

**Raven SC1™/TC1™  
Calibration & Operation  
Manual for Tractors and  
Sprayers**

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## SAFETY

### **NOTICE**

Follow the operation and safety instructions included with the implement and/or controller and read this manual carefully before installing or operating this Raven system.

- Follow all safety information presented within this manual. Review implement operation with your local dealer.
- Contact a local Raven dealer for assistance with any portion of the installation, service, or operation of Raven equipment.
- Follow all safety labels affixed to system components. Be sure to keep safety labels in good condition and replace any missing or damaged labels. Contact a local Raven dealer to obtain replacements for safety labels.

Observe the following safety measures when operating the implement after installing this Raven system:

- Do not operate this Raven system or any agricultural equipment while under the influence of alcohol or an illegal substance.
- Be alert and aware of surroundings and remain in the operator seat at all times when operating this Raven system.
  - Do not operate the implement on any public road with this Raven system enabled.
  - Disable this Raven system before exiting the operator seat.
  - Determine and remain a safe working distance from obstacles and bystanders. The operator is responsible for disabling the system when a safe working distance has diminished.
  - Disable this Raven system prior to starting any maintenance work on the implement or components of this Raven system.
- Do not attempt to modify or lengthen any of the system control cables. Extension cables are available from a local Raven dealer.



### **CAUTION**

#### ELECTRICAL SAFETY

- Always verify that power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the Raven system or other components.
- To prevent personal injury or fire, replace defective or blown fuses with only fuses of the same type and amperage.
- Do not connect the power leads to the battery until all system components are mounted and all electrical connections are completed.

- Always start the machine before initializing this Raven system to prevent power surges or peak voltage.
- To avoid tripping and entanglement hazards, route cables and harnesses away from walkways, steps, grab bars, and other areas used by the operator or service personnel when operating or servicing the equipment.

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## RECOMMENDATIONS AND BEST PRACTICES

### AERIALS AND SIGNAL INTERFERENCE

Due to the relatively low broadcast power from satellites, all GNSS receivers and aerials tend to be susceptible to sources of signal noise and interference as compared to terrestrial signals (i.e. radio or cellular).

**NOTE:** Poor GNSS signal reception may cause other systems which rely on GNSS solutions (e.g. auto-steer systems, rate control systems, etc.) to disengage or may cause undesired operation or results.

The following recommendations are intended to provide an optimal environment for GNSS systems and provide the best up-time results, even as sources of interference may spike throughout the day.

- Mount GNSS antennas with a clear, unobstructed view of the sky.
  - A minimum clearance of 1 m [39 in] is recommended around the GNSS antenna to help avoid common issues with signal interference. Do not mount cellular, radio, or other GNSS antennas within this area.
  - Mount the GNSS antenna to the tallest point of the machine. Avoid mounting the antenna in a location where obstructions (e.g. bins/hoppers, cab roof lines, equipment frame or structural elements, etc.) may rise into the antenna view.

**NOTE:** The antenna view typically starts 5° to 10° above horizontal from the base of the antenna and extends over the skyward face of the receiver/antenna.

- GNSS is a line-of-sight system. A clear path must exist between the satellite and the GNSS antenna.
  - Obstructions such as buildings, tree branches and limbs, as well as components of the vehicle such as a fiberglass or metal roof, and etc. may cause signal multi-path or completely block the GNSS receiver.
- Electrical and magnetic fields can interfere with GNSS or L-Band signals.
  - Avoid mounting GNSS receivers or antennas near components such as radio or cellular antennas, electrical motors, generators, alternators, strobe lights, radio transmitters, radio or cellular antennas, etc.
  - Over-head power lines, microwave dishes, radar, other active antennas, etc. can interfere with GNSS signal.
- Mount the Field Hub cellular and diversity antennas at least 1 m [39 in] apart. Avoid mounting other cellular, radio, or GNSS aerials within this area.

## HARNESS ROUTING

The word “harness” is used to describe any electrical cables and leads, both bundled and unbundled. Use the following guidelines and recommendations when connecting and routing harnesses while installing or maintaining this Raven system:

- Leave protective caps/covers over harness connectors until needed to avoid dirt and moisture from contaminating electrical circuits.
- Secure the harness to the frame or solid structural members at least every 12 in [30 cm].
- Follow existing harness runs already routed on the implement as much as possible. Proper harness routing should:
  - Secure harnessing and prevent the harness from hanging below the implement.
  - Provide sufficient clearance from moving components and operational zones around shafts; universal joints and suspension components; pulleys, gears, belts, and chains; moving linkages, cylinders, articulation joints, etc.
  - Protect harnessing from field debris and surrounding hazards (e.g. tree limbs, fence posts, crop stubble, dirt clumps or rocks that may fall or be thrown by the implement).
  - Protect harnessing from sharp bends, twisting, or flexing over short distances and normal implement operation.
  - Connectors and splices should not be located at bending points or in harness sections that move.
  - Ensure sufficient length for free movement of the implement during normal operation and prevent pulling, pinching, catching, or rubbing, especially in articulation and pivot points. Clamp harnessing securely to force controlled movement of the harness.
  - Avoid abrasive surfaces and sharp edges such as sheared or flame cut corners, fastener threads or cap screw heads, hose clamp ends, etc.
- Do not connect, affix, or allow harnessing to come into contact with components with high vibration forces, hot surfaces, or components carrying hot fluids beyond the temperature rating of harness components.
  - Harnessing should be protected or shielded if routing requires the hose to be exposed to conditions beyond harnessing component specifications.
- Avoid routing harnesses in areas where damage may occur due to build up of material (e.g. dirt, mud, snow, ice, etc.).
- Avoid routing harnesses in areas where the operator or service personnel might step or use as a grab bar.

**IMPORTANT:** Avoid applying direct spray or pressure washing of electrical components and connections. High pressure streams and sprays can penetrate seals, cause corrosion, or otherwise damage electrical components. When performing maintenance:

- Inspect electrical components and connectors for corrosion, damaged pins or housings, etc. Repair or replace components or harnessing as necessary.
- Ensure connectors are kept clean and dry. Apply dielectric grease to the sealing surfaces of all connections exposed to moisture, dirt, debris, and other contaminants. Repair or replace harnessing as necessary.
- Clean electrical components with pressurized air, aerosol electrical cleaning agent, or low pressure rinse.
- Remove visible surface water from electrical components and connections using pressurized air or an aerosol cleaning agent. Allow components to dry thoroughly before reconnecting cables.

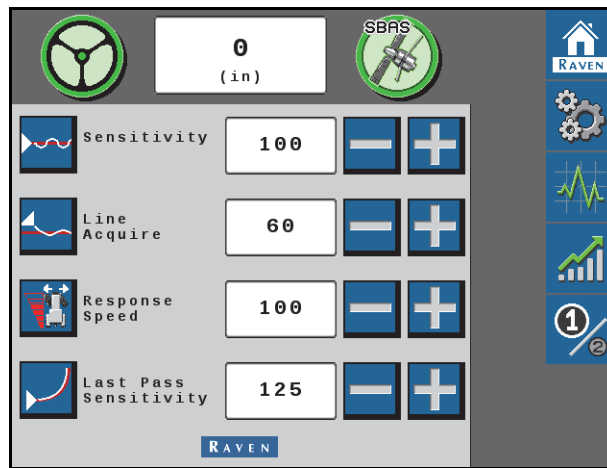




When coupled with a Raven field computer and a GPS solution of your choice, SC1/TC1™ is designed to offer hands-free steering of agricultural equipment including sprayers, spreaders, and tractors. When coupled with an implement steering system, SC1/TC1 is capable of keeping both your tractor and a towed implement on track.

The chapters in this manual are intended to assist with the proper calibration and operation of the SC1/TC1 system.

FIGURE 1. SC1/TC1 Home Page




## SYSTEM SPECIFICATIONS

### SC1/TC1 ELECTRICAL RATING

The specifications below are specific to the SC1/TC1 system:

Current Rating	Voltage Range
60 mA	8 - 36 Volts

## INSTALLATION

	<p><b>WARNING</b></p> <p>Carefully read and follow all safety requirements and precautions contained in this manual and the machine-specific or implement Installation Manual. Failure to follow safety instructions may lead to equipment damage, personal injury, or death.</p>
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## RECOMMENDATIONS

Raven Industries recommends the following best practices when installing or operating the SC1/TC1 system for the first time, at the start of the season, or when moving the SC1/TC1 system to another machine:

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

## UPDATES

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

<https://portal.ravenprecision.com/>

Refer to the Viper 4 Installation & Operation Manual (P/N 016-0171-539) or CRX Operation Manual (P/N 016-0171-664) for instructions on updating the SC1/TC1 node software.

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](mailto:techwriting@ravenind.com)

- Raven SC1™/TC1™ Calibration & Operation Manual for Towed Implements
- 016-4010-008 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.

**WARNING**

The machine will steer automatically. While calibrating or operating the SC1/TC1 system, be sure the area around the vehicle is clear of people and obstacles before engaging the steering system.

To disengage auto-steering at any time, turn the steering wheel or select the on-screen Stop button.

**WARNING**

During the auto-steering calibration, the machine will make several hard left and right turns. Adjust the vehicle speed and location as necessary.

**NOTICE**

Calibration of the machine steering system should be performed in a field or other large, open space and with conditions similar to normal vehicle operation.

If the ground or surface is slippery, muddy, or freshly tilled, the SC1/TC1 system may learn incorrect steering responses for normal operating conditions.

Ensure the machine hydraulics are operating properly and there are no other mechanical issues that may affect the performance of the SC1/TC1 system.

### CALIBRATION OVERVIEW

**IMPORTANT:** Installation of the SC1/TC1 system must be completed before calibrating the system. Refer to the machine-specific SC1/TC1 installation manual or contact your local Raven dealer for assistance with installing the SC1/TC1 system.

#### PREPARATION AND BEST PRACTICES

- For best performance, the SC1/TC1 guidance and steering system must be calibrated specifically for each machine configuration (e.g. tractor and implement combination).
- Start the calibration process with the machine parked on a level surface with several acres of smooth ground available.
- Ensure that the engine and hydraulic systems are at normal operating temperature and perform all calibration procedures at typical operating RPM.
- It is recommended to calibrate in conditions as close to actual field operations as possible. Before starting the calibration process:
  - Fold and rack booms on self-propelled applicators.
  - Disconnect any implements from the tractor hitch. Best results are obtained by completing the machine calibration without any towed implements. Refer to Chapter 3, *Initial Implement Calibration*, for assistance with calibrating the SC1/TC1 implement guidance features.
  - Verify machine measurements are correctly entered into the UT.
- During the auto-steering calibration, the machine will make several hard left and right turns. Adjust the vehicle speed and location as necessary.
  - To pause the calibration at any time, turn the steering wheel or press the **Stop** button on the UT. Tap the foot/resume switch to resume the calibration process.
  - To ensure successful auto-steering calibration, try to minimize the number of pauses.
  - If an error message is displayed during calibration, refer to Chapter 9, *Diagnostics and Troubleshooting* on page 67 for possible causes and corrective action steps to be taken.

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### INITIAL MACHINE CALIBRATION

Initial calibration of the SC1/TC1 system consists of the following component setup calibrations:

- *GPS Setup*
- *Terrain Compensation Calibration*
- *Auto-Steering Calibration*

**NOTE:** The SC1/TC1 system can be used for GPS only or for GPS and auto-steering. The following sections walk through the calibration procedures for both GPS only as well as GPS guidance and auto-steering. If using the system for GPS only, the steering calibration steps will not be completed.

1. When prompted, accept Operator Liability. Refer to the *Operator Liability* section on page 25 for additional information.

**NOTE:** The calibration wizard will be displayed the first time the SC1/TC1 module is accessed after installation or any time the Reset SC1/TC1 option is selected. Refer to *Resetting Calibrated Gains* section on page 113 for additional information about resetting the SC1/TC1 system.

2. Select the **Guidance and Steering** terminal from the UT menu. The Machine Selection page will be displayed.

GPS SETUP

**NOTE:** System Information, Diagnostic Trouble Codes (DTCs), and Machine Test pages may be viewed during the calibration process. For additional assistance with the settings available on these pages, please refer to the:

- *System Information* section on page 89
- *Diagnostic Trouble Codes (DTC)* section on page 67
- *Wheel Angle Sensor Settings* section on page 46.



Information



Alarms

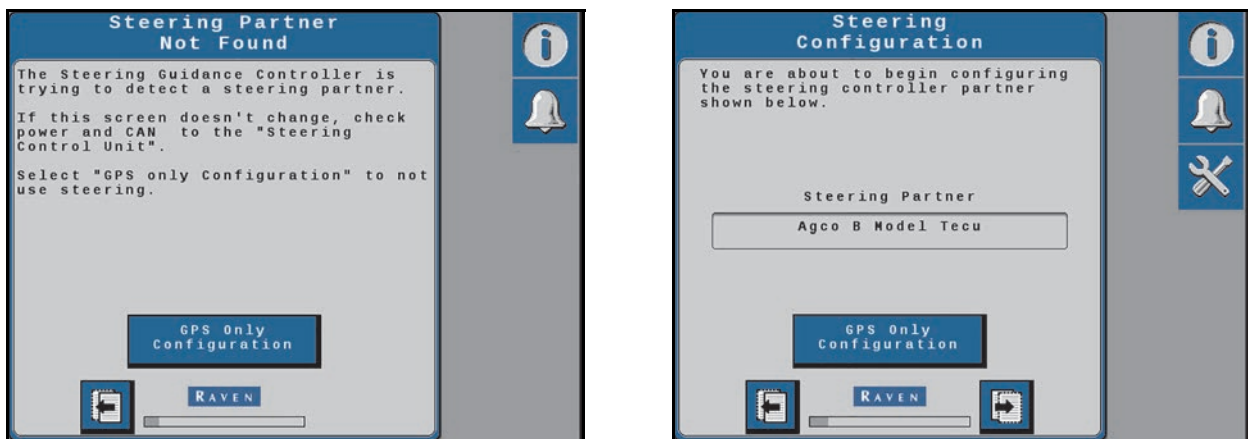


Machine Test

**NOTE:** The Machine Test icon will only be displayed if a Steering Partner is detected.

3. Use the drop-down options to select the Machine Type, Machine Make, and Machine Model most closely matching the equipment used for the current machine configuration.
4. When all options have been set, select the Next button. One of the two following pages will be displayed.
  - Steering Partner Not Found
  - Steering Configuration

**FIGURE 1. Steering Partner and Configuration**



5. Select the **GPS Only Configuration** button to set up and use only the GPS features of the SC1/TC1 system. Proceed to step 6 to continue the GPS Only Configuration.  
To calibrate both the GPS and auto-steering features of the SC1/TC1 system, confirm that the Steering Configuration page displays the correct Steering Partner and touch the **Next** button.
6. Use the drop-down to select the appropriate GPS receiver.

FIGURE 2. Receiver Selection

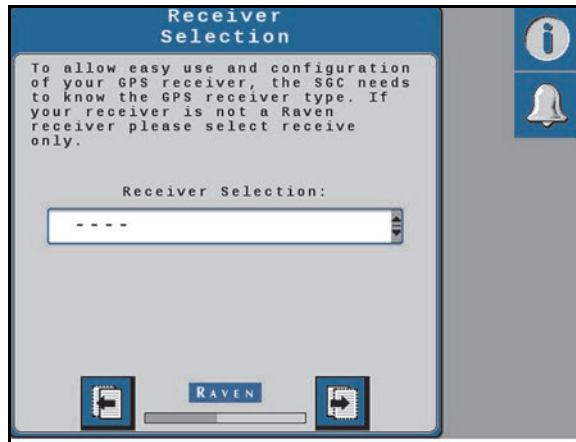


FIGURE 3. Antenna Fore/Aft Page



7. Select the value box to enter the Antenna Fore/Aft position.

**NOTE:** The Antenna Fore/Aft Offset is measured from the rear axle of the machine to the center of the GPS antenna. A negative value should be entered if the GPS antenna is located behind the rear axle.

8. Select the **Next** arrow.

FIGURE 4. Antenna Center Offset Page



9. Select the value box to enter the Antenna Center Offset position.

**NOTE:** The Antenna Center Offset position is measured from the centerline of the machine to the center of the GPS antenna. A negative value should be entered if the GPS antenna is located to the left of the centerline.

10. Select the **Next** arrow.

FIGURE 5. Antenna Height Page



11. Select the value box to enter the Antenna Height.

**NOTE:** The Antenna Height is measured from the ground to the mid-point of the GPS antenna.

12. Select the **Next** arrow.

FIGURE 6. Wheel Base Page

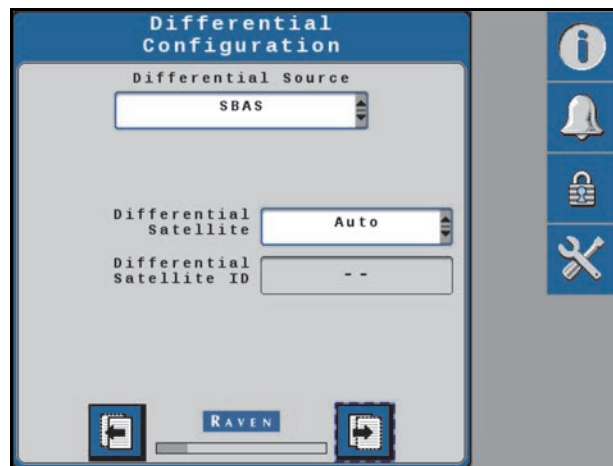


13. Select the value box to enter the Wheel Base.

**NOTE:** The Wheel Base is calculated by measuring from the center of the front tire to the center of the rear tire on both sides of the machine. Add these measurements together and then divide by 2 to get the average Wheel Base value.

14. Select the **Next** arrow.

FIGURE 7. GPS Differential Configuration Page



15. Select the appropriate GPS Differential Configuration from the drop-down box:

**NOTE:** Some differential sources may require a feature unlock. Refer to Chapter 7, *Feature Unlock Codes*, for additional assistance with entering feature unlocks. Contact your local Raven dealer for assistance with purchasing feature unlocks.

16. Select the **Next** arrow.



FIGURE 8. Position Accuracy Page



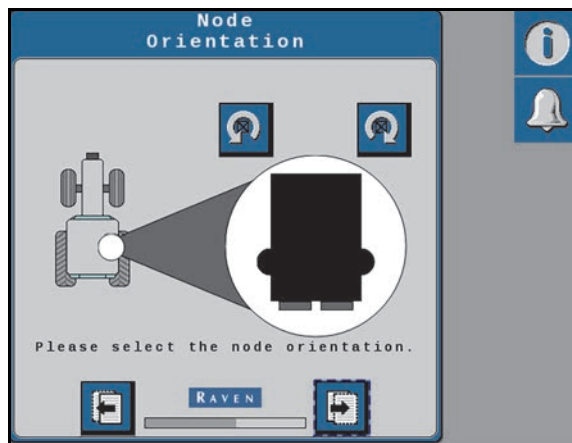
17. Review the GPS Status Information displayed and select the Next button to proceed with the calibration process.

**NOTE:** The GPS solution must be converged to calibrate and proceed with the initial system calibration.

18. Select the **Next** arrow.

19. Use the rotation buttons until the on-screen display matches the orientation of the SC1/TC1 ECU.

FIGURE 9. SC1/TC1 ECU Orientation



20. Select the **Next** arrow.

## TERRAIN COMPENSATION CALIBRATION

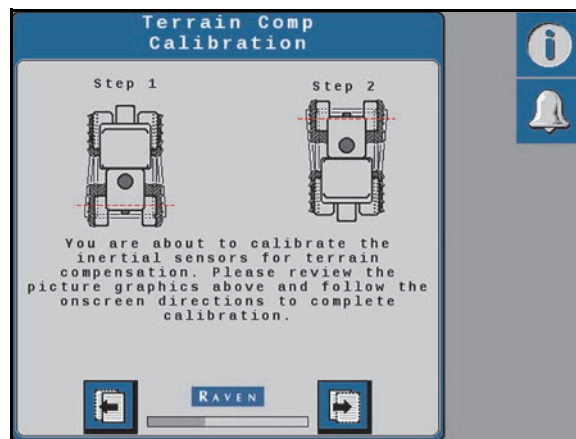
FIGURE 10. Terrain Compensation Calibration (page 1)



1. Drive the machine forward 10 m [33 feet] and park on a flat surface.

**NOTE:** The SC1/TC1 system must detect the direction of forward travel to properly calibrate the terrain compensation features.

FIGURE 11. Terrain Compensation Calibration (page 2)



2. Stop the machine on a level surface.
3. Place flags or markers to mark rear tire position on each side of the machine.
4. Select the **Next** button and follow the on-screen instructions to begin the terrain compensation calibration.

FIGURE 12. Step 1 - Marking the Pivot Point Before Calibration

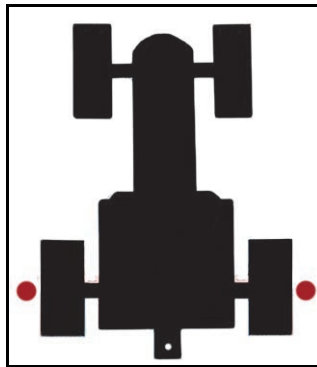
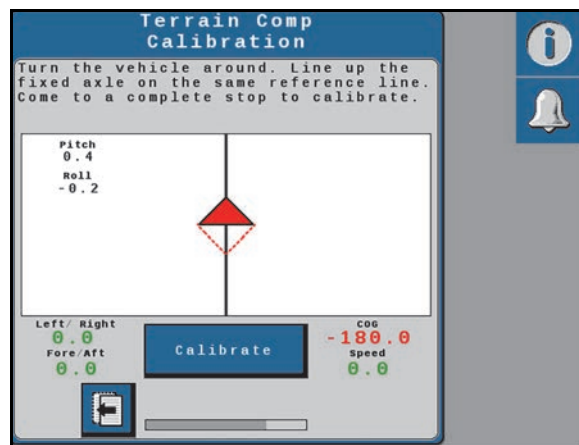
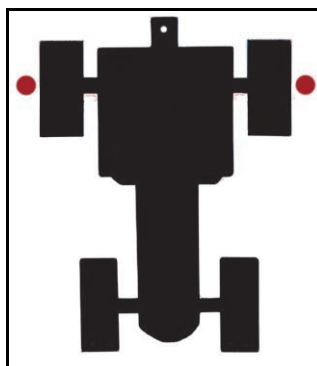


FIGURE 13. Terrain Compensation Calibration



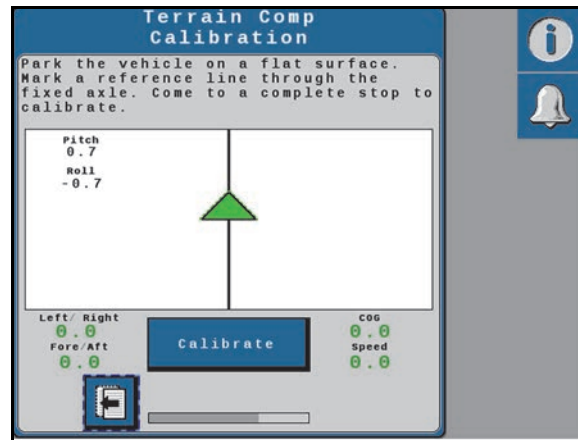
5. Select the **Calibrate** button to begin the calibration process.
6. The progress of the terrain compensation calibration will be displayed on the page. Wait for the calibration process to be completed before moving the vehicle.
7. Drive forward and turn the machine around (180°). Park the vehicle between the markers facing in the opposite direction as when the Calibrate button was first selected. Make sure the markers are aligned with the pivot point of the machine on opposite sides of the machine.

FIGURE 14. Step 2 - Machine Orientation to Complete Calibration



**NOTE:** The two triangles on the display should line up on top of each other when the machine is in the correct position.

FIGURE 15. Terrain Comp Calibration Page



8. Select the **Calibrate** button again to complete the Terrain Compensation Calibration.
9. Select the **Next** arrow.

**NOTE:** If calibrating the SC1/TC1 system for GPS only operation, the Calibration Wizard Summary will be displayed. Touch the Accept button to go to the GPS Only Home page. Refer to Chapter 4, *Routine Machine Operation*, for assistance with operating the SC1/TC1 system in GPS only mode.

If calibrating the auto-steering features, continue to the next section to continue the SC1/TC1 system calibration.

FIGURE 16. Calibration Summary



## AUTO-STEERING CALIBRATION

The Auto-Steering calibration consists of the following component setup calibrations:

- *Resume and Disengage Switch Calibration*
- *Wheel Angle Sensor (WAS) Calibration*

RESUME AND DISENGAGE SWITCH CALIBRATION

FIGURE 17. Resume Switch Verification Page



1. Press the foot/resume switch. The switch status icon will change if the switch input is detected and the calibration will automatically proceed to the next page.

**NOTE:** Select the **Use On-Screen Engage** option to use an on-screen engage widget to start and stop auto-steering during SC1/TC1 operation.

FIGURE 18. Disengage Switch Calibration Page



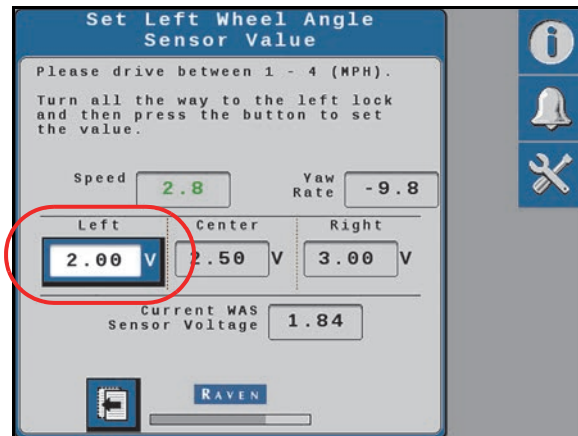
2. Turn the steering wheel to calibrate the disengage sensor. The status icon will change if the input is detected and the calibration will automatically proceed to the next page.

**NOTE:** In a SmarTrax MD/HD system, a page displaying the calibrated disengage value will be displayed. This value is editable.

WHEEL ANGLE SENSOR (WAS) CALIBRATION

**NOTE:** The machine must remain moving during the WAS calibration.

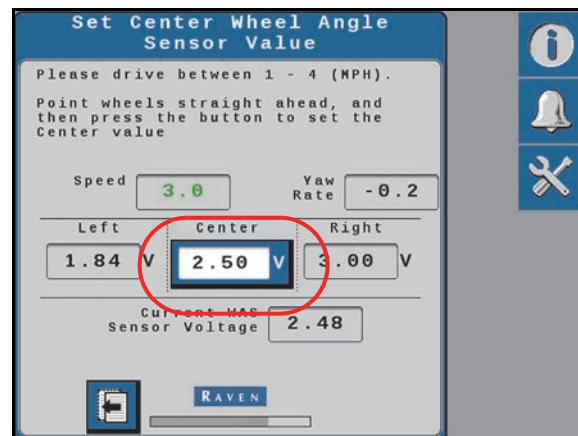
FIGURE 19. Left WAS Calibration Page



1. Drive forward between 2 - 6 km/h [1 - 4 mph].
2. Turn the steering wheel all the way to the left steering lock.
3. Select the **Left** button to set the left WAS value.

**NOTE:** Do not move the steering wheel until the calibration page advances to the Center WAS setting.

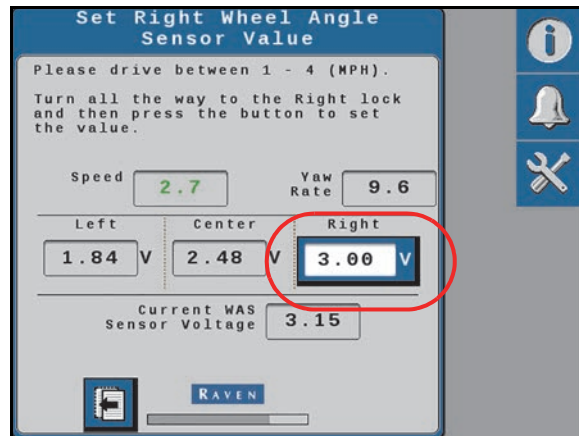
FIGURE 20. Center WAS Calibration Page



4. While driving forward between 2 - 6 km/h [1 - 4 mph], recenter the steering wheel to drive straight ahead.
5. Select the **Center** button to set the center WAS value.

**NOTE:** Do not move the steering wheel until the calibration page advances to the Right WAS setting.

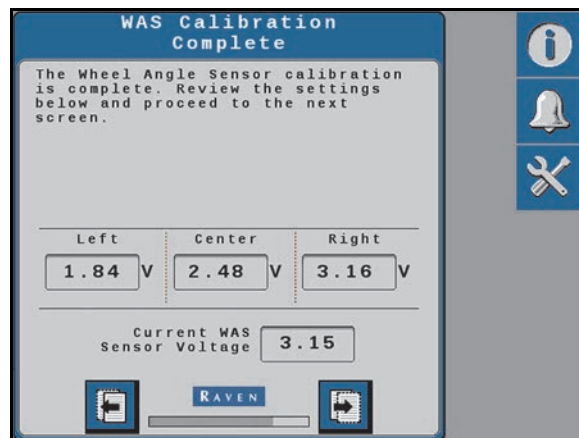
FIGURE 21. Right WAS Calibration Page



6. Continue driving forward between 2 - 6 km/h [1 - 4 mph].
7. Turn the steering wheel all the way to the right steering lock.
8. Select the **Right** button to set the right WAS value.

**NOTE:** Do not move the steering wheel until the Calibration Complete page is displayed.

FIGURE 22. WAS Calibration Complete Page



9. Review the WAS calibration details.
10. Press the **Next** arrow.

### HYDRAULIC SYSTEM CALIBRATION

The steering control calibration process allows the SC1/TC1 system to learn the hydraulic capabilities of the machine for optimal steering performance in the field.

**NOTE:** Review the *Preparation and Best Practices* section on page 8 for tips on completing the auto-steering calibration successfully.


It is recommended to complete the SC1/TC1 Steering Control Calibration for optimal system performance. However, the automatic calibration may be bypassed by selecting the **Use Quick**

**Calibration** option. The system will load default gains for the machine selected during the calibration process.

The Quick Calibration option will not be available if a “Generic” machine make was selected during the GPS calibration process.

**NOTE:** If an error message is displayed during calibration, refer to Chapter 9, *Diagnostics and Troubleshooting* on page 67 for possible causes and corrective action steps to be taken.

NOTICE



Calibration of the machine steering system should be performed in a field or other large, open space and with conditions similar to normal vehicle operation.

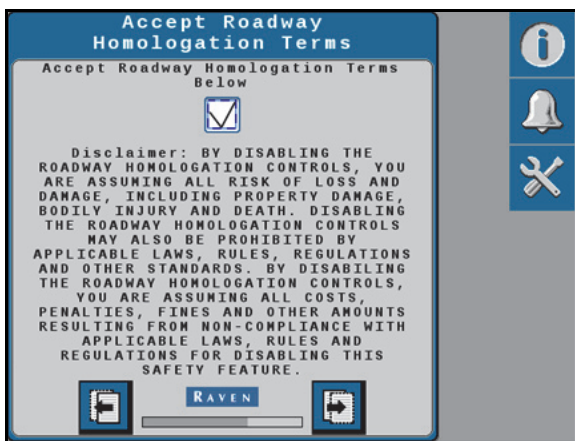
If the ground or surface is slippery, muddy, or freshly tilled, the SC1/TC1 system may learn incorrect steering responses for normal operating conditions.

Ensure the hydraulic systems are operating properly and there are no other mechanical issues that may affect the performance of the SC1/TC1 system.

To complete the Steering Control Calibration:

1. Accept the Roadway Homologation terms. Carefully review the on-screen disclaimer and select the check box option.

**FIGURE 23. Roadway Homologation**





**NOTE:** Refer to the Chapter 11, *Roadway Homologation*, for additional information about the SC1/TC1 homologation terms and certifications.

2. Select the **Next** arrow.

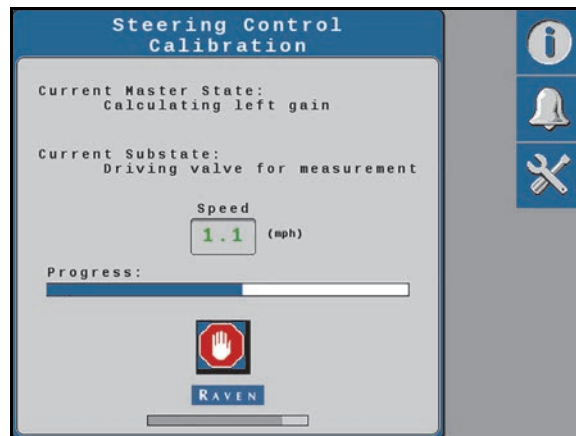


3. Drive forward between 2 - 6 km/h [1 - 4 mph].

	<p><b>WARNING</b></p> <p>The machine will steer automatically. While calibrating or operating the SC1/TC1 system, be sure the area around the vehicle is clear of people and obstacles before engaging the steering system.</p> <p>To disengage auto-steering at any time, turn the steering wheel or select the on-screen Stop button.</p>
	<p><b>WARNING</b></p> <p>Always remain in control of the machine. During the auto-steering calibration, the machine will make several hard left and right turns. Adjust the vehicle speed and location as necessary.</p>

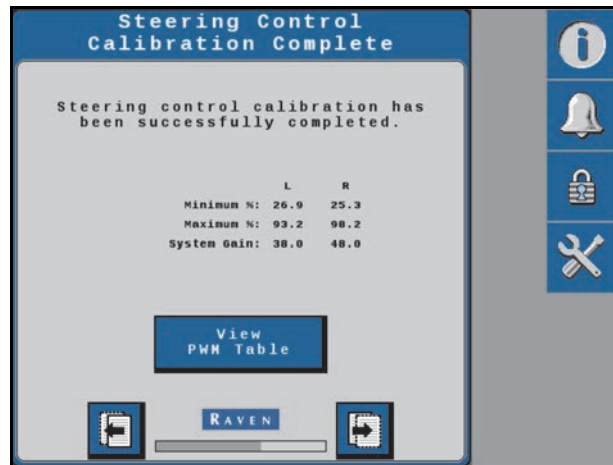
4. Press the foot/resume switch or use the on-screen arrow to begin calibration.
5. The display will show progress of the auto-steering calibration.

FIGURE 24. Calibration in Process Page



6. Once the calibration process is complete, select the **Accept** button.

FIGURE 25. Auto Calibration Complete



CALIBRATION SUMMARY

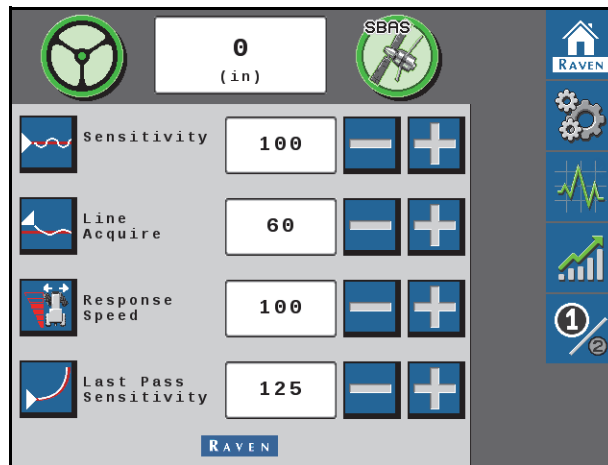
1. Review the Calibration Wizard Summary information.

FIGURE 26. Calibration Wizard Summary



2. Select the **Accept** button to complete the calibration process. Refer to Chapter 4, *Routine Machine Operation*, for assistance with operation of the SC1/TC1 guidance and steering system.

FIGURE 27. SC1/TC1 Home Page





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**NOTE:** The ISO UT must be calibrated specifically for the vehicle before being used to operate the SC1/TC1 system. Refer to the UT operation manual for additional assistance with using your UT display.

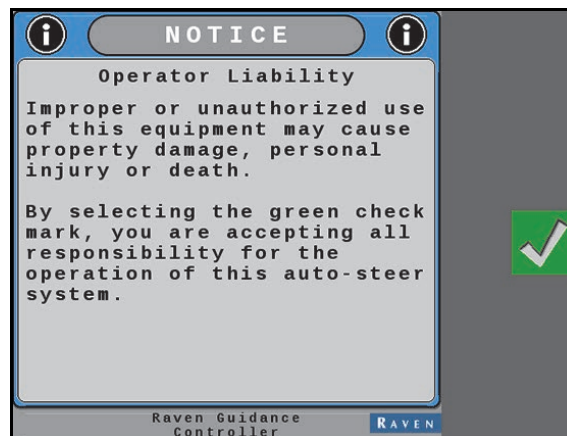
Refer to the UT display or Raven field computer operation manual for assistance with setting up and starting a job, setting guidance lines, and other guidance settings during in-field operations.

---

## OPERATOR LIABILITY

The Operator Liability Warning is displayed each time the SC1/TC1 system is powered on. If the operator does not accept liability, the SC1/TC1 system will be disabled and cannot be reengaged until the liability warning is accepted.

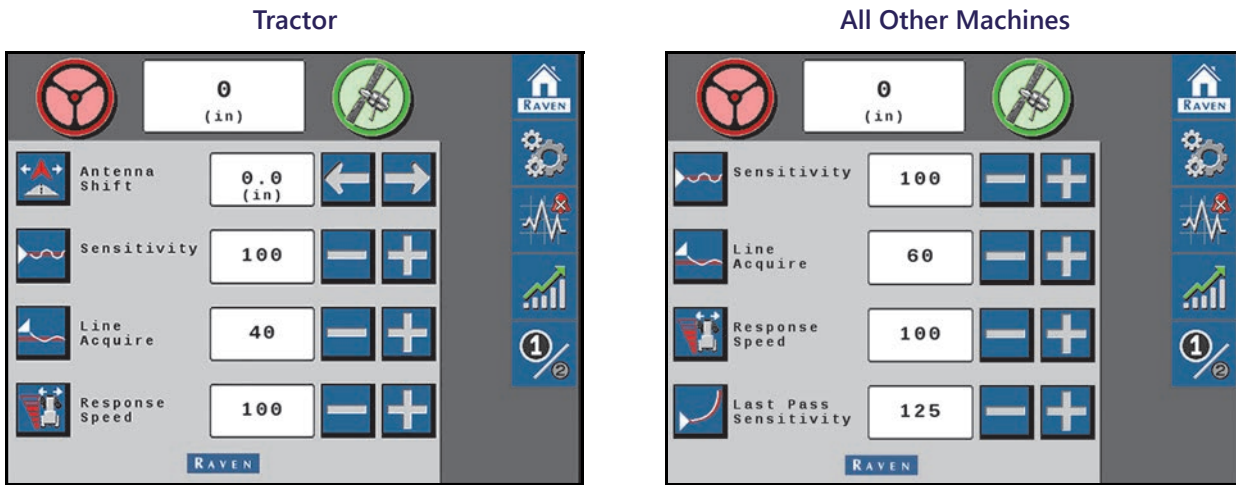
**FIGURE 1. Operator Liability Prompt**



To proceed with normal operation of the SC1/TC1 GPS and auto-steering features, read and accept the Operator Liability Warning.

HOME PAGE

FIGURE 2. Home Page Examples



**NOTE:** The Home page will display settings and options based upon the machine type and the features selected during the machine configuration calibration.

When operating in GPS Only mode, the Home page is replaced with the GPS Status information. See the *GPS Status Page* section on page 32 for information displayed on this page.

STEERING STATUS INDICATOR

The following are common steering status or mode messages which may occur while the SC1/TC1 system is on the ISOBUS:

Display	Message
	System critical DTCs are present. The SC1/TC1 system cannot be engaged in this state. Refer to Chapter 9, <i>Diagnostics and Troubleshooting</i> , for assistance with resolving active DTCs and troubleshooting the system..
	Warning DTCs are present. The SC1/TC1 system may be engaged in this state, but system performance may be impacted.
	No active DTCs are present. The SC1/TC1 system is ready to be engaged.
	Steering is engaged, with no active diagnostic or troubleshooting codes present in the SC1/TC1 system.





Select the steering wheel icon to display the Steering Status page. Refer to the *Steering Status Page* section on page 28 for additional assistance with the information available on this page.

## OFF-LINE INDICATOR

Shown in the top, center of the Home page, the off-line indicator displays the distance and direction to the current guidance line.

## GPS STATUS INDICATOR

The following are common GPS status or mode information which may occur while the SC1/TC1 system is engaged:

	<p>No GPS information is detected by the SC1/TC1 system.</p>
	<p>GPS solution is not converged or an active DTC has been detected.</p>
	<p>GPS solution is converged and no active DTCs are detected. <b>NOTE:</b> Both the steering wheel and GPS icons must be green in order to engage the SC1/TC1 system.</p>
	<p>GPS RTK-L or RTK Pro solutions are being used for field guidance. DTCs may be present.</p>

Select the satellite icon to display the GPS Status page. Refer to the *GPS Status Page* section on page 32 for additional assistance with the information available on this page.

## TUNING SETTINGS

The following settings and adjustments are displayed on the SC1/TC1 Home page and may be used during normal operation to adjust or tune the system:

- **Antenna Shift (Tractors Only)** - The Antenna Shift settings allows the user to shift the center point of the antenna relative to the center point of the machine. Negative values indicate that the antenna is located to the left of the center point.

**NOTE:** The Antenna Shift value can be verified by marking the hitch pin of the tractor with a flag, setting a guidance line, turning the machine around 180° degrees, and stopping on the guidance line with the hitch pin in the same location. If the hitch pin does not line up with the flag, divide the number of inches [cm] by two and enter that value into the Antenna Shift field. If the hitch pin falls to the right of the flag, enter a positive Antenna Shift value. If the hitch pin falls to the left of the flag, enter a negative value.

- **Sensitivity** - The Sensitivity value determines how aggressively the machine will attempt to remain on the guidance line. The Sensitivity value is used to fine-tune the SC1/TC1 system. Values range between 50 - 200.

**NOTE:** If the machine is slow to react after a steering adjustment, increase the Sensitivity setting in increments of 10. If the machine makes an adjustment too quickly, decrease the Sensitivity value.

- **Line Acquire** - The Line Acquire value determines the distance away from the set guidance line at which the machine will make adjustments to come closer to the guidance line. If a low value is entered, the machine will

make an adjustment at a greater distance as it drifts away from the guidance line. If a high value is entered, the machine is quicker to adjust the steering while it is still close to the guidance line. Values range between 1 - 200.

**NOTE:** A low value will minimize the risk of over-correction, but it could take longer to acquire the guidance line. A high value increases the risk of over-correction, but the machine is quicker to re-acquire the guidance line. If the machine takes too long to acquire the guidance line, increase the Line Acquire value in increments of 10. If the machine over-shoots the guidance line, decrease the value in increments of 10.

- **Response Speed** - The Response Speed determines how quickly the machine will steer when prompted. If the Response Speed is too high, the steering may become jittery. If the Response Speed is too low, the machine may wander lazily. Values range between 1 - 255.

**NOTE:** If steering becomes jittery, lower the Response Speed value in increments of 10. If steering does not become jittery, the Response Speed value may be increased in increments of 10 until the desired Response Speed is reached.

- **Last Pass Sensitivity (non-Tractors Only)** - The Last Pass Sensitivity determines how tightly the machine tries to steer on a curved path. Too high of a value will cause the machine to steer to the inside of a curve. Too low of a value will cause the machine to steer to the outside of a curve. Values range from 1 - 500.

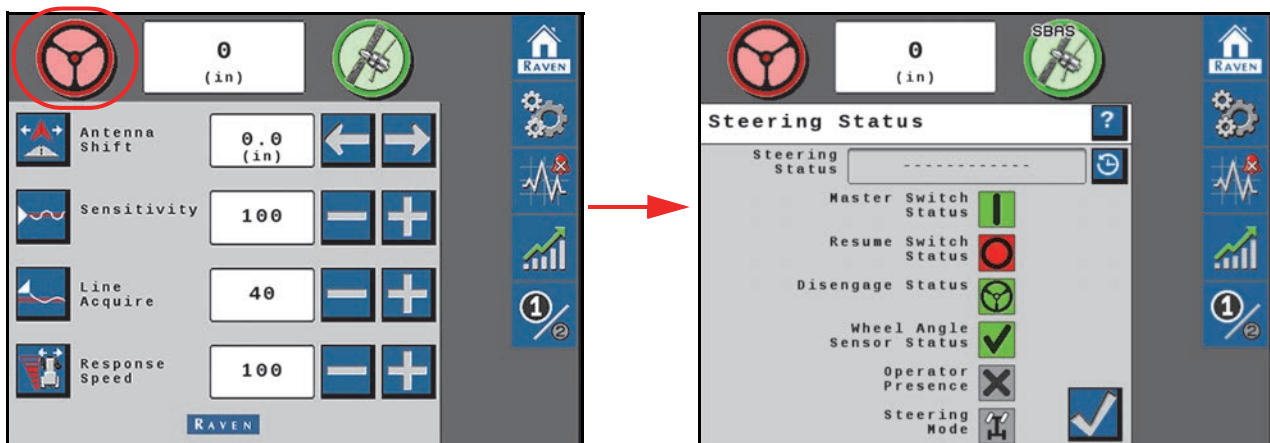
**NOTE:** Refer to the *Advanced Tuning* section on page 39 for assistance with the Last Pass Sensitivity setting when operating on conventional tractors. Last Pass Sensitivity only adjusts the system performance on Last Pass and A-B Curve lines.

Adjusting the Last Pass Sensitivity will not affect pivot performance. To adjust Pivot performance, tune the Response Speed and Sensitivity values.

## STEERING STATUS PAGE

Select the steering wheel icon to display the Steering Status page. The Steering Status field displays the last exit code and the reason why steering was disabled.

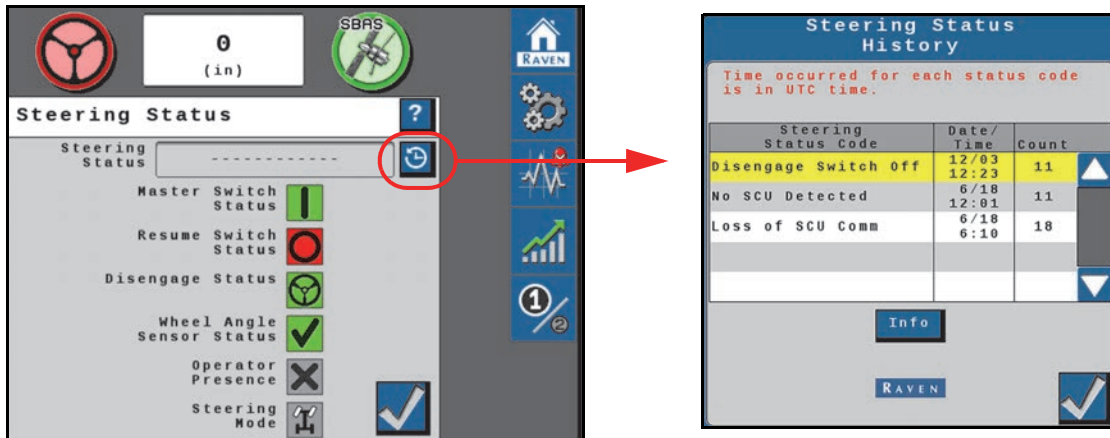
FIGURE 3. Steering Status Page



Select the Steering Status History icon next to the Steering Status field to view the history including the times the system disengaged and why it disengaged.

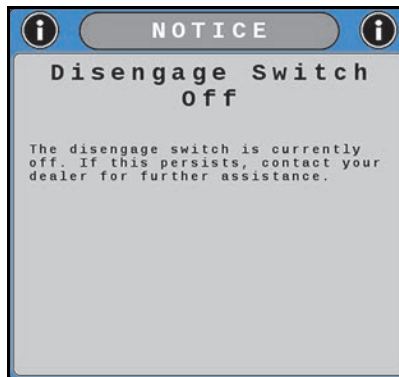


FIGURE 4. Steering Status History





Select the **Info** button on the bottom of the Steering Status History page to display a description of the disengagement code.

FIGURE 5. Info Button Information





## STATUS DISPLAYS

### MASTER SWITCH

Display	Message
	The master switch is set to "road mode." The SC1/TC1 system cannot be enabled until the master switch is toggled to "field mode."
	The master switch is set to "field mode" and the SC1/TC1 system can be enabled.




RESUME SWITCH

The status of the enable switch (e.g. foot switch) used to engage the steering system.

Display	Message
	The resume switch is set in the OFF position.
	The resume switch is in the ON position.




DISENGAGE SENSOR

Status of the pressure sensor used to disable steering when the steering wheel is turned.

Display	Message
	The SC1/TC1 disengage sensor is active. The SC1/TC1 system cannot be enabled.
	The SC1/TC1 disengage sensor is out of range or disconnected.
	The SC1/TC1 disengage sensor is inactive. The SC1/TC1 system can be enabled.





WHEEL ANGLE SENSOR

Displays the status of the position sensor.

Display	Message
	The wheel angle sensor (WAS) is out of range or disconnected.
	Wheel angle sensor (WAS) is not calibrated.
	The wheel angle sensor (WAS) is calibrated and ready to operate.



OPERATOR PRESENCE SWITCH

Displays the status or presence of the operator presence switch.

Display	Message
	The presence switch is not available or not used with the selected machine profile.
	The operator is not present in the seat.
	The operator presence switch is disconnected.
	The operator presence switch detects the operator. The SC1/TC1 system can be operated.

STEERING MODE

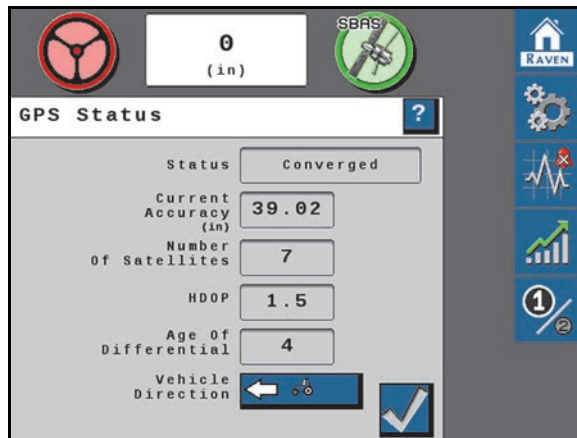
If the machine is equipped with two steerable axles, the steering mode provides an indicator for which steering mode is detected by the ECU.

Display	Message
	Front wheel steering mode.
	Four wheel steering mode.

**NOTE:** Front wheel steering will be displayed for all machines not equipped with a second steerable axle, or for machines not compatible with this feature.

GPS STATUS PAGE

FIGURE 6. GPS Status Page









Select the GPS icon to display the GPS Status page.

Display	Message
Status	Displays the selected GPS convergence status. <ul style="list-style-type: none"> <li>• Error</li> <li>• No Signal</li> <li>• Converging</li> <li>• Converged</li> </ul>
Current Accuracy	A value representing the reported horizontal accuracy of the current GNSS solution as detected by the receiver.
Number of Satellites	The number of satellites currently in view by the GPS receiver.
HDOP	Horizontal Dilution of Precision. A higher value indicates that the satellites currently used for the machine position are grouped closer together and accuracy may be reduced. If the satellites are too close, the system may record a High HDOP DTC.
Age of Differential	Time (in seconds) since the last differential correction was received. This field will not display a value if a differential source is not currently tracked.
Vehicle Direction	Select the Vehicle Direction button to manually override the displayed direction of travel.

## CRX FEATURES AND OPERATION

### CRX WIDGET DEFINITIONS

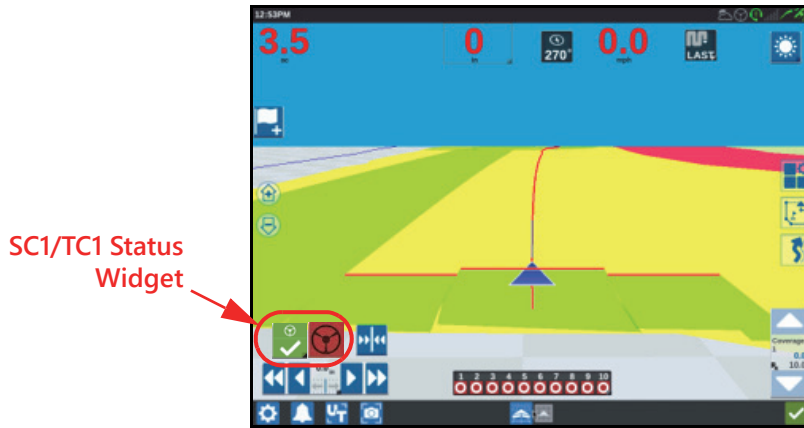
The following are common status or mode information which may be displayed on a ROS device while operating the SC1/TC1 system while in a job:

Display	Message
	The SC1/TC1 node is detected, but the operator must accept responsibility for the operation of the SC1/TC1 system.
	No A-B path or guidance line has been set or an active DTC is preventing the SC1/TC1 system from engaging.
	SC1/TC1 is detected, turned on, and calibrated. A non-critical DTC is present.
	SC1/TC1 is detected, on, and calibrated.
	SC1/TC1 is detected and in operation.
	SC1/TC1 is detected and in operation. A non-critical DTC is present.

**NOTE:** Refer to *Diagnostic Trouble Codes (DTC)* section on page 67 for additional status conditions which may be displayed in the SC1/TC1 on-screen widget.

ENGAGING SC1/TC1

FIGURE 7. SC1/TC1 Status Widget



**NOTE:** If the SC1/TC1 steering widget does not appear on the page, refer to the Viper/Viper 4+ Installation and Operation manual (P/N 016-0171-539) for further information on adding widgets.

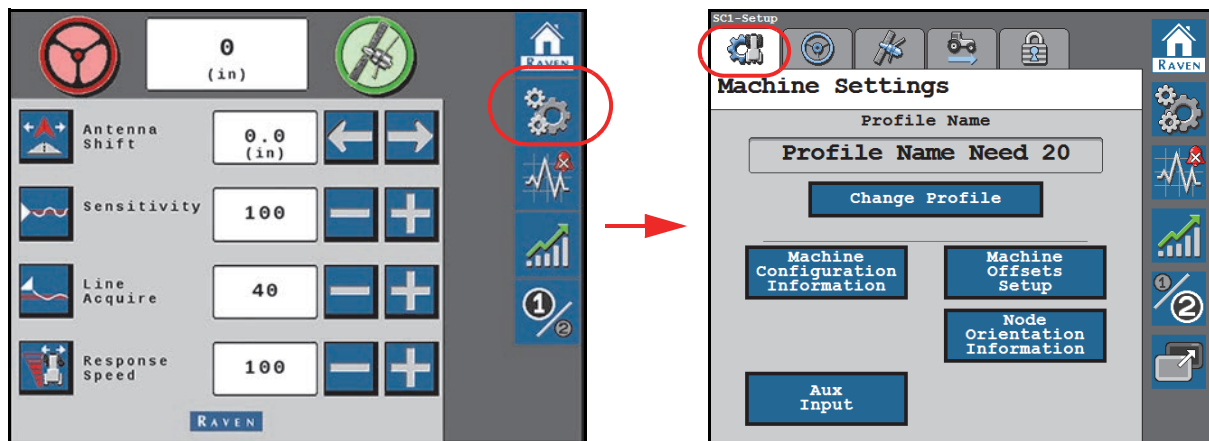
**NOTE:** The operator liability waiver must be accepted before the SC1/TC1 system can be enabled for operation.

The SC1/TC1 steering may also be engaged using the following methods:

- Tap the foot switch or rocker switch to engage SC1/TC1 features during field operation.
- Press the SC1/TC1 on-screen status widget to engage the SC1/TC1 during field operation.

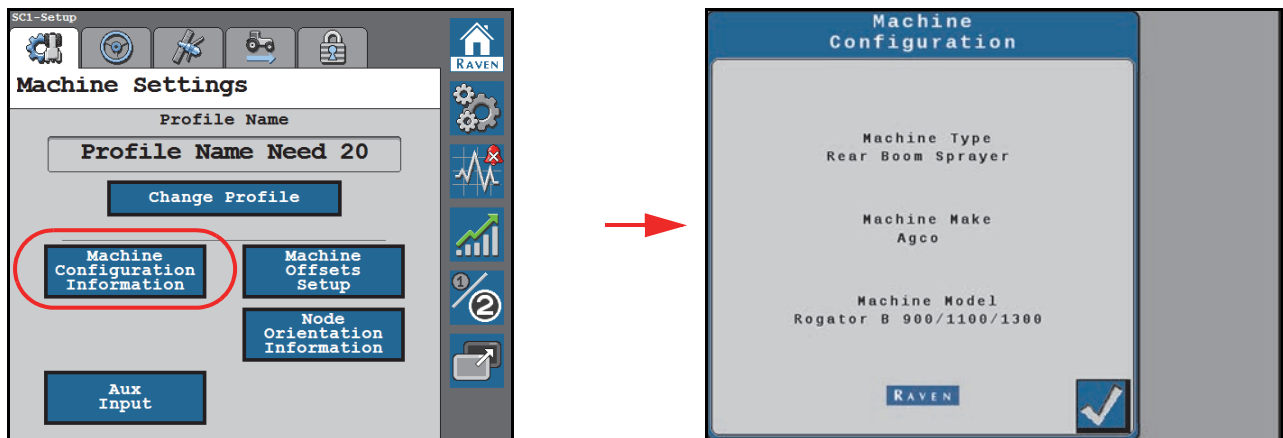
## MACHINE SETTINGS TAB

FIGURE 1. Machine Settings Page



## MACHINE CONFIGURATION

FIGURE 2. Machine Configuration Page



To view the current machine configuration:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. On the Machine Settings tab, select the Machine Configuration Information button.
3. The current machine type, make, and model information that was entered during the calibration process. The Machine Configuration settings cannot be changed unless the SC1/TC1 system is recalibrated.

4. Select the Accept button in the lower, right corner of the page to return to the Machine Settings tab.

## ANTENNA OFFSETS SETTINGS

FIGURE 3. Machine Offsets Setup Page



To adjust the antenna offset measurements:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. On the Machine Settings tab, select the Machine Offsets Setup button.
3. The Machine Offsets page displays the machine-specific measurements that were entered during the system calibration:

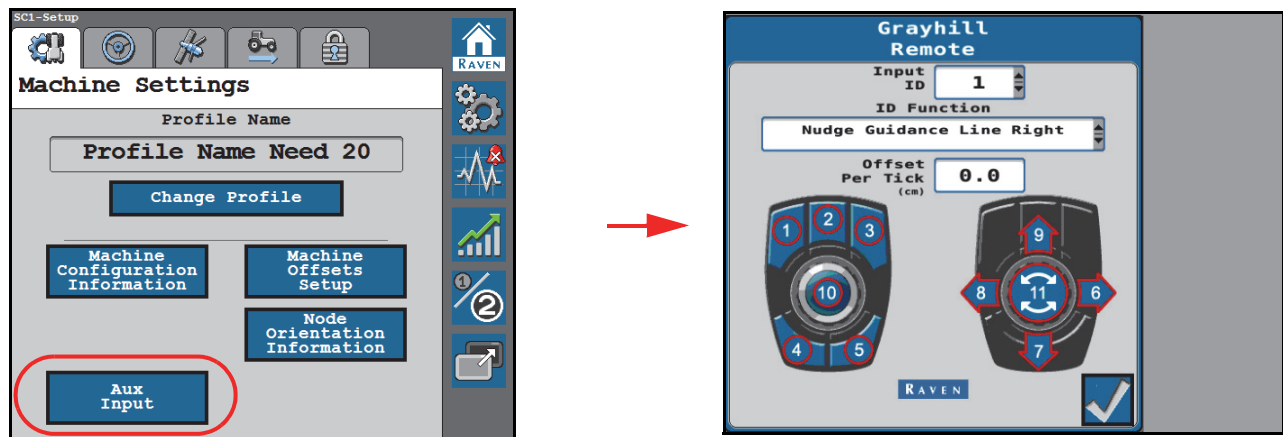
**NOTE:** Select the **Help ?** icon for more information about the settings shown on the page.

- **Antenna Height** - The Antenna Height is measured from the ground to the middle of the GPS antenna.
  - **Antenna Center Offset** - The Antenna Center Offset position measured from the centerline of the machine to the center of the GPS antenna. A negative value should be entered if the GPS antenna is located to the left of the center line.
  - **Antenna Fore/Aft** - The Antenna Fore/Aft position is measured from the rear axle of the machine to the center of the GPS antenna. A negative value should be entered if the GPS antenna is located behind the rear axle.
  - **Wheel Base** - The Wheel Base is calculated by measuring from the center of the front tire to the center of the rear tire.
4. Select the Accept button in the lower, right corner of the page to return to the Machine Settings tab.



## AUX INPUT OPTIONS

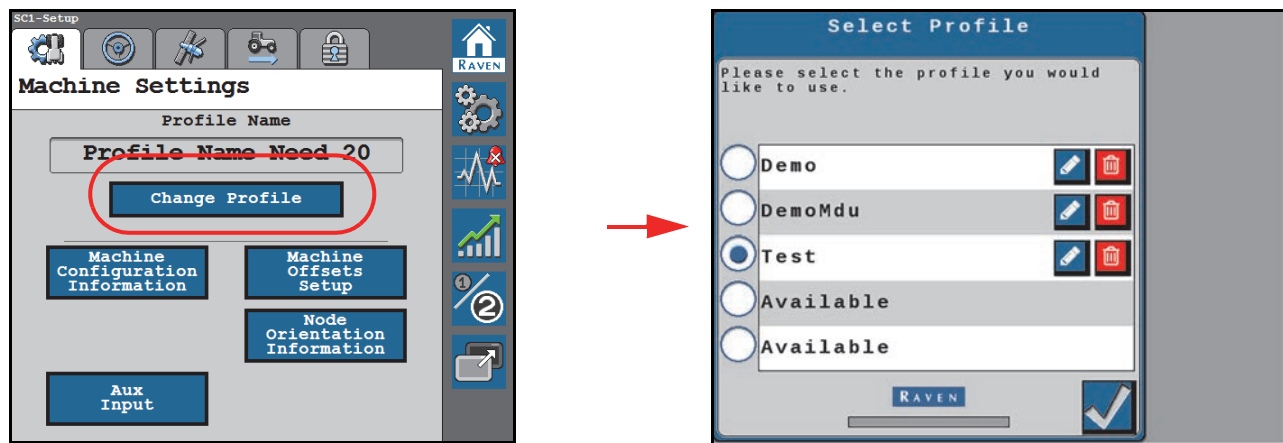
FIGURE 4. Machine Offsets Setup Page.



Refer to Chapter 8, *Aux Input Setup and Operation*, for assistance with the Auxiliary Input options and Grayhill controller.

## CHANGE PROFILE

FIGURE 5. Change Profile



To select a different profile, create a new profile, or recalibrate the current profile:

1. From the SC1/TC1 Home page, select the Settings Menu button.

**NOTE:** The name of the current profile selected is displayed at the top of the Machine Settings tab.

2. Select the Change Profile button.

**NOTE:** Up to 5 machine profiles may be saved for the SC1/TC1 system.

3. Use the radio buttons to select a different profile.

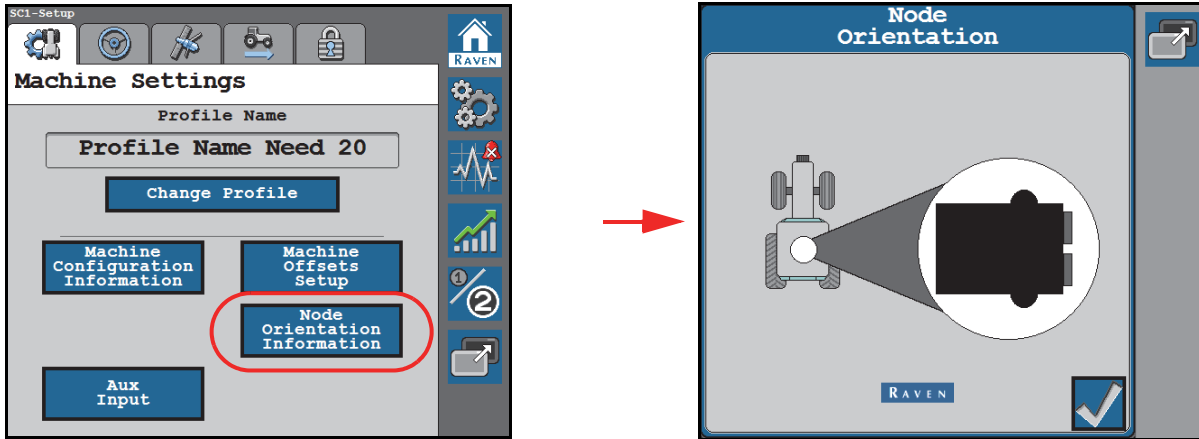
Selecting an "Available" profile will require the operator to complete the Initial Machine Configuration process.

4. Select the Edit button to rename the selected profile or the Delete button to remove profile settings from the SC1/TC1 system. The profile will need to be recalibrated.
5. Select the Accept button in the lower, right corner of the page to return to the Machine Settings tab.



## NODE ORIENTATION

FIGURE 6. Node Orientation



To adjust the node orientation:

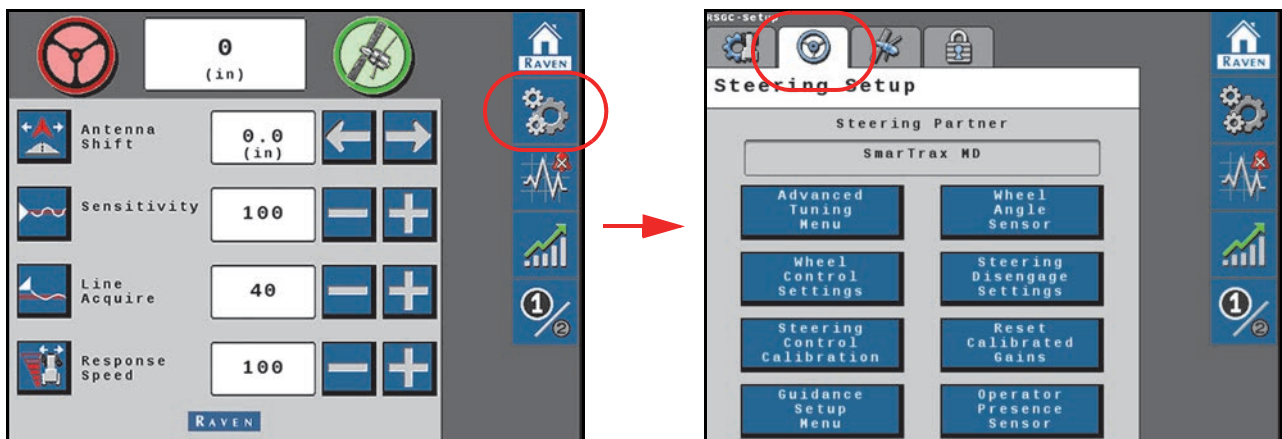
1. From the SC1/TC1 Home page, select the Settings Menu button.
2. On the Machine Settings tab, select the Node Orientation button.
3. The Node Orientation page displays the currently configured orientation of the SC1/TC1 ECU. To change the orientation, restart the profile set up.

**NOTE:** The SC1/TC1 ECU must be mounted in a horizontal orientation. Vertical orientations are not supported.

4. Select the Accept button in the lower, right corner of the page to return to the Machine Settings tab.

## STEERING SETUP TAB

FIGURE 7. Steering Setup Page

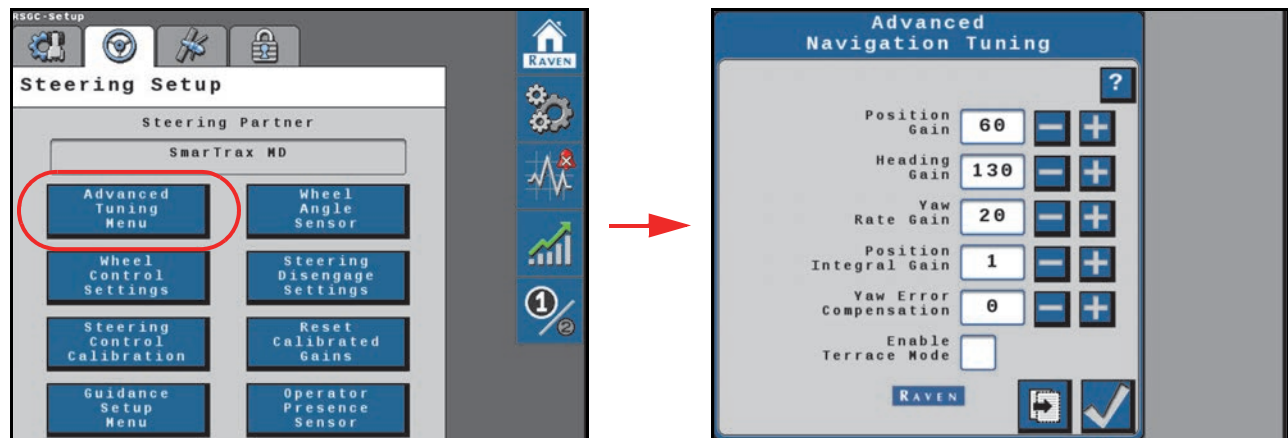


The Steering Setup tab displays the steering partner with which SC1/TC1 works during auto-steering operation. The Steering Setup tab offers settings and options which allow the operator to fine-tune the steering system.

**NOTE:** The Steering Setup tab will not be available if the SC1/TC1 system is calibrated for the GPS Only mode.

## ADVANCED TUNING

FIGURE 8. Advanced Tuning Menu



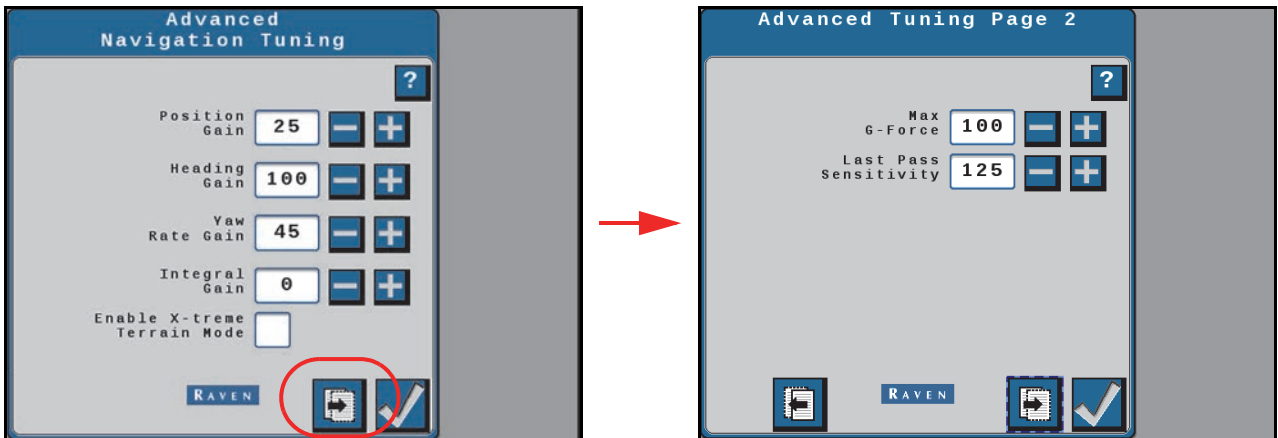
To access advanced auto-steering tuning options and settings:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the Steering Setup tab and the Advanced Tuning Menu button.

The following settings and options are displayed on the Advanced Navigation Tuning page:

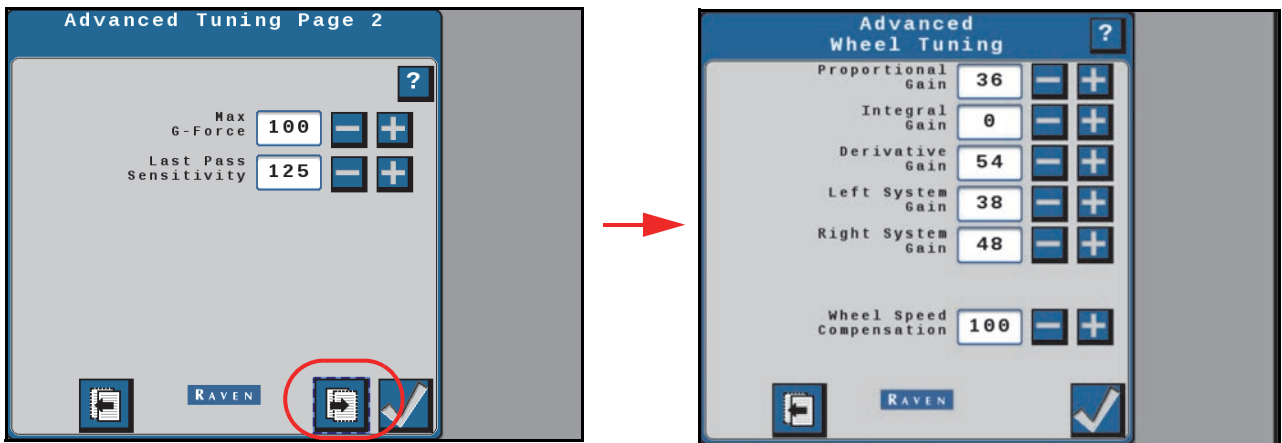
- **Position Gain** - Determines how aggressively the SC1/TC1 system responds to an off-track error. A higher Position Gain value results in a more aggressive response to an off-track error, while a lower value indicates a less aggressive response.
  - **Heading Gain** - Determines how aggressively the SC1/TC1 system responds to a heading error. A higher Heading Gain value results in a more aggressive response to a heading error, while a lower value indicates a less aggressive response.
  - **Yaw Rate Gain** - Determines the impact of the yaw rate on tracking performance. A higher Yaw Rate Gain value results in a more aggressive response to yaw rate, while a lower value results in a less aggressive response.
  - **Integral Gain** - This value corrects long-term errors in the wheel control. If the system is not achieving the desired wheel angle during operation, the system will re-direct the wheels to the desired set point. This value is generally at or near 0.
  - **Yaw Error Compensation** - Increase the yaw error compensation value to allow the machine steer more aggressively on curves.
  - **Enable Terrace Mode** - This setting allows adjustment for steering performance on terraces.
3. Select the Next button to display the Advanced Tuning Page 2. The following settings and options are displayed:

FIGURE 9. Advanced Tuning Page 2



- **Max G-Force** - Limits the centripetal force experienced by the operator during a turn. A higher value allows to the machine to perform sharper turns, while a lower value limits the machine turning radius.
  - **Last Pass Sensitivity** - The Last Pass Sensitivity determines how tightly the machine tries to steer on a curved path. Too high of a value will cause the machine to steer to the inside of a curve. Too low of a value will cause the machine to steer to the outside of a curve. Values range from 1 - 500.
4. Select the Next button to display the Advanced Wheel Tuning page. The following settings and options are displayed:

FIGURE 10. Advanced Wheel Tuning Page

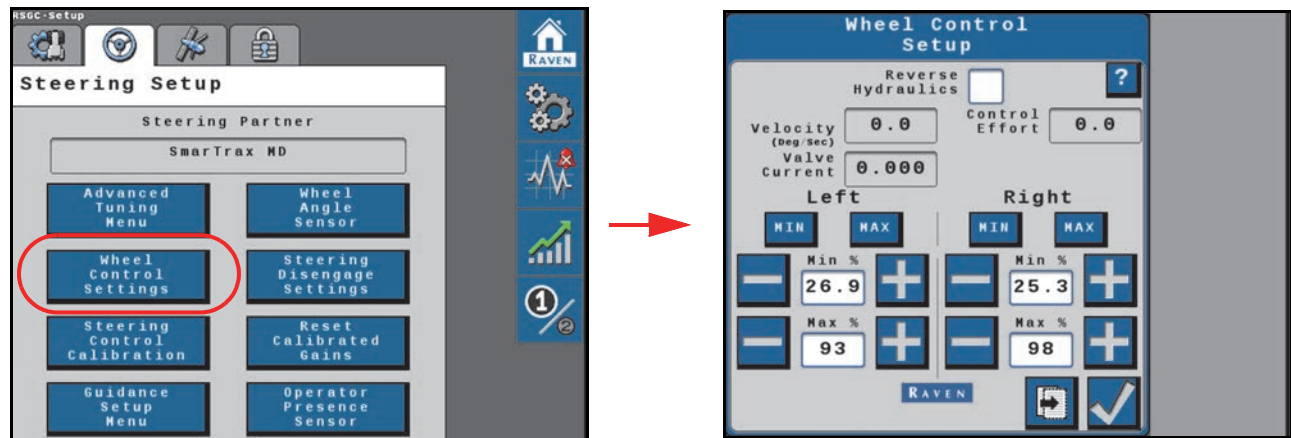


- **Proportional Gain** - Determines the rate of the wheel response. Increasing the Proportional Gain value causes the wheel response to be faster, but can result in the machine overshooting the target wheel angle position or can cause the wheels to take a longer time to stabilize.
- **Integral Gain** - This value corrects long-term errors in the steering control loop. This setting should be adjusted by qualified technicians only. Raven Industries does not recommend that anyone other than a qualified technician make changes to this setting.
- **Derivative Gain** - The Derivative Gain value limits the wheel response time. A larger Derivative Gain value will reduce the tendency to overshoot the target wheel angle position, but will limit the wheel speed.
- **Left System Gain** - Compensates for any bias or non-linearity in the steering valve while the machine is turning to the left.
- **Right System Gain** - Compensates for any bias or non-linearity in the steering valve while the machine is turning to the right.

- **Wheel Speed compensation** - This value allows the system to steer the machine more rapidly while steering on curves. A higher value will allow the system to steer more aggressively, but may cause the machine steering to be unstable. Lower the value to improve stability of the system on curved guidance lines.
5. Select the Accept button in the lower, right corner of the page to save the displayed selections and values and return to the Steering Setup tab.

## WHEEL CONTROL SETTINGS

FIGURE 11. Wheel Control Setup Page



To access wheel control settings:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the Steering Setup tab and the Wheel Control Settings button. The following information and settings are displayed on the page:

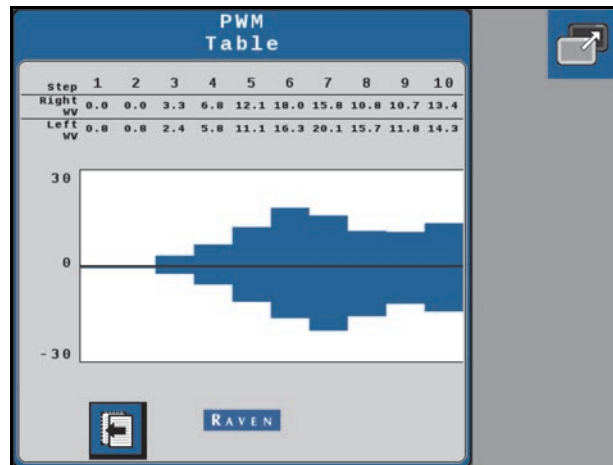
**NOTE:** Select the **Help ?** icon for more information about the settings shown on the page.

- **Reverse Hydraulics** - Enable this option if the hydraulic hoses are connected in reverse orientation (e.g. when steering left moves the wheels right, etc.).
- **Wheel Velocity** - The speed at which the wheels are moving, measured in degrees per second.
- **Control Effort** - The amount of effort the SC1/TC1 system is using to drive the wheels.
- **Valve/Motor Current** - Displays the current draw of the steering valve/steering motor.
- **Left/Right MIN/MAX** - Touch and hold the MIN or MAX button to test the steering system response using the set minimum and maximum values. For example, touching the Left MIN button will steer the machine to the left using the minimum control effort.
- **Left/Right Min %** - The minimum Control Effort that the control valve must use to turn the wheels. Values range from 0 - 99.

**NOTE:** The Min values cannot exceed the Max values.

- **Left/Right Max %** - The maximum Control Effort that the valve may use to turn the wheels. Values range from 1 - 100.
3. Select the **Next** button to review the PWM Table page and the control effort at various target angles. Or, select the **Accept** button in the lower, right corner of the page to save the displayed settings and return to the Steering Setup tab.

FIGURE 12. PWM Table Page




4. Select the **Back** button in the lower, left corner of the page to return to the Wheel Control Setup page.

### WHEEL CONTROL CALIBRATION

The Wheel Control Calibration process allows SC1/TC1 to learn the hydraulic capabilities of the machine hydraulic system for optimal steering performance in the field. Complete the following steps to calibrate SC1/TC1 to the machine hydraulic system without completing the full SC1/TC1 system calibration.


**NOTE:** Review the *Preparation and Best Practices* section on page 8 for tips on preparing for and completing the calibration process.



**WARNING**

The machine will steer automatically. While calibrating or operating the SC1/TC1 system, be sure the area around the vehicle is clear of people and obstacles before engaging the steering system.

To disengage auto-steering at any time, turn the steering wheel or select the on-screen Stop button.



**WARNING**

During the auto-steering calibration, the machine will make several hard left and right turns. Adjust the vehicle speed and location as necessary.

FIGURE 13. Wheel Control Calibration Page

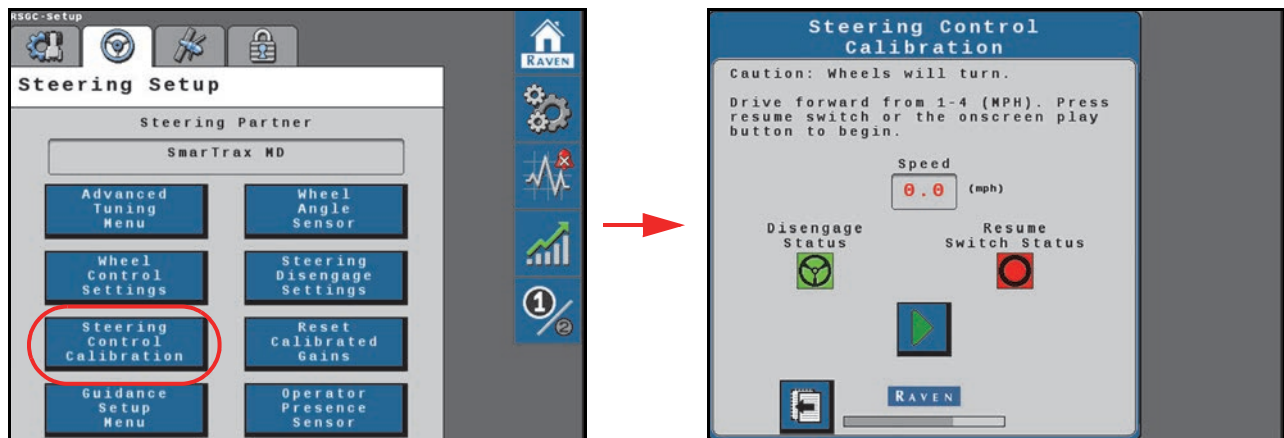
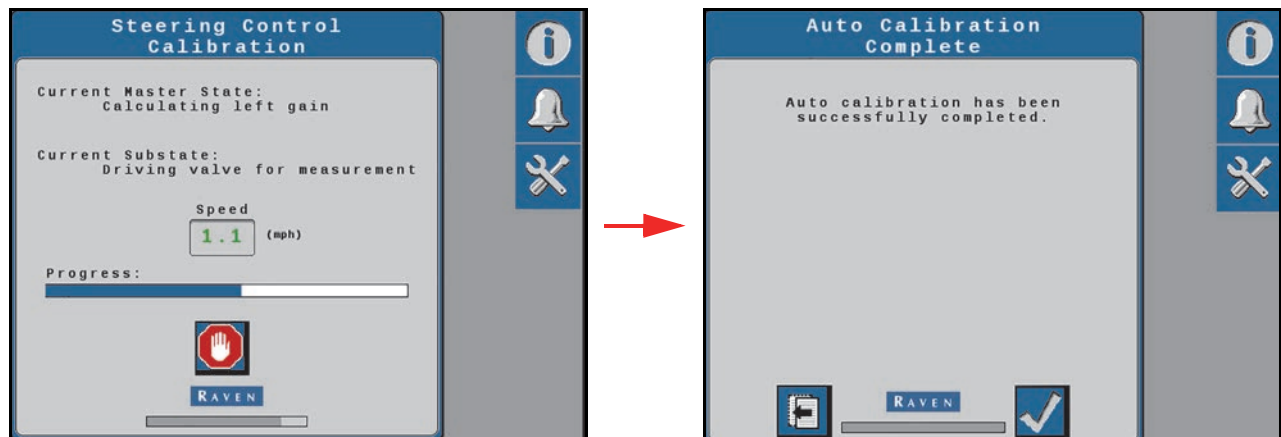


FIGURE 14. Calibration in Process Pages



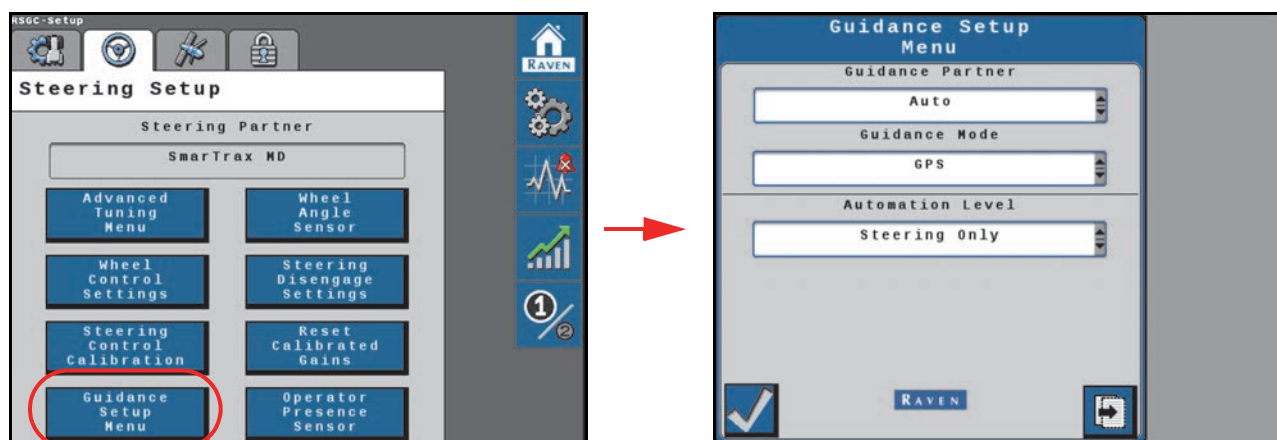
To perform a wheel calibration:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the Steering Setup tab and the Wheel Control Calibration button.
3. Drive the machine forward at 1 - 4 mph [2 - 6 km/h].
4. Press the resume switch or use the on-screen Start button to begin calibration. SC1/TC1 will display the progress of the calibration.
5. When the calibration is complete, select the Accept button in the lower, right corner of the page to return to the Steering Setup tab.

## GUIDANCE SETUP MENU

If a Raven VSN™ visual guidance system is connected, the Guidance Setup Menu allows the operator to set the mode and row guidance

FIGURE 15. Wheel Control Calibration Page



### GUIDANCE PARTNER

Use the drop down to select the desired guidance partner.

### GUIDANCE MODE

Displays the following guidance modes:

- **GPS** - Guidance is performed via GPS guidance points only.
- **Vision** - Guidance is performed via the VSN camera only. GPS corrections are neither utilized for guidance nor available as a fall-back solution. Line acquire must be performed manually. When the solution quality falls below the minimum threshold the steering system will disengage.
- **Vision+** - Guidance is performed via a combination of GPS and the VSN camera. This mode can be utilized for line acquire via GPS with the system switching to the VSN camera when the machine is aligned and near the guidance line. This mode will also fall back to GPS guidance if the solution quality falls below the minimum threshold. The system will then return to VSN guidance automatically when the solution quality is above the minimum threshold.

### AUTOMATION LEVEL

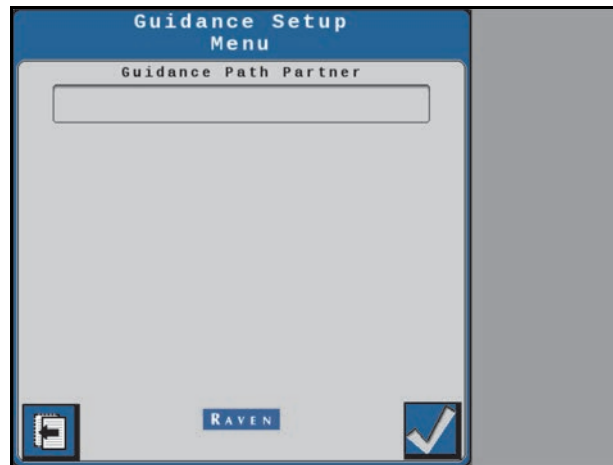
Set the mode for devices installed on an OMNi system.

- **GPS Only** - Stream GNSS correction information only. Select this option for guidance only applications or to stream corrections to a separate automated steering system.
- **Steering Only** - Use the guidance and automated steering features of the device. Select this option for automated tractor or sprayer steering applications.
- **Autonomy Driveless** - Select this option to enable features for autonomous systems such as OMNiDRIVE.

Select the **Next** arrow from the Guidance Setup Menu page for additional settings.



FIGURE 16. Guidance Path Partner Page

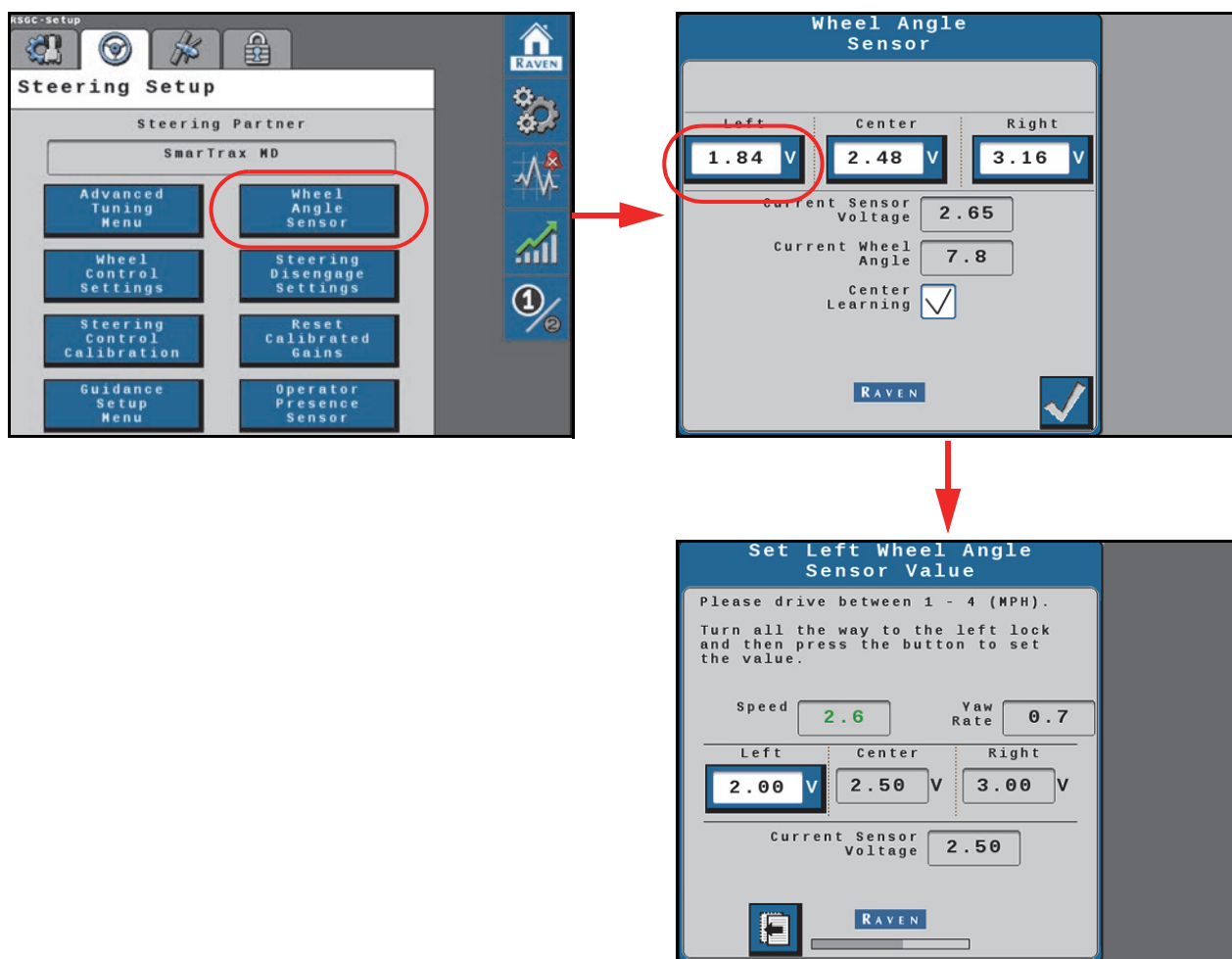


Guidance Path Partner: Displays the recognized device which provides a guidance path for the automated steering system.

WHEEL ANGLE SENSOR SETTINGS

To set the wheel angle sensor calibration values:

FIGURE 17. Wheel Angle Sensor Calibration Page

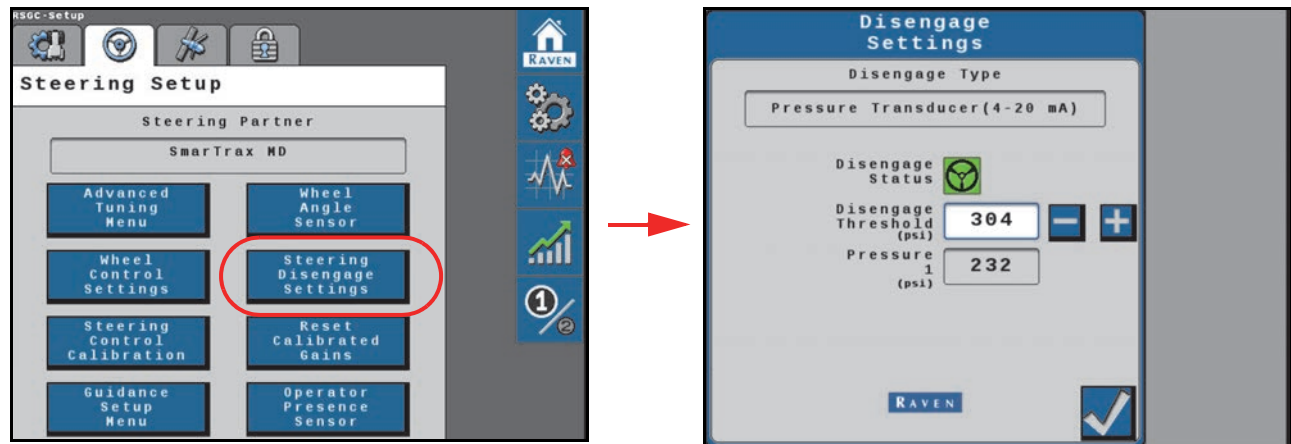


1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the Steering Setup tab and the Wheel Angle Sensor button. The following values and options are displayed on the Wheel Angle Sensor page:
  - **Left/Center/Right** - Displays the current calibration values. Complete the following steps to adjust or tune the wheel angle sensor (WAS).
  - **Current Sensor Voltage** - Displays the sensor voltage detected during calibration.
  - **Current Wheel Angle** - Displays the WAS angle detected during calibration.
  - **Center Learning** - When selected, the Center Learning option the system will continuously correct its calibrated center position while the machine is steering straight ahead.
3. Drive the machine forward at 1 - 4 mph [2 - 6 km/h].
4. Manually turn the steering wheel to the left steering lock, right steering lock, or center position to drive straight ahead.
5. Select the Left, Center, or Right value as appropriate to the steering wheel position.
6. Select the Accept button to save the new value.

- When the calibration is complete, select the Accept button in the lower, right corner of the page to return to the Steering Setup tab.

## RESUME/DISENGAGE SETTINGS

FIGURE 18. Steering Disengage Settings Page



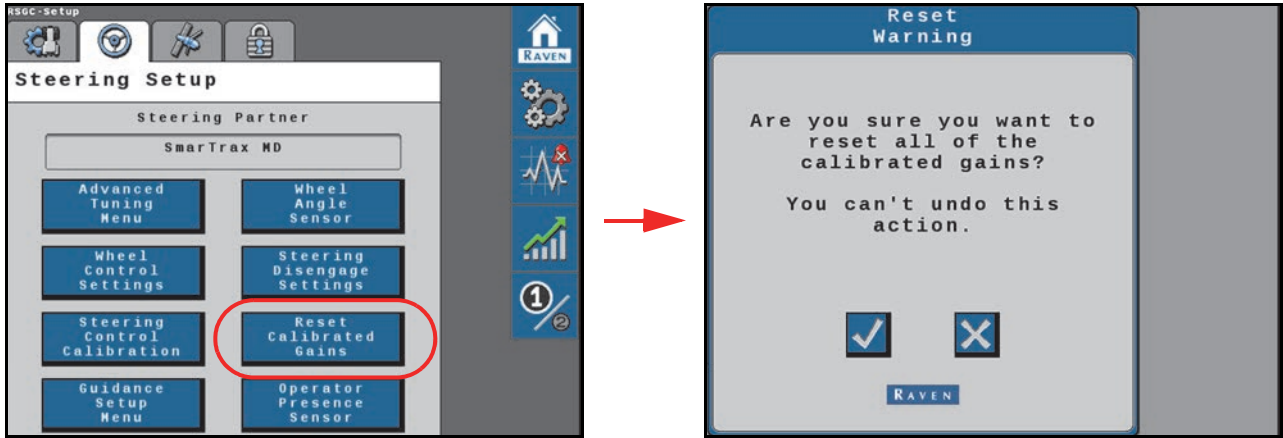
To access disengage switch settings:

- From the SC1/TC1 Home page, select the Settings Menu button.
- Select the Steering Setup tab and the Steering Disengage Settings button. Depending upon the type of sensor configured, the following options and information may be displayed on the page:
  - **Disengage Type** - Displays the type of disengage switch calibrated with the auto-steering system.
  - **Disengage Status** - Indicates the status of the disengage switch. The disengage status will display:
    - Green - The disengage switch is detected and the steering wheel is not moving. The SC1/TC1 system may be engaged when this status is displayed.
    - Red - The disengage switch is detected and the steering wheel is moving. The SC1/TC1 system may not be engaged when this status is displayed.
    - Yellow - No disengage switch is detected in the system. Turn the steering wheel to activate the disengage switch. If the disengage switch is not activated, check cabling for loose or missing connections.
  - **Disengage Threshold** - Set the threshold for when the steering disengage switch disengages auto-steering. Adjust the value so that the disengage status changes to red when the steering disengage switch is engaged. When the steering input stops, this status should return to green, which indicates that auto-steer may be engaged. Adjust the threshold to minimize the delay between detecting steering input and the status toggling between red and green.
  - **Pressure 1** - For single and dual pressure disengage types, the pressure measured by the first pressure transducer is shown in this field.
  - **Pressure 2** - For dual pressure disengage types, the pressure measured by the second pressure transducer is shown in this field.
  - **Disengage Differential** - For dual pressure disengage types, this field shows the differential between the two transducers.
  - **Measured Rotation Rate** - This rate displays for steering wheel encoder disengage types and displays the rate of steering in degrees per second.
  - **Measured PWM Encoder Change Rate** - When configured as a PWM encoder disengage type, this field displays the change in steering position in percent per second.
  - **Encoder Rate** - For a motor encoder, this displays the change in steering in Hz.

3. Select the Accept button in the lower, right corner of the page to return to the Steering Setup tab.

## RESET CALIBRATED GAINS

FIGURE 19. Reset Calibrated Gains Page

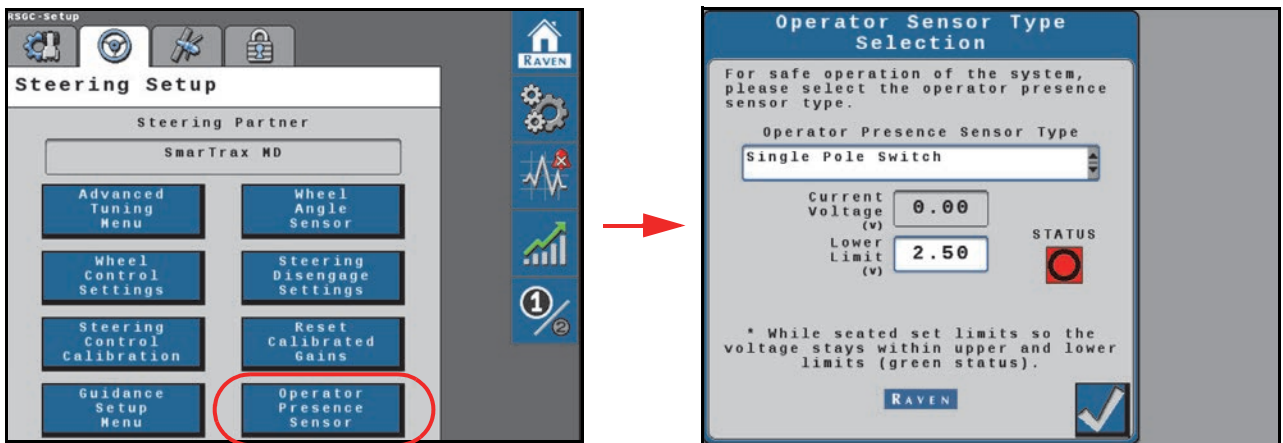


To reset the SC1/TC1 system to factory defaults:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the Steering Setup tab and the Reset Calibrated Gains button.
3. Review the warning prompt and select the Accept button to reset the SC1/TC1 to a factory condition. Select the Cancel button to keep the current system configuration and return to the Steering Setup tab.

## OPERATOR PRESENCE SENSOR

FIGURE 20. Steering Disengage Settings Page



### SENSOR TYPE

Use the drop down list to select the type of switch used to detect the presence of the operator while the system is engaged.

- Single Pole
- Double Pole
- CAN Switch

- Touch Screen (Activity Monitor)

If the operator switch is in a non-functional state, the operator may opt to use the touch screen activity monitor. The activity monitor uses input on the field computer touch screen to reset a 7 minute timer. If the timer does expire, the system will disable automated steering until the operator touches the screen and reengages the steering system.

#### CURRENT VOLTAGE

Displays the current switch voltage. This display may be useful to adjust the upper and lower voltage limits if necessary.

#### LOWER LIMIT

Use this setting to set the lower voltage limit. This is the voltage at which the switch will toggle when the operator is seated or the Activity Monitor is enabled.

#### UPPER LIMIT (DOUBLE POLE SWITCH ONLY)

Use this setting to adjust the upper voltage limit. Set the upper limit so that the current voltage reading remains below the upper limit while the operator is seated. If the presence switch voltage exceeds the upper limit, the presence switch will disengage steering.

#### STATUS

Displays the operator presence switch status. Toggle the presence switch (e.g. stand or sit in the operator seat) and confirm that the status indicates the switch is on when the operator is seated.

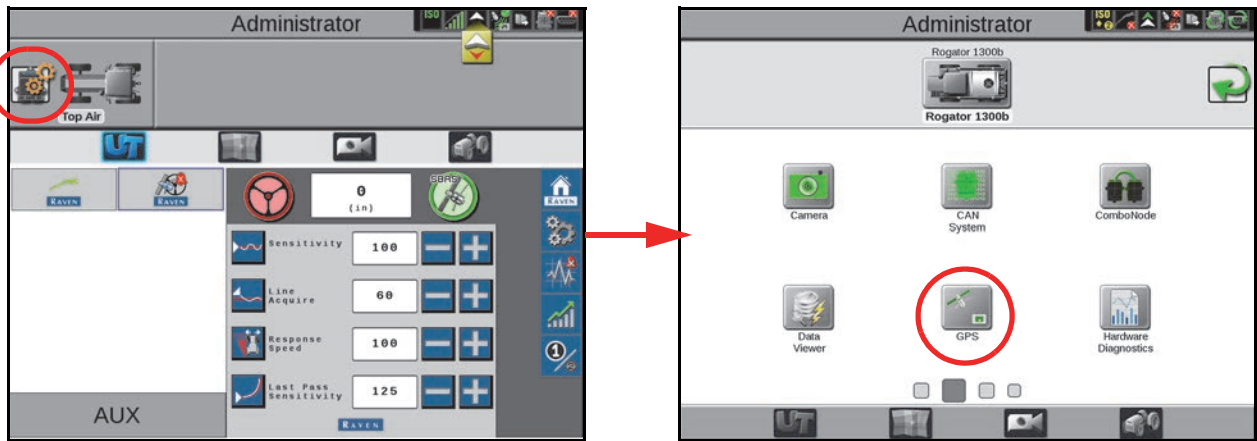
If the status does not change, but the current voltage changes, adjust the upper and lower limit settings as necessary.

**NOTE:** Review the *Operator Presence Switch* section on page 31 for information on the status displayed in this area.



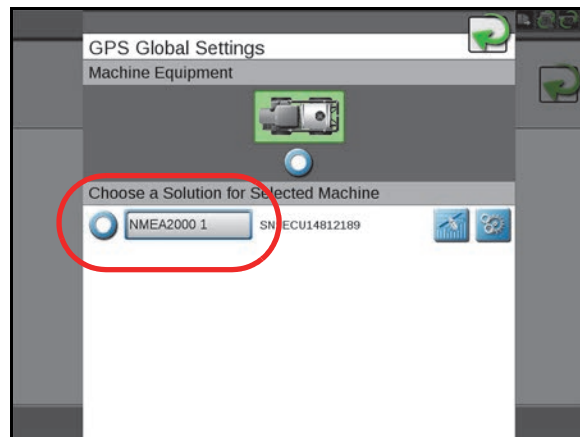
CONFIGURE GPS IN THE VIPER 4/VIPER 4+

FIGURE 1. ROS Settings DGPS Settings



1. Select **Edit**.
2. Select **GPS**.

FIGURE 2. GPS Setup Page



3. Select **NMEA2000**.

**NOTE:** The ROS device will automatically select NMEA 2000. If there are multiple devices outputting NMEA messages, be sure that the correct device to allow the RS1 to ensure proper operation of the SC1 system.

**IMPORTANT:** If the RS1 is replacing a steering system, the old steering ECU must be unplugged and a Serial Redetection performed before continuing.

## GPS RECEIVER CONFIGURATION

SC1/TC1 will automatically configure the following Raven receivers to output the correct messages and message rates:

- Raven 600S™
- Raven 700S™
- Viper 4/4+
- Viper 4/4+ Twin

If a different receiver is being used, configure the receiver output to the settings below before performing calibration.

**TABLE 1. GPS Receiver Message Settings**

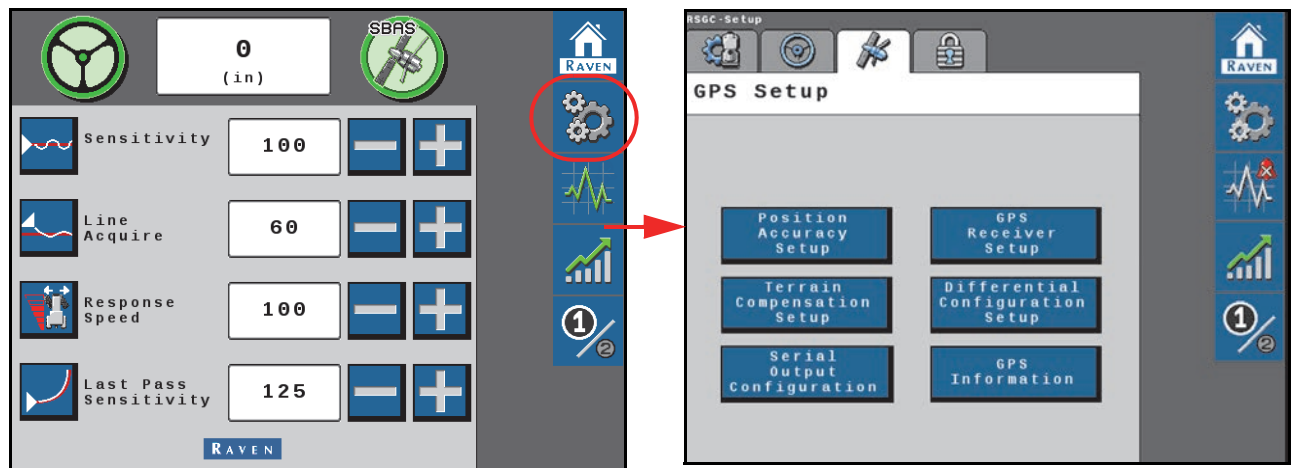
Baud Rate	Message Type	Frequency
115200	GGA	10 Hz
	VTG	0.1 Hz
	GSV	0.1 Hz
	ZDA	0.1 Hz
	GSA	0.1 Hz
	GST	1 Hz
	GRS	0.1 Hz

**NOTE:** Refer to Chapter 10, *Trimble 372 Configuration using AgRemote*, for assistance with these settings when using a Trimble receiver.



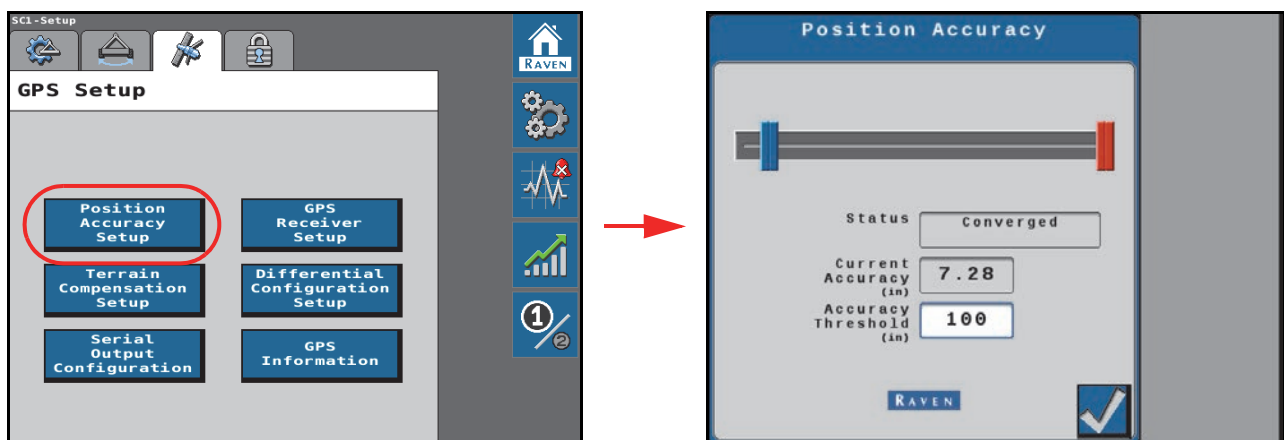
## CONFIGURE GPS IN THE SC1/TC1

FIGURE 3. GPS Setup Page



## POSITION ACCURACY SETUP

FIGURE 4. Position Accuracy Setup Page

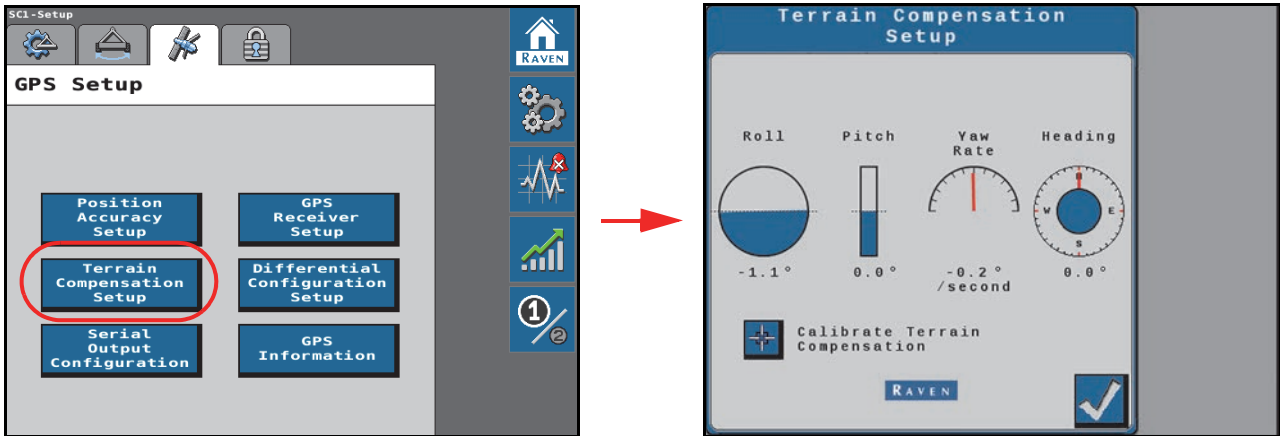


- **Status** - Displays the absolute status of the GPS accuracy. Statuses that may be displayed in this area include:
  - No Signal
  - Error
  - Converging
  - Converged
- **Current Accuracy** - A value representing the reported horizontal accuracy of the current solution as detected by the receiver.
- **Accuracy Threshold** - Set the maximum distance allowed for the Current Accuracy value. If the Current Accuracy value is greater than the set Accuracy Threshold, a DTC entry will be recorded on the Diagnostic Trouble Code page.

Select the **Accept** button in the lower, right corner of the page to return to the GPS Setup tab.

TERRAIN COMPENSATION SETUP

FIGURE 5. Terrain Compensation Setup Page

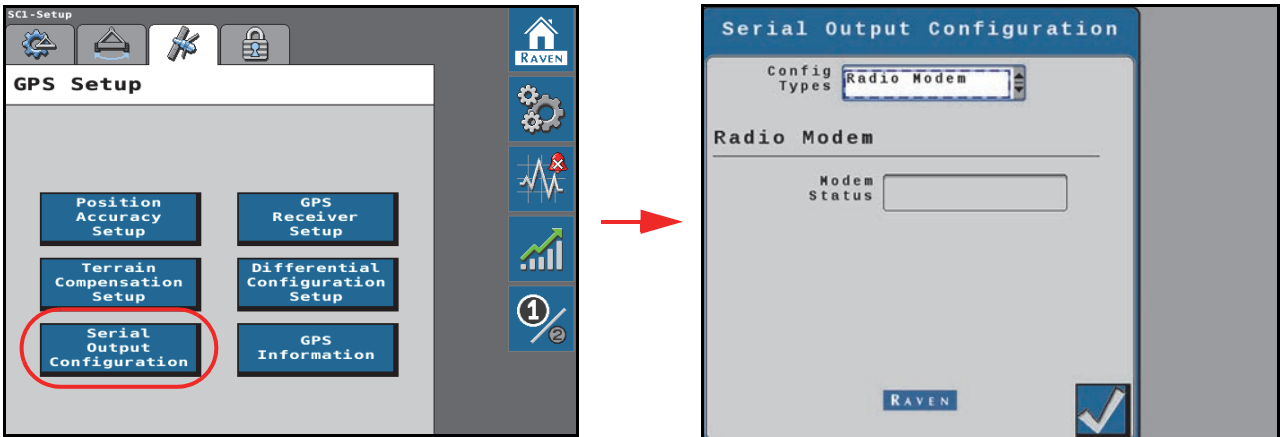


- **Roll, Pitch, Yaw Rate, and Heading** - Real-time measurement data used by the 3D terrain compensation feature.
- **Calibrate Terrain Compensation** - Begins the terrain compensation process. Refer to *Terrain Compensation Calibration* section on page 14 for additional information on completing the Terrain Compensation Calibration.

Select the Accept button in the lower, right corner of the page to return to the GPS Setup tab.

SERIAL OUTPUT CONFIGURATION

FIGURE 6. GPS Serial Output/Serial Output Configuration Page

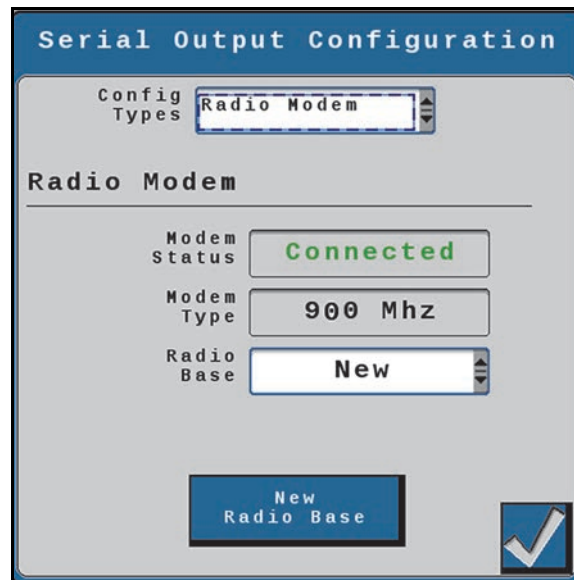


- **GPS Output** - Allows the SC1/TC1 system to output NMEA 0183 messages at configurable rates. See the *GPS Serial Output Configuration* section on page 57 for details.
- **Radar Out** - Use the radar out option to output a simulated radar speed.
- **Radio Modem** - Select Radio Modem to configure the radio modem. See the *Radio Modem Configuration* section on page 55 for information on configuring the Radio Modem.
- **RTK Out** - Allows the SC1/TC1 system to Output RTK corrections to another ECU. See the *RTK Out* section on page 58 for information on configuring the Radio Modem.

Select the Accept button in the lower, right corner of the page to accept the current output settings displayed and return to the GPS Setup tab.

## RADIO MODEM CONFIGURATION

FIGURE 7. Modem Type Page

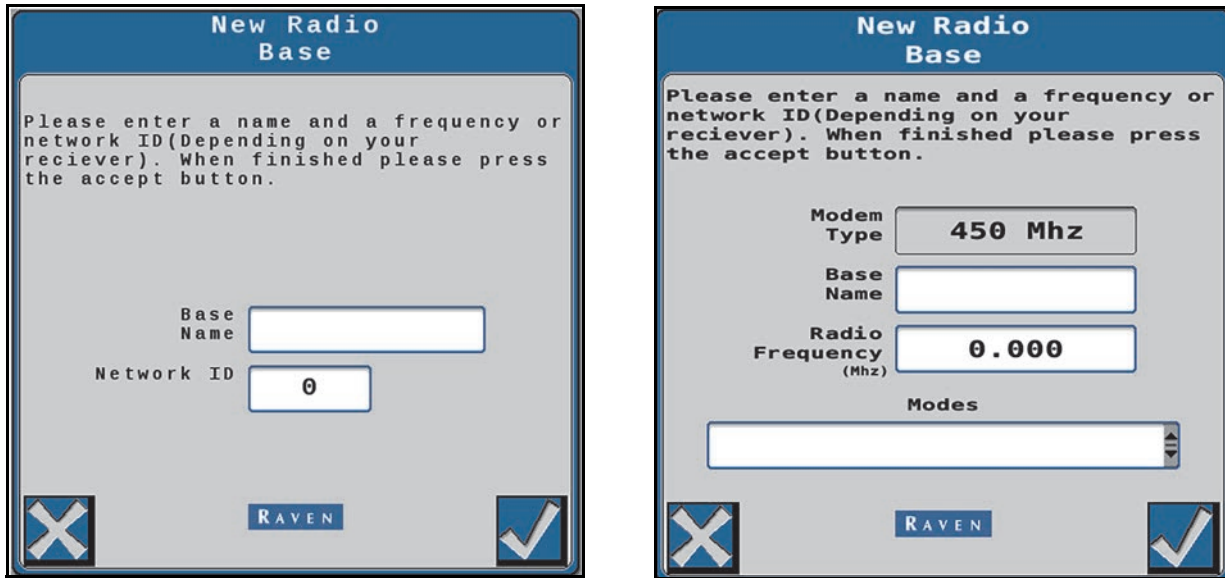


- **Modem Status** - Displays if a modem is detected. The status can be:
    - No Comm: No modem detected.
    - Configuring: Modem is detected.
    - Connected: Modem is connected to the SC1/TC1.
  - **Modem Type** - The detected radio modem type will display here. Modem type options are:
    - 450 MHz
    - 900 MHz
  - **Radio Base** - Allows the user to toggle between stored radio bases.
4. Select **New** in the Radio Base drop-down list to setup a new radio base station.

**NOTE:** If a base station has already been configured, use the Base Name drop-down field to select the stored base station for SC1/TC1 operation. Select the Accept button in the lower, right corner of the page to save the selection and return to the GPS Setup tab.

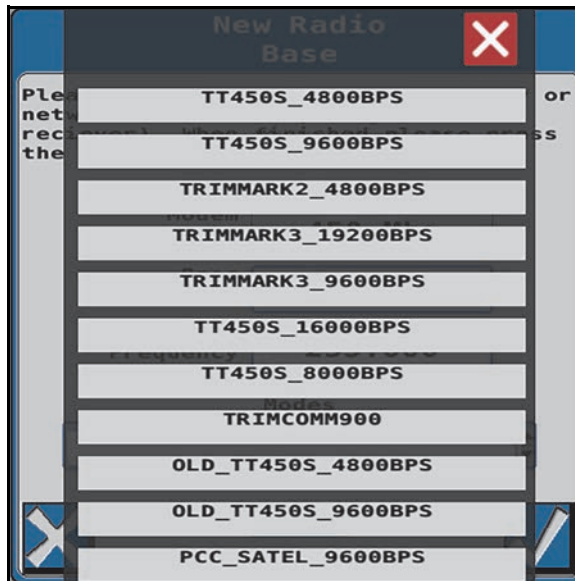
5. Enter a name for the new base station.

FIGURE 8. New Radio Base Page



- When configuring a 900 MHz radio modem, set the Network ID. When configuring a 450 MHz radio modem, enter the radio frequency and select the proper Mode from the drop-down.

FIGURE 9. 450 MHz Modem Modes Page



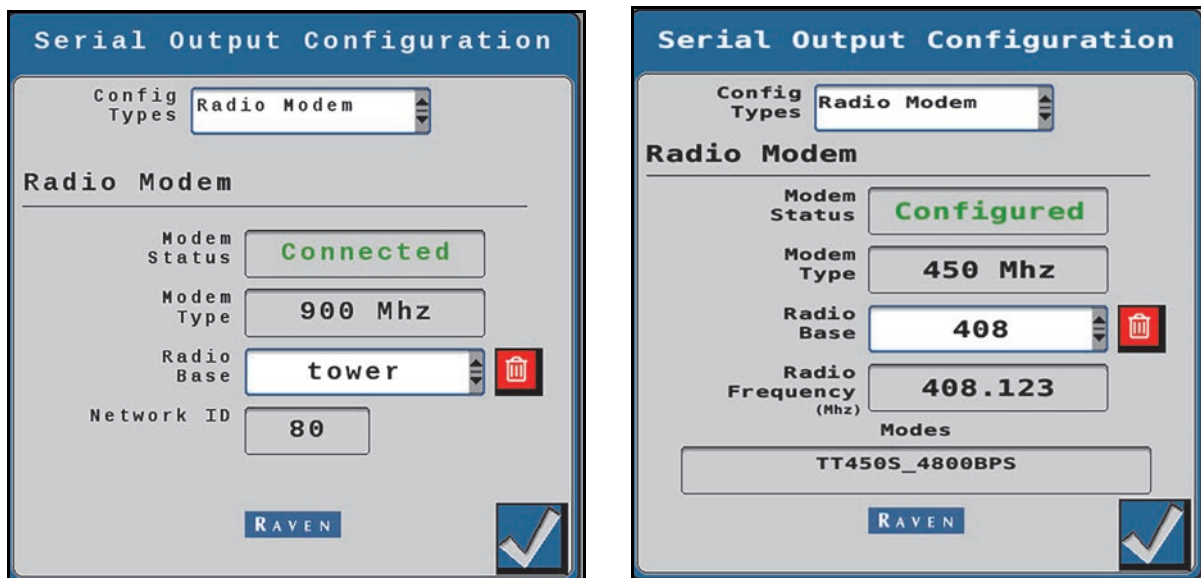
- Select the Accept button in the lower, right corner of the page to save the displayed radio modem settings and return to the Serial Output Configuration page.
- Select the Accept button again to return to the Machine Settings tab.

## DELETE A RADIO MODEM

To remove a configured a radio modem:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the GPS Setup tab and the Serial Output Configuration button.
3. Select the Radio Modem from the Config Types drop-down.
4. Select the stored radio modem in the Radio Base drop-down list.
5. Select the Delete button.
6. Select the Accept button to confirm removing the stored base and return to the Serial Output Configuration page.

FIGURE 10. Configured Radio Base Pages



7. Select the Accept button in the lower, right corner of the page to return to the GPS Setup tab.

## GPS SERIAL OUTPUT CONFIGURATION

To configure GPS message output from or passed through the SC1/TC1 system:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the GPS Setup tab and the Serial Output Configuration button.
3. Select GPS Out from the Config Types drop-down to output 3D compensated GPS to another ECU.
4. Select the Baud rate and frequencies for specific message types.
5. Select the Accept button in the lower, right corner of the page to return to the GPS Setup tab.

FIGURE 11. GPS Configuration Page

**Serial Output Configuration**

Config Types: **GPS Out**

**GPS Out**

Baud: **115200**

**Message Types**

GGA (Hz)	<b>0.0</b>	GSA (Hz)	<b>0.0</b>
VTG (Hz)	<b>0.0</b>	GST (Hz)	<b>0.0</b>
ZDA (Hz)	<b>0.0</b>	GSV (Hz)	<b>0.0</b>
RMC (Hz)	<b>0.0</b>		

RAVEN

## RTK OUT

To configure RTK corrections output from or passed through the SC1/TC1 system:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the GPS Setup tab and the Serial Output Configuration button.
3. Select RTK Out from the Config Types drop-down to output 3D compensated RTK to another ECU.
4. Select the Baud rate for corrections.
5. Select the Accept button in the lower, right corner of the page to return to the GPS Setup tab.

FIGURE 12. RTK Out Settings Page

**Serial Output Configuration**

Config Types: **RTK Out**

**RTK Out**

Baud: **115200**

RAVEN

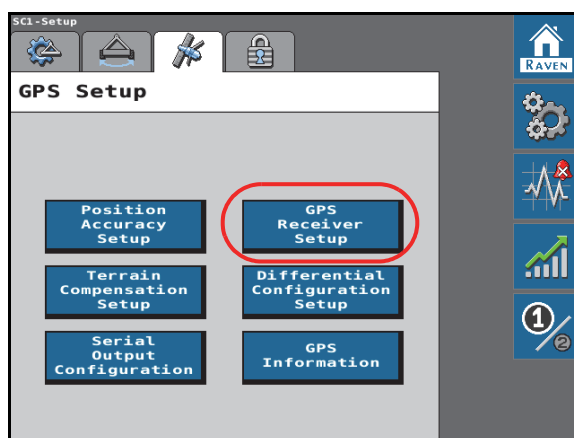
## GPS RECEIVER SETUP

To configure the type of receiver connected to the SC1/TC1 system:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the GPS Setup tab and the GPS Receiver Setup button.
3. Select the receiver supplying GPS to the SC1/TC1 system:
  - Raven 500S™
  - Raven 600S™
  - Raven 700S™
  - Viper 4/4+ Twin
  - Viper 4/4+
  - Receive Only

**NOTE:** Receive Only can be used with any GPS Receiver that is outputting GPS into the serial port of the SC1/TC1 system. The GPS Receiver may need to be configured to output the correct messages if the Receive Only option is selected. Refer to the *Configure GPS in the Viper 4/Viper 4+* section on page 51 for additional information on required GPS receiver outputs for SC1/TC1.

**FIGURE 13. GPS Setup Page**



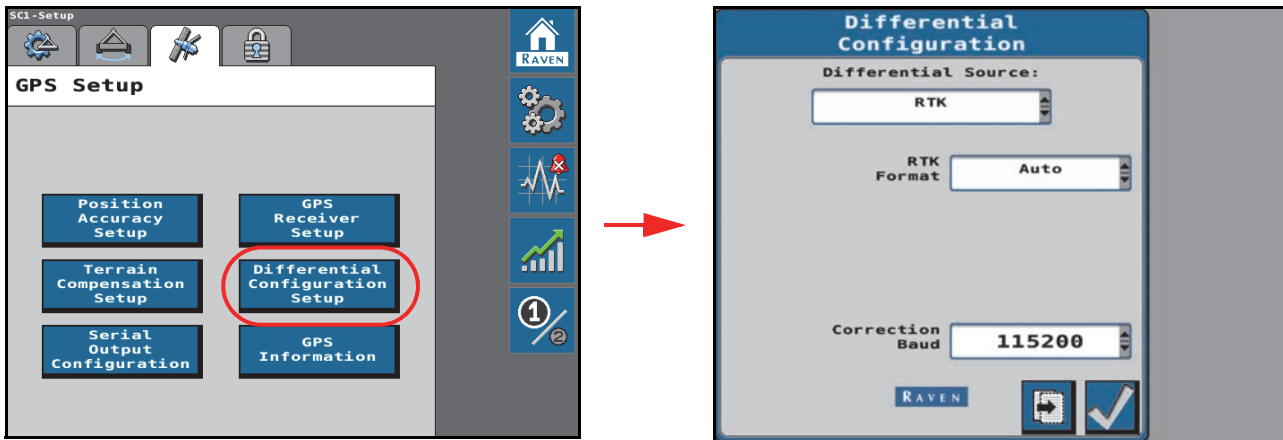
4. Select the Accept button in the lower, right corner of the page to return to the GPS Setup tab.

## DIFFERENTIAL CONFIGURATION PAGE

To set the differential solution used with the SC1/TC1 system:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the GPS Setup tab and the Differential Configuration Setup button.
3. Select source of differential position corrections provided to the SC1/TC1 system.
4. Select the Accept button in the lower, right corner of the page to return to the GPS Setup tab.

FIGURE 14. Differential Configuration Page



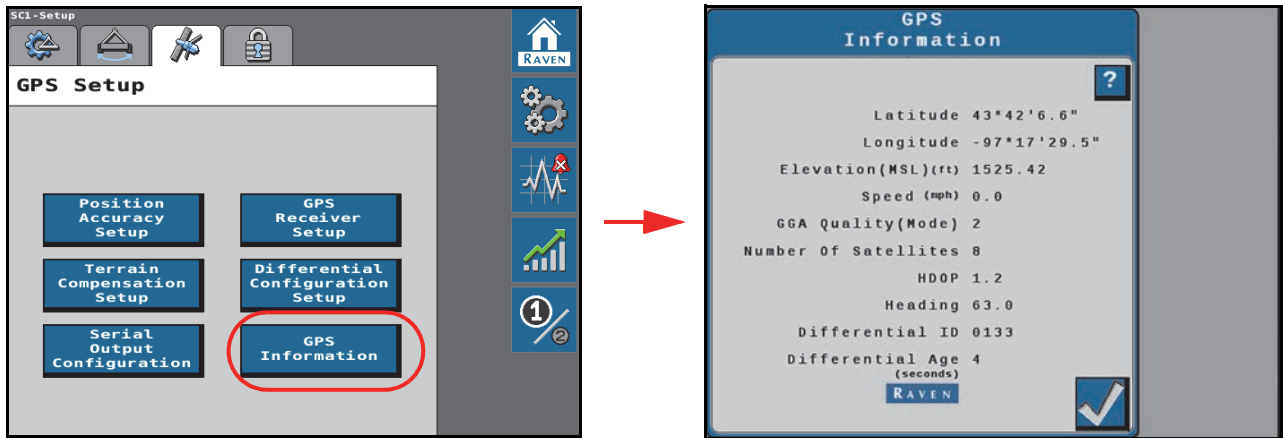
**NOTE:** Refer to Chapter 7, *Feature Unlock Codes*, for additional assistance with activating additional differential sources.

GPS INFORMATION

To view detailed GPS information:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the GPS Setup tab and the GPS Information button. The following information will be displayed:

FIGURE 15. GPS Information Page



- **Latitude** - The angular distance of a place north or south of the earth's equator.
- **Longitude** - The angular distance of a place east or west of the meridian at Greenwich, England.
- **Elevation (MSL)** - The height of the antenna in reference to sea level.
- **Speed** - Current speed based on GPS measurements.
- **GGA Quality (Mode)** - The current state of the GPS receiver.
  - 0 = No Signal
  - 1 = Single solution
  - 2 = SBAS converged, GL1DE®, GS-Lite converged, Satellite GS converging
  - 3 = N/A



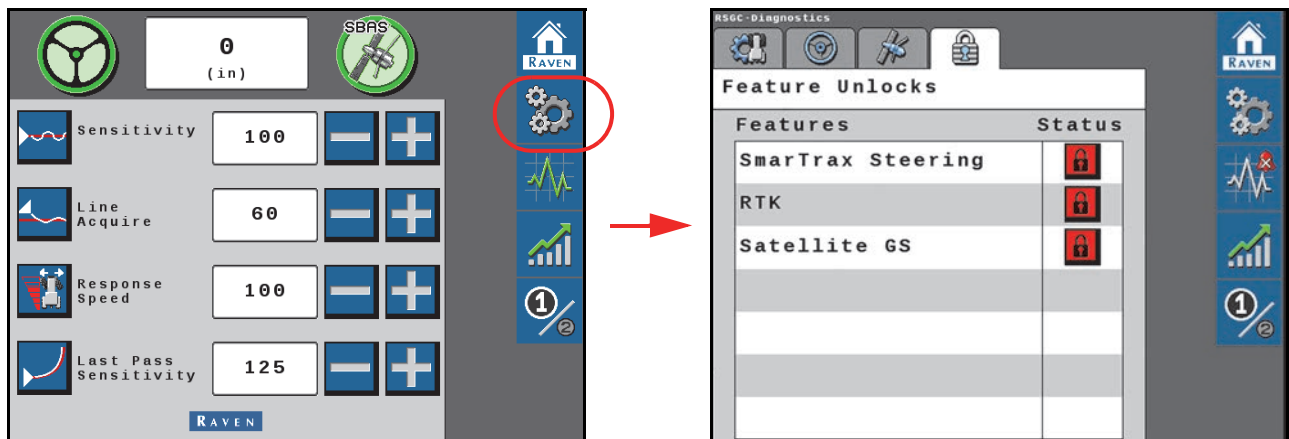
- 4 = RTK converged, Satellite GS (500S) converged
  - 5 = RTK Float, Satellite GS converged
  - 6 = Dead reckoning
  - **Number of Satellites** - The number of satellites currently in view by the GPS receiver.
  - **HDOP** - Horizontal Dilution of Precision. If all of the satellites in view are from the same direction, the number will be higher and the accuracy will be reduced.
  - **Heading** - The current direction of travel.
  - **Differential ID** - The ID of the satellite used for differential corrections.
  - **Age of Differential** - Time (in seconds) since the last differential correction was received. When using the GL1DE corrections, or if a differential source is not currently tracked, this entry will be "- - -".
3. Select the Accept button in the lower, right corner of the page to return to the GPS Setup tab.



In order to activate desired features, a feature unlock code is required. Contact your local Raven dealer to purchase feature unlock codes.

**NOTE:** Contact your local Raven dealer for additional information and assistance with purchasing activation and feature unlock codes.

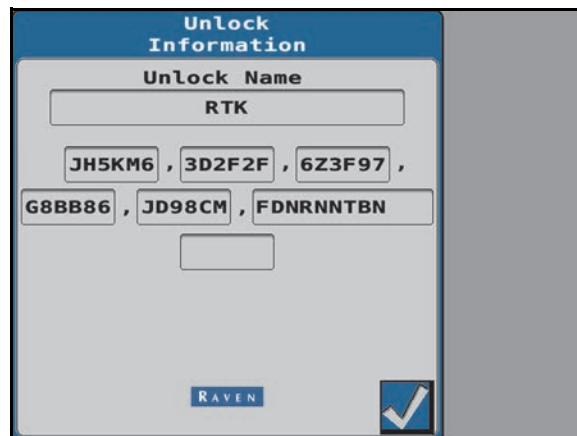
**FIGURE 1. Feature Unlock Page**



To activate features of the SC1/TC1 steering system:

1. From the SC1/TC1 Home page, select the Settings Menu button.
2. Select the Feature Unlocks tab.
3. Select the Lock icon next to the feature to be activated.

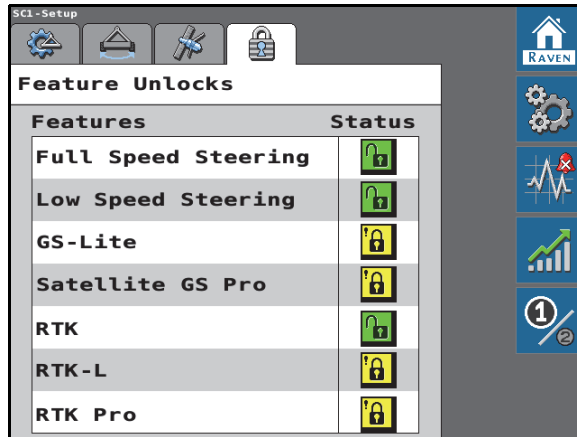
**FIGURE 2. Feature Unlock Information Page**



4. In the code field, enter the feature activation code obtained from your Raven dealer.
5. Select the Accept button.

**NOTE:** SC1/TC1 will display a message indicating whether the unlock code is valid. If the code is accepted, the padlock will turn green and indicate that the feature is ready for use.




**FIGURE 3. Feature Unlocks Page**



**NOTE:** GS-Lite, Satellite GS, and RTK unlocks can only be applied for the following GPS Receivers:

- Raven 600S™
- Raven 700S™
- Viper 4/4+ Twin
- Viper 4/4+

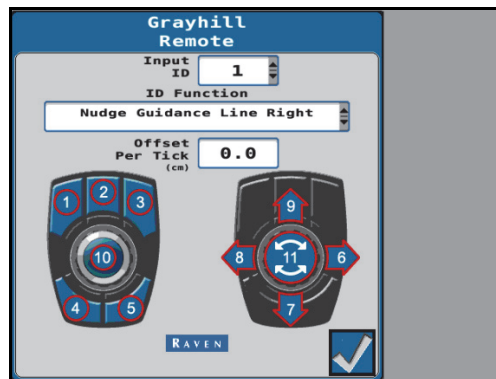
**NOTE:** Some pages and options may differ based on how the machine is equipped.

1. From the auto-steer Home page, select the **Tools**  button.
2. Select the **Machine Settings**  /  tab.
3. Select the **Aux Input** button.

**NOTE:** The Aux Input option is available when a compatible controller (e.g. a Grayhill controller) is detected by the steering system.

The Auxiliary Input provides settings and options for an auxiliary device such as the Grayhill remote. Refer to the auxiliary device manual for additional assistance with device configuration, features, and options.

**FIGURE 1. Grayhill Remote Page**



4. Use the **Input ID** drop-down options to select a function or button on the Grayhill remote.
5. Next, use the **ID Function** list to assign a desired action to the button.

**NOTE:** Input ID number 11 on the Grayhill remote is a rotary button.

## ID FUNCTION 1-10 DEFINITIONS

The following functions can be used for ID 1-10.

**Engage Steering.** This function is used to engage the steering system.

**Manual Steering Left.** This function is used to manually steer the implement to the left.

**Manual Steering Right.** This function is used to manually steer the implement to the right.

**Increase Antenna Offset.** This function is used to increase the implement GNSS antenna offset.

**Decrease Antenna Offset.** This function is used to decrease the implement GNSS antenna offset.

**Reset Antenna Offset.** This function is used to undo the antenna offset changes made with the Grayhill controller.

**Nudge Guidance Line Left.** This function is used to nudge the implement guidance line left.

**Nudge Guidance Line Right.** This function is used to nudge the implement guidance line right.

**Center Guidance Line.** This function is used to center the implement guidance line.

**Nudge Camera Offset Left.** This function is used to nudge the implement camera offset to the left 0.5 cm [0.2 in.].

**Nudge Camera Offset Right.** This function is used to nudge the implement camera offset to the right 0.5 cm [0.2 in.].

### ID FUNCTION 11 DEFINITIONS

The following functions can be used for ID - 11.

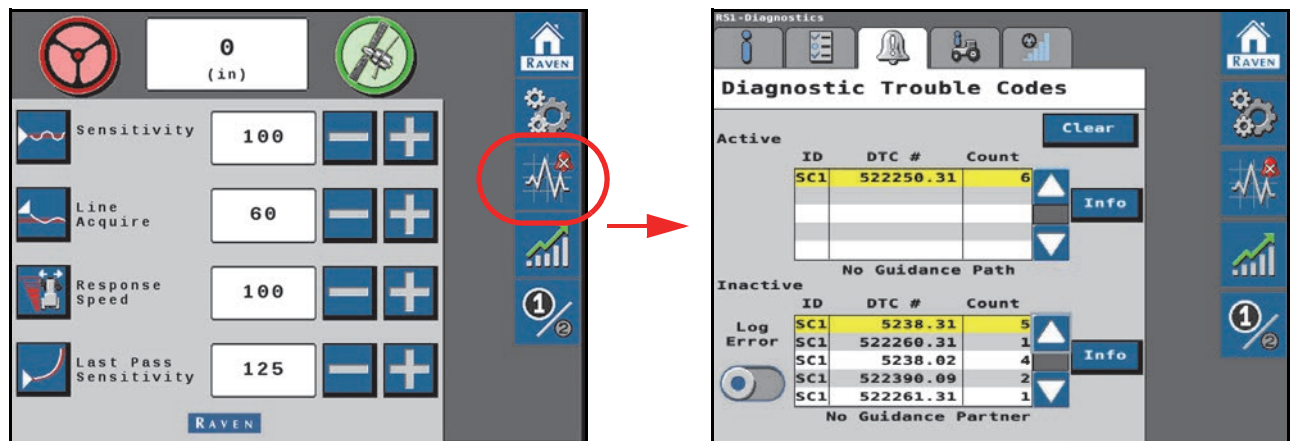
**Nudge Guidance Line.** This function is used to nudge the guidance line left or right depending on which way the button is rotated.

**Change Antenna Offset.** This function is used to increase or decrease the GNSS antenna offset depending on which way the button is rotated.

**Nudge Camera Furrow Offset.** This function is used to increase or decrease the camera furrow offset by 0.5 cm [0.2 in.].

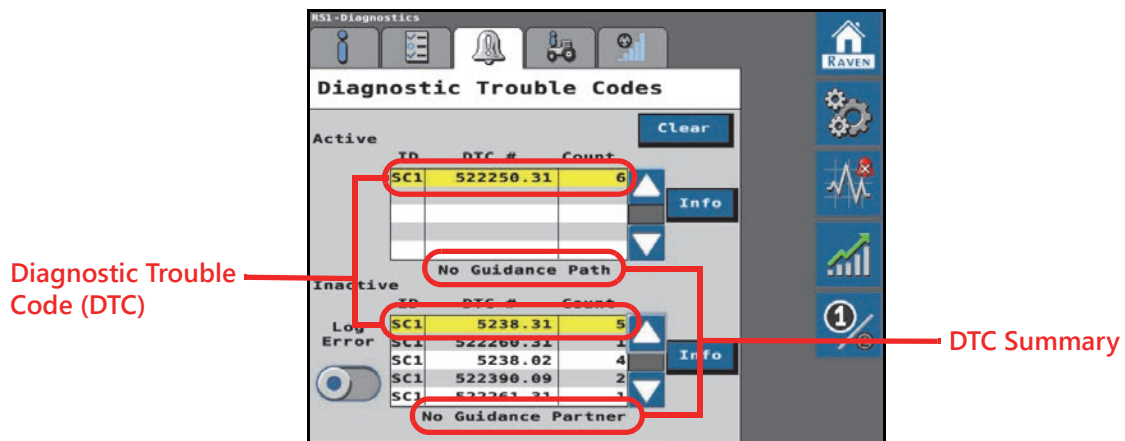
DIAGNOSTIC TROUBLE CODES (DTC)

FIGURE 1. Diagnostic Trouble Codes Page



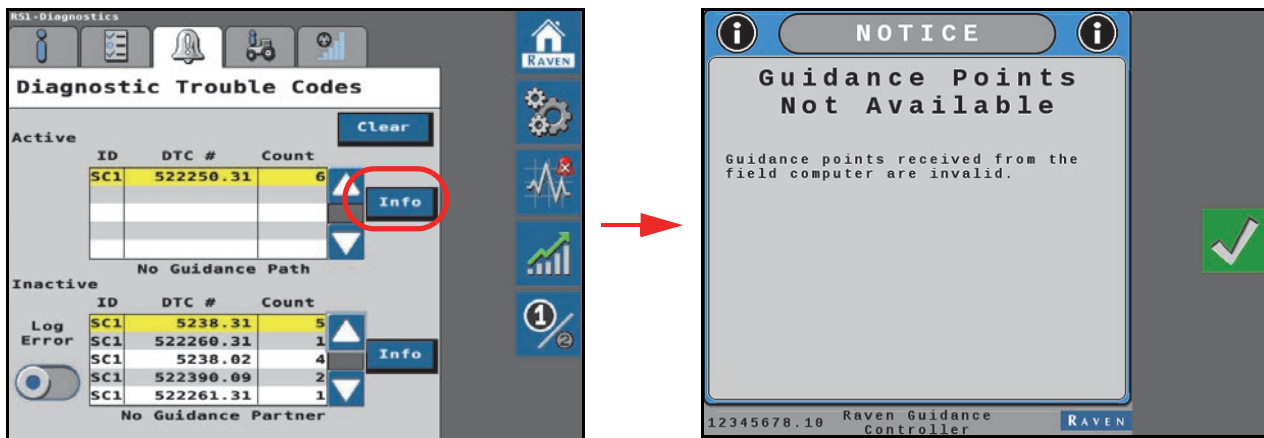
The Diagnostic Trouble Code page displays active and previous diagnostic trouble codes (DTCs) that occur during SC1/TC1 system operation. Active DTCs must be fixed before the SC1/TC1 system can be enabled for guidance and steering operation. Once a DTC has been corrected, the code moves to the inactive DTC code list. Refer to Figure 3 for an example of DTCs and DTC summaries.

FIGURE 2. Diagnostic Trouble Codes Page



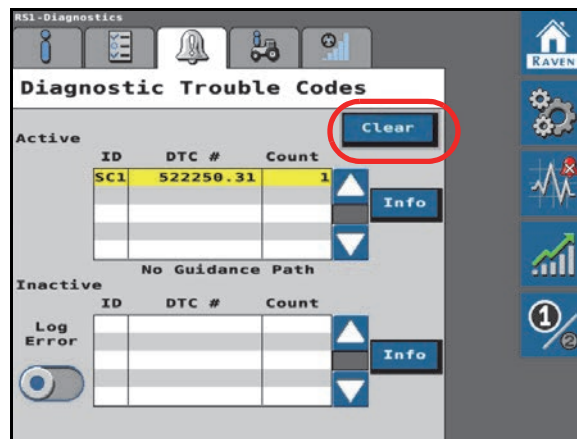
**NOTE:** In Figure 3 above, the active DTC is 522250.31 and the DTC summary is "No Guidance Points." The inactive DTC is 522261.31 and the DTC summary is "No SCU Detected."

FIGURE 3. Info Prompt



Pressing the **Info** button displays the complete description of the highlighted active DTC.

FIGURE 4. Inactive DTCs Cleared from Error Log



Pressing **Clear** deletes the inactive DTCs from the Inactive DTC error log.



DIAGNOSTIC TROUBLE CODE (DTC) LIST

TABLE 1. Diagnostic Trouble Codes

Code ID		Description	Recommended Actions
74	.0	Maximum engage speed shutdown.	<p>Machine speed exceeds maximum auto-steer speed. Auto-steering is disengaged.</p> <p>Reduce machine speed below maximum engage speed and re-engage auto-steering. SC1/TC1 maximum auto-steer operating speed is:</p> <ul style="list-style-type: none"> <li>• 19.3 km/h [12 mph] for machines operating in Europe with homologation terms accepted.</li> <li>• 32.1 km/h [20 mph] for tracked machines and swathers.</li> <li>• 46.7 km/h [29 mph] for units capable of high-speed steering and not subject to homologation terms.</li> </ul> <p>Contact a local Raven dealer for additional assistance with high-speed steering unlocks.</p>
	.16	Maximum engage speed warning.	<p>Machine speed is approaching the maximum auto-steer speed. To maintain auto-steer operation, do not exceed the maximum auto-steering speed (refer to 74.0 above). SC1/TC1 maximum steering warning DTC is triggered at:</p> <ul style="list-style-type: none"> <li>• 16.1 km/h [10 mph] for machines operating in Europe with homologation terms accepted.</li> <li>• 29 km/h [18 mph] for tracked machines and swathers.</li> <li>• 43.5 km/h [27 mph] for units capable of high-speed steering and not subject to homologation terms.</li> </ul> <p>Contact a local Raven dealer for additional assistance with high-speed steering unlocks.</p>
87	.0	Maximum speed engage.	<p>Reduce machine speed below maximum engage speed to engage auto-steering.</p> <p>SC1/TC1 maximum engage speed is:</p> <ul style="list-style-type: none"> <li>• 16.1 km/h [10 mph] for machines operating in Europe with homologation terms accepted.</li> <li>• 19.3 km/h [12 mph] for tracked machines and swathers.</li> <li>• 29 km/h [18 mph] for units capable of high-speed steering and not subject to homologation terms.</li> </ul> <p>Contact a local Raven dealer for additional assistance with high-speed steering unlocks.</p>
		Maximum engage speed engage warning.	
88	.1	Too slow to engage.	Increase machine speed above 0.5 km/h [0.3 mph] (RTK - 0.1 km/h [0.1 mph]) to engage auto-steering.
168	.3	High voltage.	Check battery voltage.
	.4	Low voltage.	



Code ID		Description	Recommended Actions
621	.11	GPS receiver error: LNA failure.	Cycle power to the machine.
	.31	GPS receiver error: Antenna power.	
	.4	GPS receiver error: Antenna shorted.	
	.5	GPS receiver error: Antenna open.	
628	.13	Memory error.	<ol style="list-style-type: none"> <li>1. Cycle power to the machine.</li> <li>2. If the error persists, contact your local Raven dealer or the Raven Technical Service team.</li> </ol>
630	.13	System not calibrated.	Complete the initial calibration wizard to use SC1/TC1. Review Chapter 3, <i>Initial Machine Calibration</i> , for additional assistance.
	.31	Steering calibration recommended.	Complete a steering control calibration. Review the <i>Auto-Steering Calibration</i> section on page 16 for additional assistance.
701	.3	Resume switch stuck on.	<ol style="list-style-type: none"> <li>1. Check the resume switch functionality in the universal terminal.</li> <li>2. Check the resume switch cabling and connections.</li> </ol>
841	.0	GPS not converged.	<ol style="list-style-type: none"> <li>1. Wait for GNSS to converge (up to 30 minutes).</li> <li>2. Cycle power to the machine.</li> </ol>
	.11	GPS error.	<ol style="list-style-type: none"> <li>1. Ensure the SC1/TC1 ECU is calibrated and the desired differential source is unlocked.</li> <li>2. Wait for GNSS to converge (up to 10 minutes).</li> <li>3. Ensure that NMEA 2000 is selected. Review the <i>GPS Setup</i> section on page 9.</li> </ol>
	.15	Poor GPS position accuracy.	<ol style="list-style-type: none"> <li>1. If using Satellite GS or RTK corrections, ensure that the GNSS quality is as expected for those correction sources. Review the <i>GPS Status Page</i> section on page 32.</li> <li>2. Adjust the position accuracy to allow greater tolerance for the current GNSS position accuracy.</li> </ol>
1504	.2	Operator not present.	<ol style="list-style-type: none"> <li>1. Check presence switch cabling and connections.</li> <li>2. Confirm presence switch functionality in the SC1/TC1 universal terminal.</li> <li>3. Choose activity monitor.</li> </ol>
2901	.2	Incompatible hardware.	A machine specific tuneset has not been developed for combination of machine type and valve type. Select a generic machine type and recalibrate the SC1/TC1.
3045	.31	Authorization denied.	Check the steering control unit (SCU) cabling is properly connected. Check connections for pins which are not making proper connection (e.g. bent or pushed in).

Code ID		Description	Recommended Actions
5238	.2	Invalid curvature.	<ol style="list-style-type: none"> <li>1. Check cabling and connections to the steering partner (steering valve).</li> <li>2. Cycle power to the machine.</li> <li>3. Update the steering partner/valve software. Refer to the machine operator manual.</li> </ol>
	.31	Loss of SCU communication.	<p>The SC1/TC1 previously registered a steering partner but is not currently communicating with the expected partner.</p> <ol style="list-style-type: none"> <li>1. Check cabling and connections to the steering partner (steering valve).</li> <li>2. Cycle power to the machine.</li> <li>3. Check the software version of the steering partner/valve and confirm compatibility with the SC1/TC1 software.</li> </ol>
5241	.31	Disengage switch is in the off position.	<ol style="list-style-type: none"> <li>1. Check the disengage switch status in the SC1/TC1 universal terminal. Switch should only be active (red status indicator) when the steering wheel is moving.</li> <li>2. If the disengage switch is showing activity (red) while the steering wheel is stationary, increase the disengage value. Review the <i>Resume/Disengage Settings</i> section on page 47. For best results, set the value as low as possible.</li> <li>3. Check the disengage switch cabling and connections.</li> <li>4. Check the sensor voltage (5 V) and current (4-20 mA). Review the <i>Resume/Disengage Settings</i> section on page 47 for assistance with the disengage switch settings.</li> </ol>
5243	.2	Master switch is in the off position.	<ol style="list-style-type: none"> <li>1. Toggle the master switch ON or to field mode.</li> <li>2. Toggle the hydraulic lock switch to the unlocked state.</li> <li>3. Check CAN communication to the steering valve.</li> </ol>
5613	.11	Field terrain compensation not calibrated.	Perform the terrain compensation calibration. Refer to the <i>Terrain Compensation Setup</i> section on page 54.
	.13	Terrain compensation not calibrated.	Perform a terrain compensation calibration. Refer to the <i>Terrain Compensation Setup</i> section on page 54.
	.2	Inertial navigation system (INS) data invalid.	<ol style="list-style-type: none"> <li>1. Perform a terrain compensation calibration. Refer to the <i>Terrain Compensation Setup</i> section on page 54.</li> <li>2. Verify inertial sensor functionality in the SC1/TC1 universal terminal.</li> </ol>
	.31	GPS receiver error: INS reset.	Cycle power to the machine.
516118	.14	Toggle autonomy switch to the OFF position.	Toggle the autonomy switch to the OFF position.
	.17	Autonomy switch in the OFF position.	<ol style="list-style-type: none"> <li>1. Toggle the autonomy switch to the ON position.</li> <li>2. Check switch cabling and connections.</li> </ol>
	.2	Machine not configured for automation.	Complete a calibration with autonomous features enabled. Complete provisioning procedures for autonomous machine operations.



Code ID		Description	Recommended Actions
516119	.2	Lockout switch invalid.	Check cabling and connections.
	.31	Lockout switch pressed.	Toggle the lockout switch off. If DTC does not clear, check lockout switch cabling.
522240	.16	GGA rate high.	Cycle power to the machine.
	.18	GGA rate low.	
	.31	No GPS comm	1. Leave SC1/TC1 powered on for 10 minutes. 2. Cycle power to the machine.
522242	.16	ZDA rate high.	Cycle power to the machine.
	.18	ZDA rate low.	
522250	.0	End of line error.	Contact Raven technical service.
	.15	Maximum point space error.	
	.16	Segment angle error.	
	.17	Minimum point space error.	
522250	.2	Curvature invalid.	1. Reset or update the field computer. 2. Contact a local Raven dealer for additional assistance.
	.31	No guidance path.	1. Cycle power to the Raven field computer. 2. Ensure the Raven field computer is used for guidance. 3. Start a job and create an A-B guidance line.
	.7	Maximum cross-track error (XTE) exceeded.	1. Recalibrate the SC1/TC1 steering system, including the hydraulic calibration. 2. Check hydraulic steering performance. Refer to the <i>Wheel Control Settings</i> section on page 41 for additional assistance.
	.8	Lookahead too large.	Contact Raven technical service.
522260	.31	No guidance partner.	Field computer is not registered as a guidance partner. 1. Cycle power to the Raven field computer. 2. Update the field computer software.
522261	.31	No steering control unit (SCU) detected.	1. Check cabling and connections to the steering valve. 2. Cycle power to the machine. 3. Update the steering valve software. 4. Check for CAN communication errors between the steering valve and the SC1/TC1. Check CAN terminators and wiring.
522268	.31	No field computer.	Check cabling and connections between the field computer and the SC1/TC1.
522390	.9	Engage switch error.	1. Check the resume switch status in the universal terminal. Ensure the status changes when the engage switch is pressed. 2. Check cabling and connections to the resume switch.
522810	.14	Vision mode invalid partner.	VSN not supported by MDU steering. Switch to GPS guidance or contact your local Raven dealer for assistance with upgrading to HDU steering.
522811	.14	Roadway homologation terms.	Homologation terms not accepted by the operator. Accept the terms of the Roadway Homologation.

Code ID		Description	Recommended Actions
522812	.16	Heading out of range.	This DTC is expected while turning the machine around such as on end rows. If this DTC activates on a straight A-B path, check the RS1/SC1 mounting.
522814	.14	Guidance width required.	A guidance width or working width must be programmed into the field computer or universal terminal.
522815	.13	No four wheel support.	Selected machine tuneset does not support four-wheel steering. Contact a local Raven dealer for additional assistance.
522818	.13	Brake connection failed.	<ol style="list-style-type: none"> <li>1. Check hydraulic connections.</li> <li>2. Check pressure sensor cabling and connections.</li> <li>3. Validate brake function by attempting to enter automation.</li> </ol>
522820	.18	System pressure low.	Check pressure sensor connection and check hydraulic lines and fluid level.
522821	.16	Maximum propulsion speed.	Raise maximum speed if desired.
522826	.16	Invalid pitch.	<p>A pitch greater than 15° has been detected for an extended period of time. Confirm that the SC1/TC1 is mounted securely to a flat surface. Confirm that any sunroofs are closed.</p> <p>If the issue persists, re-calibrate the terrain compensation. Review the <i>Terrain Compensation Setup</i> section on page 54 for additional assistance.</p>
523766	.31	Steering control partner serial number mismatch.	Select the correct steering profile or connect to the correct machine and steering control unit.
523827	.0	Reverse steer not supported.	Reverse steering is not supported on this machine. If the machine is moving forward when this DTC activates, select the direction toggle icon on the field computer or the SC1/TC1 universal terminal.
523830	.31	Steering not unlocked.	Enter a steering unlock code. An unlock code is not necessary if using a SmarTrax MD unit.
523832	.0	GPS mode not unlocked.	Contact a local Raven dealer for a GNSS unlock or select a different GNSS correction type.
523839	.31	Selected tuneset not released.	<ol style="list-style-type: none"> <li>1. Update the SC1/TC1 software for the latest list of released tunesets.</li> <li>2. Recalibrate SC1/TC1 using a generic tuneset.</li> </ol>
523842	.31	Liability acceptance.	Accept the SC1/TC1 liability.
523843	.0	Lost internal communication.	<ol style="list-style-type: none"> <li>1. Cycle power to the machine.</li> <li>2. Ensure proper CAN termination.</li> <li>3. Ensure cable connections are properly seated.</li> </ol>

Code ID		Description	Recommended Actions
523844	.11	GPS receiver error.	Cycle power to the machine.
523845	.16	GPS receiver error: temperature.	
523846	.16	GPS receiver error: voltage.	
523847	.31	GPS receiver error: CPU overload.	
523848	.2	GPS receiver error: COM1 buffer overrun.	
523849	.2	GPS receiver error: COM2 buffer overrun.	
523850	.2	GPS receiver error: COM3 buffer overrun.	
523851	.2	GPS receiver error: link overrun.	
523852	.31	GPS receiver: auxiliary transmit overrun.	
523853	.3	GPS receiver error: AGC out of range.	
523854	.11	GPS receiver error: almanac.	
523855	.31	GPS receiver error: position solution.	
523856	.31	GPS receiver error: position fixed.	
523857	.31	GPS receiver error: clock steering	
523858	.31	GPS receiver error: clock model.	
523859	.31	GPS receiver error: external oscillator locked.	
523860	.31	GPS receiver error: software resource.	
523861	.31	GPS receiver error: Auxiliary 3 event.	
523862	.31	GPS receiver error: Auxiliary 2 event.	
523863	.31	GPS receiver error: Auxiliary 1 event.	
523864	.31	GPS source mismatch.	Machine and implement steering systems are using different correction type. Ensure that the machine and the implement are setup for the same correction type.
523868	.31	G-force limit active.	The maximum G-force has been reached during line acquire or curvature steering operation. Contact Raven technical service.
523874	.13	Memory communication error.	Cycle power to the machine. If the issue persists, contact Raven technical service.
523875	.13	SCU software out of date.	Update the HDU, MDU, or IDU software.
523898	.31	OEM engage error.	Field computer on-screen engage switch not supported. Use the machine engage switch to initiate auto-steer.

Code ID		Description	Recommended Actions
523913	.31	GPS invalid authorization.	Some correction types require an unlock code. Either the code was not entered correctly or an existing code has expired. Review Chapter 7, <i>Feature Unlock Codes</i> for additional information on entering unlock codes. Contact a local Raven dealer or Raven technical service for additional support.
523916	.13	SC1 software out of date.	Update the SC1/TC1 ECU software version.
523918	.2	GPS receiver error: input overrun.	Cycle power to the machine.
523919	.31	GPS receiver error: jammer detected.	
523920	.2	GPS receiver error: IMU communication failure.	
523921	.31	GPS receiver error: tracking mode.	
523922	.31	GPS receiver error: digital filter enabled.	
523923	.0	VSN data invalid warning.	VSN is unable to provide valid row guidance. Check the camera feed and solution quality from the VSN object pool Home page.
523924	.0	VSN data invalid error.	VSN guidance vectors not valid. Restart the VSN.
523925	.2	No row camera communication.	VSN times out after 10 seconds. Check cabling and connections.
523926	.31	No user activity.	Check operator switch settings and operator switch cabling and connections if present.
523927	.31	VSN only needs TC (task controller).	VSN requires a task controller. Open a job on a field computer to use VSN guidance.
523928	.13	Invalid factory calibration	1. Restart the SC1/TC1. 2. Contact a local Raven dealer for additional assistance.
573927	.31	VSN only job required.	Start a job on the field computer or universal terminal to function.

TABLE 2. HDU/MDU/IDU DTC Codes

Code ID		Description	Recommended Actions
87	.0	Too fast to engage.	<p>Reduce machine speed below maximum engage speed to engage auto-steering. SC1/TC1 maximum engage speed is:</p> <ul style="list-style-type: none"> <li>• 16.1 km/h [10 mph] for machines operating in Europe with homologation terms accepted.</li> <li>• 19.3 km/h [12 mph] for tracked machines and swathers.</li> <li>• 29 km/h [18 mph] for units capable of high-speed steering and not subject to homologation terms.</li> </ul> <p>Contact a local Raven dealer for additional assistance with high-speed steering unlocks.</p>
168	.3	HC (high current) high voltage.	<p>Input voltage is above the upper limit (32 V). Optimal system voltage should be 12 V.</p> <ol style="list-style-type: none"> <li>1. Check cabling for shorts or loose connections.</li> <li>2. Check the machine battery voltage.</li> </ol>
	.4	HC (high current) low voltage.	<p>Input voltage is below the lower limit (9 V).</p> <ol style="list-style-type: none"> <li>1. Check cabling for broken or frayed wiring.</li> <li>2. Check the machine battery voltage.</li> </ol>
628	.2	NVM (non-volatile memory) warning.	<ol style="list-style-type: none"> <li>1. Cycle power to the machine.</li> <li>2. Contact Raven technical support if the error persists.</li> </ol>
	.31	NVM (non-volatile memory) Error.	
630	.13	SCU (steering controller unit) not calibrated.	<p>Complete the profile calibration wizard to calibrate the HDU, MDU, or IDU. Refer to Chapter 3, <i>Initial Machine Calibration</i>, for assistance with completing the profile calibration wizard.</p>
701	.2	Auto resume error.	<p>Resume switch is stuck ON.</p> <ol style="list-style-type: none"> <li>1. Check the resume switch and test functionality in the UT. Review the <i>Machine Test</i> section on page 86 to test the switch.</li> <li>2. Check the resume switch cabling and connections.</li> </ol>
702	.1	Master off.	<p>The master switch must be toggled to the ON position.</p>
1385	.11	Node temperature error.	<p>Temperature within the ECU exceeds the operational temperature range. Contact Raven technical support if this issue persists.</p>



Code ID		Description	Recommended Actions
1504	.14	OP (operator presence) active.	The operator override sensor is OFF and does not detect an operator in the operator seat. Refer to the <i>Machine Test</i> section on page 86 for assistance with testing the operator presence sensor.
	.31	Operator presence warning.	The operator override sensor is OFF. The steering system is about to disengage. Refer to the <i>Machine Test</i> section on page 86 for assistance with testing the operator presence sensor.
2901	.2	Incompatible hardware.	Update the SC1/TC1 software version. Refer to the Raven field computer operation manual for additional assistance with ECU updates.

Code ID	Description	Recommended Actions
3509	.3 WAS supply high.	Wheel angle sensor signal voltage is above the expected range. <ol style="list-style-type: none"> <li>Recalibrate the WAS. Review <i>Wheel Angle Sensor Settings</i> section on page 46 for additional assistance.</li> <li>Check mounting of the WAS or for damage to the WAS.</li> <li>If the problem persists, contact a local Raven dealer for additional assistance.</li> </ol>
	.31 WAS alignment fault.	The wheel angle sensor measurement is not aligned with the yaw rate sensor measurement. <ol style="list-style-type: none"> <li>Cycle power to the machine.</li> <li>Recalibrate the WAS. Review <i>Wheel Angle Sensor Settings</i> section on page 46 for additional assistance.</li> <li>Ensure cable connections are properly seated.</li> <li>Check mounting of the WAS or for damage to the WAS.</li> </ol>
	.4 WAS supply low.	Wheel angle sensor signal voltage is below the expected range. <ol style="list-style-type: none"> <li>Recalibrate the WAS. Review <i>Wheel Angle Sensor Settings</i> section on page 46 for additional assistance.</li> <li>Check mounting of the WAS or for damage to the WAS.</li> <li>If the problem persists, contact a local Raven dealer for additional assistance.</li> </ol>
	.5 SID 1 signal high.	The disengage sensor signal (#1) is above the upper limit. <ol style="list-style-type: none"> <li>Cycle power to the machine.</li> <li>Ensure cable connections are properly seated.</li> <li>Contact a local Raven dealer for additional assistance.</li> </ol>
	.6 SID 1 signal low.	The disengage sensor signal (#1) is below the lower limit. <ol style="list-style-type: none"> <li>Cycle power to the machine.</li> <li>Ensure cable connections are properly seated.</li> <li>Contact a local Raven dealer for additional assistance.</li> </ol>
4985	.9 No yaw rate.	The steering control unit (SCU) is not receiving the yaw rate CAN message. <ol style="list-style-type: none"> <li>Ensure cable connections are properly seated. Inspect for loose or missing pins.</li> <li>Contact a local Raven dealer for additional assistance.</li> </ol>

Code ID		Description	Recommended Actions
5237	.2	Invalid command.	<p>The input guidance line or path for auto-steering is not valid.</p> <ol style="list-style-type: none"> <li>1. Check that GNSS corrections are converged.</li> <li>2. Close the active job or task.</li> <li>3. Restart the field computer or UT display.</li> <li>4. Resume the previous job or task.</li> <li>5. If the issue persists, contact a local Raven dealer.</li> </ol>
5237	.31	Loss SC1 comm.	<p>The steering control unit (HDU, MDU, or IDU) is not receiving the input line or path message from the navigation controller.</p>
5241	.31	Disengage switch off.	<ol style="list-style-type: none"> <li>1. Check the disengage switch status in the object pool. The switch should only be active when the steering wheel is moving. Review the <i>Resume/Disengage Settings</i> section on page 47 for assistance.</li> <li>2. Adjust the Disengage Threshold value if the system disengages without the operator using the steering wheel. Review the <i>Resume/Disengage Settings</i> section on page 47 for assistance.</li> <li>3. Check the switch cabling and the sensor voltage/current.</li> <li>4. If the problem persists, contact a local Raven dealer for further assistance.</li> </ol>
253875	.13	SCU software compatibility.	<p>The steering control unit (HDU, MDU, or IDU) software is incompatible with the steering guidance control unit. Update the MDU/HDU software to a supported version.</p>
523877	.13	SPI (serial peripheral interface) error.	<p>A memory error has occurred while trying to use the interface.</p> <ol style="list-style-type: none"> <li>1. Cycle power to the machine.</li> <li>2. If the error persists, contact a local Raven dealer for additional assistance.</li> </ol>
523878	.0	Logic SW power error.	<ol style="list-style-type: none"> <li>1. Check fuses which the HDU is powered through.</li> <li>2. Check voltage at the HDU.</li> <li>3. If the issue persists, contact a local Raven dealer for additional assistance.</li> </ol>
523880	.0	CAN power error.	<p>If the issue persists, contact a local Raven dealer for assistance.</p>
523881	.0	Internal Vref error (what is Vref?)	<p>Reference voltage of 3.3 V is not present (either high or low).</p> <ol style="list-style-type: none"> <li>1. Cycle power to the machine.</li> <li>2. Contact a local Raven dealer for additional assistance.</li> </ol>


Code ID		Description	Recommended Actions
523882	.0	Vbatt voltage error.	<p>Battery voltage</p> <ol style="list-style-type: none"> <li>1. Cycle power to the machine.</li> <li>2. Check the machine electrical system for issues.</li> <li>3. Contact a local Raven dealer for additional assistance.</li> </ol>
523883	.13	Jumper pin invalid.	<p>The actuator type does not match the jumper selection.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections to the machine steering valve and SC1/HDU are properly seated.</li> <li>2. Inspect the connectors near the SC1/HDU for a jumper wire and check connection of the wire.</li> <li>3. Contact a local Raven dealer for additional assistance.</li> </ol>
523884	.11	Valve fault.	<p>The machine steering valve has indicated a fault.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections to the machine steering valve are properly seated.</li> <li>2. Cycle power to the machine.</li> <li>3. Contact a local Raven dealer for additional assistance if the issue persists.</li> </ol>
523885	.31	PWM Out != PWM in.	<p>Amperage supplied to the left or right PWM valve does not match return.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Contact a local Raven dealer for additional assistance.</li> </ol>
	.5	PWM pwr current (mA) low.	<p>Amperage supplied to the left and right solenoids is too low.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Check for broken or frayed wiring.</li> </ol>
	.6	PWM pwr current (mA) high.	<p>Amperage supplied to the left and right solenoids is too high.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Check for shorts in the wiring.</li> </ol>
523886	.6	PWM pwr current (mA) fail.	<p>Unexpected amperage supplied to the left and right solenoids while auto-steering is not active.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Check for shorts in the wiring.</li> </ol>
523887	.5	PWM Ignd (left ground) current (mA) low.	<p>Amperage supplied to left solenoid is too low.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Check for broken or frayed wiring.</li> </ol>
	.6	PWM Ignd (left ground) current (mA) high.	<p>Amperage supplied to left solenoid is too high.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Check for shorts in the wiring.</li> </ol>

Code ID		Description	Recommended Actions
523888	.6	PWM lgnd (left ground) current (mA) fail.	Unexpected amperage supplied to the left solenoid while auto-steering is not active. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring.
523889	.5	PWM rgnd (right ground) current (mA) low.	Amperage supplied to right solenoid is too low. 1. Ensure cable connections are properly seated. 2. Check for broken or frayed wiring.
	.6	PWM rgnd (right ground) current (mA) high.	Amperage supplied to right solenoid is too high. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring.
523890	.6	PWM lgnd (left ground) current (mA) fail.	Unexpected amperage supplied to the right solenoid while auto-steering is not active. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring.
523891	.31	DB Out != DB in.	Amperage supplied to double blocker solenoid does not match amperage return. 1. Ensure cable connections are properly seated. 2. Check for supply voltage on the connections to the machine steering valve. 3. Contact a local Raven dealer for additional assistance.
	.5	DB pwr (power) current (mA) low.	Amperage supplied to double blocker solenoid too low. 1. Ensure cable connections are properly seated. 2. Check for broken or frayed wiring. 3. Check for supply voltage on the connections to the machine steering valve.
523891	.6	DB pwr (power) current (mA) high.	Amperage supplied to double blocker solenoid is too high. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring. 3. Check for supply voltage on the connections to the machine steering valve.
523892	.6	DB pwr (power) current (mA) fail.	Unexpected amperage supplied to the double blocker solenoid while auto-steering is not active. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring. 3. Check for supply voltage on the connections to the machine steering valve.

Code ID		Description	Recommended Actions
523893	.5	DB gnd (ground) current (mA) low.	Amperage supplied to double blocker solenoid too low. 1. Ensure cable connections are properly seated. 2. Check for broken or frayed wiring. 3. Check for supply voltage on the connections to the machine steering valve.
	.6	DB gnd (ground) current (mA) high.	Amperage supplied to double blocker solenoid is too high. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring.
523894	.6	DB gnd (ground) current (mA) fail.	Unexpected amperage supplied to the double blocker solenoid while auto-steering is not active. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring.
523895	.6	Sen pwr (sensor power) current (mA) high.	Amperage output from sensor (e.g. wheel angle sensor, disengage sensor, etc.) is too high. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring.
523896	.6	Sen gnd (sensor ground) current (mA) high.	Amperage output from sensor (e.g. wheel angle sensor, disengage sensor, etc.) is too high. 1. Ensure cable connections are properly seated. 2. Check for shorts in the wiring.
523897	.0	Safety micro-comm err.	No communication to the safety micro. 1. Cycle power to the machine. 2. Contact a local Raven dealer for additional assistance if the problem persists.
523899	.3	WAS 1 signal high.	1. Check the wheel angle sensor and sensor mounting for damage. 2. Recalibrate the WAS. Refer to the <i>Wheel Angle Sensor Settings</i> section on page 46.
	.4	WAS 1 signal low.	
	.7	Small WAS range.	A narrow range between the minimum and maximum wheel angle set-points may cause instable or undesired steering performance. 1. Ensure WAS mounting location. 2. Recalibrate the WAS. Refer to the <i>Wheel Angle Sensor Settings</i> section on page 46.
523900	.3	WAS 2 signal high.	1. Check the wheel angle sensor and sensor mounting for damage. 2. Recalibrate the WAS. Refer to the <i>Wheel Angle Sensor Settings</i> section on page 46.
	.4	WAS 2 signal low.	
523902	.5	SID 2 signal low.	1. Check the disengage sensor and sensor mounting for damage. 2. Recalibrate the disengage sensor. Refer to the <i>Resume/Disengage Settings</i> section on page 47.
	.6	SID 2 signal high.	

Code ID		Description	Recommended Actions
523903	.1	Wheels turning no SID.	<p>Wheel angle movement detected without operator disengage being detected or auto-steer control being active.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Contact a local Raven dealer for additional assistance if the issue persists.</li> </ol>
523904	.7	WAS response expected.	<p>No wheel angle sensor change detected while commanding the valve (HDU) or motor (MDU).</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Recalibrate the WAS. Refer to <i>Wheel Angle Sensor Settings</i> section on page 46 for assistance.</li> <li>3. Check for software compatibility DTC messages (253875.13 or 523916.13). If these DTCs are also present, update SC1/TC1 or HDU software as appropriate.</li> </ol>
523907	.5	EH (electro-hydraulic)valve not connected.	<p>No current (mA) draw detected when commanding the valve (HDU) or motor (MDU).</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Check for broken or frayed wiring.</li> <li>3. If the machine steering valve offers LED status lights, review the machine operator manual for additional troubleshooting procedures.</li> </ol>
523908	.31	No SGC (steering guidance controller) detected.	<p>The steering guidance controller (SC1/TC1) has not detected a navigation controller on the CAN bus.</p> <ol style="list-style-type: none"> <li>1. Ensure cable connections are properly seated.</li> <li>2. Inspect connectors for damage including missing, bent, or unseated pins.</li> <li>3. Check CAN bus communication.</li> </ol>
523910	.2	Current (mA) out of sync.	<p>Amperage measured by the high side driver and proportional control driver are significantly different. Contact a local Raven dealer for additional assistance.</p>
523912	.0	Over torque.	<p>The SmarTrax MD system has exceeded the allowable current draw (mA) for the system.</p> <ol style="list-style-type: none"> <li>1. Cycle power to the machine.</li> <li>2. Contact a local Raven dealer if the DTC persists.</li> </ol>
523916	.13	SGC (steering guidance controller) software compatibility	<p>The current steering guidance controller software is out of date. It is recommended to suspend auto-steer operation.</p> <ol style="list-style-type: none"> <li>1. Update HDU software.</li> </ol>
583879	.0	Logic LDO (Linear and Low Drop Out) power error.	<p>The logic power supplied to the ECU is out of range. Contact a local Raven dealer if the DTC persists.</p>

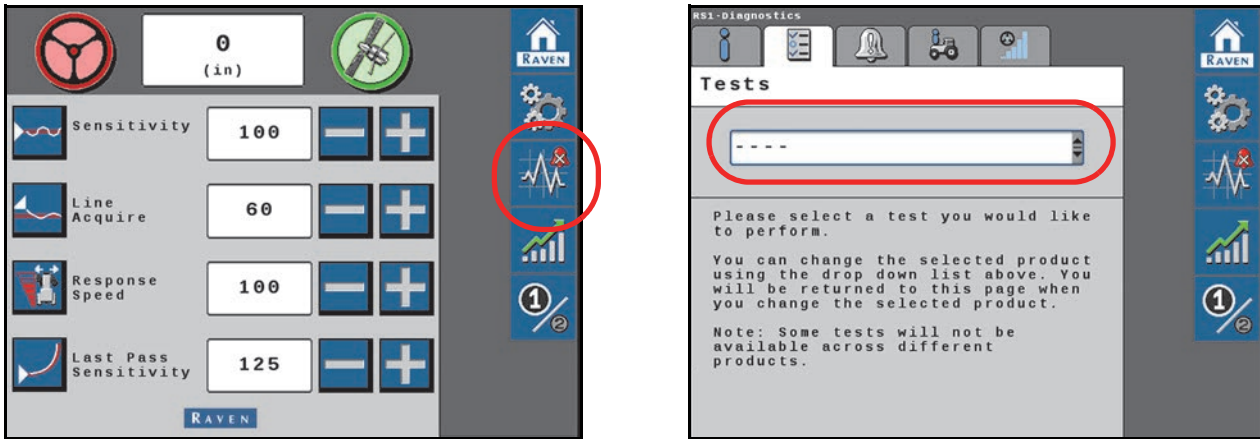
SYSTEM HEALTH TESTS



⚠ WARNING

The machine will steer automatically while system health tests are being performed. Be sure the area around the vehicle is clear of people and equipment before engaging the SC1/TC1 system.

FIGURE 5. Test Selection Page



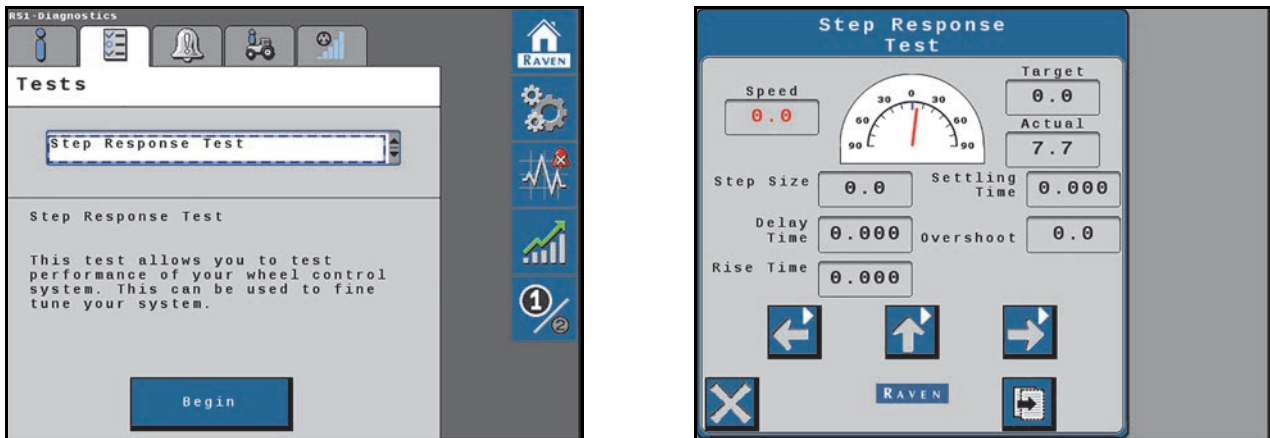
System health tests are performed to diagnose and correct machine and SC1/TC1 calibration issues. The following system health tests can be performed via the SC1/TC1 system:

- Step Response Test
- Machine Test

STEP RESPONSE TEST

The Step Response Test is used to determine the responsiveness of the implement steering system.

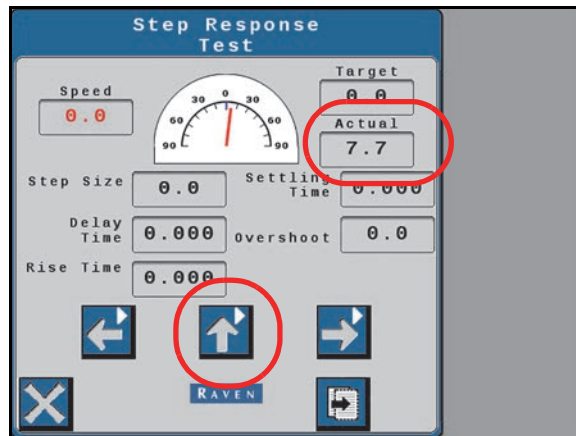
FIGURE 6. Step Response Test Page



1. Drive forward 1 - 4 mph with the engine RPM set at 3/4 throttle.



FIGURE 7. Step Response Test Page



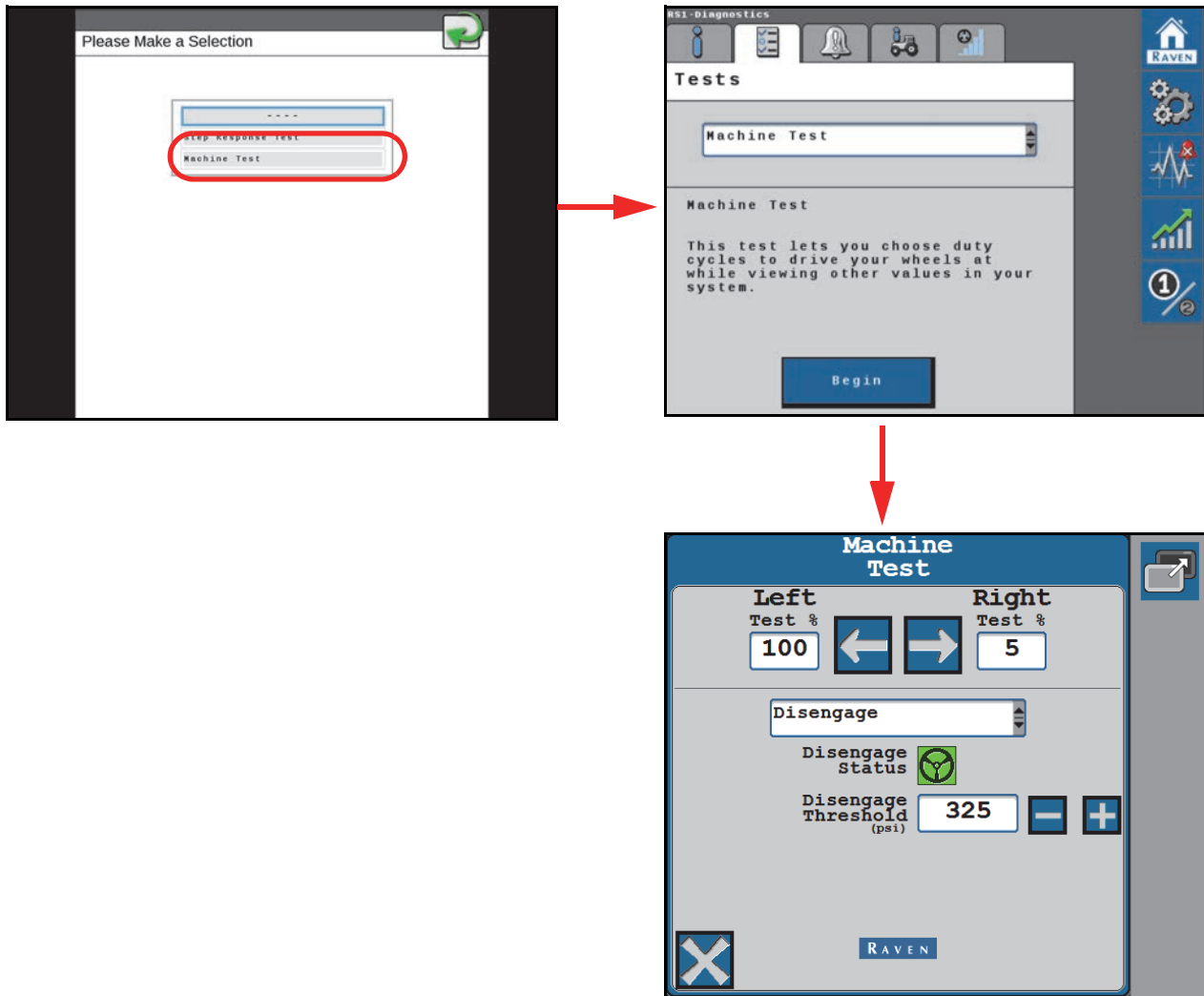
2. Press the center up arrow. Wait for the actuator to reach the center position.
3. Press the left arrow.
4. Wait for the following fields to populate and record the data:
  - a. Step Size
  - b. Delay Time
  - c. Rise Time
  - d. Settling Time
  - e. Overshoot
5. Drive forward 1 - 4 mph with the engine RPM set at 3/4 throttle.
6. Press the center up arrow. Wait for the actuator to reach the center position.
7. Press the right arrow.
8. Wait for the following fields to populate and record the data:
  - a. Step Size
  - b. Delay Time
  - c. Rise Time
  - d. Settling Time
  - e. Overshoot
9. To test consistency, repeat steps 1 - 8.

**NOTE:** Once the Step Response Test has been completed, the machine performance reading should fall within the recommended system settings. Provide the collected data to a Raven Service Technician to verify machine performance falls within the recommended settings.

MACHINE TEST

The Machine Test is used to determine the responsiveness of the machine steering system.

FIGURE 8. Machine Test Page



Use the drop-down list options to select the following machine test pages:

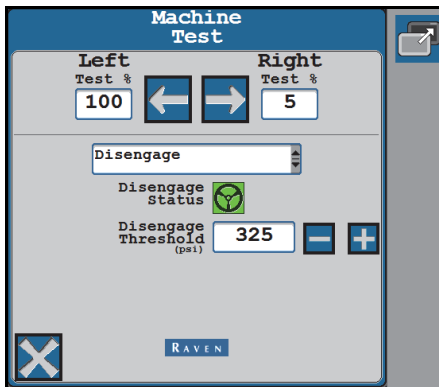
- Disengage
- Machine Info
- Readouts
- Switches

MACHINE CONTROL EFFORT STEERING TEST

The top of the Machine Test page allows the operator to test the steering system and valve control effort.

1. Enter the test control effort percent in the left or right field.

FIGURE 9. Disengage Switch Test Page

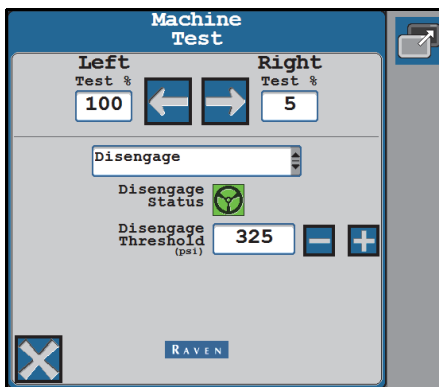


2. Use the blue arrow buttons to manually steer the wheels left or right.
3. Select the 'X' in the lower, left corner to return to the Tests tab.

## DISENGAGE

Review the disengage switch settings and confirm switch operation and status.

FIGURE 10. Disengage Switch Test Page

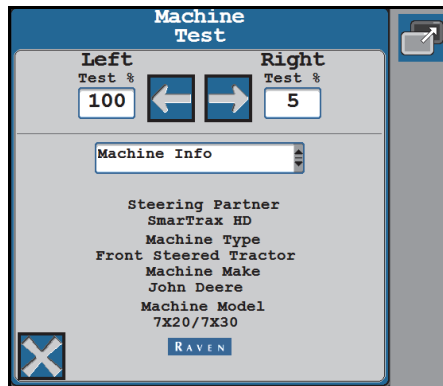


**NOTE:** Adjust the Disengage Threshold value to test the disengage status based upon steering wheel inputs.

MACHINE INFO

Review basic tune-set profile information.

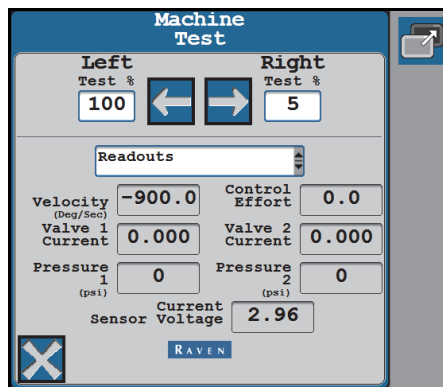
FIGURE 11. Machine Information Machine Test Page



READOUTS

Page offers information such as velocity (wheel speed), control effort for the steering valve, the amperage per valve, current pressure at each transducer (if applicable), and the WAS voltage.

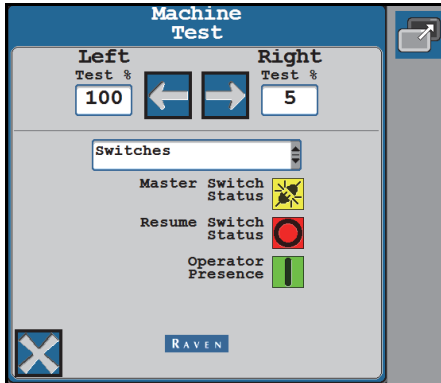
FIGURE 12. Machine Test Readouts Page



SWITCHES

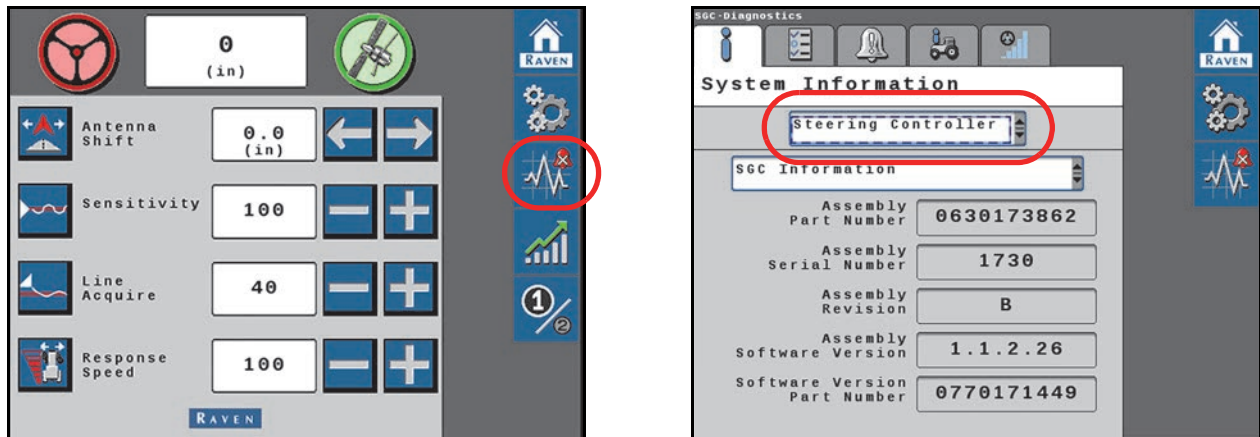
The switches page allows the operator to troubleshoot the machine steering master switch, resume switch, and operator presence switch. The icons shown on this page should change when the switch status changes.

FIGURE 13. Machine Test Switches Page



SYSTEM INFORMATION

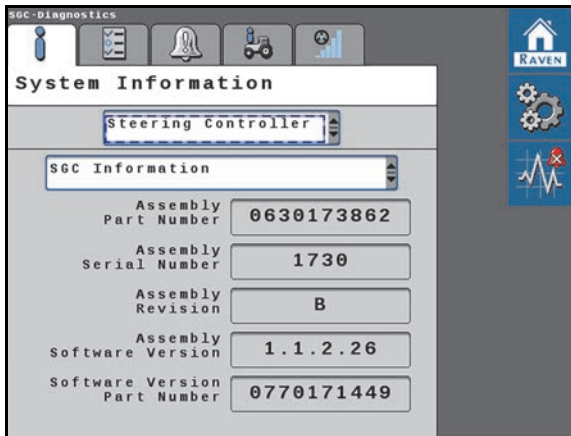
FIGURE 14. System Information Page



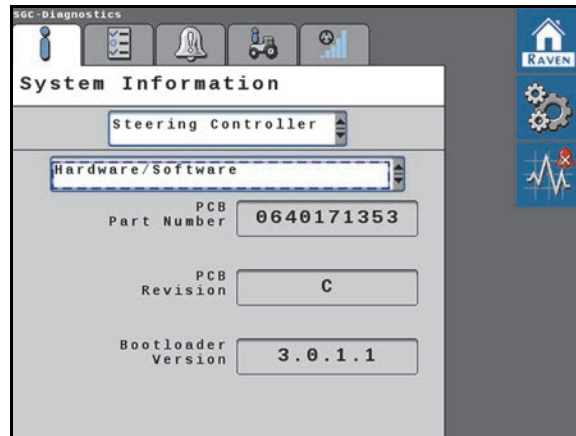
1. Select the desired device from the drop-down menu.
2. Select the desired system component from the second drop-down menu.

FIGURE 15. System Information Pages

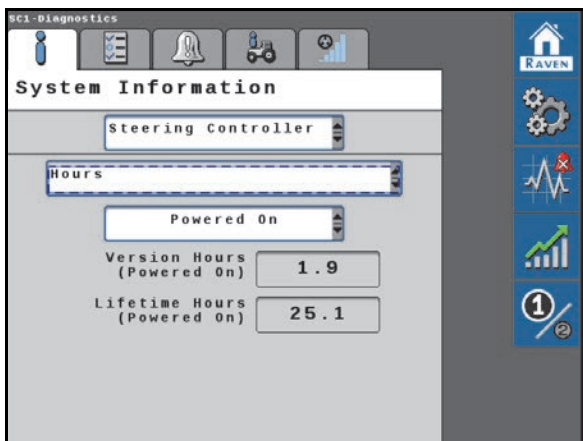
SC1/TC1 Information



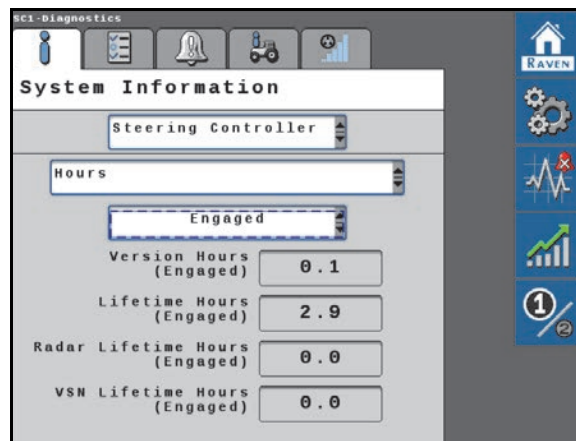
Hardware/Software Information



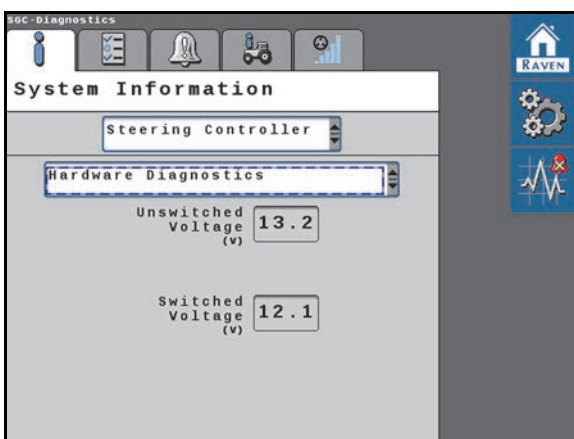
SC1/TC1 Unit Hours - Powered On



SC1/TC1 Unit Hours - Engaged



SC1/TC1 Hardware Diagnostics



GPS Receiver

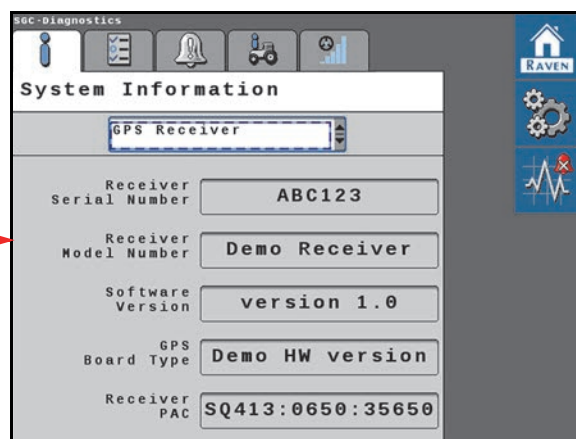
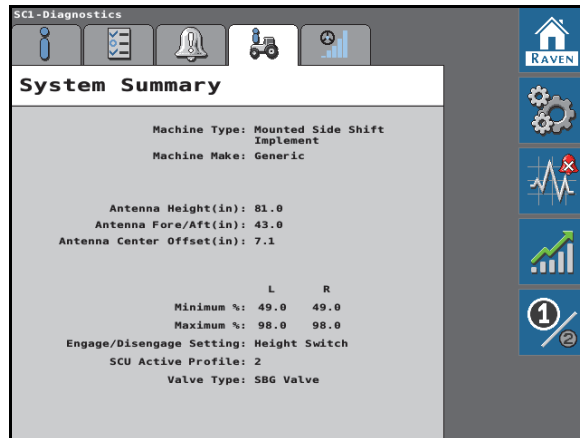
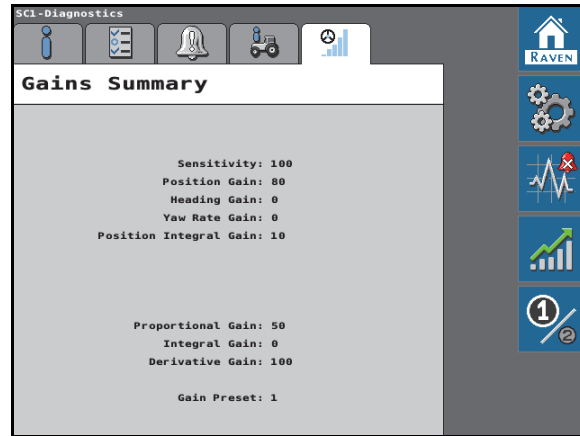


FIGURE 16. System Summary Page



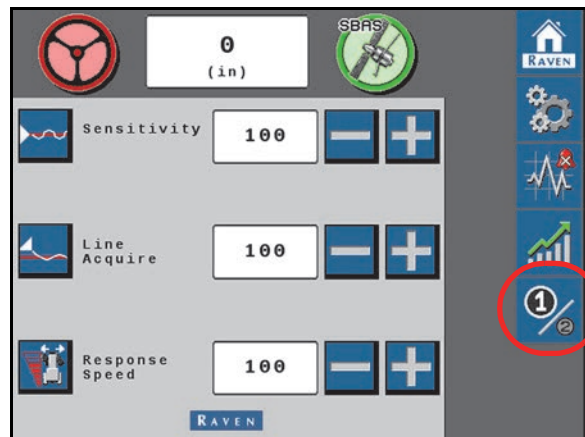
The System Summary page displays the machine settings and calibrated steering settings for the SC1/TC1 system.

FIGURE 17. Gains Summary Page



The Gains Summary page displays all of the advanced steering settings used to steer the machine.

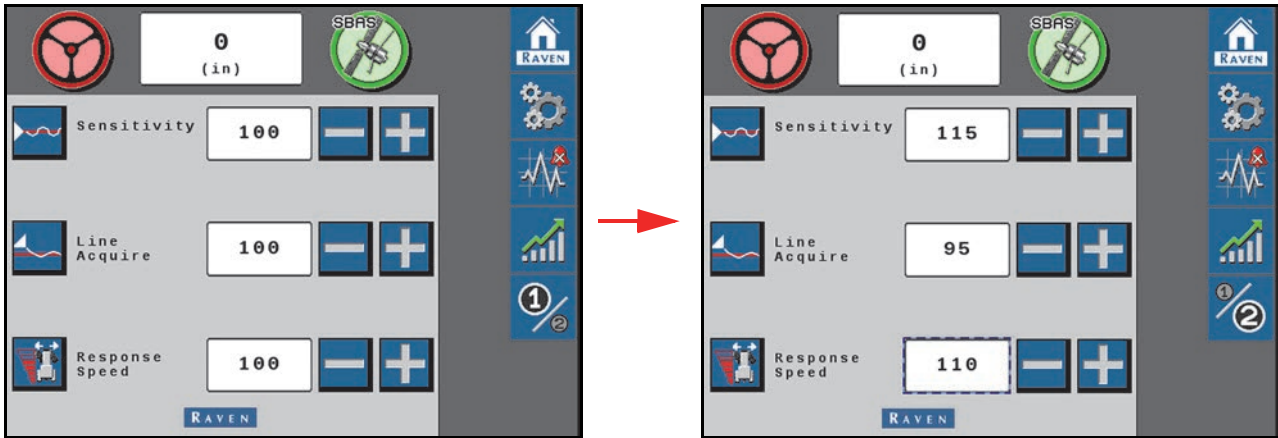
FIGURE 18. Preset Steering Gains



The Preset Gains option allows the operator to switch back and forth between two sets of steering gain settings. Different sets of settings may be useful when:

- The machine uses two tire configurations (floater vs. row crop tires)
- Different terrain conditions
- Different soil types
- Different speeds (planting vs. spraying)

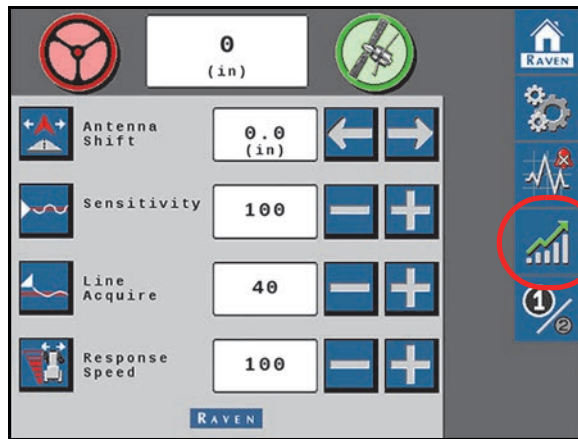
FIGURE 19. Preset Gains Settings



Press the  button to toggle between the two sets of steering gains.

## PERFORMANCE MONITOR

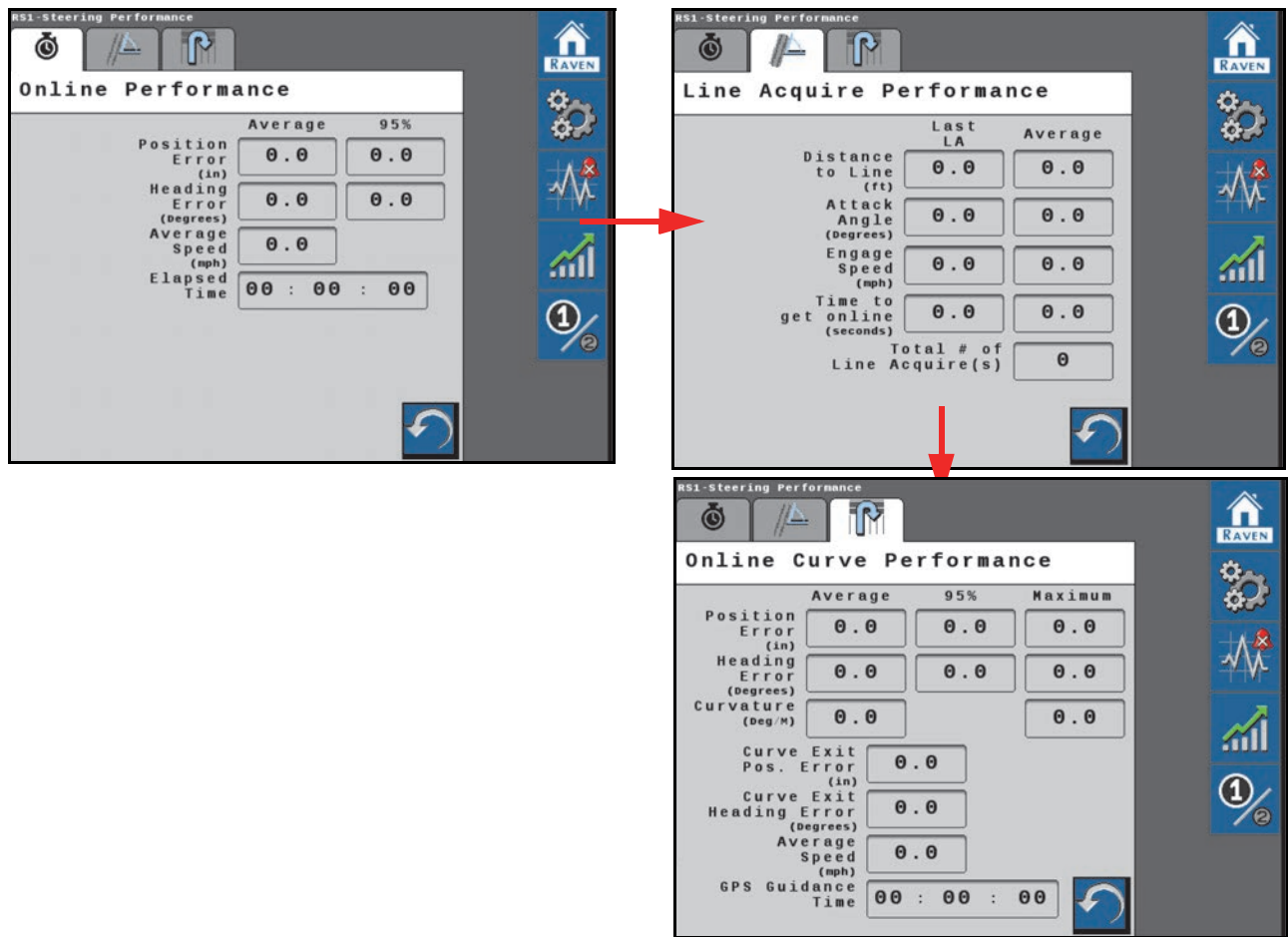
FIGURE 20. SC1/TC1 Home Page



1. Select the **Performance** icon on the right side of the Machine Settings page to view the short-term system performance.



FIGURE 21. Performance Monitor Pages

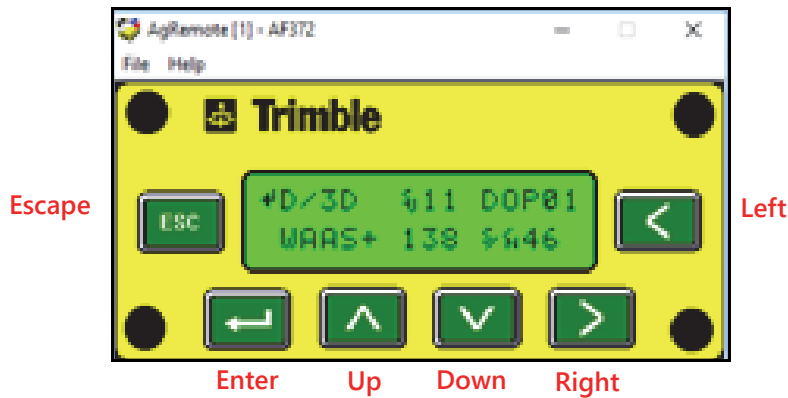


**NOTE:** The Short-Term Performance page displays the averages and 95% performance values.

2. Select the tab with the watch icon to view the Resettable Performance values.
3. Select the **Reset** icon to reset the values.



FIGURE 1. AgRemote Interface

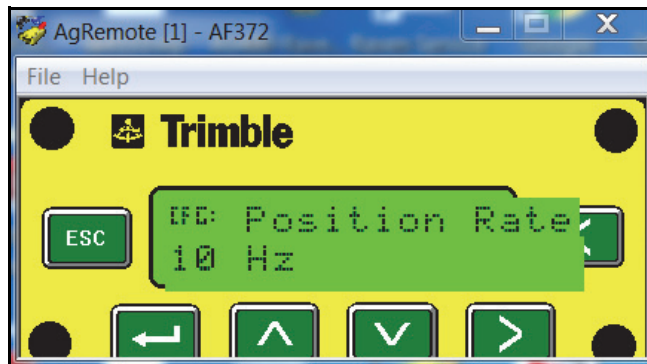


Connect the 372 to the AgRemote via Port B.

### GPS CONFIGURATION

1. Press the Right button until "Configuration" displays on the screen.
2. Press the Down button to select "Configuration".
3. Press the Right button until "GPS Config" displays.
4. Press the Down button until "Position Rate" displays.
5. Press Right to set the "Position Rate" to 10Hz.

FIGURE 2. Position Rate Setting



6. Press Enter to save the settings.

## RADIO MODE CONFIGURATION

1. Press the Right button until "Configuration" displays on the screen.
2. Press the Down button to select "Configuration".
3. Press the Right button until "RTK Config" displays.
4. Press the Down button to select "RTK Config" displays.
5. Press the Down button until "Delivery" displays.
6. Select the Right button to set "Delivery" to Trimble CMRRadio.

**FIGURE 3. Delivery Setting**

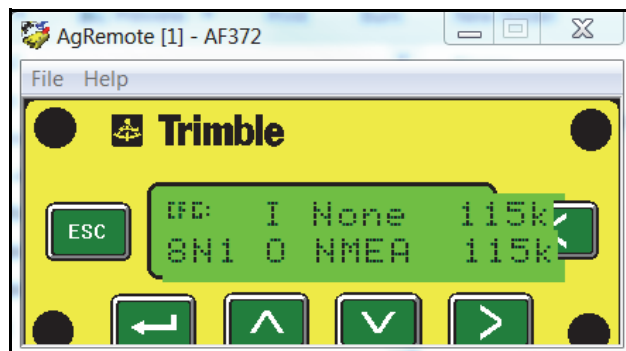


7. Select Enter to save the settings.

## PORT A CONFIGURATION

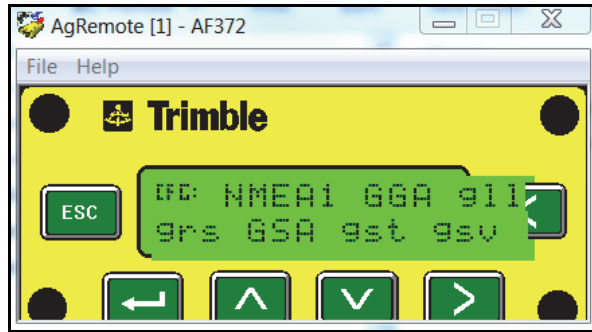
1. Press the Right button until "Configuration" displays on the screen.
2. Press the Down button to select "Configuration".
3. Press the Right button until "Port A Config" displays.
4. Press the Down button to select "Port A Config".
5. Ensure the Input (I) messages are set to None and the baud rate is set to 115K.
6. Verify the Output (O) messages are set to 8N1 and that the NEMA and baud rates are set to 115K.

**FIGURE 4. Port A Configuration**



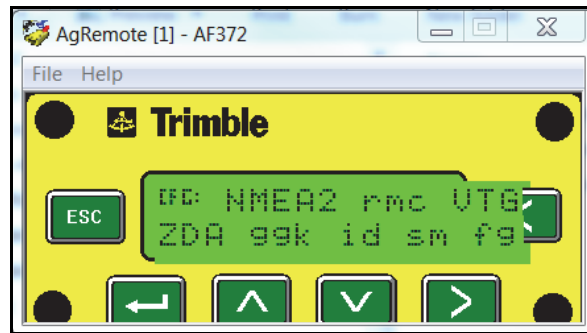
7. Press Enter to save the settings.
8. Press the Down button until "NEMA1" displays.
9. Verify GGA and GSA are capitalized so they are on.

FIGURE 5. Port A NEMA1 Configuration



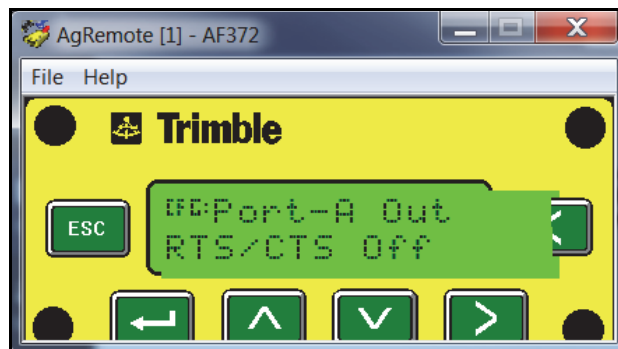
10. Press Enter to save the settings.
11. Press the Down button until "NEMA2" displays.
12. Verify that VTG and ZDA are capitalized so they are turned on.

FIGURE 6. NEMA 2 Configuration



13. Press the Down button to continue configuring Port A.
14. Press the Down button until "CFG: Port A Out RTS\_CTS" displays.
15. Verify "CFG: Port A Out RTS\_CTS" is off.

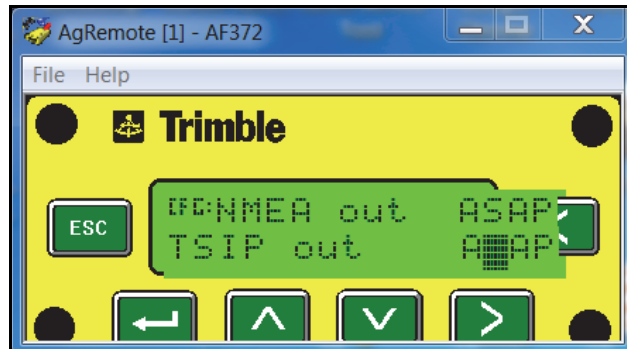
FIGURE 7. Port A RTS/CTS Configuration



16. Press Enter to save the settings.
17. Press the Down button to continue configuring Port A.
18. Press Enter to save the settings.
19. Press the Down button until "NMEA" out displays.

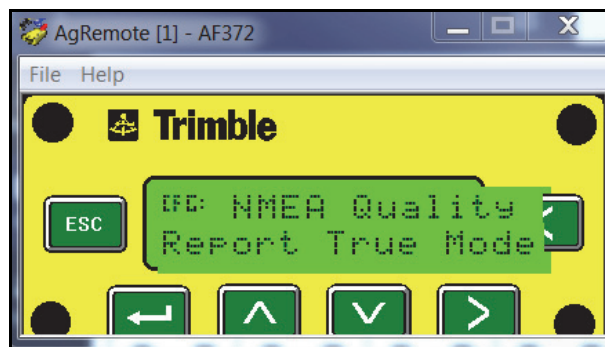
20. Ensure that "NEMA" out and TSIP out are set to ASAP.

**FIGURE 8. NEMA Configuration**



- 21. Press Enter to save the settings.
- 22. Press the Down button until "CFG: NEMA QUALITY" displays.
- 23. Verify the setting is Report True Mode.

**FIGURE 9. Port A NEMA Quality**

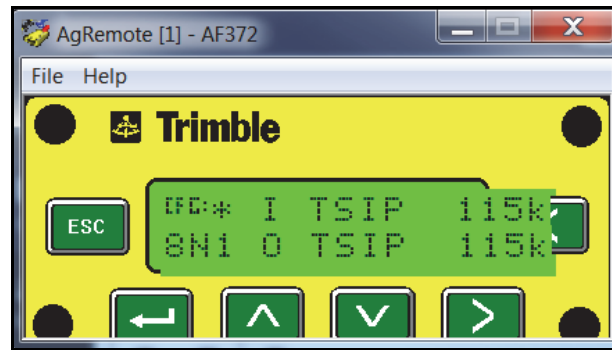


24. Press Enter to save the settings.

### PORT B CONFIGURATION

- 1. Press the Right button until "Configuration" displays.
- 2. Press the Down button to select "Configuration".
- 3. Press the Right button until "Port B Config" displays.
- 4. Press the Down button to select Port B Config.
- 5. Verify the Input (I) messages are set to TSIP and the baud rate is set to 115K.
- 6. Ensure the Output (O) messages are set to 8N1 and the TSIP and baud rate are set to 115K.

FIGURE 10. Port B Configuration



7. Press Enter to save the settings.



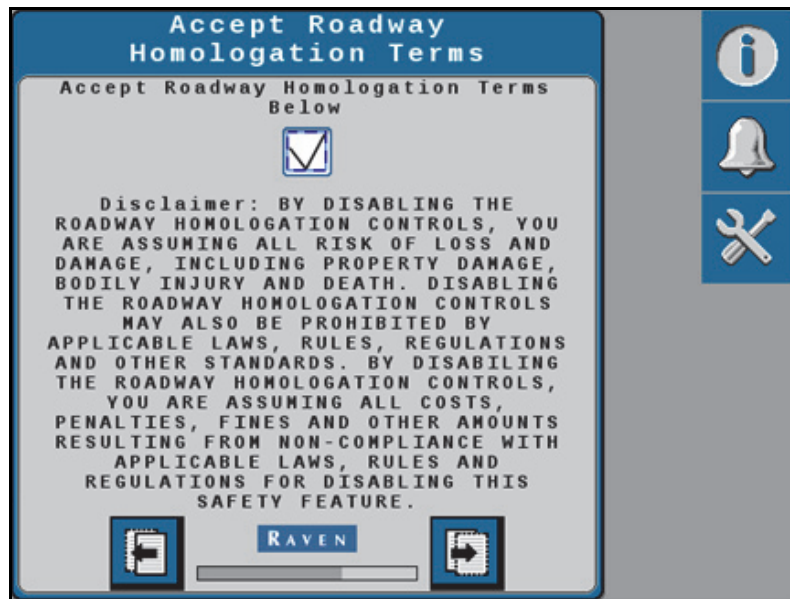


The Accept Roadway Homologation Terms page will be displayed during the initial calibration of the SC1/TC1 system in either of the following conditions:

- Operating with a generic tune-set
- Operating on the European continent

Carefully review the on-screen disclaimer before proceeding.

**FIGURE 1. Roadway Homologation**



When roadway homologation is accepted, the following parameters will be applied to SC1/TC1 operation:


- An operator presence method will be required while operating with the SC1/TC1 auto-steering system enabled.
- Auto-steering cannot be enabled above 10 mph (16.1 km/h).
- Auto-steering will disengage above 12 mph (19.3 km/h).

## CERTIFICATION

**NOTE:** The Raven RS1/SC1/TC1 system is an approved steering system per the requirements of 2009/66/EC, § 38 StVZO (EU) 2015/208 IV and V incl. all amendments up to (EU) 2015/208. By GTÜ No. GTÜ 2015/208/V-19002.00.

A copy of the full report may be requested by contacting Raven Europe.

**FIGURE 2. Certification Test Report**

<b>Test Report / Prüfbericht</b>		
<b>No. / Nr. : GTÜ 2015/208/V-19002.00</b>		
Type / Typ	: RS1/SC1	
Manufacturer / Hersteller	: Raven Europe	

---

**9. Certification / Schlussbescheinigung**

The system as mentioned under no. 1. and 2. is in compliance with the test specification mentioned above. /

*Das unter Nr. 1. und 2. beschriebene System - entspricht - der o. a. Prüfspezifikation.*

With regard to the required level of performance to be achieved, the tested items were representative for the type to be validated.

*Die verwendeten Prüfmuster waren im Hinblick auf das erforderliche Leistungsniveau für den zu beurteilenden Typ repräsentativ.*

This Test Report comprises pages 1 to 16 and attachments. The Test Report shall be reproduced and published in full only and by the client only. It shall be reproduced partially with the written permission of the Test Laboratory only.

*Dieser Prüfbericht umfasst Blatt 1 bis 16 sowie die Anlagen. Dieser Prüfbericht darf nur vom Auftraggeber und nur in vollem Wortlaut vervielfältigt und weitergegeben werden. Eine auszugsweise Vervielfältigung und Veröffentlichung des Prüfberichtes ist nur nach schriftlicher Genehmigung des Prüflaboratoriums zulässig.*

**TEST LABORATORY / PRÜFLABORATORIUM**

designated by designation department of Kraftfahrt-Bundesamt,  
Federal Republic of Germany. /


*benannt von der Benennungsstelle des Kraftfahrt-Bundesamtes,  
Bundesrepublik Deutschland.*


Stuttgart, 16.06.2019

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GTÜ - Gesellschaft für Technische Überwachung mbH Vor dem Lauch 25 DE-70567 Stuttgart	TEST LABORATORY / PRÜFLABORATORIUM DIN EN ISO/IEC 17025 and / DIN EN ISO/IEC 17020 und <b>Registration number / Registrier-Nr.</b> KBA-P 00077-09	Document / Dokument: Rev. 04
		Page / Seite: 16 of / von 16

## SAFETY NOTES

- The system "RS1/SC1/TC1" can be installed by authorized dealers / workshops only.
- Before driving on public roads:
  - the "RS1/SC1/TC1" has to be switched off by the master switch.
  - the monitor must be mounted outside of the required visibility of the driver.

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# LIMITED WARRANTY

## WHAT DOES THIS WARRANTY COVER?

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

## HOW LONG IS THE COVERAGE PERIOD?

Raven Applied Technology products are covered by this warranty for 12 months from the date of retail sale. In no case will the Limited Warranty period exceed 36 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 completed RMA form, Certificate of Decontamination, and retail 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 this product or any component of the product found to be defective during the warranty period. Replacement will be made with a new or remanufactured product or component. Standard return freight will be paid, regardless of 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 outside our facility 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, improper installation and maintenance are not covered by this warranty.
- Worn/Chafed hoses and cables.
- Items in contact with fluids and chemicals including seals and O-rings.
- Software downloads and updates.
- Tamper-Evident label broken or customer disassembly.
- Any customer modification to the original product outside normal calibration and adjustments, without written approval.
- Intentional modification to cables.
- Failures due to lack of cleaning or preventive maintenance, and any condition, malfunction or damage not resulting from defects in material or workmanship.
- Items in contact with fluids or chemicals, returned without proper cleaning, decontamination and documentation.

# 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 <https://portal.ravenprecision.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 completed RMA form, Certificate of Decontamination, and Extended Warranty Registration Number) 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 warranty claim, Raven Industries will (at our discretion) repair or replace this product or any component of the product found to be defective during the warranty period. Replacement will be made with a new or remanufactured product or component. Standard return freight will be paid, regardless of 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 outside our facility 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, improper installation and maintenance are not covered by this warranty.
- Worn/Chafed hoses and cables.
- Items in contact with fluids and chemicals including seals and O-rings.
- Software downloads and updates.
- Tamper-Evident label broken or customer disassembly.
- Any customer modification to the original product outside normal calibration and adjustments, without written approval.
- Intentional modification to cables.
- Failures due to lack of cleaning or preventive maintenance, and any condition, malfunction or damage not resulting from defects in material or workmanship.
- Items in contact with fluids or chemicals, returned without proper cleaning, decontamination and documentation.