OPERATOR'S MANUAL

# ECU-S1

## AutoSteering Controller

Welcome to the world of precision, hands-free steering

2014-10

PN 602-0559-03-A

# Important Information

Please refer to your vehicle specific hardware installation manual for complete installation requirements before operating the ECU-S1 system.

There are no serviceable parts inside ECU-S1. Do not open the unit. Opening the unit will void warranty.

Retain this *Operator's Manual* in safe place for future reference.

## *Trademark*

Unless otherwise stated, all brands and product names marked with ™ or ® are trademarks of Novariant, Inc.

## *Life Support Policy and Use in Safety-Critical Compliance*

Products are not authorized for use in life-support or safety-critical applications. Use in such applications is done at the sole discretion of the customer. Manufacturer will not warrant the use of its devices in such applications.

## *About this Manual*

While every effort has been taken to ensure the accuracy of the contents of this manual, the manufacturer cannot accept responsibility for any errors or omissions. This manual is based on ECU-S1 software version 1.8. In case of differences between the manual and product, use information from the product.

## *Product and Serial Numbers*

Please record the product and serial numbers of your ECU-S1 unit in the space below:

Product Number (PN): _____

Serial Number (SN): _____

The product number and serial numbers are located on a right side of the unit. Keep those numbers handy when contacting Technical Support.

## *Technical Support*

Contact your dealer for technical support.

# LEGAL DISCLAIMER

**Note:** Read and follow ALL instructions in this manual carefully before installing or operating the ECU-S1 system.

**Note:** Take careful note of the safety information in the *Safety Information* section of this manual and the additional safety messages provided throughout this and any other supplemental manuals provided.

The manufacturer disclaims any liability for damage or injury that results from the failure to follow the instructions, cautions, and warnings set forth herein.

Please take special note of the following warnings:

1. There is NO obstacle avoidance system included with the manufacturer's product. The owner must always have a human present in the operator's seat of the vehicle when the ECU-S1 system is in use to look for any obstacles to avoid including people, animals, trees, power poles, ditches, buildings, etc. and take control of the vehicle to manually avoid them if necessary.
2. The ECU-S1 system does NOT control the speed of the vehicle. The operator must always adjust the speed of the vehicle manually so that it is operated at a safe speed that will not cause the vehicle to roll over or go out of control.
3. The ECU-S1 system will take over control of the vehicle's steering system when the ECU-S1 system is activated during testing, calibration, tuning, and automatic steering operations. The vehicle's steering axles, tracks, articulation point, or wheels may move unpredictably when activated. Prior to starting the vehicle and/or activating the ECU-S1 system, verify that all people and obstacles are clear of the vehicle to prevent death, injury, or damage to property.
4. Use of the ECU-S1 system is NOT permitted while the vehicle is on public roads or in public areas. Verify that the system is powered OFF before driving on roads or in public areas.

# Safety Information

## *Warning Alerts*

The ECU-S1 system installer and manufacturer disclaim any responsibility for damage or physical harm caused by failure to adhere to the following safety requirements:

- As the operator of the vehicle, you are responsible for its safe operation.
- The ECU-S1 system is *not* designed to replace the vehicle's operator.

**Note:** Prior to operating the ECU-S1 system, verify that all the screws, bolts, nuts, and harness connections are tight and that all the cables and hoses have been secured to prevent them from being damaged. Verify there are no oil leaks in the steering circuit.

**⚠ WARNING**

To understand the potential hazards associated with the operation of an ECU-S1 equipped vehicle, read the provided documentation prior to installing or operating the ECU-S1 system on a vehicle.

**⚠ WARNING**

To prevent accidental death or injury from being run over by the vehicle, never leave the vehicle's operator seat with the ECU-S1 system engaged.

**⚠ WARNING**

To prevent accidental death or injury from being run over by the vehicle, verify that area around the vehicle is clear of people and obstacles before startup, calibration, tuning, or use of the ECU-S1 system.

**⚠ WARNING**

To prevent the accidental engagement of the ECU-S1 system and loss of vehicle control, power down the ECU-S1 system while driving on roads. Never drive on roads or in public areas with the ECU-S1 system powered up.

**⚠ WARNING**

Verify that you are in a stable position on the vehicle's platform or stairs when installing or removing the antenna assembly on top of the cab so you do not fall. If the vehicle does not provide a safe platform, use a ladder to safely access the vehicle's roof.

**⚠ WARNING**

To avoid electrical shock hazards, remove the antennas from the vehicle before driving under low structures or low electrical power lines.

**⚠ WARNING**

**High-Pressure Fluid Hazard**

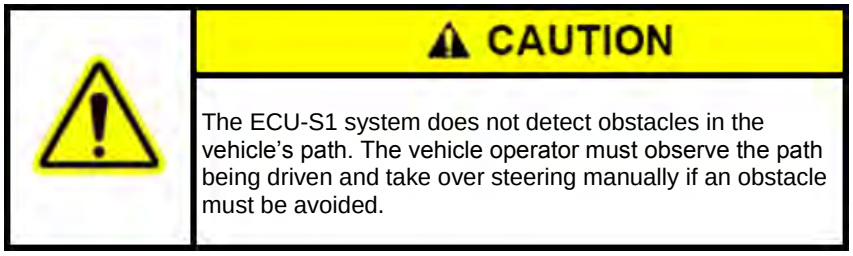
If the installation requires working on the hydraulic system on the vehicle, read and understand the hydraulic sections of the vehicle manufacturer's operators manual before starting the installation. Wear hand and eye protection while performing hydraulic system maintenance. Relieve hydraulic system pressure before servicing the hydraulic system.

**⚠ WARNING**

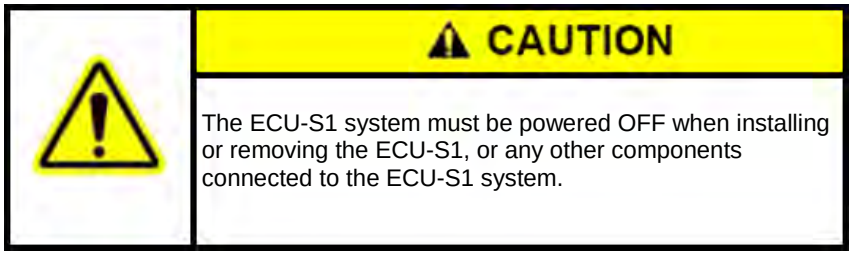
If the vehicle has a Wheel Angle Senor as part of the installation, always shut off the vehicle when working around the Wheel Angle Sensor while installing, checking, and adjusting the Wheel Angle Sensor and rod lengths. The steering mechanism could move suddenly and cause severe injury or death.

## *Caution Alerts*

The ECU-S1 system installer and manufacturer disclaim any responsibility for damage or physical harm caused by the failure to adhere to the following safety requirements:







# Contents

# ECU-S1 System

## Overview

The ECU-S1 is a high precision electronic controller that provides automatic steering capability to the vehicle. The ECU-S1 controller receives guidance information from the Display device and sends steering commands to the vehicle. This *Operator's Manual* provides information on how to setup, configure, and manage the various settings on the ECU-S1 controller and how to navigate through the software menus.

The ECU-S1 controller is compatible with multiple Displays. Please refer to the *Display Operator's Manual* or contact your AutoSteer dealer for specific instructions on how to connect the ECU-S1 system components to the Display. Also refer to the *Display Operator's Manual* for information on how to access ECU-S1 software menus and options. For information about setting up farms, fields, jobs, guidance patterns, and other Display related functions, please refer to your *Display Operator's Manual*.

The ECU-S1 can be installed easily on most agricultural vehicle makes and models. This chapter provides basic information on how the ECU-S1 system components are organized and installed. Refer to the *Installation Manual* that comes with the vehicle installation kit for more details on the complete installation of the ECU-S1 system.

## Features

The ECU-S1 system is designed to be compatible with many makes and models of vehicles available in today's agricultural market. The ECU-S1 can be installed on most agricultural platforms including articulated tractors, combines, MFWDs and standard front axle tractors, floaters, sprayers, swathers, track tractors, and others from most manufacturers including AGCO, Ag Chem, Case, Challenger, Fendt, John Deere, New Holland, Massey Ferguson, and many others. The same operator interface can be used on all vehicles, regardless of the make or model, making it easy for drivers to become familiar with the controls even if the system is installed on multiple vehicle types.

ECU-S1 features include:

- Automatic precision steering for agriculture vehicles
- Support for most vehicle controller types: mechanical, hydraulic, steer-by-wire, factory steer ready, and ISO-Bus (CAN)
- Support for various Displays including consumer tablets and laptops
- Support for Ethernet wired or WiFi wireless connection to the Display
- Support for various GPS/GNSS receivers that provide NMEA messages
- High level of accuracy with cm-level (sub-inch) repeatability with compatible GNSS RTK receivers
- High precision 9-axis inertial sensors to provide enhanced terrain compensation and high accuracy

# ECU-S1 Kit

The ECU-S1 Kit includes a version of the ECU-S1 Electronic Control Unit, the ECU-S1 Main Harness, and Operators' Manual.

**Figure 1-1 ECU-S1 Kit Content**

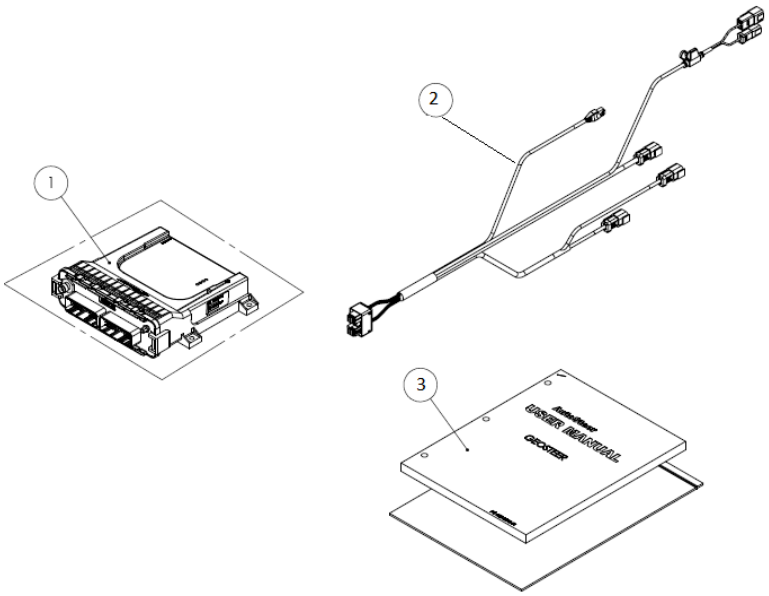



**Table 1-1 ECU-S1 Kit Content**

| Item | Component |
|---|---|
| **1.** | ECU-S1 Electronic Control Unit |
| **2.** | ECU-S1 Main Harness |
| **3.** | Kit Documentation |

# ECU-S1 Device

This section describes ECU-S1 device.

**Figure 1-2 ECU-S1 Top and Bottom Views**

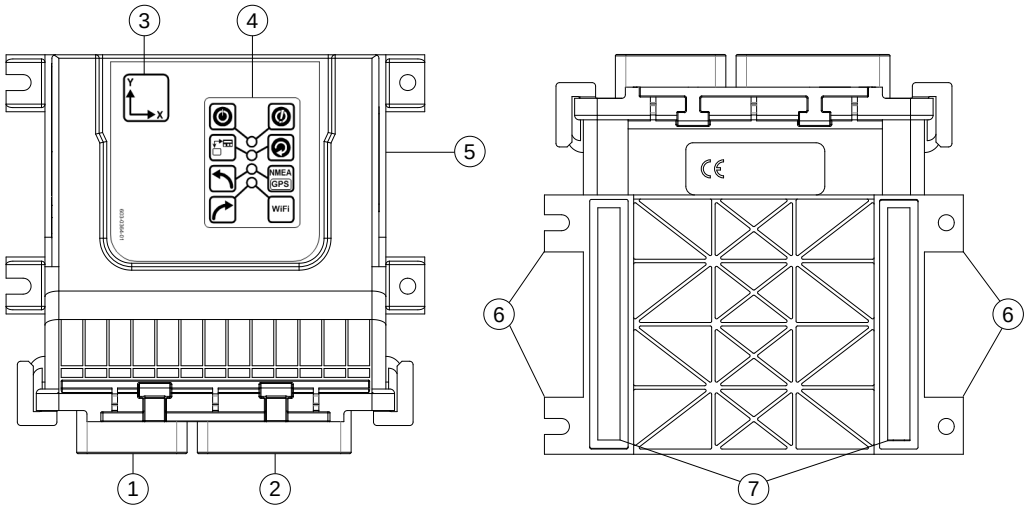



**Table 1-2 ECU-S1 Device Description**

| Item | Description |
|---|---|
| **1.** | ECU-S1 Main Harness connector |
| **2.** | Vehicle Specific Harness connector |
| **3.** | Unit orientation label |
| **4.** | LED indicators panel |
| **5.** | Product and serial number label (on the side) |
| **6.** | Mounting tabs |
| **7.** | Heat sink pads |

**Note:** For proper operation the heat sink pads of the ECU-S1 Electronic Control Unit must be firmly attached to a metal plate. The metal mounting plate must then be firmly attached to the vehicle. Verify the unit is secured with the four mounting screws before AutoSteering. Keep magnetic and electromagnetic devices away from the ECU-S1.

# ECU-S1 LED Indicators

The ECU-S1 is equipped with four dual-color LEDs that can be used to determine the status of the ECU-S1 system as well as provide some basic troubleshooting information. *Figure 1-3* shows the LED panel. Each LED can be off, green, amber or blinking between amber and green at the same time. Refer to *Table 1-3* for each LED description.

**Figure 1-3 LED Panel**

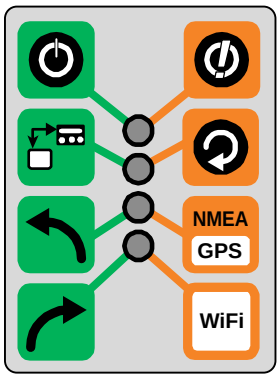



**Table 1-3 LED Indicators Description**

| LED Icon | Description | LED Icon | Description |
|---|---|---|---|
|  | **Solid Green** – ECU-S1 Power On<br>**Off** – ECU-S1 Power Off |  | **Flashing Amber** – Power supply issue or system boot error |
|  | **Flashing Green** – Display Communication active (wired connection only)<br>**Off** – No Display Communication |  | **Flashing** or **Solid Amber** – Software Upgrade in progress |
|  | **Flashing Green** – Left turn command sent to the steering controller device |   | **Flashing Amber** – Receiving GPS NMEA data from external receiver or Display |
|  | **Flashing Green** – Right turn command sent to the steering controller device |   | **Flashing Amber** – WiFi communication active |

# ECU-S1 Connections

The ECU-S1 requires connections to a power source, Display, GPS/GNSS receiver, and a vehicle. Additionally it can be connected to optional accessories. There are various ways these devices can be attached to the ECU-S1. A few generic connections are described in the following sections. For more information on connections please refer to the *Installation Manuals* that are provided with those components.

# Power Connections

The ECU-S1 requires 9 to 16 V DC power supply with a minimum rate of 10 A. It also requires a 5 to 16 V DC Power-On activation signal. That signal may be provided from a dedicated on/off switch or from the Display.

**Figure 1-4 ESU-S1 Power Connections**

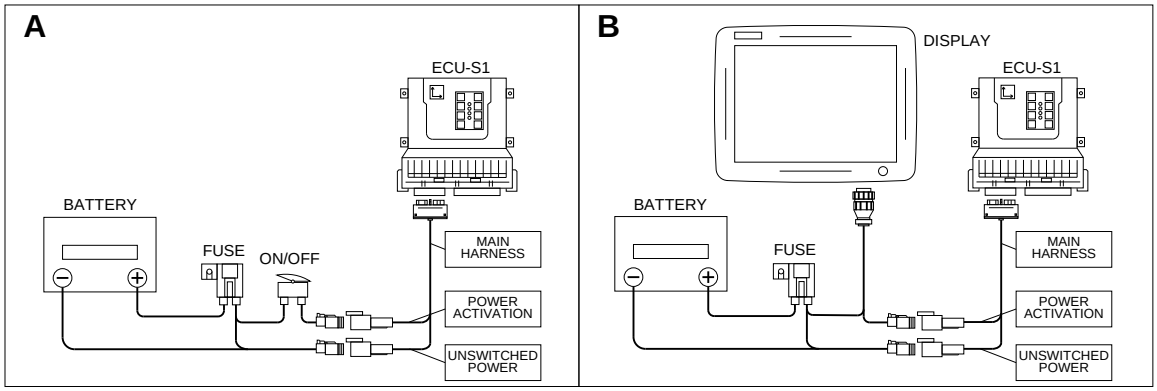



*Figure 1-4* shows two possible power connections. Diagram A shows the use of a dedicated switch and diagram B shows the Display controlling the power of ECU-S1.

# Display Connections

The ECU-S1 requires a wired or wireless connection to the Display. Wired connections could be via Ethernet or RS-232 Serial cable. The wireless connection uses IEEE 802.11 b/g WiFi. Dedicated Displays will establish communication automatically after power up.

Consumer tablet or laptop PC can access the *AutoSteer Setup* screens directly via a web browser. If using Ethernet, connect RJ-45 cable to your computer and type 10.1.1.1 in the web page address line. If using WiFi, connect to ECU-S1-XXXX wireless network, where XXXX are last four digits of ECU-S1 serial number and type 10.100.100.100 in the web page address line.

**Figure 1-5 Display Connections**

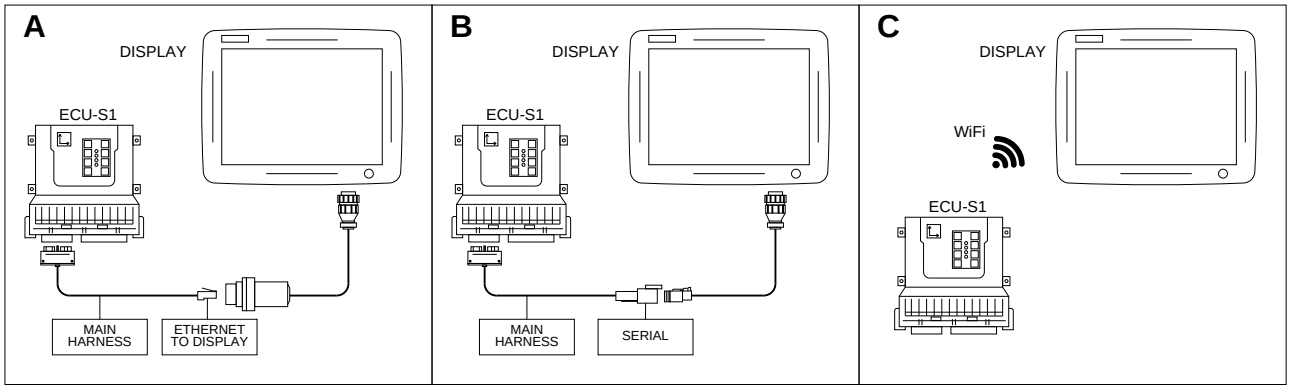



*Figure 1-5* shows three possible Display connections. Diagram A shows an Ethernet connection, diagram B shows RS-232 Serial connection, and diagram C shows a wireless WiFi connection.

# GPS/GNSS Receiver Connections

The ECU-S1 requires the position information from an external GPS or GNSS receiver. The GPS/GNSS receiver providing NMEA messages can be directly connected to the ECU-S1 over the RS-232 Serial interface. Alternatively the GPS/GNSS

receiver can be connected to the Display, and then the Display will provide position information back to the ECU-S1 over the Display connection.

The minimum GPS/GNSS receiver configuration requirements are as follows:

- 38400 bps baud rate; 115200 is recommended
- GGA NMEA messages at 10 Hz
- VTG NMEA messages at 10 Hz
- ZDA NMEA messages at 1 Hz
- Position data resolution must have at least 6 decimal places; 8 places are recommended
- RTK, DGPS, OmniSTAR™ or other correction mode improving position quality is highly recommended

**Figure 1-6 GPS/GNSS Receiver Connections**

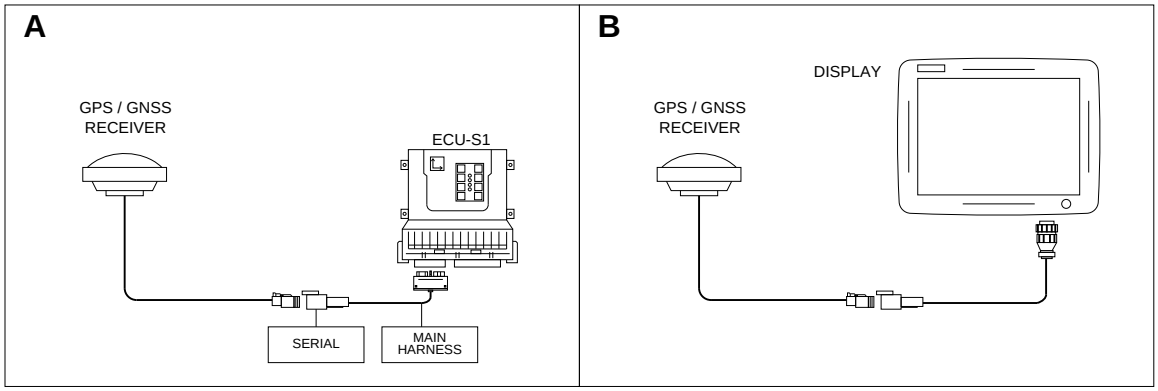



*Figure 1-6* shows two possible GPS/GNSS receiver connections. Diagram A shows the receiver connected directly to ECU-S1 (this is recommended option) and diagram B shows receiver connected to the Display (in this case Display will forward position information to ECU over the Display connection as shown on *Figure 1-5*).

# *Vehicle Connections*

The ECU-S1 requires a direct connection to a vehicle steering controller. Compatible vehicle steering controllers include add-on hydraulic steering valves and mechanical drive units. The ECU-S1 can also be directly connected to most vehicle manufacturer factory installed steering systems (ex. Steer-By-Wire, ISO-Bus, CAN, etc.).

Many vehicle-specific installation kits are available to fit on each individual make and model. Even if there is not a vehicle-specific kit available for a vehicle, a properly trained installers can often use a custom installation kit to connect the ECU-S1 system to the vehicle. Refer to the vehicle specific installation instructions for additional details on how the ECU-S1 is connected to the vehicle.

**Figure 1-7 Vehicle Connections**

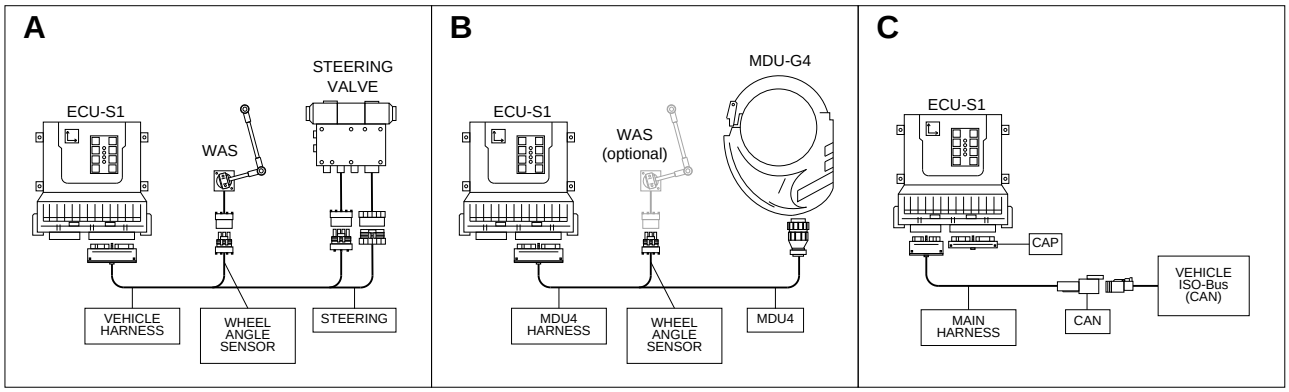



*Figure 1-7* shows three possible vehicle connections. Diagram A shows a connection to a hydraulic valve and Wheel Angle Sensor, diagram B shows connection to MDU-G4 with optional Wheel Angle Sensor, and diagram C shows connection to a ISO-Bus (CAN) on the vehicle.

## *Accessories Connections*

For improved performance and enhanced functionality the ECU-S1 controller can be connected to additional sensors and accessories. Those accessories include:

- **Remote Engage/Disengage Switch** - Allows operator to easily engage and disengage the AutoSteer activation from a remote switch or foot pedal without the need to press the on screen activation deactivate button.

**Figure 1-8 Accessories Connections**

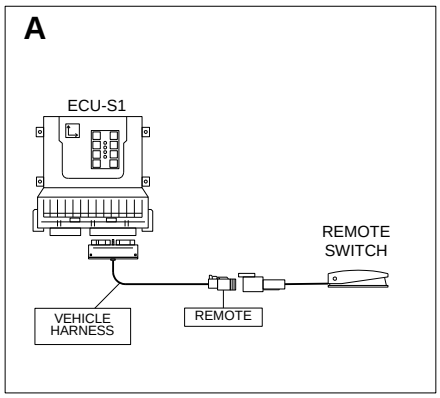



*Figure 1-8* shows a possible connection to a remote foot switch.

# Turning On and Off the Power

The ECU-S1 does not have a built-in power switch and in most installations it is directly connected to the vehicle battery. The ECU-S1 power state (operation/standby) is controlled by the power activation signal. Depending on your installation that, signal may come either from a Display or from a dedicated power switch. If it comes from a Display, refer to the *Display Operator's Manual* for information how to turn the ECU-S1 on and off. If the control signal comes from a dedicated switch, use it to control the power state.

When the power activation signal is deactivated, the ECU-S1 performs a graceful shut down procedure. This process takes about 10 seconds. It is recommended to use this graceful shut down procedure and do not cut the battery power from a system.

The ECU-S1 also provides a software option to control the shutdown delay to keep the ECU-S1 running for up to 2 hours after deactivation of the power activation signal. This option can be used to keep ECU and GPS receiver "warmed up" during short breaks. For more details refer to *Shutdown Delay* section on page 79.

The ECU-S1 draws a very low current from a battery when in standby mode. However, if the vehicle is going to be left inactive for a long period of time, it is recommended to completely disconnect the ECU-S1 from the battery to avoid excessive discharge of the battery.

**Note:** Verify that all connections to the ECU-S1 are connected and secured before turning system on.

# AutoSteer Setup Menu Operation

The AutoSteer Setup menu allows for creating and managing vehicle profiles, performing system calibrations, adjusting steering behavior, checking system status, editing system settings, upgrading ECU-S1 software, performing system diagnostic and obtaining system information. If changes need to be made to move the system to a different vehicle profile, the operator will need to manage those options in the AutoSteer Setup menu.

## Accessing AutoSteer Setup Menu

The ECU-S1 system adds automatic vehicle steering control to compliment the features of your Display. The settings, configuration options, and monitoring features for the GPS and vehicle communications are kept separate from the Display controls. To access these ECU-S1 system specific screens, navigate to the *AutoSteer Setup* screens from the Display. Your *Display Operator's Manual* will provide instructions on navigating to the *AutoSteer Setup* page. Please refer to that document for those instructions. *Figure 2-1* shows the *AutoSteer Setup* opening screen when it is first accessed.

**Figure 2-1 AutoSteer Setup Opening Screen**

# Menu Overview

**Figure 2-2 AutoSteer Setup Screen**


**Table 2-1 AutoSteer Setup Screen**

| Item | Description |
|---|---|
| **1.** | **Back Menu Arrow** - This button returns the operator to the previous menu or exits the operator from the AutoSteer Setup screens if at the main menu level. Depending on Display, this button may not be present at the very top menu level, in such case operator should use other Display button to exit from AutoSteer Setup menu. |
| **2.** | **Configuration Group Selection Tabs** - Configuration options are separated into five groups. Selecting one of these tabs changes which configuration group is selected. The currently selected (active) tab is lower than the rest. |
| **3.** | **Menu Buttons** - These buttons allow the operator to start the action assigned to that menu item. Buttons present will depend on the system configuration and vehicle status. |
| **4.** | **Version** - Shows the ECU-S1 software version currently running on the system. |

The five **Configuration Group Selection Tabs** along the top of the screen separate the ECU-S1 configuration and monitoring functions into sub groups to simplify usage. The five tabs and the options for each are shown *Table 2-2*.

**Table 2-2 AutoSteer Setup Menu Structure**

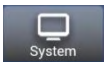
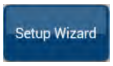
| Vehicle | System | GPS | Connections | My Account |
|---|---|---|---|---|
|  |  |  |  |  |
| Setup Wizard<br>Manage Vehicle<br>Auto Calibrate<br>Tilt Calibration<br>Steering Adjust<br>Steering Components<br>Wheel Angle Calibration<br><br>See page 15 | System Health<br>Manage Settings<br>Accessories<br>Technician<br>Software Upgrade<br>System Log<br><br>See page 69 | GPS Diagnostic<br>GPS Setup<br>Precision Settings<br><br>See page 87 | WiFi<br><br>See page 93 | Details<br>Feature Code<br><br>See page 97 |

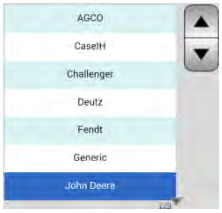
Each of these tabs is described in detail in the following chapters starting at the page number indicated. For more information about each feature, refer to the corresponding chapter.

# Menu Controls and Indicators

Most Displays use a touch screens for operator input and control. The ECU-S1 takes advantage of that technology to allow easy and intuitive control of all ECU-S1 functions. Depending on the Display, the operator may need to press, tap, or just touch the control shown on the Display to start the action. Throughout this manual word **press** is used to indicate the operator should touch the control on the screen. *Table 2-3* provides an list of the types of controls and indicators that might be displayed.

**Table 2-3 Menu and Control Indicators Definitions**

| Item | Function |
|---|---|
|  | **Configuration Group Selection Tab -** Changes the active configuration group to the tab selected. |
|  | **Back Menu Arrow** - Button returns the operator to the previous menu or exits the operator from the AutoSteer screens if at the main menu level. |
|  | **Help Button** - Button to display a pop-up window with additional information regarding the current screen. |
|  | **Standard Button** - Standard selection button present in all screens. Text on the button indicates what will happen if the button is pressed. |
|  | **Decrease/Increase** - Pressing the - button decreases a value and pressing the + button increases the value. |
|  | **Active Buttons** - Button that are colored are active and allow the operator to select them to enter a menu item or start associated action as written on the button. |
|  | **Green and Blue Check Mark Buttons** - Pressing these buttons confirms the action or information screen. |
|  | **Red X Mark Button** - Button used to cancel current operation and discard data. |

| Item | Function |
|---|---|
|  | **Slow/Smooth and Fast/Aggressive Buttons** - Buttons used to adjust steering performance parameters. |
|  | **Inactive Buttons** - Buttons that are dark grey are inactive and make no action when pressed. |
|  | **Step Back and Next Step Buttons -** The back arrow (Step Back) moves the screen one step back. The forward arrow (Next Step) advances the screen to the next step. Sometimes only one button is displayed. Numbers to the left indicate current screen number and a total number of screens in the process. |
|  | **Menu Options List** - Some configuration screens have multiple options that can be selected. These options are displayed on the right side of the screen. The menu item that is highlighted is the one that is currently selected. The operator can use the up  and down  buttons to move the selected item up and down and change the active menu. The small gray triangle that sometimes show up at the top and at the bottom of the list indicate that there are more items above or below. |
|  | **Selection List** - Some screens require the operator to select one of the values provided. The operator can directly select one of the items from the list or use the up and down  scroll buttons to change the highlighted selection. The small gray triangles that sometimes show up at the top and at the bottom of the list indicate that there are more items above or below. Numbers at bottom right indicate the currently selected item number and a total number of items in the list. |
|  | **Alphanumeric Keypad** - Press these keys to enter letters or numbers. Press the **abc** or **ABC** button to toggle the keyboard to letters. Press **123** to toggle the keyboard to type numbers and special characters. Press the **Up Arrow** (Shift) to toggle between lower and upper case letters. The currently selected mode is shown in green. Use the **Back Arrow** (Backspace) to delete characters. |
|  | **Numerical Keypad** - Press these keys to enter numbers. Use **Back Arrow** (Backspace) to delete characters. |
|  | **Text or Number Entry Field** - Use alphanumeric or numerical keypad on the screen to enter desired data. |
|  | **DMS/DEC Switch**. Toggles latitude and longitude display format between Degrees, Minutes, and Seconds and Degrees with fractional part. |
|  | **Bar Graph Display** - Graphical representation of numerical values. |
|  | **Vehicle Speed Indicator with Limits** - The thin, vertical red bar indicates the current vehicle speed which is also shown on the right in a numerical form. The Green portion of the graph indicates the required speed range for the operation being performed. The required speed range limits are shown below the graph in numerical form using the same speed units as used by the current speed indicator. |
|  | **Compass Indicator** - The Red needle indicates the current heading calculated from the GPS which is also shown in numerical form in the upper, right hand corner. The Green needle indicates heading reading from an internal magnetic compass. North is to the top of the compass. |

| Item | Function |
|---|---|
|  | **Graphical Value Indicator** - Shows numerical values in a graphic form. The upside down arrow icon indicates the current value. This is an indicator only, use the **+** and **-** buttons to adjust the value. |
|  | **On-Screen LED Indicators**. Shows bright color when "on". Dark gray when "off" |
|  | **Green Check Mark Indicator** - Indicates item is good/correct |
|  | **Exclamation Point Mark** - Indicates a warning or item is expired. |
|  | **Red X Mark** - Indicates item is not good/correct |

# Vehicle Tab Menu Operations

## Overview

The *Vehicle* menu enables the operator to configure a new vehicle, manage existing vehicles, perform an auto calibration of a vehicle, make steering adjustments and manage steering components. This menu allows the operator to configure and monitor the various components related to the vehicle interface with the ECU-S1.

To access the *Vehicle* menu, refer to your *Display Operator's Manual* for instructions on accessing the *AutoSteer Setup* screens. The *Vehicle* menu will be the first one that is displayed when the *AutoSteer Setup* screen is accessed.

**Figure 3-1 AutoSteer Setup Vehicle Tab**


Each of the following menu options are explained in detail in this chapter.

- **Setup Wizard** – Walks the operator through setting up and calibration of a new vehicle.
- **Manage Vehicle** – Allows the operator to select, edit, delete, or export/import vehicle profiles into the ECU-S1 system.
- **Auto Calibrate** – Allows the operator to start or restart a vehicle full calibration for the current vehicle.
- **Tilt Calibration** - Allows the operator to perform tilt calibration only. This option is available only after initial calibration.
- **Steering Adjust** – Allows the operator to make adjustments to steering response, line acquisition, heading aggressiveness, and reverse response
- **Steering Components** – Provides status screens and set some values for all the components that are connected to the vehicle. This includes CAN communication, steering kick out information, Wheel Angle Sensor readings, Steering Valve control, Remote Engage detection, etc.
- **Wheel Angle Calibration** - Allows the operator to perform a Wheel Angle Sensor calibration only. This option is available only after initial calibration.

# Setup Wizard

The *Setup Wizard* is a step-by-step guide that leads the operator thru the procedure required to create a new vehicle profile. The *Setup Wizard* procedure will change depending on what type of vehicle is selected and/or what options are installed on the ECU-S1 System. This manual will describe possible options that ECU-S1 may come equipped with. Not all screens described in this manual will be displayed for all vehicle setups.

**Note:** Before starting the wizard it is recommended to obtain vehicle measurements (copy and use handy worksheet from Appendix on page 107). To be able to complete calibration, drive the vehicle to a flat and empty field with no obstructions. Before starting the wizard, the operator should set the proper units of measure on the Display menu so the system units will match the measurements.

To setup a new vehicle profile, press the **Setup Wizard** button from the *AutoSteer Setup Vehicle* tab.

## Select Vehicle Type

The *Vehicle Type* represents the type of vehicle the ECU-S1 is installed on. The various vehicle types generally have different control parameters and measurement points. This setting allows the system to determine which options will be presented to the operator in later steps. Press the **Gray Up** and **Down** arrows or directly select the vehicle type.

**Figure 3-2 Vehicle Type**

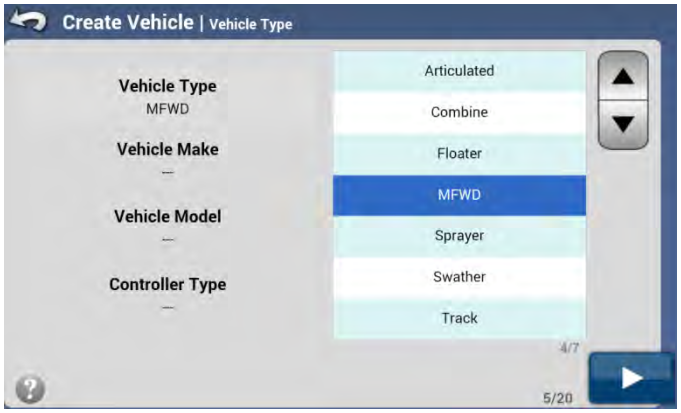
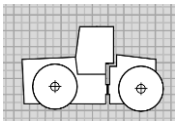
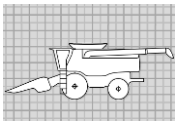
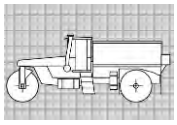
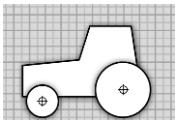
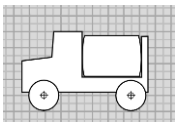
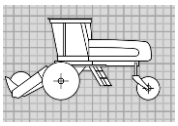
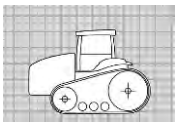



*Table 3-1* shows the vehicle types that can be chosen from.

**Table 3-1 Vehicle Type Descriptions**

| Vehicle Type | Description |
|---|---|
|  | **Articulated** –Large four wheel drive vehicles that steer by articulating in the center of the vehicle are in this group. This group includes Quadtrac vehicles. |
|  | **Combine** – Grain harvesting and forage harvesting machines where the rear axle is used to steer the vehicle are in this group. |
|  | **Floater** – Three and four wheeled vehicles with large floatation tires used to spread fertilizer or chemicals on broad acres at high speeds are in this group. |

| Vehicle Type | Description |
|---|---|
|  | **MFWD** – Standard tractors with the steering axle on the front of the machine are in this group. |
|  | **Sprayer** – High clearance self propelled sprayers with spray booms are in this group. |
|  | **Swather** – Swathers and self propelled mowers are in this group. |
|  | **Track** – Vehicles that have tracks are in this group. |

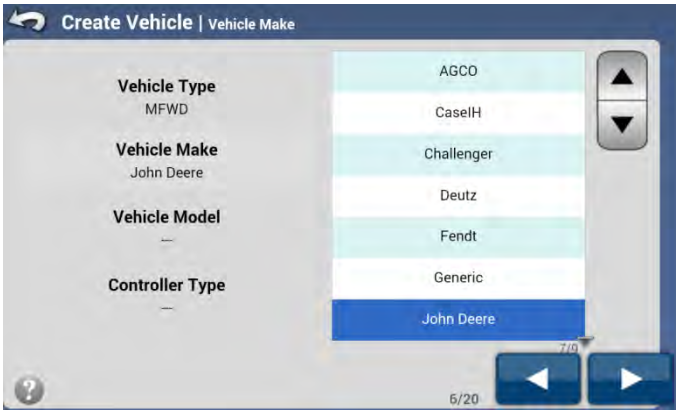
After the *Vehicle Type* has been selected, press the **Blue Right** arrow button shown in *Figure 3-2* to continue to the next step.

## Select Vehicle Make

The *Vehicle Make* represents the manufacturer of the vehicle. The vehicle manufacturers that have Vehicle Specific ECU-S1 Installation Kits available are shown in this list. Press the **Gray Up** and **Down** arrows or directly select the appropriate *Vehicle Make* from the list.

**Note:** If the vehicle manufacturer is not listed on this screen, select **Generic** from the list. This allows you to create a vehicle that does not have a factory supported installation kit.

**Figure 3-3 Vehicle Make**



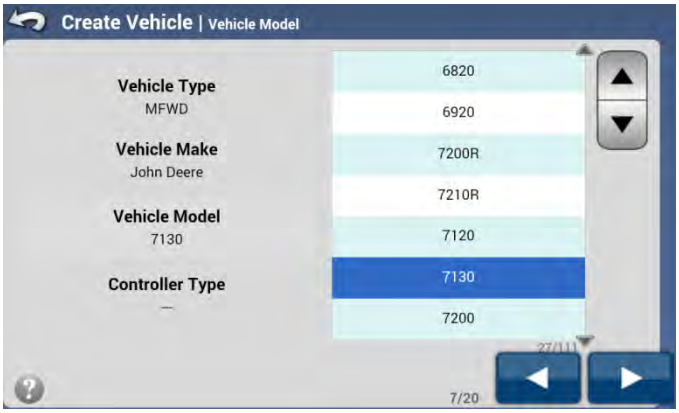

After the *Vehicle Make* has been selected, press the **Blue Right** arrow button to continue to the next step.

## Select Vehicle Model

The *Vehicle Model* represents the model of the vehicle. In most cases if the model has a Vehicle Specific ECU-S1 Installation Kit available, the model will be shown in the list. Press the **Gray Up** and **Down** arrows or directly select the appropriate *Vehicle Model* from the list.

**Note:** If the vehicle model is not listed on this screen, you can select a model that is similar to the one that is being installed on or go back to the *Vehicle Make* screen and select **Generic** from the list. This allows you to create a vehicle and model that does not have a factory supported installation kit. Generic settings do not support CAN/ISO vehicles.

**Figure 3-4 Vehicle Model**




After *Vehicle Model* has been selected, press the **Blue Right** arrow button to continue to the next step.

## Select Controller Type

The *Controller Type* represents the controller the ECU-S1 will be interfaced with in order to steer the vehicle. The ECU-S1 can be interfaced with a number of controller options including the standard AutoSteer valves, MDU-G4, as well as a number of factory installed steering systems. Press the **Gray Up** and **Down** arrows or directly select the appropriate *Controller Type* from the list.

**Note:** To enable the selection of *Standard – Hydraulic, John Deere AutoTrac Ready ISO, a Steer-By-Wire or CAN Controller Type,* the appropriate *Feature Code* must be purchased from an authorized AutoSteer dealer and entered as described in the *My Account* section.

**Note:** *Figure 3-5* shows the possibilities for one particular make and model. The list of options will change depending on what Vehicle Type, Make, and Model are selected in the previous steps.

**Figure 3-5 Controller Type**

*Table 3-2* shows the possible Controller Types that may be displayed.

**Table 3-2 Controller Types**

| Controller Type | Description | Required Feature Code |
|---|---|---|
| Standard – Hydraulic | This is an AutoSteer steering valve that was installed on the vehicle with the Vehicle Specific Installation kit or generic install. This valve is not a factory installed option. | Hydraulic Steering Interface |
| MDU-G4[1] | This is a MDU-G4, or other supported mechanically steered controller. | When using an optional Wheel Angle Sensor, a Feature Code is required. |
| AccuGuide Ready[2] | This represents a factory installed steering system used by CaseIH. | Steer-By-Wire or CAN Interface |
| Auto-Guide2 [3] | This is used to communicate to the ISO Bus of vehicles under the AGCO manufacturing umbrella. Vehicle makes in this group include AGCO, Challenger, Fendt, Gleaner, Massey Ferguson, and others using the same ISO Bus communications hardware. | |
| AutoTrac Ready[4] | This represents a factory installed steering system used by John Deere if the ECU-S1 is being connected directly to the sensors and valves on the vehicle. | |
| Vehicle – CAN | This is used for vehicles that use a standard ISO Bus interface such as for Challenger Track and Articulated vehicles and Krone to interface directly with the vehicles CAN Bus. | |
| IntelliSteer Ready[5] | This represents a factory installed steering system used by New Holland. | |
| AutoTrac Ready ISO | This represents a factory installed steering system used by John Deere if the ECU-S1 is being connected directly to the ISO Bus on the vehicle and not being connected to the individual sensors and valve. | JD ISO-Steer |

After the Controller Type has been selected, press the **Blue Right** arrow button to continue to the next step.

[1] This is a registered trademark of Novariant, Inc.
[2] This is a registered trademark of CNH
[3] This is a registered trademark of the AGCO Corporation
[4] This is a registered trademark of John Deere Company
[5] This is a registered trademark of CNH

## Vehicle Name

The *Vehicle Name* screen allows the operator to enter a custom name for the vehicle. This name is independent of the name provided on the Display side of the vehicle setup. Maximum length of the name is 20 characters. The same name cannot be used twice in ECU-S1 system, the name cannot be empty and it cannot start with a number. Use the on-screen keyboard to type in the name of the vehicle.

**Figure 3-6 Vehicle Name**


**Note:** If you plan to export vehicle profiles and use them on other machines in the future, use a very distinctive name for each vehicle to avoid confusion.

After the *Vehicle Name* has been entered, press the **Blue Right** arrow button to continue to the next step.

## Wheel Angle Sensor

If the selected controller type is MDU-G4 and the Wheel Angle Sensor Feature Code is activated then the next step is to enable or disable use of the Wheel Angle Sensor.

**Figure 3-7 Wheel Angle Sensor**


Select if a Wheel Angle Sensor should be used for this vehicle setup.

- **Yes** - Indicates that a Wheel Angle Sensor is to be used
- **No** - Indicates that a Wheel Angle Sensor is not to be used.

**Note:** The only way to enable or disable Wheel Angle Sensor for MDU-G4 is during vehicle create process.

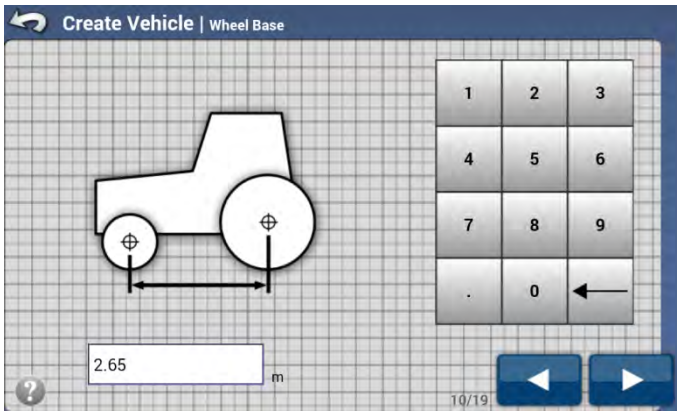
After the *Wheel Angle Sensor* selection has been set, press the **Blue Right** arrow button to continue to the next step.

## Wheel Base

This measurement is only required for vehicles with two axles, the ECU-S1 system needs to know the distance between the front and rear axle. This distance is the vehicle's *Wheel Base*. Use a tape measure to measure the distance between the two axles and then enter that value into the Display. This measurement should be accurate to within 2 inch (5 cm).

**Note:** For better accuracy always measure both sides of the vehicle and use the average of the two measurements.

**Figure 3-8 Vehicle Wheel Base**

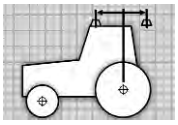
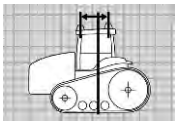
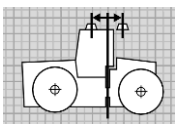


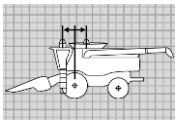

After the *Wheel Base* has been entered, press the **Blue Right** arrow button to continue to the next step.

## Antenna Fore/Aft

The *Antenna Fore/Aft* measurement is the distance of the GPS antenna attached to the vehicle as compared to the Pivot Point of the vehicle. The Pivot Point of the vehicle is the place where the vehicle rotates around as it turns left or right. The location of the Pivot Point is different depending on what vehicle type is being installed on. *Table 3-3* shows the common Pivot Points for most vehicles.

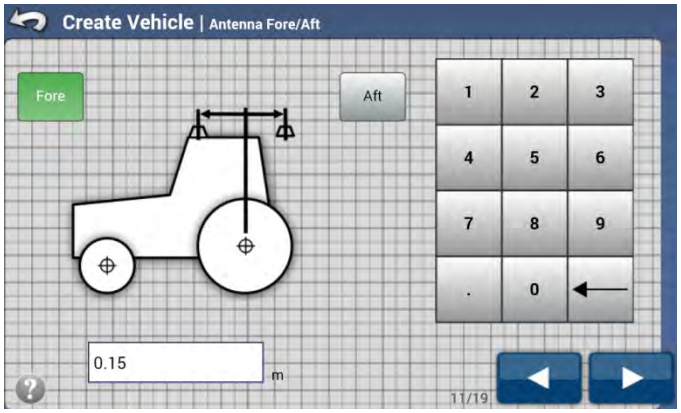
**Table 3-3 Pivot Point Locations of Vehicle Types**

| Vehicle Type | Description |
|---|---|
|  | **Front Axle Steering** – The Pivot Point is at the rear axle for MFWD, SPRAYER, FLOATER vehicle profiles. |
|  | **Track Vehicle** – The Pivot Point is at the center point of the track. |
|  | **Articulated Vehicles** – The Pivot Point is at the articulation joint of the vehicle. |

| Vehicle Type | Description |
|---|---|
|  | **Rear Axle Steering** – The Pivot Point is at the front axle for COMBINE and SWATHER vehicle profiles. |

First identify the Pivot Point on the vehicle that the ECU-S1 is being installed on. Take a tape measure and measure the distance between the Pivot Point and the GPS antenna. Enter that value into the *Antenna Fore/Aft* window. This measurement should be accurate to within 1 inch (2.5 cm).

**Figure 3-9 Antenna Fore/Aft**




The GPS antenna can be mounted in front or behind the Pivot Point. Press the button that indicates which side of the Pivot Point the GPS antenna is mounted. If the value is 0.0, it does not matter which button is pressed.

- **Fore** – This indicates the GPS antenna is located in front of the vehicle's Pivot Point.
- **Aft** – This indicates the GPS antenna is located behind the vehicle's Pivot Point.

After *Antenna Fore/Aft* has been entered, press the **Blue Right** arrow button to continue to the next step.

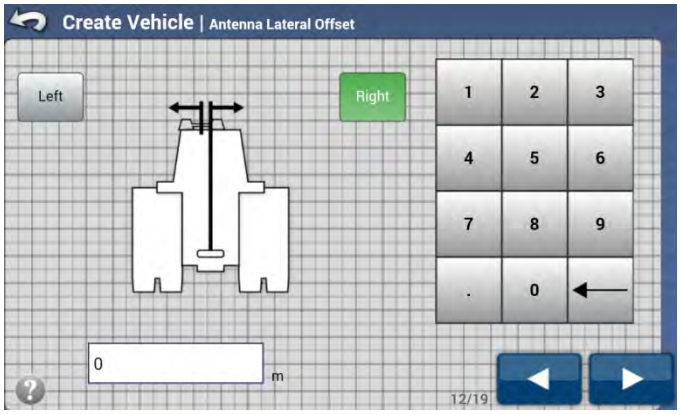
## Antenna Lateral Offset

The *Antenna Lateral Offset* is the distance from the center of the drawbar to the GPS antenna. This value should be 0.0 if the GPS antenna is mounted in the center of the vehicle. If the GPS antenna is not mounted in the center, measure this offset and enter it into this screen. This value will be adjusted later after the calibration process is complete to ensure the center of the vehicle is in the same position going both directions on the same A/B Line.

**Note**: If the *Antenna Lateral Offset* is ever changed by more than 4 inches (10 cm), a new calibration procedure must be performed on the vehicle.

Take a tape measure and measure the distance between the center of the vehicle (typically the drawbar) and the GPS antenna. Enter that value into the *Antenna Lateral Offset* window. This measurement should be accurate to within 1 inch (2.5 cm).

**Figure 3-10 Antenna Lateral Offset**




For best results, the GPS antenna should be mounted along the centerline of the vehicle; however it can be mounted to the left or right of the centerline if necessary. Press the button that indicates which side of the centerline the GPS antenna is mounted. If the offset is 0.0, it does not matter which one is selected.

- **Left** – This indicates that the GPS is to the left of the centerline.
- **Right** – This indicates that the GPS is to the right of the centerline.

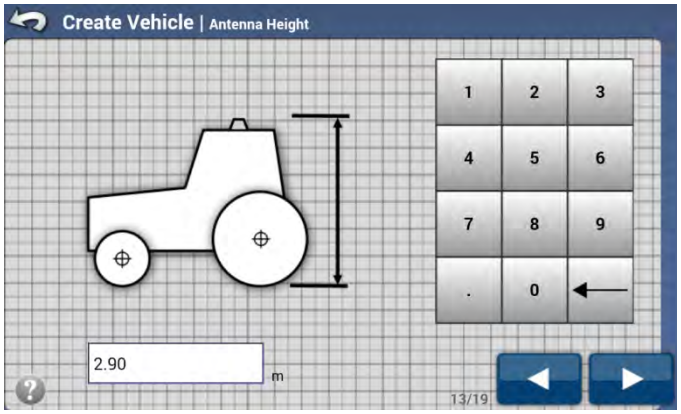
After the *Antenna Lateral Offset* has been entered, press the **Blue Right** arrow button to continue to the next step.

## Antenna Height

The *Antenna Height* is the distance from the ground to GPS antenna.

Take a tape measure and measure the distance from the ground to the GPS antenna. Enter that value into the *Antenna Height* window. This measurement should be accurate to within 2 inches (5 cm). Measured to the top center of the GPS antenna.

**Figure 3-11 Antenna Height**




After the *Antenna Height* has been entered, press the **Blue Right** arrow button to continue to the next step.

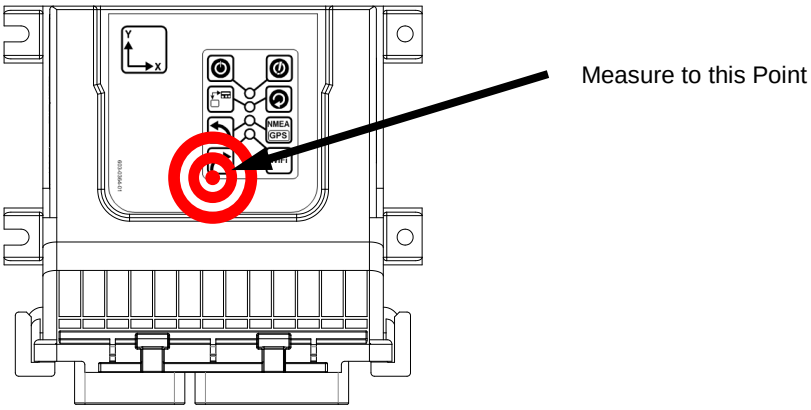
## ECU-S1 Fore/Aft

Just like the GPS antenna, the location of the ECU-S1 must be entered into the system. These measurements are important for ECU-S1 to achieve its rated performance. All measurements entered into the ECU-S1 system should be measured to the center point of the ECU-S1 box at the top surface.

**Notes:** Once the system has been calibrated the ECU-S1 location measurements should never be changed without completely re-calibrating the system.

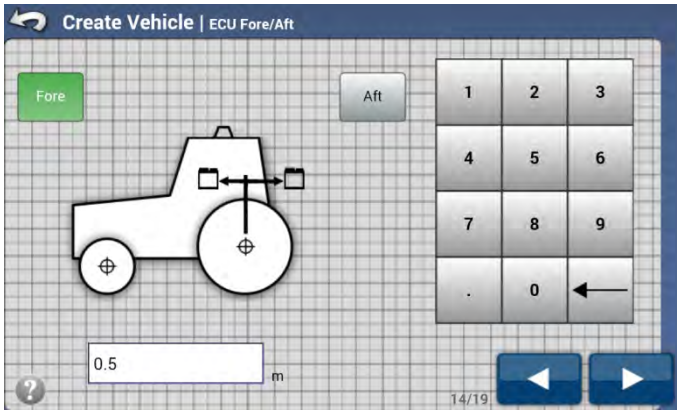
**Note:** The bull's eye, shown in *Figure 3-12*, is not on the actual ECU-S1 label. It is shown here only to show the approximate location of the measurement point on the ECU-S1.

**Figure 3-12 Measurement Point on ECU-S1**




The *ECU-S1 Fore/Aft* measurement is the distance the ECU-S1 is attached to the vehicle as compared to the Pivot Point of the vehicle. The Pivot Point of the vehicle is the same point that was used to enter the *Antenna Fore/Aft*. For an explanation of the location of the Pivot Point on the vehicle refer to the *Antenna Fore/Aft* section on *Page 21*. First identify the Pivot Point on the vehicle that the ECU-S1 is being installed on. Take a tape measure and measure the distance between the Pivot Point and the center point of the ECU-S1 shown in *Figure 3-12*. Enter that value into the *ECU-S1 Fore/Aft* window. This measurement should be accurate to within 1 inch (2.5 cm).

**Figure 3-13 ECU Fore/Aft**




The ECU-S1 can be mounted in front or behind the Pivot Point. Press the button that indicates which side of the Pivot Point the ECU-S1 is mounted. If the value is 0.0, it does not matter which button is pressed.

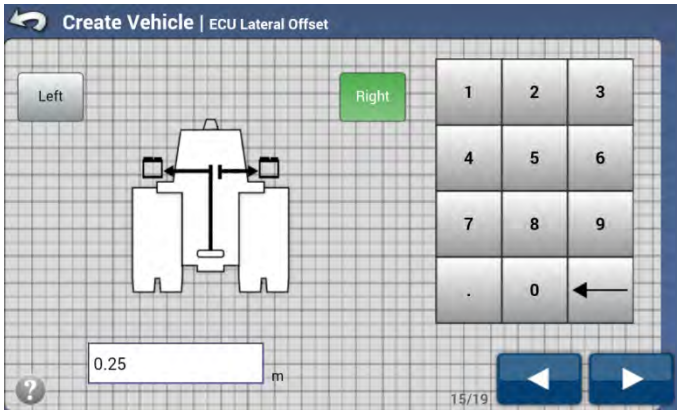
- **Fore** – This indicates the ECU-S1 is located in front of the vehicle's Pivot Point.
- **Aft** – This indicates the ECU-S1 is located behind the vehicle's Pivot Point.

After *ECU-S1 Fore/Aft* has been entered, press the **Blue Right** arrow button to continue to the next step.

# ECU Lateral Offset

The *ECU-S1 Lateral Offset* is the distance from the center of the drawbar the center point of the ECU-S1 shown in *Figure 3-12*. Take a tape measure and measure the distance between the center of the vehicle (typically the draw bar) and the ECU-S1. Enter that value into the *ECU-S1 Lateral Offset* window. This measurement should be accurate to within 1 inch (2.5 cm).

**Figure 3-14 ECU Lateral Offset**




The ECU-S1 can be mounted to the left or right side of the centerline. Press the button that indicates which side of the centerline the ECU-S1 is mounted. If the offset is 0.0, it does not matter which one is selected.

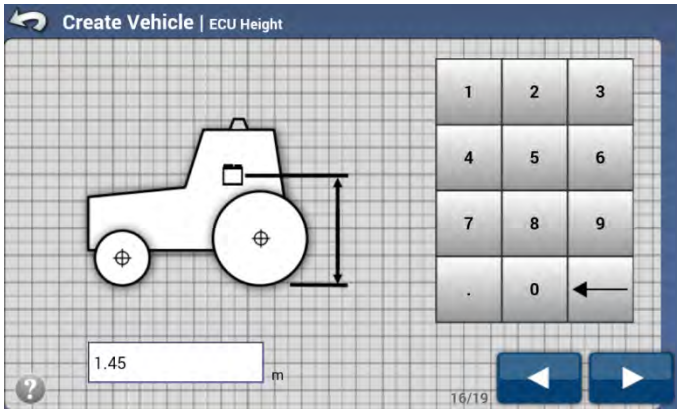
- **Left** – This indicates that the ECU-S1 is to the left of the centerline.
- **Right** – This indicates that the ECU-S1 is to the right of the centerline.

After *ECU-S1 Lateral Offset* has been entered, press the **Blue Right** arrow button to continue to the next step.

# ECU Height

The *ECU-S1 Height* is the distance from the ground to the center of ECU-S1 as shown in *Figure 3-12*. Take a tape measure and measure the distance from the ground to the ECU-S1. Enter that value into the *ECU-S1 Height* window. This measurement should be accurate to within 1 inch (2.5 cm).

**Figure 3-15 ECU Height**




After the *ECU-S1 Height* has been entered, press the **Blue Right** arrow button to continue to the next step.

# ECU Orientation

The ECU-S1 needs to know which orientation it is mounted in or the system will not work properly. If the ECU-S1 has been installed according to the Vehicle Specific Installation Instructions, the orientation will already be shown on the *ECU Orientation* screen as shown in *Figure 3-16*. A graphic showing how the ECU-S1 is installed compared to the orientation of the vehicle is shown on the left. The view will always be as if the operator is looking down from the top of the cab with the front of the vehicle pointing to the top of the screen. Note the direction of the X and Y on the ECU-S1 label in relation to the direction of the tractor icon.

**Note:** A small tractor icon  showing a tractor from above will be shown in all graphics to help the operator visualize how the ECU-S1 should be installed on the vehicle.

**Figure 3-16 ECU Orientation**


If the default position shown matches the actual mounting position of the installation, press the **Green Check Mark** button to continue to the next step.

If the default orientation does not match your installation there are two options:

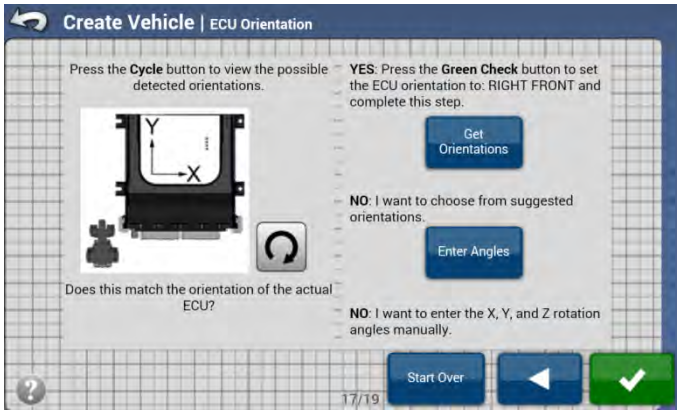
- **Get Orientations** – Use this button if the ECU-S1 is not in the orientation shown in the diagram and the ECU-S1 is mounted orthogonally on the vehicle. This means that the ECU-S1 is at a 90 degree angle or some multiple of 90 (0, 90, 180, 270) degrees at all three axes (vertically, horizontally, and perpendicular to the other two) when compared to the direction of travel of the vehicle.
- **Enter Angles** – Use this button if the ECU-S1 is not in the orientation shown and it is not mounted orthogonally. This is only used when custom angles must be entered. Contact your AutoSteer Dealer for assistance in entering the correct angles.

For more information on how to use the *Get Orientation* and *Enter Angles* screens for entering custom orientations of the ECU-S1, refer to one of the corresponding sub-sections.

## Get Orientation

When the **Get Orientation** button is pressed, the system is expecting that the ECU-S1 is installed at one of the 24 possible orthogonal orientations. To simplify the selection, the ECU-S1 will use the built in sensors to detect which way gravity is pulling on the ECU-S1. This allows the ECU-S1 to narrow the choice of orientations down to four.

**Figure 3-17 ECU Get Orientation**




The following options are available in the *Get Orientation* screen:

- **Rotate ECU** – This button cycles through the four ECU orientations that are possible after the orientation detection has been completed by the ECU-S1. Press this button until the figure on the left side of the screen shows the ECU-S1 in the same orientation as it is installed in the vehicle. When the correct orientation is found, press the **Green Check** button to save the orientation and to continue to the next step.
- **Start Over** – If none of the orientations match, press this button to return the settings back to the default position. This will return the screen back to the one shown in *Figure 3-16*.

## Enter Angles

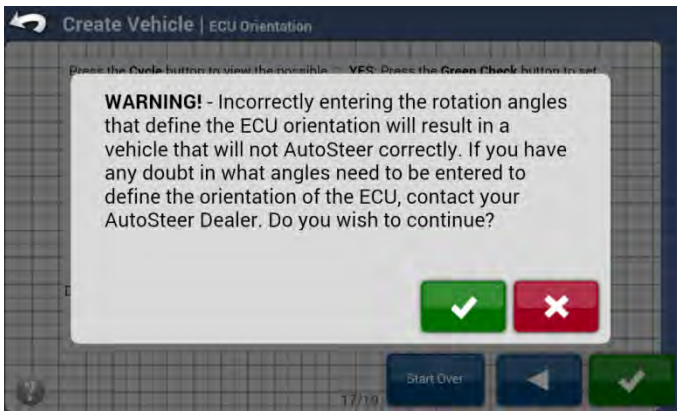
When the **Enter Angles** button is pressed, the system will show a warning screen about how important it is to enter the values accurately.

---

**Note:** Only properly trained technicians should use this option. The angles need to be precisely measured and calculated to allow the ECU-S1 system to work properly. Entering incorrect values will cause the system to perform poorly. Always attempt to attach the ECU-S1 orthogonally if possible. Always contact your AutoSteer Dealer for assistance in entering the correct angles.

---

**Figure 3-18 ECU Orientation Warning**




Press the **Green Check** button only if the angles have been provided by your AutoSteer Dealership. If the angles are not known, press the **Red X** button.

Once the *Warning* screen has been accepted, the ECU-S1 expects the operator to enter custom angles to tell the system how the ECU-S1 is mounted on the vehicle. These angles must be accurate. There are three angles that need to be entered.

- **(X) Pitch** – This is the front to back rotation of the ECU-S1 as compared to the vehicle.
- **(Y) Roll** – This is the side to side rotation of the ECU-S1 as compared to the vehicle.
- **(Z) Yaw** – This is the rotation of the ECU-S1 compared to the vehicle looking down from the top.

**Figure 3-19 ECU Enter Angles**

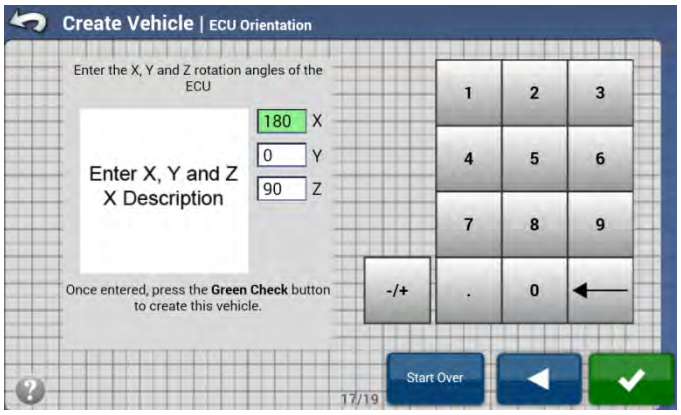
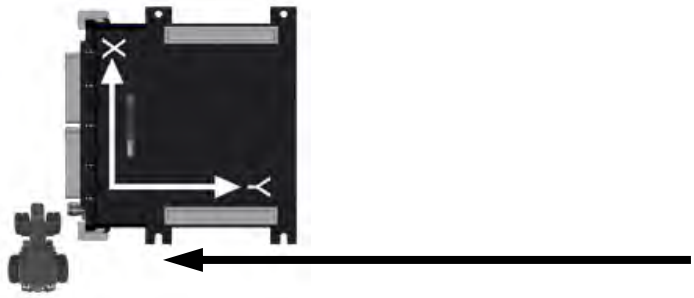



**Figure 3-20 Base Orientation Position with (X=0, Y=0, Z=0)**



Notice ECU-S1 Orientation as Compared to Vehicle Orientation

Adjust the angles for X, Y, and Z so that they tell the ECU-S1 system how many degrees it must be rotated from the Base Orientation Position shown in *Figure 3-20* to match the actual orientation on the vehicle. This process should only performed by someone that has had the proper training. Contact your AutoSteer dealer for support.

- Start Over – Press this button to return the settings back to the default position. This will return the screen back to the one shown in Figure 3-16.

When the correct orientation is entered, press the Green Check button to save the orientation and to continue to the next step.

# Manual Steering Override

If the installation has a pressure transducer installed on the vehicle or the ECU-S1 is connected to the MDU-G4 or other mechanical steering device, the *Setup Wizard* will automatically take the operator to the *Manual Steering Override* screen so that it can be adjusted prior to beginning the *Auto Calibrate* procedure. Depending on the installation, refer to the proper sub-section below.

- *Pressure Transducer Installations*
- *Mechanical Steering Installation (MDU-G4)*

## Pressure Transducer Installations

The pressure transducer is used to detect when the operator is turning the steering wheel and therefore automated steering should be immediately disabled. When the operator manually turns the steering wheel on the vehicle, the ECU-S1 system uses the pressure transducer to detect a pressure spike in the steering circuit. The ECU-S1 then disables AutoSteer when this spike is detected.

---

**Note:** If the *Manual Steering Override* is not properly adjusted, the system may not disengage properly when the operator turns the steering wheel which may cause the operator not to be able to avoid an obstacle. Never operate an AutoSteered vehicle without the *Manual Steering Override* properly set.

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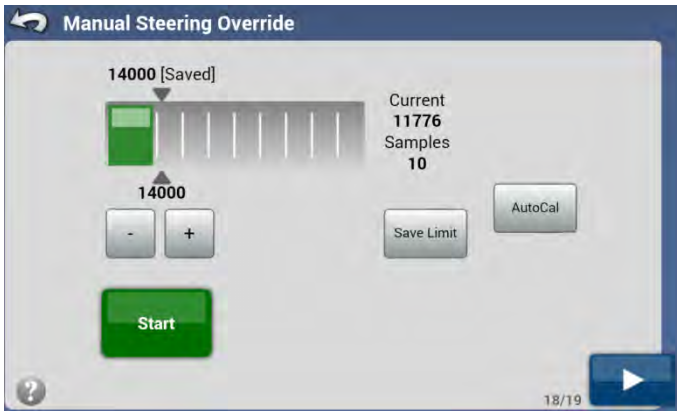
**Figure 3-21 Manual Steering Override Adjustment (Hydraulic)**




The following information and controls are available on the *Manual Steering Override* screen for pressure transducers:

- **Pressure Graph** – This graph shows a graphical representation of the current oil pressure which is the shaded green area starting from the left side of the graph. The kick out pressure reading is shown on the graph by the triangles on the bottom and top of the graph.
- **Saved** – This is the pressure value that is currently saved as the kick out pressure.
- **Current** – This is the current pressure reading coming from the pressure transducer.
- **Minus (-)** and **Plus (+) Buttons** – This decreases or increases the setting for the kick out pressure. Pushing these buttons will move the two triangles left or right on the graph. Use these buttons to manually adjust the kick out pressure value.
- **Save Limit** – If the kick out pressure values are changed from the saved values, you must press this button to save them. If they are not saved, any changes will be lost when the operator leaves this screen.
- **AutoCal** – This button will take the operator to an *Auto Calibration* wizard for the pressure transducer. This is generally the best way to set up the **Manual Steering Override** value. More information on this procedure is provided in this section. It may be necessary to manually adjust this kick out value after the **AutoCal** wizard to take into account vehicle specific behavior. Always test the kick out in AutoSteer mode to determine if it working properly.
- **Start** – Press this button to put the system into an AutoSteer simulation. The green **Start** button will change to a red **Stop** button. Test the kick out setting by turning the steering wheel. If the ECU-S1 system reaches the kick out pressure, the

**Stop** button will change back to the **Start** button. Use this procedure to test the ECU-S1 and ensure the kick out works properly.

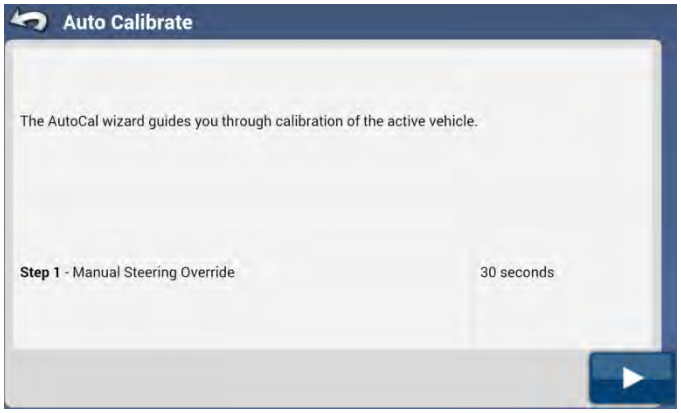
Once the *Manual Steering Override* setting has been set, press the Blue Right Arrow button to continue to the next step. The *Setup Wizard* will automatically start the *Auto Calibrate* procedure. Refer to the Vehicle *Auto Calibrate* section on *Page 40* for more information on these steps.

### *Manual Steering Override AutoCal*

The *Manual Steering Override Auto Calibrate* automatically calibrates the manual steering override value. The AutoCal automatically tests the system pressures and sets the kick out value to a value that should be close to where it needs to be.

To start the process, press the **AutoCal** button at the *Manual Steering Override* screen.

**Figure 3-22 Manual Steering Override Auto Calibrate**




Press the Blue Right Arrow to continue.

**Figure 3-23 Manual Steering Override Auto Calibrate Ready to Start**


Start driving the vehicle forward between 2.0 and 5.0 mph (3.2 and 8.0 km/h) with the engine RPM at the working level. With a stable vehicle speed press the **Green** Start button to start the calibration. The vehicle will first appear to do nothing and then later the steering axle will make a series of quick left and right small turns. Once the auto calibration is complete, the process will automatically continue to the next step.

The *Setup Wizard* will automatically start the *Auto Calibrate* procedure. Refer to the *Auto Calibrate* section on *Page 40* for more information on these steps.

## Mechanical Steering Installation (MDU-G4)

For Mechanical Steering installations, the ECU-S1 receives information from an encoder in the MDU. The encoder detects steering wheel movement, speed, and direction. When the operator manually turns the steering wheel, the encoder detects this motion and the ECU-S1 disengages the AutoSteer.

**Note:** If the *Manual Steering Override* is not properly calibrated, the system may not disengage properly when the operator turns the steering wheel which may cause accident. Never operate an AutoSteered vehicle without the *Manual Steering Override* properly set.

**Figure 3-24 Manual Steering Override Adjustment (Mechanical Steering Devices)**

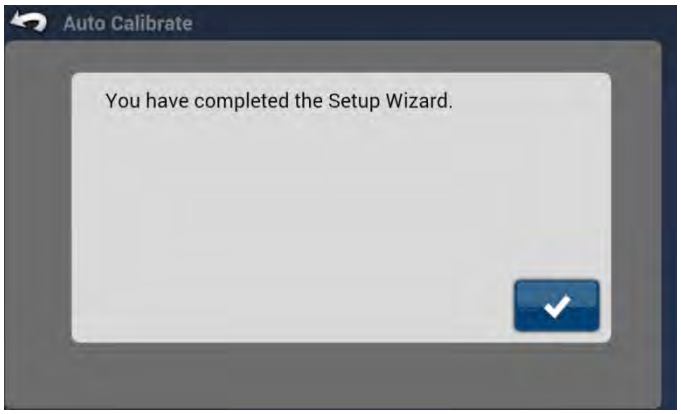

The *Manual Steering Override* screen provides a test to ensure that the steering system can be manually disengaged with the steering wheel. The following information and controls are available:

- **Number above the bar graph [Saved]** – This is the value that has been in use previously and it can be updated with a new value by pressing the **Save Limit** button.
- **Bar Graph and number below the bar graph** – This is graphical and numeric indicator of the limit currently under test, it can be raised or lowered to require more or less resistance to the steering wheel for disengage. The bar graph shows the value under test in the adjustable range.
- **Minus (-)** and **Plus(+) Buttons** – This decreases or increases the limit value under test.
- **Save Limit** – If the limit value is changed from the saved value, you must press this button to save it for the future use. A pop-up confirmation window will show up when the new limit has been saved successfully.
- **Start** – pressing this button will start the test. After the **Start** button has been pressed, the steering wheel will turn to the right and button color will change to red. While the steering wheel is turning, grab and hold the steering wheel to disengage (steering wheel will stop turning and the button will become back green). Press **Save Limit** button when an appropriate value has been obtained.

Once the *Manual Steering Override* setting has been set, press the Blue Right Arrow button to continue to the next step. The *Setup Wizard* will automatically start the *Auto Calibrate* procedure. Refer to the *Auto Calibrate* section on *Page 40* for more information on these steps.

Once all calibration steps are completed a confirmation message is displayed:

**Figure 3-25 Setup Wizard completed**

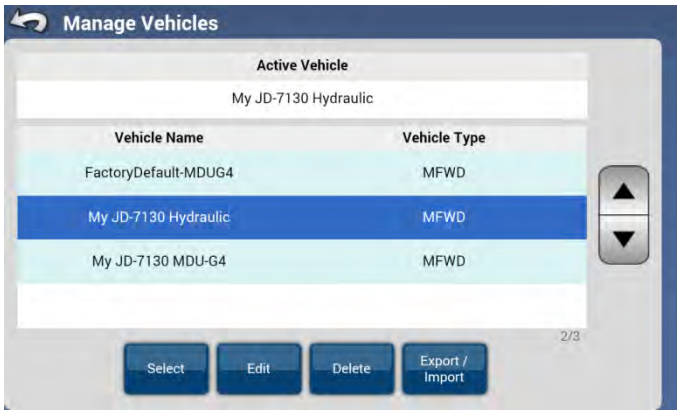



# Manage Vehicle

The Manage Vehicles screen allows the operator to manage the various vehicle profiles that may be loaded on the ECU-S1 system. The ECU-S1 system is designed to be able to be moved from one vehicle to another easily. Each vehicle that it is installed on can have a new vehicle profile that saves the settings, calibration, and tuning values specific to that vehicle. When the system is installed on a different vehicle, the operator must use the *Manage Vehicle* screens to activate the proper vehicle profile.

To access the *Manage Vehicles* menu press the Manage Vehicles button from the AutoSteer Setup screen. The *Manage Vehicles* menu is displayed.

**Figure 3-26 Manage Vehicles Screen**




The *Manage Vehicles* screen allows the operator to do four actions. They are:

- **Select** – This activates the highlighted vehicle profile.
- **Edit** – This allows the operator to modify the parameters that were entered during the *Setup Wizard* process.
- **Delete** – This allows the operator to delete a vehicle profile that is no longer needed.
- **Export/Import** – This allows the operator to import or export vehicle profiles to or from other ECU-S1 systems.

## *Select*

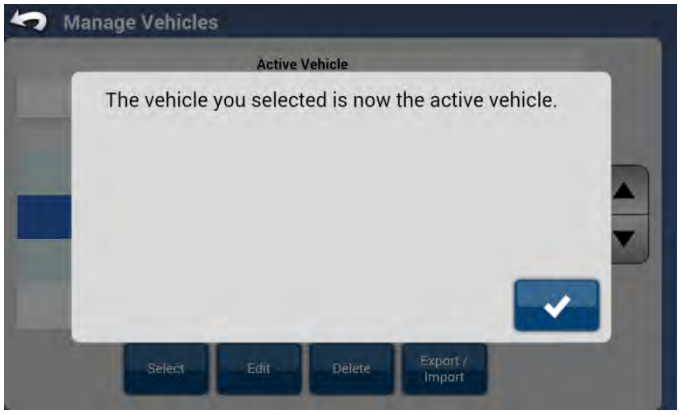
The vehicle profile that is active on the ECU-S1 system is displayed in the Active Vehicle box near the top of the screen. The Active Vehicle must match the vehicle that the system is installed on for the ECU-S1 to control it. A list of vehicle profiles

stored on the ECU-S1 is displayed below the Active Vehicle. If the ECU-S1 is moved to a different vehicle, the operator must activate the new vehicle on the ECU-S1.

To select a new vehicle, use the Up/Down Arrows, or directly select the vehicle from the list, and highlight it. Next press the Select button. This will change the vehicle that is displayed in the Active Vehicle box to the one that was highlighted and reprogram the ECU-S1 to control that vehicle.

After the Select button has been pressed a message is displayed telling the operator the new vehicle is now active.

**Figure 3-27 Vehicle is Now Active Notification**



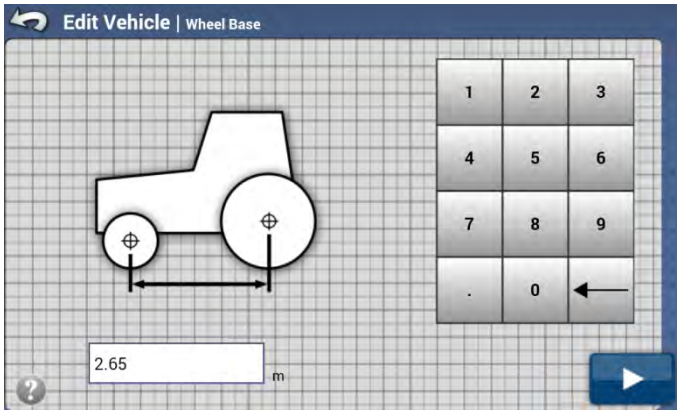

Press the Blue Check Mark button to continue and return to the previous menu.

**Note:** The vehicle profiles used to control the vehicles are stored on the ECU-S1. These profiles are independent of the vehicle profiles loaded on the Display. The vehicle profile must be changed both on the Display as well as the ECU-S1 system in order for it to properly interface with the vehicle.

## *Edit*

The Edit button allows the operator to make changes to the highlighted vehicle's configuration settings. These settings are the same as the ones entered during the initial *Setup Wizard* procedure as shown on *Figure 3-8* thru *Figure 3-20*. The only difference between the *Create* and the *Edit* screens are how they are labeled on top of the screen. The *Edit Vehicle* screens will be labeled *Edit Vehicle* as shown in *Figure 3-28* instead of *Create Vehicle* as shown in *Figure 3-8*.

**Figure 3-28 Edit Vehicle Wheel Base**



To edit a vehicle, first use the Up/Down Arrows or directly select the vehicle from the list and highlight it. Next press the Edit button. This will take the operator through the *Edit Vehicle* wizard. Instead of repeating all the information for the *Edit Vehicle* screens in this section, please refer back to the *Create Vehicle* section for specific information on how to measure and enter the proper information for each configuration option. The operator can edit the following parameters:

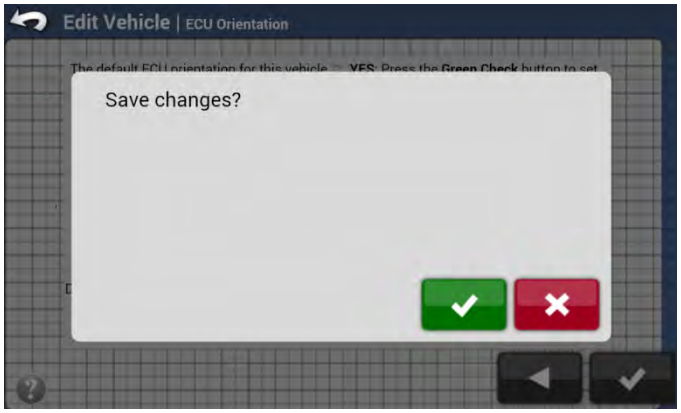
- **Wheel Base** – Refer to the *Wheel Base* section on *Page 21*.
- **Antenna Fore/Aft** – Refer to the *Antenna Fore/Aft* section on *Page 21*.
- **Antenna Lateral Offset** – Refer to the *Antenna Lateral Offset* section on *Page 22*.
- **Antenna Height** – Refer to the *Antenna Height* section on *Page 23*.
- **ECU-S1 Fore/Aft** – Refer to the *ECU-S1 Fore/Aft* section on *Page 23*
- **ECU-S1 Lateral Offset** – Refer to *ECU Lateral Offset* section on *Page 25*.
- **ECU-S1 Height** – Refer to the *ECU Height* section on *Page 25*.
- **ECU-S1 Orientation** – Refer to the *ECU Orientation* section on *Page 26*.

The *Edit Vehicle* wizard will take the operator through each of the above configuration options one at a time from the top of the list to the end. Press the Blue Right Arrow button to move to the next configuration screen. Press the Left Blue Arrow button to return to the previous configuration screen. To escape the *Edit* menu without saving any of the changes, press the Previous Menu Arrow on the top left corner of screen.

When all the editable options have been cycled thru, the *Save Changes* dialog box appears

**Note:** The operator must cycle thru all the configuration screens and press the **Green Check** button in order to save any of the changes made. If the operator does not do this, the changes will not be saved.

**Figure 3-29 Save Changes**




Press the Green Check button to save the changes and return to the *Manage Vehicle* screen. Press the Red X button to return back to the *Edit Vehicle* screens.

**Note:** If any of the ECU-S1 location measurements were changed a full vehicle re-calibration is required.

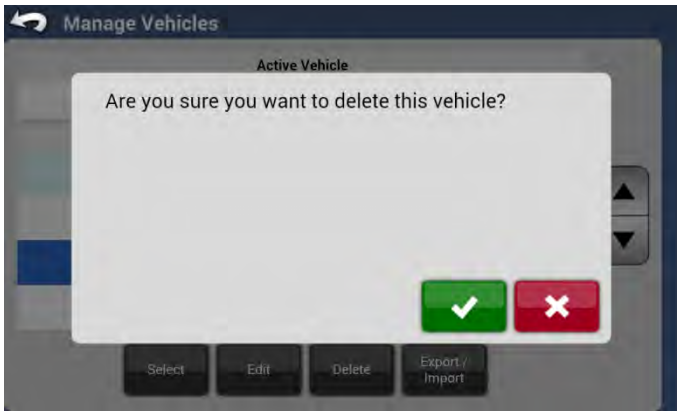
## *Delete*

The Delete button allows the operator to delete the highlighted vehicle profile from the ECU-S1.

To delete a vehicle, first use the Up/Down Arrows or directly select the vehicle from the list and highlight it. Next press the Delete button. The *Confirm Delete Vehicle* message will appear.

**Note:** The **Active Vehicle** cannot be deleted. First select or create another vehicle and make it active, then go back and delete the desired vehicle profile.

**Figure 3-30 Confirm Delete Vehicle**




Press the Green Check button to delete the vehicle and return to the *Manage Vehicle* screen. Press the Red X button to cancel deleting the vehicle and return to the *Manage Vehicle* screen.

## *Export/Import Vehicles*

The Export/Import button allows the operator to import or export vehicle profiles to or from a Display storage device (USB drive, SD card, etc.) to or from other ECU-S1 systems. Operators may have more than one ECU-S1 system and multiple vehicles they work on. The ECU-S1 system can also be transferred to multiple vehicles. The Export/Import feature allows the operator to easily transfer all the vehicle profiles to all ECU-S1 units in the fleet.

Importing and exporting vehicles have the following limitations:

1. The ECU-S1 you export from and the ECU-S1 you import into must be running the same firmware version. For best results always upgrade all ECU-S1s to the latest version prior to importing and exporting vehicles.
2. Only one vehicle can be imported and exported at a time from the *Manage Vehicle* screen.
3. After importing a vehicle it is necessary to perform complete vehicle calibration.
4. Importing and exporting the vehicle works only if Display is connected by wire. Import/Export feature is disabled when Display is connected over WiFi.

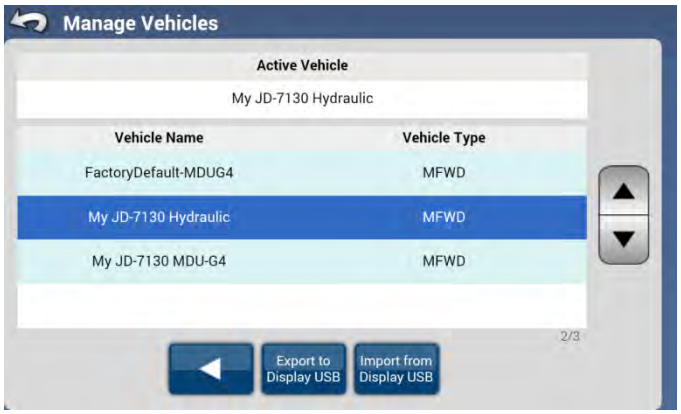
**Note:** Multiple vehicles can be stored on the storage drive at one time, but they can only be saved to the storage or loaded from it one at a time.

If there are multiple vehicles with the same name on different ECU-S1s, copying vehicle profiles from one ECU-S1s to the next may overwrite the data. Each vehicle must have a unique name so the data is kept separate when copying vehicles from one ECU-S1 to another.

For example if a customer has three JD8430 vehicles, each JD8430 must have a different name such as "JD8430-1", "JD8430-2", and "JD8430-3". This limitation needs to be considered prior to creating a vehicle as the name of the vehicle in the ECU-S1 cannot be changed after it has been created. To rename the vehicle, the operator must create a new vehicle with the desired name and recalibrate it.

To import or export a vehicle profile, press the Export/Import button. This opens the *Export/Import Management* screen.

**Figure 3-31 Export/Import Management Screen**




The *Export/Import Management* window gives the operator the following options:

- **Blue Back Arrow** – Pressing this button returns the operator to the *Manage Vehicle* screen.
- **Export to Display USB** – Pressing this button will start the process of exporting the selected vehicle profile to the storage (USB drive, SD card, etc.) on the Display.
- **Import from Display USB** – Pressing this button will start the process of importing a vehicle profile from the Display storage (USB drive, SD card, etc.)

**Note:** Files have a .sqlite extension.

## Export to Display USB

To export vehicle profiles to the Display storage device, follow the procedure in this section.

1. If necessary insert a storage device (USB drive, SD card, etc.) into the external storage slot on the Display.
2. Select the vehicle profile that is to be exported by using the **Up/Down Arrows** or by directly selecting the vehicle from the list
3. Press the **Export to Display USB** button.
4. The system will show a “Please Wait” message while it compiles the information required to create the export file.

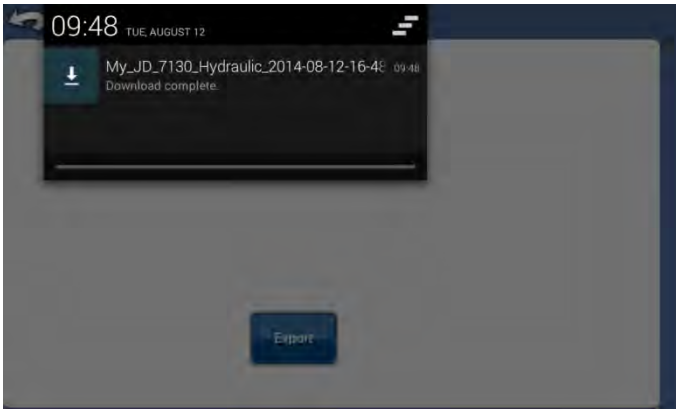
**Figure 3-32 Preparation to Export Vehicle Profile**

5. Once the file is ready for export, the *Export Vehicle to Display* screen will appear. Press the **Export** button to export the file.

**Figure 3-33 Export to Display Storage**


6. The export process will begin. Depending on Display a progress indicator might be displayed. Figure below shows exporting on Android based tablet connected to ECU-S1 via Ethernet cable with Chrome browser. Other displays/browsers will show progress in a different way.

**Figure 3-34 Export Progress Indicator**




7. Once the export is complete, press and the **Previous Menu Arrow** on the top left corner of screen to return to the *Manage Vehicle* menu. The export is now complete.

# Import from Display USB

To import vehicle profiles from the Display storage device, follow the procedure in this section.

1. If necessary insert a storage device (USB drive, SD card, etc.) with vehicle profile file(s) into the external storage slot on the Display.
2. Press the **Import from Display USB** button.
3. The *Select a Vehicle Database File* screen will display. Press the **Choose File** button to select the file to be imported.

**Figure 3-35 Select Import File**


4. As required by your Display navigate (browse) through the file selection menu and select vehicle file to import (usually filename.sqlite). Figure 3-36 below shows file selection example.

**Figure 3-36 File Selection Example on Android Based Tablet**

5. Once the file is selected press the **Import** button, which is now blue.

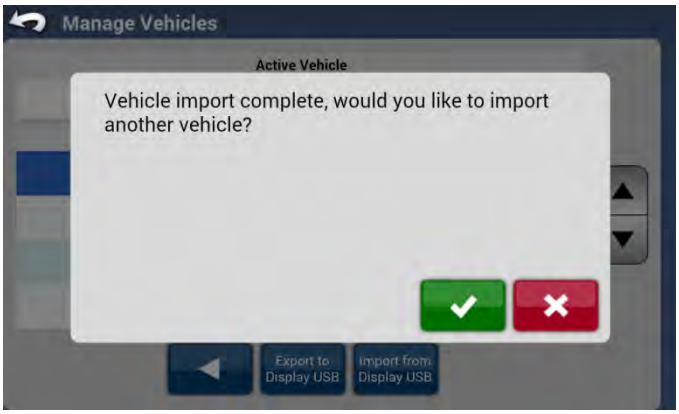
**Figure 3-37 Importing Profile from Storage**


6. Wait for the import to complete. During the importing process messages "Uploading File", "Please Wait", "Preparing Vehicle Database", "Checking if Vehicle Database is Compatible" and "Checking if Vehicle Already Exists" are displayed in yellow pop-up window. They indicate current state of the import process.

**Figure 3-38 Importing Profile in Progress**


7. When import is complete and file saved on ECU-S1 a new pop-up window is displayed as shown on *Figure 3-39*. Press the **Green Check** button to import another vehicle or **Red X** to return to the *Manage Vehicle* screen.

**Figure 3-39 Import Complete**



# Auto Calibrate

The *Auto Calibrate* guides the operator through the calibration process for the active vehicle. The calibration steps teach the ECU-S1 system the characteristics of the vehicle and the steps are critical to achieve optimal control performance.

**Notes:** The *Auto Calibrate* process takes a significant amount of space for your vehicle to operate within. Depending upon the vehicle size and type it may take at minimum approximately 300 x 700 ft (90 x 200 meters) to complete the *Auto Calibrate* procedure.

The vehicle will execute a series of maneuvers during the calibration process including turning full left and full right.

The field used for calibration has to be dry (no water, snow or mud) and should be flat.

It is critical to have the best possible GPS/GNSS position quality for successful calibration. Before staring calibration please ensure GPS uses maximum of available satellites and the augmentation system (like RTK, DGPS) is up and running.

The *Auto Calibrate* provides specific instructions about the required maneuver, speed, and engine RPM during each step of the process. The calibration steps and time vary according to the vehicle type. Follow the onscreen instructions to perform the Auto Calibration procedure.

*Figure 3-40* below depicts a calibration trajectory example recorded on the JD-7130 tractor.

**Figure 3-40 Calibration Trajectory Example**


**Note:** The calibration trajectory changes depending vehicle type, controller and other differences in the vehicle.

The calibration process comprises of two main sections:

- **Common Calibration Steps** – These are the steps that all vehicles must perform during the *Auto Calibrate* process.
- **Vehicle Type Specific Calibration Steps** – Once the Common Calibration Steps have been completed, the *Auto Calibrate* will go on to different steps depending on which vehicle type has been selected. The calibration routine for Valve / Steer-by-Wire, Mechanical Steering Unit / MDU-G4, and CAN Bus / ISO Controllers are different. The procedures for the three different types will be discussed later.

To start the *Auto Calibrate* process, press the Auto Calibrate button from the *AutoSteer Setup* screen. The initial *Auto Calibrate* screen is displayed. This screen will be different depending on which vehicle type is being calibrated. The screen will summarize all the steps required to complete the calibration and provide an approximate amount of time each step will take. The following three figures show the Initial Screen for the *Auto Calibrate* process for each of the three vehicle types.

**Figure 3-41 Auto Calibrate Initial Screen (Valve / Steer-by-Wire)**

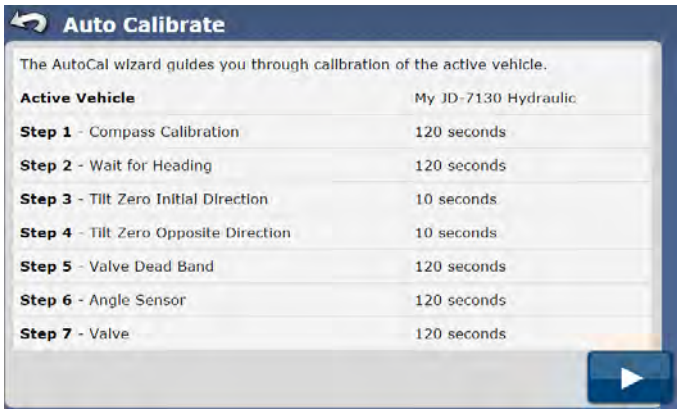



**Figure 3-42 Auto Calibrate Initial Screen (Mechanical Steering Unit / MDU-G4 with WAS)**

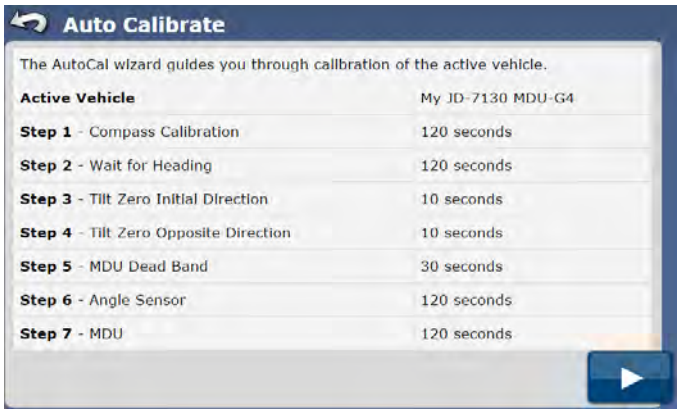
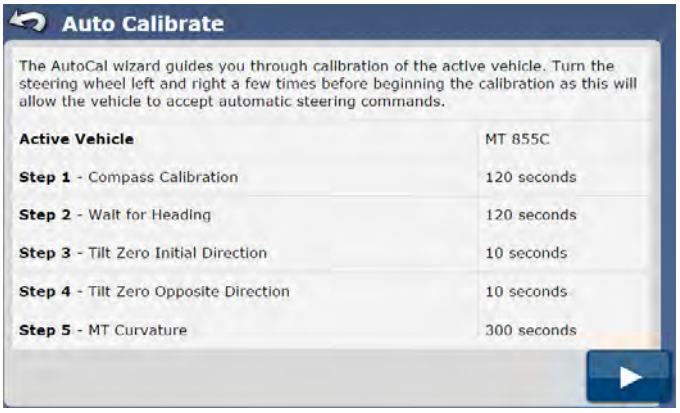


**Figure 3-43 Auto Calibrate Initial Screen (CAN Bus / ISO)**




**Note:** All of the steps of the Auto Calibrate process must be successfully completed and the results saved before the ECU-S1 will allow the system to AutoSteer the vehicle.

# *Common Calibration Steps*

All *Auto Calibrate* processes will start with the same Common Calibration Steps. They are as follows:

- **Compass Calibration** – Calibrates the electronic compass.
- **Wait For Heading** – Step to verify that the compass and GPS heading calculation are equal.
- **Tilt Zero Initial Direction** – Initial step for calibrating the terrain compensation sensors.
- **Tilt Zero Opposite Direction** – Second step for calibrating the terrain compensation sensors.

During above steps operator is required to steer vehicle manually.

To start the *Auto Calibrate* process, press the Blue Right Arrow button in the *Auto Calibrate* screen.

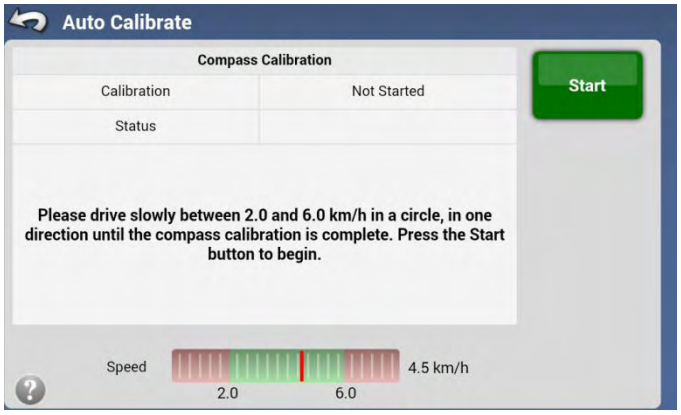
## Compass Calibration

The ECU-S1 has a built in compass that allows it to determine the heading the vehicle is facing. The compass needs to be calibrated against the heading calculated by the GPS system. For this step the operator must drive the vehicle in a slow concentric circle to allow the ECU-S1 to compare compass readings with the GPS heading.

To successfully calibrate the compass, start driving the vehicle between 1.3 to 3.7 mph (2.0 to 6.0 km/h). Turn the steering wheel in either direction and hold it at a constant angle so the vehicle will make a constant radius circle. Steer the vehicle so it makes a circle around 30 to 50 feet (9 to 15 m) in diameter. When the vehicle is moving at the correct speed and in a circle, press the Start button to start the calibration. Continue driving in a circle until the compass calibrates and the next screen appears.

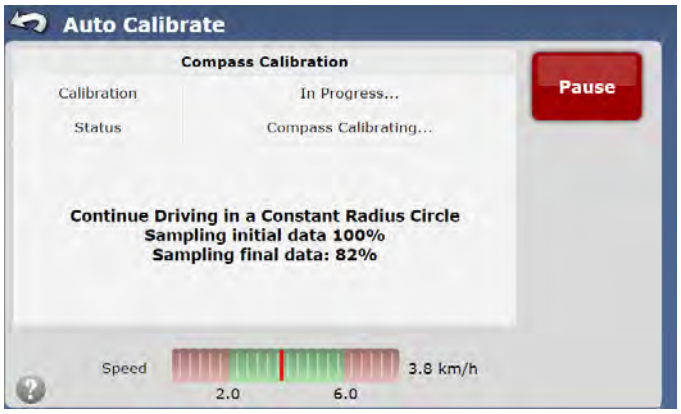
**Note:** In order to increase the integrity of the Compass Calibration, the driver must hold the steering wheel at a constant angle and keep the vehicle at a constant speed. Do not start the calibration process until the vehicle is in this constant arc motion. It is suggested to drive an entire circle prior to start the compass calibration. It'll ensure there is enough space available and will help to keep vehicle on the constant turning when the operator can see prior tracks.

**Figure 3-44 Compass Calibration**




**Note:** Pressing the **Pause** button and then pressing the **Resume** button will restart the *Compass Calibration* from the beginning.

**Figure 3-45 Compass Calibration In Progress**




During calibration process system will display progress indicators for sampling an initial and then a final data.

If the calibration process did not complete successfully one of the following errors may be shown:

**Table 3-4 Compass Calibration Errors and Remedies**

| Error Message | Possible Cause | Remedy |
|---|---|---|
| Speed out of range | Vehicle speed has gone outside the allowable speed range | Drive at constant speed in range between the values shown on the screen. Avoid speeds close to the range limits. |
| Circle is not round enough | Vehicle was driven over an ellipsoid or rectangle | Drive in a round circle between 9 to 15 meters (30 to 50 feet) in diameter |
| Data distribution is not even | Vehicle was not driven at a constant speed | Drive circles at a constant speed. Set the speed before pressing the **Start** button. |
| Compass data too noisy | Vehicle electromagnetic equipment like AC, fan near ECU was turned on or off, metal tools were moved around ECU or ECU is not mounted firmly | Drive on a flat area and do not change state or position of any devices or tools that can change an electromagnetic field near ECU, ensure ECU is mounted firmly on the bracket |

If any of above errors occur operator should correct the situation and press **Resume** button to perform a compass calibration process again.

When the *Compass Calibration* steps have completed successfully, the system will automatically move on to the next step.

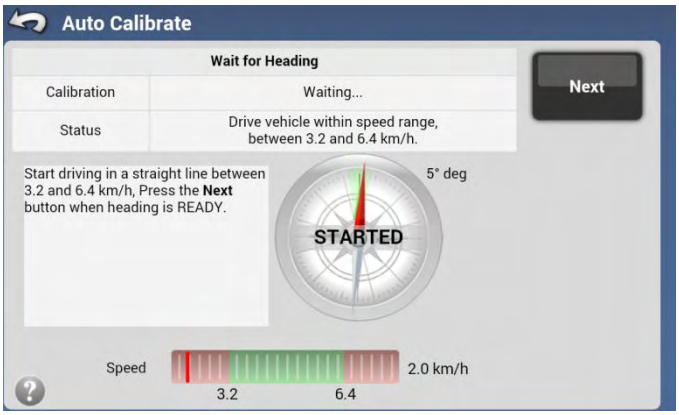
## Wait For Heading

After the compass has been calibrated, the system will display a verification screen. This screen shows a compass with a red needle and a green shaded area. The red needle represents the calculated heading based on the GPS. The green shaded area represents the measured compass heading. If the calibration was successful, the needle and shaded area should be pointing the same direction.

**Note:** This step will require operator to drive in a straight line. Before this step operator may turn vehicle to any direction where such driving is safely permitted.

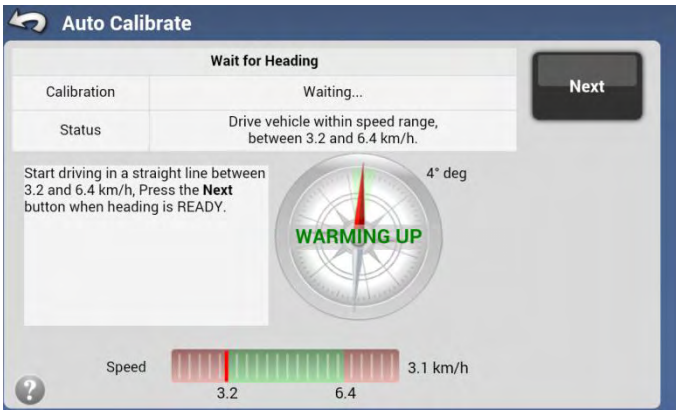
1. Start driving in a straight line at 2.0 to 4.0 mph (3.2 to 6.4 km/h).

**Figure 3-46 Waiting for Heading**



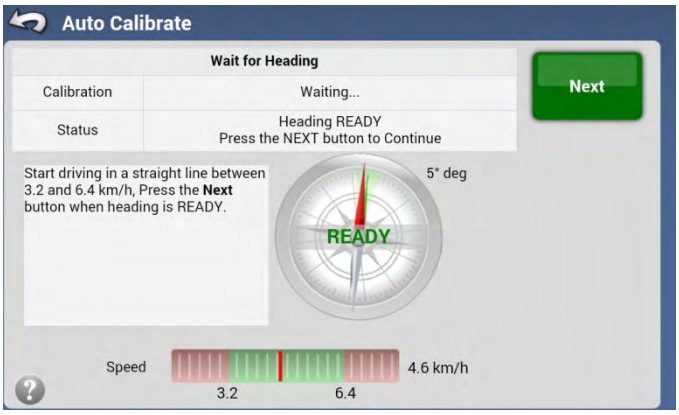

2. When the vehicle has reached the minimum speed, the verification process will begin and the Display will show the system is **WARMING UP.** Continue driving in a straight line.

**Figure 3-47 Wait for Heading Warming Up**



3. If the calibration was successful and there are no problems, the system should quickly show the arrow and shaded area aligned and pointing in the direction the vehicle is traveling. At this point, press the **Green Next** button to continue with the calibration.

**Figure 3-48 Wait for Heading Calibration Successful**




**Note:** If the red needle and the green shaded area do not line up shortly after the **WARMING UP** stage begins, navigate to the *Edit Vehicle* screens and verify that the ECU-S1 has been set to the correct orientation. If the orientation has been set incorrectly, the ECU-S1 system will not be able to accurately determine a heading. Drive the vehicle forward for 500 feet (150 meters) and then restart the calibration.

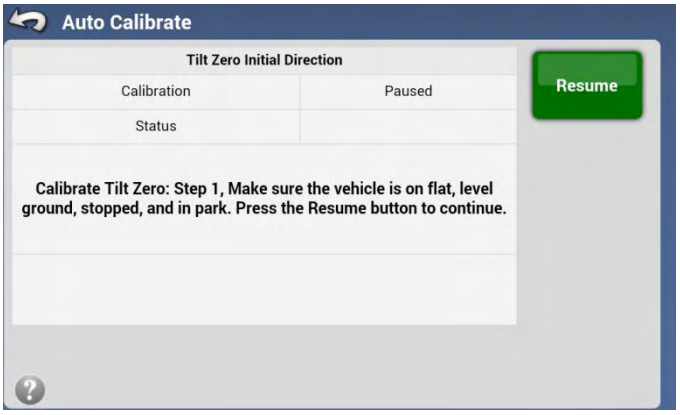
## Tilt Zero Initial Direction

The ECU-S1 uses its sensors to determine the tilt of the vehicle as it travels through the field. This is important to allow the system to calculate the true position of the wheels if the cab is tilting to one side or another. The GPS is mounted on top of the cab so even though the GPS may move as the cab moves, the wheels will still be in the same place. If the tilt of the vehicle is not accurately measured, the system will not be able to control the vehicle accurately.

The Tilt Calibration is a two step process. The vehicle must be parked on a flat area and left to sit. The system then averages the sensor readings for a short time to get a base line. The vehicle must then be driven and turned around to face the opposite direction and stopped at the exact same spot. The system then averages the sensor reading while faced in the other direction. The system is then able to use the two readings to zero out the slight tilt errors of the gyros.

**Note:** It is important that the Tilt Calibration takes place on a flat area with no slope. If this step is performed on a slope, the ECU-S1 system may not be able to accurately control the vehicle.

**Figure 3-49 Tilt Zero Initial Direction Calibration**




To start the *Tilt Zero Initial Direction* calibration, drive the vehicle onto a flat surface, stop and apply brake. When vehicle is stationary and stabilized, press the Resume button and wait for the system to finish this step.

**Note:** It is suggested to mark front and rear wheels location so they can be used for the next step.

**Figure 3-50 Tilt Zero Initial Direction Calibration In Progress**


When this step is complete, the calibration process will automatically move on to the next step.

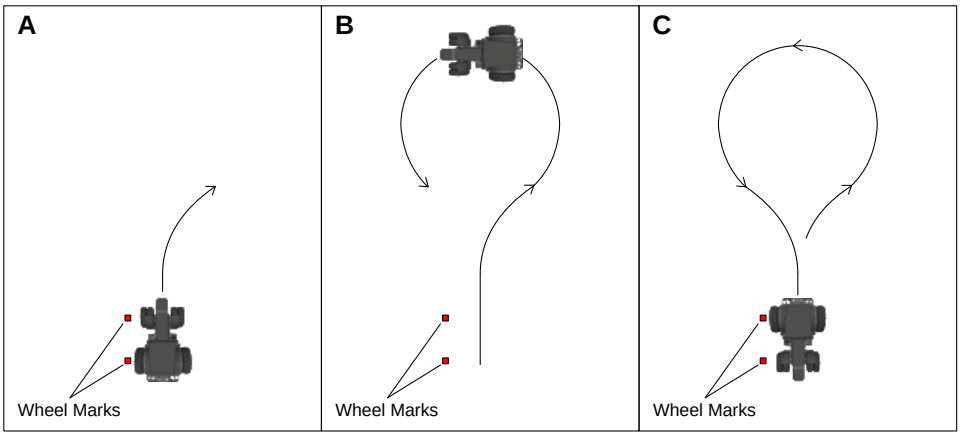
## Tilt Zero Opposite Direction

This is the second stage of this calibration procedure.

**Note:** It is important that the vehicle is positioned in the exact same place as the previous step but facing in the opposite direction. If the vehicle is not placed in the same position, the tilt compensation will be incorrectly calculated and vehicle steering performance will be degraded.

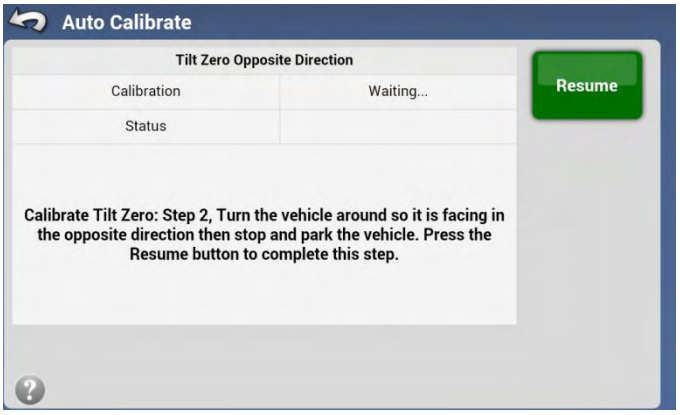
To finish the Tilt Calibration, turn the vehicle around as shown on *Figure 3-51* and stop in the exact same location so that the rear tires are now over the marks of the front tires (center of the track is at the same point but in the opposite direction).

**Figure 3-51 Driving Around for Tilt Calibration**




When vehicle is stationary and stabilized, press the Resume button and wait for system to finish measuring.

**Figure 3-52 Tilt Zero Opposite Direction Calibration**




If the calibration is successful the system will automatically jump to the next step.

If the calibration did not complete successfully a pop-up window with one of the following errors may be shown:

**Table 3-5 Tilt Calibration Errors and Remedies**

| Error Message | Possible Cause | Remedy |
|---|---|---|
| Tilt error has exceeded the allowable limit | Incorrect ECU installation or incorrect orientation is entered in the vehicle profile | Check and correct ECU installation and orientation settings in the vehicle profile |
| | Initial and Opposite Direction Calibration steps were done on uneven surface | Repeat the calibration on a flat surface. Ensure vehicle is stationary and stabilized before pressing **Resume** button |

This is the end of the Common Calibration Steps.

## *Vehicle Type Specific Calibration Steps*

Depending on the vehicle controller type, the *Auto Calibrate* process will use one of three different procedures to calibrate the remaining sensors and actuators. The vehicle controller types are:

- Hydraulic Valve / Steer-by-Wire
- Mechanical Steering Unit / MDU-G4
- CAN Bus / ISO Controllers

Follow the procedure for the vehicle controller type that the system is being installed on.

During this steps vehicle will be steered automatically.

# Hydraulic Valve / Steer-by-Wire

This vehicle type has a steering valve that is controlled directly by the ECU-S1 system. This includes vehicles that use the standard AutoSteer valves, AutoTrac Ready (non ISO), AccuGuide Ready, and IntelliSteer, and some others. There are three steps to finish the calibration process:

- **Valve Dead Band** – This step determines the valve's dead band which is the minimum signal that must be sent to start oil flow.
- **Angle Sensor** – This calibrates the Wheel Angle Sensor on the steering axle.
- **Valve** – This calibrates the hydraulic valve.

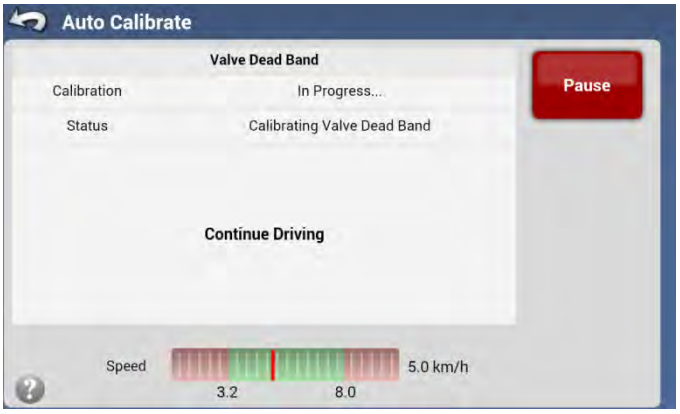
The next step of the calibration process should have started automatically from the Common Calibration Steps.

**Note:** Verify that the engine RPM is at the working speed while this part of the calibration is taking place.

## Valve Dead Band

Oil flow is proportional to the signal changes sent from the ECU-S1. It takes a certain minimum amount of signal to start oil flow through the valve. If the signal is below that minimum amount no oil flows and the steering axle will not move. The Dead Band is detected by incrementally increasing the signal sent to the valve in both directions until the ECU-S1 detects motion from the Wheel Angle Sensor.

**Figure 3-53 Dead Band Calibration in Progress**

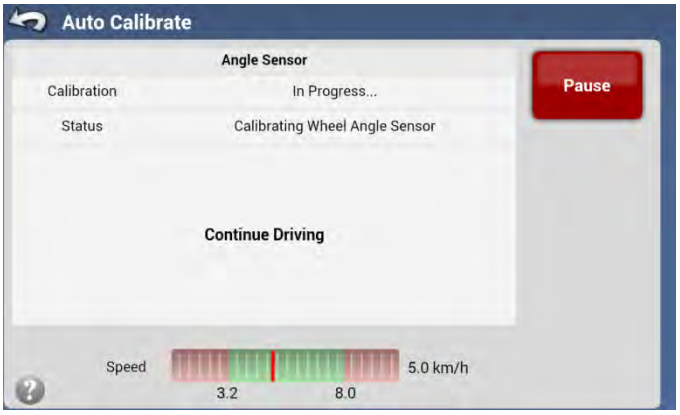



To begin the *Valve Dead Band* calibration, drive the vehicle in a straight line between 2.0 and 5.0 mph (3.2 and 8.0 km/h) and then press the Resume button to start the calibration process. The vehicle will continue to drive in a straight line for a time. Eventually the steering axle will begin to move to both sides. Once this happens the system will have determined the dead band for the valve and move on to the next step.

## Angle Sensor

The ECU-S1 reads the value of the Wheel Angle Sensor (WAS) to determine the position of the steering mechanism. During the calibration process, the ECU-S1 holds the Angle Sensor at a constant angle at different positions from full left to full right and measures what the actual change of heading is at each position. The change of heading is calculated using the GPS receiver. At the conclusion of the calibration the ECU-S1 can determine the expected change of heading for any Angle Sensor position. It is also able to determine the exact Angle Sensor reading that should steer the vehicle in a straight line, even if the Angle Sensor is not installed with the steering angles to the left and right not equal.

**Figure 3-54 Angle Sensor Calibration in Progress**



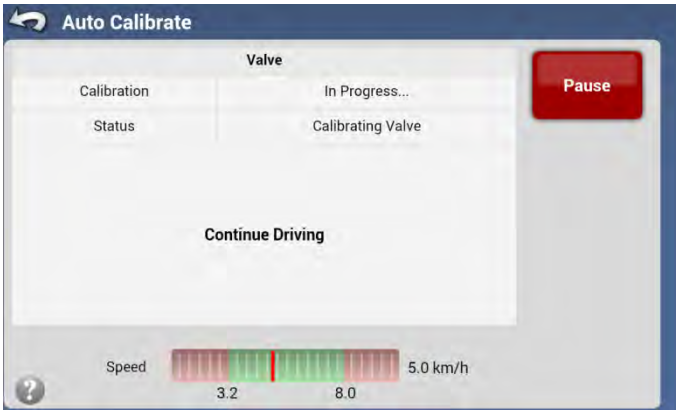

**Note:** For the next step in the calibration process, the vehicle will turn full left and full right. Make sure all objects are clear of the area where calibration is taking place.

The *Angle Sensor* calibration should start automatically once the *Valve Dead Band* has been determined. If it does not, press the Resume button to start the calibration process. The steering axle will make a hard turn to one direction and then back to the opposite direction to find the maximum Angle Sensor stops. The system will then reposition the Angle Sensor at regularly spaced increments between the two maximum positions and measure the change of heading at each position. The system will work from one direction, making increasingly less sharp turns, then continue past the straight ahead position, and then start making increasing sharp turns in the opposite direction. It will then repeat the process in the opposite direction. Once this is completed, the calibration process will move on to the next step.

## Valve

The *Valve* calibration measures the rate of turn using the Angle Sensor when a signal command is sent to the Steering Valve. As the signal to the valve is increased, the rate of turn at the Angle Sensor increases. The ECU-S1 takes readings of the Angle Sensor rate of turn at different signal commands so the system knows how fast the vehicle will turn at any signal command sent to the Steering Valve.

**Figure 3-55 Valve Calibration in Progress**

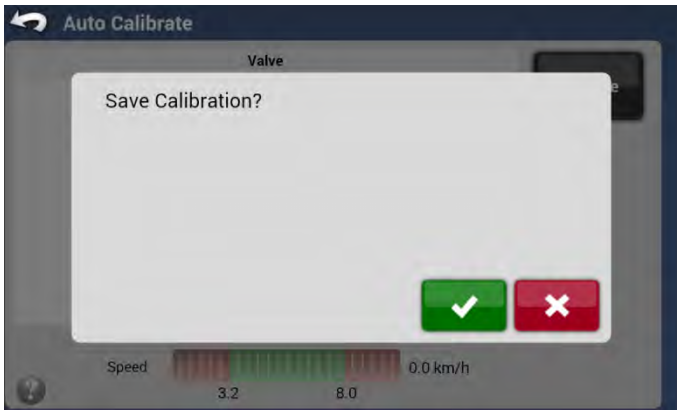



The *Valve* calibration should start automatically once the *Angle Sensor* calibration has finished. If not, press the Resume button to start the calibration process. The first step of this calibration procedure will be to determine the maximum rate that the steering axle can be turned using the Steering Valve. The ECU-S1 will command the vehicle to turn the steering axle to one direction at the maximum signal and then to the opposite direction at the maximum signal. It repeats this two more times.

The ECU-S1 will then start turning the steering axle slowly in both directions and measure the speed at which it turns. It will regularly increase the speed at which it turns the steering axle until it reaches the maximum turning rate it measured at the first part of this test. At the conclusion of the calibration step, the ECU-S1 will be able to know how fast it will turn the steering axle at any signal strength it sends to the Steering Valve. When this step is complete, the calibration procedure is complete.

### Save Calibration

**Figure 3-56 Save Calibration**




Once the *Valve* calibration process has completed, the *Save Calibration* screen will appear. Press the Green Check button to accept and save calibration values. Press the Red X button to discard all changes.

If the calibration has been started from the *Setup Wizard* the *Save Calibration* screen is replaced by the *Setup Wizard Completed* screen as shown on *Figure 3-25*.

## Mechanical Steering Unit / MDU-G4

Vehicle types that use a mechanical device attached to the steering wheel to control the direction the vehicle steers are calibrated with this procedure. Almost any vehicle can be fitted with a mechanical steering unit. The ECU-S1 must detect the minimum current that is required to start turning the steering wheel as the final step of the calibration process. This step will automatically perform a series of left and right turns a differing turning rates. There are two steps to finish the calibration process:

- **MDU-G4 Dead Band** – This step determines the minimum current required to start turning the steering wheel to the right or left
- **MDU** - This step calibrates MDU turning rates

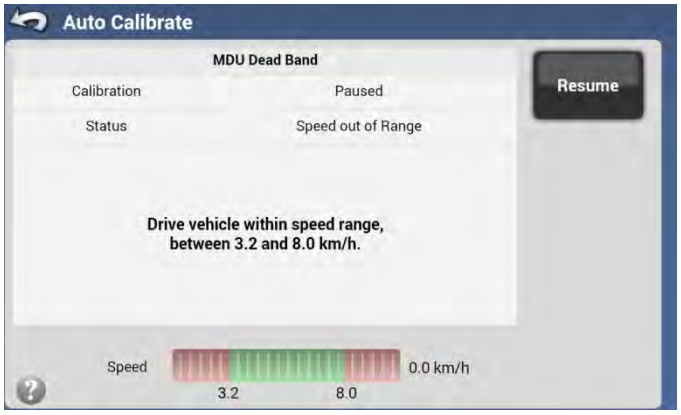
If the system is equipped with a wheel angle sensor (WAS) then there will be one more step to calibrate it. This step is identical to Angle Sensor calibration with valve steering and is not described in this section.

**Note:** Verify that the engine RPM is at the working speed while this part of the calibration is taking place.

### MDU Dead Band Calibration

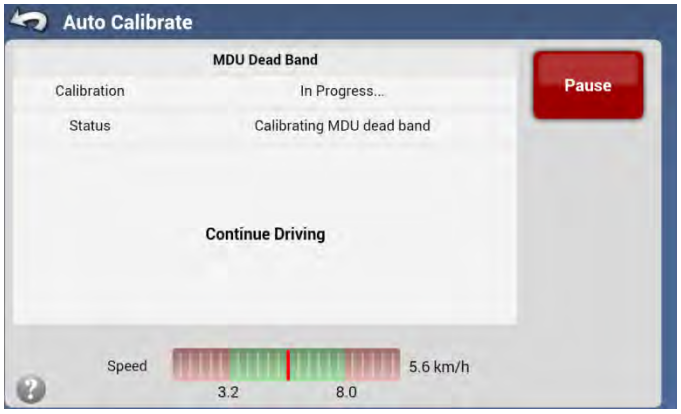
The first part of the test measures the minimum current required to start turning the steering wheel to the right and to the left. To begin calibration, start driving the vehicle in a straight line between 2.0 and 5.0 mph (3.2 and 8.0 km/h). When the speed is in correct range **Resume** button becomes green. Press this button to begin the calibration process.

**Figure 3-57 MDU Dead Band Calibration**




The calibration process will perform a series of left and right turns at various turning rates.

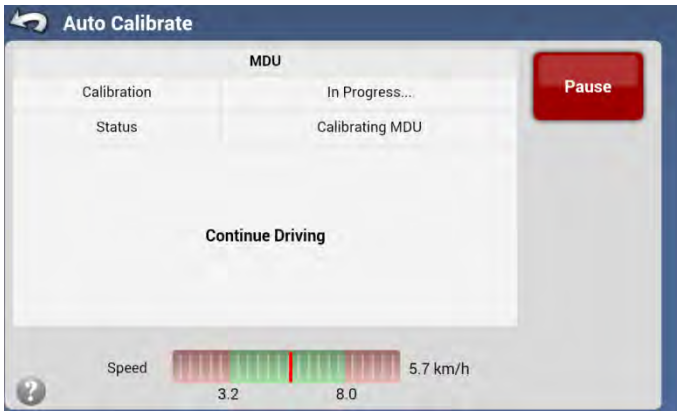
**Figure 3-58 MDU Dead Band Calibration in Progress**




## MDU Calibration

The second part is MDU calibration. Continue driving as in previous step. Vehicle will perform a series left and right turns.

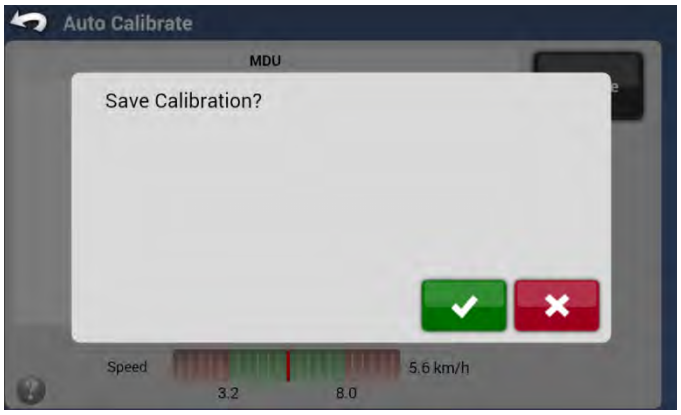
**Figure 3-59 MDU Calibration in Progress**



### Save Calibration

Once the *MDU* calibration process has completed, the *Save Calibration* screen will appear.

**Figure 3-60 Save Calibration**




Press the Green Check button to accept and save calibration values. Press the Red X button to discard all changes.

## CAN Bus / ISO Controllers

Vehicle types that provide a CAN Bus or ISO Bus connection on the machine to receive steering commands by the vehicle's steering controller are calibrated with this procedure. The vehicle may have a Angle Sensor and Steering Valve built-in from the factory. These two components must be calibrated by the vehicle manufacturer so that the vehicle can accurately determine the curvature it will travel at the various angle sensor readings. The vehicle's steering valve adjusts the position of the steering axle to get a desired curvature independently of the ECU-S1 system.

To control these vehicles, the ECU-S1 sends a desired curvature command to the vehicle via the CAN Bus. The vehicle then attempts to adjust the valve to match the desired curvature. There can be some error to what the vehicle thinks the curvature is as compared to what it actually is. This calibration step compares the estimated curvature the vehicle thinks it is using to the actual curvature calculated by the GPS system. There is only one step to finish the calibration.

- **Curvature** – This step compares the estimated curvature from the vehicle to the true curvature as measured by the GPS.

The next step of the calibration process should have started automatically from the Common Calibration Steps.

---

**Note:** Verify that the engine RPM is at the working speed while this part of the calibration is taking place.

---

### Curvature

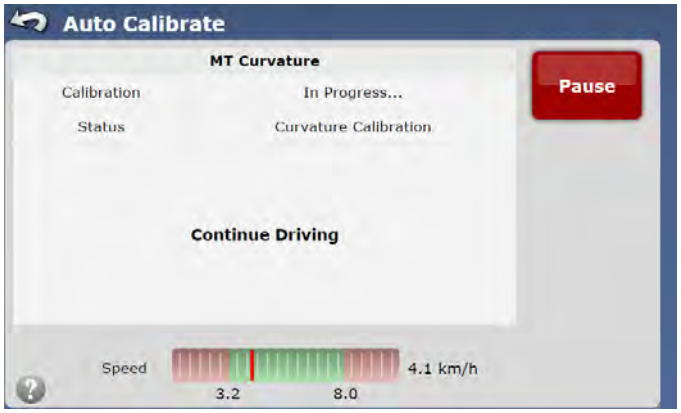
The ECU-S1 system sends various curvature commands to the vehicle. The vehicle then steers to what it believes are those curvature values. The ECU-S1 system then measures what the actual curvature is using the GPS receiver. To begin the calibration step, start driving the vehicle in a straight line between 2 and 5 mph (3.2 and 8 km/h) and press the Resume button to begin the calibration process.

---

**Note:** Some CAN Bus / ISO Controlled vehicles require the operator to use the vehicle's factory supplied engage switch to start the calibration process. If this is required, the calibration screen will notify the operator to use that device instead of pressing **Resume** or **Resume** button on the screen.

---

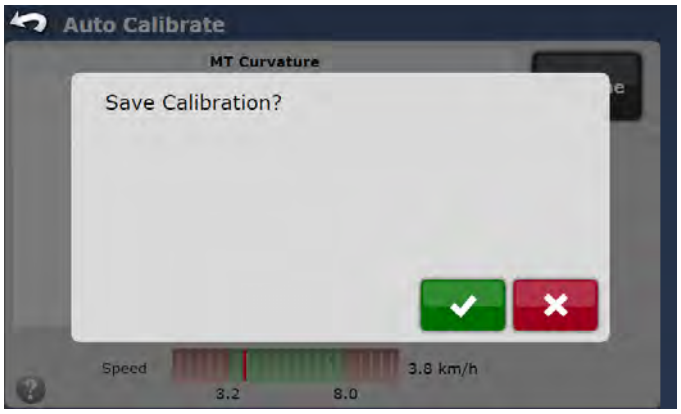
**Figure 3-61 CAN Bus / ISO Controlled Calibration in Progress**




The vehicle will start by driving in a straight line for a short time, it will then start making increasingly sharp turns to the right until eventually it reaches the maximum right turn. It will then go back to center and then start making increasingly sharp turns to the left until it reaches the maximum left turn. Once it gets to the maximum left turn, the calibration will be complete.

### Save Calibration

**Figure 3-62 Save Calibration**




Once the *Curvature* calibration process has completed, the *Save Calibration* screen will appear. Press the Green Check button to accept and save calibration. Press the Red X button to discard all changes.

## *Adjust GPS Antenna Lateral Offset*

After the vehicle has been created and calibrated, perform the following procedure to ensure that the GPS antenna lateral offset is entered correctly. This procedure will detect and eliminate skips and overlaps in adjacent rows due to an incorrect lateral offset.

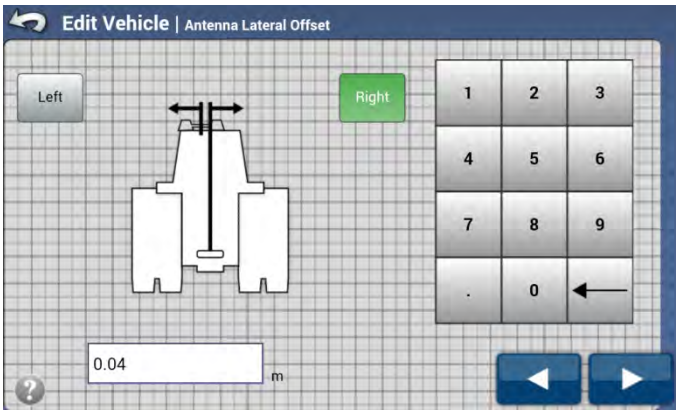
**Note:** Before the calibration process was started, the Antenna Lateral Offset value should be as close to zero as possible. If the value is off by more than 4 inches (10 cm), the calibration process will have to be redone after changing this value.

**Note:** Always verify that the implement selected during this test on the Display has a zero offset even if there is no implement on the back of the vehicle. Any vehicle offsets will cause an incorrect measurement to be entered in this procedure.

To verify GPS antenna lateral offset follow this procedure:

1. Set an AB line, engage the AutoSteering, and let the vehicle AutoSteer for at least 100 feet (30 m).
2. Stop the vehicle, place it in park, and disengage the ECU-S1 system.
3. Use a plumb bob to place a flag in the ground directly beneath the center of the draw bar.
4. Return to the vehicle, start the ECU-S1 system, and engage the AutoSteer for at least another 100 feet (30 m) on the same AB line.
5. Disengage the AutoSteer, turn the vehicle around, and AutoSteer back down the same AB line in the opposite direction.
6. When the vehicle's draw bar reaches the flag stop the vehicle, place it in park, disengage off the ECU-S1 system, and exit the vehicle.
7. Check to see if the center of the draw bar is over the flag.
8. If the flag is exactly beneath the center of the draw bar, no adjustment is needed.
9. If not, use a plumb bob to mark the spot directly beneath the draw bar, and then measure the distance between that spot and the flag.
10. Calculate the Offset Error by dividing the measured distance by 2. (The measurement is divided by two because taking the measurements driving in opposite directions doubles any error.)
11. From the *AutoSteer Setup Vehicle* screen, go to the **Manage Vehicle** > **Edit** > **Antenna Lateral Offset** screen (see *Antenna Lateral Offset* on *Page 22*). Adjust the existing value by adding or subtracting the Offset Error. The adjustment must be made in the same direction of the error.

**Figure 3-63 Edit Vehicle Adjust Lateral Offset**




**Note:** This measurement may require that the **Left** or **Right** button may have to be changed.

12. Repeat the procedure to ensure that the lateral offset is now correct using a new A/B line for both directions.

**Note:** Always make sure the draw bar is centered on the vehicle and measure from this point for this test. This is the point where the implement will be attached and thus be expected to repeat in the same point in both directions. If the wheels of the vehicle are equally spaced from the draw bar, they should pass over the top of each other in opposite directions in this test. However this measurement must be confirmed prior to using wheel tracks for offset measurements. Measuring from the draw bar will always provide the most consistent results.

Example:

After AutoSteering up and down the AB line, the center of the draw bar is 3.0 inches (7.6 cm) to the right of the flag. Divide the measurement by 2, which gives an adjustment of 1.5 inches (3.8 cm). Go to the *Edit Antenna Lateral Offset* screen and adjust the lateral offset 1.5 inches (3.8 cm, round it to 4 cm) to the right (the adjustment must be made in the same direction of the error).

**Note:** if the adjustment is more than 4 inches (10 cm), the vehicle will have to be recalibrated.

**Note:** Once the Vehicle Offset has been determined, this value should NEVER need to be changed again unless the GPS antenna has been physically repositioned on the roof of the vehicle. If a field operation shows a guess row error with a certain implement, the offset should be adjusted on the implement settings, NOT the vehicle offset. Changing the Vehicle Offset will cause other implements to show unpredictable guess row errors.

# Tilt Calibration

This menu option starts the tilt calibration as described in section *Tilt Zero Initial Direction* on page 45. This menu item is available only after initial calibration of the vehicle.

# Wheel Angle Calibration

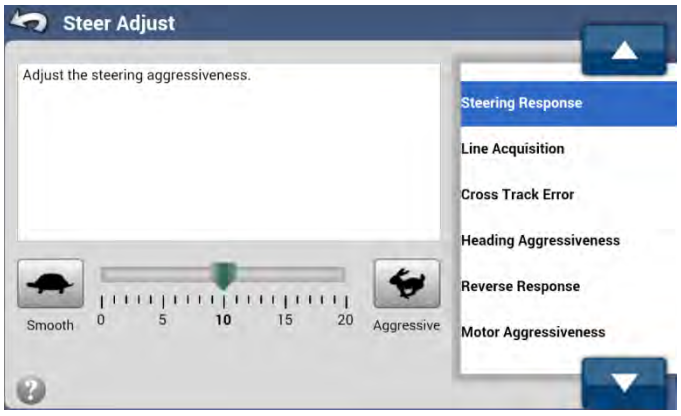
This menu option starts the Wheel Angle Sensor calibration as described in section *Angle Sensor* on page 48. This menu item is available only after initial calibration of the vehicle.

# Steering Adjust

After the vehicle has been calibrated, it should perform adequately for most normal field operations. However in some situations, it may be necessary to adjust the steering performance to take into account field conditions, implement selection, traveling speed, etc. The *Steering Adjust* screen enables the operator to adjust the vehicle steering performance to match these changing conditions. You can change the response of the selected item by using the slider bar.

To access the *Steering Adjust* screens, press the Steering Adjust button on the *AutoSteer Setup Vehicle* screen.

**Figure 3-64 Steering Adjust**




The *Steering Adjust* screen has the following items that can be adjusted:

- **Steering Response** – This adjusts for oscillations of vehicle when it is on the desired path.
- **Line Acquisition** – This adjusts how aggressively the vehicle steers onto the desired steering path (A/B line). The goal is to tune the system to take the shortest route without excessively sharp or sudden movements of the vehicle.
- **Cross Track Error** – This adjusts how aggressively the vehicle reacts to changes in cross-track error.
- **Heading Aggressiveness** – This adjusts how aggressively the vehicle reacts to changes in the vehicles heading.
- **Reverse Response** – This adjusts steering aggressiveness when the vehicle is traveling in reverse.
- **Motor Aggressiveness -** Adjust how aggressively the MDU motor turns the steering wheel (this option is available for MDU control only)

Each of the items in the *Steering Adjust* screen allow operator to alter AutoSteering performance by allowing minor adjustments to the control system. The item selected from the list on the right can be changed by moving the slide bar using the following buttons:

- **Turtle Icon** – Pressing this button moves the bar towards the turtle to slow the response rate of the steering system and makes slower smoother turns. If this value is moved too far to the left, the vehicle will get into a slow weaving pattern as it travels across the field.
- **Rabbit Icon** – Pressing this button moves the bar towards the rabbit to increase the response rate of the steering system. This causes the system to react faster, however if the value is moved too far to the right, the vehicle will get into a rapid oscillating pattern as it travels across the field.

To make adjustments, Press the Blue Up/Down Arrows or directly select the response rate to be adjusted. Move the slider bar using Turtle or Rabbit buttons to increase or decrease the response.

**Note:** Some Displays may allow the operator to make some of above settings from their job menu.

# Steering Components

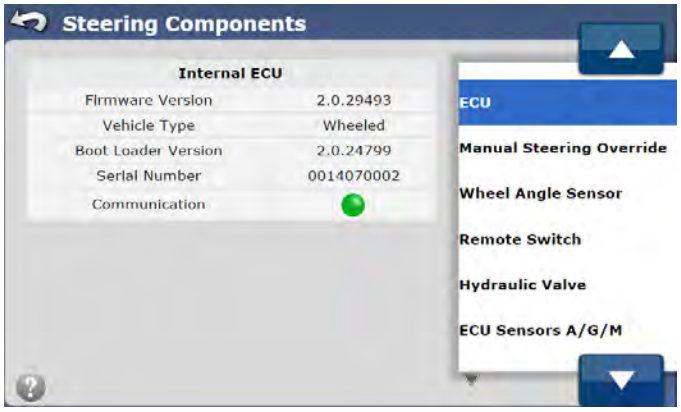
This *Steering Components* screens allows the operator to view real time sensor reading to verify they are working, adjust the sensitivity to some components, and test the reaction of other components. These screens are used to test and manage all the components related to the ECU-S1's interaction with the vehicle. The list of components that can be managed and is displayed will vary depending on the vehicle profile that has been activated.

To access the *Steering Components* screen, press the Steering Components button from the *AutoSteer Setup Vehicle* screen.

## *ECU - Hydraulic, CAN, ISO, Steer-By-Wire*

Following screen is shown with hydraulic, CAN, ISO-Bus and Steer-By-Wire controller type.

**Figure 3-65 Steering Components (Hydraulic Control example)**



The internal Electronic Control Unit (Internal ECU) is the interface between ECU-S1 and all the sensors and actuators on the vehicle. The Internal ECU receives information from all the sensors such as the WAS, pressure transducer, steering encoder, etc. and sends electrical signals to the hydraulic valve.

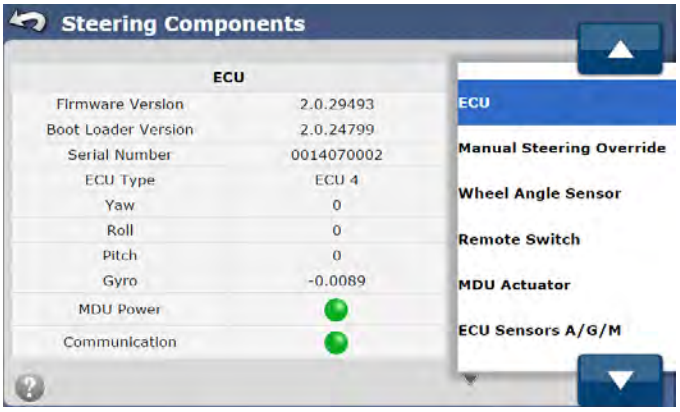
The *ECU* screen provides the following information:

- **Firmware Version** – The version of software that is loaded on the Internal ECU. Note: this is not the ECU-S1 software version.
- **Vehicle Type** – The current vehicle type that the ECU is configured for. This is important to know to ensure the ECU is configured properly to communicate to the vehicle type selected.
- **Boot Loader Version** – This is the version of software that is loaded on the ECU to allow it to start (boot up).
- **Serial Number** – This is the serial number of the Internal ECU board.
- **Communication** – Green when ECU-S1 is communicating with the Internal ECU. If this light is not green, there is a problem with the ECU-S1.

## ECU - Mechanical MDU-G4

Following screen is shown with MDU-G4 controller type. This screen provides additional information about the MDU Actuator.

**Figure 3-66 ECU (MDU-G4 Control Example)**




The *MDU-G4 ECU* screen provides the following information:

- **Firmware Version** – The version of software that is loaded on the Internal ECU. Note: this is not ECU-S1 software version.
- **Boot Loader Version** – This is the version of software that is loaded on the ECU to allow it to start (boot up).
- **Serial Number** – This is the Serial Number of the ECU board.
- **ECU Type** – This provides the type of ECU that is used.
- **Yaw, Roll,** and **Pitch** – These are the raw measurements provided by the ECU.
- **Gyro** – This provides the raw gyro information.
- **MDU Power** – This provides an indicator that shows if the MDU is powered on or off. The switch on the MDU must be on for the MDU to run. If the switch is off, this light will not be green.
- **Communication** – If this light is green, the ECU-S1 is communicating with the ECU. If this light is not green, there is a problem with the ECU-S1.

## Manual Steering Override

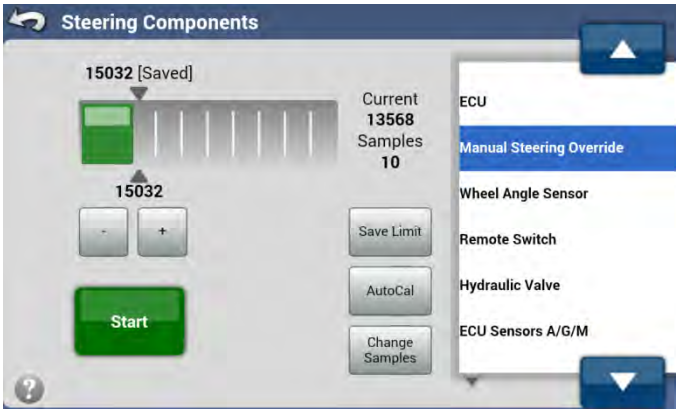
The Manual Steering Override refers to the sensor that is used to detect when the operator manually turns the steering wheel. The AutoSteer system needs to know when the driver wants to take over steering manually and the AutoSteering should be disabled. The AutoSteer system can detect this by getting a signal from a pressure transducer, flow switch, steering encoder, the electrical resistance, or other method. The *Manual Steering Override* screen shows the status of that sensor and allows the operator to adjust the sensitivity of the sensor.

The screen that displays will depend on the vehicle profile that has been activated. Refer to the section that corresponds to sensor used for the vehicle profile being used.

**Note:** It is critically important for the *Manual Steering Override* to be functioning and set to the proper level to allow the operator to disengage AutoSteer manually. Never operate an AutoSteer system without this feature working or set properly.

## Pressure Transducer

**Figure 3-67 Manual Steering Override (Pressure Transducer)**




This screen is displayed for vehicle profiles that use a pressure transducer on Steering Valve. It allows the operator to verify the sensor is working and to adjust the sensitivity of the kick out to match the operator preferences. These screens are described in detail in the *Setup Wizard* section of this manual.

Additional option available on this screen:

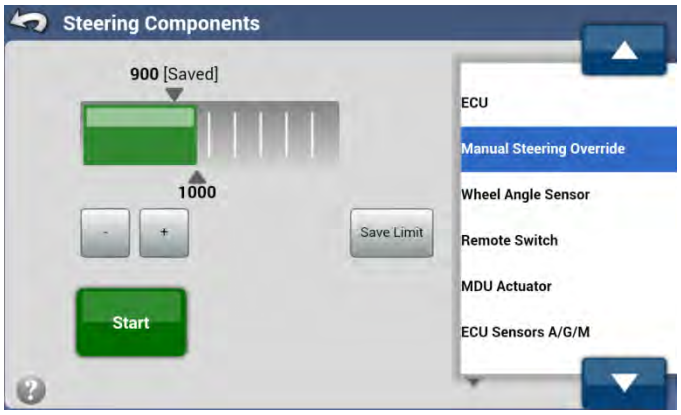
**Change Samples** – This setting sets the number of times the system must detect the kick out reading in a row before it considers that the operator has started turning the wheel. If this value is set too high, the kick out will be slow to happen or not happen at all. If this value is set too low, the vehicle may spontaneously kick out from random pressure spikes. This value should be left at the default value and the kick out limit adjusted first. Modify this value only if the kick out limit is unable to provide a good balance.

For more information understanding and using this screen please refer to *Pressure Transducer Installations* section on *Page 29*.

At the end of Manual Steering Override AutoCal the confirmation screen is displayed. Press **Green Check Mark** button to save new calibration data or press the Red X button to discard the new values.

## Mechanical Steering Device

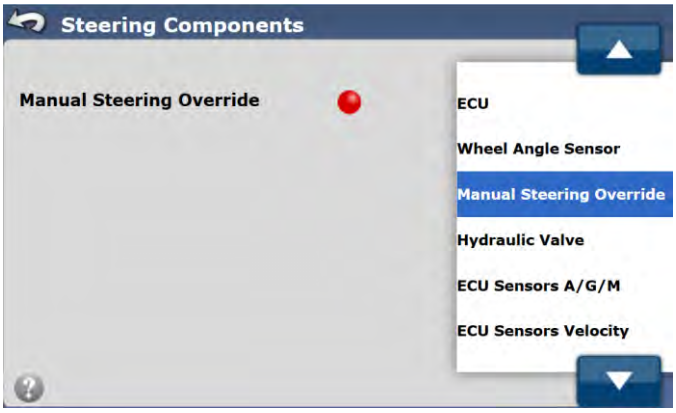
**Figure 3-68 Manual Steering Override (Mechanical Steering Device)**




This screen is displayed for vehicle profiles that use a Mechanical Steering Device such as MDU-G4. It allows the operator to verify the system can receive encoder information from MDU and to adjust the sensitivity of the kick out to match the operator preferences. These screens are described in detail in the Setup Wizard section of this manual.

## Steering Encoder and Flow Switch

**Figure 3-69 Manual Steering Override (Steering Encoders)**

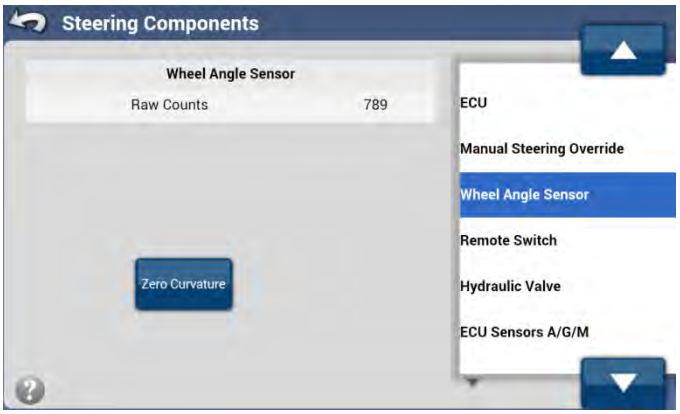



Some vehicle profiles use an encoder on the steering wheel or a flow switch in the steering hydraulic lines to detect motion at the steering wheel. The encoder will send a signal when the steering wheel is turned by the operator. The flow sensor will close the circuit when it detects oil flow through the hydraulic line. In either case, there are only two states, on and off so there is no adjustment required for these sensors. The only information provided in this screen is:

- **Manual Steering Override** – A green light indicates that the AutoSteer system is detecting steering wheel motion or flow at the flow switch. A red light indicates no motion or flow is detected.

# *Wheel Angle Sensor*

**Figure 3-70 Wheel Angle Sensor**




The *Wheel Angle Sensor* screen shows the sensor reading coming from the Wheel Angle Sensor on the vehicle. The sensor sends wheel angle position signals to the system in order to ensure precise AutoSteering operations.

The *Wheel Angle Sensor* screen provides the following information and tools:

- **Raw Counts** – This is the reading that is sent from the Wheel Angle Sensor. This value should increase and decrease smoothly as the steering wheel is turned left and right. If it does not move there is a problem with the Wheel Angle Sensor communications and this will need to be solved before the system can AutoSteer.
- **Zero Curvature** – Pressing this button will start a Wheel Angle Sensor test procedure to see if the calibration information is still valid.

## Zero Curvature

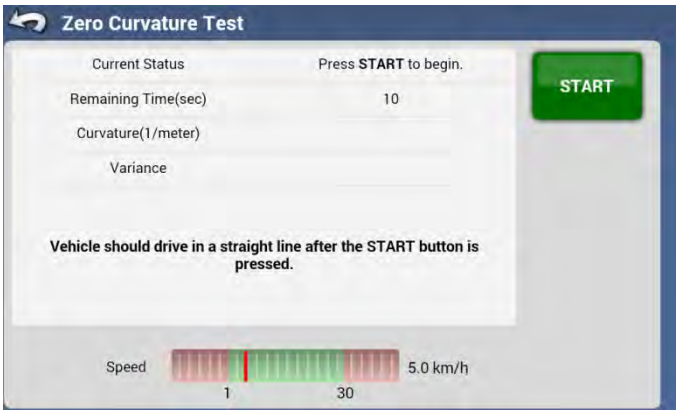
After the Wheel Angle Sensor has been calibrated, the system should be able to know exactly what angle the steering wheels need to be at in order to drive a straight line. This test is designed to provide a quick verification that the Wheel Angle Sensor calibration is valid. If the vehicle stops steering properly, this test can be run to verify that the Wheel Angle Sensor is still working correctly. If the Wheel Angle Sensor, its brackets, or linkage rods have been damaged or altered, this test will be able to show that the calibration is no longer valid.

If this test fails, check the Wheel Angle Sensor components for physical damage and that the steering axles are working properly. Recalibrate the system and see if that resolves the issue.

Use the following procedure to use the Zero Curvature test.

1. Press the **Zero Curvature** button to access the test screen.
2. Find a location with a flat and smooth ground where the vehicle can be driven in a straight line for 10 seconds at the normal operating speed of the vehicle. Verify that all bystanders are away from the vehicle.

**Figure 3-71 Zero Curvature Test**




3. Begin driving the vehicle in a straight line and then press the **Start** button.
4. The vehicle should drive automatically in a straight line for about 10 seconds. At the end of the countdown, the test will give one of two following results.

**Figure 3-72 Zero Curvature Test Result is Good**

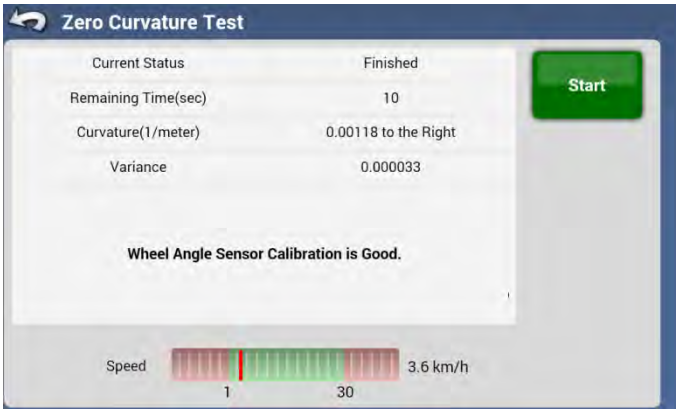
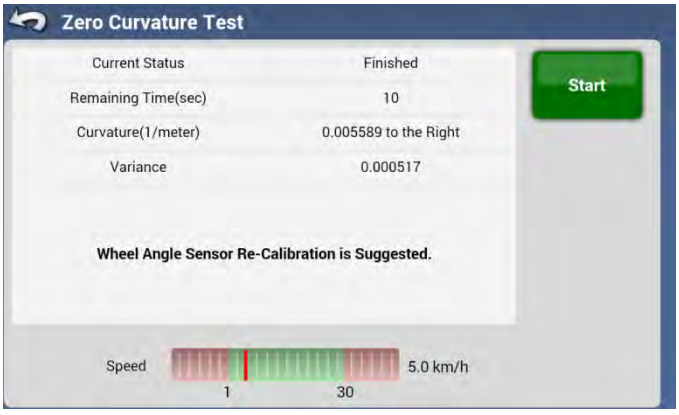



**Figure 3-73 Zero Curvature Test Result has Failed**

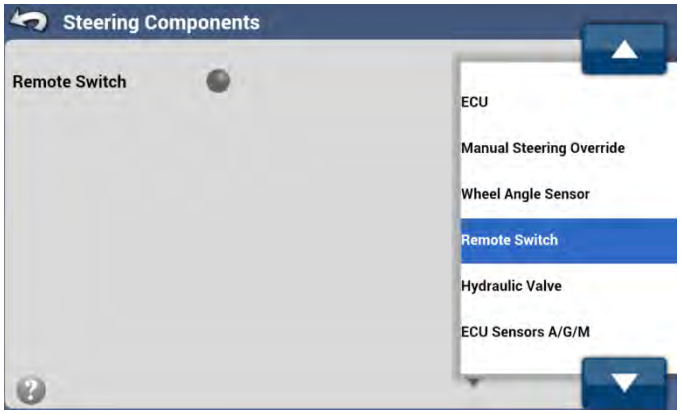


If the *Zero Curvature* test passes, the Wheel Angle Sensor is working properly. If the test fails it might be a problem with the Wheel Angle Sensor. This can occur if the Wheel Angle Sensor or linkage has been damaged since the original calibration, improper Wheel Angle Sensor installations, or conditions for the test were not favorable (ex. bumpy ground, bad GPS, etc.). Try running the test again. If the problem continues, check the Wheel Angle Sensor hardware and recalibrate the vehicle. After recalibrating verify the system is working properly by running the *Zero Curvature* test again.

## Remote Switch

If a Remote Engage switch has been activated on the ECU-S1, the Steering Components screen will show an option for Remote Switch in the list on the right. The Remote Engage or Disengage switch must be enabled in the Accessories screen before it is visible here. To enable or disable the Remote Engage switch, refer to *Accessories* section on Page 80. This screen will provide an indicator as to whether the Remote Switch is being detected by the ECU-S1 system.

**Figure 3-74 Remote Switch Screen**




The *Remote Switch* screen provides the following information:

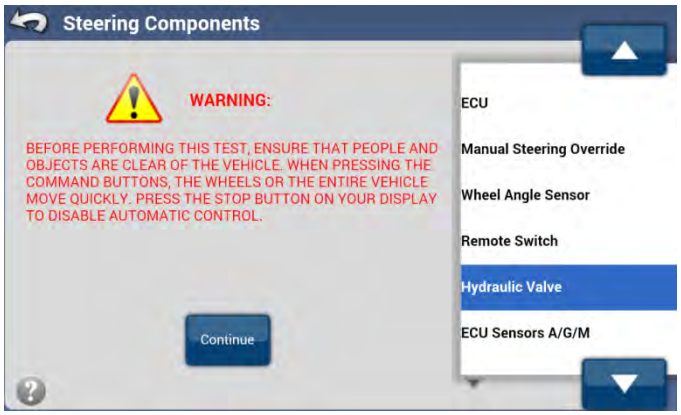
- **Remote Switch** – This indicator will turn green when the Remote Switch is activated and turn gray when it is deactivated.

## Hydraulic Valve

The *Hydraulic Valve* screen is used to verify that the hydraulic setup is operating correctly and to validate new installations.

Read the *WARNING* message and press the Continue button when all bystanders are away from the vehicle.

**Figure 3-75 Hydraulic Valve**

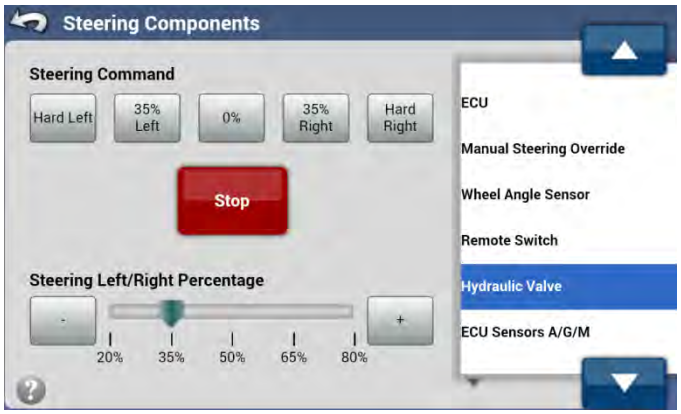



**Notes:** Before performing this test, ensure people and objects are clear of the vehicle. When pressing the **Steering Command** buttons, the wheels move quickly from side to side. Press the **STOP** button to halt the wheel movement.

The **Steering Command** buttons control the rate at which the steering axle turns. When a button is pressed, the steering axle should turn at a constant rate until the steering axle reaches the stop.

On some installations the steering axle will turn left when the right **Steering Command** buttons are pressed and vise versa. This screen sends the raw signals to the valve for the commands. If the signals are backwards in this screen, the calibration process will catch this and still allow accurate AutoSteering performance. The steering axle turning the wrong way is not generally considered a problem. If the wheels move in one direction the expected speed, the test can be considered successful.

**Figure 3-76 Hydraulic Valve Control Screen**



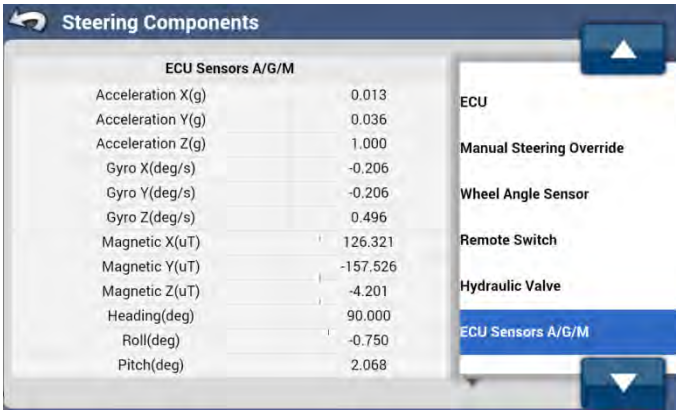

The following controls are available:

- **Hard Left** – Pressing this button turns the steering axle at 100% to one direction (normally to the left).
- **xx% Left** – The xx represents the **Steering Left/Right Percentage** that the slider bar has been set to. Pressing this button will turn the steering axle at the percentage of the full signal. The steering axle should turn slower the lower the **Steering Left/Right Percentage** is set to.
- **0%** – Pressing this button energizes the enabler coils on the valve, if equipped, but does not drive the steering axle in either direction.
- **% Right** – The xx represents the **Steering Left/Right Percentage** that the slider bar has been set to. Pressing this button will turn the steering axle at the percentage of the full signal in the opposite direction as the **xx% Left** button. The steering axle should turn slower the lower the **Steering Left/Right Percentage** is set to.
- **Hard Right** – Pressing this button turns the steering axle at 100% to one direction (normally to the right).
- **Stop** – Pressing this button stops the valve from moving and cuts all power to the steering valve.
- **Steering Left/Right Percentage** – This slider controls the change percentage for the **xx% Left** and **xx% Right** buttons. Changing these values allows the operator to test how the valve reacts at different loads. Generally the steering valve will not turn with a signal percentage below 30%.
- **Minus (-)** and **Plus (+) Buttons** – Pressing these buttons adjusts the **Steering Left/Right Slider Bar**. Those buttons are active only when axle is not moving.

# ECU Sensors

The *ECU Sensors A/G/M* screen provides the raw data that the ECU is measuring. The ECU has a three axes Accelerometer, three axes Gyroscope, and three axes Compass. These sensors allow the ECU-S1 to determine the Heading, Roll, and Pitch of the unit.

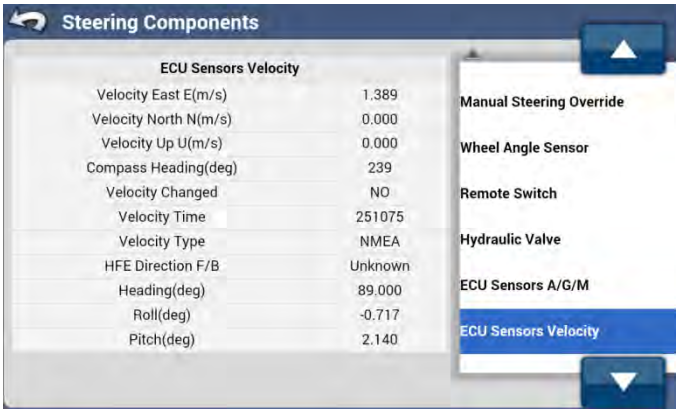
**Figure 3-77 ECU Sensors A/G/M**




# ECU Sensors Velocity

The *ECU Sensors Velocity* screen provides the data the system is using for measuring the velocity of the system. This information helps the technician to understand how the system is operating.

**Figure 3-78 ECU Sensors Velocity**

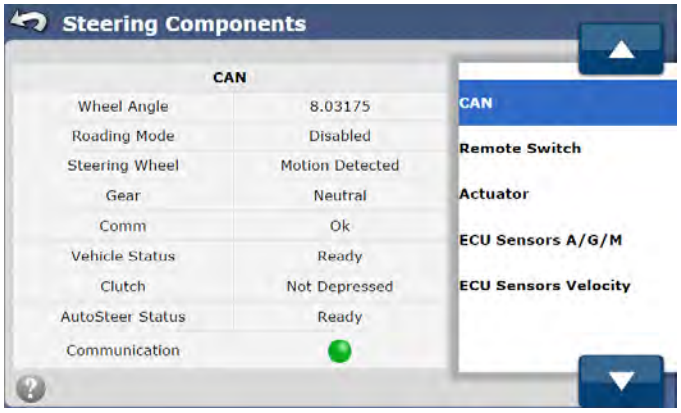



# CAN

If the ECU-S1 system is installed on a vehicle that is interfaced via the CAN Bus or ISO Connection, the *CAN* screen will display in the *Steering Components* screens. The *CAN* screen will provide specific information about the communication status between the vehicle and ECU-S1 system.

**Note:** The options displayed in the *CAN* screens will be different depending on the vehicle profile that the system is installed on. Not all CAN Bus / ISO Controlled vehicles provide the same information.

**Figure 3-79 CAN Screen for Challenger MT Track Vehicle**




Some of the options that can be displayed in the *CAN* screen are as follows:

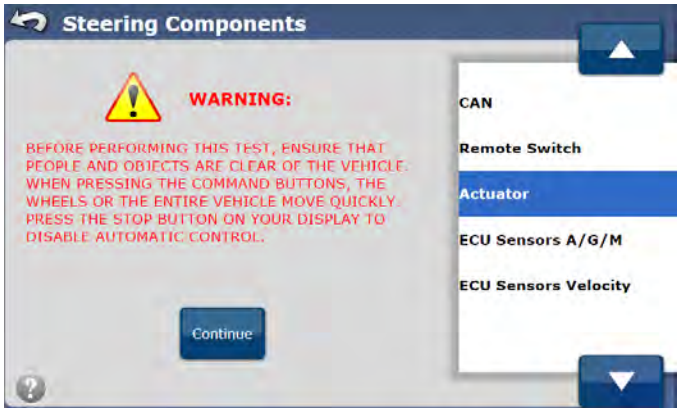
- **Wheel Angle** or **Curvature** – For CAN vehicles, this is the estimated Curvature or a calculation based on it that the vehicle sends to the ECU-S1 Unit. This value should change as the steering wheel on the vehicle is manually turned.
- **Roading Mode** – Some vehicles have a lock out switch that prevents CAN Steering when the vehicle is on the road. If this switch is enabled, the display will show: **Enabled**.
- **Steering Wheel** – If the system detects motion of the steering wheel, this will show **Motion Detected**.
- **Gear** – If the vehicle provides transmission information, this will display if the vehicle is in forward, reverse, neutral, or park.
- **Comm** – This provides an indicator if the communications are working. If they are not the display will show: **Not Ok**.
- **Vehicle Status** – Some vehicles need an indicator that there is a human in the machine, this is determined by the operator turning the steering wheel manually. If the system is waiting for the operator to indicate their presence, the display will show: **Not Ready**.
- **Clutch** – Some vehicles provide a status message of the clutch position.
- **AutoSteer Status** – This shows if the system is ready to AutoSteer. If it is not the display will show: **Not Ready**.
- **Communication** – If the vehicle is communicating with the CAN Bus or ISO Bus of the vehicle, this light will be green.

## *Actuator*

The *Actuator* screen is used to verify that the vehicle can send commands through the CAN Bus or ISO Controller to steer the vehicle. It is similar to the *Steering Valve* but the commands are not the same.

Read the WARNING message and press the Continue button when all bystanders are away from the vehicle.

**Figure 3-80 Actuator**



**Notes:** Before performing this test, ensure people and objects are clear of the vehicle. When pressing the **Steering Command** buttons, the wheels or vehicle will move quickly from side to side. Press the **STOP** button to halt the vehicle movement.

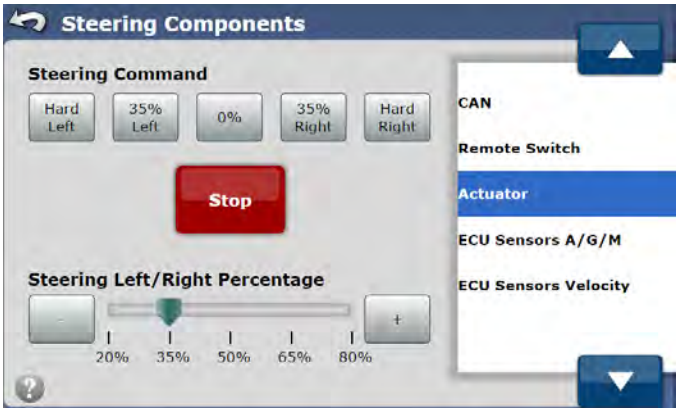
For the *Actuator* screen, the **Steering Command** buttons control the direction the steering axle will turn to not the speed of turn. When a button is pressed, the steering axle should turn the percentage of curvature and stop there. The **Steering Command** does not change the speed at which the steering axle will change, only the direction.

Some vehicles will need to be moving for the system to be able to send commands.

Some CAN Bus / ISO Controlled vehicles require the operator to use the vehicle's factory supplied engage switch to start the test process. If this is require, the test screen will notify the operator to use factory switch instead of the screen.

Track vehicles will not turn the steering axle, they will start turning at a constant curvature of the command that has been given them.

**Figure 3-81 Actuator Control Screen**




The following are the controls available on the *Actuator* screen:

- **Hard Left** – Pressing this button turns the steering axle to the 100% left position and holds it there.
- **xx% Left** – The xx represents the **Steering Left/Right Percentage** that the slider bar has been set to. Pressing this button will turn the steering axle to the percentage of arc selected and hold the wheel there. The lower the percentage, the closer to the center position the steering axle will turn to.
- **0%** – Pressing this button will turn the steering axle straight ahead.
- **% Right** – The xx represents the **Steering Left/Right Percentage** that the slider bar has been set to. Pressing this button will turn the steering axle to the percentage of arc selected and hold the wheel there. The lower the percentage, the closer to the center position the steering axle will turn to.
- **Hard Right** – Pressing this button turns the steering axle at 100% right position and holds it there
- **Stop** – Pressing this button stops all commands to the vehicle.
- **Steering Left/Right Percentage** – This slider controls the change percentage for the **xx% Left** and **xx% Right** buttons. Changing these values allows the operator to test how the valve reacts at different loads. Generally the steering valve will not turn with a signal percentage below 30%.
- **Minus (-)** and **Plus (+) Buttons** – Pressing these buttons adjusts the **Steering Left/Right Percentage Slider Bar**.

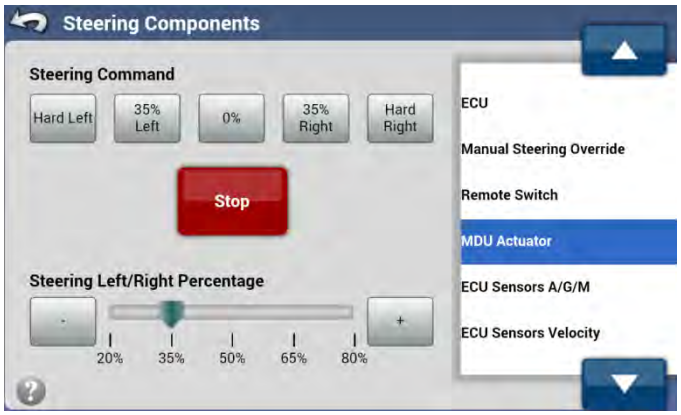
## *MDU Actuator*

The Mechanical Drive Unit (MDU) refers to any mechanical steering option such as MDU-G4. The *MDU Actuator* screen provides the operator a way to command the Mechanical Drive Unit to turn left or right and confirm the AutoSteer system can control the device.

**Notes:** Before performing this test, ensure people and objects are clear of the vehicle. When pressing the **Steering Command** buttons, the wheels or vehicle should move quickly from side to side. Press the **STOP** button to halt the vehicle movement.

For the *MDU Actuator* screen, the **Steering Command** buttons control the direction the Mechanical Drive Unit (MDU) rotates.

**Figure 3-82 MDU Actuator**




The following are the controls available on the *MDU Actuator* screen:

- **Hard Left** – Pressing this button tells the MDU to turn to the right at 100% speed.
- **xx% Left** – The xx represents the **Steering Left/Right Percentage** that the slider bar has been set to. Pressing this button will turn the MDU to the right at xx% speed.
- **0%** – The MDU will not rotate.
- **% Right** – The xx represents the **Steering Left/Right Percentage** that the slider bar has been set to. Pressing this button will turn the MDU to the left at xx% speed.
- **Hard Right** – Pressing this button tells the MDU to turn to the left at 100% speed.
- **Stop** – Pressing this button stops all commands to the MDU.
- **Steering Left/Right Percentage** – This slider controls the change percentage for the **xx% Left** and **xx% Right** buttons. Changing these values allows the operator to test how the MDU reacts at different loads.
- **Minus (-)** and **Plus (+) Buttons** – Pressing these buttons adjusts the **Steering Left/Right Percentage Slider Bar**.

# System Tab Menu Operations

## Overview

The *System* menu enables the operator to view the system health status, save logs and database, reset settings to factory defaults, adjust shutdown delay, manage optional accessories and upgrade to new software.

**Figure 4-1 AutoSteer Setup System Tab**


To access the *System* menu, refer to your *Display Operator's Manual* for instructions on accessing the *AutoSteer Setup* screens. Once there, press the **System** tab.

Each of the following menu options are explained in detail in this chapter.

- **System Health** – This provides an overview of the system and displays any issues that may be present.
- **Manage Settings** – This allows the operator to manage log files, databases, or reset the system back to factory defaults.
- **Accessories** – This allows the operator to manage any accessories connected to the ECU-S1.
- **Technician** – This area is reserved for Service Technicians only. Operators do not have access to this area.
- **Software Upgrade** – This is where new versions of firmware can be loaded onto the ECU-S1.
- **System Log -** This menu displays steering and GPS log entries that can be used in troubleshooting the system

# System Health

The system health screen provides a quick status view for the various aspects of the ECU-S1 system. If a problem should occur, this allows the operator to take quick glance at the status of the various sensors and see if any obvious problems appear. If they do, the operator can look more closely at the aspect that is not working.

**Figure 4-2 System Health**


To access the different screens, use the Blue Up/Down Arrows or buttons or directly select the hardware group from the list on the right. The status for each item is shown by one of three icons:

**Table 4-1 System Health Icons**

| Icon | Description |
|---|---|
| ✓ | **Green Check** – Indicates the component is working correctly. |
| ⚠ | **Exclamation Point** – Indicates the component is not ready yet. |
| ✗ | **Red X** – Indicates there might be a problem with the function of the component or a feature code has not been purchased for this item. Diagnostic from some other menus might be required. |

The various components are broken down into hardware groups. The items inside each group change based on which vehicle type is active. The groups are as follows:

- **Overview** – This is an overview of the four other groups and provides a quick glance at which group may be causing the problem so it can be looked into more closely.
- **GPS** – This group has to do with all the items that have to do with getting a position. This includes GPS signals and correction signals.
- **Steering** – This group has to do with all the items that have to do with interfacing with the steering system.
- **Hardware** – This group has to do with the hardware error checks. Do the various sensors values detected fall within the normal or expected ranges

*Figure 4-3* shows an example of one of the *System Health* screens. Each item in the group shows a specific item that is being monitored, a code that explains the status, and a quick reference status symbol that quickly alerts the operator to good, bad, or possible problems.

**Figure 4-3 System Health Hardware Example**

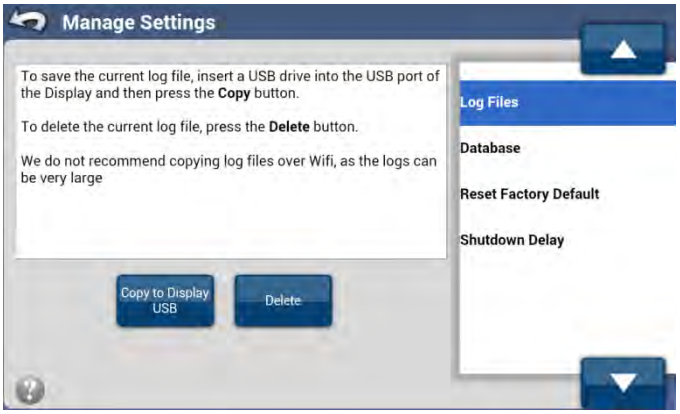

# Manage Settings

The *Manage Settings* screens allow the operator to manage the internal databases and logs files. The database stores all the vehicle configuration, calibration, and history information for the system. The log files keep a running list of everything the system has done. The *Manage Settings* screens available are:

- **Log Files** – Allows the operator to copy or delete the internal log files.
- **Database** – Allows the operator to backup or restore databases to the unit.
- **Reset Factory Default** – Allows the operator to reset all the settings back to the default factory settings.
- **Shutdown Delay** - Allows the operator to adjust shutdown delay for ECU-S1

## *Log Files*

**Figure 4-4 Mange Settings Log Files**




The ECU-S1 system continually records information while it is powered up to log files stored internally on the unit. These log files contain the GPS data, correction information, steering performance, errors, and configuration changes that are made over the time of the log. The data is stored in 5 minute chunks and can store up to five hours of past data. Once the system fills its logging storage space, it begins to overwrite the earliest files with the latest ones.

The logs contain system data that can be used for diagnostic and troubleshooting purposes should a problem occur. If there is a need the data can be copied to a Display storage device and then sent to your AutoSteer dealer for analysis. There are two choices in the *Log Files* section.

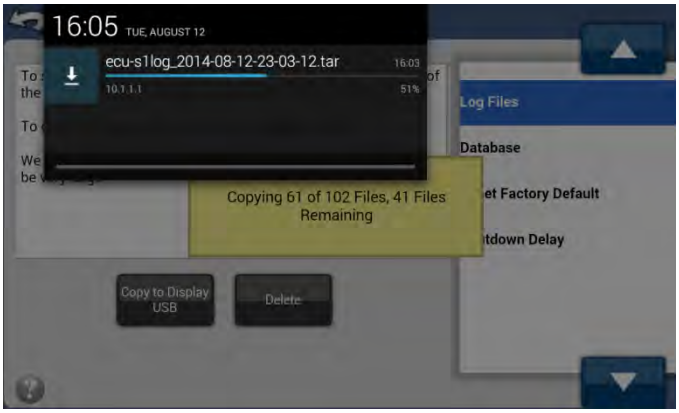
- **Copy to Display USB** – This copies data to the Display storage device.
- **Delete** – This deletes all log files stored on the ECU-S1 system.

# Copy to Display USB

If your AutoSteer Dealer requests the log files, follow the procedure below to copy the log files stored on the system.

1. If necessary, insert an external storage device (USB drive, SD card, etc.) to the Display external storage interface port.
2. From the *System* tab, press the **Manage Settings** button, highlight **Log Files** from the menu list on the right, and then press the **Copy to Display USB** button.
3. The copying process begins and depending on Display type a progress window may appear. Allow the file to be copied to the Display storage. The download time will depend on file size. Picture below shows copying screen from Android based Display. That screen may look different on other Display.

**Figure 4-5 Log File Copying Example**




All log files from ECU-S1 are combined into one archive file and saved on Display storage under name of ecu-s1log_YYYY-MM-DD-HH-mm-SS.tar, where YYYY is a year, MM is a month, DD is a day, HH is an hour, mm is a minutes and SS is a number of seconds. On typical tablet file will be saved in /Download folder. Please check in your Display manual for exact location of the file.

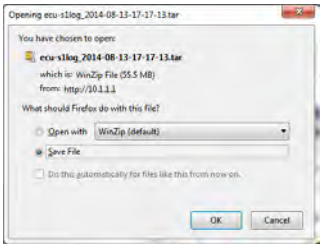
The log archive file can be rather large (about 230 MB). It is recommended to compress it (use WinZIP, 7-Zip, tgz, etc.) before sending to an AutoSteer dealer.

If your Display is not equipped with a storage device it is also possible to copy logs directly to your laptop computer. In such case it is recommended to connect ECU-S1 Ethernet cable directly to your computer. It is also possible to copy logs using WiFi connection but it'll be a very slow process and copying 230 MB will take more than an hour. Follow steps below to copy logs directly to your computer.

1. Disconnect ECU-S1 RJ-45 Ethernet network cable from the Display and connect it to your laptop directly. For WiFi connect to ECU-S1-XXXX network, where XXXX are last four digits of the ECU-S1 serial number.
2. Open web browser of your choice and type 10.1.1.1 at web page address line. For WiFi type 10.100.100.100 in that line.
3. After a moment an ECU-S1 AutoSteer Setup screen should be displayed. Press **System** tab button and then **Manage Settings** button.
4. Select **Log Files** menu on the list and press **Copy to Display USB** button.

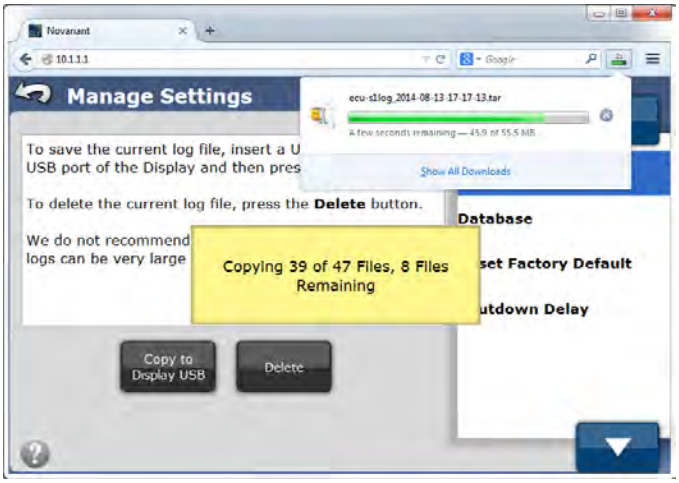
5. Usually web browser will ask whether to open or save a file. Select Save File as shown below.

**Figure 4-6 Save Log File Example**




6. The copying process begins and depending on your browser a progress window may appear. Allow the file to be copied. It may take few minutes. Picture below shows copying screen on Windows laptop with Firefox browser.

**Figure 4-7 Log File Copying**




7. When copying is complete connect the ECU-S1 Ethernet cable back to the Display.

## Delete

Sometimes it is advantageous to clear the log files and then duplicate the problem with a clean log. This allows the copy procedure to precede much faster as there is a lot less data to transfer. If it becomes necessary to delete log files, follow the procedure below:

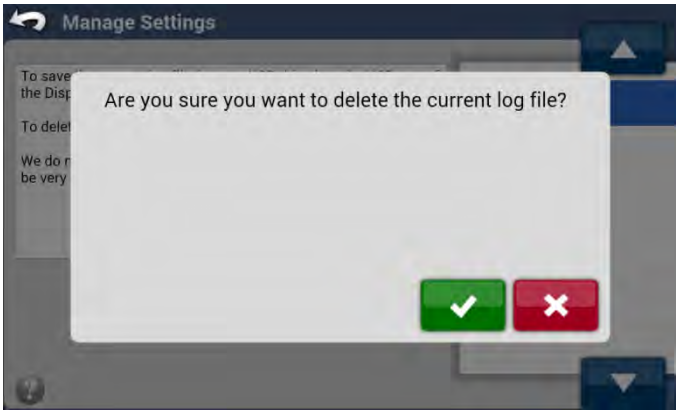
1. From the *System* tab, press the **Manage Settings** button, highlight **Log Files** from the list on the right, and then press the **Delete** button.
2. A *Warning* message will appear.
3. To accept deleting the log files, press the **Green Check** button. To cancel deleting the log files, press the **Red X** button.

---

**Note:** Delete the logs files only if you can reliably replicate a problem and want to copy log files faster. If the problem is not repeatable, do not delete the log file, copy all of them so the issue can be found. Be sure to record the time and date that the issue occurred before contacting your AutoSteer dealer.

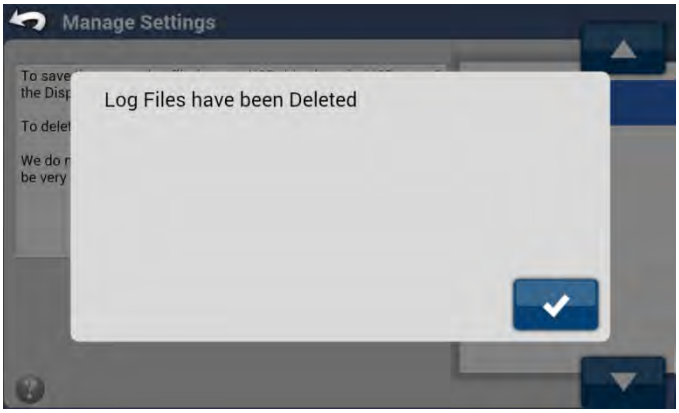
---

**Figure 4-8 Log File Deletion Warning**




4. When the log files have been deleted, a confirmation screen will appear. Press the **Blue Check** to accept it and to return to the *Log Files* screen.

**Figure 4-9 Log Files have been Deleted**




## *Database*

The ECU-S1 system stores all the system configurations, vehicle profiles, and historical data, and other information in a database in the internal memory. This database can be exported, saved, and used to restore back onto a system later if necessary. The database also contains important information that can be used by your AutoSteer dealer to help in troubleshooting.

**Figure 4-10 Manage Settings Database**

There are two choices in the *Database* section.

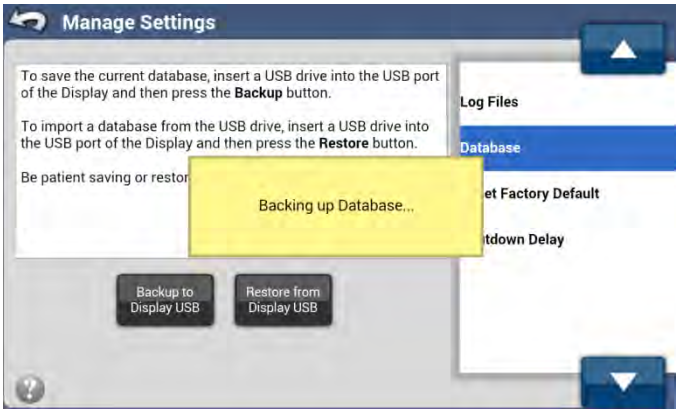
- **Backup to Display USB** – Saves the current database on the ECU-S1 system to the Display storage device.
- **Restore from Display USB** – Replaces the current database on the ECU-S1 system with the database stored on Display storage device.

## Backup to Display USB

It is a good practice to backup the database on the ECU-S1 system regularly. With the backup available the system can be restored from it quickly without having to redo all the vehicle setups. To backup the database, follow the procedure below:

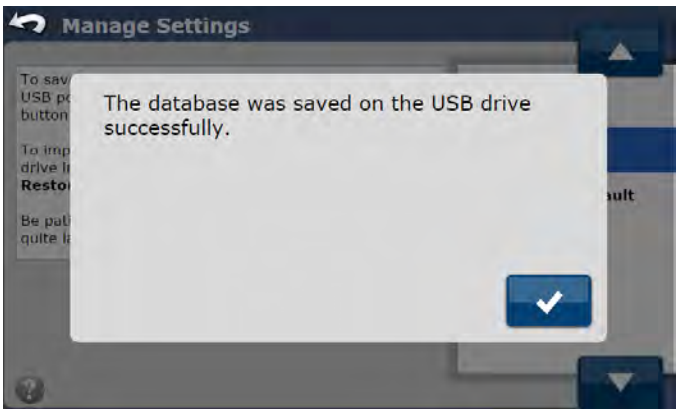
1. If necessary, insert an external storage device (USB drive, SD card, etc.) to the Display external storage interface port.
2. From the *System* tab, press the **Manage Settings** button, highlight **Database** from the list on the right, and then press the **Backup to Display USB** button.
3. The saving process begins and depending on Display a progress window may appear. Allow the file to be saved to the Display storage device. It can take about a minute.

**Figure 4-11 Database File Download**




4. The system will notify when the database has been saved. Press the **Blue Check** button to acknowledge it. The backup is complete. Store the backup in a safe place for future use.

**Figure 4-12 Database Backup Complete**




The database file is saved on Display storage under name of ecu-s1dbbackup_YYYY-MM-DD-HH-mm-SS.sqlite, where YYYY is a year, MM is a month, DD is a day, HH is an hour, mm is a minutes and SS is a number of seconds. On typical tablet file will be saved in /Download folder. Please check in your Display manual for exact location of the file.

The database file is about 2 MB. It is recommended to compress it (use WinZIP, 7-Zip, TGZ, etc.) before sending to an AutoSteer dealer.

## Restore from Display USB

The restore feature allows loading all database settings from a previously saved file. The feature works only on the database file that was saved from the same unit (i.e. with the same serial number and the same software version).

To restore the system ECU-S1 database follow the procedure below:

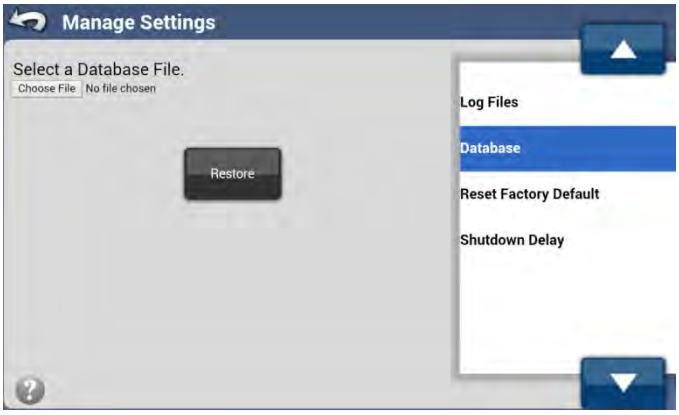
---

**Note:** All data on the ECU-S1 will be replaced with the database that is restored. All existing data will be lost on the ECU-S1.

---

1. If necessary, insert an external storage device (USB drive, SD card, etc.) to the Display external storage interface port.
2. From the *System* tab, press the **Manage Settings** button, highlight **Database** from the list on the right, and then press the **Restore from Display USB** button.
3. Press the **Choose File** button to locate the database to import.

**Figure 4-13 Selecting a Database File**

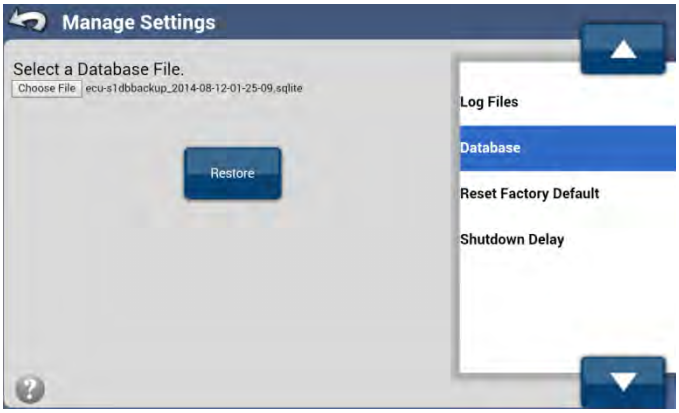



4. As required by your Display navigate (browse) through the file selection menu and select database file to restore. *Figure 4-14* below shows file selection example on Android based tablet.

**Figure 4-14 Select Database File to Restore**

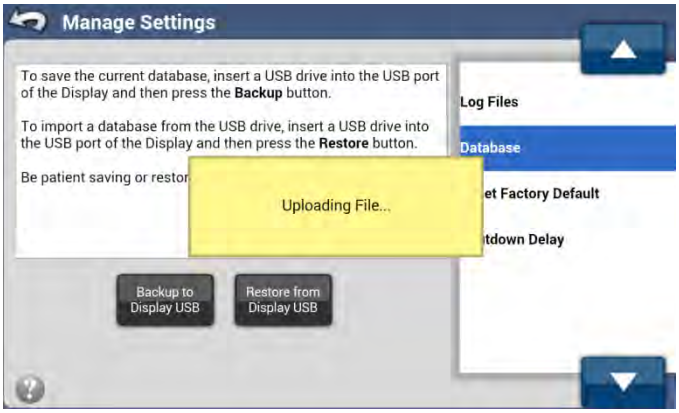
5. Once the file has been selected, press the **Restore** button to start the process.

**Figure 4-15 Database File Ready to Restore**



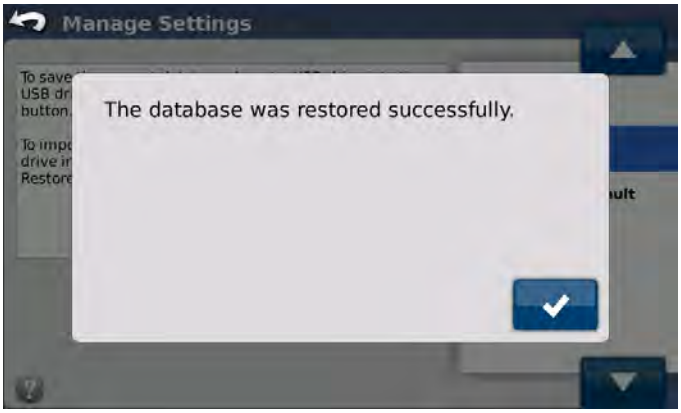

6. The restore will begin. The process will take a couple of minutes. Do not touch the system while the restore is taking place.

**Figure 4-16 Uploading Restore File**




7. The system will notify when the database has been restored. Press the **Blue Check** to acknowledge it. The restore is complete.

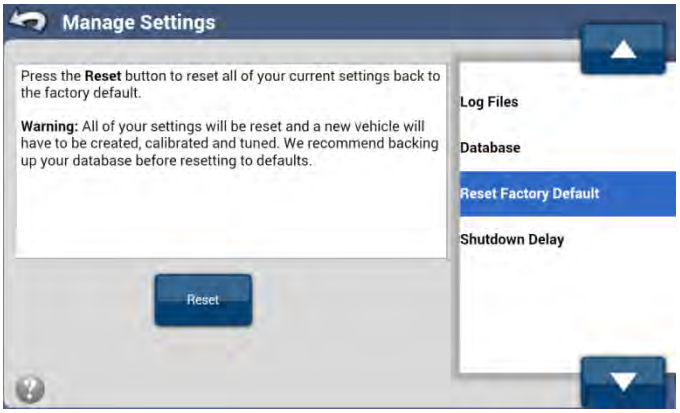
**Figure 4-17 Database Restore Complete**



# *Reset To Factory Default*

There may be occasions when it is necessary to restore an ECU-S1 system back to the Factory Default settings. For example, this could be necessary if the system is transferred to a new owner.

**Figure 4-18 Reset To Factory Default**




There is only one choice in the *Reset Factory Default* section.

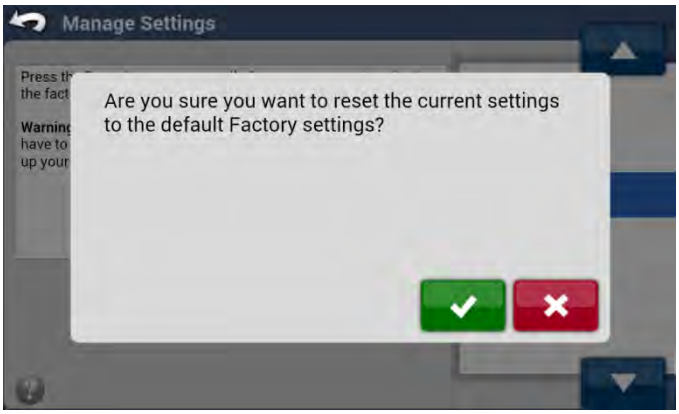
- **Reset** – Pressing this button will return the ECU-S1 system back to factory default settings.

**Note:** Resetting the system to factory default will erase all current settings including vehicle profiles and GPS configuration. However, *Feature Codes* are preserved. It is strongly suggested to backup the database using the procedure provided on *Page 75* prior to resetting to factory default settings.

## Reset

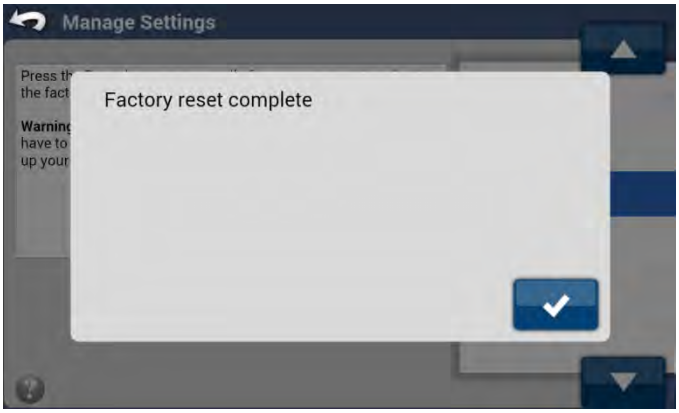
1. From the *System* tab, press the **Manage Settings** button, highlight **Reset Factory Default** from the menu list on the right, and then press the **Reset** button. A reset warning message will be displayed.
2. Press the **Green Check** button to start the reset. Press the **Red X** button to cancel the reset.

**Figure 4-19 Factory Reset Warning**



3. The system will notify when the system has been restored. Press the **Blue Check** to acknowledge it. The reset is complete.

**Figure 4-20 Factory Reset Complete**



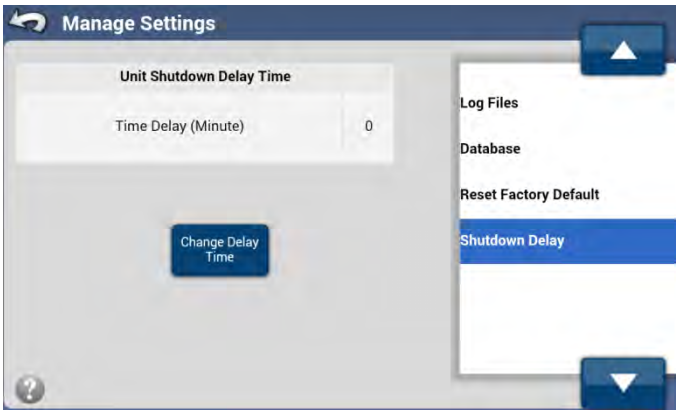

## *Shutdown Delay*

The Shutdown Delay feature allows the ECU-S1 to keep running for a set period of time after power signal has been deactivated. This feature can be used to keep system "warmed up" and GPS powered during short breaks. The maximum shutdown delay time is 2 hours.

There is only one choice in the *Shutdown Delay* section.

- **Change Delay Time** – Pressing this button will allow to set delay time.

**Figure 4-21 Shutdown Delay**

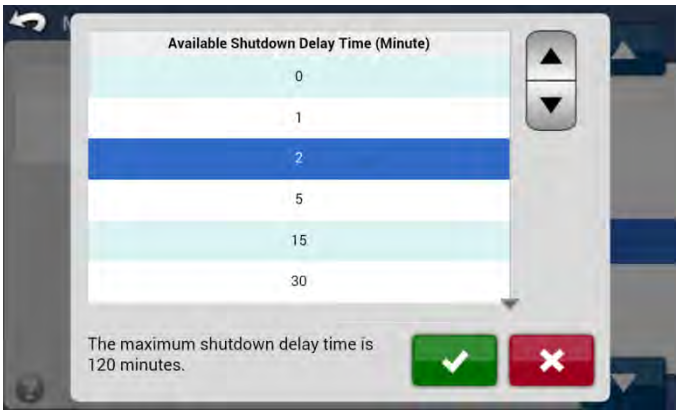



## Change Delay Time

1. From the *System* tab, press the **Manage Settings** button, highlight **Shutdown Delay** from the menu list on the right, and then press the **Change Delay Time** button. A pop-up window with a list of available times will be displayed.

2. Select desired time from a list using gray up and down arrows or by pressing directly on the item in the list. Press the **Green Check** button to save the value. Press the **Red X** button to cancel the operation.

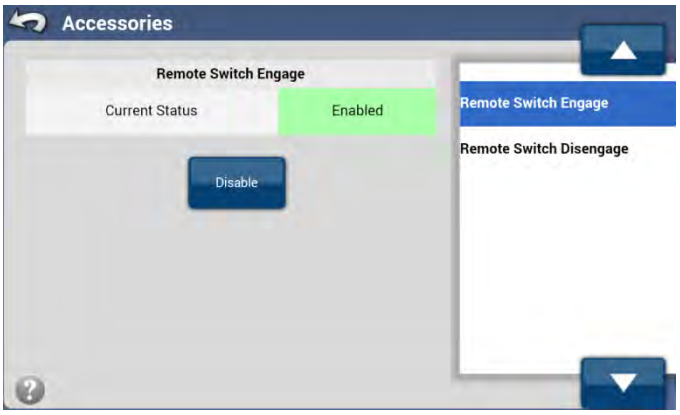
**Figure 4-22 Setting Shutdown Delay Time**




# Accessories

The ECU-S1 was designed to allow additional accessories to be developed and attached to it over time if new ones arise. The *Accessories* menu is used to manage these optional attachments.

**Figure 4-23 Accessories**




Currently there are two options available for ECU-S1. Additional accessories may be added in the future. The available accessories are:

- **Remote Switch Engage** – Allows the operator to use a Remote Switch to engage AutoSteering.
- **Remote Switch Disengage** – Allows the operator to use a Remote Switch to disengage AutoSteering.

## Remote Switch Engage

The *Remote Switch Engage* option allows the operator to connect an external device (foot switch, rocker switch, toggle switch, etc.) to the ECU-S1 harness. The operator can then use the external switch to Engage AutoSteer by pressing the switch. This allows the operator an easier way to Engage AutoSteer so they do not have to reach up to the Display every time and press the on screen button.

The *Remote Switch Engage* accessory is by default disabled. The *Remote Switch Engage* accessory option will show the operator the Current Status (Enabled or Disabled) of the switch and provide the operator a way to change that status. This screen has one option:

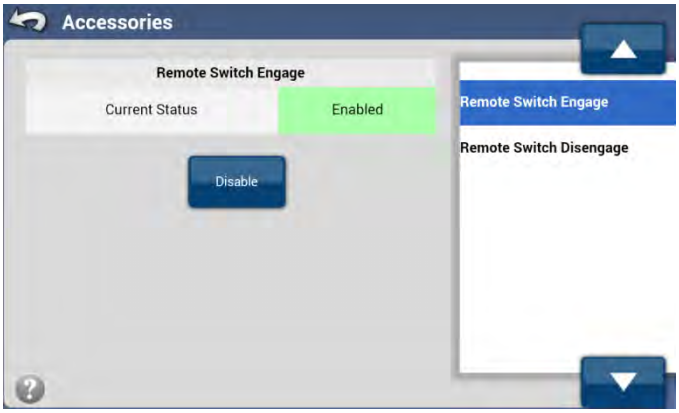
- **Enable (Disable)** – This button switches between the two states after you push it. It enables or disables the **Remote Switch Engage** option.

## Enable (Disable)

To Enable or Disable the Remote Switch Engage, follow the instructions below:

1. From the *System* tab, press the **Accessories** button, highlight **Remote Switch** from the list on the right, and then press the **Enable (Disable)** button.
2. Once the **Enable (Disable)** button has been pressed, the button will change to the opposite of what it was and the **Current Status** will be updated.

**Figure 4-24 Remote Switch Engage**




**Note:** Disabling Remote Switch Engage function also disables Remote Switch Disengage function.

## Remote Switch Disengage

The *Remote Switch Disengage* option allows the operator to connect an external device (foot switch, rocker switch, toggle switch, etc.) to the ECU-S1 harness. The operator can then use the external switch to Disengage AutoSteer by pressing the switch. This allows the operator to Disengage AutoSteer.

The *Remote Switch Disengage* accessory is by default disabled. The *Remote Switch Disengage* accessory option will show the operator the Current Status (Enabled or Disabled) of the switch and provide the operator a way to change that status. This screen has one option:

- **Enable (Disable)** – This button switches between the two states after you push it. It enables or disables the **Remote Switch Disengage** option.

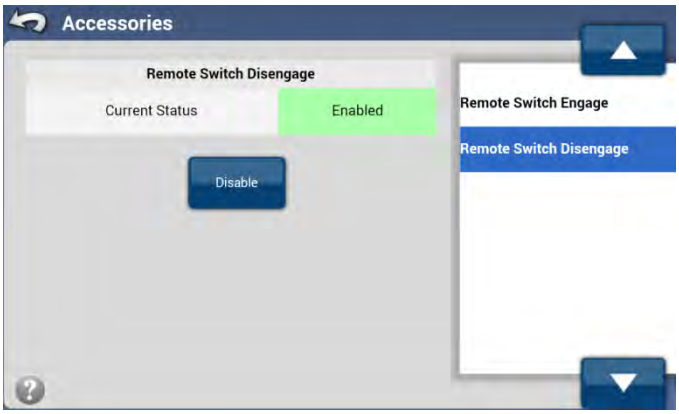
## Enable (Disable)

To Enable or Disable the Remote Switch Disengage, follow the instructions below:

1. From the *System* tab, press the **Accessories** button, highlight **Remote Switch Disengage** from the list on the right, and then press the **Enable (Disable)** button.

2. Once the **Enable (Disable)** button has been pressed, the button will change to the opposite of what it was and the **Current Status** will be updated.

**Figure 4-25 Remote Switch Disengage**




**Note:** Enabling Remote Switch Disengage function also enables Remote Switch Engage function.

# Technician

The Technician screen is password protected. Entry past this screen requires proper training and is only to be used by qualified service technicians. There are no normal operation options required by operators in this screen.

**Figure 4-26 Technician Screen Access Protected by Password**

# Software Upgrade

**Note:** When using the WiFi or Ethernet connection to a Tablet or Laptop the Tablet or Laptop is considered the Display.

The Software Upgrade screen enables the operator to upgrade the ECU-S1 to new versions as the new application software bundles are released. It is recommended to upgrade system to the latest software release to get new features and improvements.

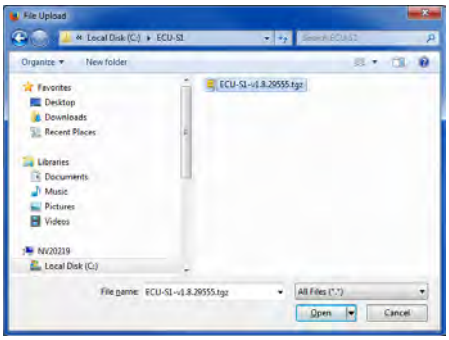
**Figure 4-27 Software Upgrade Screen (shown on Windows PC with Firefox browser)**


## *Software Upgrade Procedure*

Use the following procedure to upgrade a ECU-S1 to the latest version.

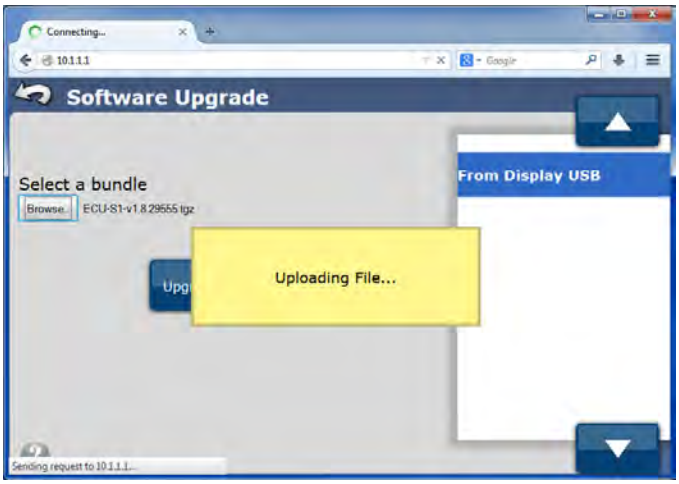
1. Acquire the latest ECU-S1 upgrade file from your AutoSteer Dealer.
2. Save the upgrade file onto a Display storage device (Display internal storage, USB drive, SD card, etc.).
3. If necessary, insert an external storage device (USB drive, SD card, etc.) to the Display external storage interface port.
4. From the *System* tab, press the **Software Upgrade** button.
5. From the *Software Upgrade* screen, press the **Choose File** button shown in *Figure 4-27*.
6. As required by your Display navigate (browse) through the file selection menu and select upgrade file to load. *Figure 4-28* below shows file selection example on Windows PC with Firefox browser.

**Figure 4-28 Select Software Bundle**



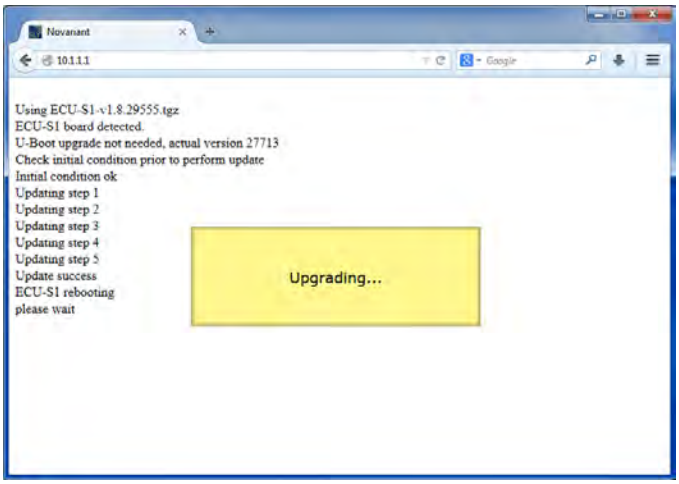
7. Press the **Upgrade** button to begin the upgrade.

**Figure 4-29 New Software Uploading in Progress**



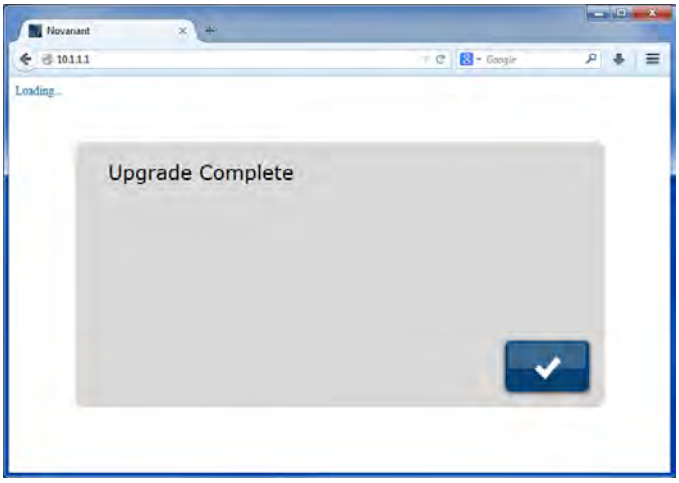

8. The system will begin the upload of the upgrade file to the ECU-S1. This process will last about a minute or two.
9. The system will then go through the upgrade process and show the progress of the upgrade on the screen. This process can take about 10 to 15 minutes.

**Figure 4-30 Software Upgrading in Progress**



10. When the upgrade is complete, the ECU-S1 will reboot and then the Upgrade complete screen will display. Press the **Blue Check Mark** button to acknowledge. The upgrade is complete.

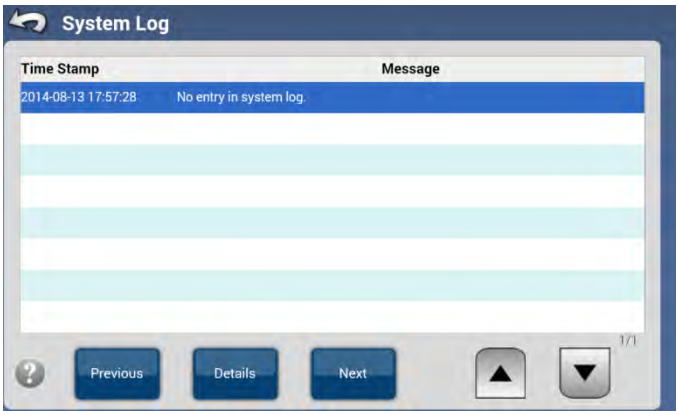
**Figure 4-31 Upgrade Complete**




# System Log

The *System Log* menu will display steering or GPS information that can be used for troubleshooting.

**Figure 4-32 System Log**




If necessary, contact your AutoSteer dealer for assistance with any *System Log* information.

# GPS Tab Menu Operations

## Overview

The *GPS* menu enables the operator to configure the ECU-S1 to work with many different external GPS and GNSS receivers and monitor their data.

**Figure 5-1 AutoSteer Setup GPS Tab**


Note: For approved External GPS and GNSS receivers please contact your AutoSteer Dealer

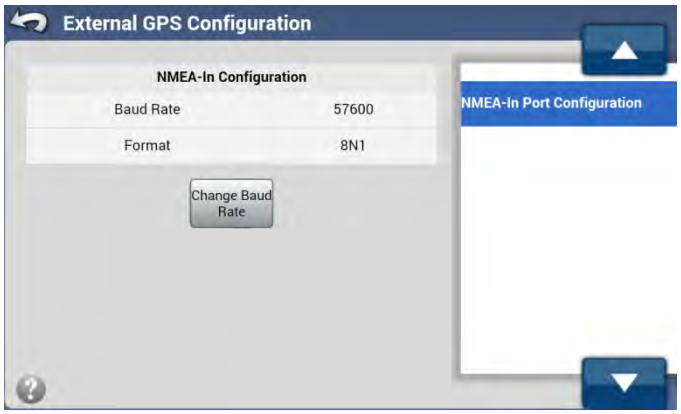
To access the *GPS* menu, refer to your *Display Operator's Manual* for instructions on accessing the *AutoSteer Setup* screens. Once there, press the GPS tab.

Each of the following menu options are explained in detail in this chapter.

- **GPS Setup** – Displays the current baud rate for communication with the external GPS source and the ability to change the Baud Rate.
- **GPS Diagnostics –** Provides information for diagnosing a possible GPS issues
- **Precision Settings** - Provides options to set a minimum GPS position quality required for AutoSteering

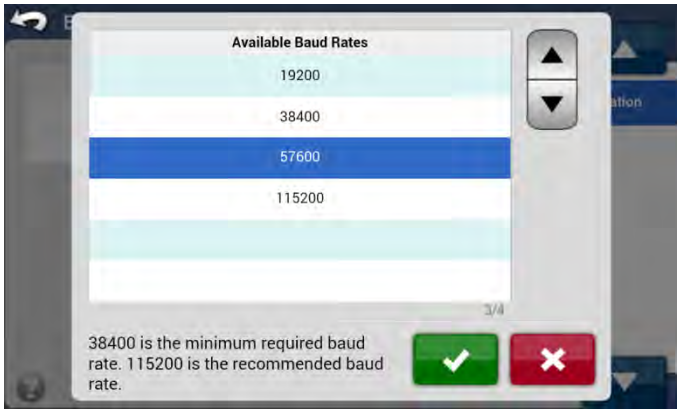
# GPS Setup

**Figure 5-2 NMEA-In Port Configuration**




The *External GPS* Configuration screen provides the necessary information and configuration options needed to establish communication with an external GPS source.

**Figure 5-3 Available Baud Rates**




Selecting the *Change Baud Rate* button allows the operator to access the *Available Baud Rates* menu. In the *Available Baud Rates* screen highlight the desired Baud Rate and press the Green check button to accept the selected value.

**Note:** A minimum baud rate of 38400 bps is required, 115200 bps is recommended.

# GPS Diagnostics

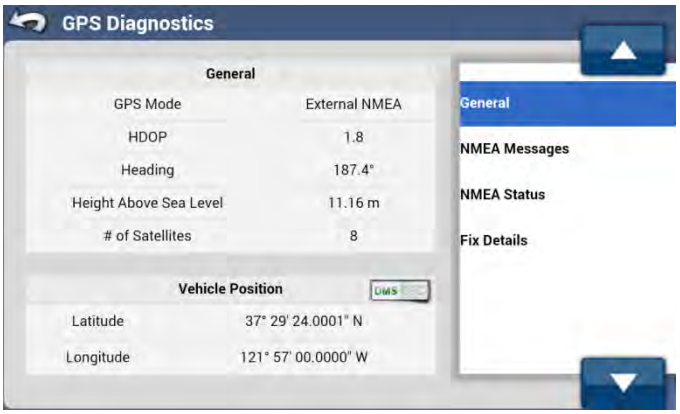
The *GPS Diagnostics* screen provides information about the quality of the GPS signals. The information provided can help to troubleshoot GPS reception problems. There are three options available in the *GPS Diagnostics* screen:

- **General** – Provides the basic information about the GPS data.
- **NMEA Messages** – Displays raw NMEA messages from GPS receiver
- **NMEA Status** - Displays GPS status, data source and computed position quality
- **Fix Details** - Provides additional information about GPS differential corrections source

To access *GPS Diagnostics* screen, press the GPS Diagnostics button from the *GPS* screen.

# General

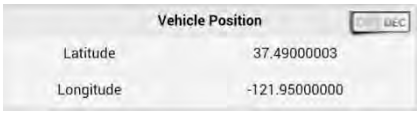
**Figure 5-4 GPS Diagnostics General**




The *General* screen displays following information:

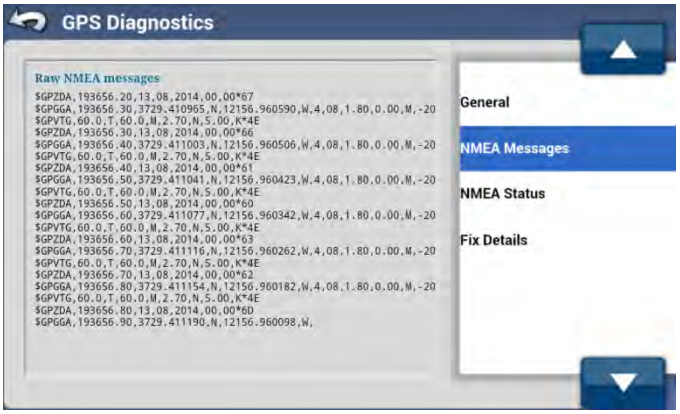
- **GPS Mode** – The current GPS mode the system is operating in.
- **HDOP** – (Horizontal Dilution of Precision) is a measure of the strength of the satellites scatter. When the satellites are close together, their geometry is not favorable for position calculations and the HDOP value is high; when their geometry is favorable and they are far apart, the HDOP value is low. Thus a lower HDOP value represents a better GPS position accuracy.
- **Heading** – Displays the heading the vehicle is facing or traveling in degrees.
- **Height Above Sea Level** – Shows the Vehicle's altitude above mean sea level (MSL).
- **# of satellites** – Displays the number of satellites being used in calculating the current position by the system.
- **Vehicle Position** – Vehicle position in latitude and longitude. Display format might be changed between Degrees, Minutes and Seconds (DMS) and degrees with fractional part (DEC) by pressing desired side of the **DMS/DEC** switch.

**Figure 5-5 Vehicle Position in DEC format**




# NMEA Messages

**Figure 5-6 NMEA Messages**




The *NMEA Messages* screen displays the raw NMEA messages that the ECU-S1 system is receiving form the GPS receiver.

# *NMEA Status*

**Figure 5-7 NMEA Status with GPS receiver connected directly**

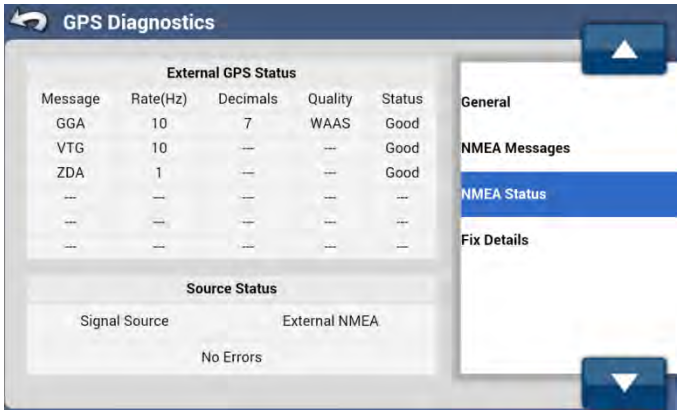
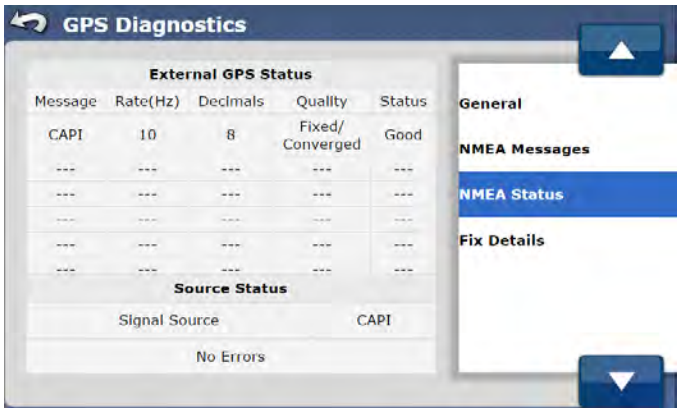



**Figure 5-8 NMEA Status with position data provided by Display over CAPI interface**

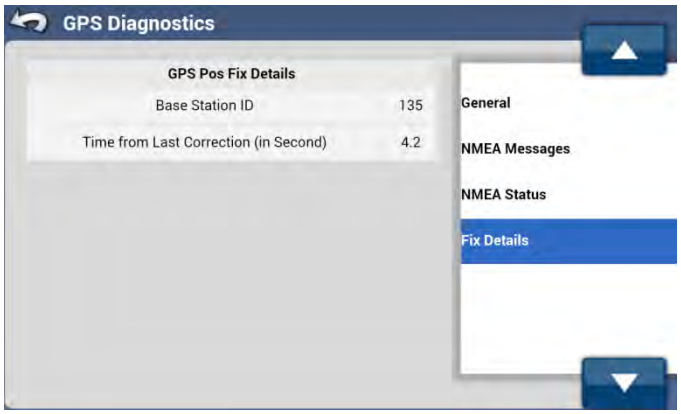



The *NMEA Status* screen displays the status and information of the NMEA messages received from the GPS receiver.

- **Message:** Type of message received NMEA or CAPI
- **Rate (Hz):** The frequency message is being received at
- **Decimals:** The number of decimal points it is receiving from the NMEA message
- **Quality:** The quality of signal it is receiving. RTK (Fixed/Converged), WAAS (shown for all SBAS DGPS), OmniSTAR
- **Status:** The status of the signal quality
- **Signal Source:** Indicates the source of the GPS data

## *Fix Details*

**Figure 5-9 Fix Details**




The *Fix Details* screen displays additional information about position data.

- **Base Station ID:** Differential reference station ID (as reported in NMEA GGA message).
- **Time from Last Correction:** Time in seconds from the last received corrections.

# Precision Settings

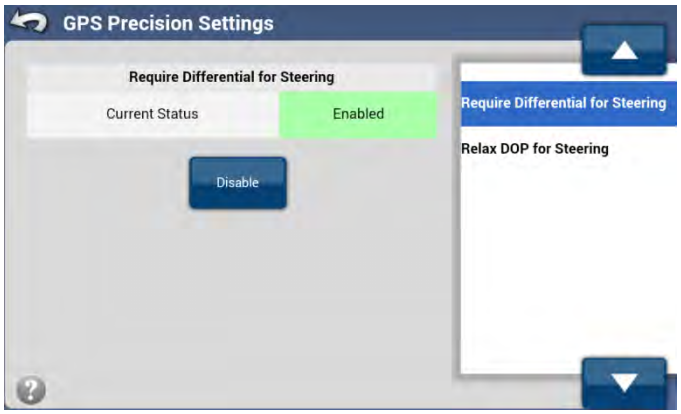
The *Precision Settings* allows configuring minimum GPS position quality requirements for AutoSteering. There are two options available:

- **Require Differential for Steering**
- **Relax DOP for Steering**

To access *Precision Settings* screen, press the Precision Settings button from the *GPS* tab.

## *Require Differential for Steering*

**Figure 5-10 Require Differential for Steering**



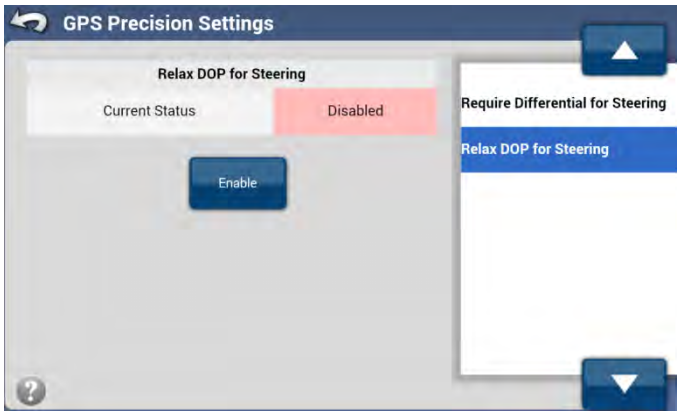

When *Require Differential for Steering* is enabled system requires a DGPS or better (like RTK) position quality to allow AutoSteering. When disabled the system will allow AutoSteering with standard GPS quality (SPS).This option might be used with some GPS/GNSS receivers that report position quality 1 in NMEA GGA message even when position quality is good enough for steering (ex. receivers with GLIDE technology).

By default this setting is enabled. To change the settings press Disable or (when disabled) Enable button.

- **Current status:**
  - **Enabled:** only GPS position with quality 2 (DGPS) or 4 (RTK Fixed/Converged) will allow AutoSteer to engage.
  - **Disabled:** Additionally, GPS position with quality 1 (SPS) or 5 (RTK Float/Converging) will also allow AutoSteer to engage.

## *Relax DOP for Steering*

**Figure 5-11 Relax DOP for Steering**




The *Relax DOP for Steering* setting determines what the highest HDOP value allowed to AutoSteer is. The HDOP is a measure of GPS position quality and AutoSteering automatically disengages when *HDOP* value goes above the limit. This option might be used for certain natural terrain cases where GPS signal reception is degraded (trees, mountains) but received position quality is still good enough for steering.

By default this setting is disabled. To change the settings press Enable or (when enabled) Disable button.

- **Current status:**
  - **Disabled:** HDOP values lower than 3 are required for AutoSteer.
  - **Enabled:** HDOP values lower than 5 are required for AutoSteer.

# Connections Tab Menu Operations

## Overview

The *Connections* tab displays the available connection options.

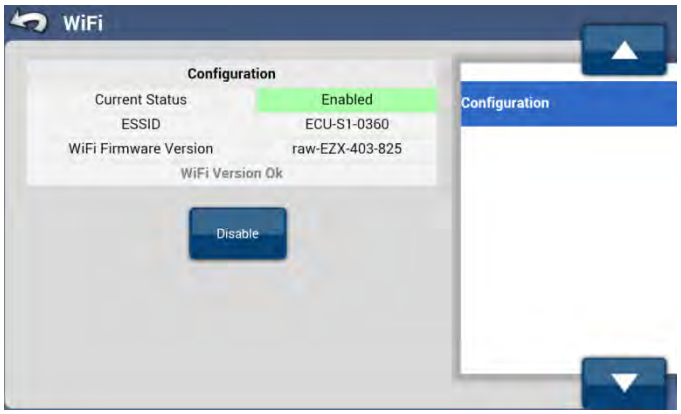
**Figure 6-1 AutoSteer Setup Connections Tab**


To access the *Connections* menu, refer to your *Display Operator's Manual* for instructions on accessing the *AutoSteer Setup* screens. Once there, press the **Connections** tab.

- **WiFi** - Gives access to WiFi network status and control.

# WiFi

**Figure 6-2 WiFi Configuration**

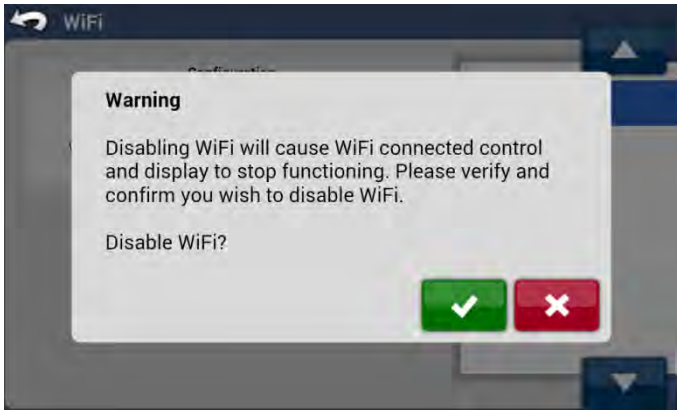



The *Configuration* screen displays status of the ECU-S1 WiFi access point and allows to enable or disable WiFi networking.

- **Current Status:** Displays the status of the WiFi access point. It can be Enabled or Disabled.
- **ESSID:** Displays the name of the WiFi network.
- **WiFi Firmware Version:** Displays the WiFi module firmware version.

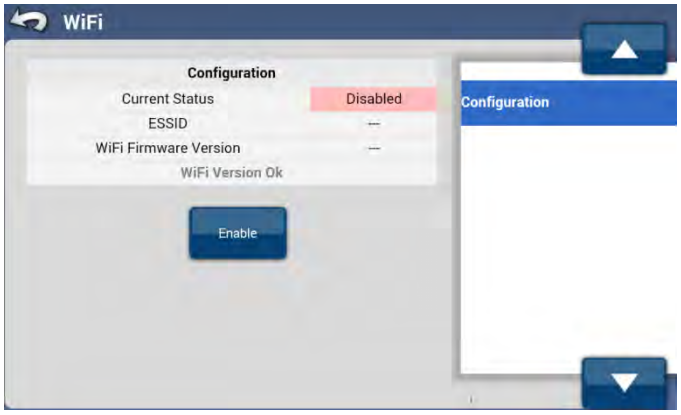
By default WiFi is enabled. To change the settings press **Disable** or (when disabled) **Enable** button.

**Figure 6-3 Disable WiFi**




When the operator presses the **Disable** button a popup message will be displayed warning that disabling the WiFi will cause certain functions to stop working.

**Figure 6-4 Enable WiFi**




If the WiFi communication has been disabled the operator can enable it by pressing the **Enable** button.

# My Account Tab Menu Operations

## Overview

The *My Account* menu provides access to the steering controller details and feature codes.

**Figure 7-1 AutoSteer Setup My Account Tab**

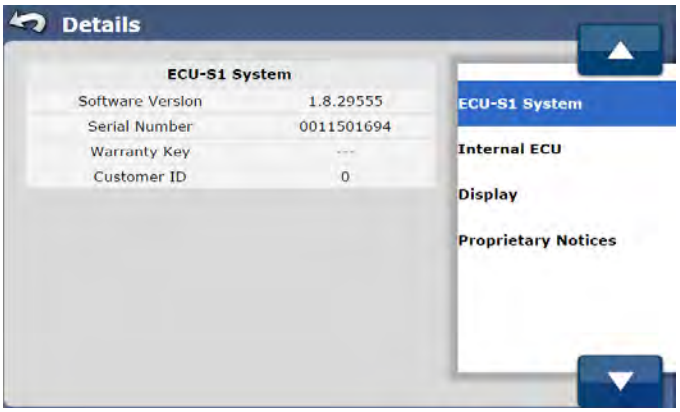

To access the *My Account* menu, refer to your *Display Operator's Manual* for instructions on accessing the *AutoSteer Setup* screens. Once there, press the **My Account** tab.

- **Details** – Gives access to detailed summary of information about the system components.
- **Feature Code** – Enables operator to enter already purchased unlock codes to activate optional system features.

# Details

The *Details* screen provides detailed information that may be required by support personnel when support is requested.

**Figure 7-2 Details**




The *Details* screen provides information on the following system components:

- **ECU-S1 System** – Provides the Software Version, Serial Number, and Warranty Key and Customer ID for the ECU-S1 Unit.
- **Internal ECU** – Provides the Firmware Version, and Serial Number of Internal ECU.
- **Display** – Provides the Display Software Version, Display Serial Number, and Display Type.
- **Proprietary Notices** – Provides legal notices.

To access the *Details* screen:

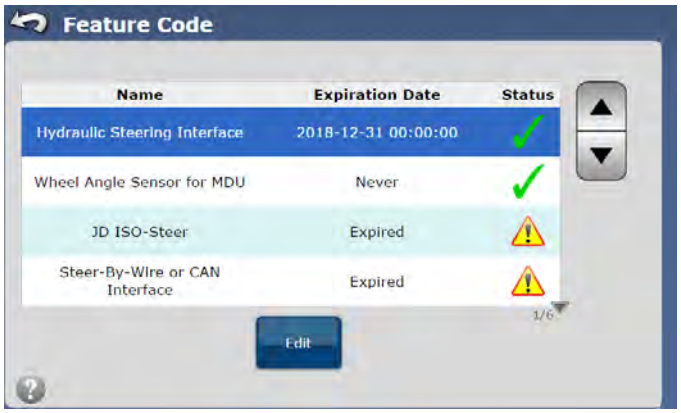
1. From the *My Account* menu, press the **Details** button.
2. Use the **Blue Up/Down Arrows** or directly select the item to view in the *Details* screen. The information about the selected item will appear.

**Note:** If a device is not present or not working properly, the data for each device will show blanks.

# Feature Code

The *Feature Code* screen displays all the optional features that can be activated on the ECU-S1 system. These *Feature Codes* can be purchased at any time. *Feature Codes* add additional capabilities and functionality to the ECU-S1 system that may be useful to the owner.

**Figure 7-3 Feature Code**




- **Hydraulic Steering Interface:** Activates the ECU-S1 to operate when directly connected to aftermarket hydraulic steering valve.
- **Wheel Angle Sensor for MDU:** Activates use of wheel angle sensor with mechanical drive unit. WAS sensors improves steering accuracy.
- **JD ISO-Steer:** Activates option to use a ECU-S1 with John Deere factory installed steering system when the ECU-S1 is being connected directly to the ISO Bus on the vehicle. This feature also requires an activated Steer-By-Wire feature code.
- **Steer-By-Wire or CAN Interface:** Activates use of following steering capabilities:
  - **AccuGuide Ready** – This represents a factory installed steering system used by CaseIH.
  - **Auto-Guide2** – This is used to communicate to the ISO Bus of vehicles under the AGCO manufacturing umbrella. Vehicle makes in this group include AGCO, Challenger, Fendt, Gleaner, Massey Ferguson, and others using the same ISO Bus communications hardware.
  - **AutoTrac Ready** – This represents a factory installed steering system used by John Deere if the ECU-S1 is being connected directly to the sensors and valves on the vehicle.
  - **Vehicle – CAN** This is used for vehicles that use a standard ISO Bus interface such as for Challenger Track and Articulated vehicles and Krone to interface directly with the vehicles CAN Bus.
  - **IntelliSteer Ready** - This represents a factory installed steering system used by New Holland.
- **Precision Steering:** This Enables the RTK correction feature.
- **SimpleSteer:** Activates SimpleSteer™ operator interface.

The *Feature Code* screen displays all available feature codes, expiration date, and their current status. The operator can activate features for which feature codes have been purchased. In the Status column following icons are shown:

**Table 7-1 Feature Code Status Icons**

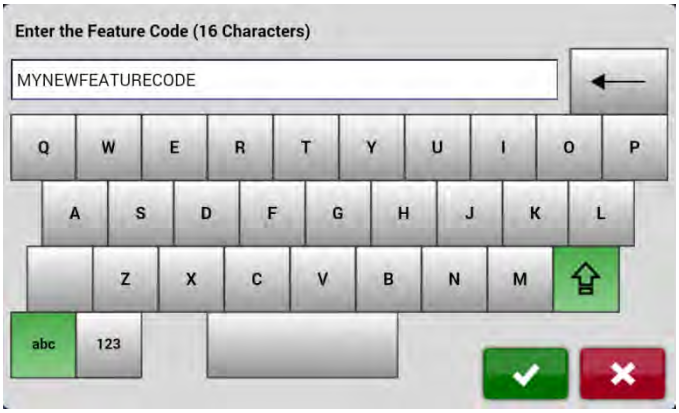
| Icon | Description |
|---|---|
| ✓ | **Activated** – The *Feature Code* is active |
| ⚠ | **Expired** – The *Feature Code* was activated but has already expired |
| ⊗ | **Never Activated** – The *Feature Code* has never been activated |

# Activating a Feature Code

To activate a new *Feature Code* follow the procedure below:

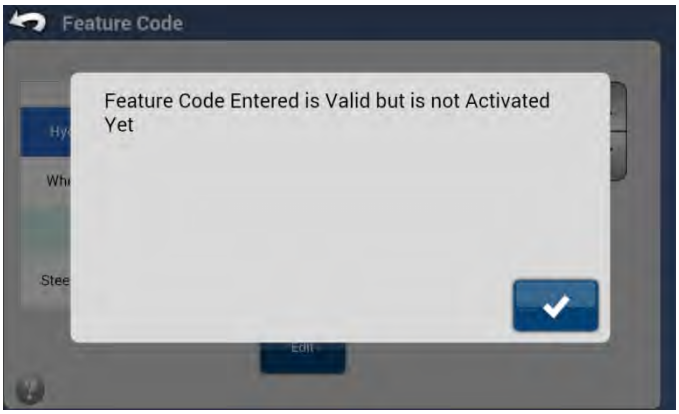
1. From the *My Account* tab menu press the **Feature Code** button.
2. Use the **Gray Up/Down Arrow** buttons or directly select an item you wish to activate.
3. Press the **Edit** button.
4. Enter the *Feature Code* and press the **Green Check** button to accept the *Feature Code* or press the **Red X** to cancel. Feature code can contain letters and numbers and is case sensitive.

**Figure 7-4 Enter the Feature Code Unlock**



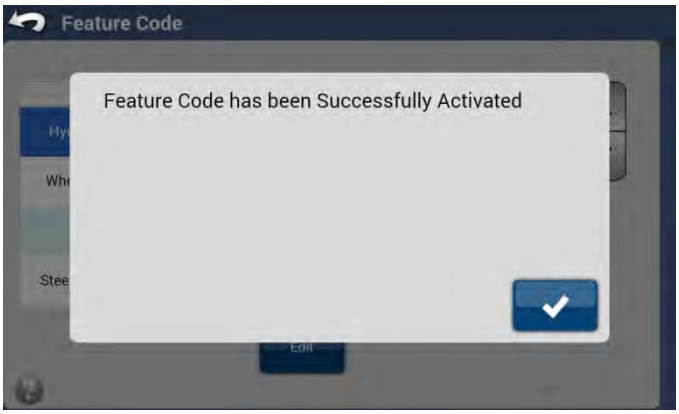

5. The ECU-S1 requires a valid GPS time to activate the newly entered feature code. If the code is entered but GPS time is not available system will display a note "Feature Code Entered is Valid but is Activated Yet" and will wait for the GPS time. Press the **Blue Check** button to return to the *My Account* menu.

**Figure 7-5 Feature Code Valid but Not Activated Yet**



**6.** If the code entered with a valid GPS time, a pop-up window appears informing operator that the *Feature Code* has been successfully activated. Press the **Blue Check** button to return to the *My Account* menu.

**Figure 7-6 Feature Code Activated**



# Technical Specifications

| | |
|---|---|
| **Display Support** | |
| Interface Options | Ethernet (10/100 Mbit/s), WiFi (IEEE 802.11 b/g), RS-232 |
| Protocols | HTTP, CAPI |
| Languages | English, German, French, Danish, Dutch, Spanish, Portuguese, Hungarian, Russian, Simplified Mandarin |
| **GPS / GNSS Receiver Support** | |
| Interface Options | RS-232 (Rx and Tx lines only), Ethernet (from Display), WiFi (from Display) |
| Protocols | NMEA, CAPI |
| **Vehicle Connectivity** | |
| CAN Ports | Two ISO 11898 compatible ports |
| Steer-By-Wire, MDU Control | Turning speed and direction |
| **Sensors Support** | |
| Wheel Angle Sensor | Analog input, CAN |
| Internal Sensors | 3-axis gyroscope, 3-axis accelerometer, 3-axis magnetometer, temperature |
| Remote engage/disengage | Digital input |
| **Indicators** | |
| LED | Four bi-color (green/amber) LEDs |
| **Environmental** | |
| Operating Temperature | -20°C to 60°C (-4°F to 140°F) |
| Storage Temperature | -40°C to 85°C (-40°F to 185°F) |
| Humidity | 95% non-condensing |
| Immunity | EN61000-6-2, FCC Part 15 Class A |
| Emissions | FCC Part 15 Class A, EN55022 Class A |
| Safety Certifications | EN60950 x, FCC, Industry Canada, RoHS, CE, C-Tick |
| **Mechanical** | |
| Enclosure protection | IP-67 |
| Dimensions | 153 mm x 147 mm x 57 mm (6.0" x 5.8" x 2.3") |
| Weight | 0.54 kg |
| Mounting Options | Fixed, four #8-32 x 1/2" hex screws |
| Connectors | 18-pin Male (power, display, CAN and GPS), 30-pin Male (for vehicle interface) |

| **Power** | |
|---|---|
| Supply Voltage | 9 - 16 V DC |
| Power Activation Control Signal | 5 - 16 V DC |
| Operation Current Draw | 0.25 A typical with no load |
| Quiescent Current Draw | 0.01 A typical |
| Recommended fuse on supply line | 10 A (Littelfuse 0287010 or equivalent) |

# Appendix

## Transferring ECU-S1 from one vehicle to another

The ECU-S1 system is designed to be easily transferred from one vehicle to another. Specific vehicle kits are available that can be installed on each vehicle so that only the Display, GPS/GNSS Receiver, and ECU-S1 need to be transferred. Each vehicle that the ECU-S1 system is to be transferred to should have the Display Harness, Power Harnesses, and Vehicle Harnesses already installed. Contact your AutoSteer dealer for information about obtaining and installing additional vehicle specific kits. Use the instructions in this section to transfer the ECU-S1 from one vehicle to another. Refer to the Display and GPS/GNSS receiver manuals for instruction on moving them.

**Figure 9-1 ECU-S1 Installation**

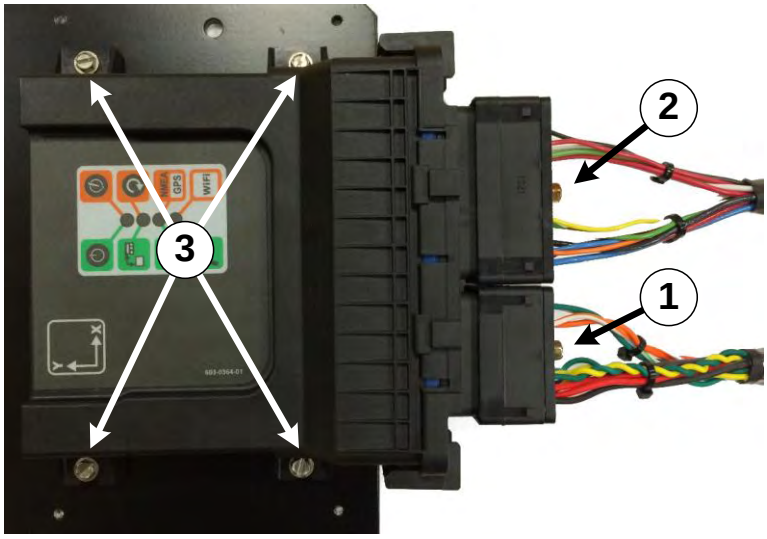



*Figure 9-1* shows ECU-S1 installed on the metal bracket with main and vehicle specific harnesses connected.

**Table 9-1 ECU-S1 Installation**

| Item | Description |
|---|---|
| 1. | Main Harness connector |
| 2. | Vehicle Specific Harness connector (optional, depends on installation) |
| 3. | Four 8-32 x 1/2 hex mounting screws |

### *Tools Required*

To remove ECU-S1 from one vehicle and install it in another vehicle only one tool is required: 1/4 inch nut driver.

## Removing the ECU-S1 from a Vehicle

1. Turn off and disconnect power from the AutoSteer system.
2. Disconnect the Main Harness connector from the ECU-S1 by unscrewing the hex screw on the connector.
3. If present, disconnect the Vehicle Specific Harness connector from the ECU-S1 by unscrewing the hex screw on the connector.
4. Remove the four ECU-S1 mounting screws. This releases the ECU-S1 from the vehicle mounting bracket so it can be moved to another vehicle. Keep screws safe for future use.
5. Remove the Display from the cab using the instructions provided in the *Display Operator's Manual*.
6. Remove GPS/GNSS Receiver using the instructions provided in the *GPS/GNSS Receiver Operator's Manual*.

## Installing the ECU-S1 on to a Vehicle

1. Disconnect power from the AutoSteer system harness.
2. Install the Display in the cab using the instructions provided in the *Display Operator's Manual*.
3. Install the GPS/GNSS Receiver using the instructions provided in the *GPS/GNSS Receiver Operator's Manual*.
4. Attach the ECU-S1 to the mounting bracket with four 8-32 x 1/2 hex screws.

**Note:** For proper operation the ECU-S1 must be firmly attached to the vehicle. It must be mounted on the metal bracket to allow heat dissipation. Do not over-tighten the screws.

5. Attach the ECU-S1 Main Harness connector to the smaller connector on the ECU-S1 and tighten the screw.
6. If present, attach the Vehicle Specific Harness connector to the larger connector on the ECU-S1 and tighten the screw.

**Note:** Both connectors are keyed so they will only fit the proper receptacle of the ECU-S1 and in one orientation. The connectors should slide easily onto the receptacle. If they do not slide easily, check if the plug matches receptacle, there is no obstacle inside and pins are not bent. Do not force the connector into the receptacle as this could damage the connectors.

7. Power up the ECU-S1 system and navigate to the *AutoSteer Setup* screen. Use the **Manage Vehicles** button to select and activate the vehicle that the ECU-S1 system has been installed on. Refer to the *Manage Vehicle* section on *Page 32* for information on setting the active vehicle.

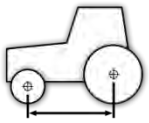
**Note:** It is always recommended to re-calibrate ECU-S1 after moving it to another vehicle.

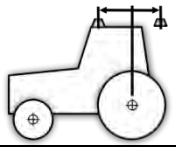
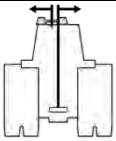
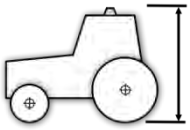
# Vehicle Profile Worksheet

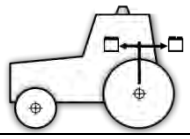
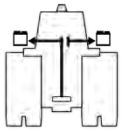
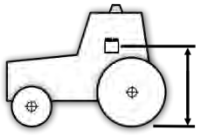
Please use this form to write down MFWD vehicle information before creating the new vehicle. Please contact your AutoSteer dealer for forms adequate for other vehicle types.

**Table 9-2 Vehicle Profile Worksheet**

| Vehicle Type | Vehicle Make | Vehicle Model | Controller Type |
|---|---|---|---|
| MFWD | | | □ MDU-G4<br>□ Hydraulic<br>□ ISO-Bus / CAN |

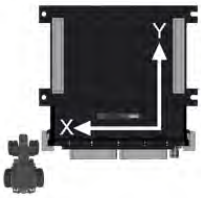
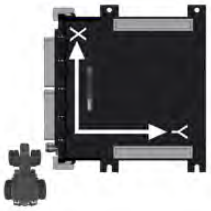
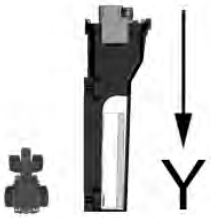
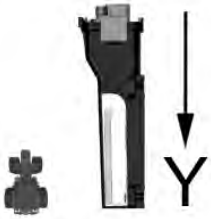
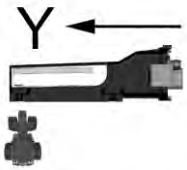
| Vehicle Name | Units Used | | Wheel Base |
|---|---|---|---|
| | □ Meters [m]<br>□ Centimetres [cm]<br>□ Feet [']<br>□ Inches ["] | |  |
| | | Measurement: | |

| GPS Antenna Location | Fore / Aft | Left / Right | Height |
|---|---|---|---|
| |  |  |  |
| Measurements: | □ Fore □ Aft | □ Left □ Right | |

| ECU-S1 Location | Fore / Aft | Left / Right | Height |
|---|---|---|---|
| |  |  |  |
| Measurements: | □ Fore □ Aft | □ Left □ Right | |

| ECU-S1 Orientation | | | |
|---|---|---|---|
| Row And Column Per Table Below | | | |
| | **X Axis** | **Y Axis** | **Z Axis** |
| Angle Measurements If Tilted [deg]: | | | |

**Table 9-3 ECU-S1 Basic Orientations in the Vehicle**

|  | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| A |  |  |  |  |
| B |  |  |  |  |
| C |  |  |  |  |
| D |  |  |  |  |
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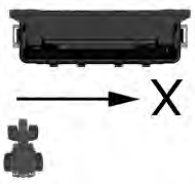
| F |  |  |  |  |

# Glossary

| Term | Description |
|---|---|
| 2D | Two-dimensional, horizontal |
| 3D | Three-dimensional |
| AB line | This is the manually entered guidance points used by an AutoSteer system to base future paths that the steering system must follow. In the simplest form, the AB line is represented by recording a GPS point at the start and the end of a swath across a field. The guidance line connect the two points in a straight line (no matter what the path of the vehicle). An alternative way to create an AB Line is to set an A Point and then choose the heading direction to go from that point. In both situations, all future steerable paths are straight and parallel to that original line at consistent swath widths |
| AC | **A**lternating **C**urrent |
| Accuracy | (Not the same as precision) It is a measurement of the closeness of one measurement to what the real or true value is. For example, how close is the measured GPS position to the actual GPS antenna position? For accuracy, measurement points are compared to the true or actual value and not with each other. The closer the measurements are to the true value, the more accurate the measurement is |
| Actuator | A mechanism by which an ECU turns a vehicle steering wheels |
| AutoSteer | Automatic vehicle steering |
| Baud Rate | A measure of data transmission speed in Bits per second. The higher the value, the faster data can be transferred per second. This rate must be matched between different devices that communicate with each other so they send and receive information at the same speed |
| bps | **b**its **p**er **s**econd, unit of baud rate |
| Byte | Packet of information made of 8 bits |
| CAN | **C**ontroller **A**rea **N**etwork – A vehicle communications standard originally developed for in-vehicle communications for networking intelligent devices |
| CAPI | **C**ustomer **A**pplication **P**rogramming **I**nterface. It defines communication protocol between Display and steering ECU.Customer Application Programming Interface. It defines communication protocol between Display and steering ECU |
| Convergence | The process of taking differentially corrected information from WAAS, EGNOS, OmniSTAR, etc. and improving the accuracy of the GPS position. Convergence is a process that may take many minutes to fully reach full accuracy levels |
| Cross-Track Error | This is the calculated distance between what the actual position is compared to what it should be (ex. how far off the current guidance path is the vehicle) |
| Curvature | This is a measure of the amount of change in heading an object has as compared to a straight line |
| DC | **D**irect **C**urrent |
| Dead Band | A range of a control signal when no action occurs in actuator |
| DGPS | **D**ifferential **G**lobal **P**ositioning **S**ystem – This is any system that utilizes Bases Stations at known geographic locations to improve GPS positioning accuracy |

| | |
|---|---|
| Display | Operator interface device with a screen and control capability. It connects with ECU to provide guidance for automatic vehicle steering functionality |
| DOD | **D**epartment **O**f **D**efense (USA) |
| DOP | **D**ilution **O**f **P**recision |
| ECU | **E**lectronic **C**ontrol **U**nit – This is a generic term for a device that controls one or more of the electrical systems or subsystems |
| ECU-S1 | Automatic Steering ECU |
| EGNOS | **E**uropean **G**eostationary **N**avigation **O**verlay **S**ervice – This is a space based GPS Correction source developed by the European Space Agency to augment the GPS and improve position accuracy. EGNOS is only available over Europe. The EGNOS satellites are geostationary and transmit correction data from ground based monitoring system to GPS receivers to provide real time, wide area corrected positions |
| ESSID | **E**xtended **S**ervice **S**et **I**dentifier (name of WiFi network) |
| Feature Code | These are unlock codes that allow additional features to be enabled/activated on the AutoSteer system |
| Fix | A state when the satellite positioning system has calculated its current location |
| GNSS | **G**lobal **N**avigation **S**atellite **S**ystem. Includes GPS, GLONASS, BeiDou (BDS) and Galileo satellites systems |
| GPS | **G**lobal **P**ositioning **S**ystem – This is a space based positioning system managed by the United States Department of Defense that uses a number of satellites to provide accurate position, velocity, and time data to suitably equipped GPS receivers. This allows the GPS receiver to accurately determine its location on the reliably almost anywhere on the planet |
| Gyro | Gyroscope, an electronic sensor that outputs a value that is proportional to the turning rate of the sensor over one or more axes |
| HDOP | **H**orizontal (2D) **DOP** |
| Hotspot | WiFi network access point |
| HTTP | **H**ypertext **T**ransfer **P**rotocol |
| Hz | Hertz – A measure of actions per second (ex. cycles per second) |
| ISO | **I**nternational **O**rganization for **S**tandardization – an organization which develops and publishes international standards to insure that products or services are safe, reliable and of good quality |
| Latitude | A geographic coordinate that specifies the north-south position of a point on the Earth's surface |
| LED | **L**ight-**E**mitting **D**iode – A semiconductor light source |
| Longitude | A geographic coordinate that specifies the east-west position of a point on the Earth's surface |
| MDU | **M**echanical **D**rive **U**nit |
| MDU-G4 | MDU device that attaches to the steering wheel |
| MFWD | **M**echanical **F**ront **W**heel **D**rive |
| MSL | **M**ean **S**ea **L**evel, an average level for the surface of Earth's oceans from which heights such as elevations may be measured |
| NMEA | **N**ational **M**arine **E**lectronics **A**ssociation – A group that provides a standard communication protocol for marine and GPS devices |
| NMEA 0183 | Serial communication protocol standard defined by NMEA for marine instruments. Widely adopted by all GPS/GNSS receiver manufactures. |
| OmniSTAR | Satellite based augmentation system (SBAS) service providerThis is a fee-based commercial SBAS service that provides differential GPS corrections to subscribers. OmniSTAR provides three levels of service: VBS, XP, and HP which provide different levels of accuracy for a fee |
| PDOP | **P**osition **D**ilution **o**f **P**recision – This is a calculated measure of the accuracy of a GPS signal that is affected by the number of satellites available and the positions of the satellites. PDOP is lower when more satellites are present and they are spread out from each other. Lower PDOP values provide more accurate GPS positions |

| | |
|---|---|
| Pitch | Rotation about the lateral (left to right) axis. The nose of the vehicle will dip or lift when vehicle pitches |
| Port | For network communications this is a software application or process the network can access and communicate with |
| PPP | **P**oint-to-**P**oint **P**rotocol |
| Precision | (Not the same as accuracy) It is the measurement of the closeness of multiple measurements to each other under unchanged conditions for each measurement. For example, how close are multiple GPS position points taken when they are taken in a static position. For precision, measurement points are compared to the other measurements taken of the same thing, but not to what the true value is. The closer the measurements are to each other, the more precise the measurements are. This is also often called as Repeatability |
| QZSS | **Q**uasi-**Z**enith **S**atellite **S**ystem, regional time transfer system and Satellite Based Augmentation System for the Global Positioning System, that would be receivable within Japan |
| Roll | Rotation about the longitudinal (front to rear) axis. The top part of the vehicle will lean to the left or to the right when vehicle rolls. |
| RPM | **R**evolutions **P**er **M**inute |
| RS-232 | Serial communication standard. This standard is commonly used in GPS/GNSS receivers and computer serial ports. |
| RTK | **R**eal **T**ime **K**inematic – This is a GPS correction technique that measures the actual radio waves from the GPS satellites as opposed to the information transmitted within the radio waves to calculate distances. This allows the position to be calculated much more accurately. RTK relies on local Base Stations to provide information about the GPS signals and to provide localized error correction |
| SBAS | **S**atellite-**B**ased **A**ugmentation **S**ystem – This is a generic term used to describe any GPS correction source that is provided by a satellite such as WAAS and EGNOS |
| Smart Antenna | A common name for a GPS/GNSS receiver with integrated antenna |
| SPS | **S**tandard **P**ositioning **S**ervice - a basic, autonomous (i.e. without any corrections) positioning mode of GPS. This is the lowest position accuracy mode of GPS. |
| SSID | **S**ervice **S**et **I**dentifier (name of WiFi network) |
| Steer-by-Wire | A type of steering solution where the steering wheel has no mechanical connection to the actuation of the steering actuators |
| UART | **U**niversal **A**synchronous **R**eceiver/**T**ransmitter |
| USB | **U**niversal **S**erial **B**us – An industry standard that defines the cables, connectors, and communications protocols used in a bus for connection |
| UTC | **U**niversal **T**ime **C**oordinated – Originally called Greenwich Mean Time, it is a coordinated time scale based on the 0 degree longitude meridian |
| WAAS | **W**ide **A**rea **A**ugmentation **S**ystem – This is a space based GPS correction source developed by the Federal Aviation Administration to augment the GPS and improve positional accuracy. WAAS is only available in North America. The WAAS satellites are geostationary and transmit correction data from ground based monitoring system to GPS receivers to provide real time, wide area corrected positions |
| WAS | **W**heel **A**ngle **S**ensor |
| Wheel Base | Distance between vehicle front and rear axles |
| WiFi | Local area wireless network technology |
| XTE | See **C**ross-**T**rack **E**rror |
| Yaw | Rotation about the vertical axis of the vehicle. The nose of the vehicle will turn left or right when vehicle yaws |