Outback eDriveX w/S3

User Guide

Part No. 875-0222-000 Rev D1

Outback® GUIDANCE by Hemisphere GPS

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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Patents

The Outback S™ and S-Lite™ automated navigation and steering guide systems are covered by U.S. Patents No. 6,539,303 and No. 6,711,501. The Outback Hitch™ automated hitch control system is covered by U.S. Patent No. 6,631,916. The Outback eDriveTC™ GPS assisted steering system is covered by U.S. Patent No. 7,142,956. Hemisphere GPS products may be covered by one or more of the following U.S. Patents:

6,111,549	6,397,147	6,469,663	6,501,346	6,539,303
6,549,091	6,631,916	6,711,501	6,744,404	6,865,465
6,876,920	7,142,956	7,162,348	7,277,792	7,292,185
7,292,186	7,373,231	7,400,956	7,400,294	7,388,539
7,429,952	7,437,230	7,460,942		

Other U.S. and foreign patents pending.

Notice to Customers

Contact your local dealer for technical assistance. To find the authorized dealer near you:

Outback Guidance
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Fax: (785) 742-4584
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Documentation Feedback

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Contents

Safety

In this user guide, you will see the warning and the safety alert symbol (examples next page). They indicate a hazardous situation that, if not avoided, could result in death or serious injury. The safety messages will provide information to identify a hazard associated with potential injury, and tell you how to avoid it.

Some safety messages apply whenever the eDriveX is being used during tractor operations. Other safety messages are located at the beginning of a section for a specific topic (for example, installation and removal of a component). In other instances, a warning may appear within the text of a particular procedure.

Read and understand this eDriveX User Guide and all the safety information before installing, operating, or performing maintenance or service on the eDriveX. If you install the eDriveX with another guidance product, make sure to read and understand the guidance product's user guide. Do not allow anyone to operate without instruction. If you have a question or need assistance, contact your local Outback Guidance dealer or Hemisphere GPS Customer Service (see the front of this User Guide for contact information).

Keep this user guide and all related safety information with the manuals for your tractor and other implements.

General Operations Safety

Role of Operator

As with other navigation guidance systems within vehicles, the tractor operator must still pay attention to driving the tractor. To avoid serious injury or death, operators should not be distracted by other tasks and should be prepared to respond to field conditions by resuming control of the direction or speed of travel. The operator must stay seated while the vehicle is moving.

Manual Override

The operator must stop following the path displayed by the eDriveX if it is unsafe to proceed, such as when an obstacle is in the line of travel or there is an emergency. To stop following the displayed path, depress the brake or turn the steering wheel in either direction.

Tractor Overturns

Overturns account for the largest number of tractor-related fatalities each year on farms. Overturns are more likely to occur on slopes. The eDriveX cannot identify environments that pose an increased risk of overturn, only the operator can do this.

Collisions with People and Objects

The second leading cause of tractor-related fatalities occurs when tractors run over people. The eDriveX cannot identify bystanders or other objects (e.g., trees, fences, boulders, other equipment). The operator must stop following the path guided by the eDriveX to avoid people and objects.

Operator Position

You must manually control the direction and speed of the tractor. Always remain in the operator's position in the tractor when the eDriveX is being used.

Pre and Post-Installation Safety Warnings

The following warnings apply to eDriveX installations and some aspects of post-installation performance of eDriveX. They must be read and understood before installation. All the warnings are repeated in the installation guides.

⚠WARNING: Inspect the tractor and perform any needed maintenance (for example loose steering wheel, wheels out of alignment, uneven tire pressure, contaminated hydraulic fluid) before installing the eDriveX. The operator cannot perform as intended using the eDriveX on a tractor that is not maintained properly. Errors in tractor performance while following the eDriveX path increase the risk of operator and bystander injury or death.

⚠WARNING: Turn off the tractor and disengage the eDriveX when installing or performing maintenance.

⚠WARNING: To avoid serious injury or death, install the eDriveX in a manner that is appropriate for your tractor make and model.

To avoid a fall injury, use an appropriate ladder or platform when installing or performing maintenance on cables, the antenna, and other components of the eDriveX.

To avoid burn or electrical shock injury when installing or removing the eDriveX, do not touch parts of the tractor that are heated or electrically charged.

Chapter 1: Introducing eDriveX

This chapter provides information on the basic eDriveX kit and the other kits that make up the complete eDriveX system, the eDriveX installation guides and their machine-specific component groups, and powering the system and performing the basic steering connectivity test.

eDriveX ECU Kit

Table 1-1 describes the parts included in the eDriveX ECU kit.

Table 1-1: eDriveX ECU kit parts list

Part No.	Description	Qty
806-1031-000	eDriveX ECU (The ECU is listed as a part in each **Automated Steering Kit Installation Guide** and its installation is detailed in each guide.)	1
750-1085-000	USB drive (2GB) with Outback S3 software	1
The eDriveX User Guide (this manual), Part No. 875-0222-000, is available for download as a PDF from the Outback Guidance website at www.outbackguidance.com.		

Complete eDriveX Kits

Table 1-2 provides details about the various eDriveX component kits. Each kit is available separately to suit individual requirements. Figure 1-1 on page 8 shows how these kits make up the full eDriveX 'Marketing Kit'.

Note: Kit requirements vary for steer ready machines. Steer ready machines always require the ECU kit, never require the hydraulic kit (automate steering kit) and may require some or all of the controller kit.

Table 1-2: eDriveX system component kits

Component	Description	Comprises	Vehicle Specific?
ECU kit	The ECU console is the "brains" of the eDriveX system. It receives commands from the Outback S3 guidance terminal, processes steering measurements, and communicates steering commands to the eDriveX steering controller.	• Console housing the electronic control unit (ECU) and Dynamic Measurement Unit (DMU) • Software and documentation	No
Optional: Remote auto-engage/ disengage cable/switch assy	A cable that connects to the 'B' port in the back of the eDriveX ECU with an auto-engage/ disengage switch and Ethernet port.	See description	No

Table 1-2: eDriveX system component kits (*continued)*

Component	Description	Comprises	Vehicle Specific?
Steering controller kit	The steering controller receives steering commands from the ECU console and maintains the desired wheel angle through the Wheel Angle Sensor and proportional hydraulic valve. The controller also uses a sensor to detect manual steering activity by the operator and immediately disable automated steering.	• Steering controller • Wheel Angle Sensor • Steering Wheel Switch • Cabling for the entire system	No
Automated steering kit	The automated steering kit provides the vehicle-specific components for the system and the installation instructions.	• Hydraulic valve block, adapter fittings and hoses • Vehicle-specific mounting instructions and brackets for the hydraulics, ECU console, steering controller and wheel angle sensor	Yes. See your Outback Guidance dealer for your vehicle-specific install-ation kit

eDriveX Installation - Overview

This short section provides summary information about eDriveX installations.

WARNING: Do not use this manual to install eDriveX. Only a vehicle-specific **Automated Steering Kit Installation Guide** provides complete instructions on eDriveX installation. This section provides an overview of key installation information only.

You can mount the eDriveX ECU in a number of orientations but it must be mounted horizontally or perpendicular to the vehicle floor. During calibration you will enter the orientation details, that is, where the 'top' of the ECU is (top, bottom, left, right, fore or aft—the top being the cooling fins surface) and where the connector sockets are (dependent on the position of the ECU's top). When mounting the ECU ensure you have adequate access to the connector sockets and the USB port. See also "eDriveX ECU Orientation" in Appendix B on page 82.

About eDriveX Installation Guides

This section provides information on the complete installation instructions that are available for specific vehicle makes and models.

Detailed, photo-supported step-by-step installation instructions for all the eDriveX components (in four 'component groups') are provided in the **Automated Steering Kit Installation Guide.** The items (and their installation) described in each installation guide are items from the various kits listed in Table 1-2 on page 6. Together they make up the eDriveX 'Marketing Kit' (Figure 1-1).

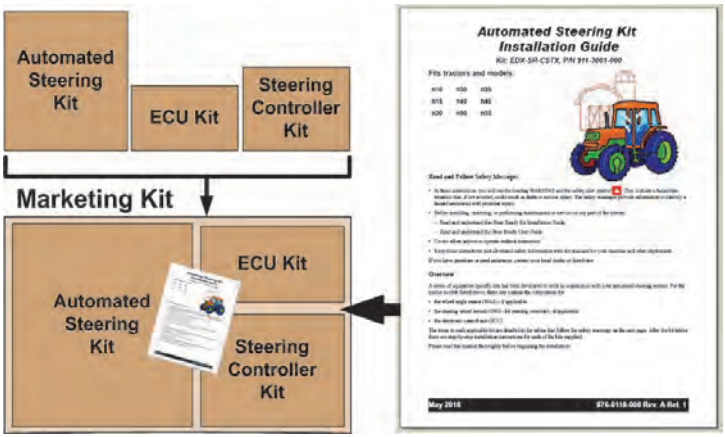


Figure 1-1: eDriveX Marketing Kit

The installation guide for each machine make comprises:

- A table of machine models covered by the guide
- An overview and safety warnings

- A series of component group tables listing all parts in that group (ID, part number, quantity, description, photo). The tables cover hydraulics, wheel angle sensor (WAS), steering wheel switch (SWS), and ECU and cabling.
- Step-by-step illustrated installation instructions for each component group
- A schematic of the cabling connections
- A schematic of the hydraulic circuits before and after installation

The hydraulics component group: Comprises vehicle-specific hydraulic components. These include a hydraulic valve block with safety and proportional steering valve solenoids, mounting brackets and hoses and fittings to accommodate the eDriveX hydraulic systems (steering output, pressure, tank and load sense), a schematic of the relevant hydraulic circuits before and after installation (Figure 1-2 is an example).

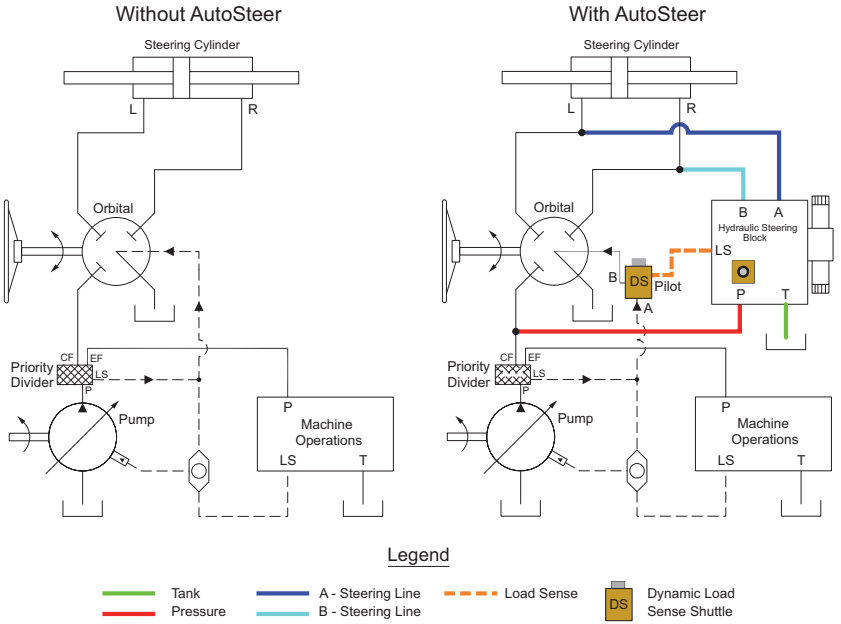


Figure 1-2: Example hydraulic circuit before and after schematic

The wheel angle sensor (WAS) component group: Comprises the items needed to accommodate the steering kinematics of the vehicle, that is the items the particular eDriveX installation needs for a slightly different WAS setup, based on the standard WAS sensor of the eDriveX system.

The steering wheel switch (SWS) component group: Comprises the items that ensure disengagement of automated steering when the system detects manual steering by the operator. A sensor mounted by the steering shaft detects movement of the shaft not present during automated steering.

The ECU and cabling component group: Comprises the eDriveX ECU for mounting in the cab, the steering controller for mounting in close proximity to the hydraulic steering block, and cabling that enables the ECU to communicate with the steering controller, the WAS and the SWS (Figure 1-3 is an example cabling

schematic). It also provides 12V power to the system and provides auxiliary connectors for service or software updates.

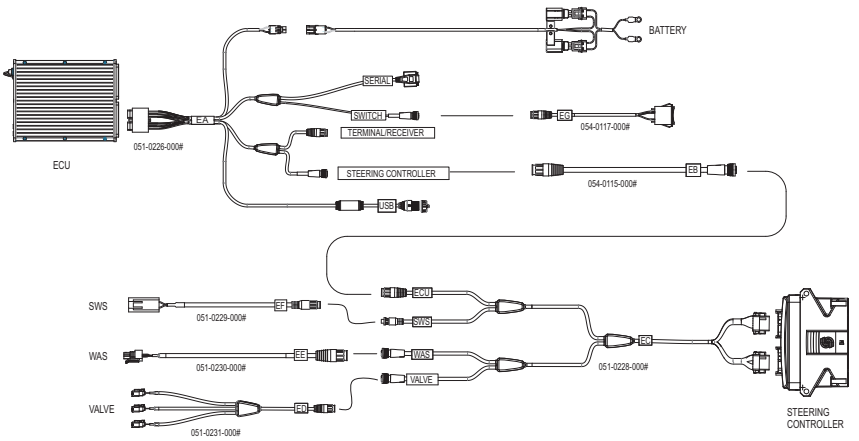


Figure 1-3: Example eDriveX cables and connections schematic

Note: A remote auto-engage cable/switch assembly is available as an option. It connects with the second socket at the back of the ECU. See Figure 1-4 following and Table 1-2 on page 6.

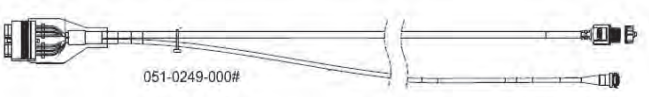


Figure 1-4: Optional Remote Auto-Engage/Disengage Cable/Switch

Chapter 2: Setting Up and Calibrating eDriveX

This chapter covers powering the system, logs and log exporting, and performing the initial steering test. It then covers configuration and calibration of eDriveX, where, using the Outback S3 console, you will:

1. Calibrate eDriveX using the calibration wizard
2. Determine and enter the antenna offset (L/R)
3. Determine and enter the implement offset (L/R)

Powering eDriveX

After the eDriveX system installation is complete, eDriveX is ready to be powered for the first time.

The power switch provides power to the eDriveX ECU and the steering controller.

Figure 2-1: eDriveX power switch

WARNING: Remove any USB flash drive BEFORE turning on power. Failure to do so may prevent eDriveX from starting up normally.

The eDriveX power switch has three positions:

- STEER: powers the ECU and steering controller
- ON: powers the ECU
- OFF: cuts power to ECU and steering controller

Note: Travel with the switch in the ON position so no steering commands are supplied.

WARNING: To reliably save job data, turn eDriveX off at its power button before turning off the ignition.

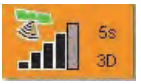
Complete the following steps to power up the eDriveX (console, for example S3, also powered up).

Step	Screen Item (when applicable)

1. Set the power switch to the middle position (ON). On the ECU:
• The red power LED (outer - nearest the edge) indicates power when illuminated.
• The (inner) communication LED indicates as follows:
  • Orange flashing - no communication with S3 or steering controller.
  • Orange solid - communication with S3.
  • Green flashing - communication with steering controller only.
  • Green solid - communication with S3 and steering controller.
When the power switch is in the top (STEER) position, the steering controller's green LED is illuminated indicating power and communication with the ECU.
When powered and connected to the ECU, an illuminated red LED on the steering controller indicates an error.	

2. Verify that the Outback S3 screen's Steering tab displays the "X" symbol (this will take 1-2 minutes). **Note:** The Steering tab gives you access to the eDriveX steering screen set comprising Auto, Details, Setup, Calibrate and Status screens. The default (from startup) is the Details screen. Subsequently it is the last screen selected from the set.	

Note: If you have **Serial** selected as your **GPS Source** (on the GPS screen) when you turn eDriveX on, the **Serial** button will disappear and you will see the message:



Serial GPS is not supported with eDriveX

Switching to Internal GPS

Contact your local servicer if this feature is essential

If you want to use an external GPS receiver connected through your S3's serial port, you must reactivate the **Serial** option on the GPS screen through a 'Service' page that your local dealer will make available to you.

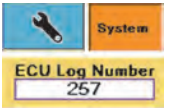
(If **Serial** is not selected as your GPS source when you turn on eDriveX, the **Serial** button still disappears but the message is not displayed.)

With eDriveX powered up, you will next need to perform a steering test (see “Performing a Steering Test” on page 14) and then calibrate the eDriveX as explained in the sections beginning “Introducing the Calibration Wizard” on page 16.

Log Files and eDriveX

All the time eDriveX is powered, session data is recorded (logged). You can export logs (as separate, named files) onto a USB flash drive. Logs—or ‘data sets’—help in the analysis of data when troubleshooting. The log number associates a particular data set with a particular session.

Log File Numbering



Each time you turn eDriveX on, the log number increments. You can view the current log number in the System display of the Setup screen. The log stores data for the current session. When you export data using the **Export ECU Logs** feature on the System display of the Setup screen, the log number identifies each file (so each session). Knowing the log (file) number for each session helps in the analysis of the ECU’s performance data when troubleshooting a particular session.

Note: The current log file number, as displayed, is added to the log filename (with added zeros) when the session ends (eDriveX powered off). If you use the **Export ECU Logs** feature without ending the session, the current log number will not show in the exported file, but will show as ‘snapshot.tgz’.

Log File Exporting

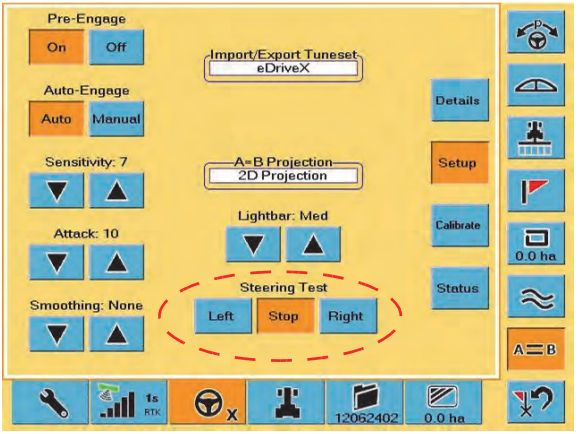
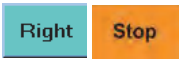
Insert a USB flash drive into the USB port on the front of the eDriveX and press **Export ECU Logs** on the Setup screen’s System display. Each separate session (power on to power off) has its own filename and the session’s log number is included in the session/log filename.

Performing a Steering Test

Perform a steering test to check the connectivity of the system. Test the steering with:

- The vehicle moving at no more than 5 kph (3 mph).
- The power switch in the ‘STEER’ position.

Complete the following steps to test the steering connectivity.

Step	Screen Item (when applicable)
1. On the **eDriveX Setup** screen, locate the **Steering Test** buttons.  **Figure 2-2: Steering test buttons**	
2. Press **Left** and confirm that the vehicle steers to the left. Press **Stop** as soon as the direction is confirmed.	
3. Press **Right** and verify that the vehicle steers to the right. Press **Stop** as soon as the direction is confirmed.	
If the system does not pass the steering test, see "Troubleshooting a Steering Test" on page 15, and re-check your installation. If the system passes the steering test, continue with the calibration wizard (see "Introducing the Calibration Wizard" on page 16.	

Troubleshooting a Steering Test

Problem	Solution
Wheels move into left or right lock position, but the direction is switched	Swap the two cables that are connected to the solenoid of the eDriveX hydraulic block.
Wheels do not move	Check the eDriveX installation for: • Hydraulics • Wheel angle sensor • Electronic components • eDriveX harness

If you are still unable to perform a successful steering test after troubleshooting, contact your local Outback Guidance dealer or Hemisphere GPS Customer Service (see the front of this User Guide for contact information).

Introducing the Calibration Wizard

The calibration wizard guides you through the calibration steps. With eDriveX installed and powered up, a successful steering test completed, and the prerequisites met (see "Before Using the Calibration Wizard" below), you are ready to use the calibration wizard.

Before Using the Calibration Wizard

Before you use the calibration wizard ensure that:

- The GPS antenna/sensor is located in its final position and initialized.
- You use the GPS source the vehicle will use in operations. (In particular, if you plan to use RTK for centimeter level control, you must use RTK during calibration.)
- All the items under Hardware Status (Steering > Status) are green (see "Viewing Steering Status" on page 68).
- The power switch is in the 'STEER' position.

Note: The calibration wizard steps and step labels (names) will change for certain valve types, track machines and electric steering (valve type VSi). Table 2-1 shows the steps\step labels that apply for the different vehicle\valve combinations.

Table 2-1: Calibration steps and step labels for vehicle\valve types

Calibration Step	Hydraulic Steering (includes Steer-Ready)		Electric Steering (VSi)
	Wheel Vehicles	Track Vehicles	
1	Vehicle	Vehicle	Vehicle
2	Dimensions	Dimensions	Dimensions
3	ECU Position	ECU Position	ECU Position
4	Coarse WAS		Curvature
5	Curvature	Max Lateral Acc	Steering Ratio
6	Current (or Lock to Lock)		Lock to Lock
7	Fine WAS		Roll Bias
8	Roll Bias	Roll Bias	

⚠WARNING: You must complete the calibration steps in sequence to ensure a proper system setup, that is 1-8 for wheel vehicles, 1-3, 5 and 8 for track vehicles, 1-7 for VSi. The following section, "About Using the Calibration Wizard", provides important information on how to use the calibration wizard.

About Using the Calibration Wizard

This section provides general information on using the calibration wizard and some step-specific information. The step-by-step guidance sections in this chapter will refer you back to the relevant parts of this section when appropriate.

About Completing the Steps in Sequence

Because the calibration steps must be completed in sequence, the step buttons are inactive (grayed out) until you can perform that step.

Example 1: The **2. Dimensions** button is inactive until you have completed **1. Vehicle.**

Example 2: The **7. Fine WAS** button is inactive until you have completed steps 1 to 6 (wheel vehicles only).

Note: For track vehicles, steps 4, 6 and 7 are never active; when you have completed steps 1-3 and 5, the **8. Roll Bias** button becomes active.

About Making Changes to a Completed Step

If, after completing a number of steps, you go back and make a change at an earlier step, previously completed steps (below that step) become inactive again. When you have completed the change, only the step following the revised step is active.

Example: After completing six steps you realize that you need to change the ECU position (step 3). When you exit the ECU position screen, having made the change, only the **4. Coarse WAS** button will be active below the **3. ECU Position** button. You will have to complete steps 4, 5 and 6 again (at least re-enter the step's screen) to continue at step **7. Fine WAS**.

Note: This behavior is only until you have completed all the calibration steps applicable to your vehicle. Once you have completed the roll bias calibration, you can make changes at other steps without having to revisit the subsequent steps.

About Engine Speed During Calibration

Some calibration steps should be carried out at full hydraulic pressure. Because some hydraulic systems need higher engine speeds that others to achieve full hydraulic pressure, we recommend executing those calibration steps with a minimum engine speed of 1500 rev/min. This is indicated as a requirement where it applies.

About Setting the Antenna Pivot

Setting the antenna pivot is part of **2. Dimensions.** The antenna pivot dimension is the perpendicular distance of the center of the antenna in front of or behind the vehicle's pivot point. The pivot point of a vehicle depends on its type: wheel, track, articulated, sprayer, combine. Figure 2-3 shows how the antenna pivot dimension (and other dimensions) are measured for each listed vehicle type.

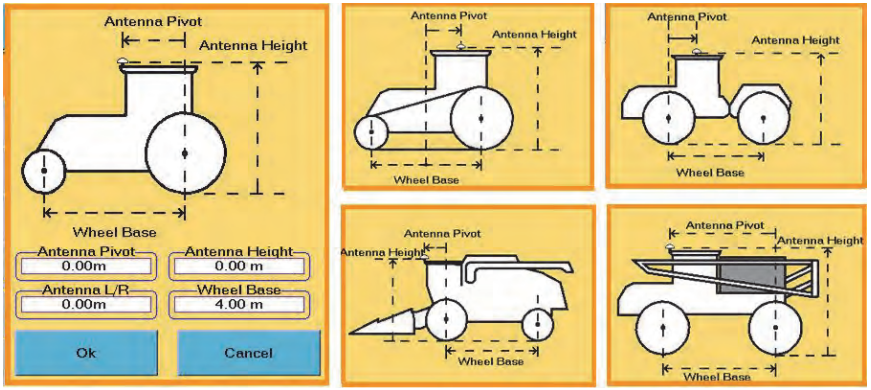


Figure 2-3: Dimensions - wheel, track, articulated, combine, sprayer

Note: Only the dimensions screen (Figure 2-3) shows different vehicle types. The antenna pivot and antenna offset (L/R) input screens show only a wheeled vehicle (see Figure 2-12 on page 24).

About Setting the Antenna Offset

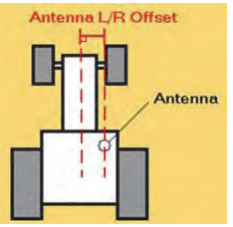
You need to have completed the calibration wizard before you can accurately determine the antenna offset and you enter the antenna offset at step **2. Dimensions.** But as you do not have an accurate antenna offset when working through the wizard you have two choices:

- Leave the antenna offset as 0.00 and enter the measured offset later.
- Enter an estimated, 'provisional' offset value. (Suggested if you have a noticeable antenna offset that you can measure or estimate.)

When you have completed the calibration wizard and determined the actual antenna offset, you can revisit **2. Dimensions** and add the actual value (you can revisit individual steps without affecting subsequent steps once you have completed the wizard - see "About Making Changes to a Completed Step" on page 17).

To enter a provisional antenna offset:

1. Measure the perpendicular distance of the center of the antenna from the centerline of the vehicle.
2. Enter the value as the **Antenna Offset L/R** via **2. Dimensions** (see 6, page 25)



The section "Introducing Antenna Offsets (L/R)" on page 42 provides general information on antenna offsets and the section "Ways to Determine Antenna Offset" on page 43 describes two methods for determining the antenna offset.

About Converging Filters

Filters are an important part of the data processing that enables precision guidance and auto-steering. To be effective, filters need to be converged.

Filters may be either converged (for immediate use) or converged with convergence data stored (for immediate and subsequent reuse). Certain driving routines will result in convergence but you need to meet more conditions for convergence data to be stored.

A check mark in the **Run Time Status** section of the Steering > Status screens indicates that filters have been converged (Figure 2-4). It does not, however, indicate that the convergence data is stored (although it may be - see "Filter 'self-convergence'" on page 20).

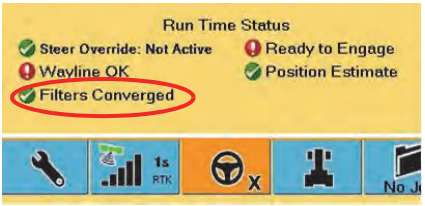


Figure 2-4: Filters Converged checked on the Steering > Status screen

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Note - vehicle/valve combination: Convergence data, if stored, is stored for each vehicle/valve type combination. If you change the vehicle/valve type combination to a combination for which there is no stored convergence data, you will need to repeat the appropriate convergence and convergence data storage requirements.

Initial convergence or re-convergence

Initial filter convergence (and re-convergence if required) is achieved through a driving pattern. The driving sequences executed manually or automatically during the calibration process are normally enough for filters to converge. If the calibration driving sequences are enough, the convergence status will show as checked. You will then have to meet the requirements for convergence data storage (see "Drive the vehicle at slow speed (typically 5-7 kph) as follows (in order) to achieve filter convergence:The data storage (additional) driving requirements:" on page 20).

If the driving sequences within the calibration process do not result in filter convergence, or a full calibration in not required, execute the 'manual' sequence described below (and then the additional storage driving requirements detailed on page 20).

See also "Re-converging filters" on page 20.

Note - antenna position: Filter convergence includes a calculation of the antenna position. If there is a difference of more than 1 m between the calculated antenna position and the entered antenna fore/aft ('pivot') dimension, the filters will converge but the filter data will not be stored. To avoid this situation, ensure you have accurately entered the antenna pivot dimension (which is part of the whole calibration process - see "Calibration Wizard Step 2 - Dimensions (wheel and track)" on page 23).

The 'manual' driving sequence

Drive the vehicle at slow speed (typically 5-7 kph) as follows (in order) to achieve filter convergence:The data storage (additional) driving requirements:

- 100 m in a straight line
- Two complete circles at near full lock (in either direction - the second can be the same as the first, not as shown for illustrative purposes in Figure 2-5)
- 100 m in a straight line (the filters will most likely have converged before this step)

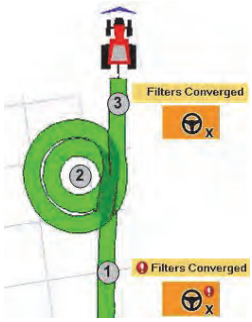


Figure 2-5: 'Manual' filter convergence driving sequence

To store the newly acquired convergence data you need to drive at least three minutes (recommended minimum) under auto-steering and bring the vehicle to a stop (the point at which the data is stored). This can be cumulative, that is, you don't have to immediately drive under auto-steer for three minutes and stop. Provided you have three minutes of auto-steering (for which filters must be converged) and come to a halt before you power off eDriveX, the convergence data will be stored (but see **Note - antenna position** on page 19).

Filter 'self-convergence'

On system startup, the filters converged status will always indicate that filters are not converged: this is normal. After you have driven forward for at least ten seconds, the status should become checked indicating the use of stored convergence data. If the status does not change, it indicates that the convergence data is not stored. Refer to "Re-converging filters" following.

Re-converging filters

Filters will need to be re-converged—and the new convergence data stored—if:

- The filter convergence data was never stored
- The antenna calibrated (entered) dimension is changed by more than 0.1 m
- The vehicle/valve type combination is changed to one that has not been used before (meaning there is no convergence data for the combination - see **Note: vehicle/valve combination**, page 19).
- The eDriveX defaults have been restored (Setup > Defaults > All).

If re-convergence is required, establish the reason and, accordingly, reset the antenna data, complete the calibration process, and/or complete the driving requirements for convergence and convergence data storage as detailed in the preceding sections.

Using the Calibration Wizard (Hydraulic Steering)

The following sections describe how to use the calibration wizard for machines using hydraulic auto-steering (which includes steer-ready machines). For details on using the wizard for machines using electric auto-steering (valve type VSi) see “Using the Calibration Wizard (Electric Steering - VSi)” on page 39

Press the Steering tab, the eDriveX steering screen set appears. Press **Calibrate.** The calibration wizard screen appears.

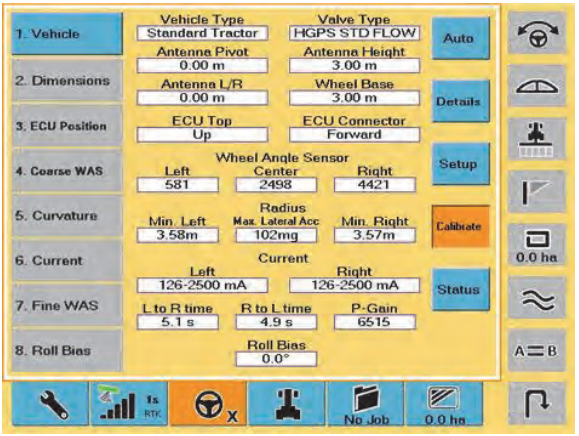


Figure 2-6: Calibration wizard screen - calibration steps on the left

Calibration Wizard Step 1 - Vehicle (tuneset, vehicle and valve type)

1. Press **1. Vehicle.** The tuneset, vehicle and valve type sub-screen appears.

Figure 2-7: Tuneset, vehicle and valve type sub-screen

2. Select the **Tuneset** field - the Tuneset window appears.

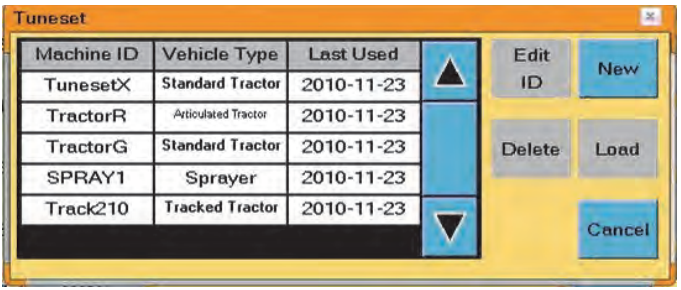
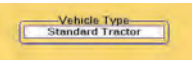


Figure 2-8: Vehicle - Tuneset window (nothing selected)

3. Select a tuneset, then press **Load.** The tuneset, vehicle and valve type sub-screen reappears.

(See also "Creating and Loading Tunesets" on page 59)

4. Select the **Vehicle Type** field - the Vehicle Type window appears.



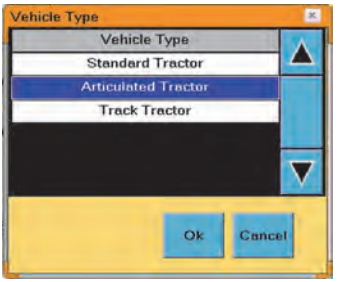


Figure 2-9: Vehicle - Vehicle Type window

Note: You can change vehicle type and/or valve type. After a change of either, a system message advises that you need to restart the ECU for the changes to take effect. Press **Ok** to acknowledge the message and continue - you will restart the ECU after changing the valve type. See also "About Making Changes to a Completed Step" on page 17 (part of "About Using the Calibration Wizard").

---

5. Select your vehicle type, then press **Ok.**

Press **Ok** to acknowledge the restart message. The tuneset, vehicle and valve type sub-screen reappears.

6. Select the **Valve Type** field - the Valve Type window appears.

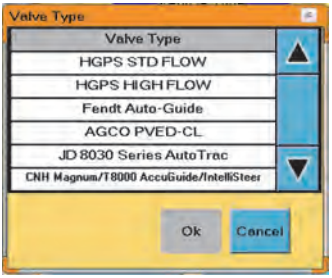


Figure 2-10: Valve Type window

Note: Only valve types valid for the currently selected vehicle type are available for selection. If you change the vehicle type and the currently selected valve type is not valid for that vehicle, the Valve Type field becomes blank and exclamation points indicate that you need to reselect a valve.

Also, for some valves, step **6. Current** becomes **6. Lock To Lock** (see "Calibration Wizard Step 6 - Current (wheel only)" on page 30).

7. Select your valve type, then press **Ok.** Press **Ok** to acknowledge the restart message. The tuneset, vehicle and valve type sub-screen reappears.

   Press **Ok** again to return to the calibration screen. The **2. Dimensions** button is now active.

8. Restart the ECU

Calibration Wizard Step 2 - Dimensions (wheel and track)

1. Press **2. Dimensions** - the dimensions setup screen appears. You enter dimensions for:

   - Antenna Pivot
   - Antenna Height
   - Antenna L/R (antenna offset)
   - Wheelbase

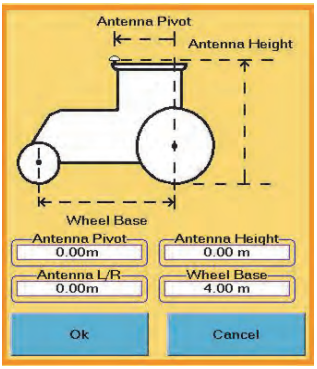


Figure 2-11: Dimensions setup screen

2. Select the **Antenna Pivot** field - the Antenna Pivot window appears.

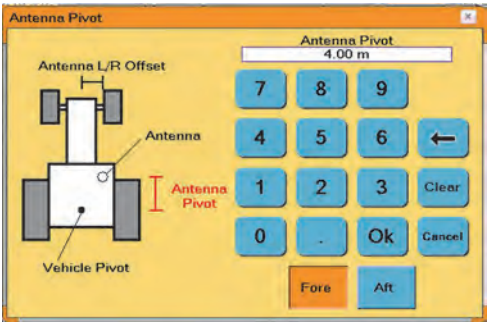


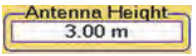
Figure 2-12: Antenna Pivot window

3. Enter the antenna pivot distance—the perpendicular distance of the center of the antenna in front of or behind the vehicle's pivot point (see "About Engine Speed During Calibration" on page 17).

   Set the position of the antenna to fore or aft of the pivot point.

   Press **Ok** - the dimensions setup screen reappears.

4. Select the **Antenna Height** field (the default value is 3.00 m) - the Edit Antenna Height window appears.



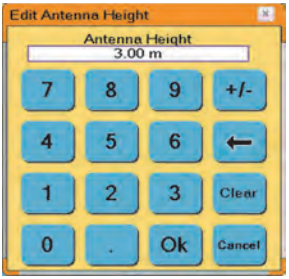


Figure 2-13: Edit Antenna Height window

5. Enter the distance from the antenna to the ground. Press **Ok** - the dimensions setup screen reappears.

6. Select the **Antenna L/R** field - the Antenna L/R Offset window appears.

Note: You can leave this as 0.00 when first working through this step of the calibration wizard. See "About Setting the Antenna Offset" on page 18.

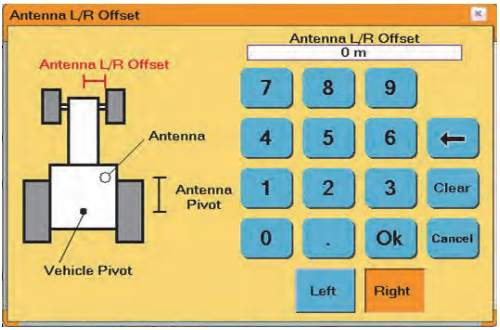


Figure 2-14: Antenna L/R Offset window

7. Enter the lateral (perpendicular) distance of the center of the antenna from the centerline of the vehicle.

   Set the offset position to left or right.

   Press **Ok** - the dimensions setup screen reappears.

8. Select the **Wheel Base** field (the default value is 4.00 m) - the Edit Wheel Base window appears.

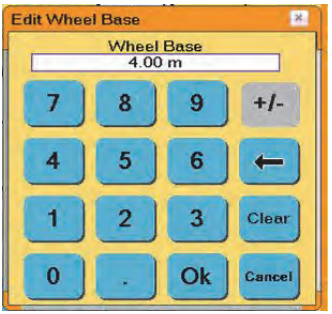


Figure 2-15: Edit Wheel Base window

9. Enter the wheelbase of the vehicle—the distance between the centers of its two axles.

   Press **Ok** - the dimensions setup screen reappears.

   Press **Ok** again - the calibration setup screen appears with the **3. ECU Position** button now active.

Calibration Wizard Step 3 - ECU Position (wheel and track)

1. Press **3. ECU Position** - the ECU position screen appears.

Note: In the two ECU position screens (Figure 2-16) you set the position of the top of the ECU (the face with the cooling fins) and the position of the two connectors. Note that the label above the arrows and the icon to the right of the arrows are different in the two screens.

The connector position options are dependent on the position of the ECU's top so you set the top position first.

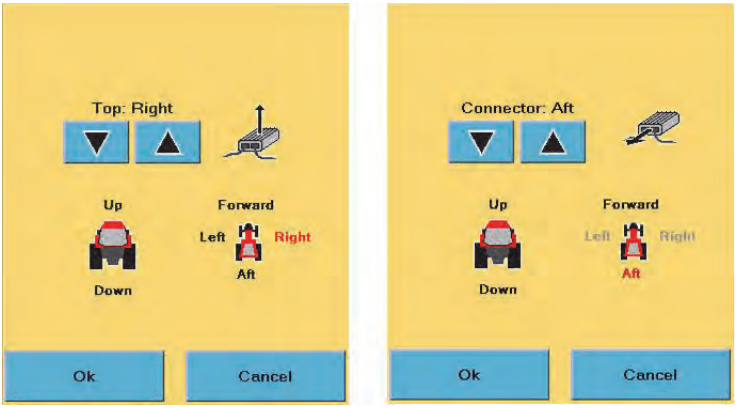


Figure 2-16: ECU position displays (Top and Connector)

2. Using the up and down arrow buttons, set the position of the ECU's top (cooling fins face). Button presses progress through the options **Up** to **Right,** (up arrow) and **Right** to **Up** (down arrow). The current selection shows in red by the appropriate vehicle icon (see **Right** in left display in Figure 2-16). Press **Ok** - the arrows label changes to **Connector** and the icon changes to indicate you are setting the connector position.

3. Using the up and down arrow buttons, set the position of the ECU's connectors. The current selection shows in red by the appropriate vehicle icon (see **Aft** in the right display in Figure 2-16).

Note: The Left and Right options are not available for the connectors in the right display of Figure 2-16 because the connectors cannot be left or right if the top of the ECU is to the left (or right).

Press **Ok** - the calibration wizard screen appears with the **4. Coarse WAS** button now active (wheel vehicles only).

Note: If your vehicle type is a track vehicle, only the **8. Roll Bias** button will now be active. Go to "Calibration Wizard Step 8. Roll Bias (wheel and track)" on page 33.

Calibration Wizard Step 4 - Coarse WAS (wheel only)

Note: When you are driving, the min/max (green/red) speed bar will help you maintain the correct speed. This is true of all steps that include the speed bar.

1. Press **4. Coarse WAS** - the 'Turn left to full lock' screen appears (Figure 2-17, first image).

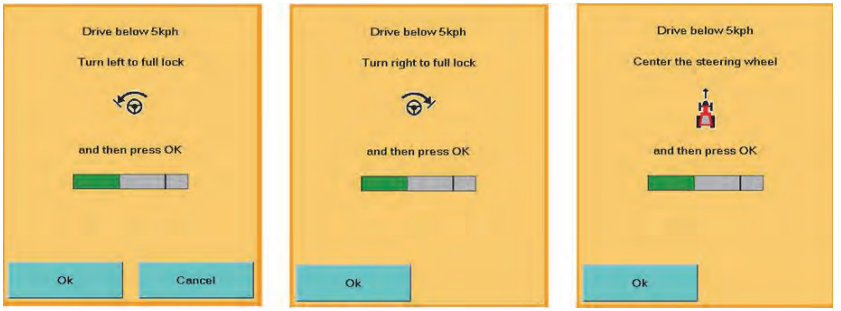
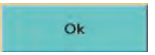


Figure 2-17: Coarse WAS screens - left and right lock and center

2. Using the speed bar to maintain a correct speed (keep the bar in the green) drive below 5 kph (3 mph) and turn left to full lock.

   Press **Ok** - the 'Turn right to full lock' screen appears (Figure 2-17, center image).



3. Drive below 5 kph (3 mph) and turn right to full lock.

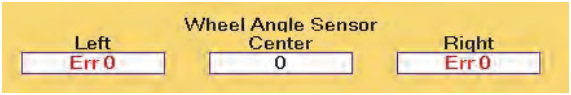
   Press **Ok** - the 'Center the steering wheel' screen appears (Figure 2-17, right image).

Drive below 5 kph (3 mph) and center the steering wheel.

***Tip**: Aim at a specific landmark to ensure that your are driving the vehicle in a straight line.*

Press **Ok** - the calibration wizard screen appears with the **5. Curvature** button now active (**5. Lateral Acceleration** for track vehicles).

Note: If the wheel angle sensor fields on the steering details screen (see "Using the Calibration Wizard (Electric Steering - VSi)" on page 39) show **Err 0,** an out-of-range WAS sensor reading is indicated.



If this occurs, check your settings for calibration wizard steps 1 to 3, redo this step 4 and if **Err 0** is still showing, adjust the wheel angle sensor and recalibrate the coarse WAS.

Calibration Wizard Step 5 - Curvature (wheel only)

Note: This calibration step is called **Lateral Acceleration** for track vehicles and only the last of the three screens in Figure 2-18 appears. Follow only step 4, page 30 for track machines (so steps 1 to 4 for wheel machines).

1. Press **5. Curvature**—the 'Turn left to full lock' screen appears (Figure 2-18, left image).

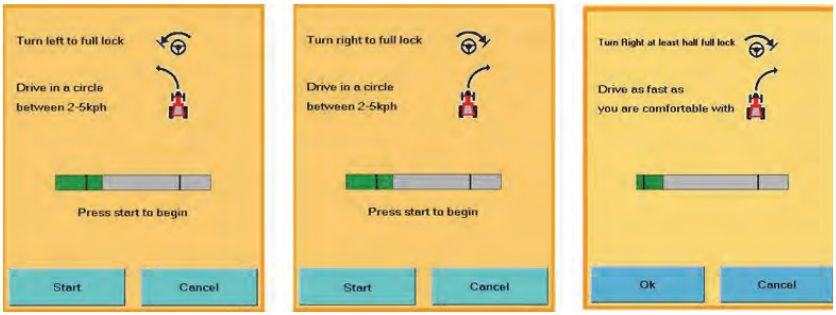


Figure 2-18: Curvature screens - left and right lock, lateral acceleration

2. Turn the wheels left to full lock and, using the speed bar to maintain a correct speed, drive in a circle at 2-5 kph (1.5-3 mph).

   Press **Start** and drive in a circle until the 'Turn right to full lock' screen appears (Figure 2-18, center image) indicating that the left calibration is complete.

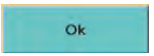
3. Turn the wheels right to full lock and drive in a circle at 2-5 kph (1.5-3 mph).

   Press **Start** and drive in a circle until the 'Turn right at least half full lock' screen appears (Figure 2-18, right image) indicating that the right calibration is complete.

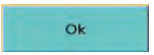
4. Reduce your right turn to no less than half lock and increase your speed to as fast as you are comfortable driving at on that turning radius.

   Note: The system uses this step to determine the maximum lateral acceleration (centrifugal force) that can occur during certain auto-steering conditions (for example during autoturns or aggressive line acquisition).

   Press **Ok** - the **Calibration Complete** screen (not shown) appears (immediately), indicating that the maximum lateral acceleration calibration is complete.



   Press **Ok** - the calibration wizard screen appears with the **6. Current** button now active (**6. Lock To Lock** for certain valves).



Calibration Wizard Step 6 - Current (wheel only)

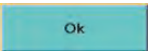
WARNING: During current calibration the vehicle will auto-steer through three tests (one test only for certain valves - see Note at step 2). You need to:

- Conduct the calibration in a level, flat-surface field with plenty of space
- Maintain a speed of 2-3 kph or 5-7 kph (1.5-2 mph or 3.1-4.4 mph) depending on the test (use the speed bar)
- Maintain an engine speed of at least 1500 rev/min (see "About Engine Speed During Calibration" on page 17)
- Not touch the steering wheel while each test is in progress (will cancel the test in progress)
- Center the wheels before each test.

1. Press **6. Current** - the first of three test screens appears ('Begin Test: 1 of 3' - Figure 2-19 on page 31, left image).

Figure 2-19: Current screens - tests 1, 2 and 3 (note test 3 speed increase)

2. Drive the vehicle straight ahead at the recommended speed and engine speed (1500 rev/min) then press **Ok** to start the first test. The **Ok** button and the 'Begin Test ... ' instruction disappear and 'Calibrating' appears.



Note: For certain valves **6. Current** becomes **6. Lock to Lock**. In this case, you only need to press **Ok** in the first screen (when at the recommended speed). The system first indicates that calibration is in progress, then that calibration is complete, displaying the minimum time (in seconds) for lock to lock to occur—that is, full left to full right, and full right to full left (see right image in Figure 2-20 on page 32).

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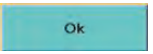
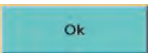
3. When the **Ok** button reappears ('Begin Test: 2 of 3' - Figure 2-19, center image), center the wheels and press **Ok** again. The **Ok** button and the 'Begin Test ... ' instruction disappear and 'Calibrating' appears.



4. When the **Ok** button reappears ('Begin Test: 3 of 3' - Figure 2-19, right image), center the wheels, accelerate to the new recommended speed and press **Ok** again. The **Ok** button and the 'Begin Test ... ' instruction disappear and 'Calibrating' appears.



Note: You will require a clear, drivable area at least 500 m long x 100 m wide for this final current test.

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5. When test 3 is complete, the **Calibration Complete** screen appears (Figure 2-20 on page 32, left image). It displays:
   - The minimum current (in milliamps) for left and right steering to occur
   - The minimum time (in seconds) for lock to lock steering in each direction (L to R, R to L)
   - The P-Gain—the scaling factor applied to the current to optimize wheel response (**Current** only, not **Lock to Lock** - see Note at step 2).

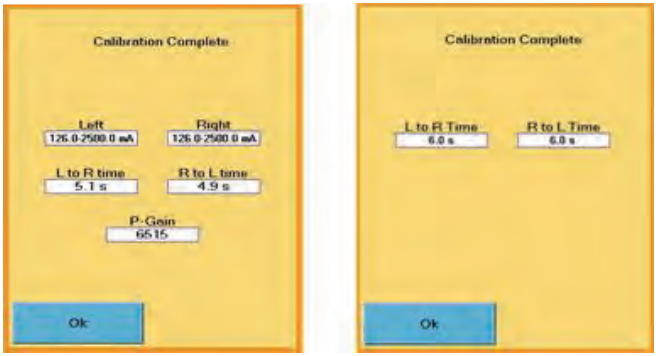


Figure 2-20: Calibration Complete screens (Current and Lock to Lock)

6. Press **Ok** - the calibration wizard screen appears with the **7. Fine WAS** button now active.

Calibration Wizard Step 7 - Fine WAS (Wheel Only)

WARNING: Ensure that you have enough room to drive your AB line before starting this calibration step. Drive at the recommended speed (see steps) and maintain an engine speed of at least 1500 rev/min (see "About Engine Speed During Calibration" on page 17).

1. Press **7. Fine WAS** - the map screen appears with the **WAS Calibration** window open.

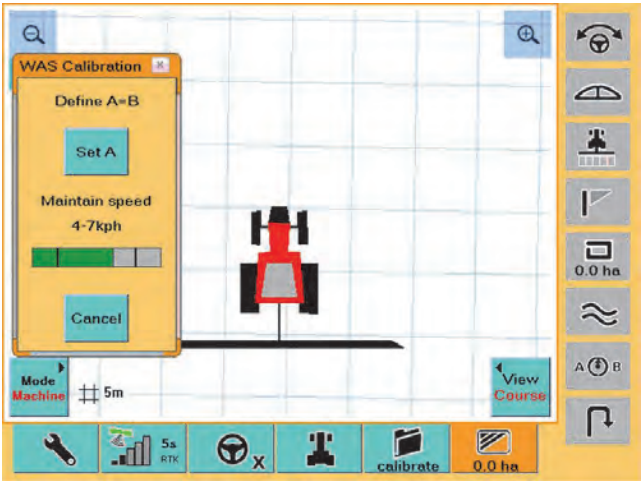


Figure 2-21: Fine WAS calibration - ready to set point A

2. Using the speed bar, drive at 4 - 7 kph (2.5-4.5 mph) (and engine speed minimum 1500 rev/min) and press **Set A**. The button in the window changes to **Set B**.

3. Maintaining the recommended speed (and engine revs), press **Set B** to create a guideline. The steering engage button appears with the instruction **Engage on A=B**.

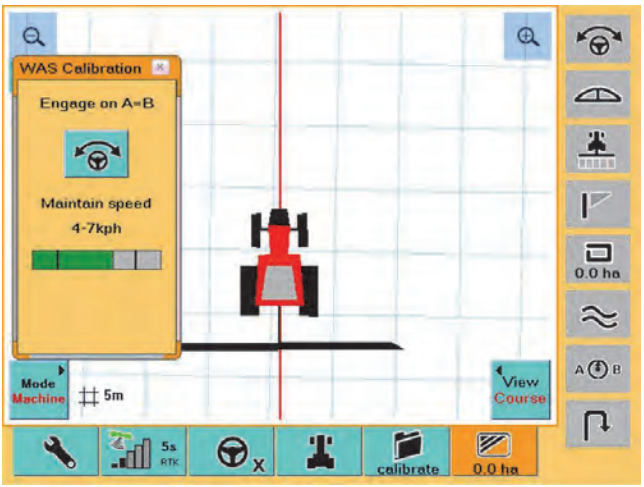


Figure 2-22: Fine WAS calibration - ready to engage on A=B

4. Continue driving on the wayline at the recommended speed (and engine revs) and press the steering engage button. The button grays out. Allow the vehicle to self-steer.

5. When the **Calibration Complete** screen appears, press **Ok**. The calibration wizard screen appears with the **8. Roll Bias** button now active.

Calibration Wizard Step 8. Roll Bias (wheel and track)

Note: The **Left/Right Offset** (implement offset) must be **0.00** for this calibration step (set in the vehicle screen), so, if there is an offset value, the calibration step automatically sets it to 0.0 and resets it to its original value when calibration is complete.

Calibrating the roll bias is a three step process.

1. Create an AB line (then turn)
2. Auto-steer the AB line B⇨A (then turn)
3. Auto-steer the AB line A⇨B

1. Press **8. Roll Bias** - the map screen appears with the Roll Bias window open and the instruction **Define A=B**.

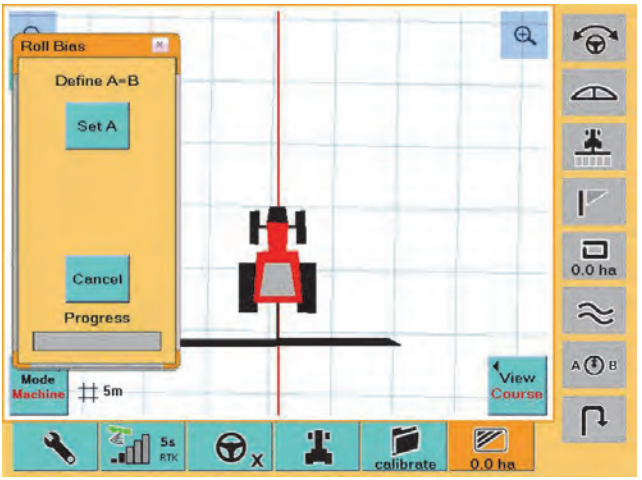


Figure 2-23: Roll Bias calibration - Define A=B

2. In an open field with at least 75 m (230 ft) of open space in front of the vehicle, drive straight ahead then press **Set A**. The **Roll Bias** window instruction changes to **Drive at least 50 m** and displays an inactive Set B button (Figure 2-24, left image).

Figure 2-24: Roll Bias calibration - setting point B

3. Continue driving while noting the distance readout. The Set B button remains inactive until you have driven at least 50 m. Press **Set B** when it becomes active (Figure 2-24, right image). You have set the AB line. The window instruction changes and an inactive steering engage button and a speed bar appear.

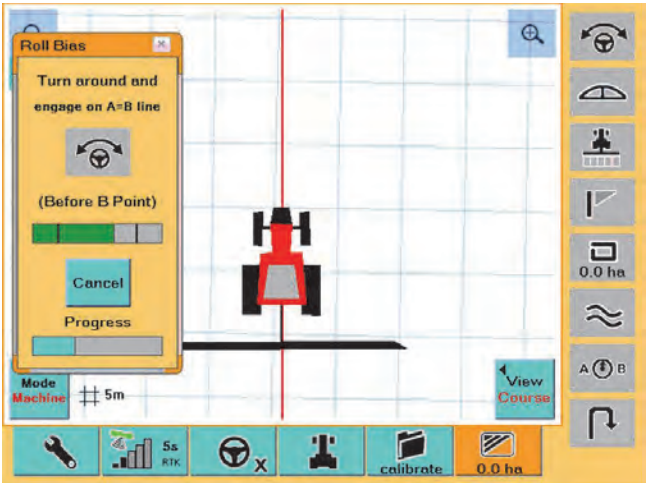
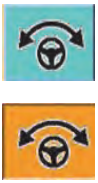


Figure 2-25: Roll Bias calibration - turn to drive B->A

4. Perform a keyhole turn and manually steer the vehicle back toward the AB line (toward point B).

   When you are close enough to the guideline for the vehicle to auto-steer, the steering engage button becomes active: press it. The window message changes to **Approaching B** and the steering button changes to the engaged condition (Figure 2-26).

   Maintain a constant speed within the speed range (and minimum engine speed of 1500 rev/min - see “About Engine Speed During Calibration” on page 17) while approaching point B of the AB line and throughout the calibration. Monitor the distance readout.



Note: To enable the vehicle to auto-steer the whole length of the AB line:

- After setting point B allow enough distance to complete the keyhole turn and get back on to or close to the AB line before you reach point B.
- Engage the steering as soon as the button becomes active. This gives the vehicle time to auto-steer onto the AB line before you reach point B.

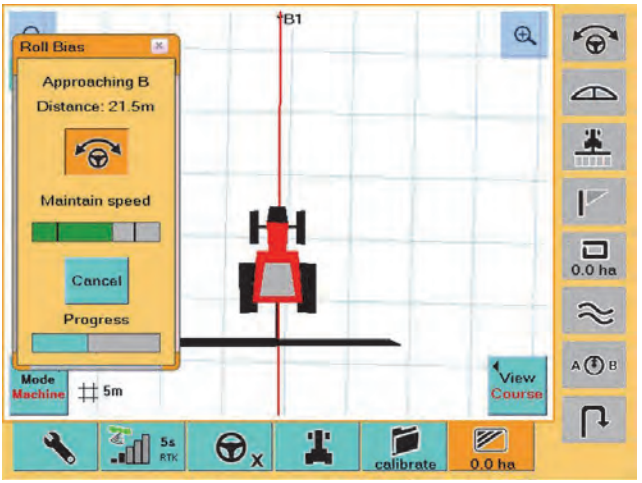


Figure 2-26: Roll Bias calibration - approaching point B

5. Let the system steer the vehicle on the line while driving to point A of the AB line. Maintain the same speed at all times. The system counts down the distance to point A.

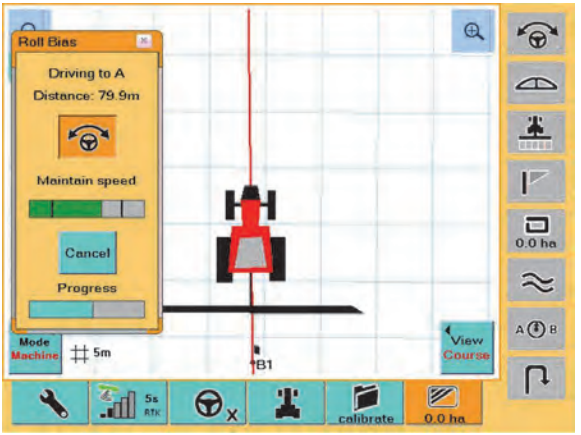


Figure 2-27: Roll Bias calibration - driving to point A

6. When you reach point A, the steering disengages and a new message appears.

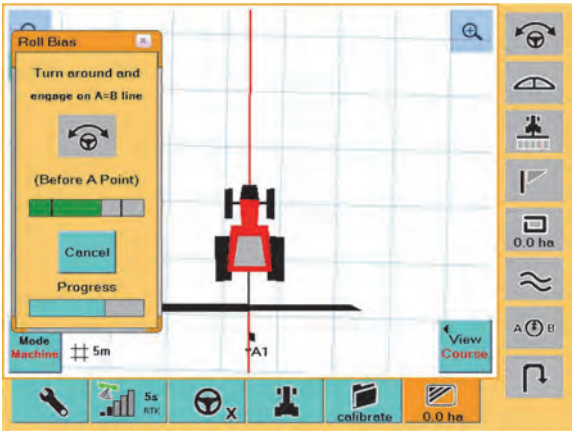


Figure 2-28: Roll Bias calibration - turn to drive A->B

7. Perform a keyhole turn and manually steer the vehicle back toward the AB line (toward point A). When you are close enough to the guideline for the vehicle to auto-steer, the steering engage button becomes active: press it. The window message changes to **Approaching A** and the steering button changes to the engaged condition (Figure 2-29).

Maintain the same speed as used for the BA pass (and a minimum engine speed of 1500 rev/min - see “About Engine Speed During Calibration” on page 17) while approaching point A of the AB line and throughout the remainder of the calibration. Monitor the distance readout.

Note: To enable the vehicle to auto-steer the whole length of the AB line:

- After reaching point A allow enough distance to complete the keyhole turn and get back on to or close to the AB line before you get back to point A.
- Engage the steering as soon as the button becomes active. This gives the vehicle maximum time to auto-steer onto the AB line before you reach point A.

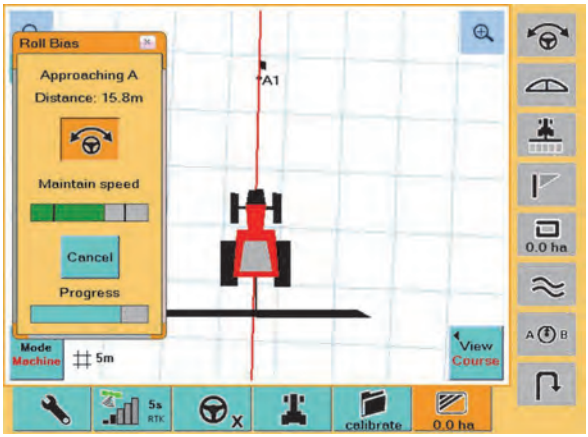


Figure 2-29: Roll Bias calibration - approaching point A

8. Let the system steer the vehicle on the line while driving to point B of the AB line. Maintain the same speed at all times. The system counts down the distance to point B.

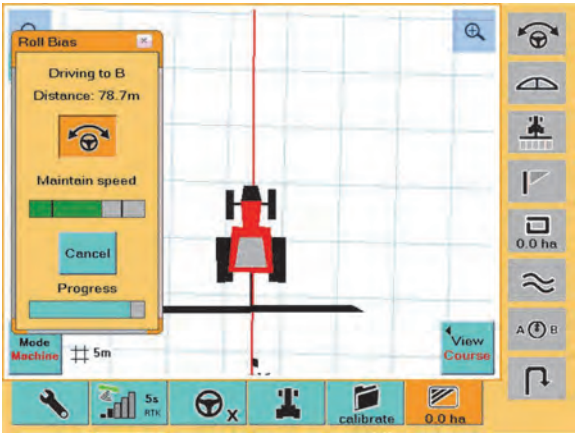
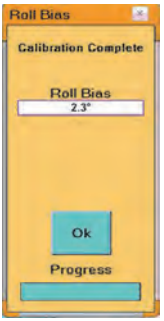


Figure 2-30: Roll Bias calibration - driving to point B

9. After reaching point B again, the calibration procedure is complete and the roll bias is displayed.



Press **Ok** to save settings and exit the Calibration Wizard.

Using the Calibration Wizard (Electric Steering - VSi)

Press the Steering tab, the eDriveX steering screen set appears. Press **Calibrate.** The VSi version of the calibration wizard screen appears.

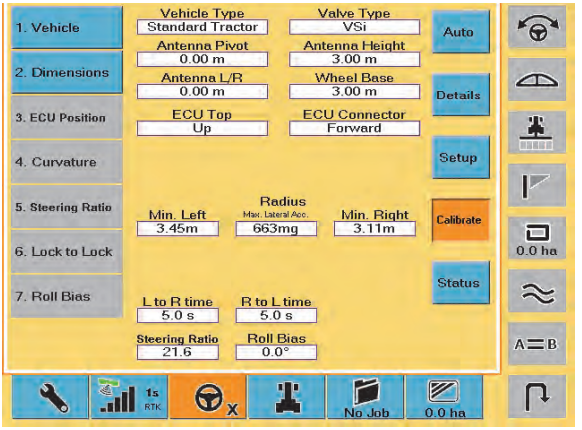


Figure 2-31: Calibration wizard screen - VSi

Complete the first three calibration steps, and step 5 as detailed for machines with hydraulic steering:

"Calibration Wizard Step 1 - Vehicle (tuneset, vehicle and valve type)" on page 21

"Calibration Wizard Step 2 - Dimensions (wheel and track)" on page 23

"Calibration Wizard Step 3 - ECU Position (wheel and track)" on page 26

"Calibration Wizard Step 5 - Curvature (wheel only)" on page 29 (as step 4)

Calibration Wizard Step 5 - Steering Ratio

Note: This calibration step determines various values that specifically relate to the operation of the VSi electric steering wheel. The results are displayed only as the 'Steering Ratio' on the Calibrate screen. Note that the steering wheel will turn full lock right when you press **Ok** at the recommended speed.

1. Press **5. Steering Ratio**—the 'Turn left to full lock' screen appears (Figure 2-32, left image). The **OK** button disappears (Figure 2-32, right image).

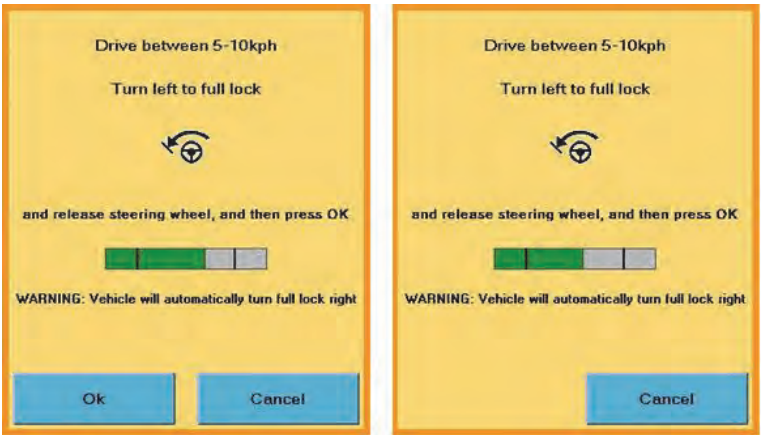
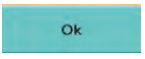


Figure 2-32: Steering Ratio screen

2. Turn the wheels left to full lock and, using the speed bar to maintain a correct speed, drive in a circle at 5-10 kph (3.1-6.2 mph).

   Press **Ok.** The vehicle will turn full right lock and drive in a circle until the **Calibration Complete** screen (not shown) appears.



Calibration Wizard Step 6 - Lock to Lock

Note: When you press **Ok** at the recommended speed in this calibration test, the steering wheel will turn from straight ahead to full left lock then to full right lock, then back to full left lock.

1. Press **6. Lock to Lock**— the 'Drive Straight' screen appears (Figure 2-33, left image).

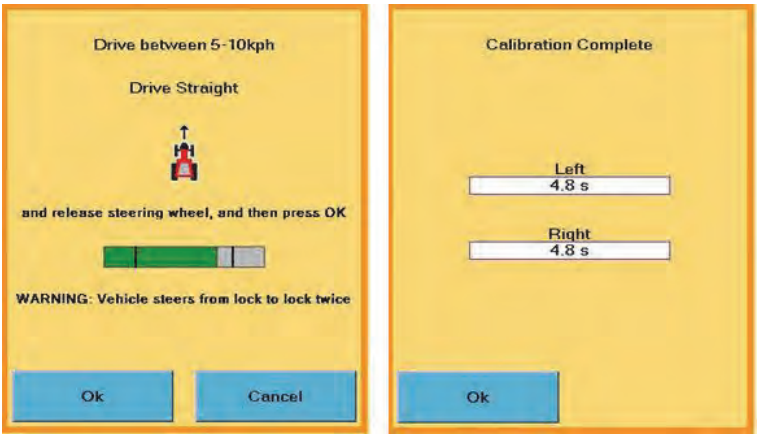
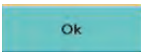


Figure 2-33: Lock to Lock screen - electric steering

2. Release the steering wheel and, using the speed bar to maintain a correct speed, drive between 5-10 kph (3.1-6.2 mph).

   Press **Ok.** The vehicle will turn to full left lock, then to full right lock, then back to full left lock. Continue in the left circle until the **Calibration Complete** screen appears displaying the lock to lock times (Figure 2-33, right image).

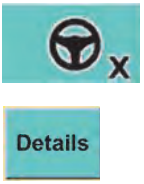


Complete the VSi calibration process with the roll bias calibration as detailed for machines with hydraulic steering:

"Calibration Wizard Step 8. Roll Bias (wheel and track)" on page 33

Reviewing Calibration Settings

1. In the eDriveX steering screen set, select **Details** and check the configuration details.



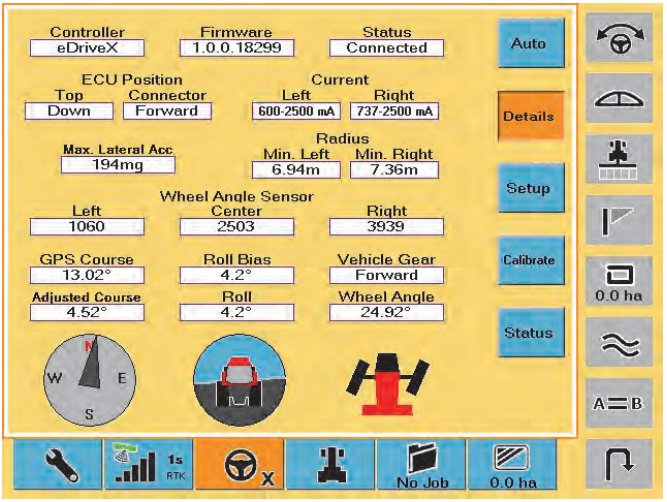


Figure 2-34: Calibration Details screen

2. Repeat any configuration wizard step necessary (see “About Making Changes to a Completed Step” on page 17).

Introducing Antenna Offsets (L/R)

The antenna offset is the lateral (perpendicular) distance between the center of the GPS antenna and the centerline of the vehicle. When ‘calibrating an antenna offset’ you are actually compensating for a physical antenna offset. And to compensate for physical antenna offset you:

- Measure the effect of the uncompensated antenna offset
- Calculate the offset adjustment required
- Enter the calculated adjustment to compensate for the physical antenna offset

An offset—for which you will compensate—comprises a measured distance (the amount of the offset) and a direction (left or right of vehicle centerline). In Figure 2-35 on page 43, the offset distance (or amount) is X, the direction is right.

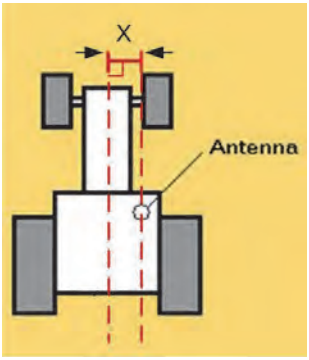


Figure 2-35: Antenna offset: Distance= X, Direction = right

Because it is difficult to measure the antenna offset on the vehicle, you must determine the antenna offset in the field to ensure maximum steering accuracy. However, you need to have completed the calibration wizard before you can conduct the field tests, and to complete the calibration wizard, you need to enter the antenna offset. This initial—or provisional—setting enables you to complete the calibration wizard so you can conduct the field test for an exact antenna offset. See "About Engine Speed During Calibration" on page 17.

Note: If the center of your antenna is exactly on the centerline of the vehicle, you have no antenna offset and no compensation is required. When you carry out the procedures for determining the offset, the result will be a measured offset of zero and no further action will be required.

⚠WARNING: Calibration is required if the system shows an offset while driving up and down on a guidance line without an implement *after* completing the roll bias calibration.

Ways to Determine Antenna Offset

There are two ways to determine the antenna offset:

- The **Track** method (preferred): This method measures the track difference, in at least three places, during two passes (one in each direction) on the same AB line. The method requires a surface where the vehicle clearly leaves tracks.

  Note: 'Track' in this context means wheel or track marks on the ground. The track method for determining antenna offset is suitable for wheel and track vehicles.

- The **Marker** method: This method measures the offset using at least three flags (or other markers) to mark the center of the vehicle (hitch pin point)

during two runs (one in each direction) on the same AB line. If using the marker method, use at least three measurement points on the AB line.

Note: Whichever method you use, the antenna offset (the physical offset on the vehicle and the compensating offset value you enter in the system) is half the measured difference in the track of the vehicle over the two runs.

Determining Antenna Offset - Track Method

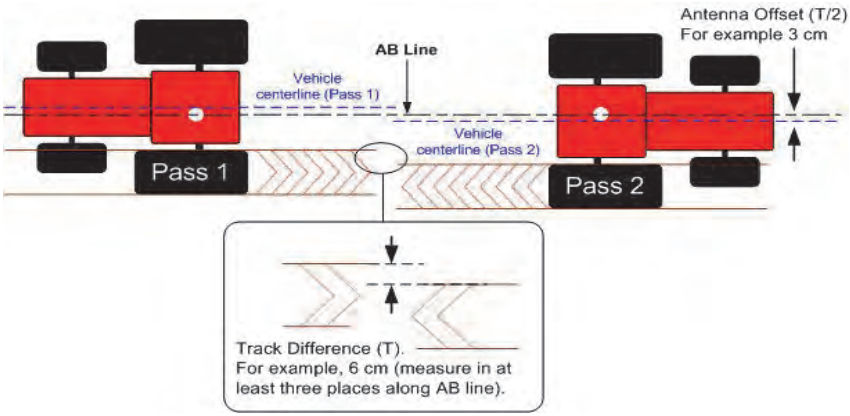


Figure 2-36: Determining the antenna offset. Example 6/2 = 3 cm Left

Complete the following steps.

1. Set up a straight AB line.
2. Maintaining a speed of 5 kph (3 mph) engage steering and let the system steer you along the guideline for at least 100 m.
3. Perform a keyhole turn, re-engage the steering and let the system steer you down the same guideline.
4. In three different places along the AB line, measure the distance between the corresponding track marks (inside edges, outside edges or centers, whichever are easiest to see and measure, see Figure 2-36). If there is variation, calculate the average difference. In our example (Figure 2-36) the track difference is 6 cm, measured at the outside edges of the track marks at one point on the AB line.

   Note: Take your measurements where the vehicle was travelling with a cross track of between 0-1, that is, not just after re-acquiring the AB line after your turn (this is sometimes referred to as 'allowing settling time').

   Halve the measurement (3 cm). This is the amount of the physical antenna offset—the offset you need to compensate for and need to enter as the antenna offset (in meters, 0.03 m) at steps 6 and 7.

5. Determine the direction of the offset. This is the direction in which the vehicle would have to move for the second pass to track exactly over the first pass (this tells you if the antenna center is to the left or the right of the vehicle centerline). In Figure 2-40 on page 46, the vehicle would need to move to the left for the second pass to be exactly on the first pass. (The direction of the offset can also be described as the left or right direction of the antenna's centerline relative to the vehicle centerline when viewed in the direction of travel.)

6. Select **2. Dimensions** in the calibration wizard setup screen - the dimensions setup screen appears.

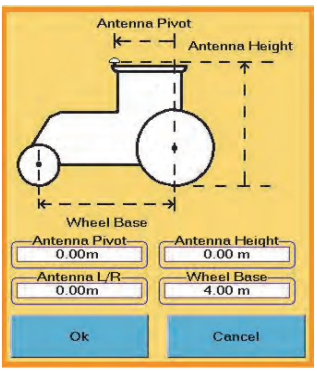
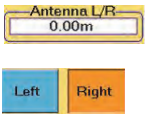


Figure 2-37: Dimensions setup screen

7. Select the **Antenna L/R** field then enter the calculated offset in meters.

   Press **Left** or **Right** to set the offset direction.



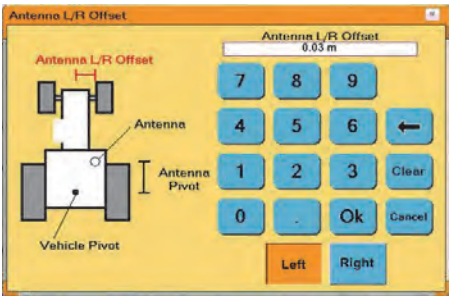


Figure 2-38: Antenna offset entered. 0.03 m, left

8. Press **Ok** - the dimensions setup screen reappears.

9. Test the completed calibration by letting the system control up and down on a new AB line. The tracks should match. If they do not match, repeat the procedure for determining the antenna offset.

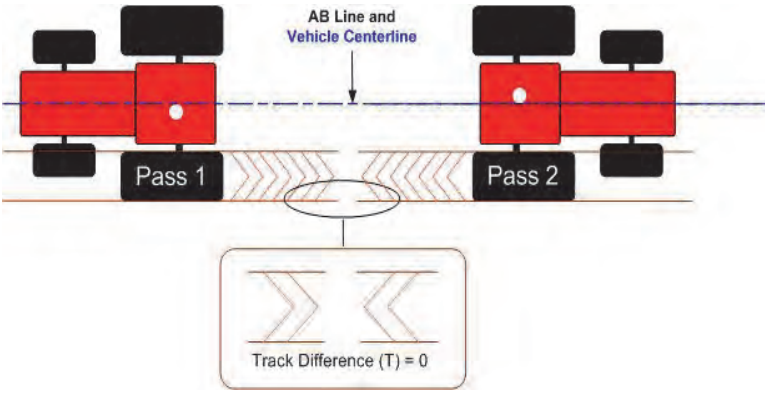


Figure 2-39: No difference in tracking after offset compensation

Determining Antenna Offset - Marker Method

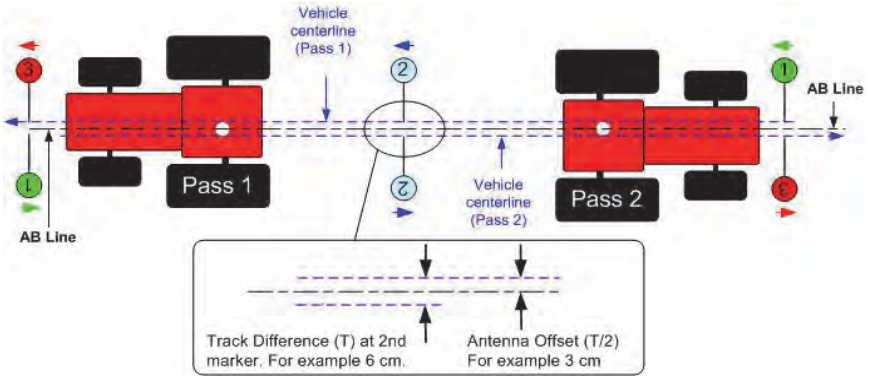


Figure 2-40: Determining the antenna offset. Example 6/2 = 3 cm Left

This is the step-by-step procedure.

1. Set up a straight AB line.

2. Maintaining a speed of 5 kph (3 mph) engage steering and let the system steer you along the wayline for at least 100 m. When the cross track has stabilized (0-1), place markers along the AB line—at least three—on the centerline of the vehicle (the hitch pin point)

3. Perform a keyhole turn, re-engage the steering and let the system steer you down the same wayline. When the cross track is stabilized (0-1), place more markers close to those placed on the first pass.

Note: Place your markers while the vehicle is travelling with a cross track of between 0-1, that is, not just after re-acquiring the AB line after your turn (this is sometimes referred to as 'allowing settling time').

---

4. Measure the distance between corresponding markers. In our example (Figure 2-40) the centerline difference is 6 cm.

   Halve the measurement (3 cm). This is the amount of the physical offset of the antenna—the offset you need to compensate for and need to enter as the antenna offset (in meters, 0.03 m).

5. Determine the direction of the offset. This is the direction in which the vehicle would have to move for the second pass to track exactly over the first pass (this tells you if the antenna center is to the left or the right of the vehicle centerline). In Figure 2-40 on page 46, the vehicle would need to move to the left for the second pass to be exactly on the first pass. (The direction of the offset can also be described as the left or right direction of the antenna's centerline relative to the vehicle centerline when viewed in the direction of travel.)

6. Complete steps 6, 7, 8 and 9 in the track method (starts at page 45).

7. Test the completed calibration by letting the system control up and down on a new AB line and placing markers as before. The centerlines should match. If they do not match, repeat the procedure for determining the antenna offset.

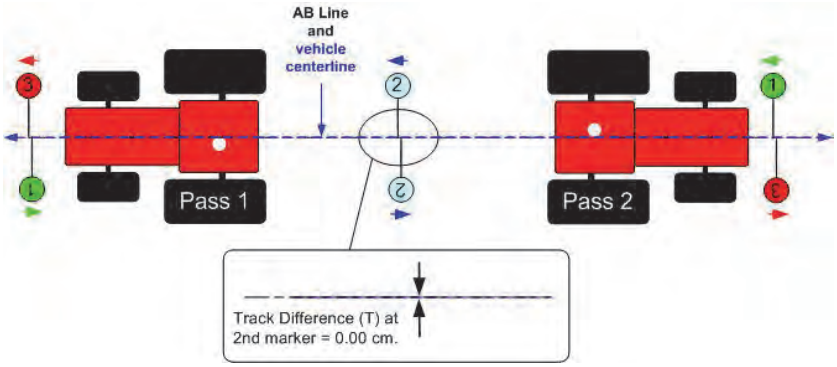


Figure 2-41: No difference in tracking after offset compensation

Introducing Implement Offsets (L\R)

The implement offset is the lateral (perpendicular) distance between the center of the implement and the centerline of the vehicle. When 'calibrating an implement offset' you are actually compensating for a physical implement offset. And to compensate for physical implement offset you:

- Measure the effect of the uncompensated implement offset
- Calculate the offset adjustment required
- Enter the calculated adjustment to compensate for the physical implement offset

Calibration is required if the vehicle successfully repeats its passes while driving up and down on a straight AB line without an implement, but still shows an offset (skip or overlap) during field work with an implement attached. In this case it is likely that the implement is not centered in relation to the centerline of the vehicle. To compensate for this you need to complete an individual implement offset calibration for each implement that is used with the eDriveX system.

The implement offset—for which you will compensate—comprises a measured distance (the amount of the offset) and a direction (left or right of vehicle centerline). In Figure 2-42, the offset distance (or amount) is X, the direction is right.

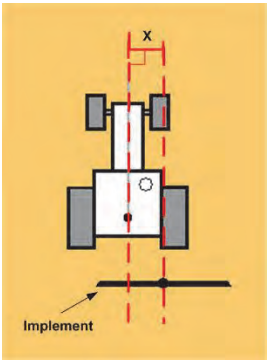


Figure 2-42: Implement offset: Distance= X, Direction = right

Because it is difficult to measure the implement offset on the vehicle/implement combination, you must determine the offset in the field to ensure maximum field work accuracy.

Note: The calibration only compensates for a static implement offset that is caused by the physical dimensions of the implement. It does not prevent offsets that are caused by dynamic movements of the implement, like drift on a slope, for example.

Determining Implement Offset (L/R)

Note: There are two ways to determine the implement offset. This section describes the preferred method. There is a brief description of the other method after the following step-by-step guidance through the preferred method. See “Determining Implement Offset (L/R) - Alternative Method” on page 51.

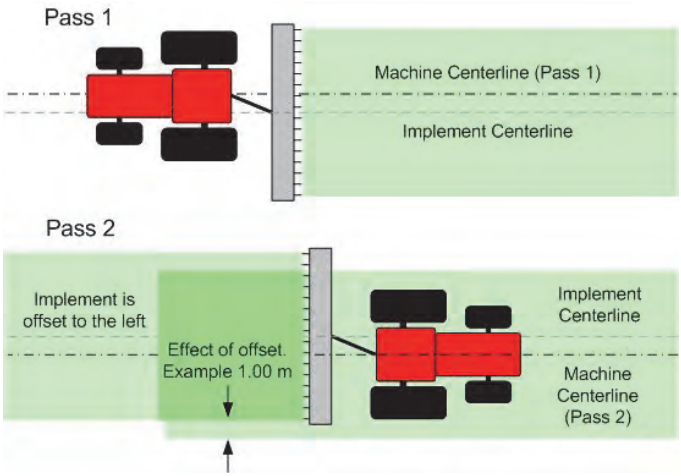
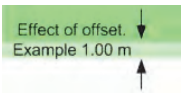


Figure 2-43: Determining the effect of implement offset

Note: This method for determining the implement offset is the preferred method because it eliminates the possibility of errors caused by an incorrect machine width (entered on the vehicle screen - see also “Machine Width” on page 59).

Complete the following steps.

1. Set up a straight AB line.
2. Maintaining a speed of 5 kph (3 mph) engage steering and, with good cross track and with the implement straight, let the system steer you along the wayline for at least 100 m. Ensure the implement is in sufficient contact with the ground to leave a visible swath.
3. Perform a keyhole turn, re-engage the steering and let the system steer you down the same wayline, again with good cross track and with the implement straight.
4. Measure the effect of the uncompensated implement offset as shown in Figure 2-43 (1.00 m in our example). It is the width of the first swath not covered by the second swath.



5. Divide the measurement by two. This is the amount of the physical offset of the implement—the offset you need to compensate for and need to enter as the implement offset in the vehicle setup screen - so 0.5 m in our example (see step 8).

6. Determine the direction of the offset. This is the direction in which the vehicle would have to move for the second pass to track exactly over the first pass (this tells you if the antenna center is to the left or the right of the vehicle centerline). In Figure 2-40 on page 46, the vehicle would need to move to the left for the second pass to be exactly on the first pass. (The direction of the offset can also be described as the left or right direction of the antenna's centerline relative to the vehicle centerline when viewed in the direction of travel.)

7. Select Vehicle tab - the vehicle setup screen appears.

   Select the Left/Right Offset button - the (implement) **Left/Right Offset** screen appears.

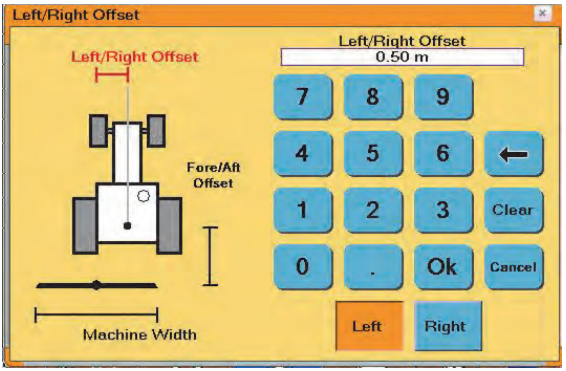
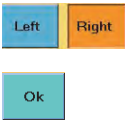


Figure 2-44: The (implement) Left/Right Offset screen

8. Enter the calculated offset value then press **Left** or **Right** to set the offset direction.

   Press **Ok** - the vehicle setup screen reappears showing the offset value and direction.



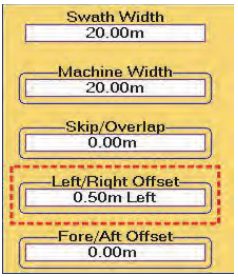


Figure 2-45: Implement offset entered. 0.5 m, left

9. Test the completed calibration by letting the system control up and down on a new AB line. The second swath should overlay the first exactly. If it does not, repeat the calibration.

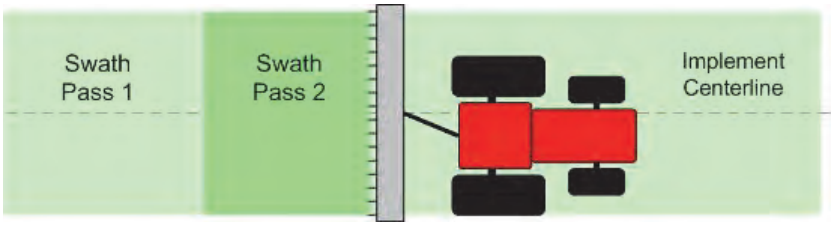


Figure 2-46: No difference after offset compensation

Note: If test results still show skips or overlaps after calibrating both the antenna and implement offsets, make sure the swath width of the implement is correct.

Determining Implement Offset (L/R) - Alternative Method

With this method, instead of driving two passes on the same wayline—one in each direction—you drive three passes on adjacent waylines. Depending on the direction of your implement offset (left or right), you will get a skip or an overlap on the second pass and the opposite on the third pass.

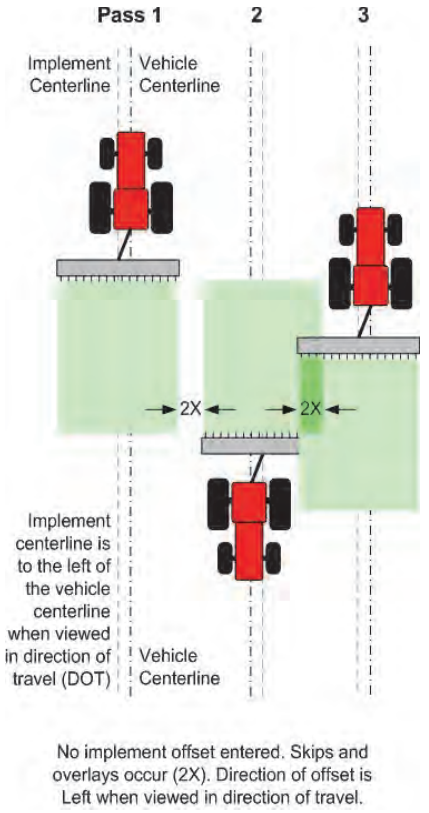


Figure 2-47: Three-Pass method for determining implement offset

The amount of skip and overlay will be the same. Whichever you measure (2X), halve it and enter result as the implement offset (X) along with the direction of the offset, which is left in the example. (**Note:** If the offset was to the right, Pass 2 would produce overlay, Pass 3 would produce skip.)

Chapter 3: Operating eDriveX

About Steering Options
Adjusting Steering Sensitivity, Attack and Smoothing
Introducing Tunesets
Tuneset Data - What's Stored
Managing Tunesets
Selecting 3D A-B Projection
Automated Steering Control Engagement
Viewing Steering Status
eTurns (Autoturns)

Operation of eDriveX is an extension of the stand-alone Outback guidance modes. If you are a first time user of Outback products, carefully review the instruction booklet provided with the Outback guidance controller.

WARNING: Set power to the ON or OFF position to disable automatic steering when traveling between fields at road speeds ('roading'). Accidental steering engagement could cause unexpected steering behavior or dangerous steering reactions.

This chapter covers:

- Setting steering options. Steering options include sensitivity, attack, and smoothing, and managing saved vehicle configurations (Tunesets).
- Using the pre-engage (set for future, one-off, engagement) functionality.
- Enabling/disabling the Auto Engage feature. When Auto Engage is enabled, eDriveX automatically re-engages interrupted auto-steering when all steering criteria are re-met.

Note: For information on eDriveX logs ('session data sets') see "Log Files and eDriveX" on page 14 in Chapter 2.

About Steering Options

Steering adjustment options include:

- **Sensitivity** - the sensitivity setting determines how aggressively the vehicle steers on the guidance line when in close proximity. For more information see "About Steering Sensitivity" on page 54.
- **Attack** - the attack setting determines how aggressively the vehicle steers onto the guidance line when approaching it from a distance. For more information see "About Steering Attack" on page 55.
- **Smoothing** - the smoothing setting determines the amount of smoothing of contours. For more information see "About Steering Smoothing" on page 56.
- **Tuneset** - eDriveX will store an unlimited number of steering settings (tunesets) for a particular vehicle type and valve type. For more information see "Creating and Loading Tunesets" on page 59.

About Steering Sensitivity

Steering sensitivity determines how aggressively the vehicle steers onto the guidance line when approaching it from close proximity.

Depending on preference and needs, you can adjust sensitivity to between 0 and 20. The default setting 7 is a good value to start with on most vehicles. Use Table 3-1 as a guide to setting the sensitivity.

Table 3-1: Sensitivity settings

Sensitivity Setting	Performance
Low value	Smooth steering adjustments, eventual lack of cross track (cross track) accuracy. **Note:** In this sense, cross track is the real-time, constantly changing horizontal offset of the vehicle to the desired position on the guidance line.
Medium value	Good compromise between smooth steering and cross track accuracy.
High value	Aggressive steering adjustments with the wheels being very active, 'twitchy'. Highest cross track accuracy.

Adjust the sensitivity setting within the eDriveX calibration wizard to maintain the GPS guideline accurately without rapidly overshooting or responding too slowly.

- If the steering corrections are too rapid, causing the machine to jerk erratically back and forth across the line, the sensitivity setting is too high.
- If the machine slowly weaves down the guideline, the sensitivity setting is too low. See Figure 3-1.

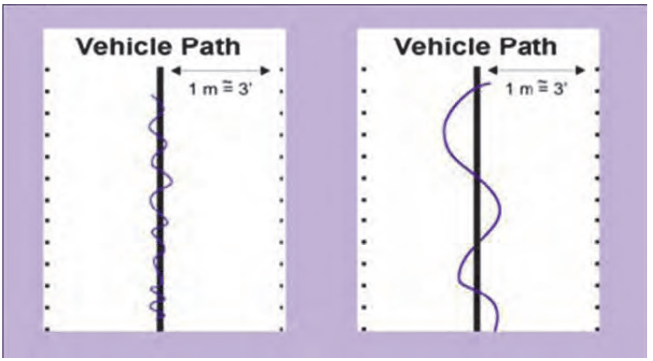


Figure 3-1: eDriveX control at different sensitivity settings

The best sensitivity setting for optimized machine control will depend on different parameters, such as vehicle type, implement, working speed and field conditions.

About Steering Attack

Steering attack determines how aggressively the vehicle steers onto the guidance line when approaching it from a distance.

Depending on preference and needs, you can set attack to between 0 and 10. The default setting 10 (maximum) is a good value to start with on most vehicles. Use

Table 3-2 as a guide to setting the attack.

Table 3-2: Attack settings

Attack Setting	Performance
Low	Very slow line acquisition. The system is not overshooting the guidance line during approach.
Medium	Good compromise between a fast line acquisition and a reasonable amount of overshoot.
High	Fast line acquisition with the potential to overshoot the guidance line until the system catches up.

About Steering Smoothing

Steering smoothing determines the amount of smoothing of contours. The smoothing applied to the current contour is based on the smoothing setting that was active during the preceding pass.

Depending on preference and needs, smoothing can be adjusted to None (the default), Low, Medium or High. For example, it might be necessary to adjust the smoothing setting if a vehicle/implement combination does not allow turning within a tight radius. In addition, a very sharp curvature might not be desired during high-speed operation. Use Table 3-3 as a guide to setting the smoothing.

Table 3-3: Smoothing settings

Smoothing Setting	Performance
None (default setting)	The system tries to follow every contour, even if the contour has a very tight curvature but may disengage when following a very tight turn.
Low	The system applies minimum smoothing.
Medium	The system applies medium smoothing.
High	The system generates optimized control paths for high-speed operation where the minimum curvature for each turn is large. It is not suitable for tight-turn operations as unwanted coverage gaps may occur.

The system has a minimum radius for each setting and cannot generate the correct path if the curve diameter is less than twice that minimum radius. The minimum radius for each smoothing setting is:

- None = 5 m
- Low = 10 m
- Medium = 15 m
- High = 20 m

Adjusting Steering Sensitivity, Attack and Smoothing

1. In the eDriveX steering screen set, press **Setup**. The setup screen appears.

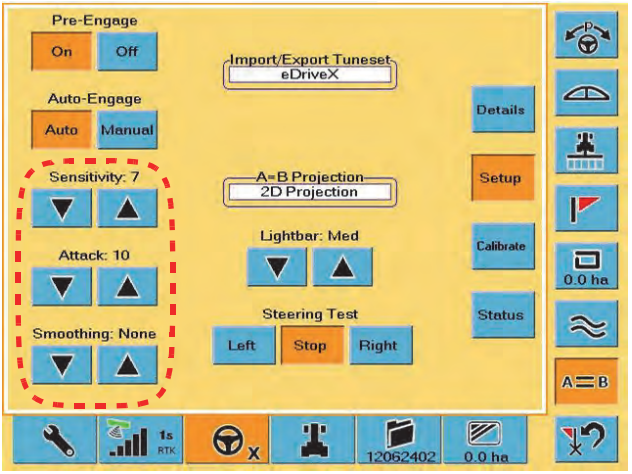


Figure 3-2: Steering setup screen - steering adjust buttons

2. Press the up and down arrows for the adjustment you want to make: sensitivity, attack or smoothing**.** The current value shows next to the button label: 7, 10 and None in our screen example.

The sensitivity adjustment buttons and current setting.

Introducing Tunesets

A tuneset is a vehicle-specific data set that, once created, you can store on your S3. You can store multiple tunesets—created on different vehicles—on a single S3. Then, with the S3 installed in a particular vehicle, you can load the stored tuneset for that vehicle. You can manage tunesets (create, edit, load, delete, export and import) in the tuneset table which you can access two ways according to what you want to do (see “Creating and Loading Tunesets” on page 59 and “Exporting and Importing Tunesets” on page 60)

Figure 3-3 shows four tunesets stored on S3 (1) each of which can be loaded on the appropriate vehicle when the S3 (1) is installed in that vehicle.

As also shown in Figure 3-3, you can export the tunesets for V3 and V4 (for example) to a USB flash drive then import those tunesets from the flash drive onto another [S3 (2)] on another vehicle. Once imported, you can load the appropriate tuneset from S3 (2) just as you could when they were on S3 (1) on the other vehicle.

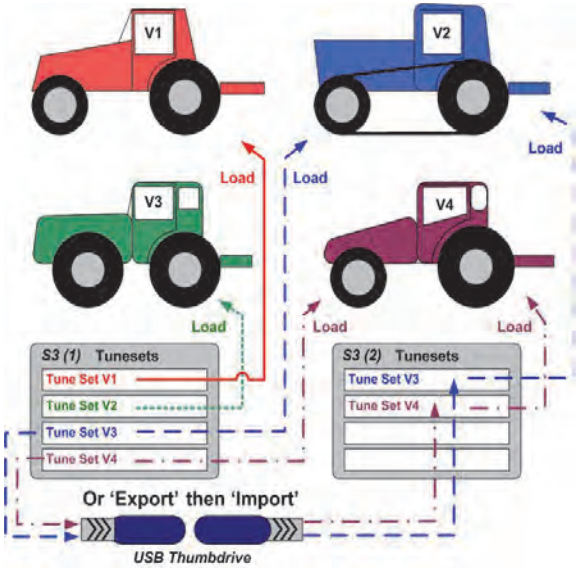


Figure 3-3: Loading, exporting and importing tunesets

Tuneset Data - What's Stored

Table 3-4 lists the data that is stored in a tuneset and provides key information about it.

Note: This is the data that is saved, deleted, exported and imported when you manage tunesets. It is also the data that the system uses in all applicable operations when you have loaded the tuneset from the tuneset table (made it the active tuneset). See "Creating and Loading Tunesets" on page 59 and Figure 3-4).

Table 3-4: Tuneset data and information

Data	Description/Source/Where Displayed
Machine ID	The name you gave the tuneset when you created it using **New.** Displays as the **Machine ID** in the tuneset table (see Figure 3-4).
Vehicle Type and Valve Type	As set at the **1. Vehicle** step of the calibration wizard and displayed in the **Calibrate** screen in the eDriveX steering screen set. See "Calibration Wizard Step 1 - Vehicle (tuneset, vehicle and valve type)" on page 21. Only **Vehicle Type** is displayed in the tuneset tables (see Figure 3-4).
Antenna Pivot, Height and Offset (L/R)	As set at **2. Dimensions** step of the calibration wizard and displayed in the Calibrate screen in the eDriveX steering screen set. See "Calibration Wizard Step 2 - Dimensions (wheel and track)" on page 23.

Table 3-4: Tuneset data and information (*continued)*

Data	Description/Source/Where Displayed
Wheelbase	As set at **2. Dimensions** step of the calibration wizard and displayed in the Calibrate screen in the eDriveX steering screen set. See "Calibration Wizard Step 2 - Dimensions (wheel and track)" on page 23.
ECU orientation	As set at the **3. ECU Position** step of the calibration wizard and displayed in the **Calibrate** screen in the eDriveX steering screen set. See "Calibration Wizard Step 3 - ECU Position (wheel and track)" on page 26.
Date	Last time the tuneset was loaded. The date is displayed as the **Last Used** value in the tuneset table (see Figure 3-4).
Smoothing, Attack and Sensitivity	As set and displayed in the Setup screen in the eDriveX steering screen set. (See "Adjusting Steering Sensitivity, Attack and Smoothing" on page 57).
Machine Width	As set in Vehicle tab screen 
Skip/Overlap	As set in the Vehicle tab screen
Left/Right Offset (Implement offset)	As set in the Vehicle tab screen
Fore/Aft Offset (Implement link length)	As set in the Vehicle tab screen
Minimum Turn Radius (eTurns)	As set in the Auto (turn) **Curvature** calibration screen of the eDriveX steering screen set. See "Calibrating Autoturns" on page 70.

Managing Tunesets

Tuneset management comprises creating, editing, loading, deleting, exporting and importing tunesets. There are two windows in which you can manage tunesets. You access them through the steering setup screen then either the **Calibrate** screen set or the **Setup** screen. Access the appropriate window for the management required (you can edit and delete tunesets in both windows).

Creating and Loading Tunesets

You create and load tunesets through the **1. Vehicle** tab in the steering setup **Calibrate** screen set. (See also "Calibration Wizard Step 1 - Vehicle (tuneset, vehicle and valve type)" on page 21). You can also edit and delete tunesets here.

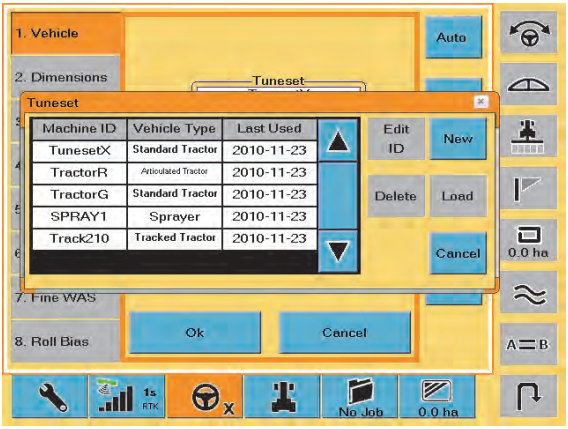


Figure 3-4: Tuneset table via the calibration screen set

New *(create a tuneset)**:*** Opens a keyboard/number pad screen for you to enter a tuneset ID. When you press **Apply** in that screen, the current value of the items that are saved in a tuneset become the values for the new tuneset. The new tuneset is added to the table and can be loaded, deleted or exported.

Load: Makes the selected tuneset active. The value of each tuneset item becomes the value the system uses in all applicable operations.

Edit ID: Opens a keyboard/number pad for you to rename a tuneset.

Delete: Deletes the row selected in the table. You cannot delete a tuneset that is currently loaded (in use).

Exporting and Importing Tunesets

You can export and import tunesets (one at a time or all at once) via the steering setup, **Setup** screen. You can also edit and delete tunesets here.

When you access this window (press the **Import/Export Tuneset** field in the **Setup** screen) the default display is the **Export** list, that is tunesets currently stored on the S3 (Figure 3-5). You can export (singly or 'All') from this display onto a flash drive.

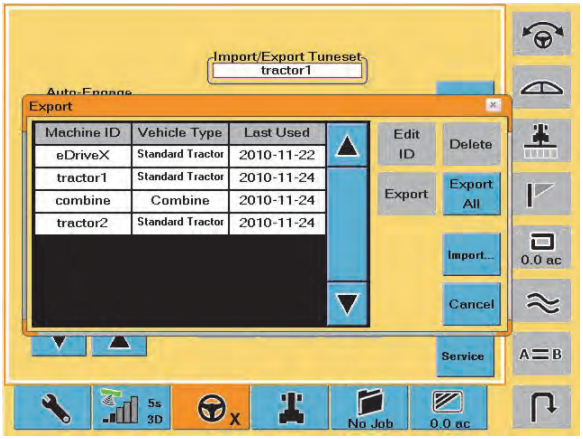


Figure 3-5: Export tuneset table via the steering Setup screen

Note: You can export tunesets to a USB flash drive without the immediate intention of importing them. For example, you could have a particular vehicle's tuneset exported to (saved on) a flash drive and simply use the flash drive as a storage device for a backup copy of the tuneset for that vehicle.

If you press **Import ...**, you will see the **Import** window (Figure 3-6). It lists the tunesets currently stored on the flash drive (note, all buttons will be inactive if no flash drive is detected). You can import singly or 'All' from the flash drive onto the S3, after which tunesets can be loaded, edited, deleted or exported in the relevant window.

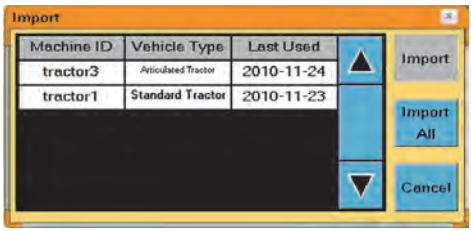


Figure 3-6: Import tuneset table via the steering Setup screen

Selecting 3D A-B Projection

The A-B projection mode relates to the effect of the earth's curvature on guidance accuracy. Select 3D (Steering > Setup screen) as the A-B projection mode for:

- Wide field operations
- Interoperability with third party guidance systems that also use 3D guidance line projection

Note: 3D A-B projection is unrelated to the 3D map view or the GPS position type you may see on the GPS tab.

Automated Steering Control Engagement

For eDriveX automated steering ('auto-steer' and 'auto-steering') to engage, all the auto-steering criteria must be met. You must always initially engage auto-steering manually although you do have the option to 'pre-engage' it, in which case you are setting it to engage by itself when all the engagement criteria are met. (Manual engagement of auto-steering when all criteria are met will be referred to as 'real-time' manual engagement to distinguish it from 'pre-engagement'.)

Note: It is important to distinguish between 'manual' engagement (in real time or through pre-engagement) and 'auto-engagement', which is actually auto-*re*-engagement. Auto-engagement is the re-engagement of interrupted auto-steering, and that auto-steering has to have been manually engaged initially.

The following sections provide detail on auto-steering in general, engagement, pre-engagement and auto-engagement.

About Automated Steering Control Engagement

The criteria for manual engagement (in real-time or by pre-engagement), and auto-(re)-engagement of auto-steering relate to:

- Having an active Job and a path (AB line, pivot or contour)
- Distance (cross track)
- Heading
- Speed
- Absence of manual steering

These are discussed in detail under "Pre-engagement and Auto-engagement"following.

Once engaged, or re-engaged, auto-steering automatically disengages when the criteria are not met, that is, it automatically disengages when:

- You start to steer manually.
- The current position error exceeds 6 ft (2 m) (or 10% of swath width, whichever is larger).
- The vehicle's ground speed is less than 1 mph or greater than 20 mph.

Pre-engagement and Auto-engagement

Pre-engagement: The pre-engagement feature enables you to pre-set auto-steering to engage automatically when all the auto-steering criteria are met. You first turn the feature on (making it available) and then activate it. Once activated, if you are outside the auto-steer engagement limits, you have twenty seconds to get within those limits (the steering engagement button will flash blue/orange). Once inside the limits, auto-steering engages. See Table 3-6.

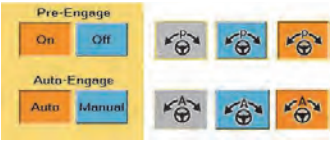


Figure 3-7: Pre-engage and auto-engage buttons and statuses

Auto-engagement: If you set auto-engagement on, auto-steering will automatically re-engage if it is interrupted. Initial engagement has to be manual (either real-time or through pre-engagement) but thereafter, whenever you interrupt auto-steering—to make a manual turn* at the end of a swath for example—auto-steering will re-engage once the machine is back within the engagement limits (provided that occurs within a time limit. See Table 3-7 (* See also “eTurns (Autoturns)” on page 69.)

Automated Steering Button Statuses

It is important to understand how the steering button indicates the status of the automated steering system. Table 3-5, Table 3-6 and Table 3-7 detail, respectively, the statuses when:

- Neither Pre-Engage nor auto-engage are selected
- Pre-Engage function on (irrespective of whether auto-engage is on or off)
- Auto-Engage is on (‘Auto’ selected) and pre-engage is off.

Table 3-5: Steering buttons - auto-engage and pre-engage off (manual, real-time engage)

Button	Indicates	Details
	‘Not ready’. Auto-steering (auto-guidance) not possible.	The auto-steering criteria are not met. Any or all of these are out of limit: • No path (A=B line, pivot or contour, or Job/path) • Heading • Distance (cross track) • Speed • The button reverts to gray (from blue) when you drive out of limits, during a turn for example. It becomes blue again when you are back within the limits.
	Auto-steering available (ready).	All criteria are met and auto-steering will begin when you press the button. Your display will show you approaching this point.
	Auto-steering in progress.	When you press the button while blue, auto-steering will begin.
	A red line through the steering icon (in any state) indicates that the steering wheel switch (the steering override sensor) has been activated.	

Table 3-6: Steering buttons - pre-engage (P) on

Button	Indicates	Details
	Pre-engage feature is on (enabled) but not yet activated. 'Not ready'. Auto-steering (auto-guidance) not possible.	The auto-steering criteria are not met. Any or all of these are out of limit: • No path (A=B line, pivot or contour, or Job/path) • Heading • Distance (cross track) • Speed
	Pre-engage feature is on. You can pre-engage but you are currently out of engagement limits.	The criteria for auto-steering (except no A=B line - see above) are not met.
 **Flashing**	Pre-engagement has been activated	Flashing: Button flashes between blue and orange to indicate that the engagement limits of heading, distance (cross track) or speed are not met and you have 20 seconds to get within the limits. If you get in limits within 20 seconds, engagement will occur. If you do not, button will revert to blue.
 or 	(When the pre-engage feature is on.) Pre-engagement no longer applies. (With/without auto-engage on)	You are within the engagement limits so normal manual (real time) engagement is required: auto-engage will operate normally if on (see Table 3-7 on page 65)
	A red line through the steering icon (in any state) indicates that the steering wheel switch (the steering override sensor) has been activated. **Note:** This will flash on during the 20 second blue/orange phase if you manually steer to meet the engagement limits.	

Note: In Table 3-7 (following) there is an **A** within the button icon. It shows in all button conditions when auto-engage is set to 'on' (Auto) except while the pre-engagement indicator **P** applies (see Table 3-6 above).

Table 3-7: Steering buttons - auto-engage (A) on

Button	Indicates	Condition Details
	'Not ready'. Auto-steering (so auto-engage) not possible.	Initially: The criteria for auto-steering are not met. Any or all of these are out of limit: • No path (A=B line, pivot or contour, or Job/path) • Heading • Distance (crosstrack) • Speed Subsequently: Auto-steering has ceased because manual steering has occurred (to make a turn for example) and has not been able to (re)auto-engage within 45 seconds. See **Flashing** below.
	Auto-steering available (ready) - auto-engage on.	All criteria are met and auto-steering will begin when you press the button. Your map screen display will show you approaching this point. Note that this means that, initially, even though auto-engage is on, you still have to engage auto-steering manually when you first approach a wayline (as if auto-engage was set to manual). (Subsequently, auto-steering will (re)auto-engage when you are back within the limits, after a turn for example. See **Flashing** below.)
	Auto-steering has auto-engaged.	Initially because you have pressed the blue button when within the limits. Subsequently after manual steering when back within limits and manual steering has ceased (see **Flashing** below).
 **Flashing**	Ready to (re)auto-engage.	Flashing: Button flashes between blue and orange when you begin manual steering during auto-engaged steering (to make a turn for example). If auto-steering cannot (re)auto-engage within 45 seconds, flashing ceases and the auto-steering status reverts to 'not ready' (gray). **Note:** Steering auto (re)engages two seconds after you release manual steering when back within the limits.

Note 1: If your system has RTK corrections, eDriveX will automatically disengage if your ground speed is less than 0.25 mph or greater than 20 mph.

Note 2: If RTK is lost, you will see (whichever screen you are currently in) a warning message "RTK Lost - Performance will be degraded". Press **Ok** to acknowledge the message understanding that, because guidance performance has been degraded, you no long longer have centimeter accuracy.

Setting Auto-Steering to Pre-Engage

1. In the eDriveX steering screen set, press **Setup** - the setup screen appears.

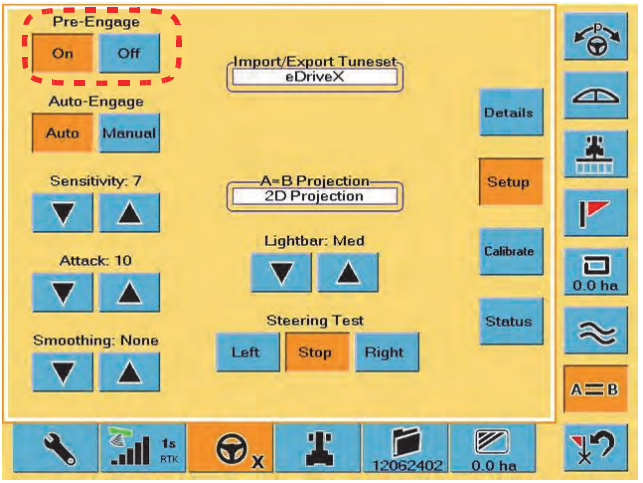


Figure 3-8: Steering setup screen - pre-engage set on

2. Under **Pre-Engage**, press **On**. The **P** appears in the steering button (top right) and auto-steering will engage when all criteria are met. (See also Table 3-6 on page 64.)

(Pre-Engage on)

Setting Auto-Steering to Auto-Engage

1. In the eDriveX steering screen set, press **Setup** - the setup screen appears.

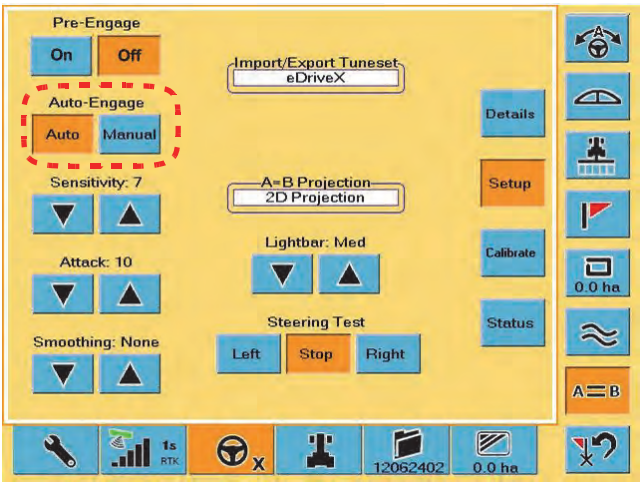


Figure 3-9: Steering setup screen - auto-engage set on (Auto)

2. Under **Auto-Engage**, press **Auto**. The **A** appears in the steering button (top right) and auto-steering will now automatically re-engage after auto-steering is interrupted and when all criteria are re-met. (See also Table 3-7 on page 65.)

(Auto-Engage on)

Viewing Steering Status

The status screen of the eDriveX steering screen set shows the hardware, calibration, and run time status of the eDriveX system. There are some variations between the status screens for hydraulic steering and electric steering (valve type VSi).

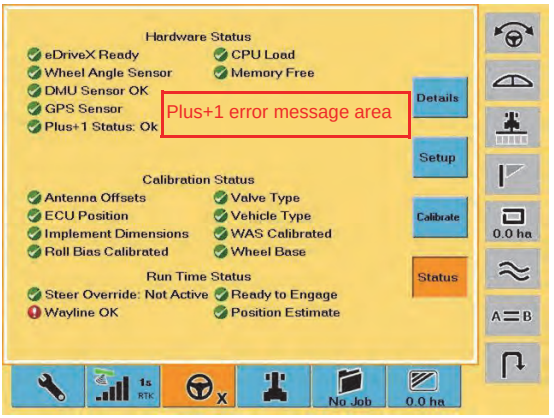


Figure 3-10: eDriveX Status screen - hydraulic steering

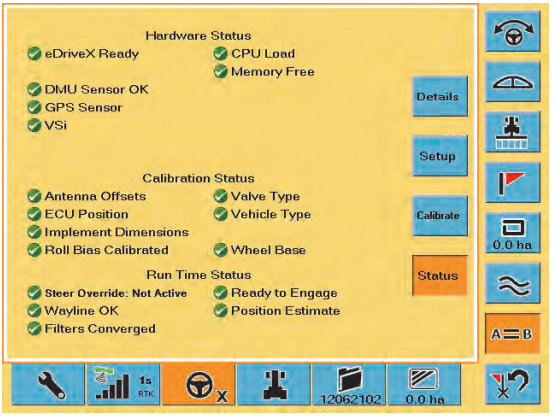


Figure 3-11: eDriveX Status screen - electric steering (VSi)

Each item's status will show as good (green/checked) or, as shown for **Wayline OK** in Figure 3-10, an alert (red/exclamation point). The alert indicates an error or limitation of some kind. The alert may be flashing or static:

- Flashing indicates a part of the system is not ready for guidance/auto-steering (for example, **Position Estimate** or **DMU Sensor** (not) **OK**).
- Non-flashing indicates that some aspect of user setup is not complete, for example there's no AB line or one of the calibration steps is incomplete.

Also, for Plus+1 errors, messages appear on screen that provide some explanation of the error (see Figure 3-10). For details about each status, see "Troubleshooting Status Alerts" on page 87.

Note: A flashing alert also shows on the Status button so you can see that there are 'system unreadiness' alerts even if you are not in the status screen.

eTurns (Autoturns)

The Hemisphere GPS optional eTurns feature enables the vehicle to automatically execute a turn—referred to as an 'autoturn'— at the end of a swath. The swath it turns onto is determined by a user setting.

The key points about autoturns are:

- They are available by subscription
- They are applicable to straight line A-B operations only.
- The manual autoturn button is not active until you have calibrated autoturns.
- Autoturn calibration is required for each tractor/implement combination.
- You can operate with a fixed turn configuration or change the configuration in real time for individual turns.
- The turn guides the vehicle turning path, not the implement's.
- The headland prompt, if used, is based on the vehicle position, not the implement's.

The rest of this section describes the calibration and configuration of autoturns, describes the features of autoturns and details how to make an autoturn depending on your configuration.

Note: Although there is no direct relationship between the configuration steps described in chapter 2, it is recommended that you complete those steps before calibrating for autoturns (see "Introducing the Calibration Wizard" on page 16). Note also that autoturn calibration is required for each implement (unless implements are identical - see Warning in the next section).

Subscribing to eTurns

You get the autoturn functionality through your local dealer or the Hemisphere GPS website, and Hemisphere GPS Customer Support. In a two-stage process you purchase eTurns and get a receipt number and then obtain an activation/subscription code from Hemisphere GPS Customer Support. When you have obtained the activation/subscription code, you enter it using the key/number pad that you access through the Subscription field in the Codes display on the Setup screen. When you have entered your subscription code, 'eTurns' shows in the Subscription field and autoturns are activated.

Note: When you enter a valid subscription code, 'Accepted' appears briefly in the field, then 'eTurns' appears (Figure 3-12, right image). If you enter an invalid code, 'Invalid' appears.

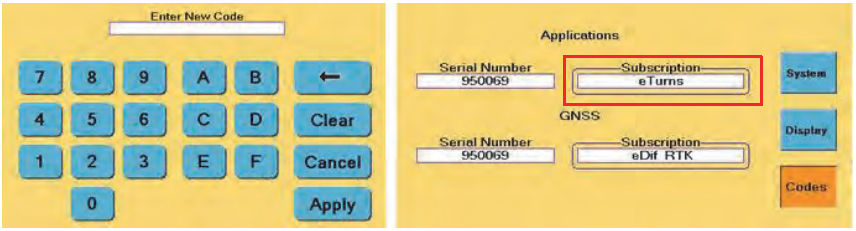


Figure 3-12: eTurns subscription entered

Calibrating Autoturns

WARNING: Because there is potential for damage to machinery if you use a larger implement with the calibration data recorded for a smaller implement, you need to recalibrate autoturns for different implements. When making the left and right turns during autoturn calibration, make the minimum radius turns possible for the current implement.

1. Press **Auto** in the steering setup screen. The autoturn **Curvature** calibration screen appears.

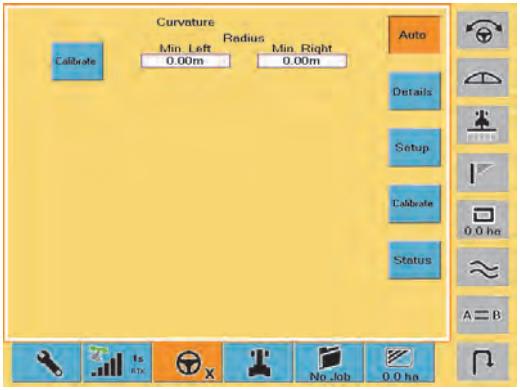


Figure 3-13: Autoturn curvature calibration screen

2. Press **Calibrate**. The first calibration step screen appears (Figure 3-14).

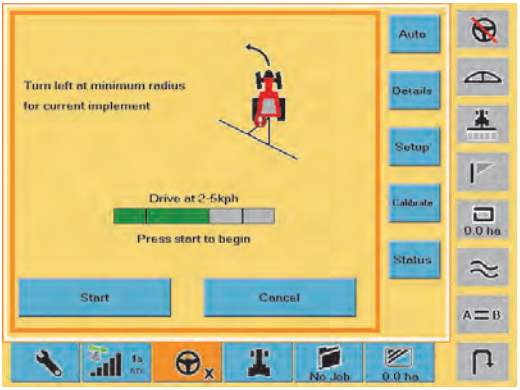


Figure 3-14: Autoturn calibration screen - step 1

3. Maintaining the recommended speed, steer to the left at the minimum radius for the current implement (that is, the tightest possible or practical turn for the current implement) then press **Start**. The calibration screen changes to reflect that the left curvature calibration is in progress (the **Press start to begin** instruction and the **Start** button disappear). When calibration is complete the second calibration step screen appears (Figure 3-15 on page 71).

Figure 3-15: Autoturn calibration screen - step 2

4. Maintaining the recommended speed, steer to the right at the minimum radius for the current implement (that is, the tightest possible or practical turn for the current implement) then press **Start**. The calibration screen changes to reflect that the right curvature calibration is in progress (the **Press start to begin** instruction and the **Start** button disappear).

   When calibration is complete the **Calibration Complete** screen appears displaying the minimum turning circles of the vehicle on left and right lock.

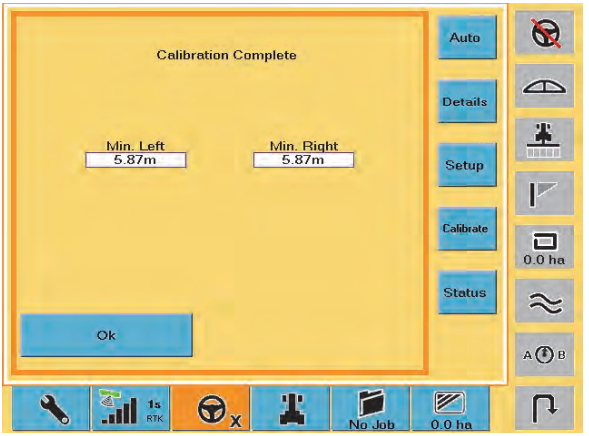
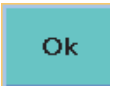


Figure 3-16: Calibration complete screen

5. Press **Ok** - the curvature calibration screen appears with the configuration fields and buttons displayed (Figure 3-17 on page 72).



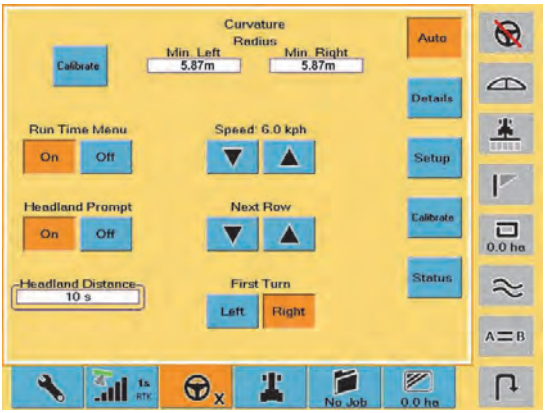


Figure 3-17: Curvature calibration screen with configuration fields and buttons

Configuring Autoturns

After you have completed the autoturn calibration, you can configure autoturns.

Run Time Menu

The run time menu comprises speed and row (current, next, skip) settings. You can change the current setting of speed and row in real time, enabling you to manage turns individually. When Run Time Menu is set to **On**, an input window appears on the map screen during operations.

The run time menu appears as the **Autoturn Inputs** window:

- Automatically with headland prompt on
- When you select the autoturn button with headland prompt off

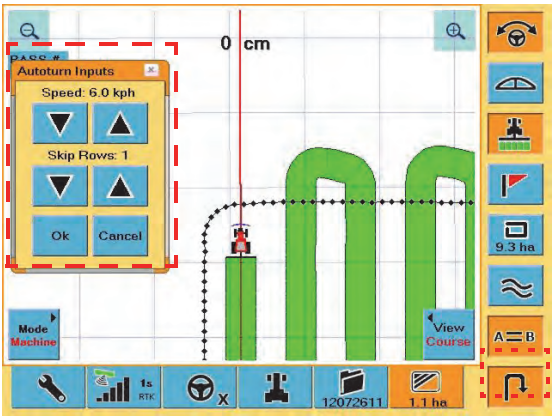


Figure 3-18: Autoturn Inputs (run time menu) on screen

Note: The autoturn button (dotted, bottom right corner of Figure 3-18) acts the same as the **Cancel** button in the **Autoturns Inputs** window in this situation.

Headland Prompt

When set **On**, the headland prompt appears on the map screen during operations. Headland, in this sense, is the end of the current swath, a defined perimeter or a previously worked swath (approached at any angle). The headland prompt will be the **Autoturn Inputs** or the **Autoturn Control** windows:

- If Run Time Menu is **On**, the headland prompt is the **Autoturn Inputs** window (speed, row, Ok/Cancel) - Figure 3-19, left image.
- If Run Time Menu is **Off**, the headland prompt is the **Autoturn Control** window (speed bar, turn direction, Go/Cancel) - Figure 3-19, right image.

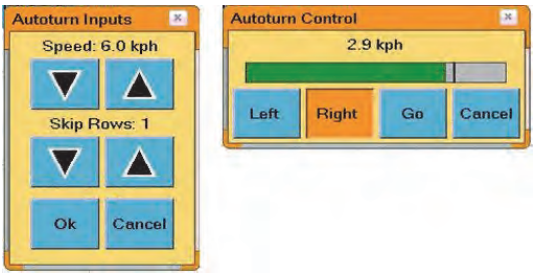


Figure 3-19: Autoturn Inputs and Autoturn Control windows
(see "Predicted Turns and Actual Turns" on page 75)

Headland Distance

This is the distance at which the headland prompt appears on the map screen during operations. The distance is specified as a time (in seconds) because it is speed dependent.

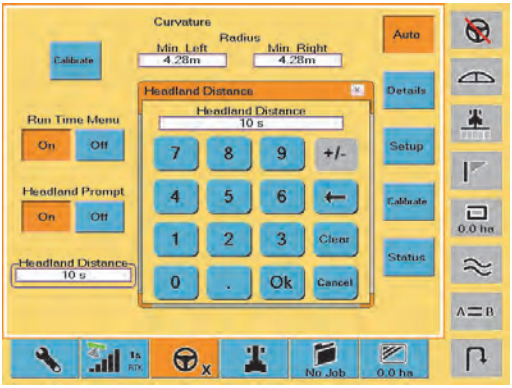
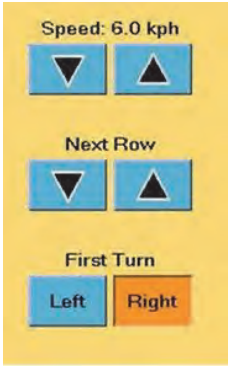


Figure 3-20: Headland Distance input window



Speed (also a run time autoturn input)

Sets the speed at which you want your vehicle to execute the autoturn. The speed and the headland 'distance' combine to determine the linear distance from the headland that the prompt appears. If, during an auto turn, you exceed the speed you set (here, or on the run time menu), automated steering (so the autoturn also) will disengage.

Rows (also a run time autoturn input)

This sets the order in which rows are worked (or 'steered to' - also known as the 'swath pattern'). The options are:

- Current Row - autoturn back onto the current row.
- Next Row - autoturn onto the adjacent row. The first turn is to your first turn setting (left or right, see **First Turn** following) then alternately left/right.
- Skip Rows: # - skip (miss) the number of adjacent rows specified. For example, for **Skip Rows: 1**, the vehicle will autoturn on the pattern 1, 3, 5, 7 etc.

First Turn (an autoturn control input*)

Sets the direction, left or right, of the first turn. *As an **Auto Control** item it represents 'next turn'.

Predicted Turns and Actual Turns

When you press the autoturn button (or **OK** in the **Autoturn Inputs** window when run time menu **On**), the system displays the **Autoturn Control** window and the predicted path of the turn in green.

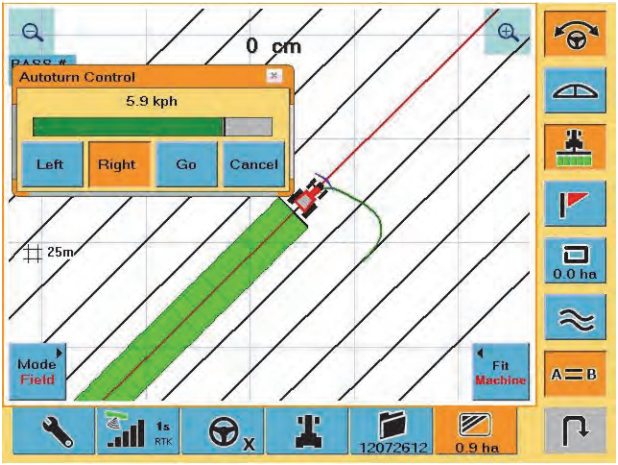


Figure 3-21: Autoturn button and predicted turn path (skip rows = 1)

When you commit to the turn—by pressing **Go** in the **Autoturn Control** window—the system displays the actual path of the turn in red (and the turn begins).

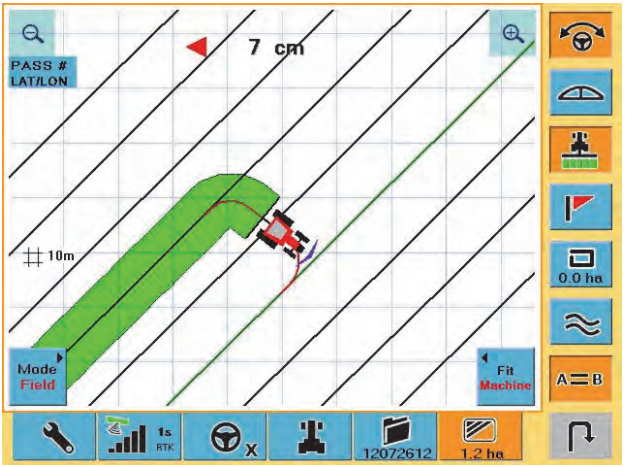


Figure 3-22: Actual turn path - turn in progress (skip rows = 1)

Autoturns and Speed

The predicted and actual turn paths of an autoturn are determined by the speed at which you set the turn to be made (and the curvature calibration for the tractor/implement combination). Figures 3-23 and 3-24 show how the speed determines the turn path.

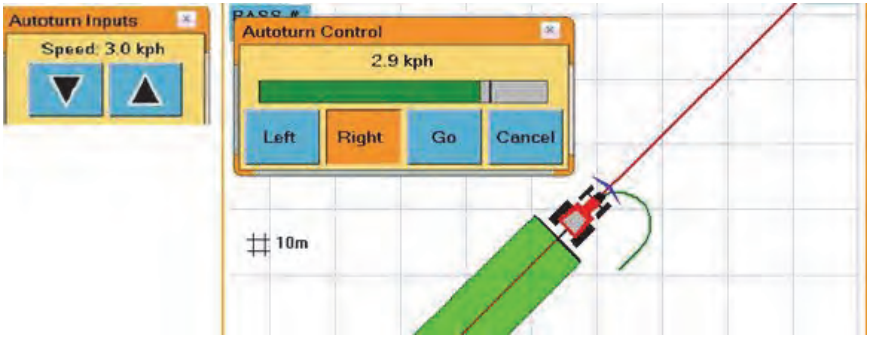


Figure 3-23: Predicted turn at 3.00/2.9 kph (Rows = Next Row)

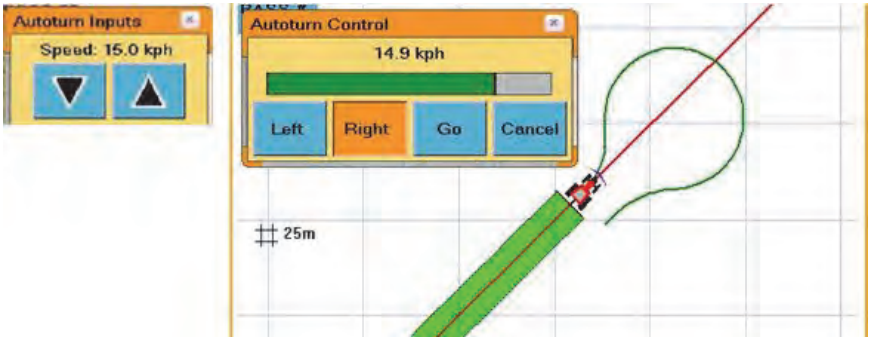


Figure 3-24: Predicted turn at 15.0/14.9 kph (Rows = Next Row)

Note: If you exceed the set speed during the autoturn (beyond a small buffer value), automated steering disengages. This applies to the speed you set in the configuration screen (see "Speed" page 74) or the speed you set (override) in the **Autoturn Inputs** (run time menu) pop-up.

Rows - 'Swath Order' or 'Swath Pattern'

As part of the autoturn configuration you set the row value. The row value determines which row you autoturn onto. You set this in the configuration screen (see "Rows" page 74) and can override it in the **Autoturn Inputs** window. Figures 3-25, 3-26 and 3-27 show the swath patterns for three row values: Current Row, Next Row, or Skip Rows: # (up to the number of rows possible based on the maximum turn distance [about 145 m] and the swath width).

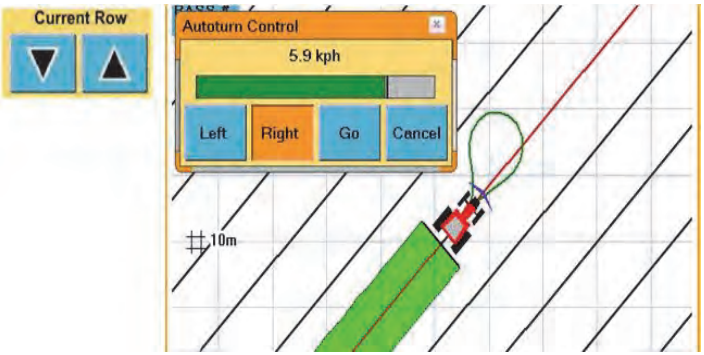


Figure 3-25: Current Row - autoturn back onto same row

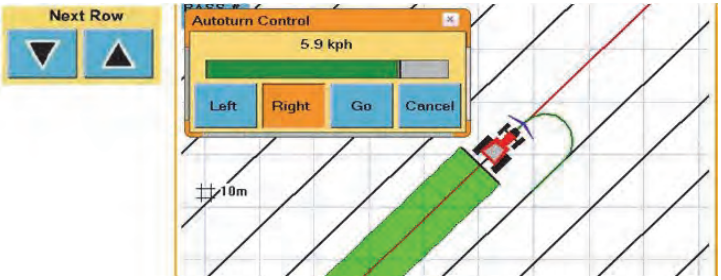


Figure 3-26: Next Row - autoturn onto adjacent row (left or right)

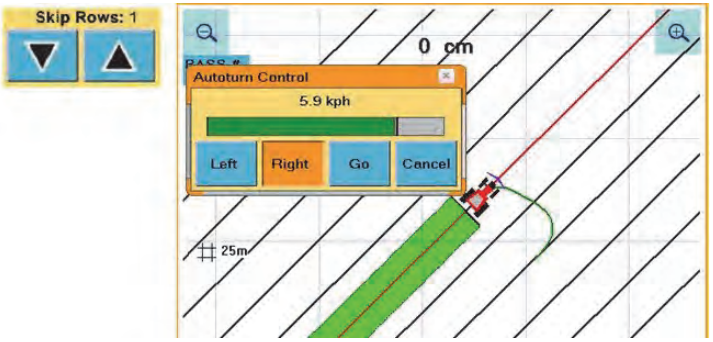


Figure 3-27: Skip Rows = 1 - autoturn skips 1 adjacent row (left or right)

Making Autoturns

Exactly how you activate an autoturn depends on how you set up your run time menu and headland prompt. Table 3-8 details the actions you take for each configuration.

Note: In all cases, the predicted turn path (green) is shown until you press **Go** in the **Autoturn Control** pop-up. The predicted turn path travels with you until you press **Go**.

Table 3-8: Actions for each configuration

Condition	Action
Run Time Menu **Off** Headland Prompt **Off**	Press the autoturn button, press **Go** in the Autoturn Control pop-up.
Run Time Menu **Off** Headland Prompt **On**	Press Left or Right, then **Go** in the Autoturn Control pop-up.
RunTime Menu **On** Headland Prompt **Off**	Press the autoturn button, adjust configuration (speed, skip rows) in the Autoturn Inputs window, press **OK**; press Left or Right then **Go** in the Autoturn Control window.
Run Time Menu **On** Headland Prompt **On**	Adjust configuration (speed, skip rows) in the Autoturn Inputs window, then **OK**; press Left or Right then **Go** in the Autoturn Control window.

Appendix A: Technical Specifications

Tables A-1 through A-5 provide the power, mechanical, communication, GPS, and environmental specifications for eDriveX.

Table A-1: Power specifications

Item	Specification
Input voltage	9 - 36 VDC, over/under/reverse polarity and short circuit protected

Table A-2: Mechanical specifications

Item	Specification
Dimensions	233 mm L x 179 mm W x 66 mm H (9.17 in L x 7.05 in W x 2.60 in H)
Inertial	6-axis gyro/accelerometer stabilized Yaw, pitch, and roll feedback Update rate: 100 Hz
Material	Alloy
Mount	Chassis mount bracket
Enclosure	Waterproof, dust proof

Table A-3: Communication specifications

Item	Specification
CAN	3 x CAN 2.0b ports
Serial	3 x RS-232 serial ports
Protocol	NMEA 2000, ISO 11783, J1939
Other	USB (1), ethernet (1)

Table A-4: Recommended GPS receiver

Item	Specification
Recommended receiver	Outback S3, Crescent
Optional receiver	Outback A220, Eclipse™ (dual frequency)

Table A-5: Environmental specifications

Item	Specification
Operating temperature	-10°C to +60°C (14°F to +140°F)
Humidity	EP455
Enclosure	IP67
Compliance	FCC, CE, C-Tick, WEEE, RoHS

Appendix B: Making the Most of Automated Steering

GPS Signal Accuracy
Machine/Vehicle Control
Implement Accuracy
Field Conditions
Consistent Accuracy and Increased Productivity

Hemisphere GPS Crescent Receiver technology sets new standards for accuracy and flexibility in precision ground agriculture.

However, in-the-field accuracy for automated steering applications is influenced by a variety of factors, not just the inherent accuracy of the GPS system. These factors include:

- GPS signal accuracy
- Machine/vehicle control
- Implement accuracy
- Field conditions

Figure B-1: Factors influencing automated steering accuracy

GPS Signal Accuracy

- **GPS Antenna Location** - install the GPS antenna on the vehicle in a location that will optimize its performance. The ideal location provides an open view of the sky. It also prevents multi-path reflections and signal masking from nearby vertical obstructions.

  It is also important to install the GPS antenna in the center (left and right) of the vehicle. This prevents swath offsets resulting in skips and overlaps. Set the Antenna Offset Calibration in the eDriveX Calibration Wizard to ensure that the antenna is centered.

  If the center of the working implement is not in line with the center of the guided vehicle, be sure to enter an appropriate Swath Offset during setup.

- **Cable Installation:** to prevent problems with signal interference and power fluctuations, give careful consideration when installing the GPS antenna cable, rover radio cable, and power cables.

  Try to route antenna and radio cables away from any other RF (radio frequency) cables. Also, be careful to avoid any cables carrying high amperage electrical pulses. Be sure that all cables are routed and secured properly to prevent crimping and abrasion.

  Connect power cables to stable 12-volt power supplies such as vehicle power outlets or direct battery connections. Avoid using cigarette lighter adapters.

- **eDriveX ECU Orientation:** the eDriveX ECU contains sensors for the yaw (left and right), pitch (up and down), and roll (rotation) axes so it is important to install and configure it in the proper orientation.

  In contrast to the Outback eDriveTC Automated Steering Controller, the eDriveX ECU can be installed in any orientation (in accordance with your

vehicle-specific installation kit), as long as it is perpendicular to the three main axes of the vehicle. Be sure to configure the orientation of the ECU in the eDriveX Calibration Wizard.

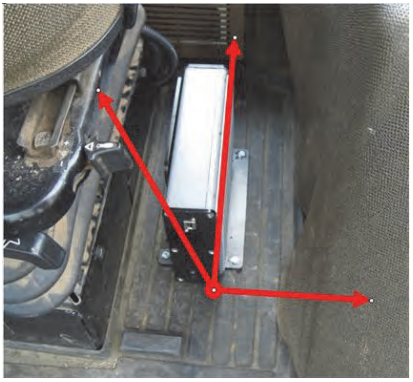


Figure B-2: Mounted eDriveX ECU

To ensure proper tilt compensation, maintain the Roll Bias Calibration within the eDriveX Calibration Wizard.

Machine/Vehicle Control

- **Automated Steering Control Tuning** - Adjust the sensitivity setting within the eDriveX calibration wizard to maintain the GPS guideline accurately without rapidly overshooting or responding too slowly.

  If the steering corrections are too rapid, causing the machine to jerk erratically back and forth across the line, the eDriveX sensitivity setting is too high.

  If the machine slowly weaves down the guideline, the eDriveX sensitivity setting is too low

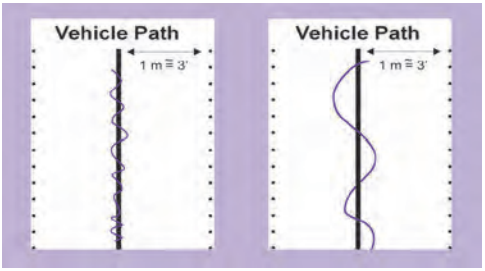


Figure B-3: eDriveX control at different sensitivity settings

The best sensitivity setting for optimized machine control may depend on different parameters, such as vehicle type, implement, working speed and field conditions.

- **Vehicle Setup: Steering Maintenance, Ballasting and Stance, Traction Aids** - It is important to consider the physical characteristics of a

vehicle that may affect the ability of the automated steering system to perform at an optimal level.

When preparing a vehicle for use with automated steering it is necessary to inspect all of the vehicle steering components including cylinders, joints, linkages, wheels, and tires. All mechanical steering connections must be within the manufacturer's specifications for free play in order to achieve maximum machine control accuracy.

Wheels must be true, properly aligned, and spaced evenly from side to side. For optimal automated steering performance, it is best to have the vehicle properly ballasted and a wide wheel stance. Ballasting improves traction for more rapid and precise steering corrections.

Additionally, a wider wheel stance with front and rear duals (where applicable) will dramatically improve vehicle stability allowing for increased steering accuracy.

Figure B-4: Machine ballasted with full set of front suitcase weights and rear wheel weights. Wide stance with duals front and rear for stability and traction

Lastly, it is important to use vehicle traction aids, when possible. The use of mechanical front wheel drive and differential lock will improve vehicle traction and steering making it easier to maintain the guideline. The use of differential lock may not be appropriate in some field conditions; however, most straight-line guidance scenarios will have improved tracking with the use of differential lock.

Implement Accuracy

The tracking performance of the implement plays a major role in accuracy. Implements can often move back and forth across the guideline independent of the guided vehicle, especially in rolling terrain or tough soil conditions. In addition, non-uniform draft loads created by an implement can actually work against the automated steering system, degrading accuracy.

- **Drawn implements** - Implements with long drawbar connections to the vehicle can often move back and forth behind a vehicle that is driving in a straight path. It is important to use stabilizing methods such as disk coulters to help the implement track inline with the towing vehicle.

- **3-Point implements** - For 3-point mounted implements, balance the implement behind the vehicle; that is, all ground engaging elements should be evenly spaced and in proper adjustment. It is common for items such as cultivator shanks or bedder row-units to gradually slip left or right on a tool bar causing uneven draft. Regular checking and adjustment will minimize this problem.

  In addition, on 3-point implements, it is necessary to adjust the sway blocks on the vehicle draft arms. Allow only a very small gap at the sway blocks to prevent large side-to-side movements of the implement.

  Similar to drawn implements, 3-point implements will benefit from evenly spaced coulters set deep enough to prevent side-to-side movements. As implement widths grow in 3-point applications, it may be necessary to use draft chains connected from the ends of the implement to the front of the vehicle to prevent deflection in the outer sections of the implement.

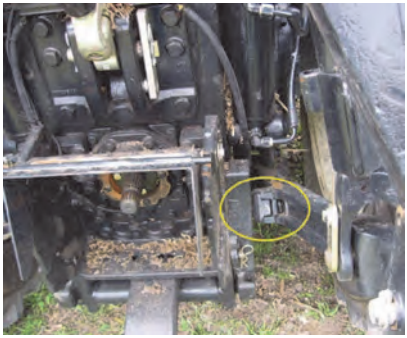


Figure B-5: Vehicle 3-point sway block set tight and spaced evenly on both sides

See “Introducing Implement Offsets (L\R)” on page 48 to properly calibrate the implement offset.

Field Conditions

Field conditions can also play a role in accuracy. Smooth, flat fields with uniform tilt allow for the best possible accuracy; however, this ideal scenario is usually unrealistic. Many fields have rolling terrain, contour terraces, old crop rows, varying soil conditions and other characteristics. Understanding these elements and how they effect steering will help to maximize the guidance accuracy.

- **Rolling terrain** - Be sure the implement is set up with stabilizing coulters for proper tracking behind the tow vehicle.
- **Contour terraces** - Similar to rolling terrain, but may require the use of contour guidance mode. Contour guidance mode uses a smoothing feature to gradually reduce curve severity with each consecutive pass; therefore, each pass will have some amount of error at the transitions of each curve. In addition, drawn implements do not track directly behind the tow vehicle when navigating curves, inherently reducing accuracy. When possible, use straight mode guidance and work up and over mild terraces in high accuracy situations.

- **Old crop rows** - Old rows can create non-uniform draft loads on an implement pulling it and possibly the tow vehicle offline. Working against old rows at an angle will improve draft uniformity. In some cases, it may be necessary to completely work down old rows in order to develop new, very accurate rows.
- **Soil conditions** - Very loose soil may require more steering effort and traction from the guided vehicle. To improve accuracy, it may be necessary to add weight over the steering wheels, use mechanical front wheel drive, and/or differential lock. Irregular and tight soil conditions, such as those encountered when working with old crop rows, can cause similar conditions. To improve accuracy, it is critical to use stabilizing elements on the implement and have the proper ballasting on the tow vehicle.

Consistent Accuracy and Increased Productivity

Special attention to the previous four main factors (GPS signal accuracy, machine/vehicle control, implement tracking and field conditions) affecting automated steering accuracy can help you achieve consistent results that maximize productivity.

Appendix C: Troubleshooting Status Alerts

The Status screen of the eDriveX steering tab set shows the hardware, calibration, and run time status of the eDriveX system (see “Viewing Steering Status” on page 68).

Tables C-1 through C-3 provide information on status alerts for eDriveX.

If the recommended action does not fix the issue, contact Customer Services.

Table C-1: Hardware status alerts

Item	Reason(s)	Action(s) as Applicable
eDriveX Ready	This will never show an alert as you cannot access this screen if eDriveX is not ready (autosteer criteria not met).	
Wheel Angle Sensor	Out of range (current WAS position is outside calibrated values). Short/Open circuit	Power cycle steering controller. Recalibrate WAS (see page 28). Check WAS harness connections for damaged wires/pins.
DMU Sensor	Roll/Pitch out of range because ECU orientation not set correctly. Failed DMU sensor.	Power cycle eDriveX. Recalibrate ECU orientation (see page 26).
GPS Sensor	Comms problem with GPS sensor (power problem) Failed GPS sensor	Power cycle eDriveX.
Plus+1 (Steering Controller)	Open/short circuit on one or more of solenoid lines. Current (mA) fault (not achieving the required current - check current and voltage rating on coils). WAS fault.	Power cycle steering controller. Check solenoid harness for broken or damaged wires/ pins. Review WS troubleshooting.
VSi	Power Required	Power electric steering at the junction box
VSi	Turn steering wheel to enable	Turn the steering wheel
CPU Load	High CPU usage	Wait for two minutes, power cycle eDriveX.
Memory Free	Low free memory	Cycle power to eDriveX.

Table C-2: Calibration status alerts

Item	Reason for Alert/Action
Antenna Offsets	Value not set, check calibration and set correct values. See “Calibration Wizard Step 2 - Dimensions (wheel and track)” on page 23 and “About Setting the Antenna Offset” on page 18

Table C-2: Calibration status alerts (*continued*)

Item	Reason for Alert/Action
ECU Position	Value not set, check calibration and set correct values. See "Calibration Wizard Step 3 - ECU Position (wheel and track)" on page 26
Implement Dimensions	Value not set, check calibration and set correct values. See "Calibration Wizard Step 2 - Dimensions (wheel and track)" on page 23 and "Determining Implement Offset (L/R)" on page 49
Roll Bias Calibrated	Value not set, check calibration and set correct values. See "Calibration Wizard Step 8. Roll Bias (wheel and track)" on page 33
Valve Type	Value not set, check calibration and set correct values. See "Calibration Wizard Step 1 - Vehicle (tuneset, vehicle and valve type)" on page 21
Vehicle Type	Value not set, check calibration and set correct values. See "Calibration Wizard Step 1 - Vehicle (tuneset, vehicle and valve type)" on page 21
WAS Calibrated	Value not set, check calibration and set correct values. See "Calibration Wizard Step 4 - Coarse WAS (wheel only)" on page 28 and "Calibration Wizard Step 7 - Fine WAS (Wheel Only)" on page 32
Wheel Base	Value not set, check calibration and set correct values. See "Calibration Wizard Step 2 - Dimensions (wheel and track)" on page 23

Table C-3: Run time status alerts

Item	Reason for Alert/Action
Steer Override: Not Active	Should be not active unless the steering wheel is being turned. If active when steering wheel not being turned, problem with override system is indicated. Power cycle the system, check alert state.
Wayline	Wayline not set. Select job / template or create new A-B line.
Ready to Engage	Not all conditions for engage are met. Drive onto A-B line and check status while moving above 1 kph.
Filters Converged	Filters not converged. Drive forward ten seconds; complete calibration; drive convergence pattern. Check antenna pivot dimension. See "About Converging Filters" on page 18.
Position Estimate	Usually occurs after startup. Drive machine for a few minutes above 4 kph, error should clear.

Appendix D: Restoring S3 and eDriveX Default Values

The System screen of the Setup tab has a **Defaults** button that you can use to restore S3 or S3 and eDriveX defaults ('All'). After pressing the button, select either All or S3 Only.

If you select All you will see an additional message advising that the ECU will shut down and need to be restarted.

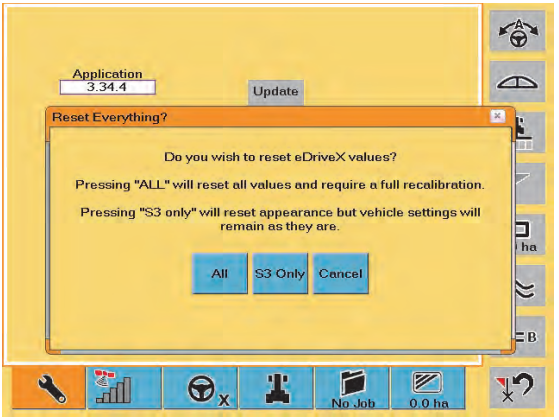


Table D-1: Default values

Tab > Screen	Item	S3 Only	All (S3 and eDriveX)
Setup  > Display	Night Mode: On/Off Control Layout: Left/Right Units: US/Metric Clock: 12 Hr/24 Hr Brightness	Off Right See **Note** 12 Hr 10	Off Right See **Note** 12 Hr 10
		Note: GPS detected within US: US GPS detected - outside US: Metric No GPS detected: Metric	
GPS  > Setup	Local Time SBAS 1 SBAS 2 GPS Source GPS Application	-7 hrs No change No change Internal No change	-7 hrs No change No change Internal No change
GPS  > NMEA	Baud Messages NMEA 2000	19200 All Off No change	19200 All Off No change

Table D-1: Default values (*continued*)

Tab > Screen	Item	S3 Only	All (S3 and eDriveX)
Steering  > Setup	Auto-Engage: Auto/Manual	No change	Manual
	Sensitivity	No change	7
	Attack	No change	10
	Smoothing	No change	None
	Vehicle Type	No change	Std Trctr
	Valve Type	No change	HGPS Std
	Light bar	No change	Med
Steering  > Calibrate	Antenna Pivot	No change	0.00
	Antenna L/R	No change	0.00
	Antenna Height	No change	3.00
	Wheelbase	No change	4.00
	ECU Top	No change	Up
	ECU Connector	No change	Forward
Vehicle 	Machine Width	No change	20.00
	Skip/Overlap	No change	0.00
	Left/Right Offset	No change	0.00
	Fore/Aft Offset	No change	0.00
	Headland Alert: On/Off	On	On
	Lines: Off/A=B/Grid	Off	Off
Other Controls	WAS	No change	No change
	Curvature	No change	No change
	Current	No change	No change
	Roll Bias	No change	No change

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W

End User License Agreement

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