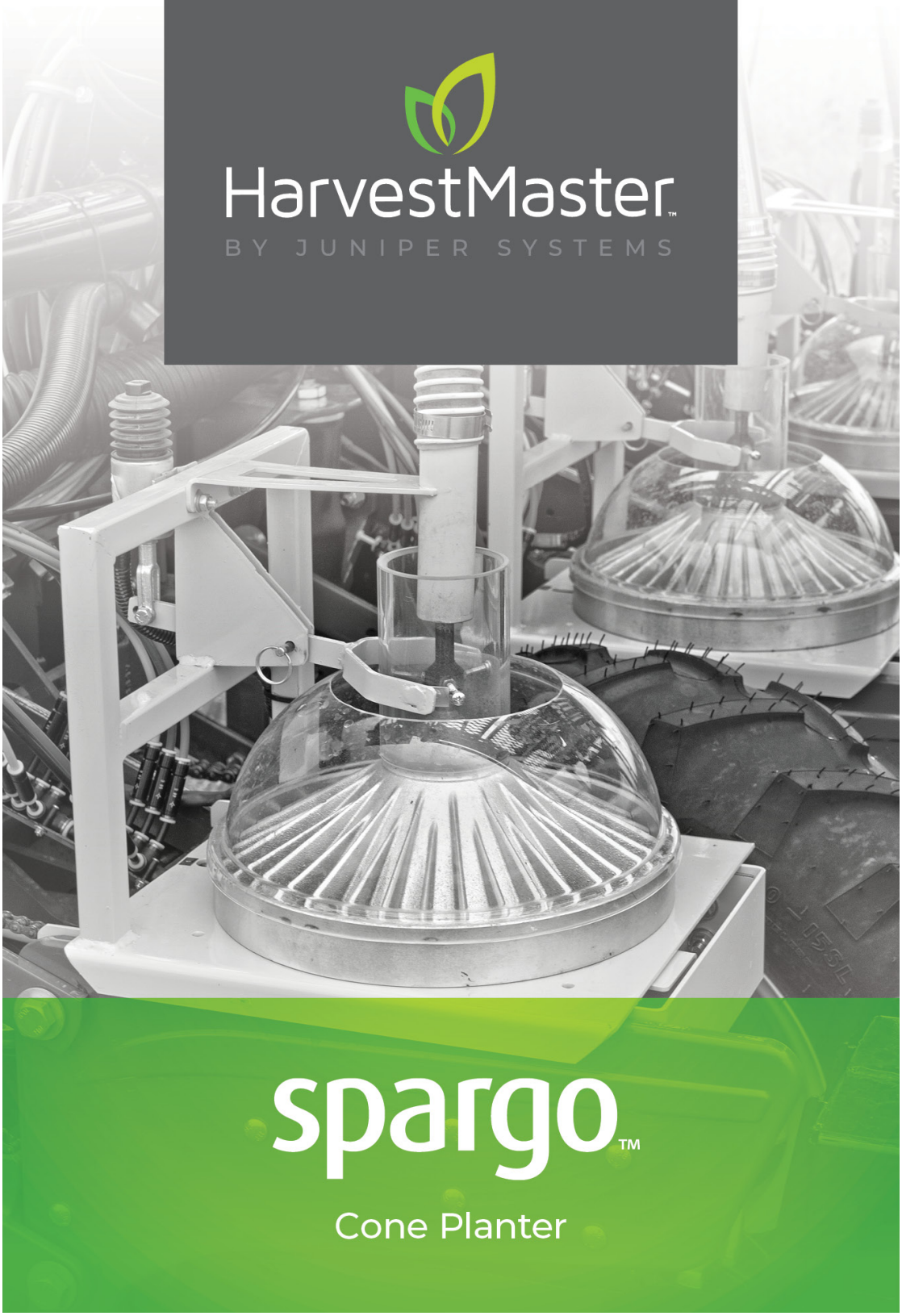
HarvestMaster™

BY JUNIPER SYSTEMS



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Cone Planter

USER MANUAL

Spargo Cone Planter User Manual

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Trademarks

Disclaimer

Information is subject to change without notices.

Cautions

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

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CHAPTER 1

Getting Started

1 Getting Started

1.1 Spargo Cone Planter Overview

The Spargo Cone Planter along with 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.

Software requirements:

- Mirus 4.3.0 or newer
- Spargo Cone Planter 1.0.1 or newer
- GNSS 2.0.0 or newer

1.2 Install Mirus

Mirus provides the user interface and software control of the Spargo Cone Planter and is designed to run on a rugged tablet under the Microsoft Windows 10 or later 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.

1. Go to www.harvestmaster.com/support.
2. Select Mirus Harvest Software.
3. From Mirus Support, select **Downloads** > **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.

1.3 Install Spargo Cone Planter and GNSS Plugin

In addition to Mirus, you'll need the Spargo Cone Planter and GNSS plugin. Note: Install and activate Mirus before installing Spargo and GNSS plugin.

Step 1: Download Spargo Cone Planter and GNSS plugin.

1. Go to www.harvestmaster.com/support.
2. Select **Mirus Plugins and Scripts**.
3. Select **Downloads** > **Mirus Harvest Software Plugins and Scripts**.
4. Download Spargo Cone Planter and GNSS plugin.

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

System Setup

2 System Setup

2.1 Spargo Cone Planter System

The Spargo Cone Planter system uses a rugged tablet computer connected to a system controller which connects to an actuator module, allowing control of up to 3 solenoids or actuators that activate the cone planter.

2.2 System Parts

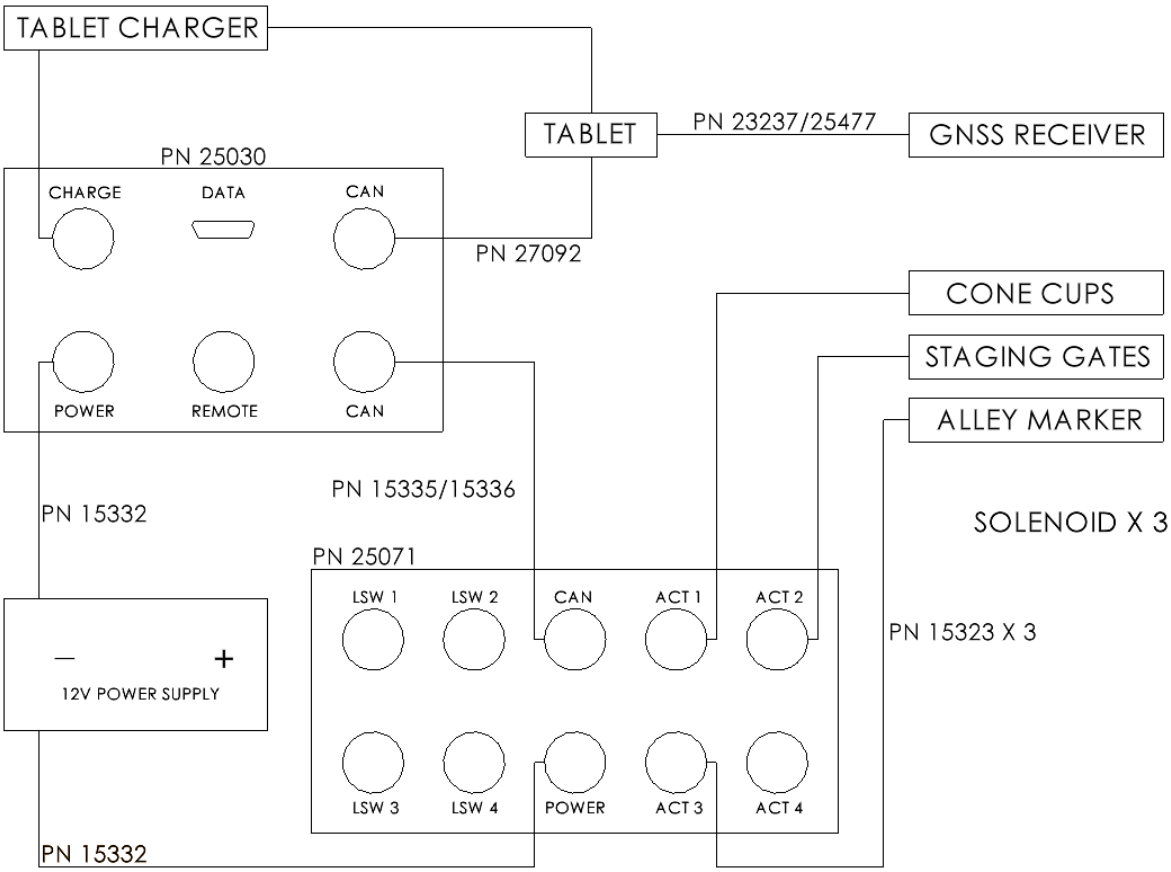
The following table lists the system parts.

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 V DC 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.	
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.	

2.3 Connection and Wiring

The system requires these connections.



2.4 GNSS/GPS Setup

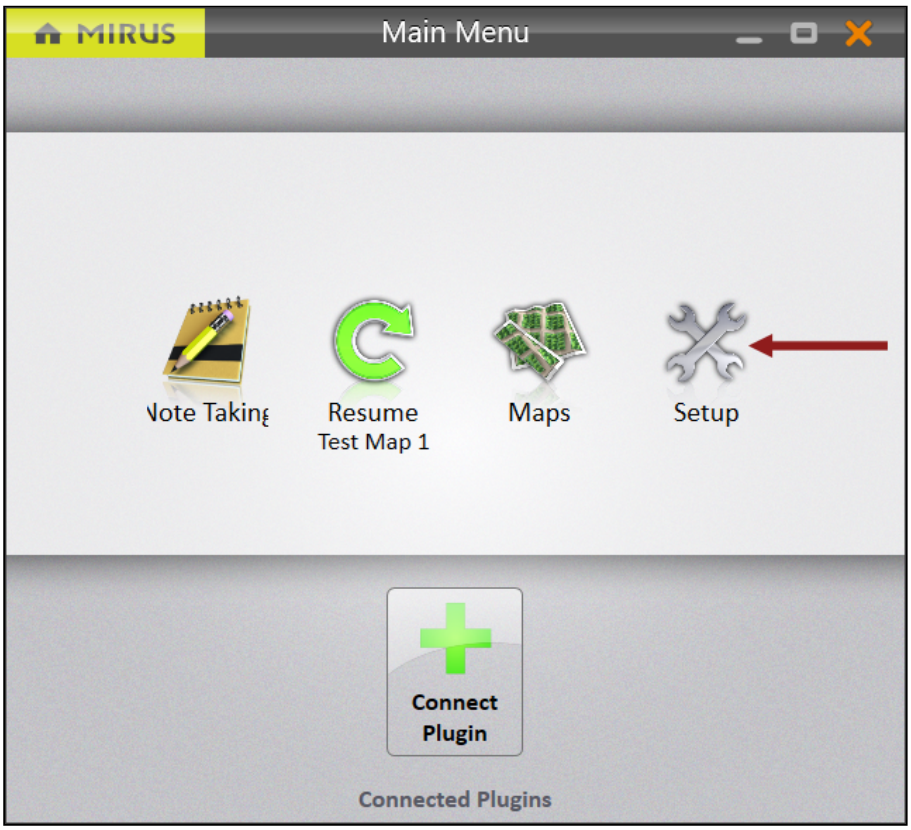
The GNSS/GPS receiver may need to be configured to communicate with Mirus. Follow the instructions provided for your GNSS/GPS receiver. You also need to configure Mirus to communicate with the GNSS/GPS.

Step 1: Refer to instructions for configuring your GNSS/GPS receiver. On the receiver, enable GGA and VTG. For the best performance, disable other NMEA message types that may be enabled in your GNSS receiver.

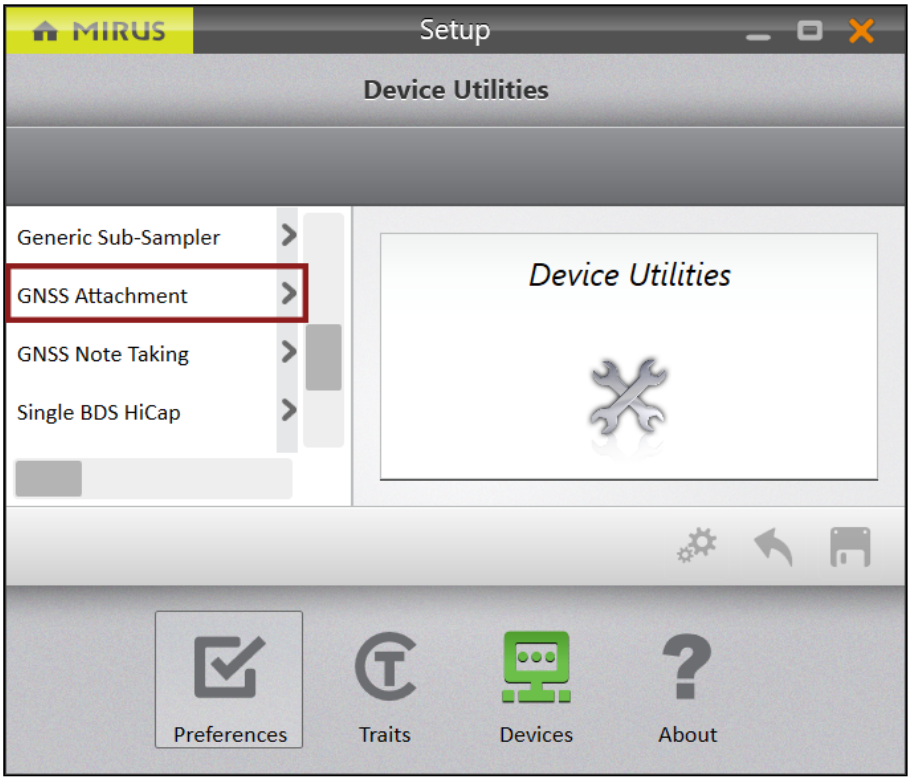
Step 2: With wiring complete and connected, power on the GNSS/GPS and the HarvestMaster Spargo Cone Planter system.

1. Disconnect any plugins.

2. Tap **Setup**.

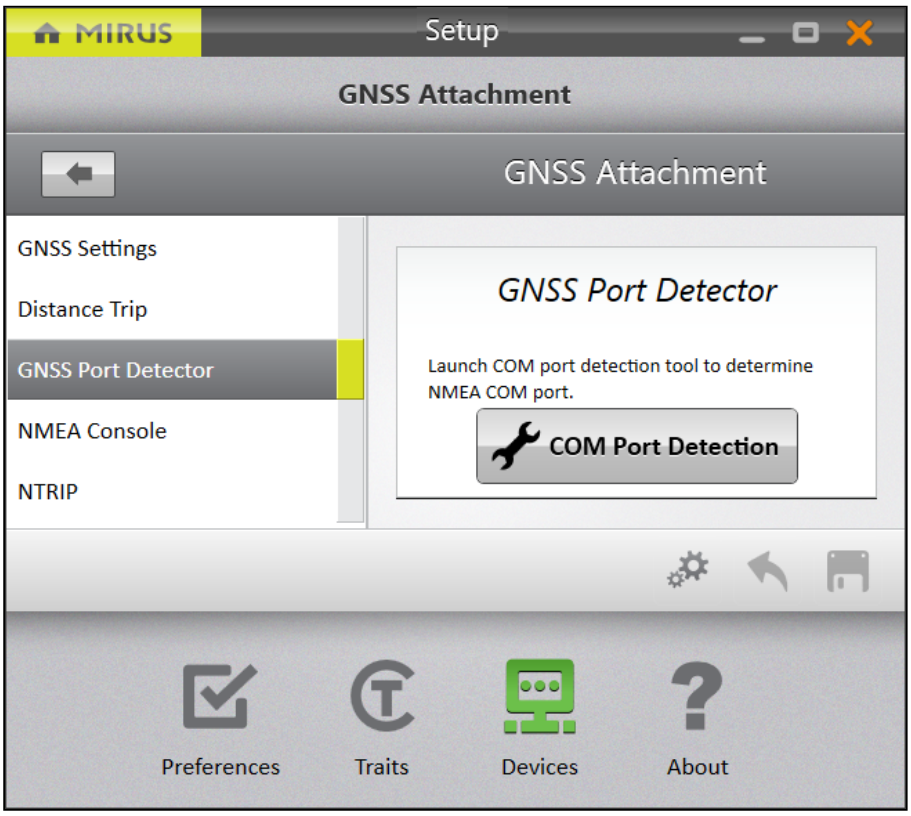


3. Scroll and tap **GNSS Attachment**.



On the **Setup** > **GNSS Attachment** screen,

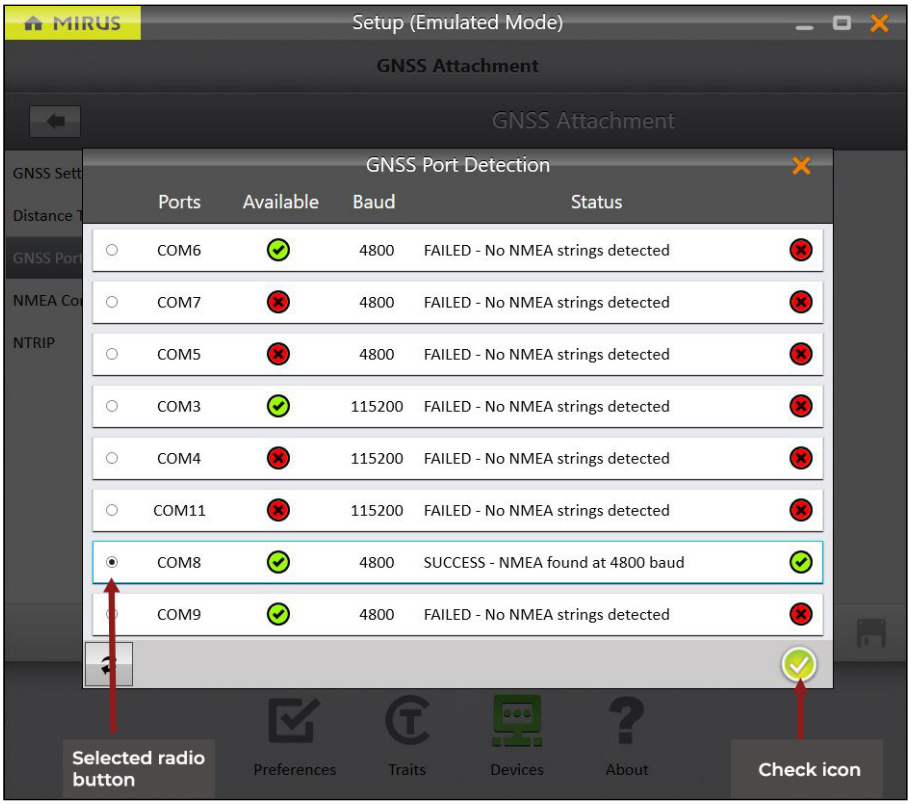
1. Tap **GNSS Port Detector** > **COM Port Detection**.



Mirus opens the GNSS Port Detection box and detects the ports.

When the COM port detection is completed, you will see the name of each port, its availability, the baud rate through each port, and the status of NMEA messages. The port

in use is indicated by the selected radio button.



If you want to use a different port,

2. Select a port for the receiver to use.

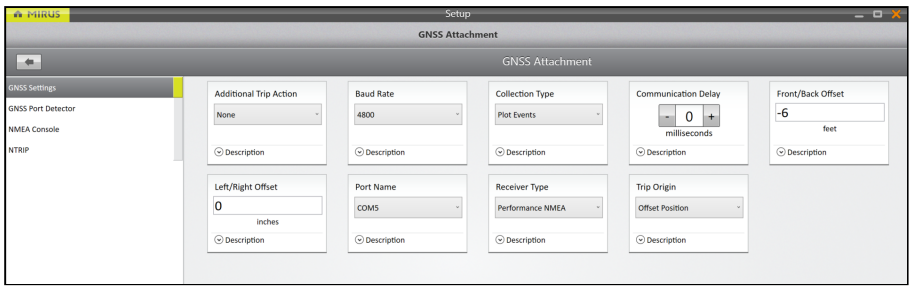
   Note: The first time you use the GNSS plugin, you will select the receiver that you want to use.

3. Tap the check icon to apply the selected 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.

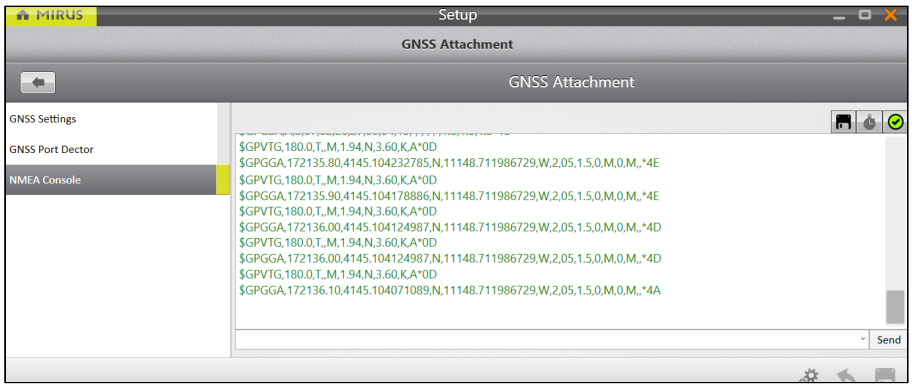


Step 6: Save the settings and then navigate to the Mirus Home screen.

Step 7: Connect the Spargo 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.



2.5 Spargo Cone Planter Setup

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

2.5.1 Settings

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

Spargo Settings	
Setting	**Description**
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 calibrates the length of the alley marker. For information on how to calibrate the start delay and alley marker start and stop delays, see Operation.
Plots Per Pass	The number of plots planted simultaneously.

2.5.2 Actuators

Actuator Module: Use to enable or disable the alley marker

Cone Actuator	
Setting	Description
Actuator Type	▪ Dual (electric) ▪ Pneumatic (air)

Close Transition Time	200 ms
Open State Time	1000 ms (this time can be lengthened to hold the cup open longer for higher volumes of seed)
Open Transition Time	200 ms (this will be adjusted during the calibration process)

Staging Actuator	
Setting	Description
Actuator Type	▪ If you have a staging cone, select **Dual** or **Pneumatic**. ▪ If you don't have a staging cone, select **None**.
Close Transition Time	200 ms
Open State Time	Controls how long the staging device stays open. This time can be lengthened for larger volumes of seed if needed.
Open Transition Time	200 ms

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CHAPTER 3

Calibration

3 Calibration

3.1 Overview

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

The process of calibrating the Spargo Cone Planter and GNSS plugin 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 can require recalibration. The following factors will require recalibration:

- If the GNSS/GPS receiver is re-calibrated or 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 planter or if the GNSS/GPS antenna is moved to a new position. 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 planter, 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.

3.2 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.

3.2.1 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.

3.2.2 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.

3.2.3 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.

3.2.4 Actuator Start

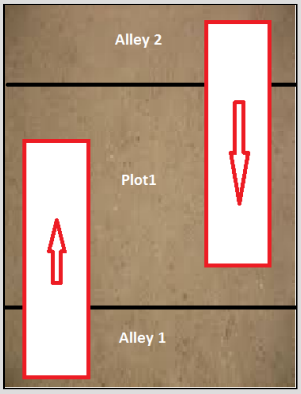
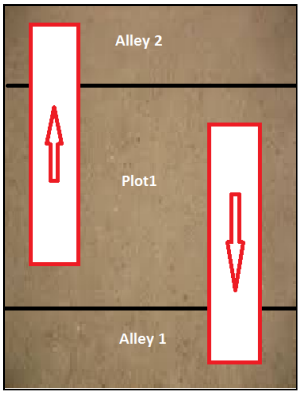
The mechanics of the actuator introduce delay from when Mirus sends the signal to start planting. The Cone Planter Delay allows adjustment to compensate for the mechanical delay. Raising this number will open the cone(s) sooner.

3.2.5 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 two 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.

Mirus Adjustments		
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.	▪ Communication delay set too long. ▪ Cone start delay is too long. ▪ Offset is too short. *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.	▪ Communication delay set too short. ▪ Cone start delay is too short. ▪ Offset is too long. *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.*	

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CHAPTER 4

Operation

4 Operation

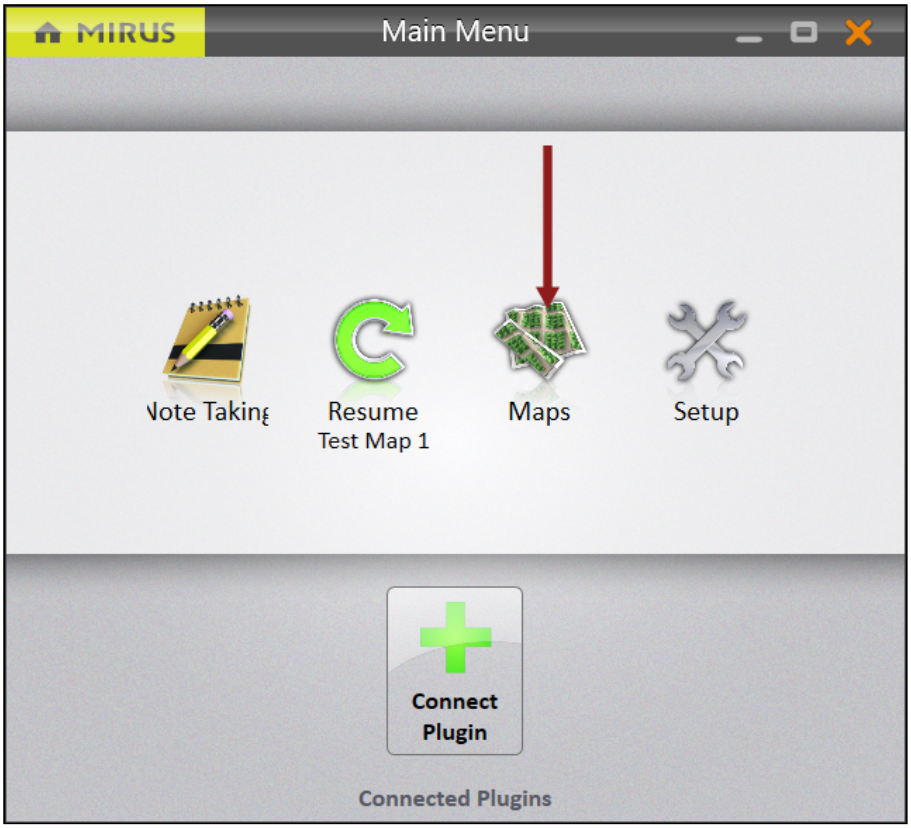
This section covers instructions for planting. Be sure that calibration and system setup have already been completed.

4.1 Create a Map

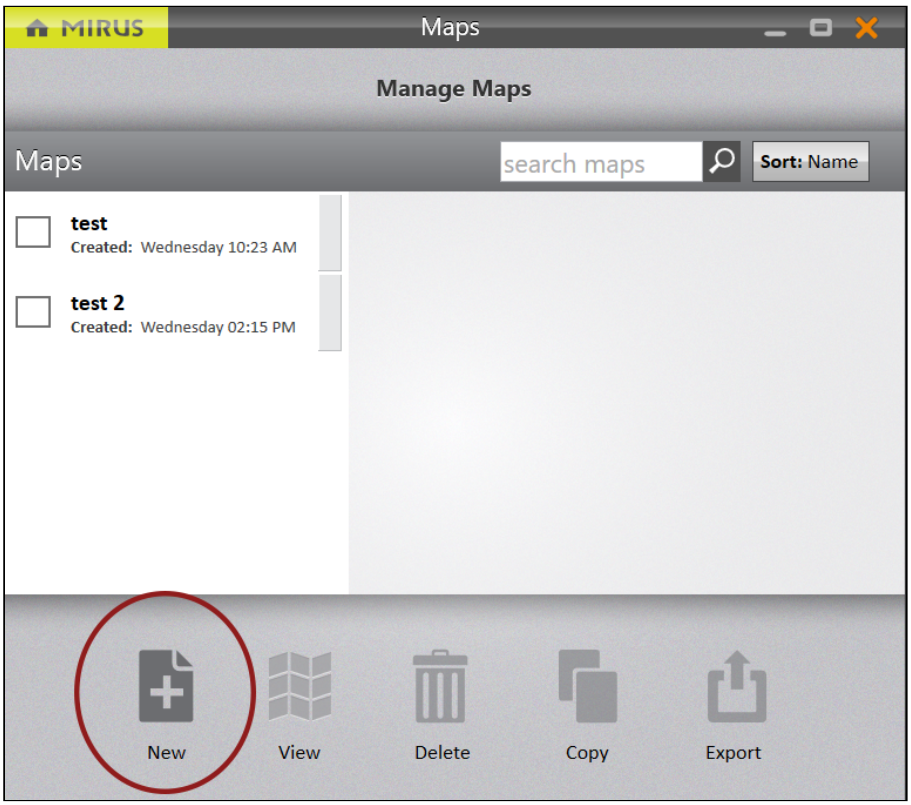
The following instructions walk you through creation of a Range Row map.

On the Mirus Home screen,

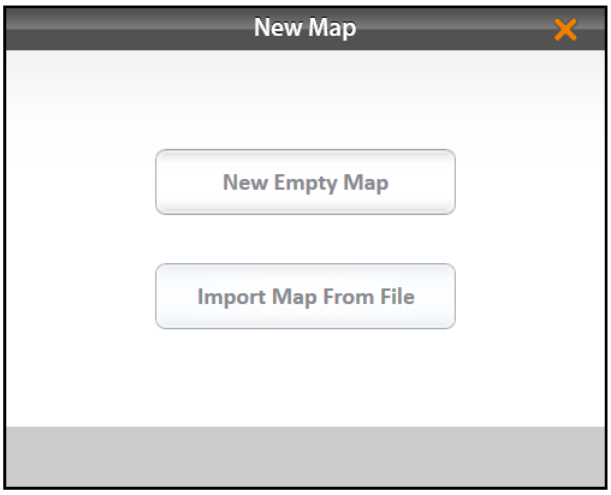
1. Tap **Maps** .



2. Tap **New**.

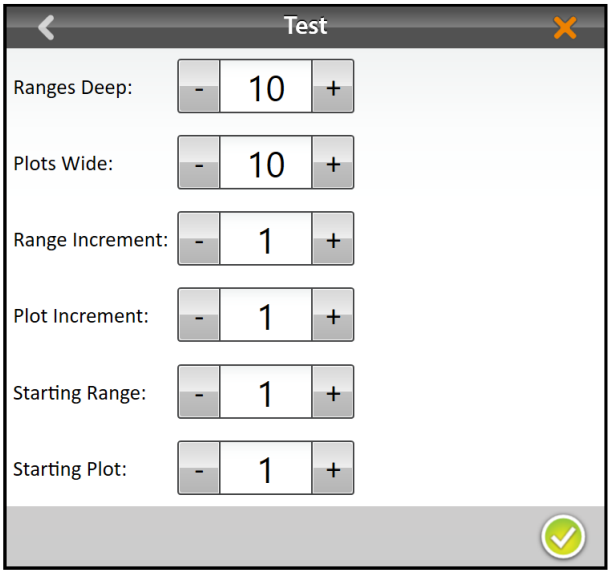


3. Select **New Empty Map**.



4. Name and describe the map.
5. Tap **Range Row**.
6. Tap the next arrow.

*Note: The Name box only accepts basic letters and numbers. Do not use emojis or the following special characters: > < : " \ ? | / **

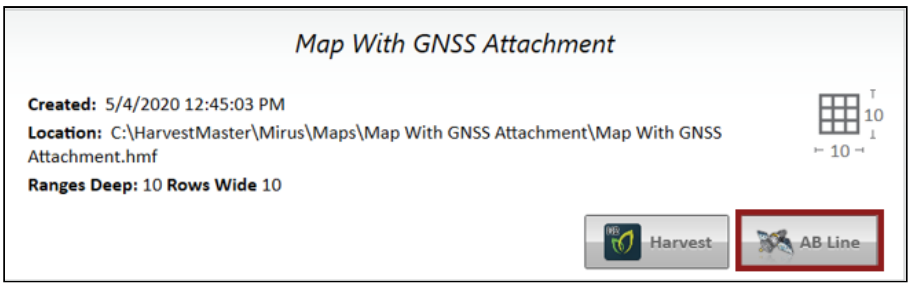


7. Set the following:
    - Ranges deep
    - Plots wide
    - Range increment
    - Plot increment
    - Starting range
    - Starting plot
8. Tap the check icon to save the map.
9. For more information about different kinds of maps or how to import a map, see the Mirus for H2/H3 GrainGage User Manual.

4.2 Automatic GPS/GNSS Cycling

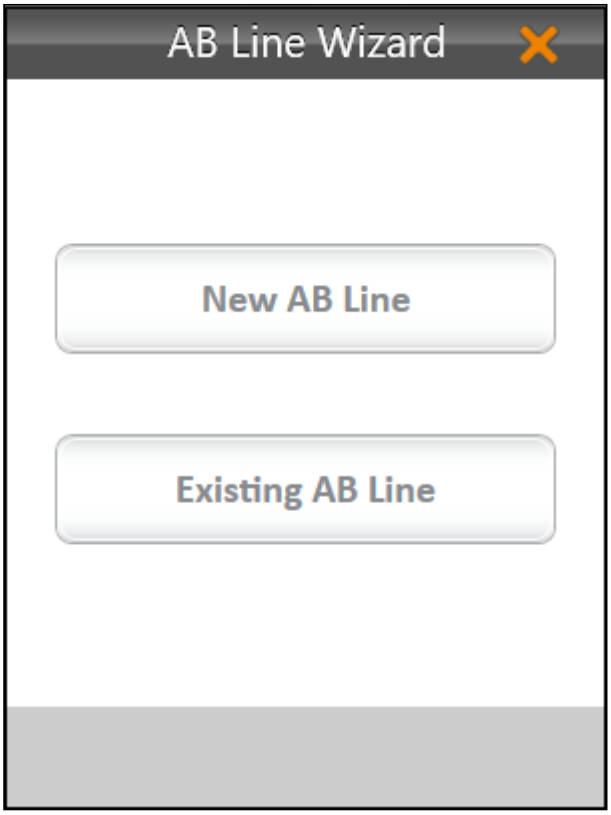
Step 1: Create the AB Line. create an AB line that corresponds to one side of your physical field.

1. Select a map, and tap **AB Line**.



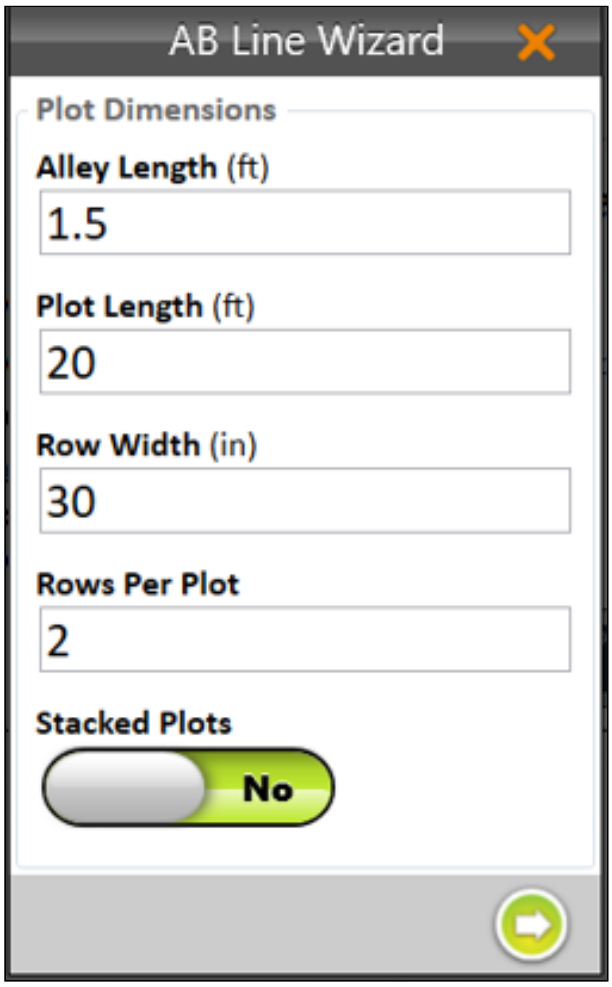
2. In the AB Line Wizard, tap **New AB Line**.

Note: If you want to edit an existing line, choose Existing AB Line and then select the map file that contains the AB line you want to copy.



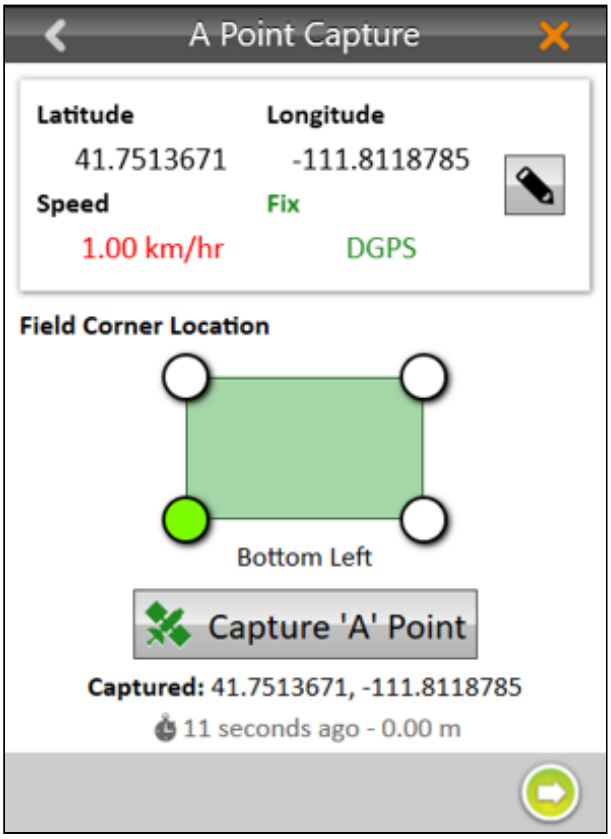
3. Set the Plot Dimensions.
    - **Alley Length**: The alley is the empty space between ranges.
      Note: The minimum Alley Length is 0.1 ft, which creates a field with no alley.
    - **Plot Length**: The length of the space allotted for the plants to grow.
    - **Row Width**: The width of the space allotted for each row of plants to grow.
    - **Rows Per Plot**: The number of plant rows to be grouped together to create a plot.
      Note: The row width and rows per plot should equal the effective swath width.
    - **Stacked Plots**: A group of plots separated from other plot groups by a larger alley. This option defines a longer alley after a specific number of smaller alleys between plots. If you are using stacked plots, enable Stacked Plots and define the number

of plots per stack and the stack alley width.



4. Tap the next arrow .
5. Move your GNSS receiver to the location you want displayed in Mirus as the lower left corner of the field. When using the GNSS attachment with a GrainGage and the correct offsets entered, position your combine in front of the first plot with the first plant contacting the cutter bar or deck plates.
6. In Mirus tap **Capture 'A' Point**.

Note: You can manually edit the latitude and longitude of the 'A' point before capturing it.



7. Tap the next arrow .
8. Move your GNSS receiver to the location you want displayed in Mirus as the upper left corner of the field. For example, position your combine, pointing the same direction, at the end of the first row of the first plot with the last plant touching the cutter bar or deck plates.

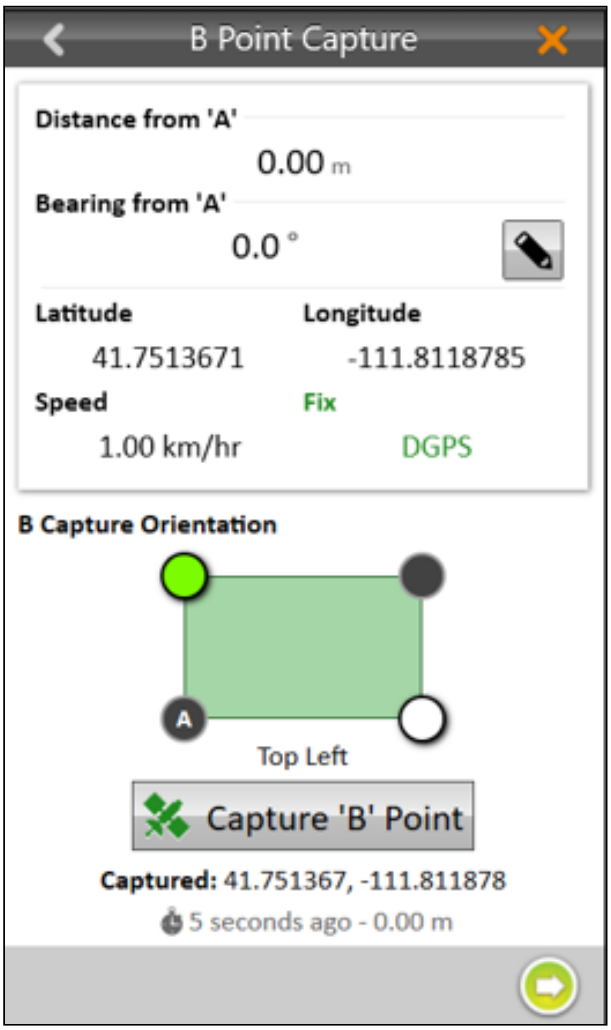
   Note: If it is not feasible to drive exactly along your row as you would to plant, you can drive the tractor parallel to your row to the side of the plot, and then reset the corner(s) using an offset distance in Mirus once the AB line has been created.

   To improve the accuracy of the map with the AB line you are defining,

   Drive the entire length of the field between capturing the 'A' and 'B' points.

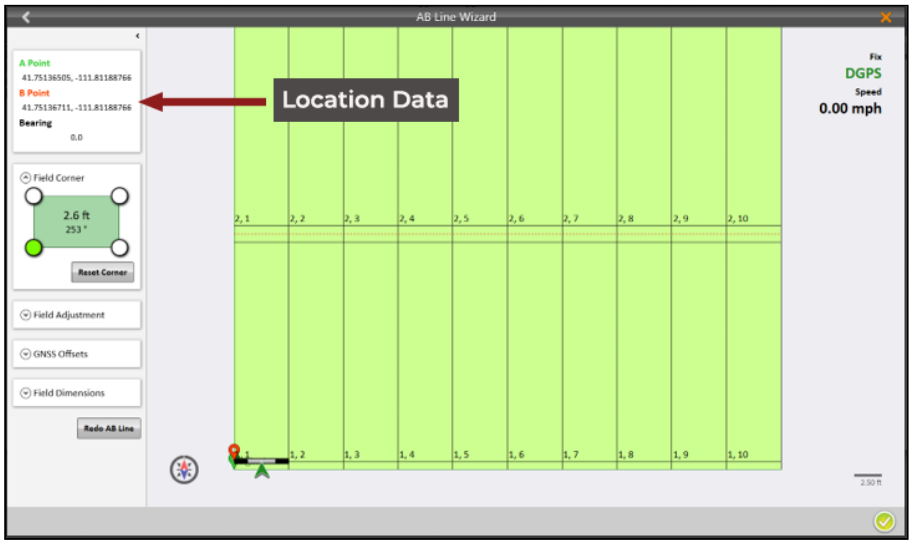
   Use the pencil button to enter the distance from your first corner A and the bearing in degrees from A to B.

9. In Mirus tap **Capture ‘B’ Point**.



10. Tap the next arrow .

Mirus will display the Map View of the field calculated from the AB Line.



All of the field parameters are displayed on the left side of the screen. Several of them can be edited from there.

AB Line Wizard Final Screen	
Setting	**Description and Options**
A Point B Point Bearing	View the A and B coordinates and the bearing entered.
Field Corner	Reset the corner to reposition the AB line based on your new position.
Field Adjustment	Change the vertical or horizontal width of your field.
GNSS Offsets	View the currently set offsets.
Field Dimensions	Adjust the Alley Length, Plot Length, Row Width, Rows Per Plot, and choose Stacked Plots.
Redo AB Line	Recapture the AB line.

Step 2: Proceed to plant.

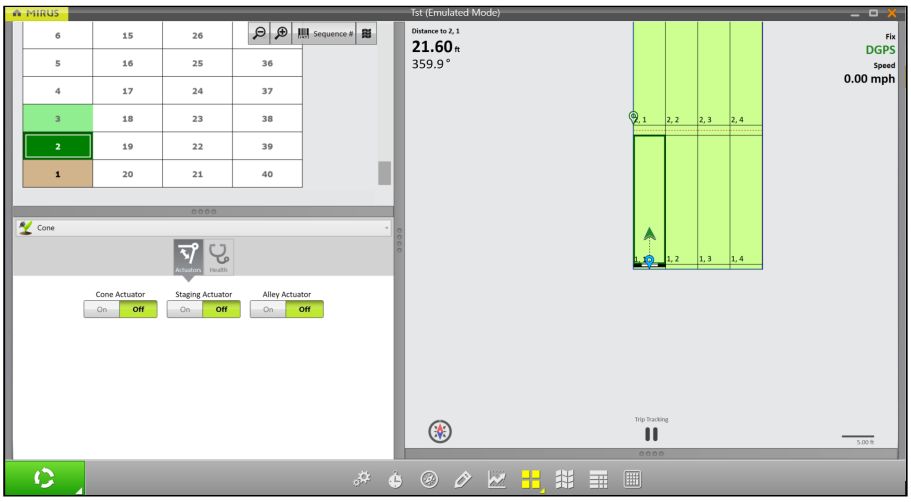
1. Under Manage Maps, tap **Plant**.

2. Select your starting location, the direction, and the navigation type. Tap the green arrow.
3. On the Data Sources window, tap the green arrow. The planting screen displays.
4. In the planting screen, tap **Start** on the bottom left.

   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.

5. Load seed into the cone.

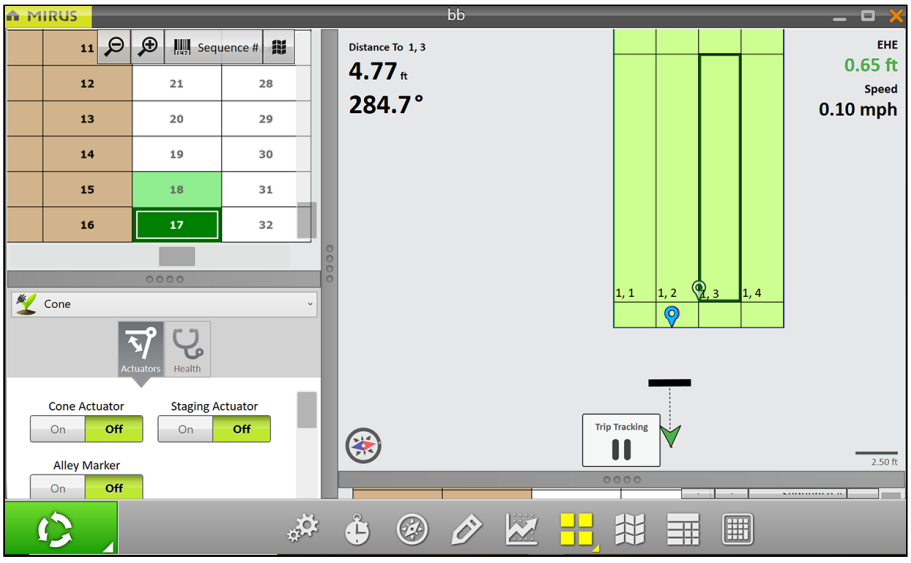
6. Drive into the field.



Step 3: 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 4: Proceed through the plots at a consistent speed. Mirus triggers the planter automatically.

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CHAPTER 5

Export

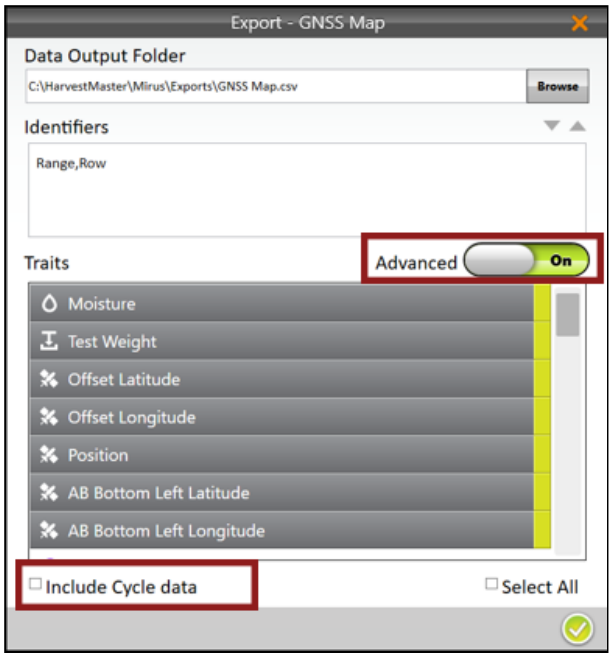
5 Export

5.1 Export GNSS Planting Data

The map export utility will export trip (start of row) positions for each plot.

To export data, see "Export Map Data" in the Mirus for H2/H3 GrainGage User Manual.

If needed, switch Advanced to **On** and select **Include Cycle Data**.



Exported data is in the CSV format, so it can be viewed easily in Excel and imported into analysis software, such as AgroBase or Prism. The following is an example of exported data with GNSS data for each cycle.

Date/ Time	Range	Row	Cycle	Weight	Moisture	Offset Latitude	Offset Longitude	Position	Harvest Sequence
7/12/2019 13:56	1	1	T	27.33	1.3	41.76216494	-111.8622119	41.762163827, -111.862199761	1
7/12/2019 13:57	1	1	1	5.09	1.27	41.7621345	-111.8619736	41.762137287, -111.861959814	1
7/12/2019 14:03	1	2	T	17.67	1.41	41.76216074	-111.8620596	41.762161798 -111.862071770	2
7/12/2019 14:03	1	2	1	3.1	1.41	41.76218637	-111.8622635	41.762183296 -111.862277148	2
7/12/2019 14:07	1	3	T	29.46	2.72	41.76218322	-111.8621941	41.762181990 -111.862182028	3
7/12/2019 14:07	1	3	1	5.08	2.72	41.76215117	-111.8619635	41.762155624 -111.861950547	3

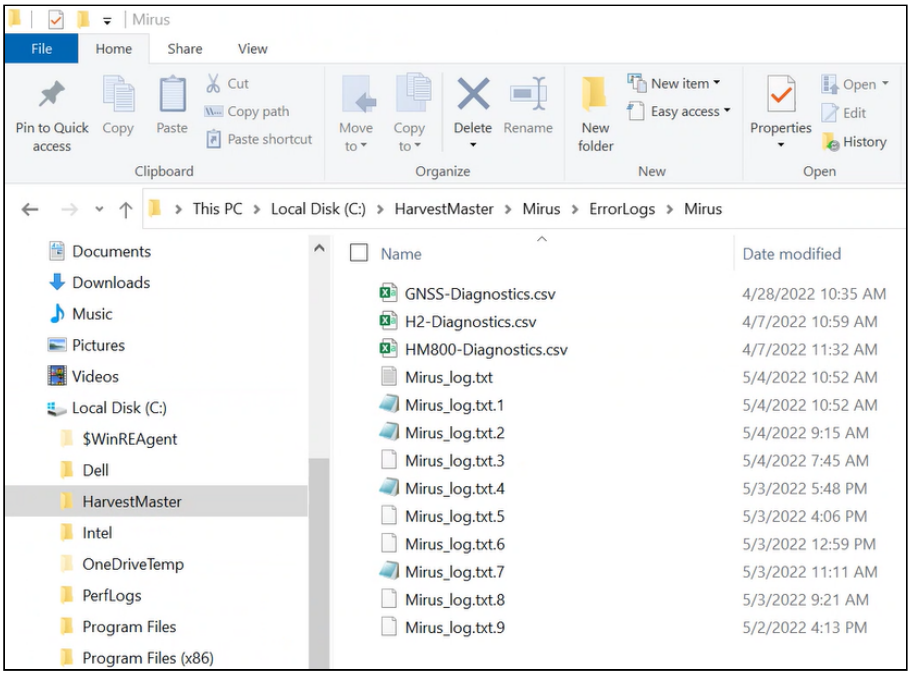
5.2 Export Error Logs

If you encounter a problem while installing or operating the Spargo Cone Planter, contact a HarvestMaster Field Service Engineer. If the HarvestMaster Field Service Engineer needs to look through the GrainGage error logs, you can find them saved on your device.

1. Insert a USB drive into your tablet.
2. Open File Explorer.
3. Go to C:\HarvestMaster\Mirus\ErrorLogs\Mirus

   The most recent error log will be saved under Mirus_log.txt. The Mirus_log.txt file will hold up to 15 MB before it moves to become Mirus_log.txt.1. When the next Mirus_log.txt fills up, Mirus_log.txt.1 will become Mirus_log.txt.2. The log will continue to cascade down until it

becomes Mirus_log.txt.9 and then is deleted from the folder.



4. Select the Mirus log file the HarvestMaster Field Service Engineer requested.
5. Copy the selected file to the USB drive.
6. Transfer the file to your desktop computer and email it to the HarvestMaster Field Service Engineer.