HarvestMaster™
BY JUNIPER SYSTEMS

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Cone Planter Plugin

USER'S GUIDE

Cone Planter User's Guide

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Cautions

CAUTION: This symbol indicates that failure to follow directions could result in damage to equipment or loss of information.

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CHAPTER ONE

GETTING STARTED

Cone Planter overview

The Cone Planter Plugin for Mirus software automates the planter on field research plots using in-furrow cone planters with a GNSS receiver.

System Features:

- Easily retrofitted and added to the most common cone planters already in use or added at time of purchase to new planters.
- Provides a simple solution to tripping the cones using your GNSS signal.
- Can actuate electric solenoids, hydraulic and pneumatic cylinders.
- Provides accurate records of which seed was applied to each plot.
- Easy connection to a wide range of GNSS receivers.
- Mirus field view shows operators which plots are being planted and the current real-time position.
- You can add a barcode scanner to scan seed packets being planted in each plot. This allows you to know exactly where each new packet of seed starts and in which plots.

Mirus installation

Mirus provides the user interface and software control of the Cone Planter system and is designed to run on a rugged tablet under the Microsoft Windows 10 operating system. You can use the Mirus software across almost all research data collection and equipment control needs.

Step 1: Download Mirus to the rugged tablet. Go to *www.harvestmaster.com/support.* Select *Mirus Harvest Software*. From Mirus Support select *Downloads* then *Mirus Harvest Software Downloads*. Download the latest version of Mirus.

Step 2: Run Mirus software installation and follow the prompts on the screen.

Step 3: Activate Mirus online at *www.harvestmaster.com/activate*.

GNSS plugin and Cone Planter plugin installation

Mirus software requires the GNSS Plugin and the Cone Planter Plugin to control the Cone Planter system. Mirus must be installed before installing these plugins.

Step 1: Download the GNSS Plugin and the Cone Planter Plugin. Go to *www.harvestmaster.com/support.* Select *Mirus Plugins and Scripts*. Select *Downloads* then *Mirus Harvest Software Plugins and Scripts*. Download the desired plugins.

Step 2: Run the .mbp files for the GNSS Plugin Cone Planter Plugin.

Step 3: Activate the plugins online at *www.harvestmaster.com/activate.* You can also call your HarvestMaster representative for assistance.

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CHAPTER TWO

SYSTEM SETUP

Cone Planter System

The Cone Planter system uses a rugged tablet computer connected to a system controller which connects to an actuator module, allowing control of up to 4 solenoids or actuators that activate the Cone Planter.

System parts

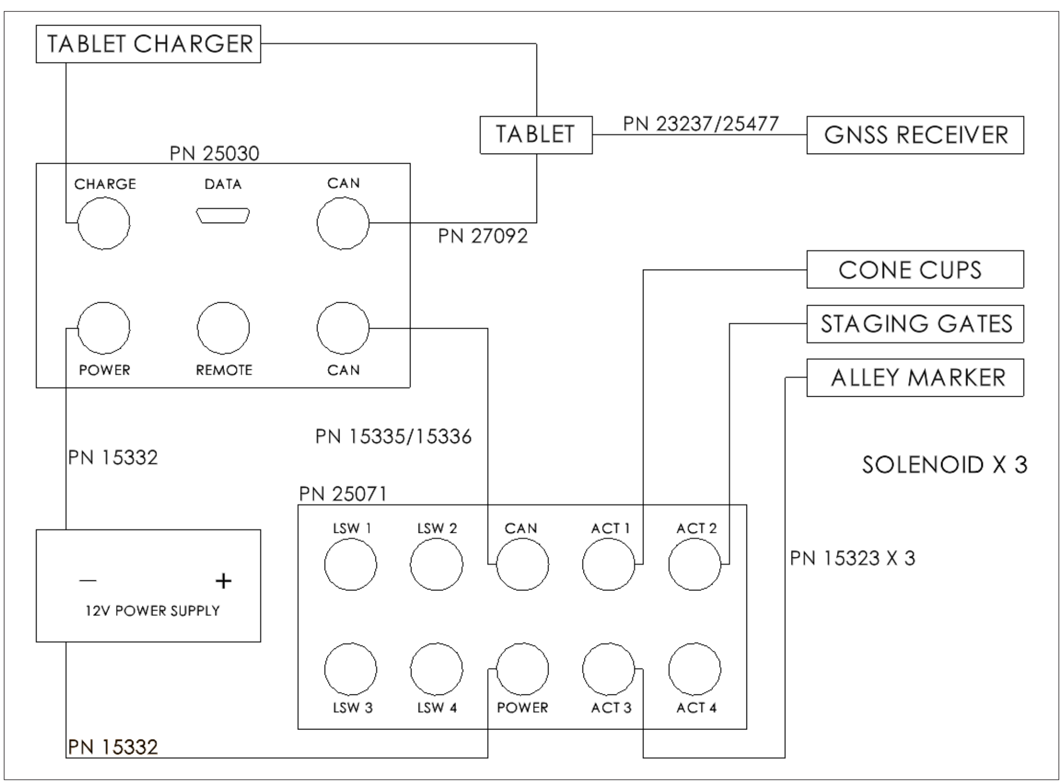
The following table lists the system parts.

PN	Qty	Description	Notes / Purpose	Photo / Drawing
25071		H2 Actuator Module	This module controls the actions of the planter.	
25030	1	H2 System Controller with RAM mount and two button head screws	The system controller provides the primary interface between the tablet computer and the other components in the system.	
15332	2	HM8 12 VDC Power Cable, 20 ft	The power cable connects between the battery, or other 12 VDC power source, and the System Controller.	
15336	1	HM8 CAN Communications Cable, 20 ft	The CAN communications cable connects to the System Controller to the actuator modules in the enclosure.	
27092	1	HM8 USB CAN Converter Cable	The CAN converter cable connects the tablet PC to the System Controller.	
23237	1	HM Serial Cable	The serial cable connects the tablet computer to the GNSS system.	

PN	Qty	Description	Notes / Purpose	Photo / Drawing
25477	1	GNSS/GPS Data Cable	This cable connects the tablet computer and the GNSS receiver.	
15323	2	Actuator Cable with pig tail ends.	Connect to actuator ports on the H2 Actuator module and to the solenoid.	
Setup Example		H2 Actuator Module with wiring, H2 System Controller, and connectors in enclosure	An enclosure with one actuator module mounted inside. The actuator module is wired to connection plugs. The system controller can be placed inside if desired.	

Connection and wiring

The system requires these connections:



GNSS/GPS setup

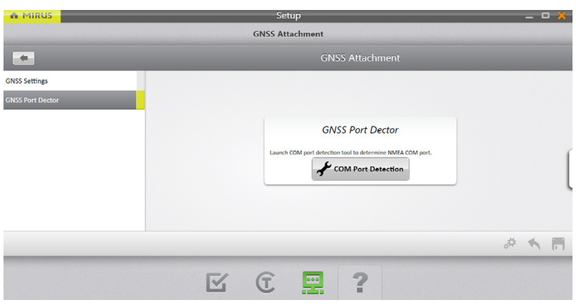
The GNSS/GPS receiver may need to be configured to communicate with Mirus. Follow the instructions provided for your GNSS/GPS receiver. You also need to configure Mirus to communicate with the GNSS/GPS.

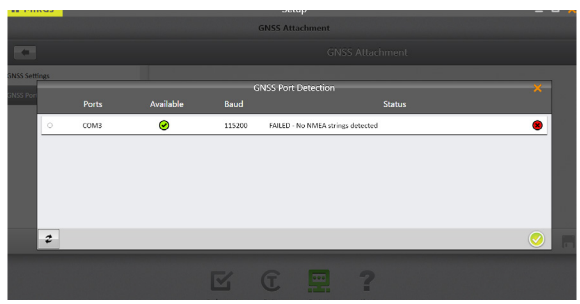
Step 1: Refer to instructions for configuring your GNSS/GPS receiver. On the receiver, enable GGA and VTG for machine control, enable GST or RRE for Estimated Horizontal Error (EHE), and enable GSV to show the satellites. For best performance, disable other NMEA message types that may be enabled in your GNSS receiver.

Step 2: With wiring complete and connected, power on the GNSS/GPS and the HarvestMaster Field Applicator system.

Step 3: Open Mirus, and navigate to the Setup menu without connecting to any plugins.

Step 4: In the Setup menu, select GNSS Attachmets and the GNSS Port Detector. This feature automatically finds the COM port on which the GNSS receiver is connected.

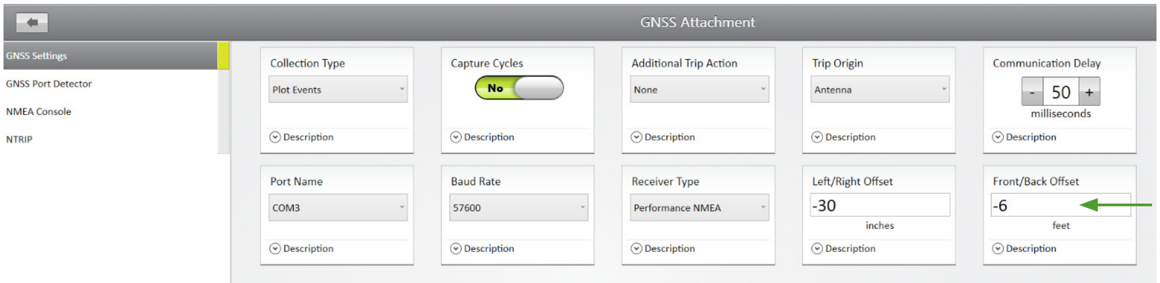




Step 5: Select the port that is detected by the software, and go to GNSS settings and set the correct COM port. The following settings are automatically filled in, except for offsets:

- Collection Type: Plot Events
- Capture Cycles: no
- Additional Trip Action: None
- Trip Origin: Offset Position
- Receiver Type: Performance NMEA

After the port detection is done, go to GNSS Settings and input either the Left/Right Offset and the Front/Back offset.

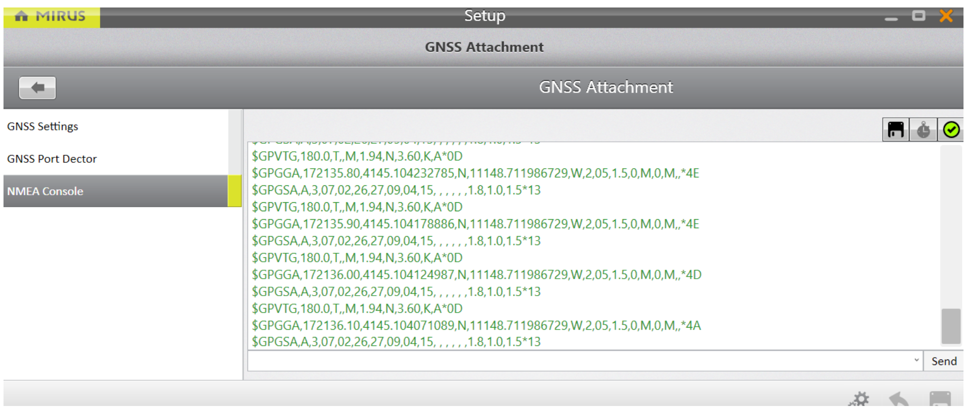


Step 6: Save the settings and then navigate to the Mirus Home screen.

Step 7: Connect the Cone Plugin under devices tab.

Step 8: Connect the GNSS Attachment under the attachments tab.

Step 9: Once connected, use the diagnostics view or the NMEA console view to verify that Mirus is receiving live GNSS data.



Cone Planter setup

In Mirus, navigate to Setup > Cone > Settings. The applicator settings should be configured as follows:

Settings

Note that the times mentioned below are subject to change based on speed.

Cone Start Delay: The amount of time it takes to actuate the cylinder or gate and for seed to drop to the ground. To begin, use a setting of 100 to 300 ms, and then calibrate as needed.

Alley Marker Start and Stop Delay: This controls when the alley marker should be turned on and off.

Plots Per Pass: How many plots are being planted at the same time (1-4 plots per pass is typical).

Actuators

Actuator Module: Use to enable the alley marker if you have one.

Cone Actuator: The Open State Time controls how long the cone/cup stays open.

Staging Actuator: If you have a staging cone, change the actuator type from None to Dual or Pneumatic. If you don't have a staging cone, make sure you have the actuator type set to None.

Open State Time controls how long the cone/cup stays open.

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CHAPTER THREE

CALIBRATION

System Calibration

When properly calibrated, the Cone Planter works at different speeds and with plots and alleys of different dimensions.

The process of calibrating the Cone Planter and GNSS plugins requires two main steps: calibrating the setback (offsets) and aligning the seed placement.

Generally, calibration is only required once. But certain changes to the system could require recalibration. The following factors will require recalibration:

- If the GNSS/GPS receiver is changed to a different model, perform recalibration for the communication delay as it may be different for different models.
- The setback may change if the applicator is being used with a different tractor or if the GNSS/GPS antenna is moved to a new position, and for situations like these the setback needs to be re-calibrated. When the planter is located behind the GNSS/GPS, the front/back offset is negative.
- Based on the travel speed of the tractor, adjust the cone start delay and alley start and stop. Any time the speed changes more than a 0.25 mph, you should make a change to the timers.

Prepare for calibration

Before calibration, ensure that all solenoids or actuators are in good condition. Valves and/or gates that are sticky will adversely affect calibration and planting.

Seed alignment with plots

With setback and offsets properly set, make sure the seed placement is calibrated to start as the cone enters the plot.

Three key factors influence how well the seed placement can be aligned to start as the planter enters the plot: GNSS/GPS accuracy, GNSS/GPS communication delay, and cone start delay associated with the mechanics of the actuator.

GNSS/GPS accuracy

The accuracy of the GNSS/GPS receiver affects how well the seed aligns to the plots. Mirus cannot compensate for misalignment that is due to lack of accuracy from the GNSS/GPS receiver. For example, consider a scenario in which an RTK receiver provides accuracy of 2 cm. The system will have up to 2 cm of stagger in both directions and could appear to be off by as much as 4 cm. Because of this factor, allow for a certain degree of imperfection in aligning the seed with the plot.

GNSS/GPS communication delay

The time for the GNSS/GPS receiver to transmit the current position to the tablet computer is a critical factor, and Mirus provides the capability to calibrate for this delay.

Actuator start

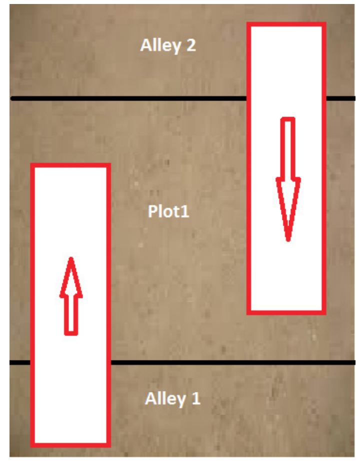
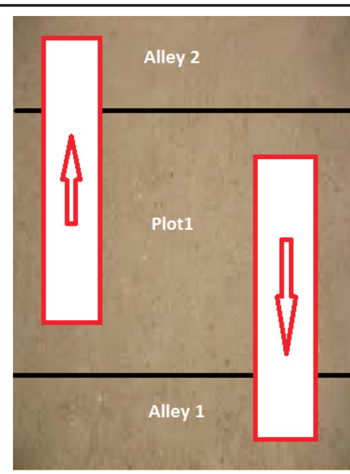
The mechanics of the actuator introduce delay from when Mirus sends the signal to start planting actually starts and the delay can be different for starting planting. Mirus provides settings to adjust the Cone Planter Start Delay.

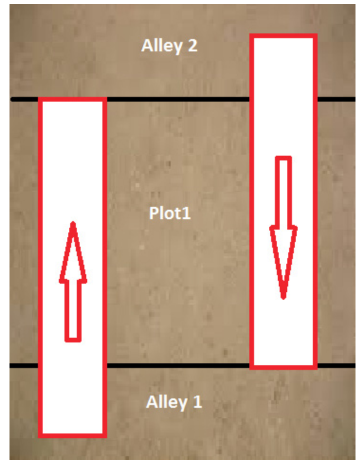
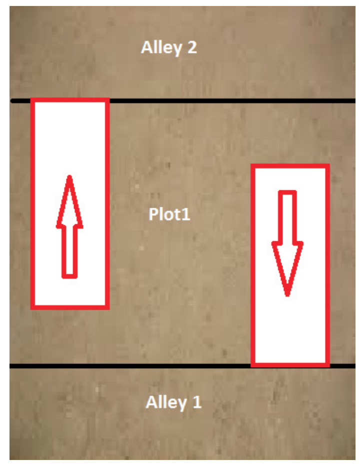
Setting delays in Mirus

Considering the stagger that can be introduced from GNSS/GPS accuracy, it can be difficult to determine which delays need to be adjusted. If the cone start delay is too early or too late, the timers might need to be adjusted. Changing the communications delay also affects the GPS positions that are saved to the database, and so it is important to adjust the right parameters.

To calibrate the planter properly, make sure to drive at least 2 passes at the same speed, preferably the same speed as when you actually plant the plots.

The following scenarios outline likely issues and provide guidance for making adjustments in the Mirus settings.

Issue description	Possible causes	Diagram
Scenario 1: The seed placement starts too early (before entering the plot) and ends too early (before leaving the plot). But the seed placement length is correct and is staggered backward.	This could be due to: • communication delay set too long, • seed placement start delay is too long, or • offset set too short. Note: Communication delay being too long is more likely than having both the seed placement start delay and seed placement stop delay off by the exact same amount. Note: Offset is unlikely, if you properly calibrated the offset previously. But you can tell if set back is the issue by testing at different speeds (fast and slow). Setback is the problem if the stagger remains the same at fast and slow speeds. Delay settings are the problem if the seed placement becomes longer at higher speeds.	
Scenario 2: The seed placement starts too late (after entering the plot) and ends too late (after leaving the plot). But the seed placement length is correct and is staggered forward.	This could be due to: • communication delay set too short, • seed placement start delay is too short, or • offset set too long. Note: Communication delay being too short is more likely than having both the seed placement start delay and seed placement stop delay off by the exact same amount. Note: Offset is unlikely, if you properly calibrated the setback previously. But you can tell if set back is the issue by testing at different speeds (fast and slow). Offset is the problem if the stagger remains the same at fast and slow speeds. Delay settings are the problem if the seed placement becomes longer at higher speeds.	

Issue description	Possible causes	Diagram
Scenario 3: The seed placement starts too early (before entering the plot) and stops correctly at the end of the plot. The seed placement is too long.	The seed placement start delay is too long. It takes less time to start seed placement than what the open transition time is indicating on the actuator. Note: Be sure to measure the seed placement length because this scenario could be confused with scenario 1, especially if you do not know exactly where the true alleys should be.	
Scenario 4: The seed placement starts too late and is too short, but ends correctly.	The seed placement start delay is too short. It takes more time for the actuator to move and the seed placement to form than what the open transition time is indicating on the sprayer actuator. Note: Be sure to measure the seed placement length because this scenario could be confused with scenario 2, especially if you do not know exactly where the true alleys should be.	

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CHAPTER FOUR

OPERATION

System Operation

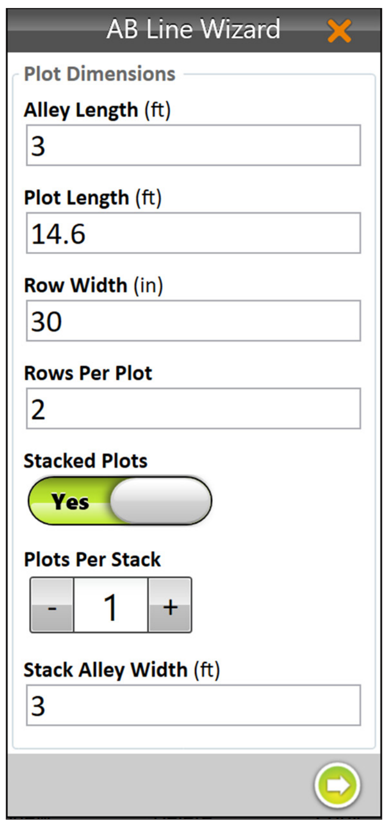
This section covers instructions for planting. Be sure that calibration and system setup have already been completed.

Automatic GNSS/GPS cycling

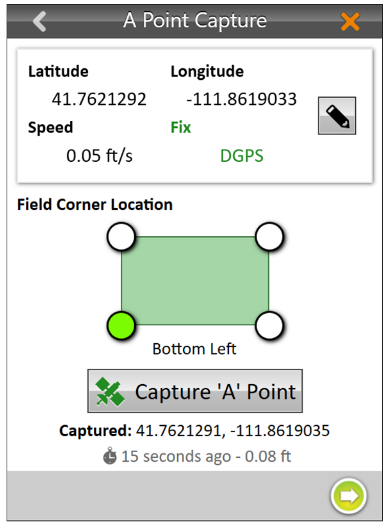
Under the maps section select the map you are going to use.

Step 1: Select the AB Line button to open the AB Line Wizard. Mirus uses the AB line to calculate the locations of plots in the field to automatically start the cone, staging, or alley marker. Enter the plot dimensions and select Yes for Stacked Plots if desired. If you use Stacked Plots, indicate how many plots you want to plant simultaneously and how wide you want the Stack Alley Width to be in feet in between the stacked plots.

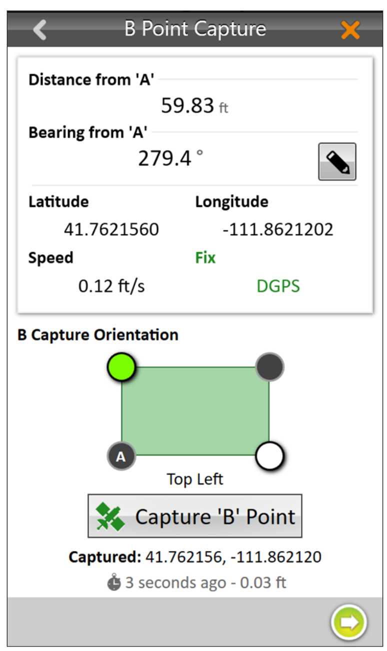
Save this information by selecting the green arrow button,



Step 2: Capture the A point by positioning planter openers at the edge of (and ready to enter) the first plot (Range 1, Row 1). Default is from the bottom left, but can be done from any corner.



Step 3: Establish a bearing by either entering a bearing, if it is known, or by moving several plots through the field to capture the B point. The accuracy of the bearing tends to be better when there is a long distance between the A point and the B point. If these points are captured at a short distance, the bearing could have some error in it



Step 4: After saving the AB line, use the Plant button.

Step 5: Select the green mark to open the AB line Wizard. In the setup window, select the starting plot, and then use the green arrow button to proceed to the next step.

Step 6: In the Setup Wizard you can make changes or adjustments to field placement and plot/alley dimensions. Once the layout of the map is set up as desired, select the green check mark to close out of the AB Line Wizard.

Step 7: Select Plant to start planting.

Step 8: Select the planting map pattern

Step 9: In the quad view, choose the views that you would like to display.

If you use the spatial view in your quad view setup, it displays plots labeled with "Range, Row" by default. But you can select from a list of different spatial attributes by clicking on the spatial attribute button in that quad. To visually distinguish plots that have been planted, select the spatial attribute with the sequence number.

Step 10: When you are ready to begin, press the Start button.
Important Note: *Be sure that you are not in the field when you select start because the system will begin planting. For best results, move the planter back to a position outside of the plots (near your starting location), and start moving into and through the plots at your target speed.*

Step 11: Proceed through the plots at a consistent speed. Mirus triggers the planter automatically.