Rx and Tx lights will flash slowly or turn off when the data transfer is complete. Attempting to access the SmarTrax MD configuration screen while language data is transferring will open a message asking the user to try again later.

NOTE: The steps in this section apply only to Envizio Pro field computers that contain internal GPS. If internal GPS is not present in the Envizio Pro, proceed to SmarTrax MD Terms of Use section on page 74.

GPS CONFIGURATION

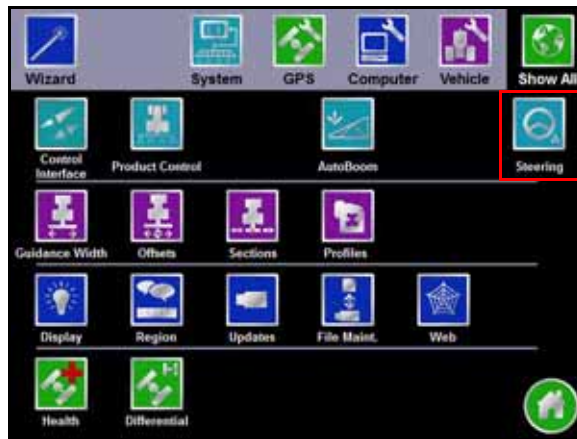
FIGURE 2. Tools Menu



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

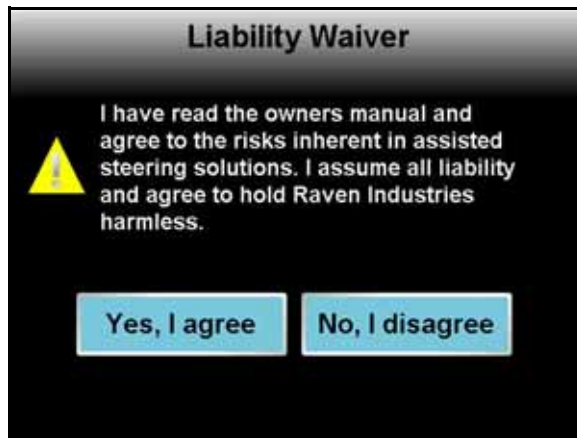
SMARTRAX MD TERMS OF USE

FIGURE 3. Steering Icon



1. Select the **Steering** icon.

FIGURE 4. Terms of Use



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

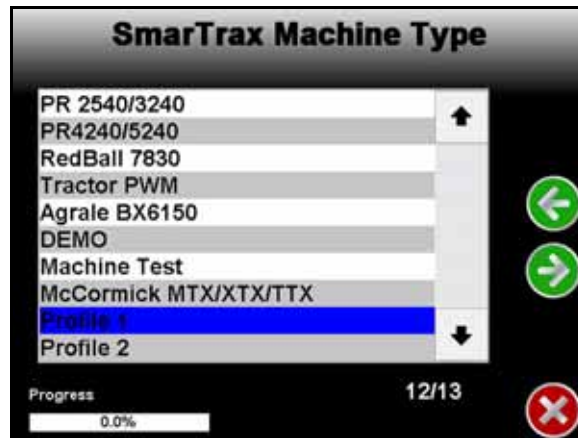
NOTE: The operator must agree to the terms of use before the SmarTrax MD system may be enabled or calibrated. The Liability Waiver screen will appear each time the field computer is turned on or rebooted.

MACHINE CONFIGURATION

SET UP MACHINE PROFILE(S) - OPTIONAL

1. Touch the SmarTrax area on the main screen.
2. Select **Yes**. The following screen will appear:

FIGURE 5. Machine Configuration Menu

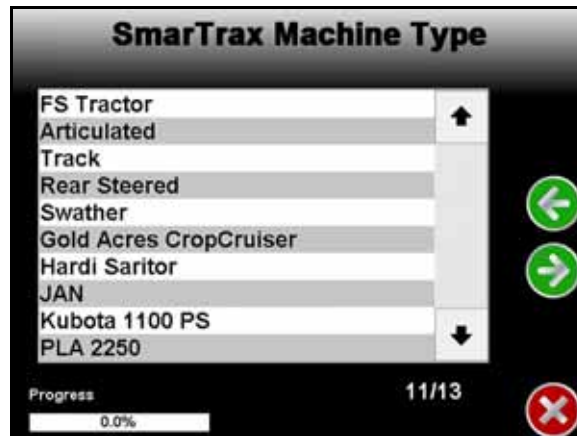


3. Select one of the profile options from the bottom of the Machine Type list.
4. Select **Next**.
5. Select **New**, **Load**, or **Reset**.
 - New creates a new machine profile. Once New is selected, the screen will return to the Machine Type list to allow the operator to select the appropriate tune set and continue with the calibration process. Once the calibration process is complete, the machine will be associated with the Profile number selected.
 - Load allows the operator to select an existing profile. Load will not be displayed as an option until the machine calibration has been performed and a new profile has been set up.
 - If the profile chosen has previously been calibrated on the machine, the calibration process is complete.
 - If the profile chosen has not been calibrated on the machine, the calibration process must be completed as outlined in the following sections in this manual.
 - Reset clears the previous profile settings. Once Reset is selected, the operator must select the machine from the Machine Type list and the calibration process must be completed as outlined in the following sections in this manual. Reset will not be displayed as an option the machine calibration has been performed and a new profile has been set up.
6. Select **Next**.

MACHINE-SPECIFIC CONFIGURATION

Before the SmarTrax MD system may be enabled, the field computer and SmarTrax MD 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 MD system.

FIGURE 6. Machine Type Screen



7. 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:

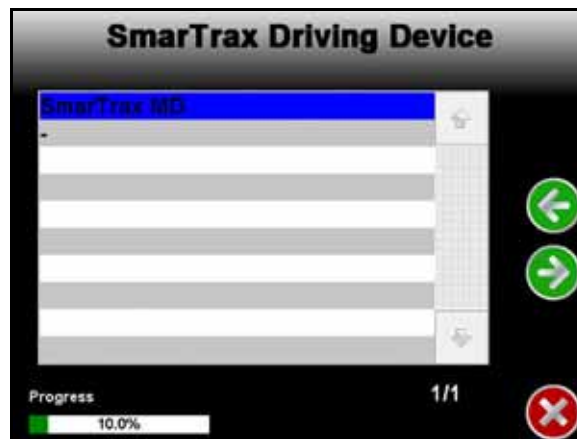
NOTE: Cruiser II only - If the Machine Type list is not populated fully or at all, press the **Previous** (left) arrow to reload the screen.

- SP Sprayer RBoom - Self-propelled sprayer with a rear boom
- FS Tractor - Front-steered tractor
- Articulated
- Track
- Rear Steered - Rear-steered machine
- Swather

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.

8. Select **Next**.

FIGURE 7. Steering Control Driving Device Selection Screen



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

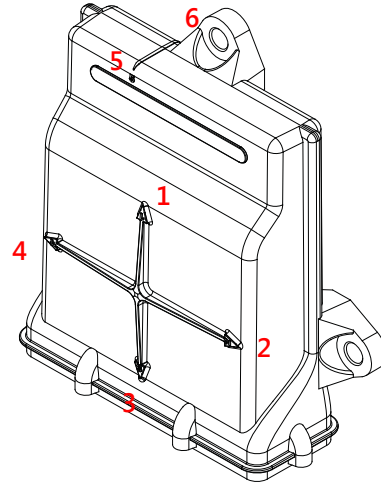
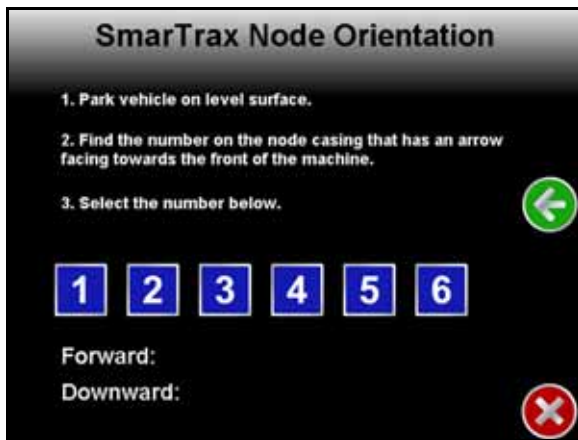
9. Select **SmarTrax MD** in the Control Device drop-down field.

10. Select **Next**.

CALIBRATE THE SMARTRAX MD SYSTEM

NODE ORIENTATION

FIGURE 8. Node Orientation Screen



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

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

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 MD 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

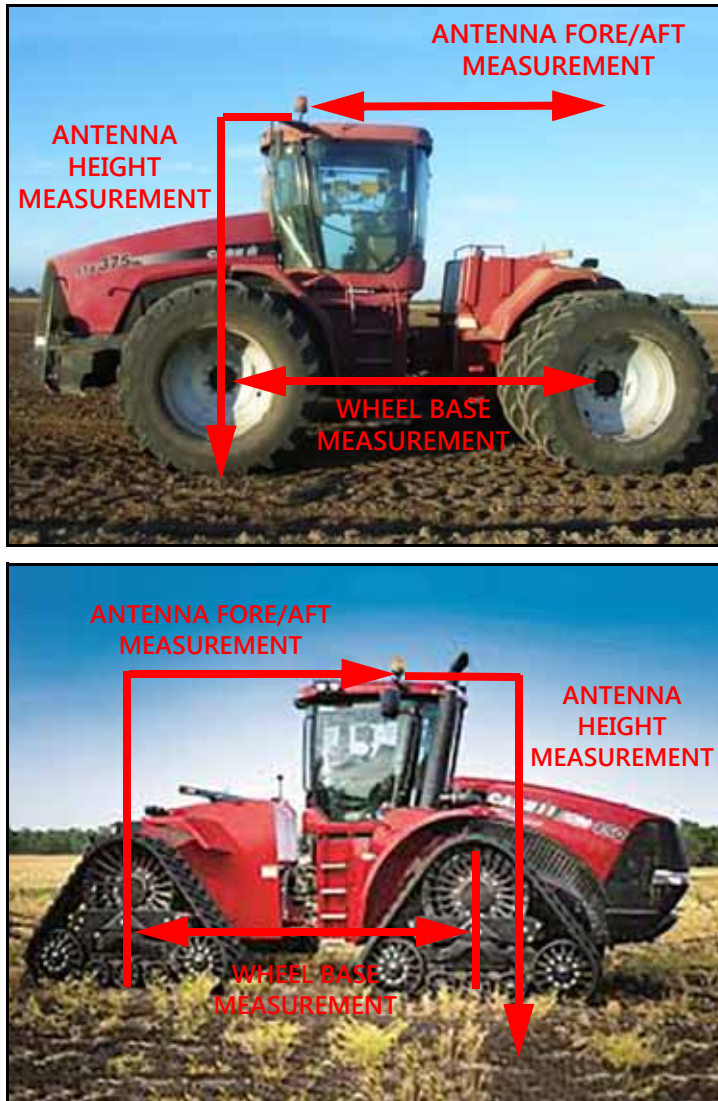
The Wheel Base, Antenna Position, and Antenna Height values are critical to the operation of the SmarTrax MD system. Measure these dimensions accurately to ensure optimal SmarTrax MD system performance!



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

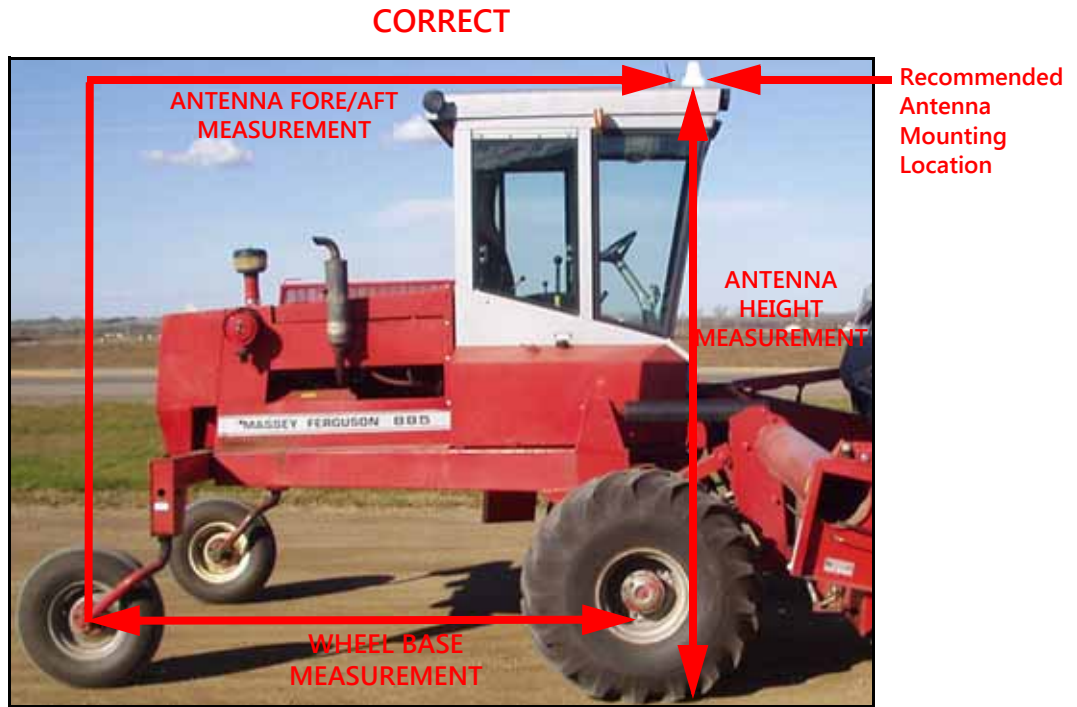
NOTE: For articulated machines, measure from the center of the front tire to the center of the rear tire on both sides of the machine. Add the values together and divide the number by two to find the average.

FIGURE 9. Articulated Machine Measurements



NOTE: For swather machines, the rear wheels MUST be positioned behind the pivot point and pointing forward to reflect the tire position during normal, straight line operation. To figure the wheelbase distance, measure from the center of the rear tire to the center of the front tire.

FIGURE 10. Swather Machine Measurements



INCORRECT WHEEL BASE MEASUREMENT

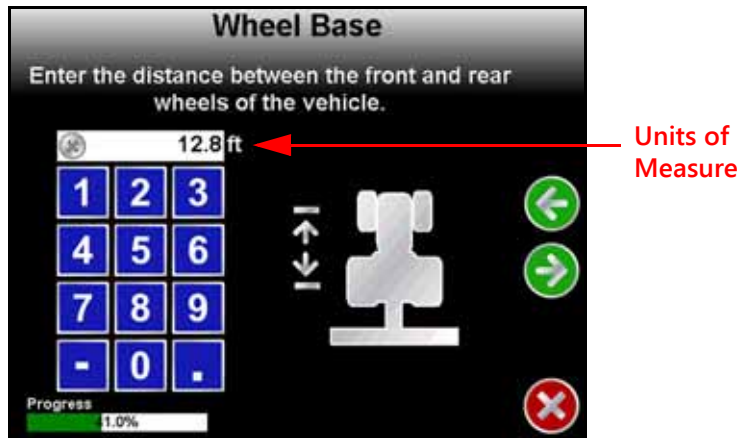


Wheel base measurement taken from pivot point instead of the center of the front wheel.



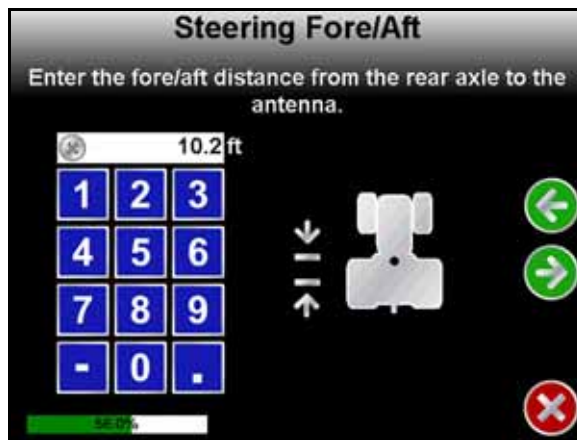
Wheel base measurement taken with wheels reversed and not in the straight line operation position.

FIGURE 11. Wheel Base Configuration Screen



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

FIGURE 12. Antenna Position Configuration Screen

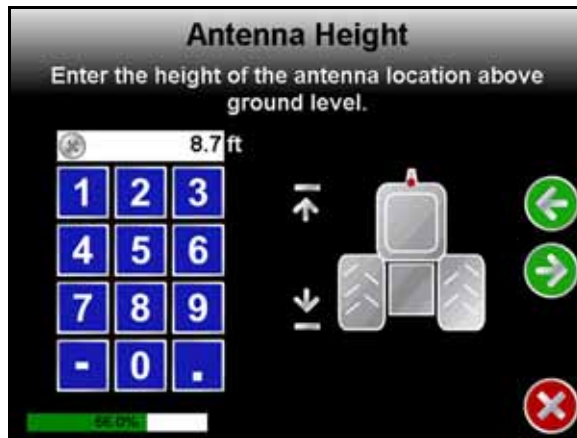


5. Enter the Antenna Position measurement.

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. Raven Industries recommends mounting the antenna in front or even with the rear axle.

6. Select **Next**.
7. To determine the Antenna Height, measure the from the ground to 4" above the base of the antenna.

FIGURE 13. Antenna Height Configuration Screen



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

FIGURE 14. Checking for GPS Screen



10. Allow the system to detect the GPS installed in the system.



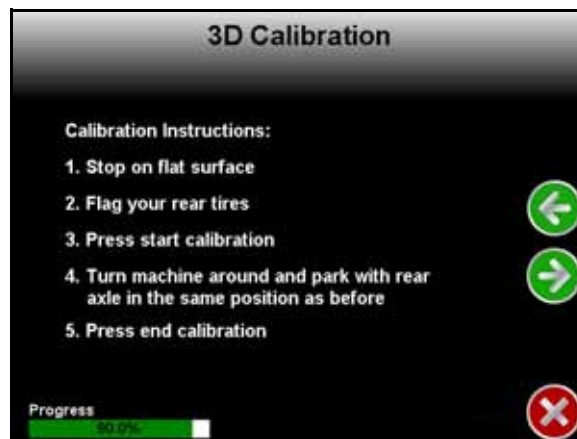
ENHANCED TILT CALIBRATION

FIGURE 15. Establishing Heading Screen



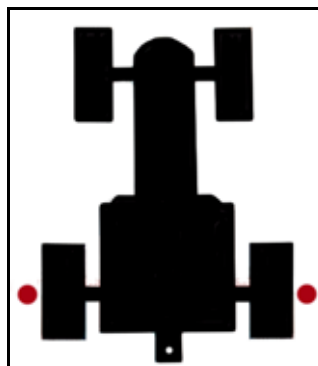
1. Drive straight ahead 33 feet to allow SmarTrax MD to acquire a heading.

FIGURE 16. Enhanced Tilt Calibration Wizard



2. Park the machine on a flat surface.

FIGURE 17. Machine's Rear Axle Marked Before Enhanced Tilt Calibration



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

4. Select **Next**.

FIGURE 18. 3D Calibration Screen



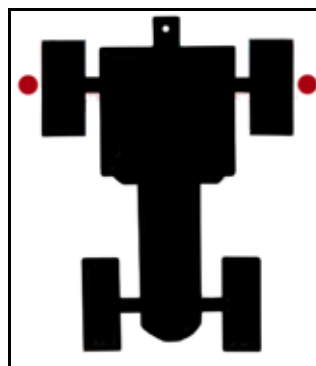
5. Select **Start Calibration**. The following screen will appear:

FIGURE 19. Calibration in Progress Screen



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

FIGURE 20. Machine Orientation After Tilt Calibration



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



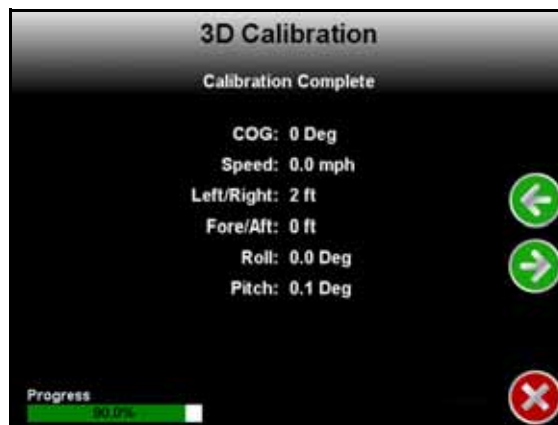
FIGURE 21. Finish Calibration



7. 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. The rear wheels will not necessarily end up aligned exactly with the markers to get the Fore/Aft number to turn black.

FIGURE 22. Calibration Complete



8. Select **Next**.

STEERING SWITCH CALIBRATION

IMPORTANT: The switch on the bottom of the mechanical drive must be turned on before calibrating the steering system.

FIGURE 23. Steering Switch Calibration Screen



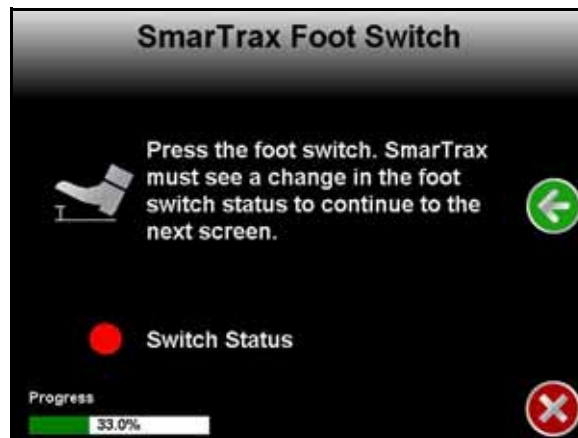
1. Review the on-screen instructions and turn the steering wheel to verify proper operation.

NOTE: The SmarTrax MD 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 6, Troubleshooting for troubleshooting information. If the problem persists, contact your local Raven dealer for further information.

2. Proceed to the Engage Switch Calibration section below to continue with the SmarTrax MD system calibration.

ENGAGE SWITCH CALIBRATION

FIGURE 24. Engage Switch Calibration Screen

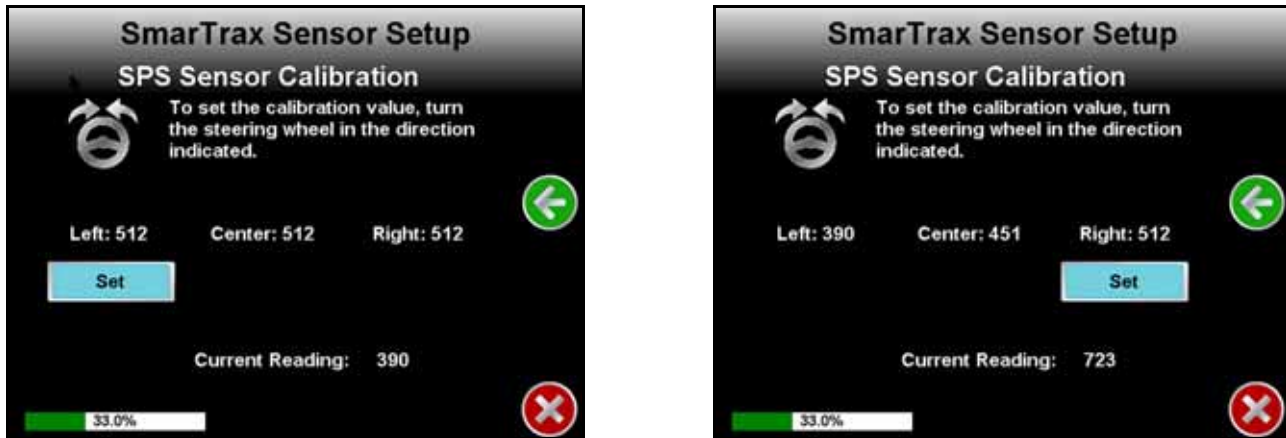


1. Review the on-screen instructions.
2. Press and release the foot switch or engage switch.

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

WHEEL ANGLE SENSOR (SPS) CALIBRATION

FIGURE 25. SPS Setup Calibration Screen



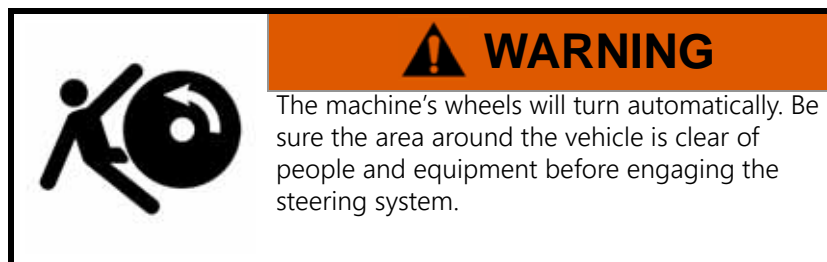
1. While driving slowly, turn the steering wheel fully to the left wheel lock.
2. Select the **Set** button displayed below the left wheel value.
3. Turn the steering wheel fully to the right wheel lock.
4. Select the **Set** button displayed below the right wheel value.
5. Select **Next**.


CALIBRATE THE MACHINE'S STEERING SYSTEM

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





NOTICE

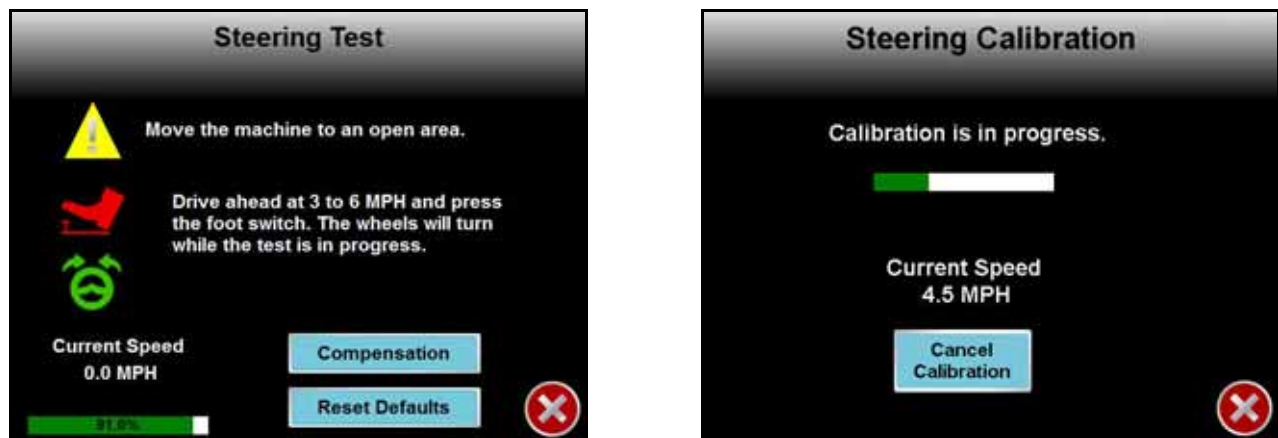
The calibration of the machine's steering system should be performed in a field or other large, open space and during conditions similar to normal vehicle operation.

If the ground or surface is slippery, muddy, or freshly tilled, the SmarTrax MD 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 MD 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 26. Steering Calibration Screens



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 and then to the right. Adjust the speed and vehicle location as necessary.

NOTE: After calibration is complete, the SmarTrax MD menu will be displayed.


FIGURE 27. Steering Calibration Resume Screen



If the wheels strike the stops at the end of travel or if a high degree of effort is required to turn the wheels during calibration, steering may be disengaged. If steering becomes disengaged during calibration:

- Press **Stop** to cancel the calibration. Adjust the amount of effort required to disengage the steering system by pressing the up or down arrow button.
- Press **Back** to return to the calibration process. Retry is most commonly used when the system is intentionally disengaged to avoid obstacles.

COMPLETE THE SMARTRAX MD 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 MD 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 MD system.</p>

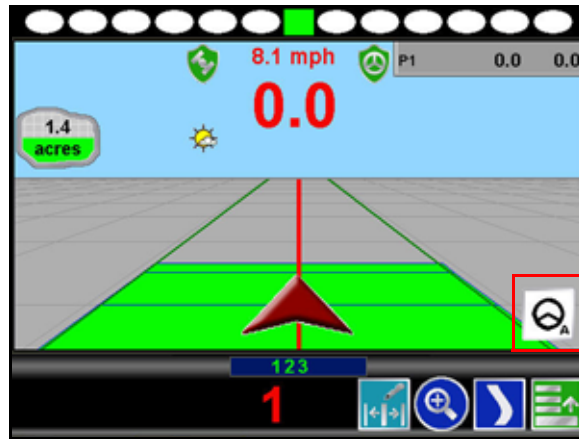
NOTE: The Line Acquire Aggressiveness and On-Line Sensitivity values may be adjusted to further tune the system or to adjust for operating conditions. Refer to the System Adjustments section below for further information on system adjustments.

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 Cruiser II Operation Guide (P/N 016-0171-415) 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 28. SmarTrax MD Enable Icon



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

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

4. Allow SmarTrax MD to run while driving back and forth along the A-B guidance line.

NOTE: If the machine is not operating to the desired specification, it may be necessary to adjust the Line Acquire Aggressiveness and On-Line Sensitivity values. Refer to the System Adjustments section below information on adjusting the SmarTrax MD system.

START A JOB

Refer to the Envizio Pro and Envizio Pro II Installation and Operation Manual (P/N 016-0171-148) or Cruiser II Operation Guide (P/N 016-0171-415) for instructions on starting a job and setting guidance lines.

SYSTEM ADJUSTMENTS

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 MD system.

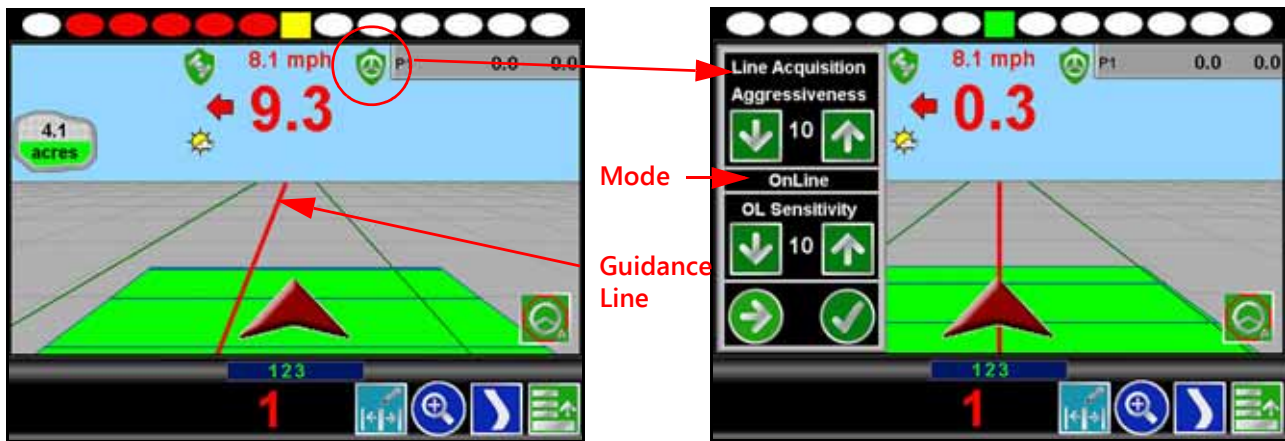
FIGURE 29. LA Adjustment Panel



The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is traveling 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 MD 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 settle on the line.

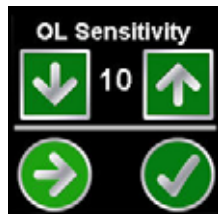
FIGURE 30. LA Mode



NOTE: The screen in Figure 27 illustrates an example of a situation in which SmarTrax MD 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

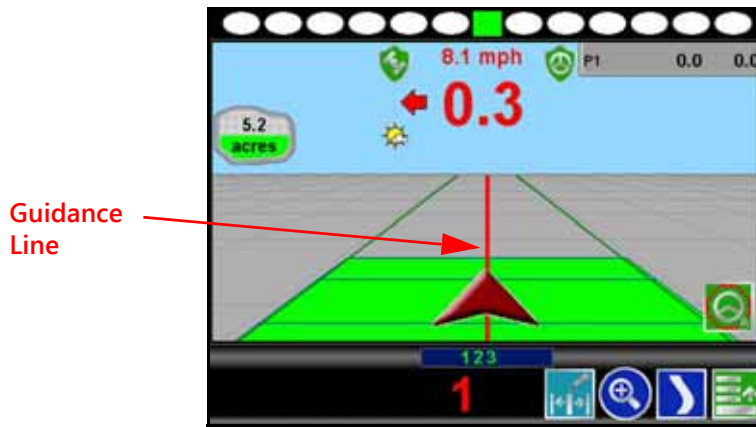
FIGURE 31. OL Mode Indicator



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 MD 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 32. OL Mode



NOTE: The screen in Figure 33 illustrates an example of a situation in which SmarTrax MD 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 MD screens. The SmarTrax MD 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 MD sidebar.

FIGURE 33. SmarTrax MD Settings Screen

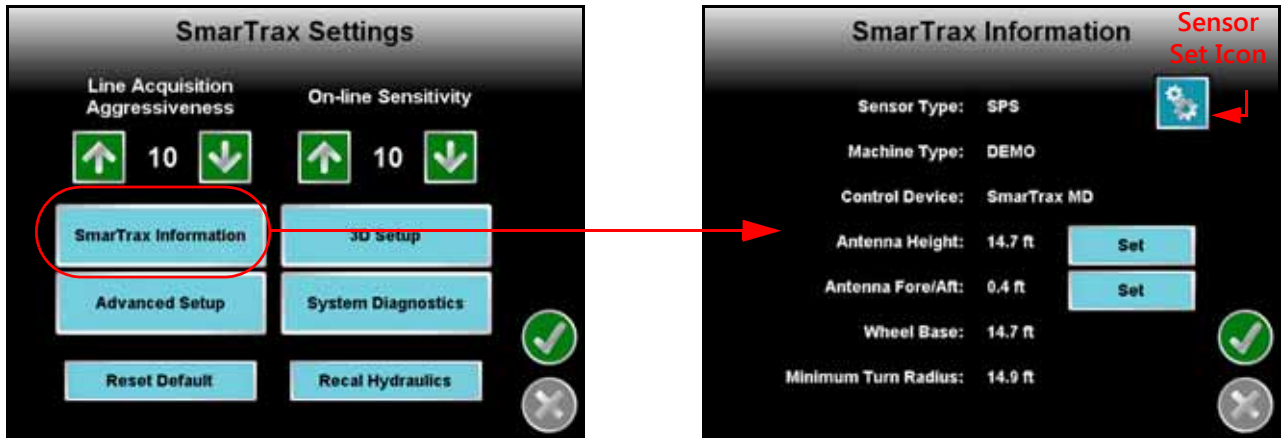


NOTE: In Cruiser II software, the “3D Setup” option is displayed as “Terrain Comp”.



SMARTRAX MD INFORMATION SCREEN

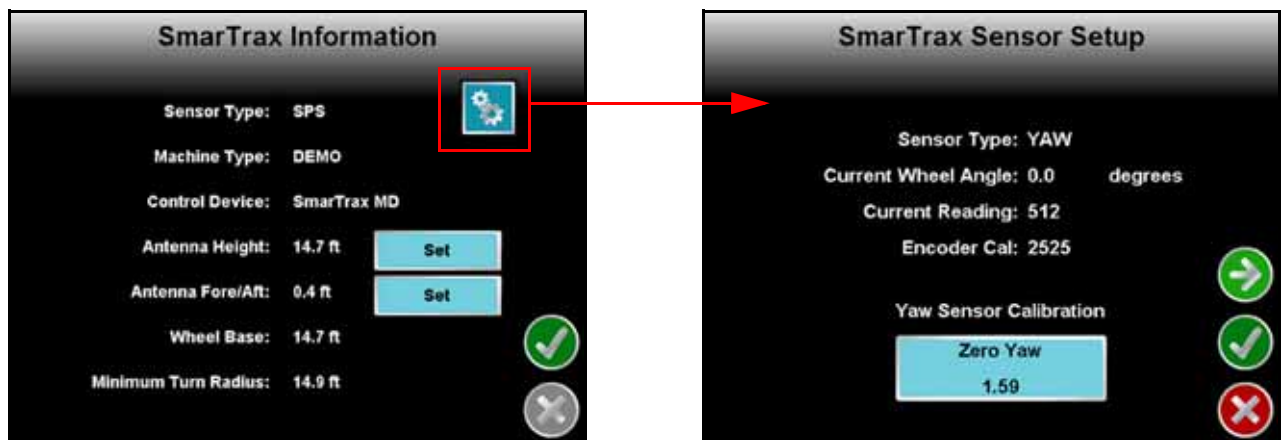
FIGURE 34. SmarTrax MD Settings and SmarTrax MD Information Screens



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

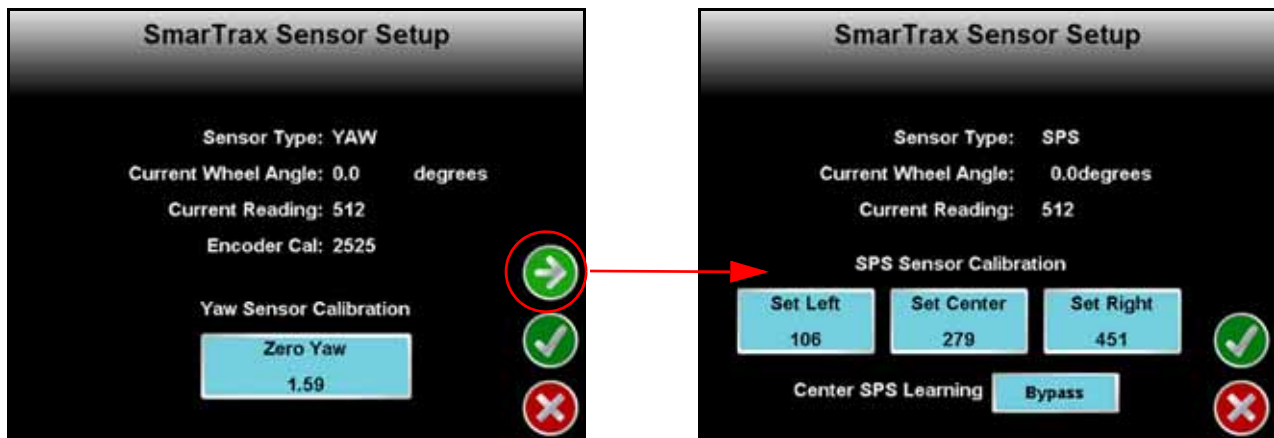
- **Antenna Height** - Selecting the Set icon next to the Antenna Height setting allows the Antenna Height measurement to be changed.
- **Antenna Fore/Aft** - Selecting the Set icon next to the Antenna Fore/Aft setting allows the Antenna Fore/Aft position measurement to be changed.
- **Sensor Type**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

FIGURE 35. SmarTrax MD Information and Sensor Setup Screen #1



- The Yaw Sensor Setup screen displays the yaw sensor status information:
 - **Current Wheel Angle** - An approximation of the machine’s wheel angle.
 - **Current Reading** - The current value of the encoder.
 - **Zero Yaw Button** - Recalibrates the yaw sensor to zero. The machine must be at a full stop before recalibrating the yaw sensor.
 - **Encoder Cal** - The ratio of the steering wheel movement to the machine’s wheel movement.

FIGURE 36. Sensor Setup Screen #1 and Sensor Setup Screen #2

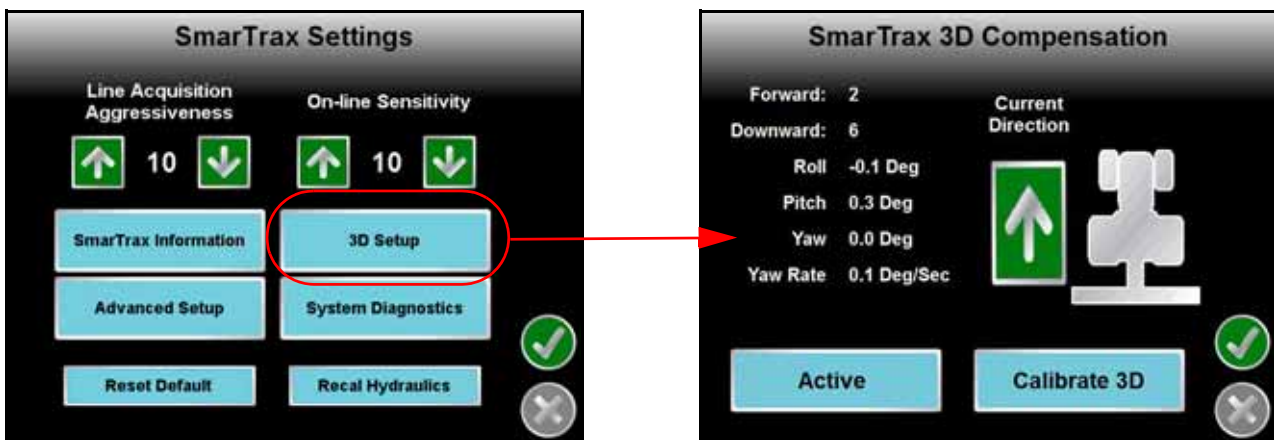


- **Current Wheel Angle** - An approximation of the machine’s wheel angle.
- **Current Reading** - The current value of the encoder.
- **SPS Sensor Calibration** - Displays the encoder’s original values during initial calibration relative to the steering wheel’s full range of travel.

ENHANCED TILT CALIBRATION SETUP SCREEN

The SmarTrax MD 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 37. SmarTrax MD Settings and 3D Terrain Compensation Activation 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 traveling. 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.



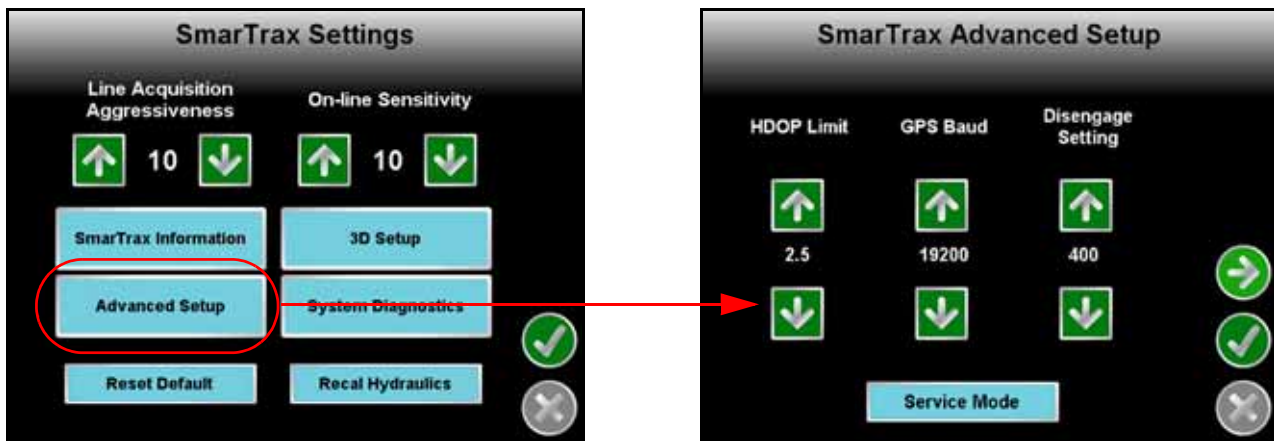
- **Calibrate 3D** - Used to calibrate the enhanced tilt compensation feature. Refer to the Enhanced Tilt Calibration section on page 82 for the calibration procedure.

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

ADVANCED SETUP SCREEN

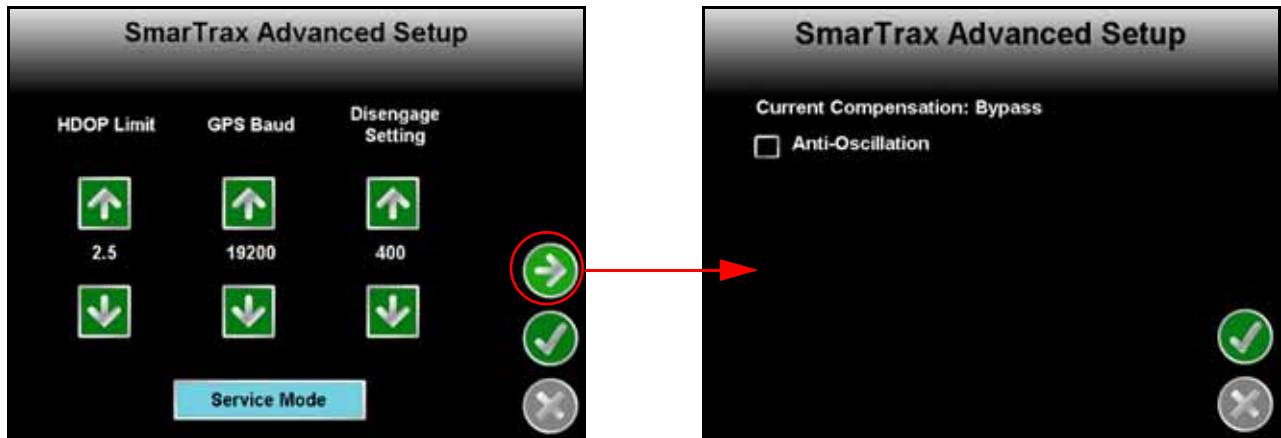
The Advanced Setup screen contains advanced diagnostic information used to fine-tune the SmarTrax MD system and improve steering accuracy.

FIGURE 38. SmarTrax MD 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 MD 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 must match the value of the GPS receiver installed in the system.
- **Disengage Setting** - Controls the amount of steering input required to disengage the SmarTrax MD 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 MD Controller screen.

FIGURE 39. Advanced Setup #1 and Advanced Setup #2 Screens

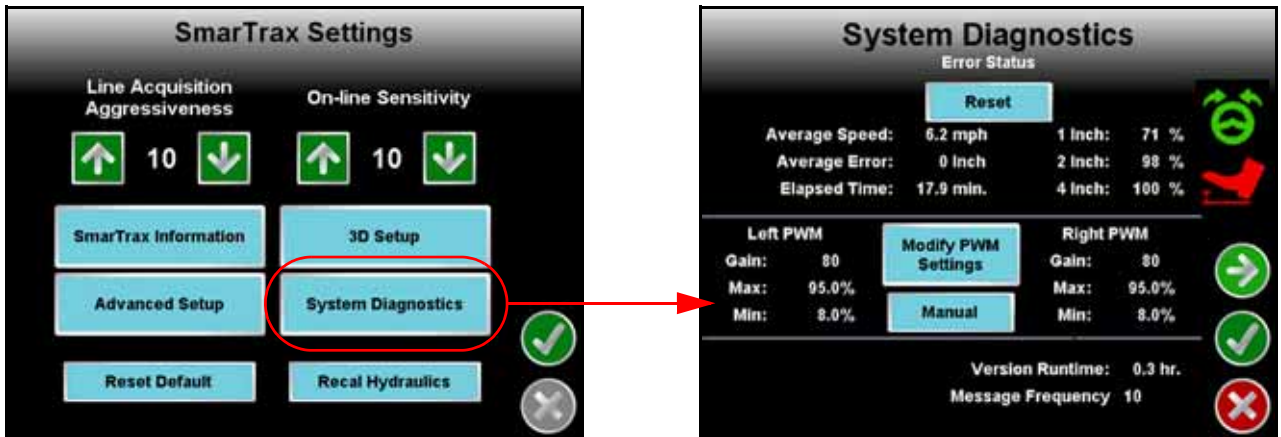


- **Current Compensation** - Used only with certain non-steering ready machines. This feature is automatically enabled or disabled during the calibration process and cannot be modified.
- **Anti-Oscillation** - This feature is only used with articulated machines and should not be enabled with any other type of machine. Anti-Oscillation automatically turns on when an articulated machine is selected during the machine configuration stage of the SmarTrax MD 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 40. SmarTrax MD Settings and System Diagnostics Screen

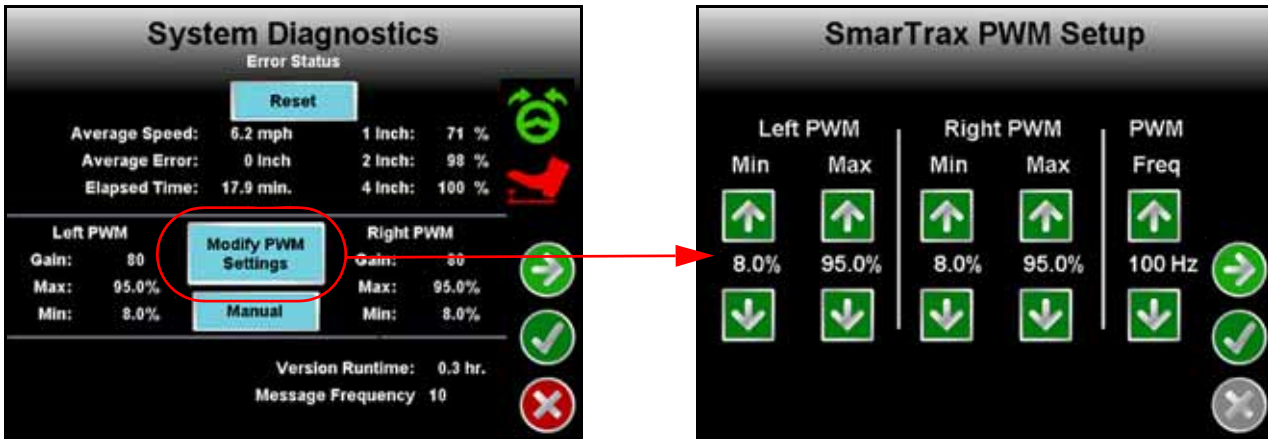


- **Average Speed** - Average vehicle speed over the last hour while SmarTrax MD has been running.
- **Average** - Average distance from the desired guidance path or line during the last hour while SmarTrax MD has been running.
- **1 Inch, 2 Inch, and 4 Inch** - The percentage of time the machine has 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 non-RTK systems, the values are 2", 4", and 8".

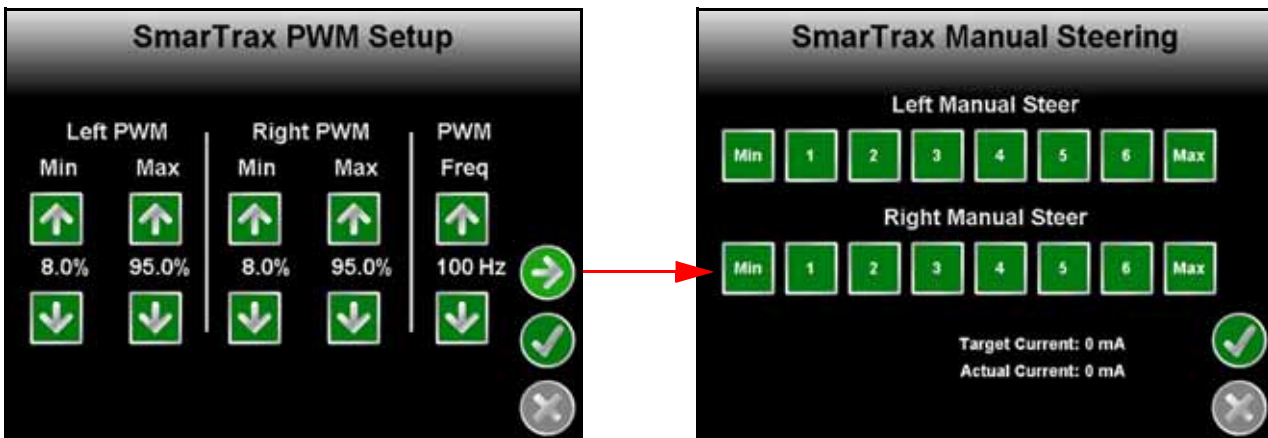
- **Message Frequency** - Displays GGA input message rate.

FIGURE 41. System Diagnostics and PWM Setup Screens



- **PWM Values** - Displays SmarTrax MD 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 MD system unless a technician instructs you to modify the settings. Pressing Modify PWM Settings displays the PWM Setup screen to allow manual adjustments to the PWM values.
 - **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 values. 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 MD 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 MD to manual mode. Raven Industries does not advise leaving the system in auto mode as the PWM minimum values may change unpredictably.

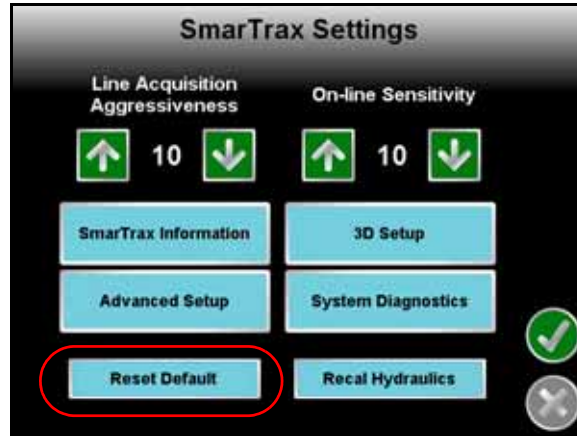
FIGURE 42. PWM Setup and Manual Steering Screens



- **Left and Right Manual Steer** - Used to manually test the SmarTrax MD 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** - Displays the expected current level for the mechanical drive to turn the steering wheel.
- **Actual Current** - Actual Current displays the amount of current the system is using to steer the machine.

RESET DEFAULT

FIGURE 43. SmarTrax MD Settings Screen

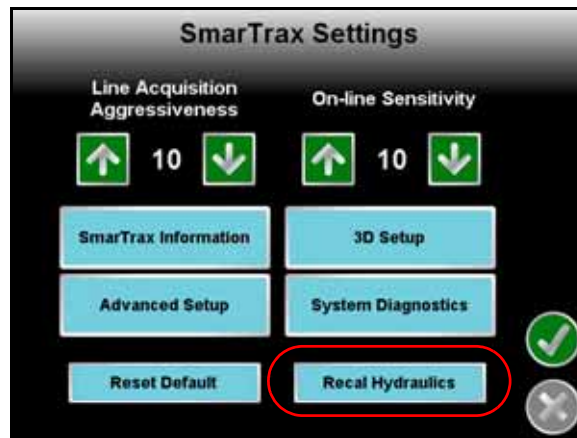


Selecting the Reset Defaults resets the SmarTrax MD system settings to the default values.

IMPORTANT: If Reset Defaults is selected, the SmarTrax MD system must be recalibrated before the system can be enabled. Refer to Calibrate the SmarTrax MD System section on page 77 for information on completing the SmarTrax MD system calibration.

RECALIBRATING HYDRAULICS

FIGURE 44. SmarTrax MD Settings Screen

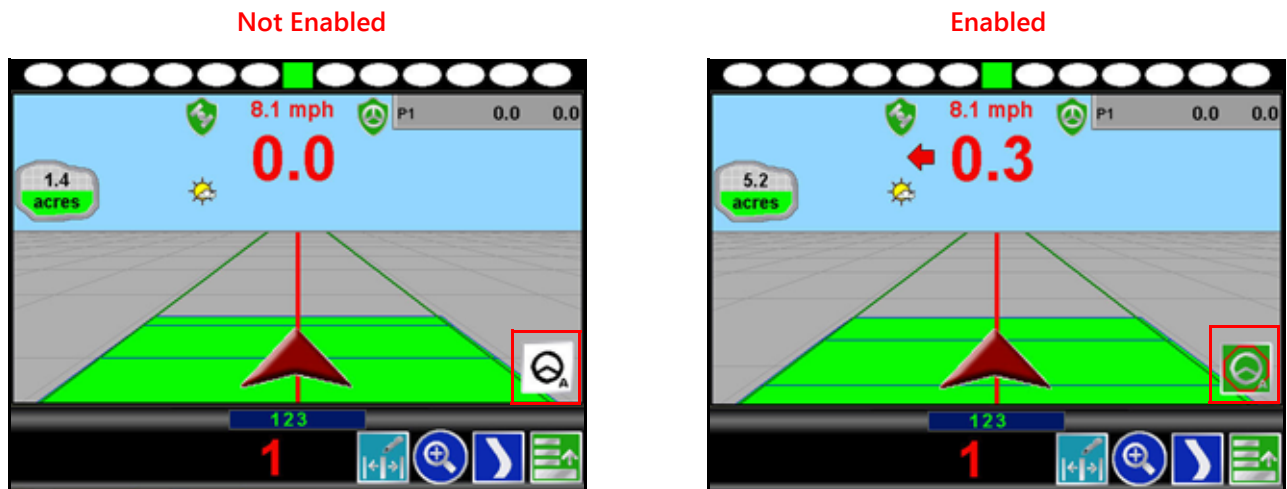


Selecting Recal Hydraulics restarts the machine’s steering calibration process. Refer to Calibrate the Machine’s Steering System section on page 86 for information on completing the machine’s steering calibration.

ROUTINE OPERATION

ENGAGING SMARTRAX MD

FIGURE 45. SmarTrax MD System Engaged



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

SYSTEM SETTINGS

System Setting	Average Setting	Suggested Range	Function
Line Acquisition (LA) Aggressiveness	10	5 to 13	The LA Aggressiveness value affects how quickly the machine steers toward a displayed guidance line when it is traveling 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	10 Hz	Displays the frequency of GGA messages from the GPS receiver.
Message Frequency - ZDA	.3 Hz	.3 Hz to 10 Hz	Displays the frequency of GGA messages from the GPS receiver.
HDOP	2.5	N/A	Indicates the quality of the GPS signal.

NODE

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



MECHANICAL DRIVE DIAGNOSTICS

FIGURE 2. SmarTrax MD Indicator Status



- White steady - The SmarTrax MD system is not ready to steer.
- White flashing - No CAN communication in the SmarTrax MD system.



- Blue flashing - Calibrating.
- Blue steady - Ready to steer or steering.
- Blue/white flashing - High speed, driving too fast (over 18 mph) to engage.

ERROR MESSAGES

Message	Possible Cause	Corrective Action
Act NoPwr	Hardware inside the SmarTrax MD system is damaged	<ol style="list-style-type: none"> 1. Navigate to the SmarTrax Manual Steering screen. 2. Toggle the master switch on and off, verifying that the Raven LED logo changes from white steady to blue steady. 3. Drive the motor at various settings while monitoring the Actual Current value. If no current is drawn and the problem persists, replace the mechanical drive.
BadCurvtr/No Curvtr/No Yaw	Poor communication between the SmarTrax node and SmarTrax mechanical drive.	<p>Check harness connections to ensure they are secure.</p> <p>Cycle power to the entire system.</p>
Encod Fail	The hardware inside the mechanical drive is damaged.	<ol style="list-style-type: none"> 1. Navigate to the SmarTrax Sensor Setup screen. 2. Manually turn the steering wheel while monitoring the Wheel Angle value. If no wheel angle change and the problem persists, replace the mechanical drive.
GPS Mode	The SmarTrax node is not receiving a correction accuracy mode high enough on the current GPS signal.	<p>Verify the GPS settings in the field computer are correct.</p> <p>Check the SmarTrax MD harness connections.</p>
Guide Com	Guidance points are no longer received by SmarTrax MD.	<p>Verify connections between SmarTrax MD and the field computer.</p> <p>Viper Pro Only - Verify that the "Send Guidance Message" option is selected on the Lightbar Setup screen.</p>
HC Volt H	SmarTrax MD has detected a supply voltage greater than 16 volts.	Check the battery voltage and connections.

Message	Possible Cause	Corrective Action
HC Volt L	SmarTrax MD has detected a supply voltage less than 10.6 volts.	Check the battery voltage and connections.
High HDOP	Insufficient GPS signal is being received.	Wait a few minutes to see if signal improves.
HS Fail	The hardware inside the mechanical drive is damaged.	<ol style="list-style-type: none"> 1. Navigate to the SmarTrax Manual Steering screen. 2. Toggle the master switch on and off, verifying that the Raven LED logo changes from white steady to blue steady. 3. Drive the motor at various settings while monitoring the Actual Current value. If no current is drawn and the problem persists, replace the mechanical drive.
HW Wrong	The device does not support the installed software.	<ol style="list-style-type: none"> 1. Verify the software versions of the mechanical drive and node are compatible. 2. Reprogram the devices with the correct software version.
Low Sats	The GPS receiver is not receiving signal from enough satellites.	Move to an open area and wait a few minutes to see if more satellites are found.
MsSw Fail	The hardware inside the mechanical drive is damaged.	Manually toggle the master switch on the mechanical drive between "ON" and "OFF".
		Replace the SmarTrax mechanical drive.
MsSw Off	The master switch is in the "OFF" position.	Manually toggle the master switch on the mechanical drive to the "ON" position.
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.	<p>Verify cabling is correct and secure.</p> <ul style="list-style-type: none"> • Viper Pro - Ensure that "Send Guidance Messages" is selected. • Envizio Pro - Ensure that GPS Source "Internal via Tilt or SmarTrax" is selected. • Viper 4 - Ensure "SmarTrax GPS on DGPS" is selected.
No Cal	SmarTrax MD has not been calibrated.	Calibrate the SmarTrax MD system using the calibration wizard.
No Diff	The GPS receiver has not acquired differential.	Wait a few minutes to see if the GPS differential is acquired.
		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.



Message	Possible Cause	Corrective Action
No HC Pwr	High current power is not being detected.	Check the high current cable connections. Check the fuse.
No HC Sync	The hardware inside the mechanical drive is damaged.	<ol style="list-style-type: none"> 1. Navigate to the SmarTrax Manual Steering screen. 2. Toggle the master switch on and off, verifying that the Raven LED logo changes from white steady to blue steady. 3. Drive the motor at various settings while monitoring the Actual Current value. If no current is drawn and the problem persists, replace the mechanical drive.
No VTG	No VTGmessages are being received.	Check the receiver settings. The recommended setting is 10Hz.
Oper Error	The operator presence switch has been disconnected for more than seven seconds.	Check the operator presence switch connection to verify it is connected to the operator presence switch or jumper plug.
OpSW Fail	The operator has been out of the seat for more than two seconds.	Return to the operator's seat. Check the operator presence switch connections.
RsSw Fail	The foot/engage switch cable connection has been disconnected.	Ensure the foot/engage switch cable connection is connected to the node harness. Replace the foot/engage switch.
RsSw StOn	The foot/engage switch is stuck in the "ON" position.	Ensure the foot/engage switch cable and connection to the node harness is not damaged. Replace the foot /engage switch.
Swath Jmp	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 MD may still be used.	Repair or replace the node when convenient.
Too Fast	The vehicle speed is above 27 mph [45 km/h] and SmarTrax MD 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 MD has been disengaged.	Decrease the vehicle speed and re-engage the SmarTrax MD system.
Too Slow	The vehicle speed is too slow and SmarTrax MD has been disengaged.	Increase the vehicle speed and re-engage the SmarTrax MD system.

Message	Possible Cause	Corrective Action
Torque H	SmarTrax MD has detected a current draw greater than 8 amps.	<p>Check the mechanical drive system for binding conditions.</p> <ol style="list-style-type: none"> 1. Navigate to the SmarTrax Manual Steering screen. 2. Toggle the master switch on and off, verifying that the Raven LED logo changes from white steady to blue steady. 3. Drive the motor at various settings while monitoring the Actual Current value. If no current is drawn and the problem persists, replace the mechanical drive.
Wrong HDW	The software and hardware versions of the node are not compatible.	Update the node software to the proper version.
Yaw Error	Yaw rate sensor values are out of range.	Replace the SmarTrax node.

SMARTRAX MD OPERATION

Problem	Possible Cause	Corrective Action
SmarTrax MD 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.
	A 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 MD 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 active error in the SmarTrax MD system.	Refer to Error Messages section on page 100 to troubleshoot the error message.
	The foot/enable switch cable is not connected or is faulty.	Check the foot/enable switch cable connection.
	The operator presence switch or jumper plug is disconnected.	Check the operator presence switch connections.
	The SmarTrax MD master switch is in the "OFF" position.	Manually toggle the master switch to the "ON" position.
	There is no guidance line set.	Set a new guidance line.



Problem	Possible Cause	Corrective Action
SmarTrax MD will not disengage when the steering wheel is turned.	The Disengage setting is incorrect.	Adjust the Disengage Setting in the field computer.
	The encoder is damaged.	<ol style="list-style-type: none"> 1. Navigate to the SmarTrax Sensor Setup screen. 2. Manually turn the steering wheel while monitoring the Wheel Angle value. If no wheel angle change and the problem persists, replace the mechanical drive.
Cannot manually steer left or right from the System Diagnostics screen.	No high current power	<p>Check the node status lights for high current (HC) power.</p> <p>Check the power/ground fuses and connections.</p>
	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.
	There is an active error in the SmarTrax MD system.	Refer to Error Messages section on page 100 to troubleshoot the error message.
System manually steers the wrong way from the System Diagnostics screen.	The motor hardware inside the mechanical drive is damaged.	<ol style="list-style-type: none"> 1. Navigate to the SmarTrax Manual Steering screen. 2. Toggle the master switch on and off, verifying that the Raven LED logo changes from white steady to blue steady. 3. Drive the motor at various settings while monitoring the Actual Current value. If no current is drawn and the problem persists, replace the mechanical drive.
The steering wheel turns by itself when the power is on and SmarTrax MD is not engaged.	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.	Verify the steering unit type functions properly.
	Possible damage to the mechanical drive.	<ol style="list-style-type: none"> 1. Navigate to the SmarTrax Manual Steering screen. 2. Toggle the master switch on and off, verifying that the Raven LED logo changes from white steady to blue steady. 3. Drive the motor at various settings while monitoring the Actual Current value. If no current is drawn and the problem persists, replace the mechanical drive.

Problem	Possible Cause	Corrective Action
SmarTrax MD will not find the guidance line.	SmarTrax MD is not engaged.	Engage the SmarTrax MD system.
	The GPS signal is hindered by the GL1DE speed filter (if applicable).	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 30 seconds between adjustments.
The machine drives on the guidance line, but the implement does not match up to the markers.	The implement is drifting relative to the tractor.	Enter an antenna offset into the field computer to compensate for the drift.
	3D terrain compensation is out of calibration.	Recalibrate 3D terrain compensation.
After calibration, the machine drives away from the guidance line.	An incorrect node orientation was entered during the SmarTrax MD system calibration.	<ol style="list-style-type: none"> 1. Verify the node orientation setting on the 3D Compensation screen. 2. Recalibrate SmarTrax MD.
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 30 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 30 seconds between adjustments.
Machine consistently drives to the left or right of the guidance line.	One of the PWM Min values is set too low.	Recalibrate the hydraulics.
	The LA Aggressiveness setting is too low.	<ul style="list-style-type: none"> • Manually adjust the PWM Min values. • Recalibrate the hydraulic system.
	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.
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 MD.	The disengage setting in the field computer is set too high.	Decrease the disengage setting.
Steering wheel is difficult to turn when attempting to turn the vehicle while SmarTrax MD is not engaged.	SmarTrax MD is not installed correctly.	<ol style="list-style-type: none"> 1. Turn the master switch to on the mechanical drive to the "OFF" position. 2. Check the mechanical drive system for binding conditions. 3. If the problem persists, verify the SmarTrax MD system installation with the applicable SmarTrax MD Installation Manual.

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

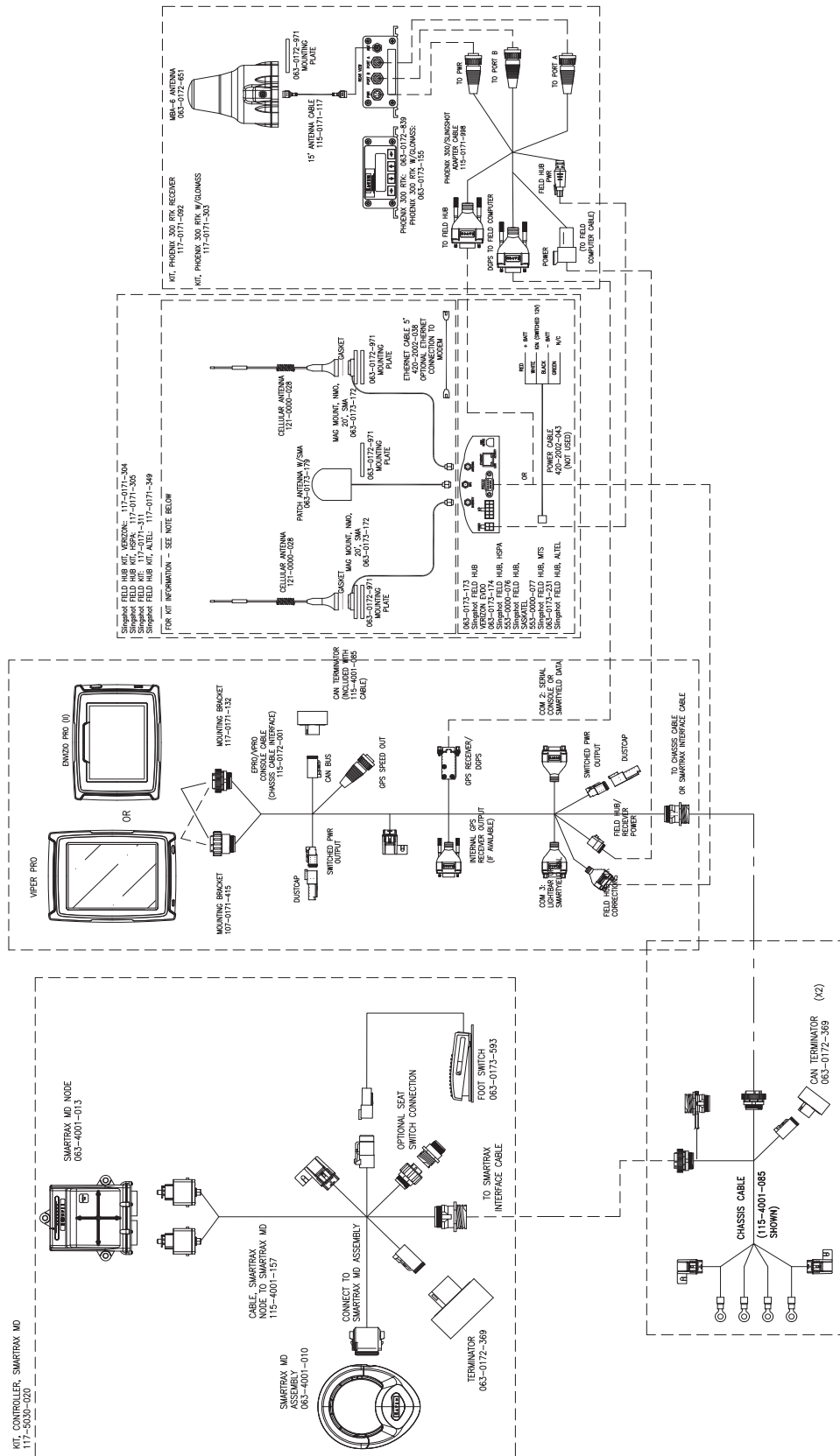
NOTE: Contact your local Raven dealer for ordering information on any optional features or components.

Additional system diagrams are available on the Raven Industries web site:

<http://www.ravenhelp.com>

FIGURE 2. Envizio Pro or Viper Pro with Slingshot (Steering Only)

ENVIZIO PRO/VIPER PRO SmartTrax MDU W/SLINGSHOT



CHAPTER

8

ROADWAY HOMOLOGATION CERTIFICATION

TÜV SÜD Automotive GmbH
Westendstraße 199
DE-80686 München



Automotive

Technical Report No. /
Technischer Bericht Nr.: 13-00314-CC-GBM-00
Manufacturer / *Hersteller:* Raven Industries
Type / *Typ:* SmarTrax MD

AM-HZSF
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TECHNICAL REPORT

No. 13-00314-CC-GBM

Extension 00

TECHNISCHER BERICHT

Nr. 13-00314-CC-GBM

Nachtrag 00

Examination in accordance to the European Communities directive on the approximation of the laws of the Member States relating to the

**Steering Equipment of Wheeled Agricultural or Forestry Tractors
as well as
the Steering Systems of Vehicles**

Prüfung gemäß Richtlinie des Rates der Europäischen Gemeinschaften zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die

***Lenkanlage von land- oder forstwirtschaftlichen Zugmaschinen auf Rädern
sowie über die
Lenkeinrichtungen von Fahrzeugen***

No. / *Nr.* 2009/66/EC

dated 13.07.2009

and / *und*

§ 38 StVZO

Technical Report No. / <i>Technischer Bericht Nr.:</i>	13-00314-CC-GBM-00	AM-HZSF
Manufacturer / <i>Hersteller:</i>	Raven Industries	Page / Seite: 2 / 14
Type / <i>Typ:</i>	SmarTrax MD	

1. **General / Allgemeines:**

- 1.1. The Technical Report includes the test of the system SmarTrax MD of the manufacturer Raven Industries.
SmarTrax MD is a mechanical drive unit and together with the controller SmarTrax MD Node and the monitor SmarTrax Cruiser II Control (opt. monitor Envizio Pro or monitor Viper Pro) it is used for the GPS based steering of vehicles.

The system SmarTrax MD is designed for the use in agricultural or forestry tractors as well as in agricultural or forestry self-propelled working machines.

It is not allowed for on road use.

The testing includes the check of the conformity with the directive 2009/66/EC as well as the § 38 StVZO.

In addition the electromagnetic compatibility of components of the system has been proved. /

*Der Technische Bericht beinhaltet die Prüfung des Systems SmarTrax MD des Herstellers Raven Industries.
SmarTrax MD ist eine mechanische Antriebseinheit zur GPS-basierten Lenkung von Fahrzeugen in Verbindung mit dem Rechner SmarTrax MD Node und dem Montior SmarTrax Cruiser II Control (ww. Monitor Envizio Pro oder Monitor Viper Pro).*

Das System SmarTrax MD ist zur Verwendung in land- oder forstwirtschaftlichen Zugmaschinen und land- oder forstwirtschaftlichen selbstfahrenden Arbeitsmaschinen vorgesehen.

Es darf nur außerhalb des öffentlichen Straßenverkehrs eingesetzt werden.

Die Prüfungen umfassen die Überprüfung der Konformität mit der Richtlinie 2009/66/EC sowie mit § 38 StVZO.

Zusätzlich wurden Komponenten des Systems auf die elektromagnetische Verträglichkeit überprüft.

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Manufacturer / <i>Hersteller:</i>	Raven Industries	Page / <i>Seite:</i> 3 / 14
Type / <i>Typ:</i>	SmarTrax MD	

- 1.2. Name and address of manufacturer /
Name und Anschrift des Herstellers: Raven Industries
205 E 6th Street
Sioux Falls, (SD) 57104
USA
- 1.3. Type / *Typ:* SmarTrax MD

**2. Description of the test object /
Beschreibung des Prüfobjektes:**

- 2.1. Kind / *Art:* GPS based steering system installed on agricultural or forestry tractors and on agricultural or forestry self-propelled working machines. /
GPS gestützte Lenkanlage eingebaut in land- oder forstwirtschaftliche Zugmaschinen und land- oder forstwirtschaftliche Arbeitsmaschinen.
- 2.2. Manufacturer / *Hersteller:* Raven Industries
205 E 6th Street
Sioux Falls, (SD) 57104
USA
- 2.3. Type / *Typ*
- 2.3.1. Type of System /
Typ des Systems: SmarTrax MD
- 2.3.2. Type of Test Vehicles /
Typen der Prüffahrzeuge:
1. John Deere 8300
 2. John Deere 9630
 3. Kubota RTV 1100
 4. Agco RoGator SS 1074
- 2.4. VIN / *FIN:*
1. RW8300P003103
 2. RW9630P004003
 3. KRTV1100810019639
 4. AGCA00SSKNSS11226

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- 2.5. Kind of Vehicle /
Art des Fahrzeugs:
1. Agricultural or Forestry Tractor /
Land- oder forstwirtschaftliche Zgm.
 2. Agricultural or Forestry Tractor /
Land- oder forstwirtschaftliche Zgm.
 3. ATV / *ATV*
 4. Agricultural or Forestry
self-propelled Working Machine /
*Land- oder forstwirtschaftliche
selbstfahrende Arbeitsmaschine*
- 2.6. Technical Description /
Technische Beschreibung:
- The tested vehicles were equipped with a prototype of the GPS based steering system SmarTrax MD.
- The mechanical drive unit is mounted with special brackets to the steering column. It uses a ring gear which is installed with an adapter to the serial steering column of the vehicle and finally the original steering wheel will be fixed.
- An anti-rotation pin between the special brackets and the mechanical drive unit prevents the rotating of the mechanical drive unit.
- The controller SmarTrax MD Node is installed besides the driver and connected with the mechanical drive unit and the monitor SmarTrax Cruiser II Control (opt. monitor Envizio Pro or monitor Viper Pro). The GPS antennas will be fixed on the cab's roof and connected to the controller.
- Below the mechanical drive unit there is a master switch for the drive unit and the lighted logo of "RAVEN" shows the condition. The system can be activated by the monitor (touch screen) or the additional foot switch.

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Die geprüften Fahrzeuge waren mit einem Prototype des GPS basierenden Lenksystem SmarTrax MD ausgerüstet.

Die mechanische Antriebseinheit wird mit speziellen Haltern an die serienmäßige Lenksäule montiert.

Sie verwendet einen Zahnkranz, der mittels eines Adapters mit der serienmäßige Lenksäule verschraubt wird. Anschließend wird das originale Lenkrad des Fahrzeugs fixiert. Ein Bolzen der eine Drehbewegung der mechanischen Antriebseinheit verhindert wird zw. dieser und den speziellen Haltern verschraubt.

Der Rechner SmarTrax MD Node wird neben dem Fahrer montiert und mit der mechanischen Antriebseinheit sowie dem Monitor SmarTrax Cruiser II Control (ww. Monitor Envizio Pro oder Monitor Viper Pro) verbunden. Die erforderlichen GPS Antennen werden auf dem Dach der Kabine angebracht und ebenfalls mit dem Rechner verbunden. Auf der Unterseite der mechanischen Antriebseinheit befindet sich ein Hauptschalter für die Antriebseinheit und das beleuchtete Firmenlogo „RAVEN“ zeigt den Status an. Das System kann durch Berührung des Monitors (Touch Screen) oder mittels eines zusätzlichen Fußschalters aktiviert werden.

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3. **Test basis / Prüfgrundlage**

The test vehicle has been tested based on the following directives /
Das Prüffahrzeug wurde nach den folgenden Richtlinien geprüft:

EC Directive / EG Richtlinie

2009/66EC	Council directive relating to the steering equipment of wheeled agricultural or forestry tractors / <i>Richtlinie des Rates über die Lenkanlage von land- oder forstwirtschaftlichen Zugmaschinen auf Rädern</i>
-----------	---

German national Standard / deutsche nationale Verordnung

§ 38 StVZO	Steering system / <i>Lenkanlage</i>
------------	--

ECE and EN ISO Standards / ECE und EN ISO Richtlinien

ECE-R10	Uniform provisions concerning the approval of vehicles with regard to the radio interference suppression / <i>Einheitliche Vorschriften für die Genehmigung der Fahrzeuge hinsichtlich der elektromagnetischen Verträglichkeit</i>
EN ISO 14982:2009	Agricultural and forestry machinery - Electromagnetic compatibility - Test methods and acceptance criteria / <i>Land- und forstwirtschaftliche Maschinen - Elektromagnetische Verträglichkeit - Prüfverfahren und Bewertungskriterien</i>

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Type / <i>Typ:</i>	SmarTrax MD	

4. **Description of tests / Beschreibung der Prüfung**

4.1. Place / *Ort:*

General Safety / <i>Sicherheitsüberprüfung:</i>	Raven Ind., 254th Street, 47513 Baltic (SD) - USA
--	---

EMC / <i>EMV:</i>	TÜV SÜD America Inc. 1775 Old Hwy 8 NW New Brighton (MN) - USA
-------------------	--

4.2. Date / <i>Datum:</i>	19. – 20.03.2013	(EMC / <i>EMV</i>)
	15.04.2013	(EMC / <i>EMV</i>)
	27.09.2013	(Safety / <i>Sicherheit</i>)

4.3. Tests carried out / *Umfang der durchgeführten Prüfungen*

- Check of the installation in respect to the installation manual
- Driving test with examination of the safety functions
- EMC /
- *Überprüfung des Einbaus unter Berücksichtigung der Montageanleitung*
- *Fahrversuche mit Überprüfung der Sicherheitsfunktionen*
- *EMV*

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Type / <i>Typ:</i>	SmarTrax MD	

4.3.1. Examination of the Safety Functions / *Überprüfung der Sicherheitsfunktionen*

The SmarTrax MD will be disengaged under the following conditions:

1. The mechanical drive unit will be switched off with the master switch. The controller SmarTrax MD Node and the monitor Cruiser II Console are still active.
2. The vehicle speed will exceed 45 kph.
3. If the driver's seat will be left (if a driver presence sensor is installed).
4. If the steering wheel will be turned.
5. Breakdown of the electric energy supply / the battery.
6. If the ignition will be switched off.
7. If the GPS signal will be lost longer than 5 sec.

If the SmarTrax MD will be disengaged automatically caused by one of the above mentioned reasons a single warning tone sounds and a failure message will be displayed on the monitor. /

Technical Report No. /

Technischer Bericht Nr.: 13-00314-CC-GBM-00

AM-HZSF

Manufacturer / Hersteller: Raven Industries

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Type / Typ: SmarTrax MD

Das SmarTrax MD wird unter folgenden Voraussetzungen inaktiv bzw. abgeschaltet:

1. *Die mechanische Antriebseinheit wird mittels Hauptschalter abgeschaltet. Der Rechner SmarTrax MD Node und der Monitor Cruizer II Console bleiben aktiv.*
2. *Durch Überschreiten von 45 km/h Fahrgeschwindigkeit.*
3. *Durch das Verlassen des Fahrersitzes (sofern ein Sitzbelegungssensor eingebaut ist).*
4. *Durch eine Lenkbewegung am Lenkrad.*
5. *Durch Ausfall der Stromversorgung / der Batterie.*
6. *Durch Abschalten der Zündung.*
7. *Durch Verlust des GPS Signals länger als 5 sek.*

Wird das SmarTrax MD automatisch durch eine der oben genannten Ursachen abgeschaltet ertönt einmalig ein Warnton und eine Fehlermeldung erscheint auf dem Display.

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**5. Range of application /
Verwendungsbereich**

The GPS based steering system SmarTrax MD is designed for the installation on agricultural or forestry tractors and agricultural or forestry self-propelled working machines. /

Das GPS basierende Lenksystem SmarTrax MD ist zum Einbau in land- oder forstwirtschaftliche Zugmaschinen sowie in land- oder forstwirtschaftliche selbst-fahrende Arbeitsmaschinen vorgesehen.

**6. Test results /
Prüfergebnisse**

Based on the realized tests and after examination of the submitted documents it can be confirmed that there are no objections against the installation of the GPS based steering system (SmarTrax MD), if all requirements of the manufacturer are fulfilled.

There is no influence of the SmarTrax MD on the conventional steering system.

The requirements of the directive 2009/66/EC as well as the § 38 StVZO are fulfilled.

The standards of the electromagnetic compatibility ECE-R10 and EN ISO 14982:2009 are kept.

Aufgrund der durchgeführten Prüfungen sowie nach Durchsicht der eingereichten Unterlagen konnte festgestellt werden, daß durch den Einbau der GPS gestützten Lenkanlage (SmarTrax MD) unter Einhaltung der vom Hersteller vorgegebenen Auflagen keine technischen Bedenken bestehen.

Ein Einfluß des SmarTrax MD auf das konventionelle Lenksystem besteht nicht. Die Anforderungen der Richtlinie 2009/66/EG sowie des § 38 StVZO werden eingehalten.

Die Normen über die elektromagnetische Verträglichkeit ECE-R 10 und EN ISO 14982:2009 wurden eingehalten.

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7. **Test Basis / Prüfgrundlagen**

The assessment is based on the following documents:

Der Beurteilung liegen folgende Dokumente zugrunde:

Title / <i>Titel</i>	Date / <i>Datum</i>
1. Installation Manual No. / <i>Einbauanleitung Nr.</i> 016-5030-021 Rev. A	2013
2. Operator's Manual No. / <i>Bedienungsanleitung Nr.</i> 016-5030-020 Rev. A	2013
3. TÜV SÜD America Inc. EMC Test Result Summary ECE-R10 / <i>EMV Prüfergebnisse ECE-R10</i>	03.06.2013
4. TÜV SÜD America Inc. EMC Test Result Summary EN ISO 14982 : 2009 / <i>EMV Prüfergebnisse EN ISO 14982 : 2009</i>	07.06.2013

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8. **Safety Notes / Sicherheitshinweise**

1. The system SmarTrax MD has to be inspected by an official recognised expert after the installation especially regarding the following issues:
 - a) Clearance around operating levers and switches acc. to 80/720/EEC, annex I, section I.3, I.4 and I.6 as wells as acc. to § 30 StVZO, guideline 8, section 6
 - b) Visibility of the driver 2008/2/EC, annex I, section 2.1 as wells as acc. to § 35b(2) StVZO, guideline 1 and 11
 - c) Covering of required control lamps acc. to 2009/61/EC as wells as acc. to § 49a – 53d StVZO
2. Before driving on public roads
 - a) the mechanical drive unit must be disengaged and removed from the steering column,
 - b) the ring gear must be covered by the protection device and
 - c) the monitor must be mounted outside of the required visibilty of the driver. /

Technical Report No. /

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AM-HZSF

Manufacturer / *Hersteller:* Raven Industries

Page / *Seite:* 13 / 14

Type / *Typ:* SmarTrax MD

1. *Das System SmarTrax MD ist nach dem Einbau durch einen amtlich anerkannten Sachverständigen für den Kraftfahrzeugverkehr insbesondere hinsichtlich der folgenden Sachverhalte zu prüfen:*
 - a) *Freiraum der Betätigungseinrichtungen gem. 80/720/EWG, Anhang I, Absatz I.3, I.4 und I.6 sowie gem. § 30 StVZO, Richtlinie 8, Absatz 6*
 - b) *Sichtfeld des Fahrers gem. 2008/2/EG, Anhang I, Absatz 2.1 sowie gem. § 35b(2) StVZO, Richtlinie 1 bzw. 11*
 - c) *Verdeckung von vorgeschriebenen Kontrollleuchten gem. 2009/61/EG sowie gem. § 49a – 53d StVZO*

2. *Vor Fahrt auf öffentlichen Straßen müssen:*
 - a) *Die mechanische Antriebseinheit deaktiviert und von der Lenksäule abgenommen,*
 - b) *der Zahnkranz mit der Schutzeinrichtung abgedeckt und*
 - c) *der Monitor außerhalb des vorgeschriebenen Sichtfeldes des Fahrers angebracht werden.*

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**9. Final remark /
Schlußbemerkung**

The GPS based steering system SmarTrax MD corresponds to the mentioned test basis.

Das GPS basierte Lenksystem entspricht den genannten Prüfgrundlagen.

This report consists of page 1 to 14. /

Der Bericht umfaßt Blatt 1 bis 14.

Test Laboratory
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KBA-P-00001-95
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Federal Republic of Germany

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Bundesrepublik Deutschland*



H. Lechner
Officially recognized expert
Ämtlich anerkannter Sachverständiger
Dipl.- Ing. (FH) H. Lechner

München, 10.10.2013
Place and Date /
Ort und Datum



TEST RESULT SUMMARY

EUROPEAN STANDARD EN ISO 14982: 2009

- Clause 6.4 - Broadband Electromagnetic Emissions Radiated from ESAs..... **COMPLIANT**
- Clause 6.5 - Narrowband Electromagnetic Emissions Radiated from ESAs..... **COMPLIANT**
- Clause 6.6 - Immunity of ESAs to Electromagnetic Radiation
 ISO 11452-2: 2004 (Absorber-lined shielded enclosure) **COMPLIANT**
- Clause 6.7 - Electrostatic Discharge
 ISO 10605: 2001..... **COMPLIANT**
- Clause 6.8 - Conducted Transients
 ISO 7637-2: 2004 + Amendment A1: 2008..... **COMPLIANT**

COMPANY NAME	Raven Industries
COMPANY ADDRESS	205 East 6 th Street Sioux Falls SD 57104
EQUIPMENT DESCRIPTION	Smartrax MD - Electro-mechanical motor drive for hands free steering control
MODEL NUMBER(S) TESTED	063-4001-010
SERIAL NUMBER(S) TESTED	0001
TEST REPORT NUMBER	NC1302798.2
TEST DATE(S)	19-20 March and 15 April 2013

TÜV SÜD America Inc, as an independent testing laboratory, declares that the equipment specified above was tested to the electromagnetic compatibility requirements of European Standard EN ISO 14982: 2009 "Agricultural and Forestry Machinery - Electromagnetic Compatibility, Test Methods and Acceptance Criteria" with results as noted above.

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

Date:	07 June 2013	Tested by:		Approved by:	
Location:	New Brighton MN USA		Doug L Dahl Senior EMC Technician Not Transferable		David T Schaefer Senior EMC Engineer



TEST RESULT SUMMARY

ECE R10: 2012 Addendum 9, Revision 4

- Clause 6.5 - Broadband Electromagnetic Emissions Radiated from ESAs..... **COMPLIANT**
- Clause 6.6 - Narrowband Electromagnetic Emissions Radiated from ESAs..... **COMPLIANT**
- Clause 6.7 - Immunity of ESAs to Electromagnetic Radiation
ISO 11452-2: 2004 (Absorber-lined shielded enclosure) **COMPLIANT**
- Clause 6.8 - Transient Disturbances Conducted Along Supply Lines
ISO 7637-2: 2004 + Amendment A1: 2008..... **COMPLIANT**
- Clause 6.9 - Transient Conducted Disturbances Generated on Supply Lines
ISO 7637-2: 2004 + Amendment A1: 2008..... **COMPLIANT**
- Clause 6.10.4 - Electrostatic Discharge
ISO 10605: 2008..... **NOT APPLICABLE**

COMPANY NAME	Raven Industries
COMPANY ADDRESS	205 East 6 th Street Sioux Falls SD 57104
EQUIPMENT DESCRIPTION	Smartrax MD - Electro-mechanical motor drive for hands free steering control
MODEL NUMBER(S) TESTED	063-4001-010
SERIAL NUMBER(S) TESTED	0001
TEST REPORT NUMBER	NC1302798.1
TEST DATE(S)	19-20 March and 15 April 2013

TÜV SÜD America Inc, as an independent testing laboratory, declares that the equipment specified above was tested to the electromagnetic compatibility requirements of ECE Regulation 10: 2012, Addendum 9, Revision 4: "Uniform Provisions Concerning the Approval of Vehicles with Regard to Electromagnetic Compatibility", for Electrical/Electronic Sub-Assemblies, with results as noted above.

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

Date:	03 June 2013	Tested by:		Approved by:	
Location:	New Brighton MN USA		Doug L Dahl Senior EMC Technician		David T Schaefer Senior EMC Engineer

Not Transferable

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RAVEN

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.