



HarvestMaster™  
BY JUNIPER SYSTEMS



alvo™  
Field Applicator

USER'S GUIDE

# Alvo Field Applicator User's Guide

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## Disclaimer

Information is subject to change without notice.

## Cautions



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



**WARNING:** This symbol indicates that failure to follow directions could result in serious injury.



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# Contents

- 1 Prepare the Software ..... 6**
  - 1.1 Install Mirus ..... 6
    - 1.1.1 System Requirements..... 6
    - 1.1.2 Download and Install Mirus..... 6
  - 1.2 Install GNSS Attachment and Alvo Field Applicator ..... 6
  - 1.3 Create Treatment Maps ..... 7
    - 1.3.1 Import Treatment Maps ..... 8
- 2 Set Up the Alvo Field Applicator ..... 11**
  - 2.1 System Parts ..... 11
  - 2.2 Wiring Diagram and Connections..... 14
  - 2.3 Actuator Wiring Connections..... 15
  - 2.4 Set Up the GNSS/GPS Receiver..... 17
    - 2.4.1 Connect the GNSS/GPS Receiver ..... 17
    - 2.4.2 Add the Alvo Field Applicator and GNSS Attachment ..... 19
    - 2.4.3 Enter Receiver Offset..... 21
    - 2.4.4 View NMEA Messages from the GNSS/GPS Receiver ..... 22
- 3 Define Settings in Mirus ..... 25**
  - 3.1 Set Up the Actuators ..... 25
  - 3.2 Define the Applicator Offsets ..... 26
  - 3.3 Define Applicator System ..... 27
  - 3.4 Check Firmware Versions..... 28
- 4 Calibrate the System ..... 30**
  - 4.1 Calibrate the Alvo Field Applicator and GNSS Attachment..... 30
    - 4.1.1 Calibrate the Offsets..... 30
    - 4.1.2 Align the Application with the Plots ..... 33
- 5 Apply Treatments ..... 38**
  - 5.1 Set Up Map Selection and Treatment..... 38
  - 5.2 Resolve Treatment Conflicts..... 39
  - 5.3 Use Automatic GNSS/GPS Cycling..... 41

5.4 Clear Application Coverage.....45

5.5 Interrupt Application Cycle .....46

5.6 Pause Application ..... 48

5.7 Use Manual Cycling ..... 48

**6 Export Information .....52**

6.1 Map Data.....52

6.2 Error Logs.....55

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**CHAPTER ONE**

**Prepare the Software**

# 1 Prepare the Software

The HarvestMaster Alvo Field Applicator automates the application of treatments on field research plots using multi-boom and in-furrow applicators in conjunction with a GPS receiver.

The Alvo Field Applicator along with Mirus software uses HarvestMaster actuator modules to control the equipment hardware. This versatile system can be easily moved to different equipment throughout the year as needed.

Compared to using multiple control systems, this system uses a single software program called Mirus and a simplified control system. This saves time and money because there is no need to retrain personnel on multiple systems. Essentially, a user can use the Mirus software across almost all research data collection and equipment control needs.

## 1.1 Install Mirus

Mirus provides the user interface and software control of the Alvo Field Applicator and is designed to run on a rugged tablet under the Microsoft Windows 10 or later operating system.

### 1.1.1 System Requirements

- Operating system: Windows® 10 or higher; 32-bit or 64-bit OS
- Processor Speed: 2.0 GHz Quad Core
- Memory: 8 GB or more recommended
- Data Storage: 500 MB available disk space
- Display Resolution: 1280 x 800 or higher
- Video Playback: Windows Media Player version 11 or higher

### 1.1.2 Download and Install Mirus

- Download Mirus from [www.harvestmaster.com](http://www.harvestmaster.com).
- Run the Mirus software installation on your rugged tablet computer and follow the prompts on the screen.
- Activate Mirus online at [www.harvestmaster.com/activate](http://www.harvestmaster.com/activate).

## 1.2 Install GNSS Attachment and Alvo Field Applicator

Mirus software requires the GNSS Attachment and the Alvo Field Applicator Plugin to control the Alvo Field Applicator. You must install Mirus before installing these plugins.

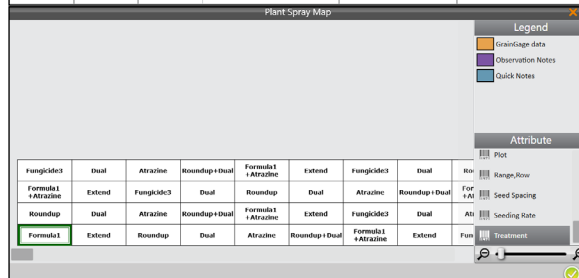
- Download the GNSS Attachment and the Alvo Field Applicator from [www.harvestmaster.com](http://www.harvestmaster.com). The files use the .mbp file extension.
- Run the .mbp file for the GNSS Attachment, and run the .mbp file for the Alvo Field Applicator Plugin.
- Activate the software online at [www.harvestmaster.com/activate](http://www.harvestmaster.com/activate).

## 1.3 Create Treatment Maps

Mirus identifies the treatments for each plot based on a map file. Create your map file outside of Mirus in a spreadsheet or a text editor and use Mirus to import the map. Map files must use either the .csv or .txt format.

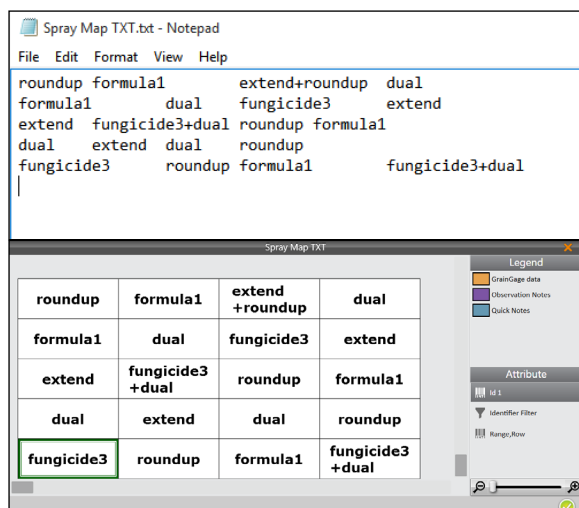
A treatment is identified by a name consisting of alphanumeric characters (letters and numbers only). To identify multiple treatments for a plot use a plus character between treatment names (for example, "roundup+formula1").

| Range | Row | Plot | Treatment         | Seeding Rate | Seed Spacing |
|-------|-----|------|-------------------|--------------|--------------|
| 1     | 1   | 101  | Formula1          | 32000        | 7            |
| 1     | 2   | 102  | Extend            | 34500        | 8            |
| 1     | 3   | 103  | Roundup           | 28000        | 11           |
| 1     | 4   | 104  | Dual              | 45000        | 4            |
| 1     | 5   | 105  | Atrazine          | 29500        | 10           |
| 1     | 6   | 106  | Roundup+Dual      | 42000        | 4.5          |
| 1     | 7   | 107  | Formula1+Atrazine | 36000        | 9            |
| 1     | 8   | 108  | Extend            | 34500        | 8            |
| 1     | 9   | 109  | Fungicide3        | 37000        | 9.5          |
| 1     | 10  | 110  | Dual              | 41000        | 5            |
| 2     | 1   | 201  | Roundup           | 32000        | 7            |
| 2     | 2   | 202  | Dual              | 34500        | 8            |



For a map in .csv format,

- Create columns to identify the range, row, and treatments for each plot.
- For each column created, a corresponding attribute will be created in Mirus.



For a map in .txt format,

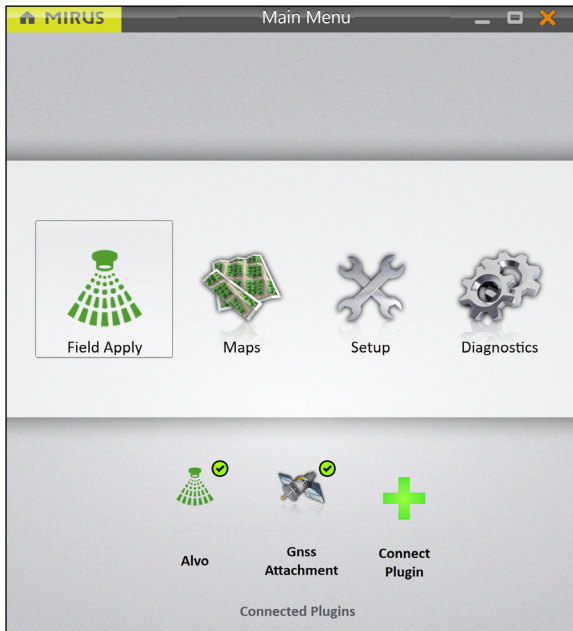
Identify the treatments for each plot in a spatial or grid layout.

- Plots on a row are separated by a tab.
- The information input into the text editor will appear in Mirus the same way it was written.


For a map exported from trial design software,

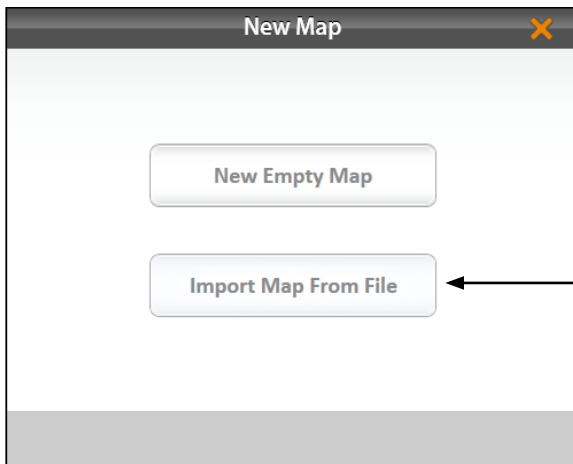
- Use a .csv format to export the map.
- Follow the software instructions for electronic data collection export.

### 1.3.1 Import Treatment Maps

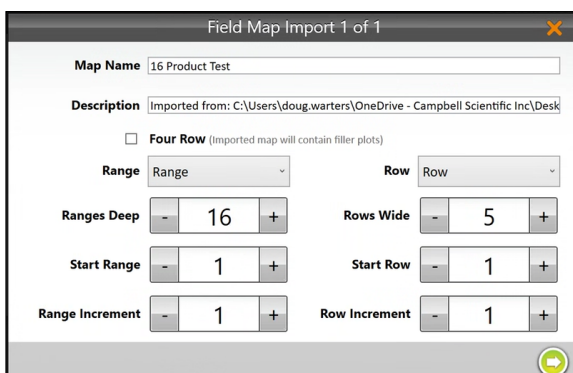



After creating a treatment map, import it into Mirus.

1. Open Mirus.
2. Tap **Maps**.
3. Tap the new icon  to create a new map.



4. Tap **Import Map From File**.
5. Locate the desired map file. Open it.



6. Check that Mirus recognizes and interprets the information as you intend.
7. Tap the next arrow .



Mirus displays the Manage Maps screen.

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**CHAPTER TWO**

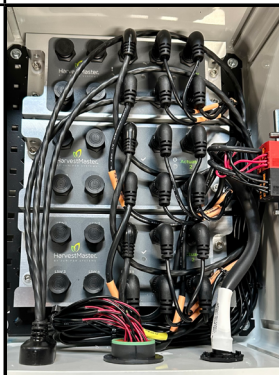



**Set Up the Alvo Field Applicator**








## 2 Set Up the Alvo Field Applicator




The Alvo Field Applicator uses a rugged tablet computer connected to a system controller. The system controller connects to the actuator modules, allowing control of up to 24 solenoids or actuators that activate the applicator.

### 2.1 System Parts

The following table lists the system parts.

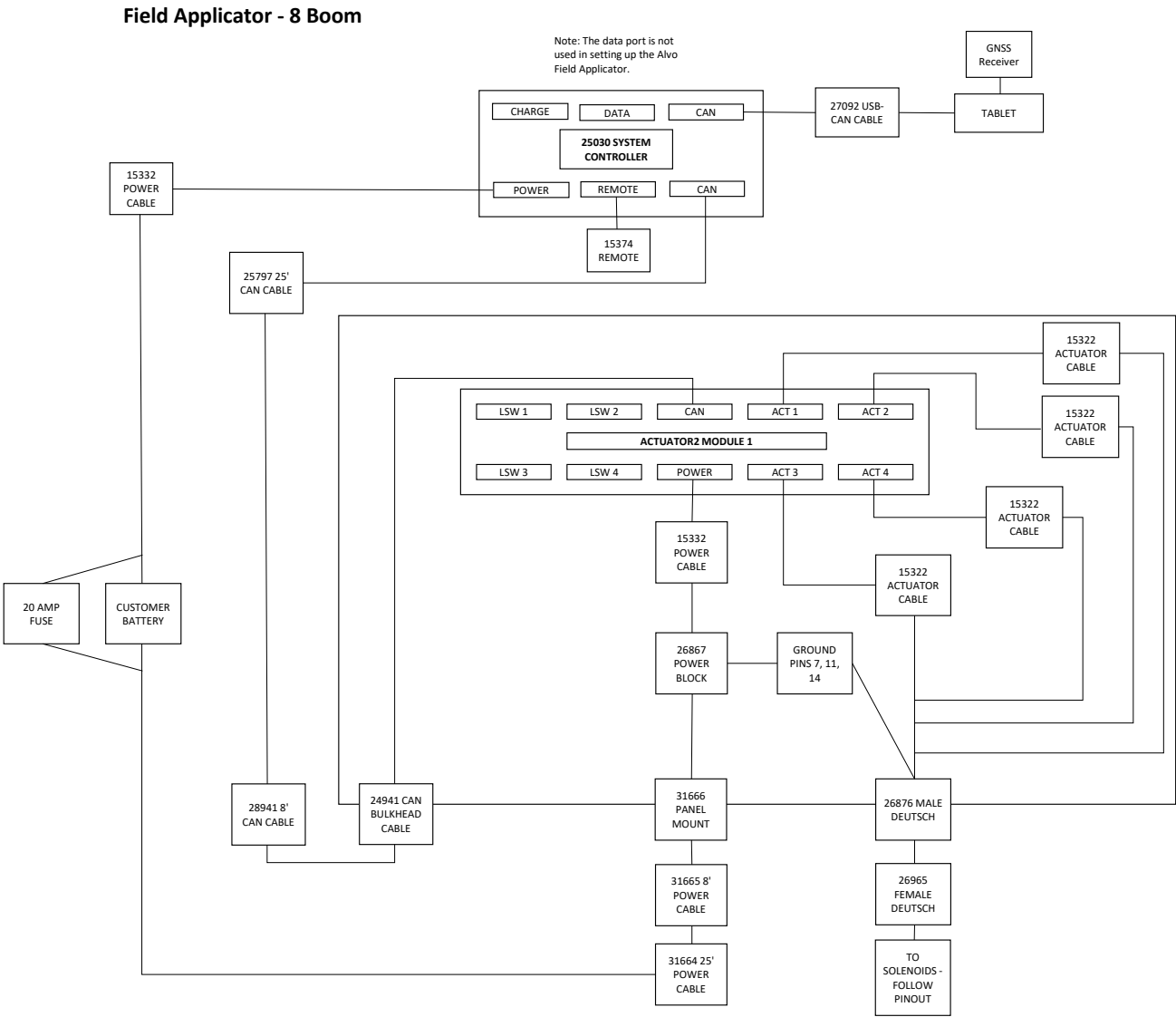
| PN    | Qty | Description  | Notes / Purpose   | Photo / Drawing   |
|-------|-----|--|---|---|
| n/a   | 1   | H2 actuator modules with wiring and connectors in enclosure    | <p>An enclosure with two actuator modules mounted inside. The actuator modules are wired to connector plugs in the wall of the enclosure.</p> <ul style="list-style-type: none"> <li>A CAN connector on the enclosure is used for connection to the system controller.</li> <li>A Deutsch connector is used for connection to the actuators on the applicator.</li> </ul> |    |
| 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 | 1   | HM8 12 V DC power cable, 20 ft                                 | The power cable connects between the battery (or other 12 V DC power source) and the system controller.   |  |
| 31754 | 1   | HM8 CAN terminator   | The terminator is used to terminate the unused CAN connection on the outside of the enclosure.  |  |

| PN    | Qty    | Description  | Notes / Purpose   | Photo / Drawing   |
|-------|--------|--|---|---|
| 25797 | 1      | HM800 CAN extension cable                          | The CAN communications cable connects to the system controller to the 8 ft CAN patch cable at the hitch.                              |    |
| 28941 | 1      | HM800 CAN patch cable 8 ft                         | The CAN communications cable that connects from bottom of enclosure to the CAN communications cable at the hitch.                     |    |
| 15374 | 1      | HM8 HMA-400 remote enter button and cable assembly | The remote enter button connects to the system controller, allowing the operator to manually trigger the applicator to start or stop. |    |
| 20363 | 1      | HM8 USB CAN converter cable                        | The CAN converter cable connects the tablet PC to the system controller.  |   |
| 31664 | 1      | 25' 8AWG   | Power cable from battery to hitch area  |  |
| 31665 | 1      | 8' 8AWG Power Cable                                | The power cable that connects from bottom of enclosure to the main power cable at the hitch.  |  |
| 31686 | varies | H2 Actuator2 Module                                | H2 actuator 2 module for controlling the solenoid.  |  |
| 27736 |        | Alvo license                                       |   |  |

| PN    | Qty | Description            | Notes / Purpose                                | Photo / Drawing   |
|-------|-----|------------------------|--|---|
| 27753 |     | GNSS license           |  |  |
| 31735 | 1   | Souriau plug cap       | Cover for the plug end of the CAN cable.       |  |
| 31734 | 1   | Souriau receptacle cap | Cover for the receptacle end of the CAN cable. |  |

## 2.2 Wiring Diagram and Connections

The system requires the following connections for eight booms:



### Connections

| Step | Cable              | Connect                              |
|------|--------------------|--------------------------------------|
| 1    | USB-CAN Cable      | The tablet and the system controller |
| 2    | Remote enter cable | The system controller                |

| Connections |                             |   |
|-------------|-----------------------------|---|
| Step        | Cable                       | Connect   |
| 3           | 12 V DC power cable         | The battery or power source and the system controller   |
| 4           | CAN cable                   | The system controller and one of the CAN ports on the bottom of the actuator module enclosure |
| 5           | CAN terminator              | The unused CAN port on the bottom of the actuator module enclosure                            |
| 6           | Actuators on the applicator | The Deutsch connector<br>(See <b>Chapter 2.3 Actuator Wiring Connections</b> on page 15.)     |
| 7           | Deutsch connector           | The matching connector on the actuator enclosure  |
| 8           | Chassis ground              | The actuators on the booms of the applicator  |

## 2.3 Actuator Wiring Connections

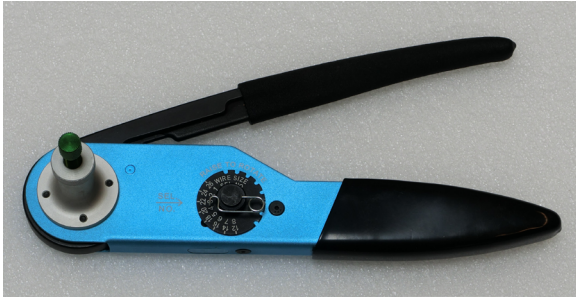
The actuator modules in the enclosure are wired to the Deutsch connector in the wall of the enclosure. The following table describes the wiring for this connector.

**CAUTION:** The maximum current draw for each actuator is 20 W at the system enclosure. Exceeding 20 W per actuator will damage the actuator 2 module.

| Wiring for the Deutsch Connector |        |                     |      |     |               |
|----------------------------------|--------|---------------------|------|-----|---------------|
| Deutsch Connector Pin Out        | Signal | HM Module Reference | Port | Pin | HM Wire Color |
| 1                                | Boom 1 | Actuator 1          | 1    | 1   | Red           |
| 2                                | Boom 5 | Actuator 1          | 1    | 2   | Black         |
| 3                                | Boom 2 | Actuator 1          | 2    | 1   | Red           |
| 4                                | Boom 6 | Actuator 1          | 2    | 2   | Black         |
| 5                                | Boom 3 | Actuator 1          | 3    | 1   | Red           |
| 6                                | Boom 7 | Actuator 1          | 3    | 2   | Black         |
| 7                                | Ground |                     |      |     | Black         |

**Wiring for the Deutsch Connector**

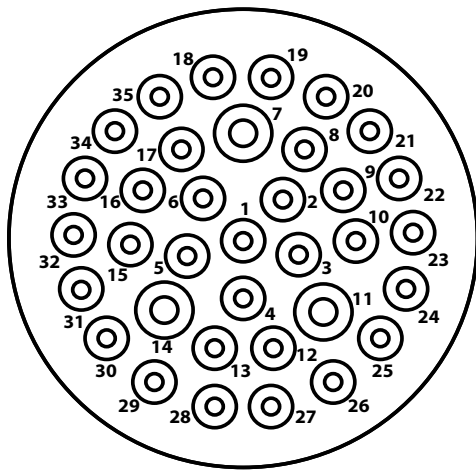
| Deutsch Connector Pin Out | Signal  | HM Module Reference | Port | Pin | HM Wire Color |
|---------------------------|---------|---------------------|------|-----|---------------|
| 8                         | Boom 4  | Actuator 1          | 4    | 1   | Red           |
| 9                         | Boom 8  | Actuator 1          | 4    | 2   | Black         |
| 10                        | Boom 9  | Actuator 2          | 1    | 1   | Red           |
| 11                        | Ground  |                     |      |     | Black         |
| 12                        | Boom 13 | Actuator 2          | 1    | 2   | Black         |
| 13                        | Boom 10 | Actuator 2          | 2    | 1   | Red           |
| 14                        | Ground  |                     |      |     | Black         |
| 15                        | Boom 14 | Actuator 2          | 2    | 2   | Black         |
| 16                        | Boom 11 | Actuator 2          | 3    | 1   | Red           |
| 17                        | Boom 15 | Actuator 2          | 3    | 2   | Black         |
| 18                        | Boom 12 | Actuator 2          | 4    | 1   | Red           |
| 19                        | Boom 16 | Actuator 2          | 4    | 2   | Black         |
| 20                        | Boom 17 | Actuator 3          | 1    | 1   | Red           |
| 21                        | Boom 21 | Actuator 3          | 1    | 2   | Black         |
| 22                        | Boom 18 | Actuator 3          | 2    | 1   | Red           |
| 23                        | Boom 22 | Actuator 3          | 2    | 2   | Black         |
| 24                        | Boom 19 | Actuator 3          | 3    | 1   | Red           |
| 25                        | Boom 23 | Actuator 3          | 3    | 2   | Black         |
| 26                        | Boom 20 | Actuator 3          | 4    | 1   | Red           |
| 27                        | Boom 24 | Actuator 3          | 4    | 2   | Black         |



The supplies needed to wire the actuators to the Deutsch connector include

- Wire strippers
- Deutsch HDT-48-00 crimp tool (pictured on left).

*Note: For instructions on how to set and use the crimp tool, open YouTube and enter the address: [www.youtube.com/MqXcaNVwpvI](https://www.youtube.com/MqXcaNVwpvI).*



To wire the actuators to the Deutsch HDP26-24-35SN connector,

- Use the information in the pin out table (See **2.3 Actuator Wiring Connections** on page 15) to populate the Deutsch HDP26-24-35SN connector.
- Pins 7, 11, and 14 can be used as actuator grounds.
- Connect the Deutsch connector to the matching connector on the enclosure.
- The drawing to the left shows the physical layout of the pins in the Deutsch connector.

## 2.4 Set Up the GNSS/GPS Receiver

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

On the receiver,


- Enable GGA.
- Enable VTG.
- Set output rate to 5 Hz.
- Disable other NMEA message types.

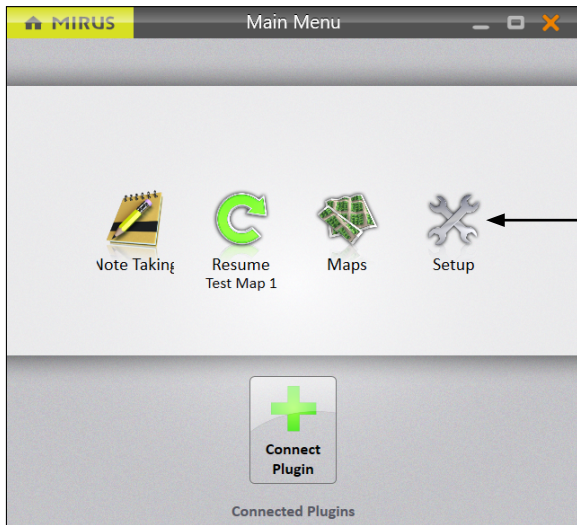
You also need to configure Mirus to communicate with the GNSS/GPS.

With wiring complete and connected, power on your receiver and the Alvo Field Applicator. Connect your receiver.

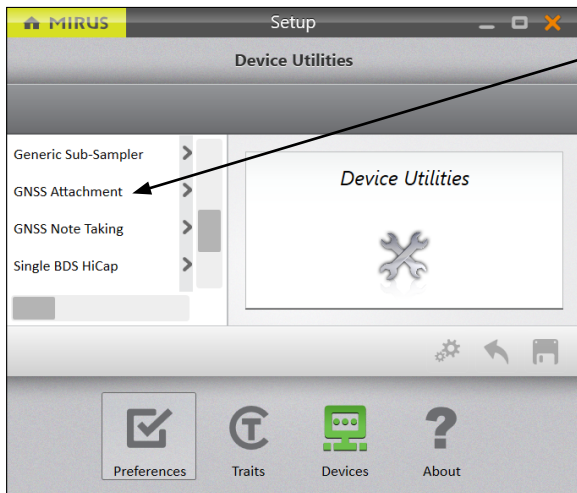
### 2.4.1 Connect the GNSS/GPS Receiver

To connect your GNSS/GPS receiver,

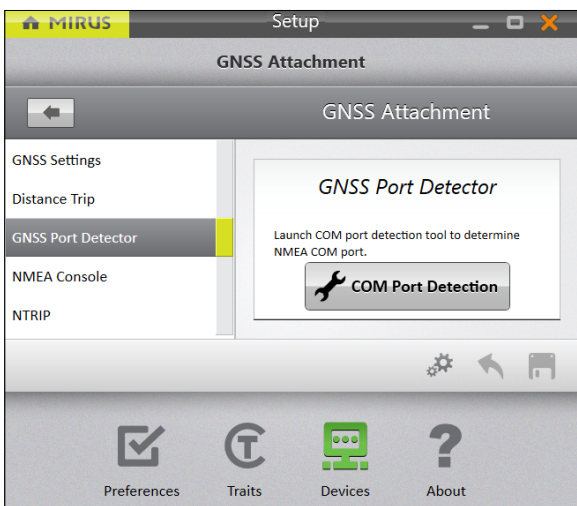
1. Open Mirus  from your Windows desktop. Mirus opens the Main Menu screen.
2. Disconnect any plugins.



3. Tap **Setup**.



4. Tap **GNSS Attachment**.

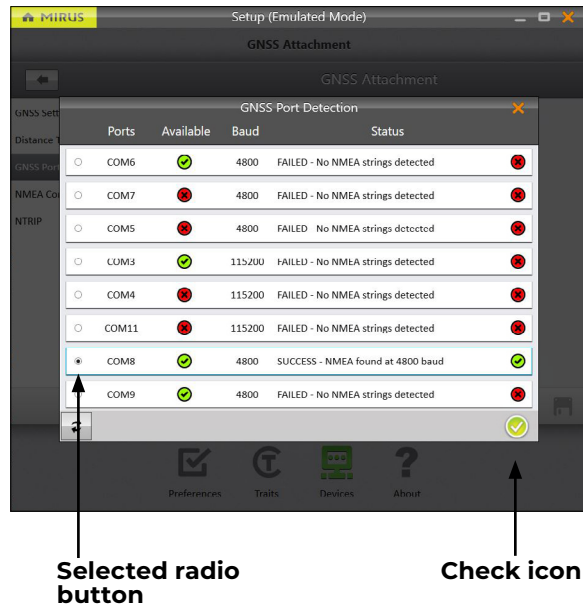


On the **Setup > GNSS Attachment** screen,

5. 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 see the name of each port, its availability and baud rate, 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,

6. Select a port for the receiver to use. Note the port for calibrating the setback. (See **4.1.1 Calibrate the Offsets on page 30.**)

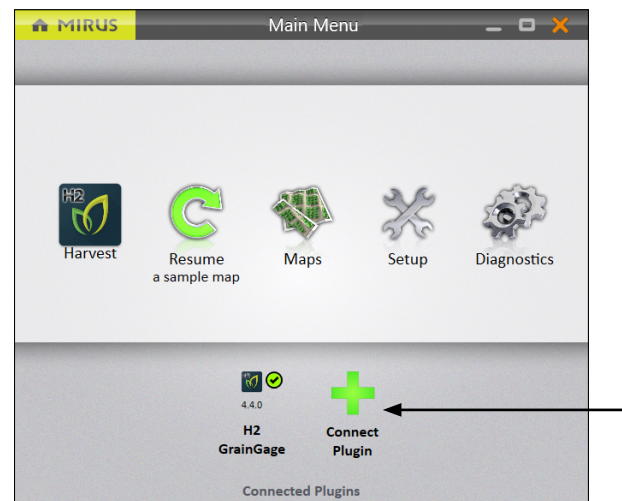
*Note: The first time that you use the GNSS Attachment you select the receiver that you want to use.*

7. Tap the check icon ✓ to apply the selected port.

The following settings are automatically filled in, except for offsets:

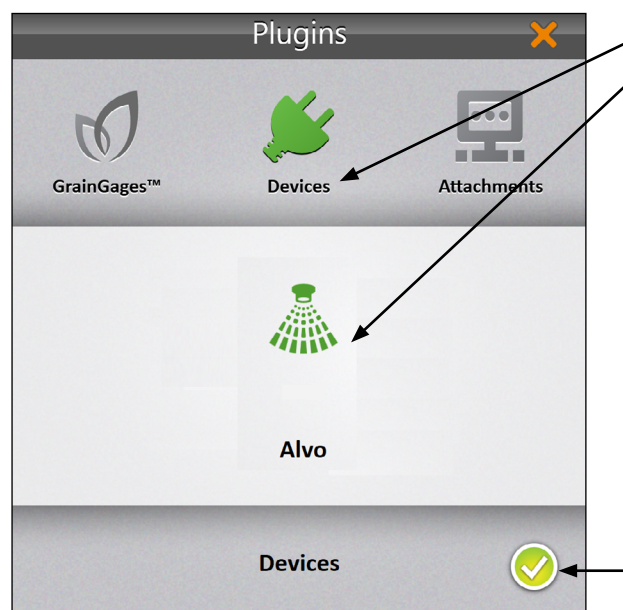
- Collection Type: Plot Events
- Capture Cycles: No
- Additional Trip Action: None
- Trip Origin: Antenna
- Receiver Type: Generic

## 2.4.2 Add the Alvo Field Applicator and GNSS Attachment

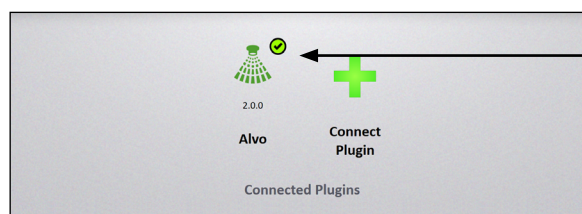


To add the Alvo Field Applicator and GNSS Attachment in Mirus,

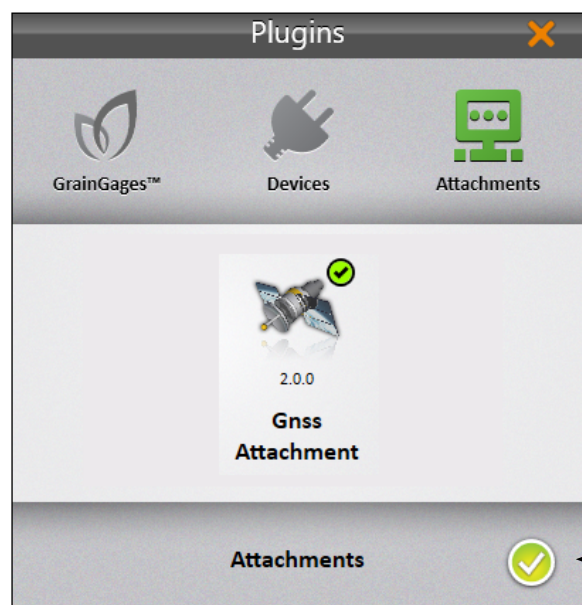
1. Tap **Connect Plugin** on the Mirus Main Menu screen.



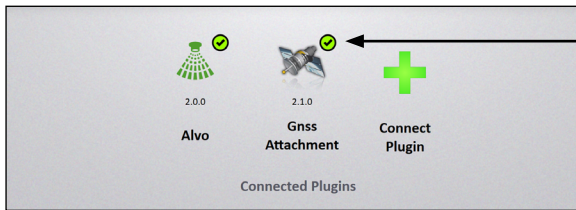
2. Tap **Devices**.
3. Tap **Alvo**.
4. Tap the check icon ✓.



- Alvo has a green check mark.
5. Tap **Connect Plugin**.



6. Tap **Attachments**.
7. Tap **GNSS Attachment**.
8. Tap the check icon ✓.

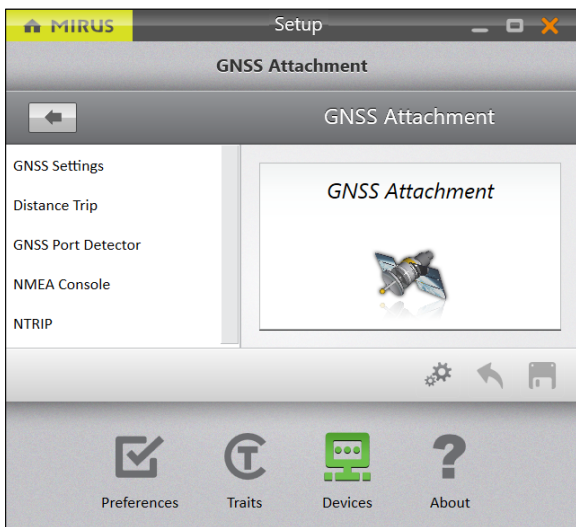


The GNSS Attachment has a green check mark.

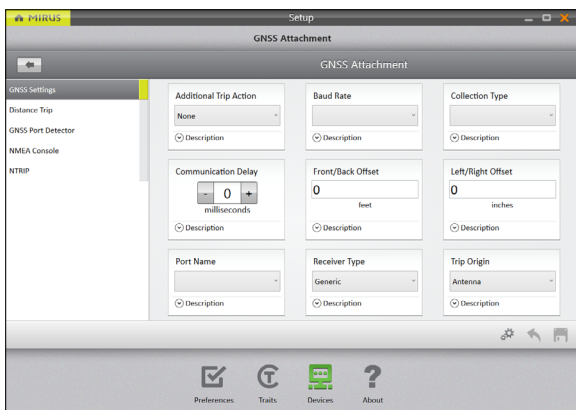
## 2.4.3 Enter Receiver Offset

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

1. Tap **GNSS Settings**.



2. Enter the front/back offset..



### GNSS Settings Screen

| Setting           | Description and Options   |
|-------------------|---|
| Front/Back Offset | <p>Enter the distance between the center dome of the GNSS antenna and boom 1, the first boom to enter the plot as you drive.</p> <ul style="list-style-type: none"> <li>Use positive numbers for equipment placed in front of the GNSS antenna.</li> <li>Use negative numbers for equipment located behind the GNSS antenna.</li> </ul>   |
| Left/Right Offset | <p>Enter the distance between the GNSS antenna and the center line (laterally) of the equipment swath.</p> <ul style="list-style-type: none"> <li>Use positive numbers for equipment to the right of the antenna.</li> <li>Use negative numbers for equipment to the left of the antenna.</li> </ul> <p>Right and left are determined by the driver facing the direction of travel.</p> |

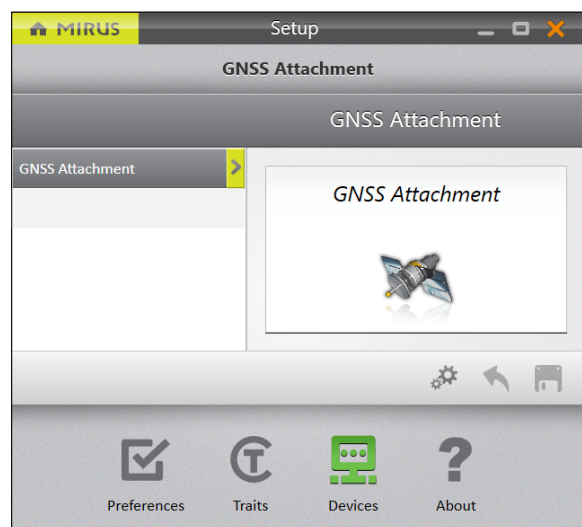
To determine the offsets, use a tape measure to find the distance from the spot on the ground directly below the items noted below.

1. Boom 1 to the center of the GNSS/GPS receiver. This is the front/back offset.
2. The GNSS/GPS receiver antenna to the center of the working equipment. This is the left/right offset.

Measure as closely as possible, even though the receiver is in the air and the boom is near the ground.

*Note: The offset is a fixed, real-world value. Do not artificially adjust the offset value to align spray placement because this can introduce error when changing speeds.*

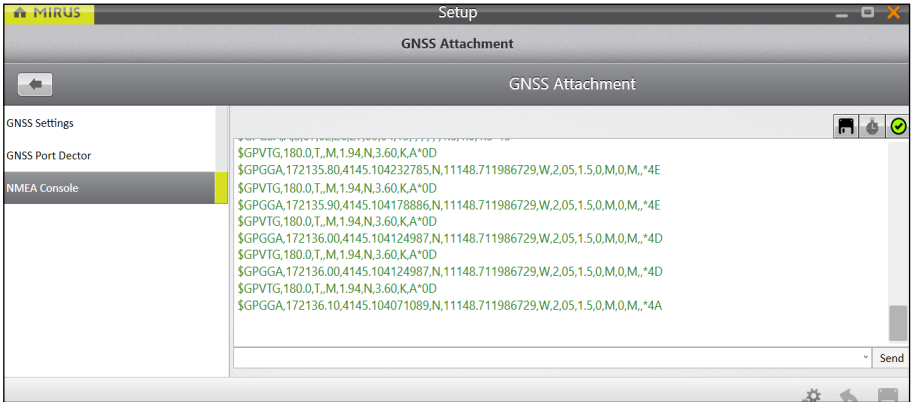
## 2.4.4 View NMEA Messages from the GNSS/GPS Receiver



To view the NMEA messages from the GNSS/GPS receiver,

1. Open the **Setup > GNSS Attachment** screen.
2. Tap **NMEA Console**.

Mirus displays the NMEA Console.



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**CHAPTER THREE**

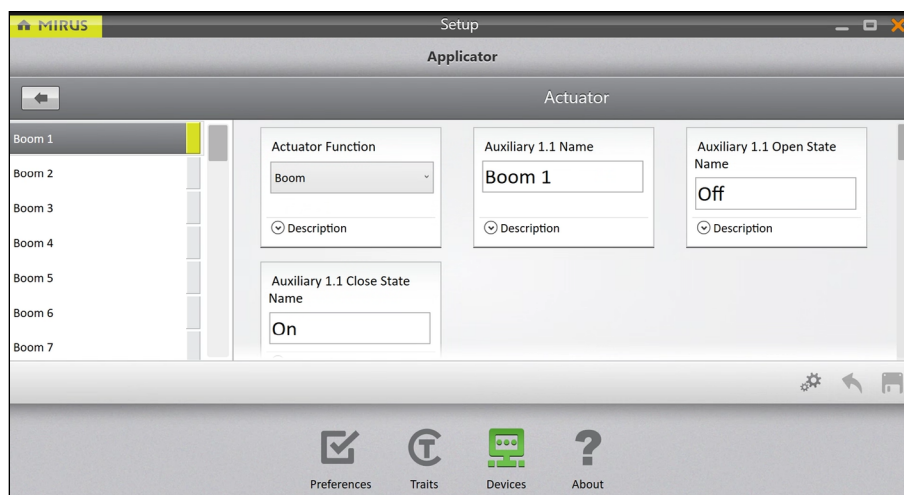
Define Settings in Mirus

## 3 Define Settings in Mirus

### 3.1 Set Up the Actuators

To set up the actuators in Mirus,

1. In Mirus, open **Setup > Applicator > Actuator**.



2. Set the desired values for each boom actuator.

#### Boom Actuator

| Item                          | Default Value | Description  |
|-------------------------------|---------------|--|
| Actuator Function             | None          | By default each boom is defined as inactive (set to none). Select the actuator function. <ul style="list-style-type: none"> <li>• None: Inactive boom</li> <li>• Boom: Active application boom</li> <li>• Air: Manual mode switch within Mirus to open the air supply solenoid</li> <li>• Wash: Manual mode switch within Mirus to open the wash solution supply solenoid</li> </ul> |
| Auxiliary 1.1 Name            | Boom order    | Customize the name of each actuator boom. The default name of the booms is their order, i.e. <i>boom 1</i> . You might call yours <i>In Furrow</i> or <i>Banding</i> . Note: If booms are renamed, the name cannot be <i>Boom #</i> .  |
| Auxiliary 1.1 Open State Name | Off           | By default the open actuator is not powered. You can customize the name of this field.   |

## Boom Actuator

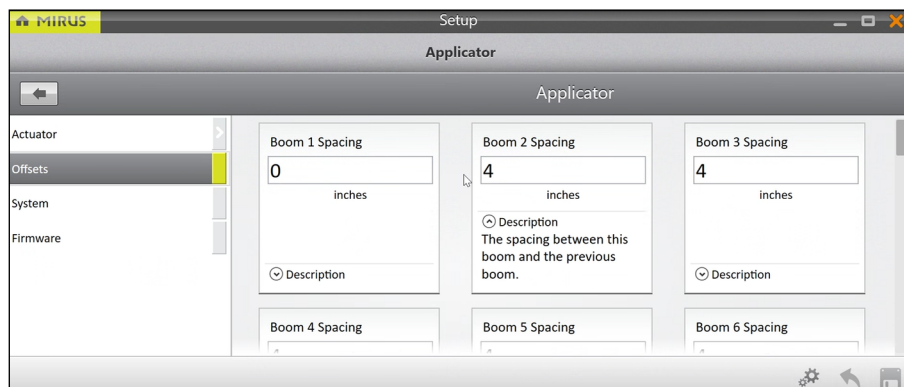
| Item                           | Default Value | Description   |
|--------------------------------|---------------|---|
| Auxiliary 1.1 Close State Name | On            | By default the closed actuator is supplied power. You can customize the name of this field. |

## 3.2 Define the Applicator Offsets

When measuring the booms to determine offset amounts, begin with the boom that leads in the direction of travel. The leading boom is always Boom 1 in Mirus. The offset measurement for Boom 1 is always 0, because it is your starting measurement. For all other booms, measure the distance between that boom and the one in front of it. For example, if the distance between boom 1 and boom 2 is four inches, enter 4 for Boom 2 spacing.

To define the applicator offsets in Mirus,

1. In Mirus, open **Setup > Applicator > Offsets**.



2. Enter the application settings, as explained in the table below.

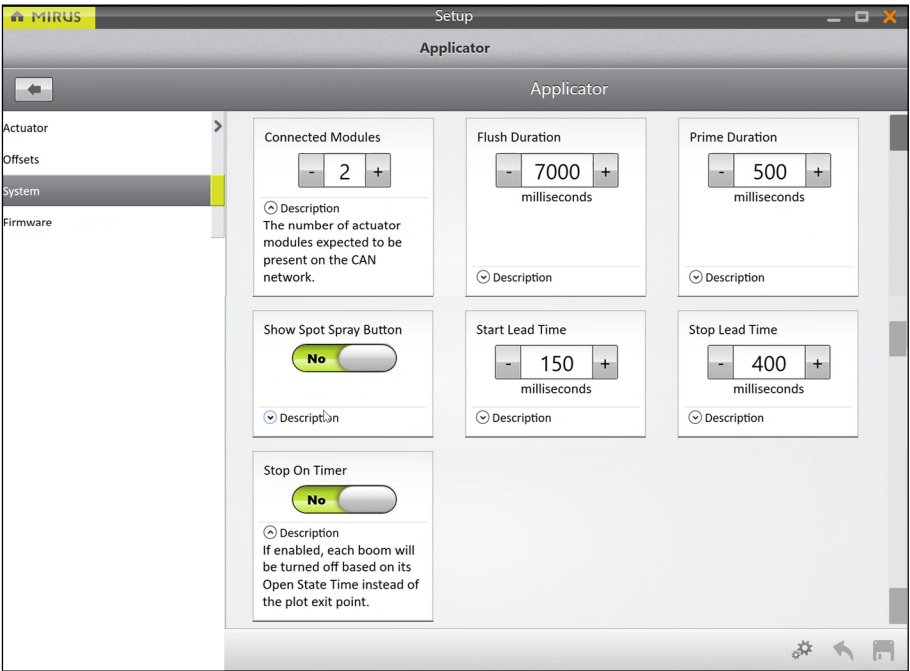
## Applicator Configuration

| Item              | Definition  |
|-------------------|---|
| Boom 1 Spacing    | Always set to 0. Boom 1 should always lead in the direction of travel.                                |
| Boom 2–24 Spacing | For Boom 2 and higher, set the spacing to the actual measured distance between one boom and the next. |

### 3.3 Define Applicator System

To set up the actuators in Mirus,

1. In Mirus, open **Setup > Applicator > System**.



| Applicator Configuration |  |
|--------------------------|--|
| Item                     | Definition   |
| Connected modules        | Each module can support eight booms. Set the number of modules. <ul style="list-style-type: none"><li>• 1: up to 8 booms</li><li>• 2: up to 16 booms</li><li>• 3: up to 24 booms</li></ul> |
| Flush duration           | Set the amount of time for each boom to fire when running wash solution (up to 30,000 msec).   |
| Prime duration           | Define the duration to prime each boom. The duration set here applies to all active booms.   |
| Show spot spray button   | When enabled, the Spot Spray button appears on the Main Menu, allowing control over individual booms.  |
| Start lead time          | Time needed to establish the desired flow or application pattern.  |

**Applicator Configuration**

| Item           | Definition  |
|----------------|---|
| Stop lead time | Time needed to terminate the flow or application pattern.   |
| Stop On Timer  | If enabled, each boom turns off when the set time has expired instead of when reaching the plot exit point. |

### 3.4 Check Firmware Versions

The firmware version on each actuator module is displayed. Ensure that all modules have the same version of firmware.

**alvo**<sup>TM</sup>  
Field Applicator



**CHAPTER FOUR**

Calibrate the System

## 4 Calibrate the System

### 4.1 Calibrate the Alvo Field Applicator and GNSS Attachment

When properly calibrated, the Alvo Field Applicator works at different speeds and with plots and alleys of different dimensions.

To calibrate the Alvo Field Applicator and GNSS Attachment, calibrate the offsets and align the applicator.

#### 4.1.1 Calibrate the Offsets

Generally calibration is only required once unless the system changes. The following changes require recalibration:

- The GNSS/GPS receiver is changed to a different model. Recalibrate to account for changes in communication delay.
- The applicator is being used with a different tractor, the GNSS/GPS antenna is moved to a new position, or the GNSS/GPS is recalibrated. Recalibrate to account for changes in the offsets.
- New solenoids, actuators, nozzles, or change to system pressure. Recalibrate to account for changes.

Before calibration,

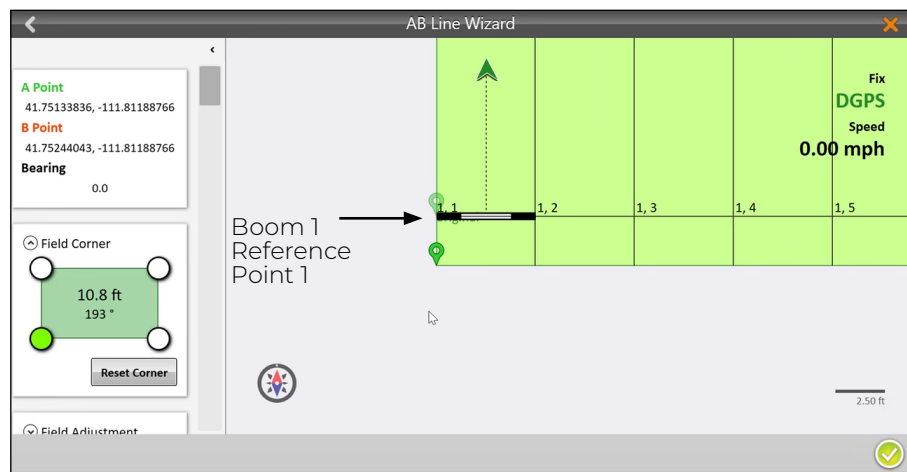
1. Ensure all solenoids or actuators are in good condition. Valves that are sticky or do not shut off completely adversely affect your application and make calibration extremely difficult.
2. Inspect for proper shut off. Turn on the boom or spray nozzle and wait for product to come out, and then shut it off. Verify that product stops flowing in less than one second.
3. Solenoid valves should be located as close to the nozzles as possible to limit the amount of hose or pipe length that is pressurized with product. Having an unnecessary amount of product in the hose or piping increases the amount of time for the system to stop spraying.

## Verify the Front/Back Offset

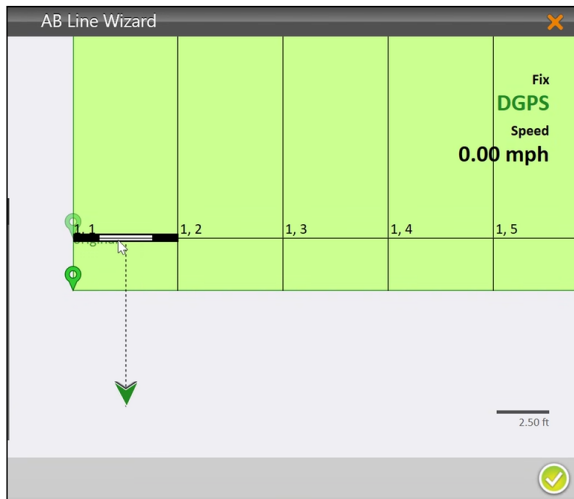
Verify the front/back offset to ensure that the GPS receiver locations received and displayed in Mirus match the locations in your field that are represented on the electronic map. To set the front/back offset, see **2.4.3 Enter Receiver Offset** on page 21.)

To verify the front/back offset,

1. In Mirus, import a multiple range map. (See **1.3.1 on page 8**.)
2. Create an AB line using actual plot dimensions.
  - From the Manage Maps screen, select **AB Line**.
  - Enter the plot dimensions in the AB Line Wizard.
  - Position boom 1 at the edge of the first plot (Range 1, Row 1 on the Mirus map).



3. Mark the position of boom 1 with a flag or stake in the ground. (Reference Point 1)
4. Tap **Capture Point A**. Tap the next arrow ➡.
5. Turn the tractor around 180 degrees.

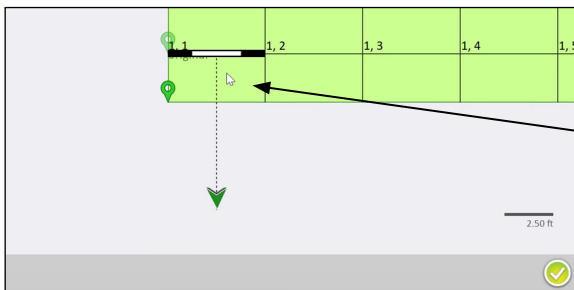


6. Position the tractor so that boom 1 matches the plot baseline in Mirus.

Plot baseline

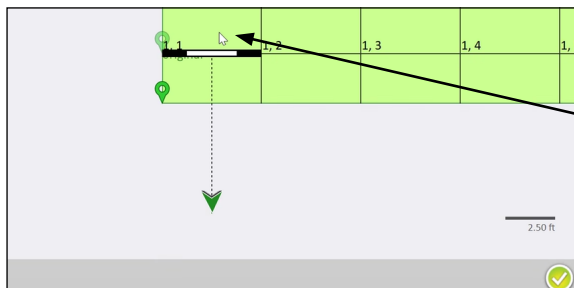
7. Measure from the boom 1 to the stake set previously. Note the measurement.

- The front/back offset is correct if boom 1 aligns with the stake set previously (within the GPS level of accuracy, usually 1–4 cm).
- If the boom and the stake do not align within the GPS level of accuracy, edit the front/back offset in the appropriate direction and repeat steps 2–7 until the offset is correct. To adjust the offset measurement in Mirus (**2.4.3 Enter Receiver Offset** on page 21), enter the combination of half of the distance between the in-ground marker and boom and the current offset distance.



If the offset is too small, your in-ground marker would be where the cursor is pointing.

In-ground marker position when offset is too small.



If the offset is too big, your flag in-ground marker would be where the cursor is pointing.

In-ground marker position when offset is too big.

## 4.1.2 Align the Application with the Plots

With the front/back offsets verified, check that the spray starts as the boom enters the plot and to stops as the boom leaves the plot. Three key factors—GNSS accuracy, GNSS communication delay, and start/stop lead time—influence how precisely the spray can be aligned to start as the boom enters the plot and stop as the boom leaves the plot.

- **GNSS/GPS Accuracy.**  
The accuracy of the GNSS/GPS receiver affects how well the applicator aligns to the plots. Mirus cannot compensate for misalignment that is due to lack of accuracy from the GNSS/GPS receiver. For example, a system using an RTK receiver that provides accuracy of 2 cm will have up to 2 cm of stagger in both directions. It could appear to be off by as much as 4 cm. Allow for the accuracy of your GNSS receiver when aligning the application with your plot.
- **GNSS/GPS Communication Delay**  
Under typical conditions GNSS signal, cable, and amplifier delays are negligible. However, if an operator wanted to compensate for a communication delay, this field allows that. The units of measure are in milliseconds.
- **Start/Stop Lead Time**  
The mechanics of the actuator cause a slight delay between the time that Mirus sends the signal to start/stop applying a product and the time when the product application begins or ends. Mirus provides settings to adjust the boom start lead time and the boom stop lead time. See **3.3 Define Applicator System on page 27**. The exact amount of time may not be the same for starting and ending the application.

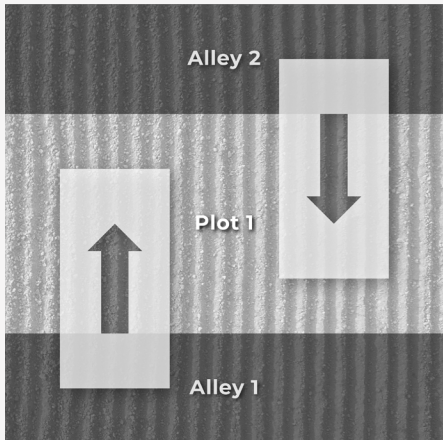
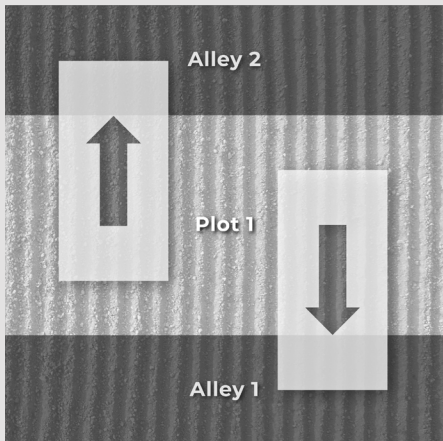
### Verify Start/Stop Lead Times in Mirus

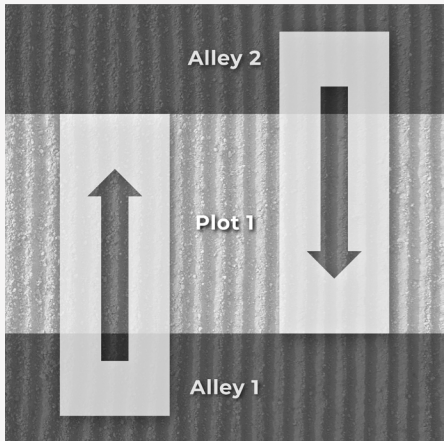
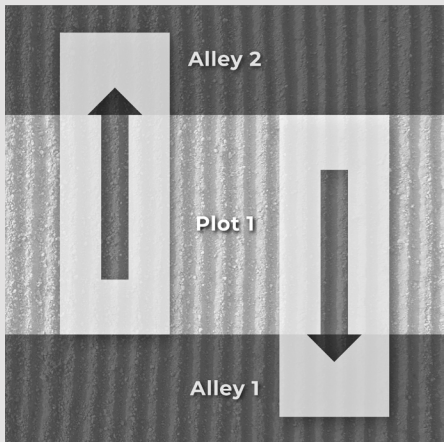
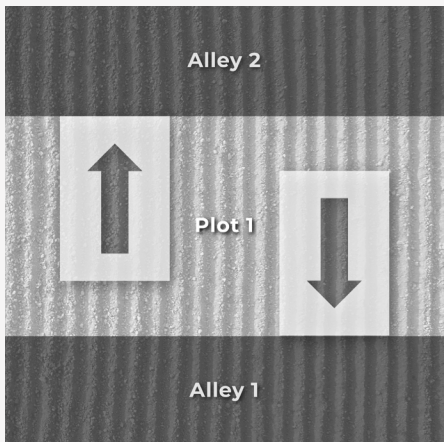
To properly calibrate the application,

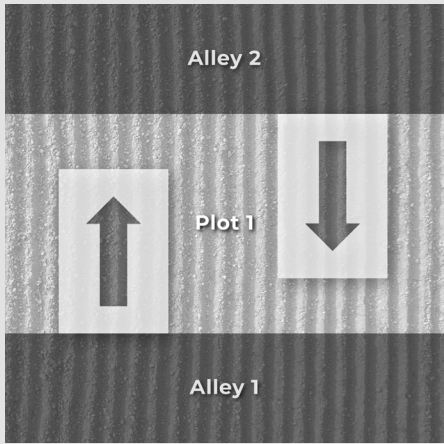
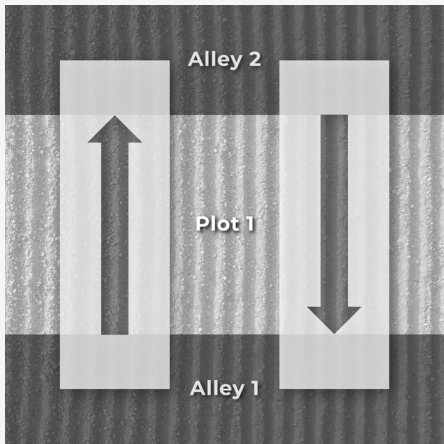
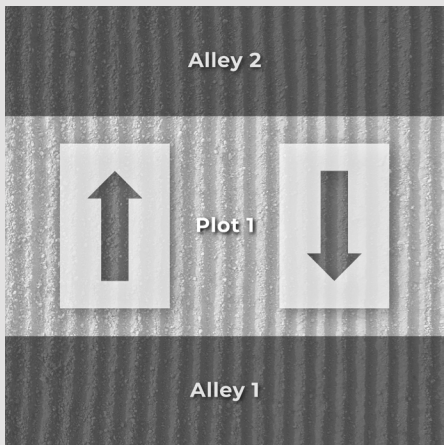
1. Create and import a map with 2 ranges and 10 rows, containing multiple treatments.
2. Load the treatments into the applicator. (See **5.1 Set Up Map Selection and Treatment on page 38**.)
3. Prime the booms. Ensure there is no air present in the system.
4. Create an AB line. (Follow steps 1–9 of **5.3 Use Automatic GNSS/GPS Cycling on page 41**.)
5. Mark the location of boom 1 with a flag or stake in the ground.
6. Drive two passes (preferably at the speed at which you will apply product). Mark where the application pattern starts and stops.

If the application patterns do not line up exactly as expected, the following table outlines likely issues and provides guidance for making adjustments in the Mirus settings. Change the start/stop lead time as described in **3.3 Define Applicator System on page 27**.

## Likely Start/Stop Issues

| Application Description   | Possible Cause(s)   | Diagram  | Mirus Action  |
|---|---|--|---|
| Start: early (before entering plot)<br>End: early (before leaving plot)<br>Length: correct<br>Stagger: backward | <ul style="list-style-type: none"> <li>Both start/stop lead time are set too long.</li> <li>Offset is too short. (Unlikely)</li> </ul> <p>Use your driving speed to determine the cause of the problem. Drive at varying speeds.</p> <ul style="list-style-type: none"> <li>If the application gets longer with higher speed, the start/stop lead time is too long.</li> <li>If the stagger remains consistent at varied speeds, the offset is too short.</li> </ul>      |    | Decrease start/stop lead time.<br><br>Or increase the front/back offset.                                |
| Start: late<br>End: late<br>Length: correct<br>Stagger: forward   | <ul style="list-style-type: none"> <li>Both start/stop lead time are set too short.</li> <li>Offset is set too long. (Unlikely)</li> </ul> <p>Use your driving speed to determine the cause of the problem. Drive at varying speeds.</p> <ul style="list-style-type: none"> <li>If the application gets longer with higher speed, the start/stop lead time is too short.</li> <li>If the stagger remains consistent at varied speeds, the offset is too short.</li> </ul> |  | Increase the start lead time.<br>Increase the stop lead time.<br><br>Or increase the front/back offset. |

| Likely Start/Stop Issues                                      |   |  |  |
|---|---|--|--|
| Application Description                                       | Possible Cause(s)   | Diagram  | Mirus Action                           |
| Start: early<br>Stop: correct<br>Length: long<br>Stagger: n/a | The boom start lead is too long.<br><br>It takes less time to start the application than what is set as the start lead time.                              |    | Decrease the start lead time in Mirus. |
| Start: correct<br>Stop: late<br>Length: long<br>Stagger: n/a  | The boom stop lead time is too short.<br><br>It takes less time to stop application than what is set as the stop lead time.                               |   | Increase stop lead time.               |
| Start: late<br>End: correct<br>Length: short<br>Stagger: n/a  | The boom start lead is too short.<br><br>It takes more time for the actuator to move and the application to form than what is set as the start lead time. |  | Increase the start lead time.          |

| Likely Start/Stop Issues                                      |   |  |   |
|---|---|--|---|
| Application Description                                       | Possible Cause(s)   | Diagram  | Mirus Action  |
| Start: correct<br>End: Early<br>Length: Short<br>Stagger: n/a | The stop lead time is too long.<br><br>It takes less time for the actuator to move and the application to form than the time set as the stop lead time. |    | Decrease the stop lead time.                                      |
| Start: early<br>End: late<br>Length: long<br>Stagger: n/a     | The start lead time is too long, and the stop lead time is too short.   |   | Decrease the start lead time.<br><br>Increase the stop lead time. |
| Start: late<br>End: early<br>Length: short<br>Stagger: n/a    | The start lead time is too short, and the boom stop lead time is too long.  |  | Increase start lead time.<br><br>Decrease stop lead time.         |

**alvo**<sup>™</sup>  
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**CHAPTER FIVE**

**Apply Treatments**

## 5 Apply Treatments


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

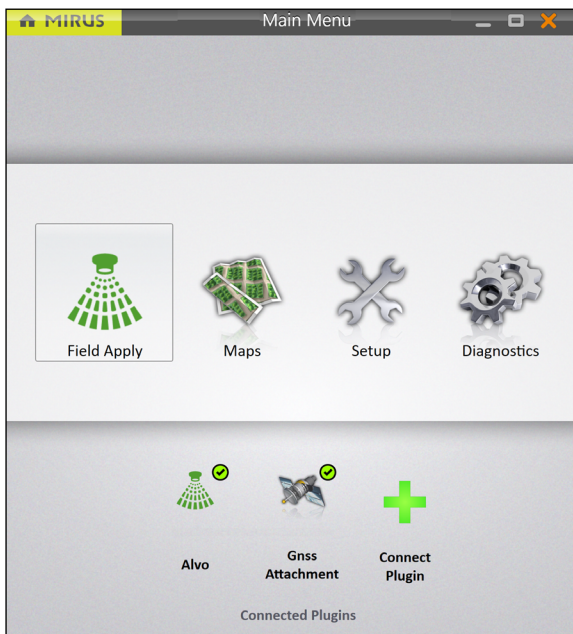
After selecting a map and setting up treatments, set up the system for automatic cycling or manual cycling. Automatic cycling triggers the applicator system automatically using GNSS/GPS.

### 5.1 Set Up Map Selection and Treatment

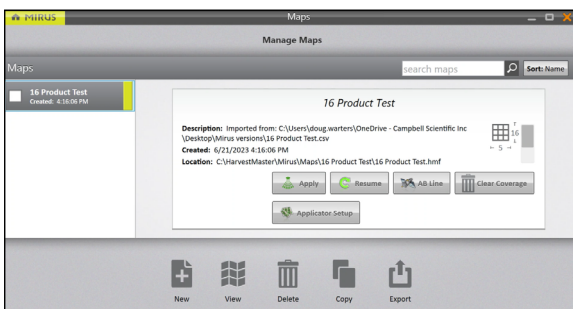
For manual cycling and automatic GNSS/GPS cycling, open the map and identify the treatments. Each Alvo actuator module can apply one or two products simultaneously. A treatment conflict warning appears if you have three or more products assigned to one actuator module.

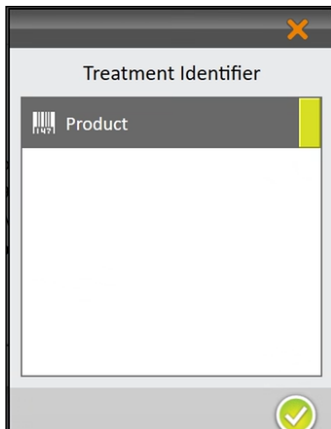
To set up the map and treatments,

1. Open Mirus.
2. Tap **Maps** .



3. Select the map.
4. Tap **Applicator Setup**.





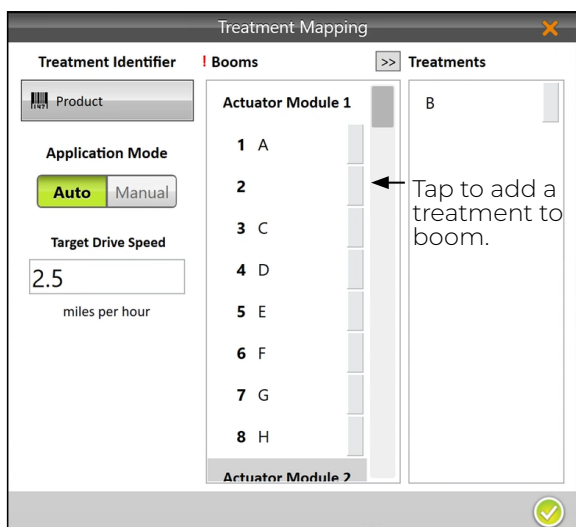
The Treatment Identifier window displays all of the treatments you have defined. You can only select one at a time.

5. Select the Treatment Identifier.

In the example to the left, the map was imported from a .csv file and the column was labeled "Product."

If the map was imported from a .txt file, the identifier would be "Id 1."

6. Tap the check icon ✓.



Mirus displays the Treatment Mapping window with all of the treatment names from the map file associated with a boom number in alphanumeric order.

Any conflicts are noted with a red exclamation point. (See **5.2 Resolve Treatment Conflicts** on page 39.)

7. To change the order or placement in the booms.,
  - Tap the treatment you want to move.
  - Tap >.
  - The treatment shows in the other column leaving the boom number empty.
  - Repeat to create an empty boom.
  - Select the unassigned treatment from the right column.
  - Tap the arrow for the empty boom where you want the treatment to go.
8. When the treatments are listed with the correct boom numbers, tap the check icon ✓.

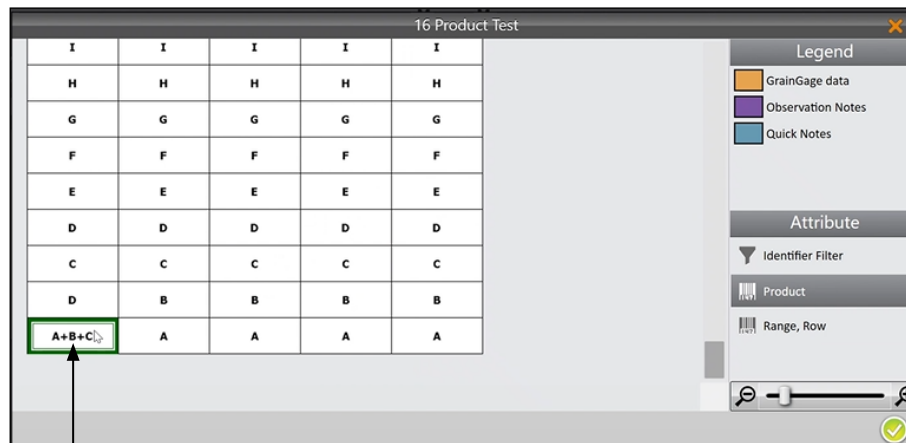
## 5.2 Resolve Treatment Conflicts

If more than two products are assigned to the same actuator module, Mirus marks the products with red exclamation marks in the Booms column on the Treatment Mapping window.



To resolve the conflict from the Treatment Mapping window,

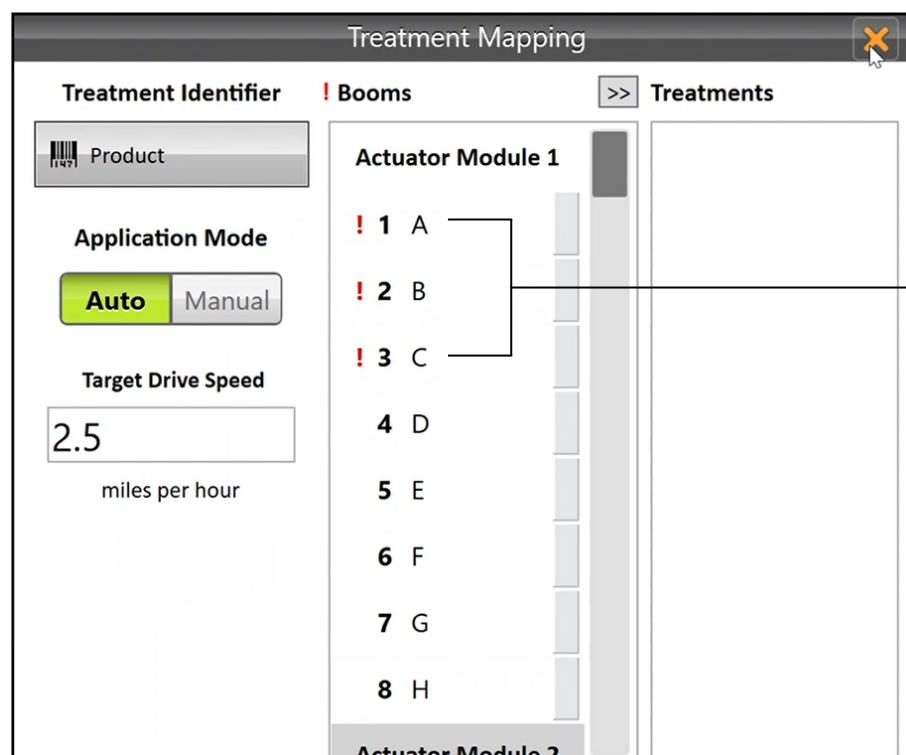
1. Close the Treatment Mapping window.
2. From the Manage Maps screen, select the map associated with the treatment.
3. Tap **View**.
4. Under Attribute, tap **Product**.

- Scan the map for three or more products assigned to the same actuator module.

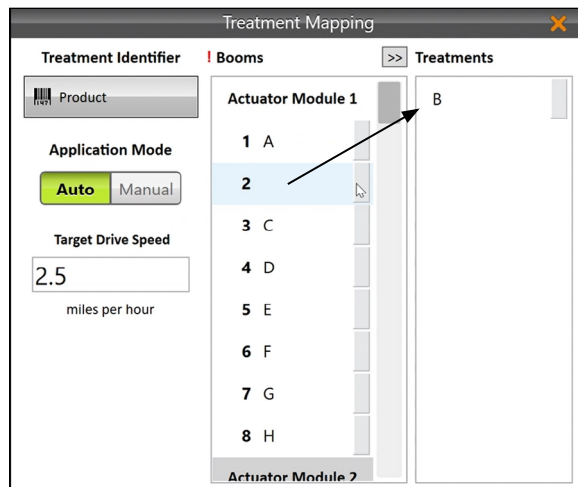


Three products assigned to the same actuator module.

- Tap the check icon .
- Tap **Applicator Setup**.
- In the Treatment Identifier window, tap **Product** and tap the check icon .
- Locate the group(s) of conflicts, marked by red exclamation marks. Each actuator module can apply up to two products simultaneously.

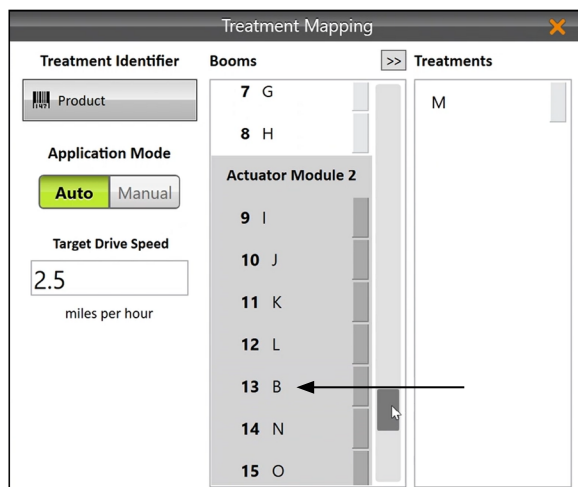


Group of product conflicts



10. Tap one product (from a group of conflicts).
11. Tap the arrow **>** to move the product to the Treatments column. This leaves the space by the boom number empty.

Repeat this step for each group of conflicts.



12. Tap a product in the Treatments column.
13. Tap an empty space on a different module in the Booms column.

*Note: If no empty space exists on a different module, move a product from a different module to the Treatments column. Now, you have two products in the Treatments column. Then, trade the module assigned to each product.*

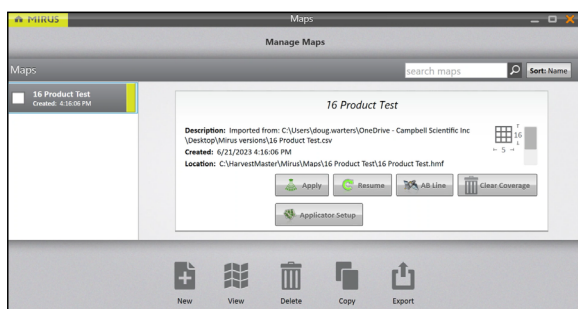
After you resolve the product conflicts, the red exclamation marks disappear.

14. Tap the check icon .

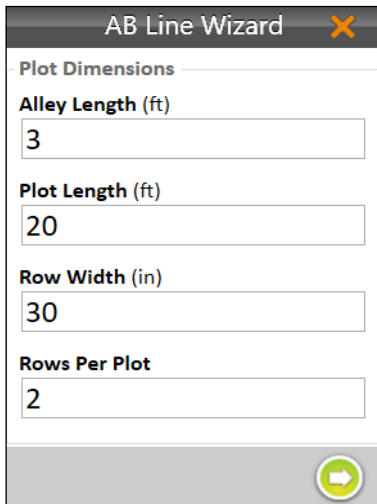
## 5.3 Use Automatic GNSS/GPS Cycling

After selecting a map and setting up treatments, you can setup the system for automatic cycling or manual cycling. Automatic cycling triggers the applicator automatically using GNSS/GPS.

Mirus uses the AB line to calculate the locations of plots in the field to automatically start the applicator when entering a plot and to automatically stop the applicator when leaving a plot.



1. In the Manage Maps screen, tap **AB Line** to open the AB Line Wizard.



**AB Line Wizard** ✕

**Plot Dimensions**

**Alley Length (ft)**  
3

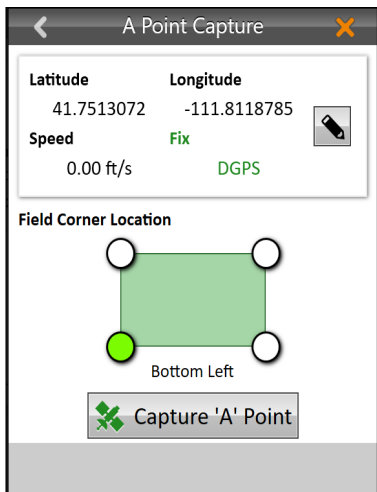
**Plot Length (ft)**  
20

**Row Width (in)**  
30

**Rows Per Plot**  
2

➡

2. Enter the plot dimensions
3. Tap the next arrow ➡ to save this information.



**A Point Capture** ✕

**Latitude** 41.7513072 **Longitude** -111.8118785

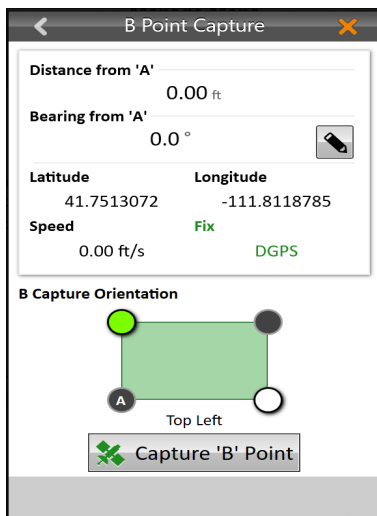
**Speed** 0.00 ft/s **Fix** DGPS

**Field Corner Location**

Bottom Left

✕ Capture 'A' Point

4. Position boom 1 to be ready to enter at the edge of the first plot (Range 1, Row 1).
5. Tap **Capture A Point**.
6. Tap the next arrow ➡.



**B Point Capture** ✕

**Distance from 'A'** 0.00 ft

**Bearing from 'A'** 0.0 °

**Latitude** 41.7513072 **Longitude** -111.8118785

**Speed** 0.00 ft/s **Fix** DGPS

**B Capture Orientation**

Top Left

✕ Capture 'B' Point

7. Establish a bearing by either entering a bearing (if known) or by moving several plots through the field to capture the B point.

To enter a bearing,

- Tap the edit icon ✎.
- Enter your manual bearing from A.
- Tap the next arrow ➡.

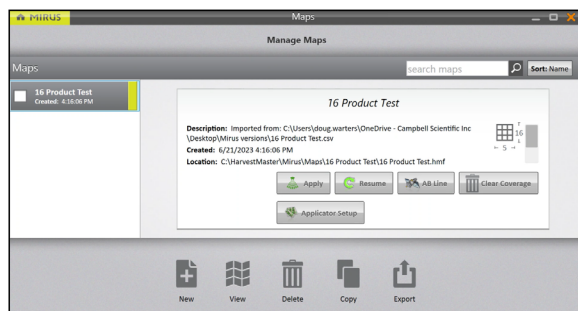
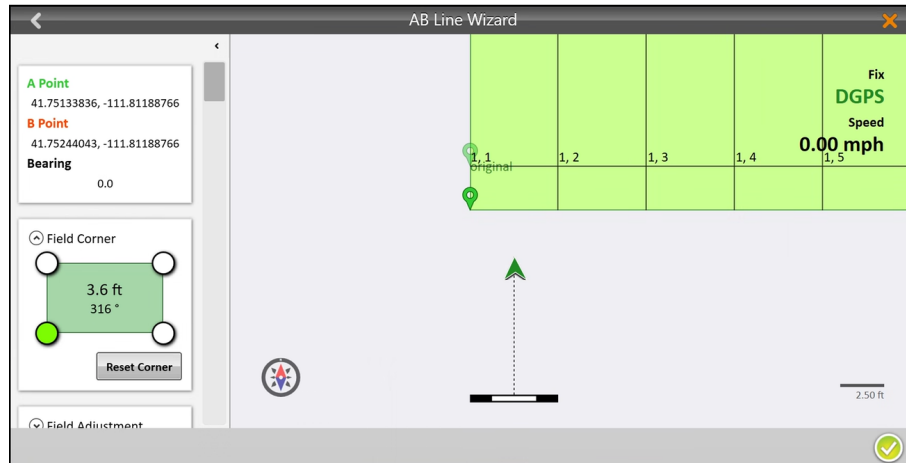
To capture the B point,

- Move several plots through the field.
- Tap **Capture B Point**.
- Tap the next arrow ➡.

The accuracy of the bearing is 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.

In the AB Line Wizard, you can see the A and B Points, Bearing, Field Corner, Field Adjustment, GNSS Offsets, and Field Dimensions.

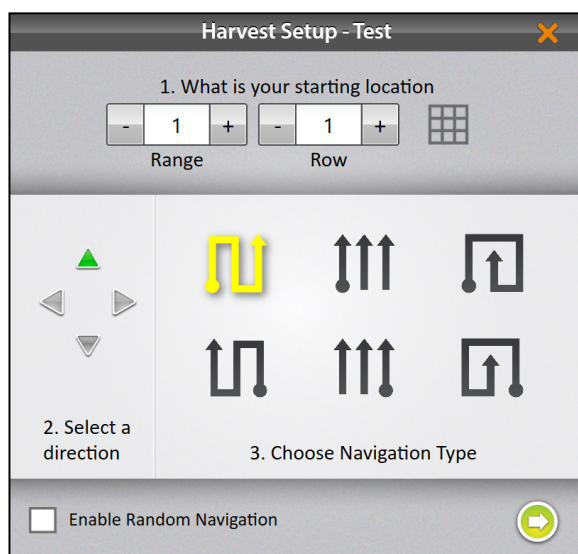
8. Back the applicator out of the plot.




9. Tap the check icon  to save the AB Line.

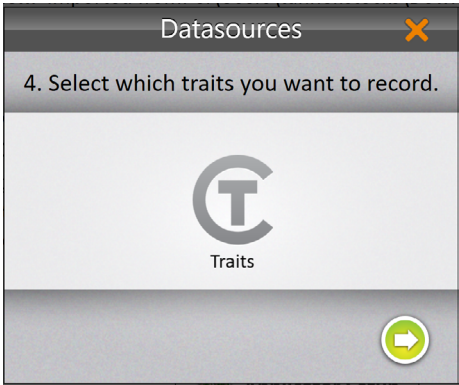
10. Tap **Apply**.


Mirus displays the Manage Maps screen.

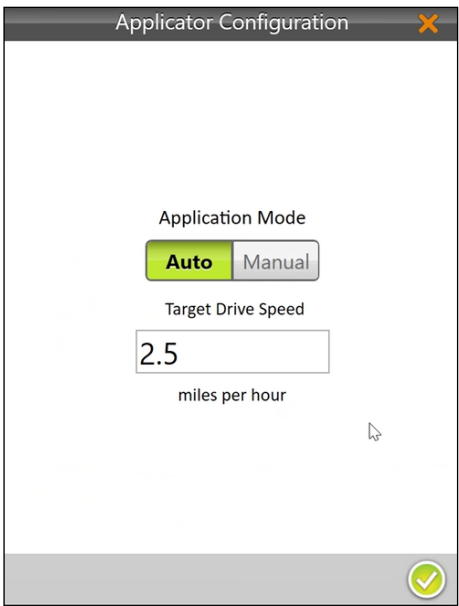



In the Harvest Setup screen,

11. Select your starting location.
12. Select a direction.
13. Choose your navigation type.
14. Tap the next arrow .

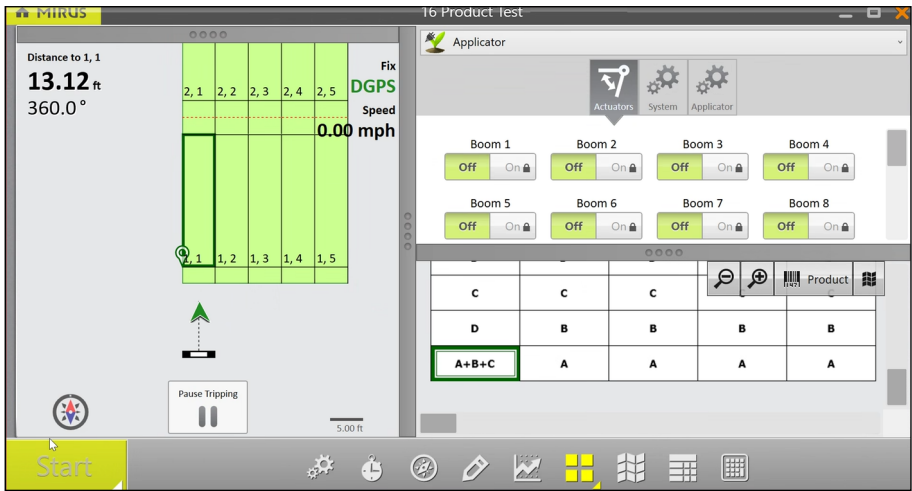



- In the Datasources screen,
15. Tap the next arrow  again.



- In the Applicator Configuration screen,
16. Select **Auto**.
17. Tap the check icon .
- Note: Manual operation is covered in the following section.*

Mirus displays the Map screen.



You can see four sections of information in the quad view. 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 tapping the spatial attribute button in that quad. To visually distinguish plots that have been treated, select the "Treatment" or "Id 1" spatial attribute with the  green custom trait icon.

When you are ready to begin,

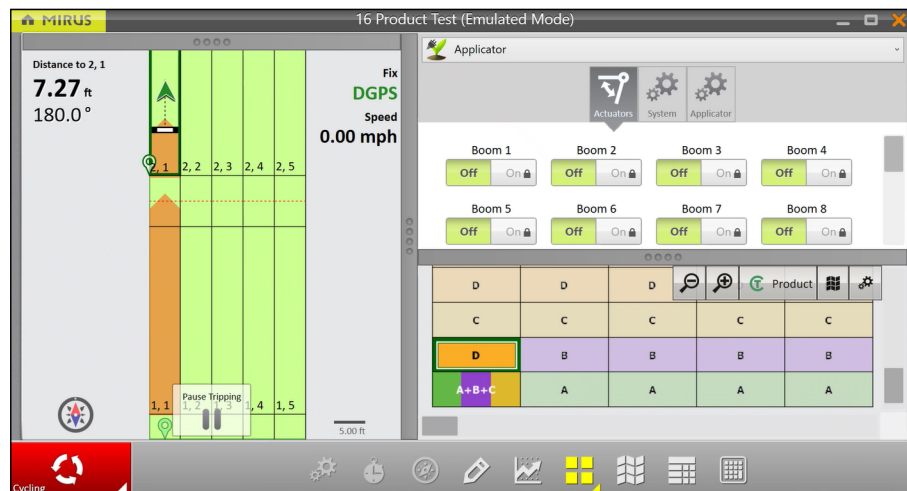
18. Tap **Start** .

The system immediately begins applying product when boom 1 enters the first plot.

19. Start moving into and through the plots at your target speed. Mirus triggers the applicators automatically.

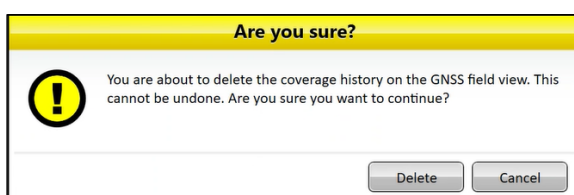
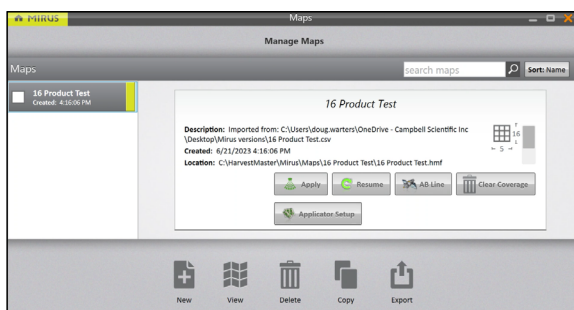
## 5.4 Clear Application Coverage

If you make multiple timing applications through the trial using the same map, you may want to remove the color indicating application coverage. By default coverage remains visible indefinitely.



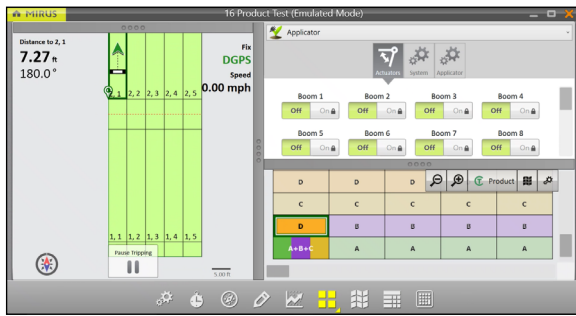
From the Manage Maps screen,

1. Tap **Clear coverage**.



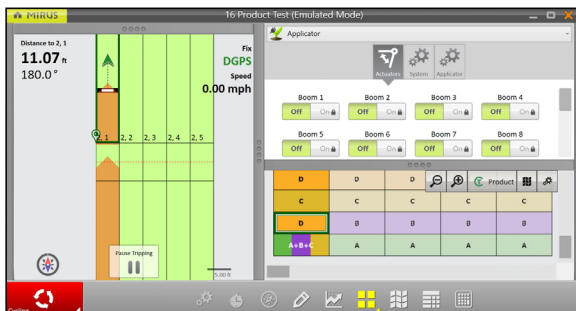
Mirus asks whether you are sure.

2. Tap **OK**.



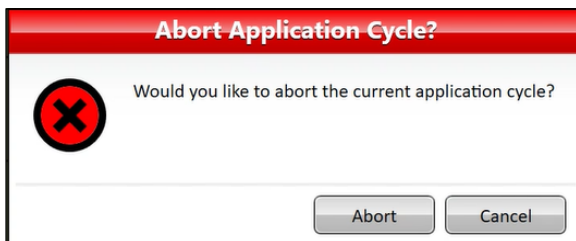
The coverage color is removed.

## 5.5 Interrupt Application Cycle



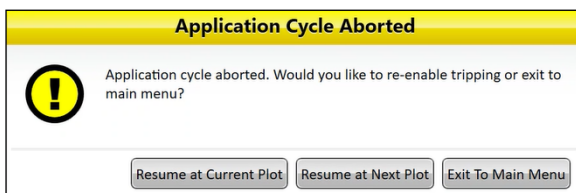
If you stop mid-application. As soon as you stop, the boom stops.

1. Tap the **Cycle** button.



Mirus asks whether you want to abort the application cycle.

2. Tap **Abort**.



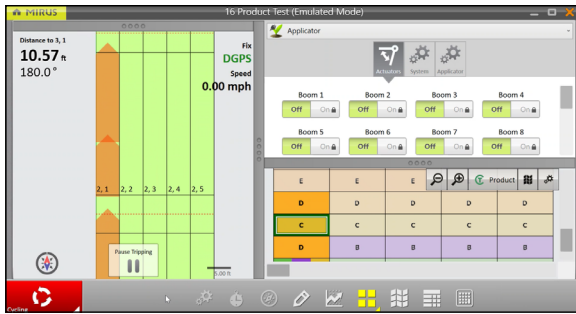
The Application Cycle Aborted warning box appears.

**Scenario 1:** Resume application from current plot.

In some situations, you will resume application from where you stopped.

1. Tap **Resume at current plot**.
2. Tap **Resume tripping**



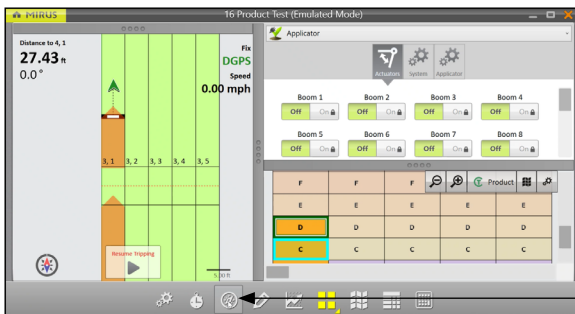


- Continue driving. The application coverage picks up from where you stopped.

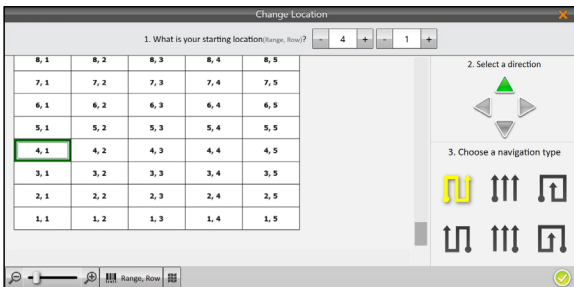
**Scenario 2:** Discard data for current trial and resume application at the next plot.

In some situations, you will resume application and discard this plot.



- Tap **Resume at next plot**.
- Tap the compass to change your location.



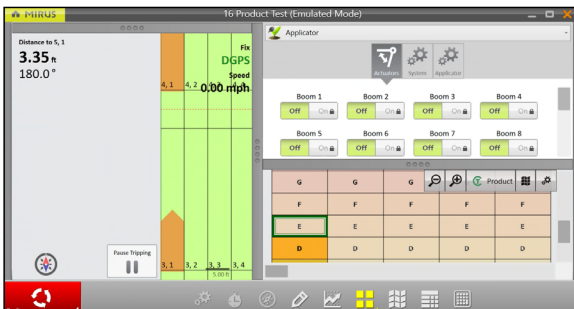
Compass



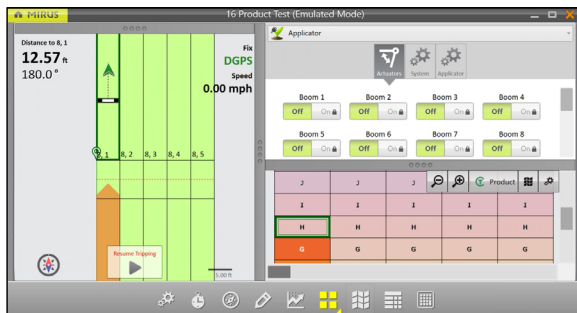
- Tap the plot where you will begin application. The green box indicates the next plot to enter.

- Check the direction of travel. Check the pattern of travel.
- Tap the check icon .
- Tap **Resume Tripping** .
- Continue driving.




The plot is discarded. The application resumes at the beginning of the selected plot.

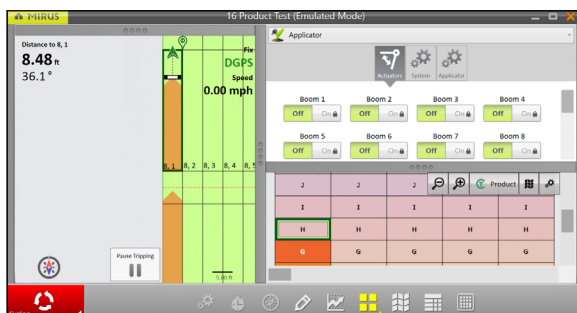
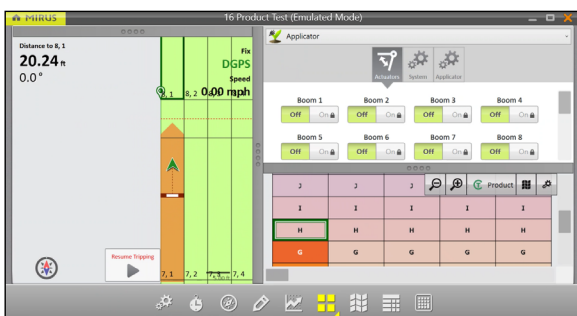


## 5.6 Pause Application



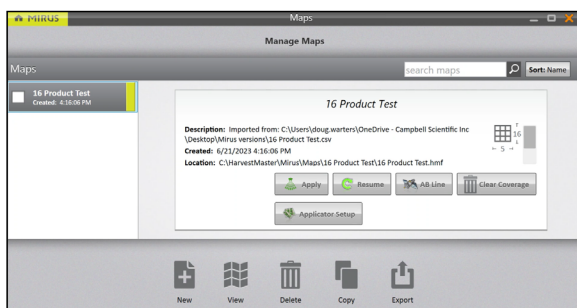
If you need to pause the spraying,

1. Tap **Pause Tripping** .
2. Finish the plot application. When you drive into the next plot, no product is applied.
3. When you are ready to resume application, drive the applicator into the previous plot.
4. Tap the compass  to verify navigation.
5. Tap **Resume Tripping** .
6. Begin driving. No product is applied until you enter the next plot.



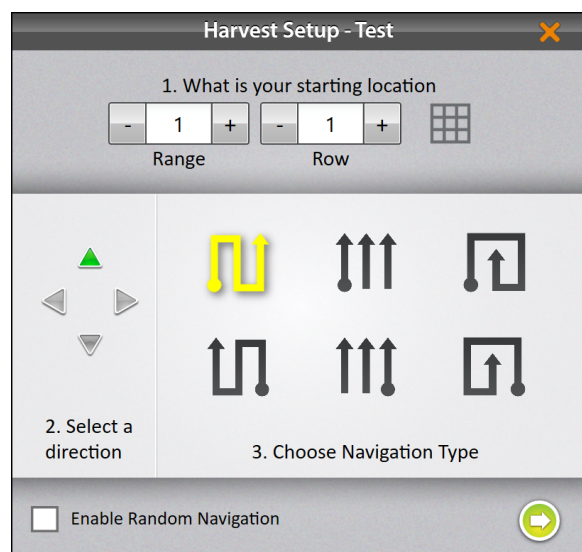
## 5.7 Use Manual Cycling

Manual cycling triggers the applicator when using the remote enter button. Ensure the remote enter button is connected to the system controller.




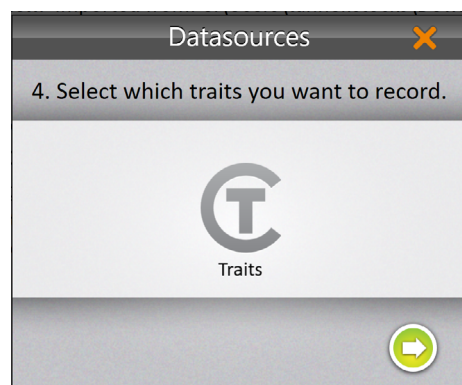
On the Manage Maps screen,

1. Tap **Spray**.



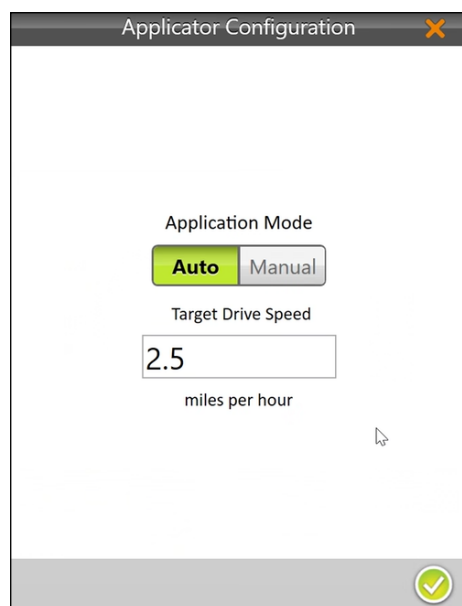
In the Harvest Setup screen,

2. Select your starting location.
3. Select a direction.
4. Choose your navigation type.
5. Tap the next arrow .





In the Datasources screen,

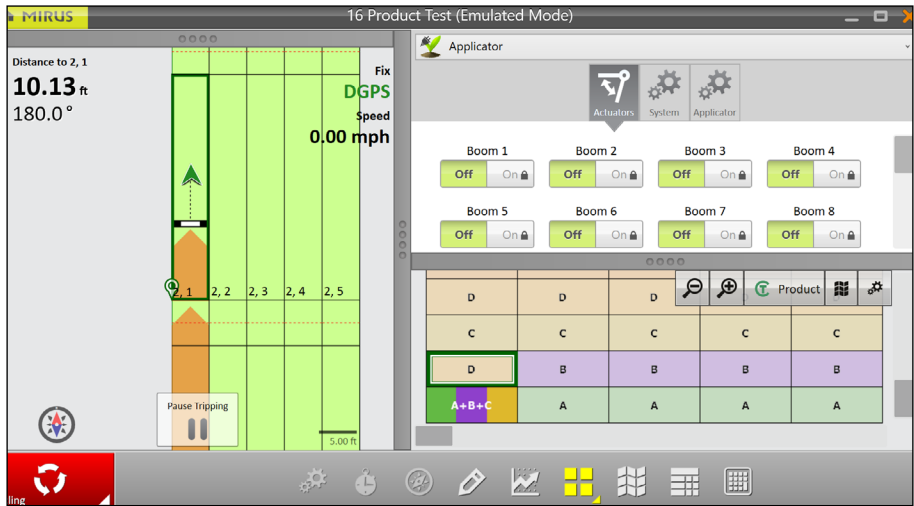
6. Tap the next arrow  again.






In the Applicator Configuration screen,




7. Tap **Manual**.
8. Tap the check icon .

If you use the spatial view in your Quad View setup, it displays plots labeled with “Range, Row” by default. 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 treated, select the “Treatment” or “Id 1” spatial attribute with the  green custom trait icon.



When you are ready to begin,

1. Tap **Start** .
2. Tap the green cycle button  to start the spray application for the plot.
3. Drive through the plot while spraying.
4. Tap the red cycle button  to stop the spray application.
5. Continue to drive through the plots using the remote enter button to cycle the applicator on and off.

| Manual Spray  |                 |  |
|---|-----------------|--|
| Button Stage  | Operator Action | Spray Stage  |
|  | Enter press     | Start at the edge of the plot.   |
|  | Enter press     | Start the spray application for the plot.  |
|   | Drive           | Drive through the plot while spraying.   |
|  | Enter press     | Stop the spray application at the end of the plot.   |
|   | Drive           | Continue to drive through plots using the remote enter button to turn the applicator on and off. |

alvo<sup>TM</sup>  
Field Applicator



CHAPTER SIX

Export Information

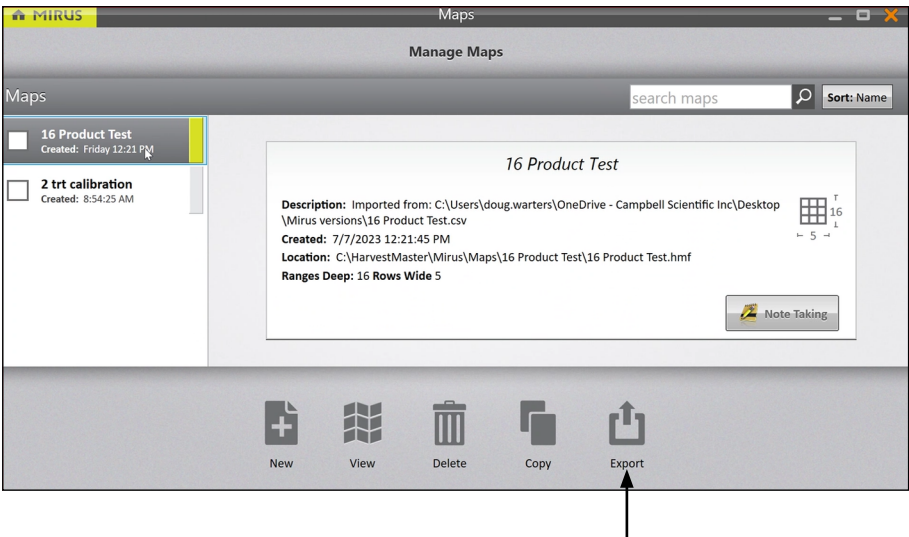
# 6 Export Information

Mirus can export information that it has collected to allow you to work with the data in different ways.

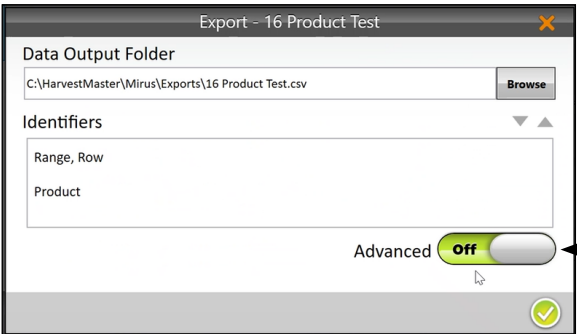
## 6.1 Map Data

You can export map data including various key location points.

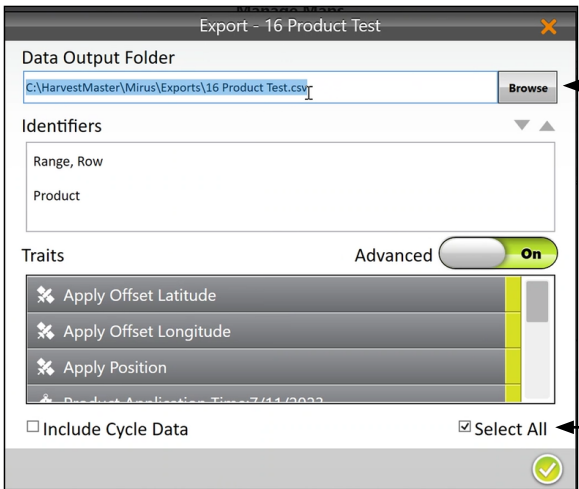
From the Manage Maps screen, choose the map you want to export data from.



1. Tap Export.  
Mirus displays the Export box.



2. Turn the Advanced slider on.



3. Check the box to select all.

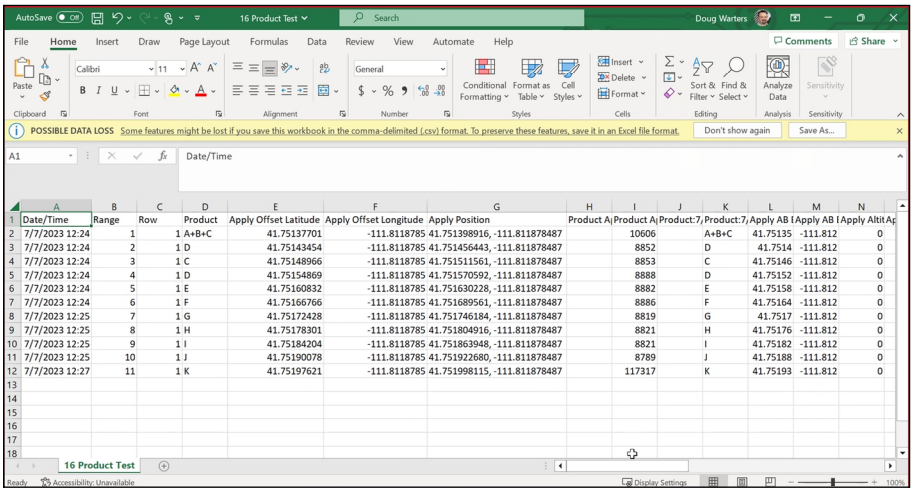
The exported information saves as a csv file with the name of the map you selected at C:\HarvestMaster\Mirus\Exports\. Use the Browse button to choose a different location.



Mirus displays the Export Successful box.

4. Tap **Open** to view the exported information.

Mirus opens a program to display the CSV file.



Each category of data specific to your field applicator included in the CSV file is described below.

| Map Export                      |  |
|---------------------------------|--|
| Field Name                      | Description  |
| Apply Offset Latitude/Longitude | The averaged offset position of boom 1 from the time the plot is entered to the time it is exited. |

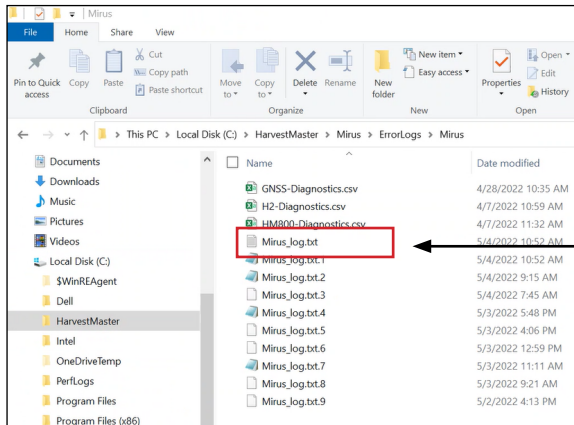
## Map Export

| Field Name                              | Description   |
|---|---|
| Apply Position                          | The averaged antenna position from plot entry to exit without any offsets applied.  |
| Apply AB Bottom Left Latitude/Longitude | Coordinates of the bottom left corner of the plot as projected by the AB line. They are not captured in real time by the GNSS receiver.   |
| Start Latitude/Longitude                | The coordinates of your GNSS/GPS antenna when boom 1 enters the plot.   |
| End Latitude/Longitude                  | The coordinates of your GNSS/GPS antenna when application to the plot ends.   |
| Start Offset Latitude/Longitude         | <p>The coordinates of the left side of boom 1 when it begins application to the plot. A larger start lead time will put the coordinates further away from the plot boundary. If the start lead time is set to 200ms, the coordinates will be approximately 200ms ahead of the plot boundary</p> <p>If you are applying overlapping treatments, these coordinates will be somewhere in the next plot and not very useful to you. The coordinates are the position of boom 1 when all of the treatments for the plot have been applied (or the application is aborted).</p> |
| End Offset Latitude/Longitude           | The coordinates of the left side of boom 1 when application to the plot ends. A larger stop lead time will put the coordinates further away from the plot boundary.   |
| Treatment                               | The Treatment Identifier that you selected during the Applicator Setup. See step 5 in <b>5.1 Set Up Map Selection and Treatment</b> on page 38.   |
| Treatment Application Time              | The total time that the specific boom was on while traveling through the plot.  |

## 6.2 Error Logs

If you encounter a problem while installing or operating the Alvo Field Applicator, 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 into your tablet.
2. Open File Explorer.



3. Go to C:\HarvestMaster\Mirus\ErrorLogs\Mirus

The most recent error log is saved under Mirus\_log.txt. The Mirus\_log.txt file holds up to 15 MB before it is saved again as Mirus\_log.txt.1. When the next Mirus\_log.txt fills up, Mirus\_log.txt.1 becomes Mirus\_log.txt.2 and so on. Mirus\_log.txt.9 is the last log maintained by the system.

4. Select the Mirus\_log.txt the HarvestMaster Field Service Engineer requested.
5. Copy the selected file to the USB.
6. Email the file to the HarvestMaster Field Service Engineer.