Raven Rate Control Module (RCM) Operation Manual for Cultivator

016-0171-730 Rev. A *10/2022* *E41426*

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CALIBRATION REFERENCE SHEET

Record settings and calibration values used when programming the system in the fields below and keep this sheet for future reference.

GENERAL IMPLEMENT INFORMATION

UNITS	US (Acres)	SI (Hectares)	Nozzle Spacing	
Speed Cal				

Section Widths (Boom Cal)			
1.	5.	9.	13.
2.	6.	10.	14.
3.	7.	11.	15.
4.	8.	12.	16.

TANK FILL SETTINGS

Tank Capacity		Low Tank Limit	
Fill Flow Meter Cal		Units	

PRODUCT CONTROL SETTINGS

Min. Pump PWM		Max. Pump PWM	
Standby Pump PWM		Pump PWM Frequency	
Minimum Nozzle PWM		Meter Cal	
Units		Response Rate	
Deadband			

PRESSURE SETTINGS

Min. Pressure		Max. Pressure	

UNIT DEFINITIONS AND CONVERSIONS

UNIT OF MEASURE DEFINITIONS

Abbreviation	Definition
GPM	Gallons per Minute
lit/min	Liters per Minute
dl/min	Deciliters per Minute
PSI	Pounds per Square Inch
kPa	Kilopascal
GPA	Gallons per Acre
lit/ha	Liters per Hectare
ml/ha	Milliliters per Hectare
GPK	Gallons per 1,000 Square Feet
mm	Millimeters
cm	Centimeters

Abbreviation	Definition
dm	Decimeters
m	Meter
MPH	Miles per Hour
km	Kilometers
km/h	Kilometers per Hour
US	Volume per Acre
SI	Volume per Hectare
TU	Volume per 1,000 Square Feet
[ ]	Metric Numbers
lb/acre	Pounds per Acre
kg/ha	Kilograms per Hectare

UNIT OF MEASURE CONVERSIONS

To convert the meter cal value into the selected unit of measure, divide the original number printed on the flow meter label by the desired conversion value.

Fluid Ounces Conversion Formula	Liters Conversion Formula	Pounds Conversion Formula
$\frac{\text{Original Meter Cal}}{128}$	$\frac{\text{Original Meter Cal}}{3.785}$	$\frac{\text{Original Meter Cal}}{\text{Weight of One Gallon of}}$

Liquid

- 1 U.S gallon = 128 fluid ounces
- 1 U.S. gallon = 3.785 liters
- 1 U.S. gallon = 0.83267 imperial gallons
- 1 U.S. gallon = 8.34 pounds (water)
- 1 U.S. gallon = 10.67 pounds (28% N)
- 1 U.S. gallon = 11.06 pounds (32% N)
- 1 U.S. gallon = 11.65 pounds (10-34-0)

Length

- 1 millimeter (mm) = 0.039 inches
- 1 centimeter (cm) = 0.393 inches
- 1 meter (m) = 3.281 feet
- 1 kilometer (km) = 0.621 miles
- 1 inch = 25.4 mm or 2.54 cm
- 1 mile = 1.609 km

Area

- 1 square meter = 10.764 square feet
- 1 hectare = 2.471 acres or 10,000 square meters
- 1 acre = 0.405 hectares or 43,560 square feet
- 1 square mile = 640 acres or 258.9 hectares

Pressure

- 1 psi = 6.89 kPa
- 1 kPa = 0.145 psi

CHAPTER 1 IMPORTANT SAFETY INFORMATION

NOTICE

Read this manual and the operation and safety instructions included with the implement and/or controller carefully before installing the Raven Rate Control Module.

- Follow all safety information presented within this manual.
- If you require assistance with any portion of the installation or service of your Raven equipment, contact a local Raven dealer for support.
- Follow all safety labels affixed to the system components. Be sure to keep safety labels in good condition and replace any missing or damaged labels. To obtain replacements for missing or damaged safety labels, contact a local Raven dealer.

When operating the machine after installing the Raven Rate Control Module, observe the following safety measures:

- Be alert and aware of surroundings.
- Do not operate any agricultural equipment while under the influence of alcohol or an illegal substance.
- Determine and remain a safe working distance from other individuals. The operator is responsible for disabling product control when a safe working distance has diminished.
- Disable the system prior to starting any maintenance work on the machine or parts of the control system.

⚠ WARNING

AGRICULTURAL CHEMICAL SAFETY

- Always follow safety labels and instructions provided by the chemical manufacturer or supplier.
- Always wear appropriate personal protective equipment as recommended by the chemical and/or equipment manufacturer.
- When storing unused agricultural chemicals:
    - Store agricultural chemicals in the original container and do not transfer chemicals to unmarked containers or containers used for food or drink.
    - Store chemicals in a secure, locked area away from human and livestock food.
    - Keep children away from chemical storage areas.
- Fill, flush, calibrate, and decontaminate chemical application systems in an area where runoff will not reach ponds, lakes, streams, livestock areas, gardens, or populated areas.
- Avoid inhaling chemical dust or spray particulate and avoid direct contact with any agricultural chemicals. Seek immediate medical attention if symptoms of illness occur during, or soon after, use of agricultural chemicals, products, or equipment.
- After handling or applying agricultural chemicals:

- Thoroughly wash hands and face after using agricultural chemicals and before eating, drinking, or using the rest room.
- Thoroughly flush or rinse equipment used to mix, transfer, or apply chemicals with water after use or before servicing any component of the application system.

Follow all federal, state, and local regulations regarding the handling, use, and disposal of agricultural chemicals, products, and containers. Triple-rinse and puncture or crush empty containers before disposing of them properly. Contact a local environmental agency or recycling center for additional information

NOTICE

- Read this manual carefully and the operation and safety instructions included with the implement and/or controller.
  - Follow safety information presented within this manual and review operation with your dealer.
  - Contact your dealer for additional assistance or support with any portion of the installation or service of Raven equipment or to obtain replacement parts, manuals, or labels.
- Follow all safety labels affixed to components. Be sure to keep safety labels in good condition and replace any missing or damaged labels.
- Review procedures for safe handling and use of anhydrous ammonia (NH_3) and properties of NH_3 with your NH_3 supplier. If you are not trained to handle, transfer, apply, transport, install, operate, or service NH_3 equipment, contact your dealer, NH_3 supplier, or the appropriate agricultural department for training information. Refresher training should be completed at least every three years.
- NH_3 can be harmful to the environment if not used properly. Follow all local, state, and federal regulations regarding proper handling of NH_3.
- Follow all label instructions for chemical mixing, handling, and disposal.
- When operating the machine:
  - Be alert and aware of surroundings.
  - Do not operate the device while under the influence of alcohol or illegal substances.
  - Ensure the device is disabled prior to starting maintenance work on the machine.
- Only NH_3 harness systems, control systems, and on/off valves approved by Raven Industries are recommended for use with this system. Raven shall not be liable for any damages and this warranty shall not cover defects from:
  - The use of a system with a harness not approved by Raven.
  - The use of a control system not approved by Raven.
  - The use of an on/off switch not approved by Raven.
  - The use of the system in a manner that is inconsistent with the instructions.
  - Unauthorized modification to the system or products used in the system.

⚠ DANGER

- Anhydrous Ammonia (NH_3) Under Pressure. NH_3 can cause severe burning, blindness, sickness, or death. Understand all safety instructions and warnings before operating or servicing equipment. Review safety requirements associated with NH_3 with your supplier.
- Seek immediate medical attention if symptoms of illness occur during, or shortly after, use of NH_3 products.
- In case of leak or accidental release of NH_3, immediately evacuate the area, contact your local fire department, and identify sources of clean water on the unit.

⚠ CAUTION

- Use caution when handling anhydrous ammonia (NH_3) products. Always wear personal protective equipment (PPE) when working with anhydrous ammonia. Appropriate PPE includes, but is not limited to:
    - Indirect vent chemical splash goggles or indirect vent chemical splash goggles with full face shield.
    - Liquid proof gauntlet-style gloves impervious to NH_3.
    - Long sleeved shirt and long pants or protective suit.
- Stand 'up wind' when working around NH_3 and related equipment. Never work on NH_3 equipment in confined spaces. Always keep NH_3 equipment away from buildings, livestock, and other people.
- Keep a full source of clean water (at least five gallons in addition to and separate from the water source on the nurse tank) readily available while working with NH_3. In case of exposure, flush exposed skin or eyes immediately with large quantities of water for at least 15 minutes and seek immediate medical attention.
- Never uncouple an NH_3 applicator or intermediate towing vehicle without appropriate parking stands, wheel chocks, or other braking systems if a nurse tank wagon is attached.
- Always remove the system from NH_3 service before performing maintenance.
    - Thoroughly bleed all system lines and disconnect nurse tank hose before beginning service or maintenance.
    - Remove all NH_3 from the system before disassembling or servicing.
- Use extreme caution when opening a previously pressurized system.
    - Pressure gauges can fail, become plugged, or display incorrect pressure. Every section where NH_3 can be trapped should be treated as if it were pressurized.
- Before performing service or maintenance on the system, read and follow the instructions provided with the equipment to properly discharge NH_3.

⚠ CAUTION

INSTRUCTIONS FOR WIRE ROUTING

The word "harness" is used to mean all electrical leads and cables, bundled and unbundled. When installing harness, secure it at least every 30 cm (12in) to the frame. Follow existing harness as much as possible and use these guidelines:

Harness should not contact or be attached to:

- Lines and hoses with high vibration forces or pressure spikes
- Lines and hoses carrying hot fluids beyond harness component specifications

Avoid contact with any sharp edge or abrading surfaces such as, but not limited to:

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads
- Ends of adjustable hose clamps
- Wire exiting conduit without protection, either ends or side of conduit
- Hose and tube fittings

Routing should not allow harnesses to:

- Hang below the unit
- Have the potential to become damaged due to exposure to the exterior environment. (i.e. tree limbs, debris, attachments)
- Be placed in areas of or in contact with machine components which develop temperatures higher than the temperature rating of harness components
- Wiring should be protected or shielded if it needs to route near hot temperatures beyond harness component specifications

Harnessing should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

- Drive shafts, universal joints and hitches (i.e. 3-point hitch)
- Pulleys, gears, sprockets
- Deflection and backlash of belts and chains
- Adjustment zones of adjustable brackets
- Changes of position in steering and suspension systems
- Moving linkages, cylinders, articulation joints, attachments
- Ground engaging components

For harness sections that move during machine operation:

- Allow sufficient length for free movement without interference to prevent: pulling, pinching, catching or rubbing, especially in articulation and pivot points
- Clamp harnesses securely to force controlled movement to occur in the desired harness section
- Avoid sharp twisting or flexing of harnesses in short distances
- Connectors and splices should not be located in harness sections that move

Protect harnesses from:

- Foreign objects such as rocks that may fall or be thrown by the unit
- Buildup of dirt, mud, snow, ice, submersion in water and oil
- Tree limbs, brush and debris
- Damage where service personnel or operators might step or use as a grab bar
- Damage when passing through metal structures

IMPORTANT: Avoid directly spraying electrical components and connections with high pressure water. High pressure water sprays can penetrate seals and cause electrical components to corrode or otherwise become damaged. When performing maintenance:

- Inspect all electrical components and connections for damage or corrosion. Repair or replace components, connections, or cable as necessary.
- Ensure connections are clean, dry, and not damaged. Repair or replace components, connections, or cable as necessary.
- Clean components or connections using low pressure water, pressurized air, or an aerosol electrical component cleaning agent.
- Remove visible surface water from components, connections, or seals using pressurized air or an aerosol electrical component cleaning agent. allow components to dry completely before reconnecting cables.

INSTRUCTIONS FOR HOSE ROUTING

The word “hose” is used to mean all flexible fluid carrying components. Follow existing hoses as much as possible and use these guidelines:

Hoses should not contact or be attached to:

- Components with high vibration forces
- Components carrying hot fluids beyond component specifications

Avoid contact with any sharp edge or abrading surfaces such as, but not limited to:

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads
- Ends of adjustable hose clamps

Routing should not allow hoses to:

- Hang below the unit
- Have the potential to become damaged due to exposure to the exterior environment. (i.e. tree limbs, debris, attachments)
- Be placed in areas of or in contact with machine components which develop temperatures higher than the temperature rating of hose components
- Hoses should be protected or shielded if it needs to route near hot temperatures beyond hose component specifications

Hoses should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

- Drive shafts, universal joints and hitches (i.e. 3-point hitch)
- Pulleys, gears, sprockets
- Deflection and backlash of belts and chains
- Adjustment zones of adjustable brackets
- Changes of position in steering and suspension systems
- Moving linkages, cylinders, articulation joints, attachments
- Ground engaging components

For hose sections that move during machine operation:

- Allow sufficient length for free movement without interference to prevent: pulling, pinching, catching or rubbing, especially in articulation and pivot points
- Clamp hoses securely to force controlled movement to occur in the desired hose section
- Avoid sharp twisting or flexing of hoses in short distances

Protect hoses from:

- Foreign objects such as rocks that may fall or be thrown by the unit
- Buildup of dirt, mud, snow, ice, submersion in water and oil
- Tree limbs, brush and debris
- Damage where service personnel or operators might step or use as a grab bar
- Damage when passing through metal structures

- High pressure wash

IMPORTANT: Avoid directly spraying electrical components and connections with high pressure water. High pressure water sprays can penetrate seals and cause electrical components to corrode or otherwise become damaged. When performing maintenance:

- Inspect all electrical components and connections for damage or corrosion. Repair or replace components, connections, or cable as necessary.
- Ensure connections are clean, dry, and not damaged. Repair or replace components, connections, or cable as necessary.
- Clean components or connections using low pressure water, pressurized air, or an aerosol electrical component cleaning agent.
- Remove visible surface water from components, connections, or seals using pressurized air or an aerosol electrical component cleaning agent. Allow components to dry completely before reconnecting cables.

CHAPTER 2 INTRODUCTION

The Raven Rate Control Module (RCM) is a multi-product application control system built on an ISOBUS platform. The Raven Rate Controller Module is designed to provide a machine operator the ability to simultaneously monitor and control five product applications such as liquid, granular, NH3, and direct injection via ISOBUS Universal Terminal (UT) and task control for as-applied documentation, prescription rate, and section control.

This document is intended to provide information regarding the following aspects of the Raven Rate Control Module:

- Initial Setup and Navigation
- Calibration
- Raven Rate Control Module System Operation
- Raven Rate Control Module Alarms
- Updating Raven Rate Control Module Components

NOTE: Prior to using the Raven Rate Control Module control features with any UT display, the Raven Rate Control Module electronic control unit (ECU) must be calibrated for the control system.

This manual assumes that the required control hardware is already installed on supported equipment and is properly connected. Contact a local Raven dealer for additional information on supported equipment configurations.

RAVEN RATE CONTROL MODULE™ FEATURES

DIRECT INJECTION

The Raven Sidekick™ Pro ICD provides for an optimal user experience by allowing control of direct injection through the Raven Rate Control Module interface. By using a separate injection module or tank, the system eliminates mixing chemicals in the tank, reduces chemical waste, and simplifies equipment care and maintenance. Connect up to four injection systems to the Viper 4 and ISOBUS to control the whole system through the Raven Rate Control Module user interface screens on the virtual terminal. Purchase a high flow injection system to control a wide range of chemical flow rates from 5 - 200 oz/min. Purchase a low flow injection system to provide chemical flow rates from 1 - 40 oz/min. Refer to the Sidekick™ ICD Manual for additional information on high and low flow injection systems.

Contact a local Raven dealer for additional details on direct injection using Sidekick Pro™ with Raven Rate Control.

MULTIPLE UT SETTINGS

When an RCM is used in a system with more than one UT (universal terminal), the RCM can be assigned a primary UT.

FIGURE 1. Set Primary UT Menu

MACHINE TYPES

The Raven Rate Control Module can be used with:

TABLE 1. RCM Machine List

Machine Type	Application Mode	Application Type
Self-Propelled Sprayer Pull-Behind Sprayer	Liquid Liquid Tiered (Direct) Liquid Tiered (External) Liquid Constant Flow	Liquid
Liquid Fertilizer Tool	Liquid Liquid Tiered (Direct) Liquid Tiered (External) Liquid Constant Flow Liquid Slurry Dragline Liquid Slurry	Liquid
NH3 Tool	NH3 NH3 HP+	NH3
Self-Propelled Spreader Pull-Behind Spreader	Dry Manure/Litter Granular Full Width Granular RPM Compensated Granular RPM Maintained Granular Split Belt Granular Dual Control Valve	Granular Fertilizer Granular Seed

TABLE 1. RCM Machine List

Machine Type	Application Mode	Application Type
Air Cart Generic	Liquid Granular Full Width Granular RPM Compensated Granular RPM Maintained Granular Split Belt Granular Dual Control Valve Granular Meter Per Section	Liquid Granular
Planter	Planter Section Control Seed Rate Control (/W Clutches) See Rate Control (no Clutches)	NA
Scale	NA	NA
Cultivator	NA	NA

CARE AND USE

Always follow equipment manufacturer's recommended maintenance procedures for storing equipment. The following maintenance procedures are generally recommended for storing equipment with the Raven Rate Control Module:

1. Empty product from the chemical supply tank and flush the application system with water.
2. Remove hardened chemical residues or build up by flushing the system with:
   a. kerosene or fuel oil if the last product applied was petroleum based.
   b. soap and water if the last product applied was water based.
3. Prime the system plumbing with a 50% water and automotive antifreeze mixture to prevent freezing of components. Freezing will result in damage to the system and other plumbing components on the system.

FEATURE UNLOCKS

Every RCM comes with different levels of unlocks. To purchase additional unlocks, navigate to portal.ravenprecision.com and purchase the desired unlocks. The table below lists unlock levels:

TABLE 2. RCM Unlocks

Level	ECU P/N	Features
0	063-0173-940	• Ground drive/no control valve product monitoring/no task controller interface (section control, as applied documentation) • Generic single channel scale/no application control
1	063-0173-941	• Single product control with section shut-off • Liquid NH_3(HP+)/Granular • Dual valve control (no support for multiple rate control sections) • Spinner/fan control (two channel) • No scale support (product or general purpose) with products enabled. • Multiple Sidekick ICD control supported • Task controller support for ground drive transmission (section control, as-applied documentation) • Planter section control - up to 16 sections/clutches • Generic four channel scale/no application control
2	063-0173-756	• Multi-product application control (up to five products) • Scale support in conjunction with application control • Tiered boom (two tiers) • Multiple rate control sections (with or without VRA capability) • Planter section control - up to 32 sections/clutches
3	063-0173-953	• Granular Meter per Section • Planter Seed Rate Control (with clutches) • Planter Seed Rate Control (without clutches) • Manure/Litter spreader
3 Stack Tiered Boom	077-0180-202	• Enable for three stacks or tiers (A, B, and C or a combination thereof).
3 Stack Blockage Monitoring	077-0180-201	• Enable interfacing to a third party blockage monitoring system to provide section awareness from RCM.

UPDATES

Updates for Raven manuals as well as software updates for Raven consoles, and product controllers are available at the Applied Technology Division web site:

https://portal.ravenprecision.com

The Raven Service Tool and a laptop PC are required to perform software updates of the Raven Rate Control Module. Refer to the Raven Service Tool Operation manual for additional assistance with updating the Raven Rate Control Module.

Sign up for e-mail alerts to receive notifications when updates for your Raven products are available on the Raven web site.

At Raven Industries, we strive to make your experience with our products as rewarding as possible. One way to improve this experience is to provide us with feedback on this manual.

Your feedback will help shape the future of our product documentation and the overall service we provide. We appreciate the opportunity to see ourselves as our customers see us and are eager to gather ideas on how we have been helping or how we can do better.

To serve you best, please send an email with the following information to

techwriting@ravenind.com

-Raven Rate Control Module (RCM) Operation Manual for Cultivator
-016-0171-730 Rev. A
-Any comments or feedback (include chapter or page numbers if applicable).
-Let us know how long have you been using this or other Raven products.

We will not share your email or any information you provide with anyone else. Your feedback is valued and extremely important to us.

Thank you for your time.

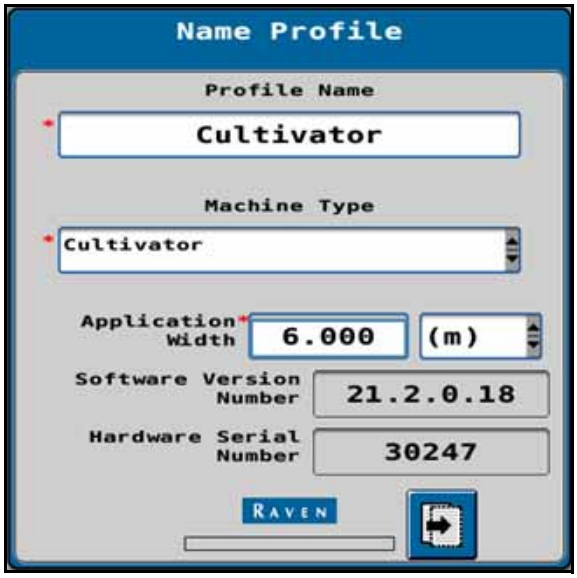
CHAPTER 3 CULTIVATOR

CREATE A CULTIVATOR PROFILE

This section provides a Cultivator profile example. Depending on machine configuration, the following screens will vary.

1. Enter the UT.
2. Select Cultivator from the Machine Type drop-down.

FIGURE 1. Name Profile



3. Enter a name for the profile in the Profile Name field.
4. Select the application width.
5. Press Next.

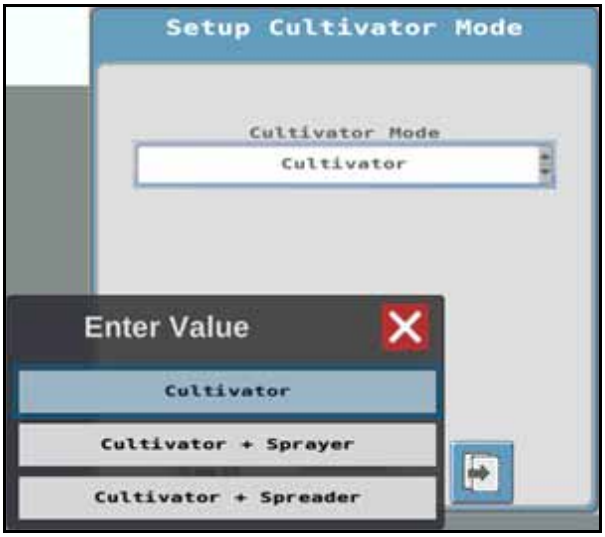
6. Select the appropriate type of cultivator for the new profile:

Cultivator. For only cultivating.

Cultivator + Sprayer. For cultivating and spraying.

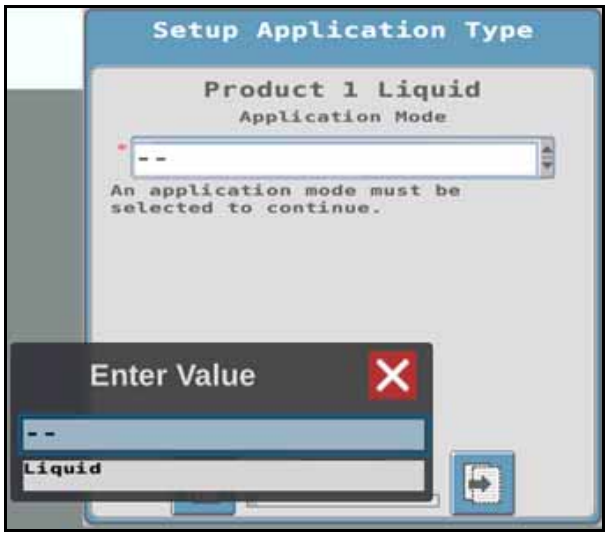
Cultivator + Spreader. For cultivating and spreading.

FIGURE 2. Setup Cultivator Mode



7. Press Next. If “Cultivator” was previously selected, skip to step 12. If “Cultivator + Spreader” was previously selected, skip to step 10. If “Cultivator + Sprayer” was previously selected, continue to the next step.
8. Select the correct application mode for product 1.

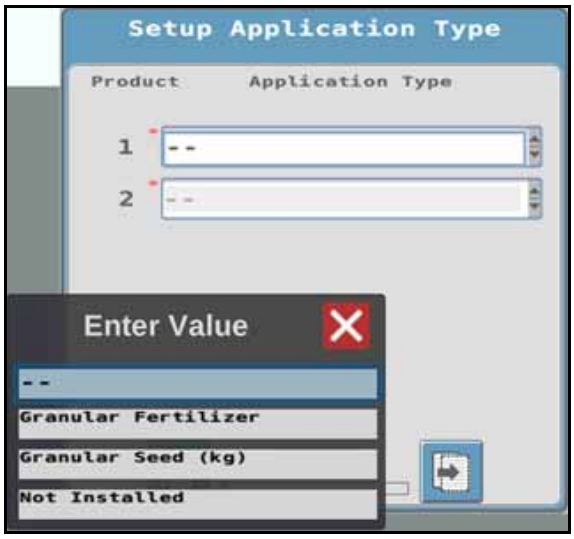
FIGURE 3. Setup Application Type - Liquid



9. Press Next. Skip to step 12.

10. Select the appropriate application type for all products shown.

FIGURE 4. Setup Application Type - Spreader



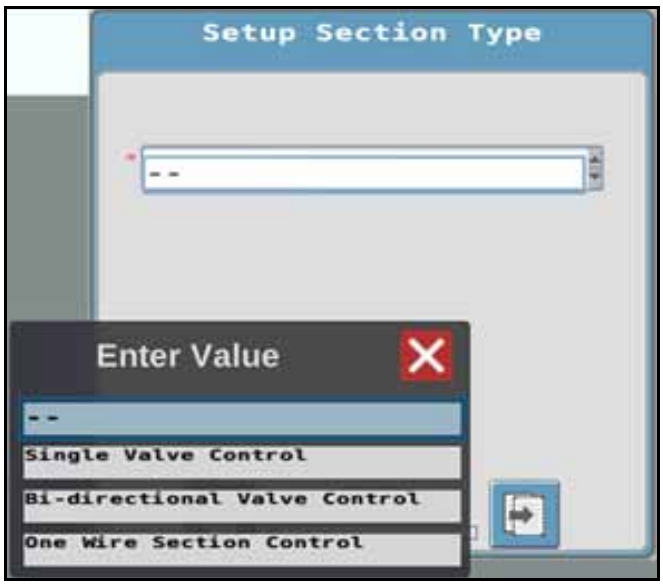
11. Press Next.
12. Select the correct type of hydraulic system on the machine:

Single Valve Control. Single acting cylinders.

Bi-Directional Valve Control. Double acting cylinders.

One Wire Section Control. Valves are controlled with a single wire.

FIGURE 5. Setup Section Type

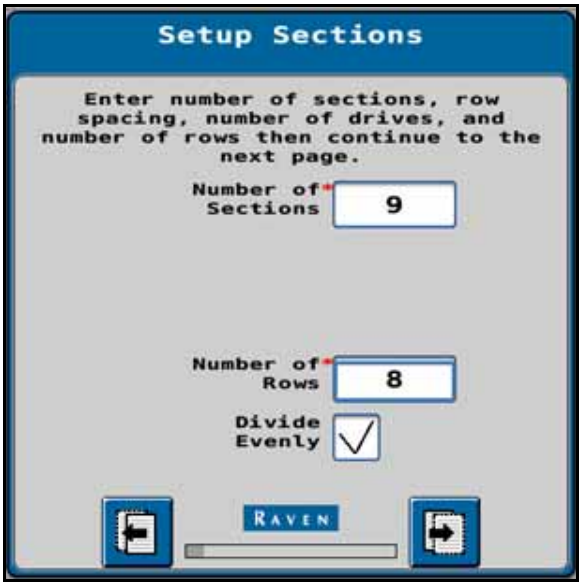


13. Press Next. If “Cultivator + Sprayer” or “Cultivator + Spreader” was previously selected, skip to step 16. If “Cultivator” was previously selected, continue to the next step.

14. Enter the number of sections and number of rows corresponding with the cultivator.

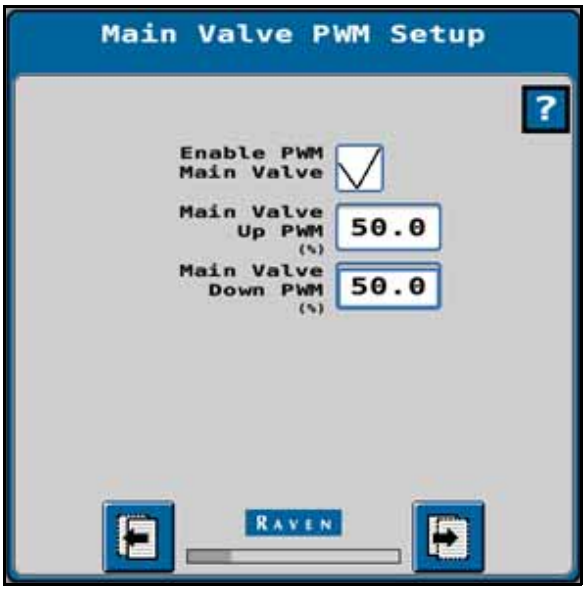
NOTE: If all sections have an equal distance between them, select Divide Evenly.

FIGURE 6. Setup Sections



15. Press Next.
16. Enable PWM Main Valve for controlling the flow of oil to the cylinders by the main valve and enter a PWM percentage if applicable.

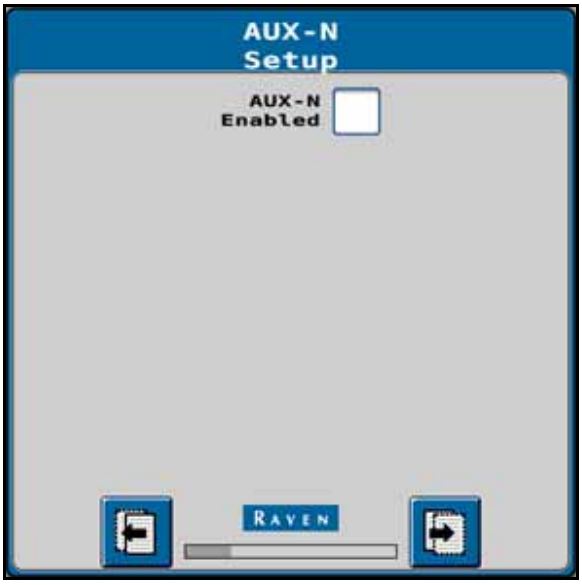
FIGURE 7. Main Valve PWM Setup



17. Press Next.

18. Enable AUX-N if an ISOBUS compatible joystick is desired to be paired with the implement.

FIGURE 8. AUX-N Setup

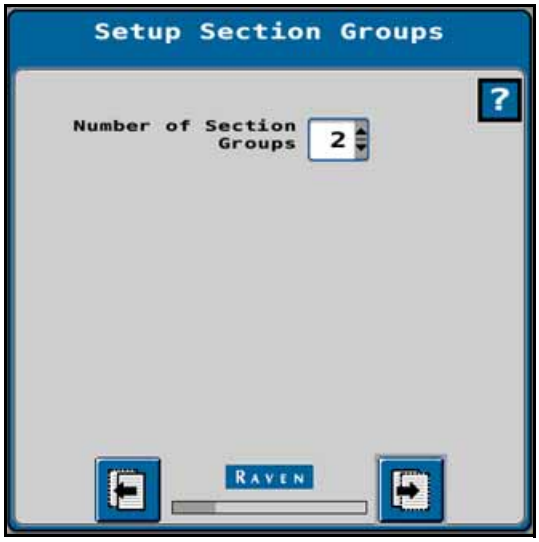


19. Press Next. If “Cultivator” was previously selected, skip to step 27. If “Cultivator + Sprayer” or “Cultivator + Spreader” was previously selected, proceed to the next step.
20. Select the amount of section groups.

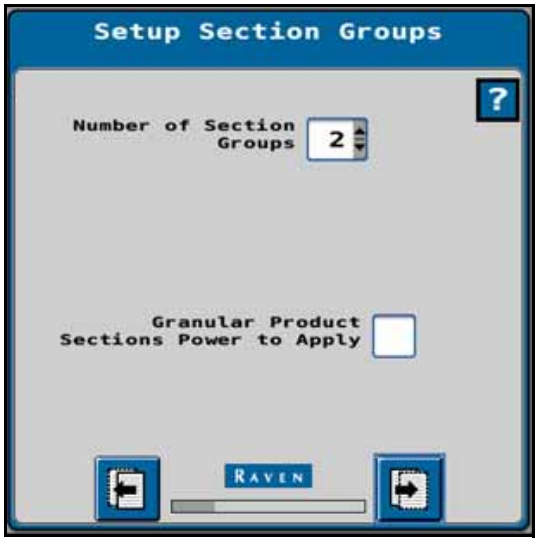
NOTE: A section group is a section which controls two ore more functions at the same time. For example, a cultivator section and the corresponding nozzle would be a section group.

FIGURE 9. Setup Section Groups

Liquid



Granular



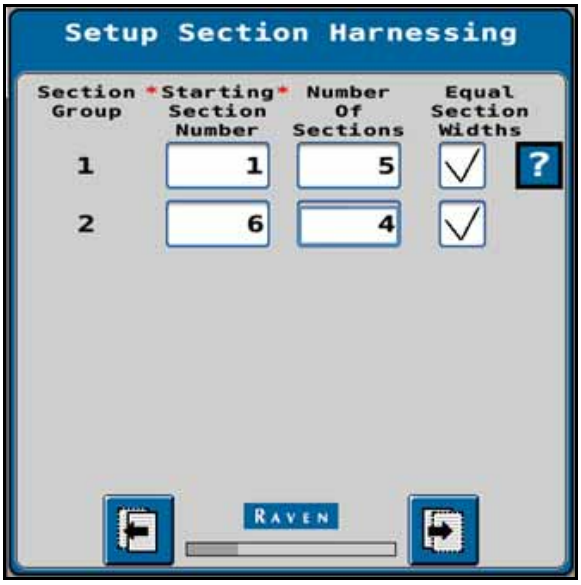
NOTE: Select the checkbox next to “Granular Product Sections Power to Apply” when the section needs a 12V signal to apply.

21. Read and review the information displayed on the Setup Section Harnessing page.

FIGURE 10. Setup Section Harnessing

22. Press Next.
23. Enter the appropriate section outputs to the corresponding section group.

FIGURE 11. Setup Section Harnessing Cont.



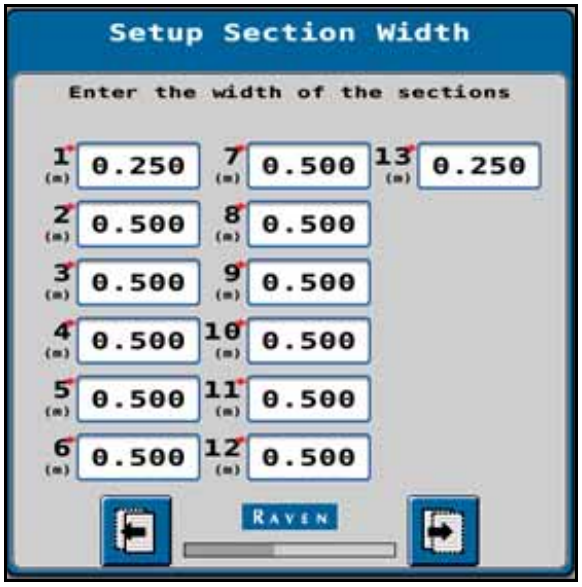
24. Press Next.

25. Assign the appropriate products to the corresponding section group.

FIGURE 12. Setup Section Group Assignment

26. Press Next.
27. Review the section width information on the Setup Section Width screen.

FIGURE 13. Setup Section Width



28. If needed, adjust the section widths.
29. Press Next.

30. If desired, configure auxiliary drivers on the Setup Auxiliary Drivers screen. Auxiliary drivers allow for unused section drivers to be setup as 12-volt outputs that can run independently of any product control with their own buttons.

NOTE: Auxiliary drivers can only be used if there are unused section drivers.

FIGURE 14. Setup Auxiliary Drivers

31. Press Next.

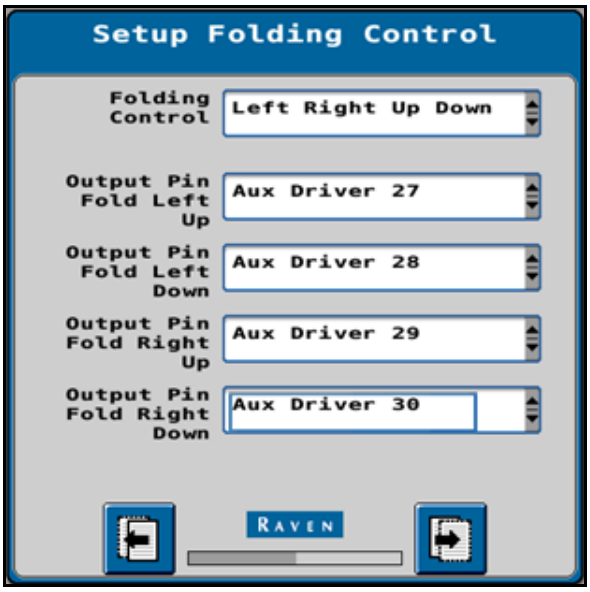
32. If the cultivator has folding capabilities, select the desired type of folding from the Folding Control drop-down:

Up Down. Both arms are controlled by a single hydraulic cylinder.

Left Right Up Down. Both arms are controlled independent of each other.

NOTE: If a Folding Control type is selected, ensure the correct auxiliary drivers are connected to the correct folding function.

FIGURE 15. Setup Folding Control



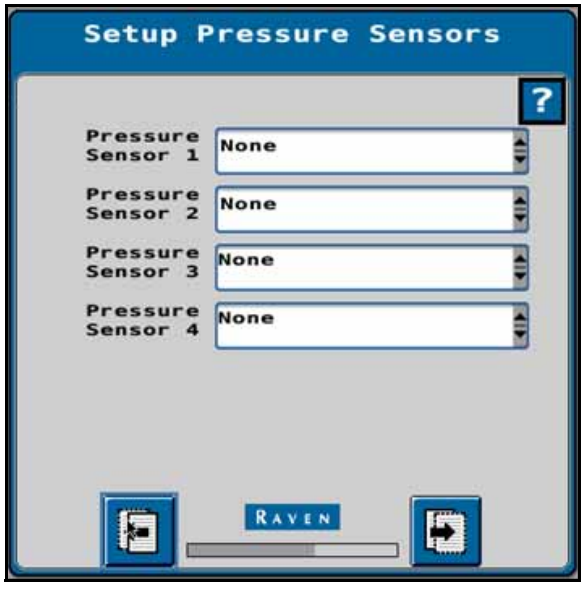
33. Press Next.

34. Configure the correct timings for the sections of the cultivator to extend or contract.

FIGURE 16. Section Timings

35. Press Next. If “Cultivator” was previously selected, skip to step 38. If “Cultivator + Sprayer” or “Cultivator + Spreader” was previously selected, proceed to the next step.
36. If necessary, select the appropriate options available for pressure sensors.

FIGURE 17. Setup Pressure Sensors



37. Press Next.

38. If desired, select the appropriate height switch implemented on the cultivator:

None. No height switch is used.

Default. Normal switch is used.

Digital PNP. Switch with a 12V signal is used.

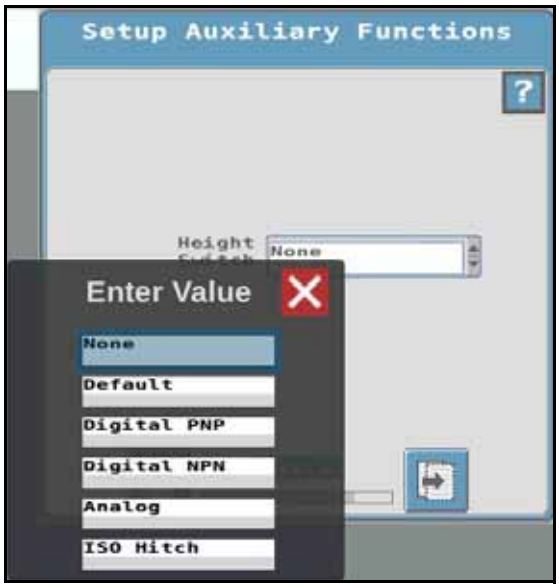
Digital NPN. Switch that switches to ground is used.

Analog. Analog height sensor is used.

ISO Hitch. Hitch height can be read from the ISOBUS of the tractor.

NOTE: The implement will begin operating when under a set hitch-height threshold.

FIGURE 18. Height Switch Setup

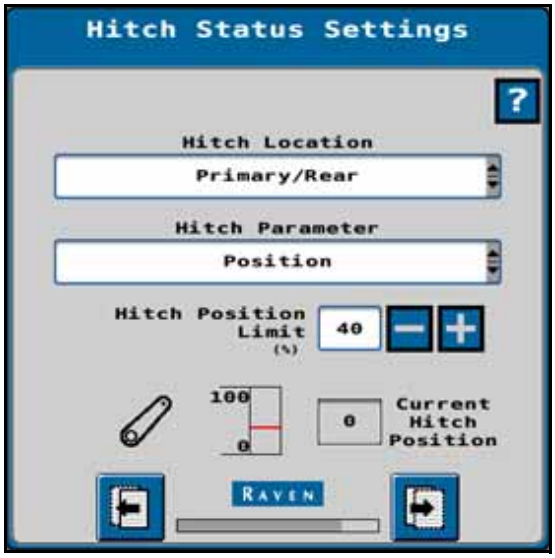


39. Press Next.

40. When a height switch is selected, set the location, parameter of the hitch, and the hitch position limit.

NOTE: The position limit value is the height (in percent) of the hitch when the implement will start/stop operating.

FIGURE 19. Hitch Status Settings



41. Press Next. If “Cultivator” was previously selected, skip to step 54. If “Cultivator + Spreader” or “Cultivator + Sprayer” was previously selected, continue to the next step.
42. Set up the control valve by entering the appropriate values in the following fields:

Control Valve Type (Liquid Only). Standard, Fast Close, Fast, PWM, PWM Close, or None

Valve Response Rate. Sets how quick the valve needs to respond to changes in flow.

Control Deadband. Sets the margin to which the control valve will attempt to reach.

Valve Delay. Sets the amount of time between when the first section is turned on and when the rate controller begins to control the flow rate.

Enable PWM Smart Control (Granular Only). When enabled, the ECU will learn the PWM percentage for common flow rates and automatically switch to those when making rate or speed changes.

Valve Advance (Liquid Only). Sets the amount of time it takes for the system to fully open the control valve after all sections are turned off.

Control Effort (Liquid Only). Sets the minimum percentage needed for the control valve to change position.

FIGURE 20. Setup Control Valve

Liquid

Granular

43. Press Next. If “Cultivator + Sprayer” was previously selected, skip to step 46. If “Cultivator + Spreader” was previously selected, continue to the next step.

44. Set up the PWM by entering the appropriate values in the following fields:

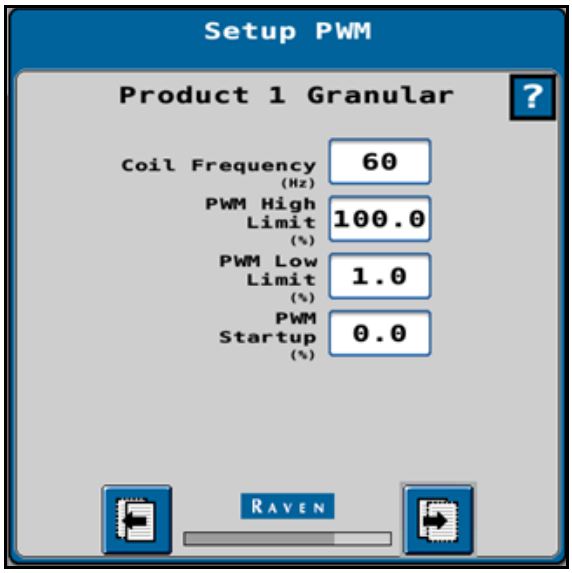
Coil Frequency. Sets the frequency of the pulses which are sent to the PWM valve.

PWM High Limit. Set the maximum PWM percent that the product controller will allow when the product is turned on.

PWM Low Limit. Set the minimum PWM percent that the product controller will allow when the product is turned on.

PWM Startup. For PWM closed type valves, set the duty cycle that the PWM valve will move to when the product is activated.

FIGURE 21. Setup PWM



45. Press Next.

46. Enter the appropriate number of pulses per unit of liquid. This information is located on the label of the flow meter. Set up the Rate Sensor by entering the appropriate values in the following fields:

Flowmeter Calibration (Liquid Only). Set the flowmeter calibration.

Flowmeter Pulse/Units (Liquid Only). Set the desired number of pulses per unit of liquid.

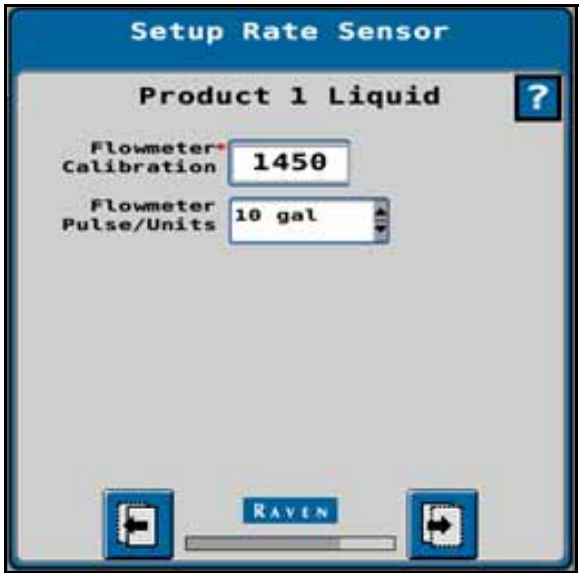
Product Density (Granular Only). Set the density in grams per liter for the used product.

Calibration Weight (Granular Only). Set the amount of product in kilograms that is applied per revolution of the spinner.

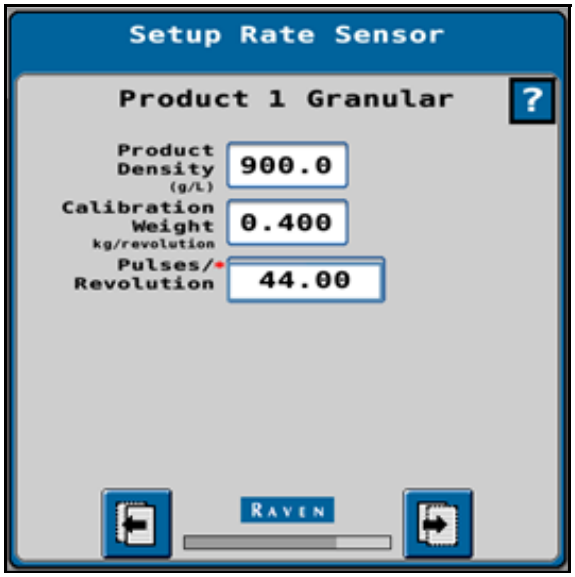
Pulses/Revolution (Granular Only). Set the number of pulses from the encoder per revolution of the spinner.

FIGURE 22. Setup Rate Sensor

Liquid



Granular



47. Press Next.

48. Set up the tank/bin information by entering the appropriate values in the following fields:

Tank Fill / Level Sensor (Liquid Only). Select either Tank Fill or Level Sensor depending on what the tank is fitted with.

Tank Capacity. The max capacity of the tank.

Current Tank Level. The current level of the tank.

Low Tank Level. Set an alarm for when the tank level goes below the determined level.

Low Bin Level Sensor (Granular Only). If a low bin level sensor is installed, select this option. Additional options will appear.

Max Tank Fill PWM (Liquid Only). Sets the speed limit to the pump when filling the tank.

FIGURE 23. Setup Tank/Bin

Liquid

Granular

49. Press Next.

50. Set up the rates by entering the appropriate values in the following fields:

Preset Rate Values. Set at least one rate the sprayer needs to apply. If multiple rates are set, the three preset rates can be selected on the RCM main run screen.

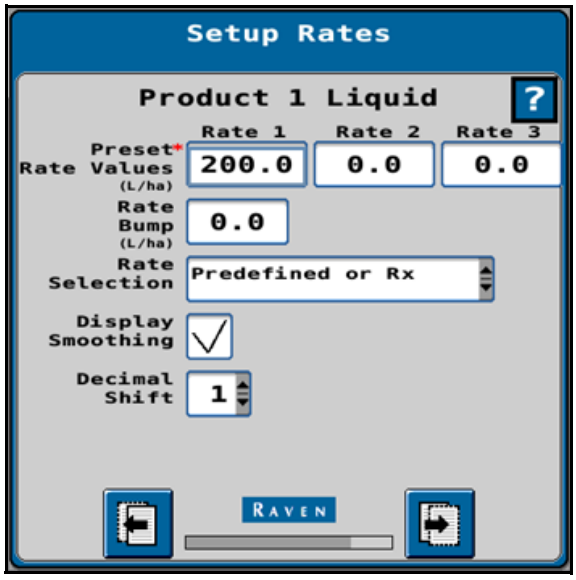
Rate Bump. Sets the increment by which either the target rate will increase or decrease when using the bump functions during application.

Rate Selection. Select the correct method for changing the target rate on the run screen and home page.

Display Smoothing. Removes small fluctuations in application rate. If the actual value is within 10% of the target value, target value is displayed.

FIGURE 24. Setup Rates

Liquid



Granular

51. Press Next.

52. Set up alarms by entering the appropriate values in the following fields: Enter the desired Off Rate Alarm value.

Off Rate Alarm. When the actual rate deviates more than this value, an alarm will activate.

Shaft Sensor Alarm (Granular Only). When the product is active and the rate sensor is reading a rate, but the shaft sensor is not seeing any shaft movement, an alarm will activate.

FIGURE 25. Setup Alarms

Liquid

Granular

53. Press Next. If “Cultivator + Sprayer” or “Cultivator + Spreader” was previously selected, skip to step 56.

54. Select the desired type of master switch:

Standard/Auxiliary. A physical master switch.

On-screen Button (Cultivator Only). A virtual, on-screen button that can be pressed and release on the run screen.

FIGURE 26. Master Switch Settings

55. Press Next.

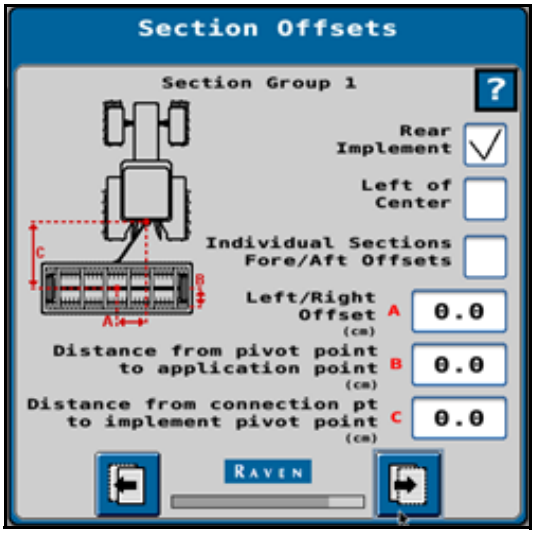
56. Set up the section offsets by entering the appropriate values in the following fields:

Rear Implement. Select this option if the implement is mounted to the rear.

Left of Center. Select this option if the implement is offset to the left of the center of the tractor.

Individual Sections Fore/Aft Offsets. Select this option if the individual sections have a different distance from the pivot point. Enter the different distances in the bottom three fields.

FIGURE 27. Section Offsets



57. Press Next.

58. Set the parameters for sections to turn on before or after entering the border of a field by entering the appropriate values in the following fields:

Section Group On/Off Times. Enter the amount of time in seconds that a section would need to turn on or off to compensate for application delay when using section control.

Individual Sections On/Off Times. Select this option to set the On/Off Time for each individual section.

Section Group On/Off Distance. Enter the distance in meters that a section would need to be lowered or raised before the implement crosses the border of a field to compensate for application delay in the system.

Individual Sections On/Off Distances. Select this option to set the On/Off Distance for each individual section.

FIGURE 28. Section Turn On/Off Settings

59. Press Next and repeat step 56 through 58 for the next section group if needed.
60. Review the information on the Setup Summary screen. If the configuration is not correct, navigate back and make any necessary adjustments before returning to the Setup Summary screen.

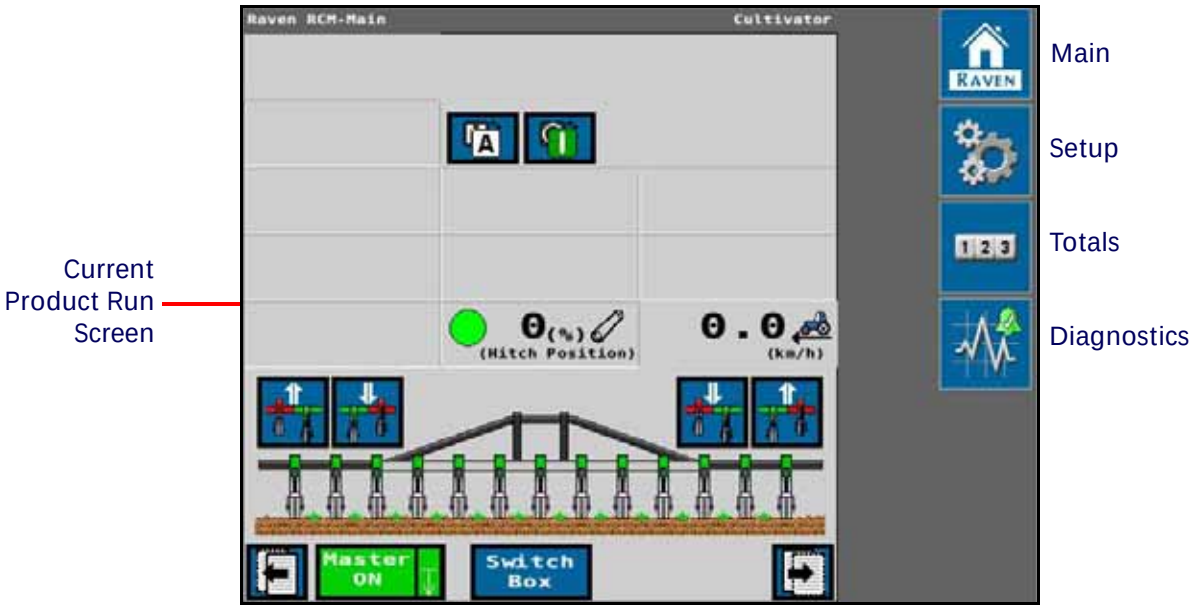
FIGURE 29. Setup Summary

61. Once the displayed configuration is correct, press Next to conclude the cultivator setup.

CULTIVATOR RUN PAGE OVERVIEW

The image below is an example of a typical run screen.

FIGURE 30. Cultivator Run Screen



CURRENT PRODUCT RUN SCREEN

The current product run screen displays information for the selected product. Each product run screen will vary based on product configuration.

Data Fields display selected settings and can be changed to the operator's preferences.

FIGURE 31. Cultivator Run Screen

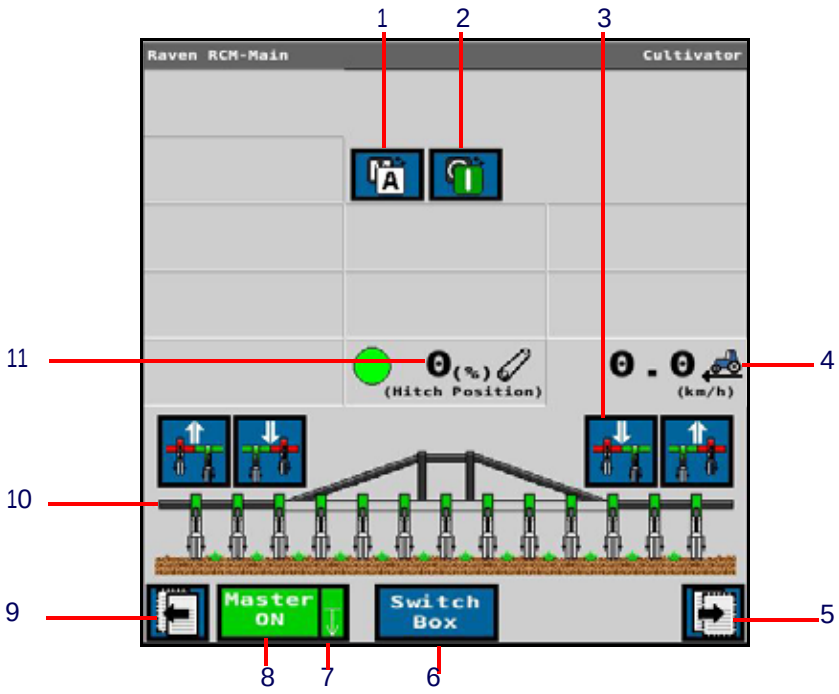


FIGURE 32. Cultivator Run Screen Cont.

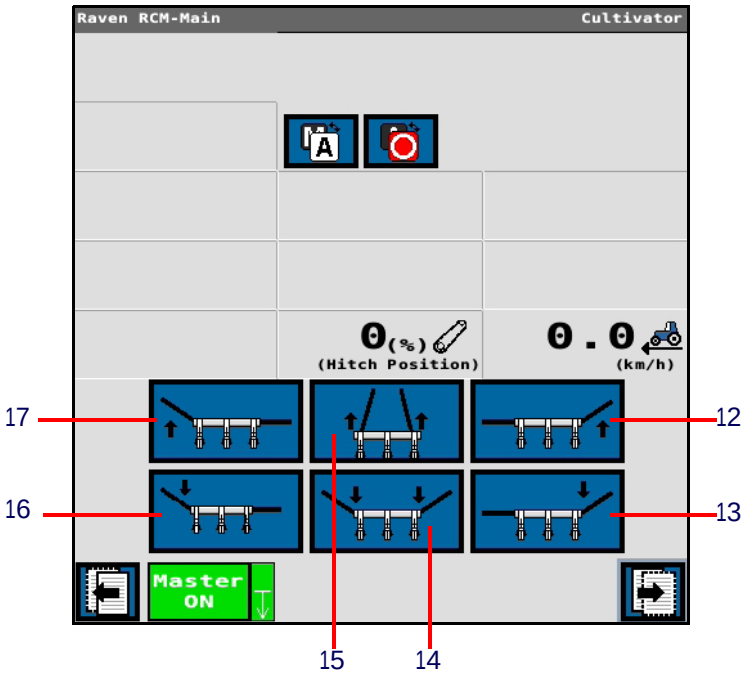


FIGURE 33. Cultivator + Sprayer/Spreader Run Screen

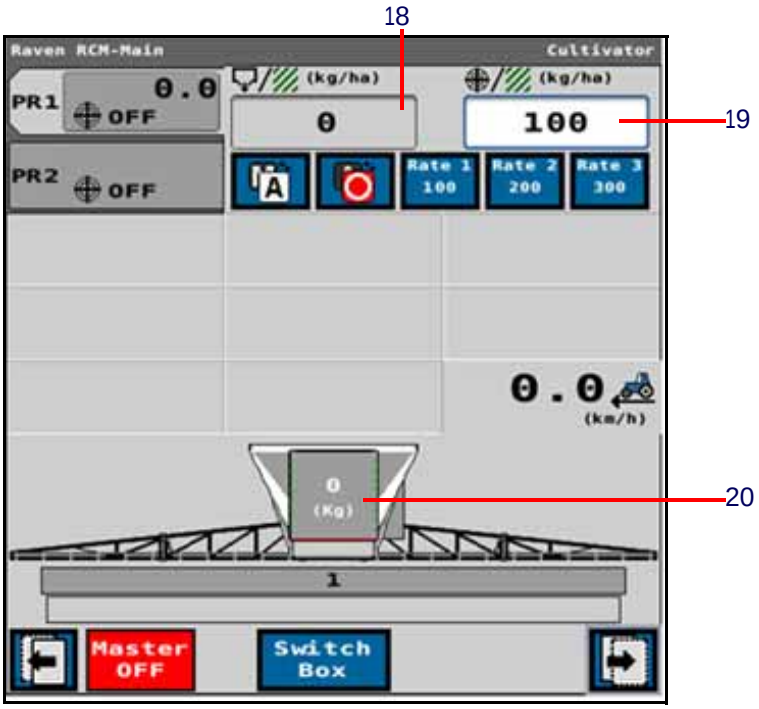


FIGURE 34. Cultivator + Sprayer/Spreader Run Screen Cont.

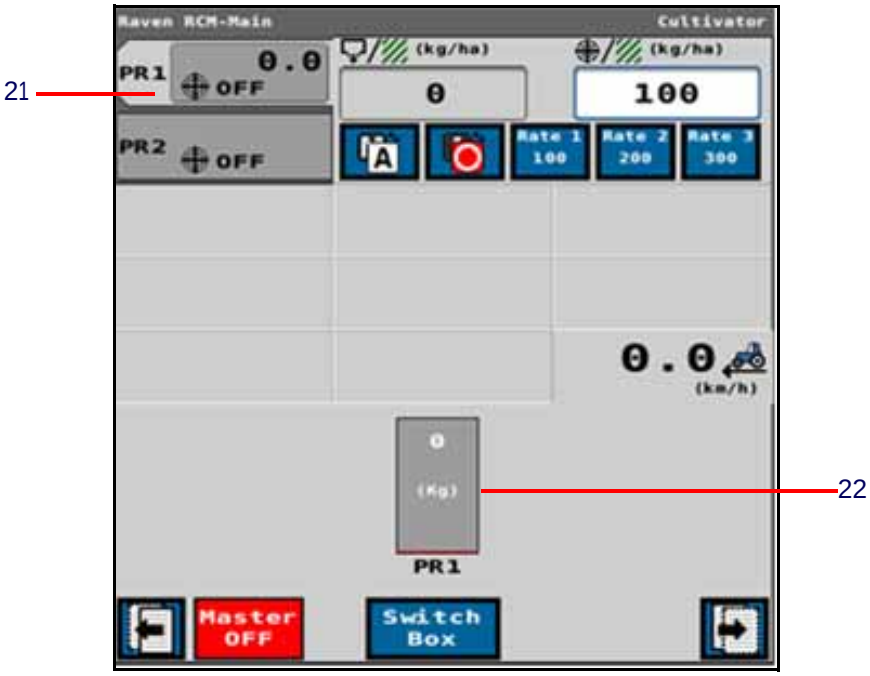
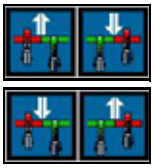
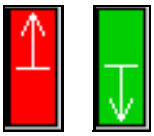
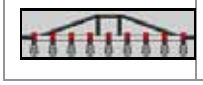
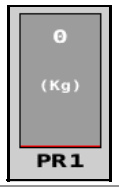


TABLE 1. Liquid Run Screen Information

	Button	Description	Function/Operation
	1	Manual/Automatic Toggle	Press this to switch between manual and automatic operation.
	2	Product Off/On/Cycle	Press this to turn the current product on or off. An orange background indicates a cycle switch.
	3	Section Control	Turns sections off from the outside inward or from the inside outward.
	4	Traveling Speed	Displays the implement/ machine speed. Can be pressed to enter the Test Speed Setup menu.
	5	Navigate to Next Page	Navigates the UT to the next page.
	6	Section Switch Box Button	Indicates if the switch box is on or off: • Green - On • Red - Off Press the switch box button to navigate to a screen that allows the user to turn off the switch boxes for individual sections.
	7	Hitch Status	When red, the hitch is above the set threshold. When green, the hitch is under the set threshold.
	8	Master Switch Indicator	The Master Switch Indicator shows the status of the master switch. • Green - On • Red - Off • Orange - Cycle the master switch
	9	Navigate to Left Page	Navigates the UT to the previous page.
	10	Section Statuses	Displays current state of each section.

	Button	Description	Function/Operation
	11	Hitch Height Percentage	Indicates current hitch height percentage if the ISO Hitch Height is configured. • Green - Hitch is below set percentage • Red - Hitch is above set percentage.
	12	Fold Right Side In	Press and hold this button to fold in the right side of the cultivator.
	13	Fold Right Side Out	Press and hold this button to fold out the right side of the cultivator.
	14	Fold Both Sides Out	Press and hold this button to fold out both sides of the cultivator.
	15	Fold Both Sides In	Press and hold this button to fold in both sides of the cultivator.
	16	Fold Left Side Out	Press and hold this button to fold out the left side of the cultivator.
	17	Fold Left Side In	Press and hold this button to fold in the left side of the cultivator.
	18	Current Rate	Displays the current application rate.
	19	Set Target Rate	Set the target application rate for spreading application.
	20	Section Statuses and Tank Level	Shows the current section statuses and tank level.
	21	Actual Products	Displays the current products.
	22	Spreader Tank Level	Displays the current tank level. When pressed, the operator can set the current level in the tank, the max tank capacity, and the product density.

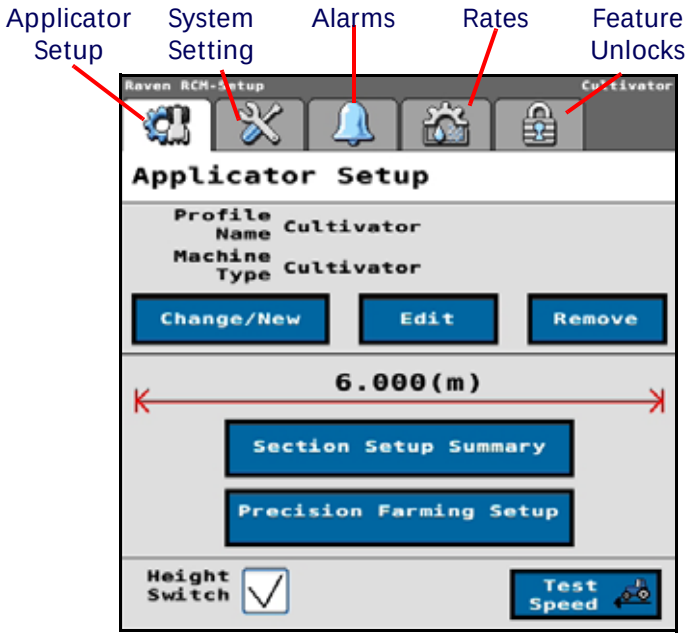
MAIN

Press main at any time to return to the Current Product Run Screen.

SETUP

Pressing setup opens a screen with many tabs.

FIGURE 35. Setup Tabs



APPLICATOR SETUP TAB

The Applicator Setup Tab provides options to create a new, edit, or remove an applicator. This tab also provides a summary to the section configuration. For more information on the Precision Farming Setup button, refer to Chapter 4, *Precision Farming*.

SYSTEM SETTINGS

The System Settings tab provides buttons that allow the user to modify the current configuration:

Cultivator Section Setup. Configure the section timings.

Hitch Setup. Allows the user to quickly change the Hitch Height Threshold.

ALARM SETTINGS

The Alarms tab allows the user to modify, set, or update the Off Rate Alarm.

FEATURE UNLOCKS

If there are additional features available for the RCM, enter the provided Activation Key to access these features.

TOTALS

The totals button provides options to access a Current Totals, Device totals, and Distance totals tabs.

DIAGNOSTICS

Selecting the Diagnostics button open a window with tabs for the items listed below.

SYSTEM INFORMATION

Displays information about the RCM including the Hardware Serial Number, Hardware Revision, and Software Version Number.

TESTS

The Tests tab allows the user to select various tests from a drop-down. These list of tests will vary by product configuration.

DIAGNOSTIC TROUBLE CODES

This tab lists Active and Inactive diagnostic trouble codes as well as the ability to Clear the active codes.

SYSTEM SUMMARY

Displays information configured during the setup process but does not provide the option to modify the configuration.

PRODUCT SUMMARY

The Product Summary provides a brief summary for all of the products such as Application Type, Control Valve type, Target Rate, and other settings. This tab does not allow the user to modify the configurations.

CHAPTER 4 PRECISION FARMING

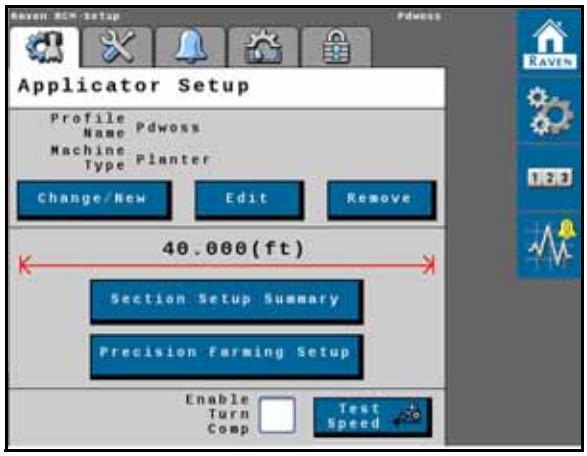
Precision farming allows the user to modify configurations that may not be available through the field computer.

IMPORTANT: Depending on the field computer, these settings may or may not be implemented.

To adjust precision farming settings after performing a machine configuration:

1. Press Setup.

FIGURE 1. RCM Settings

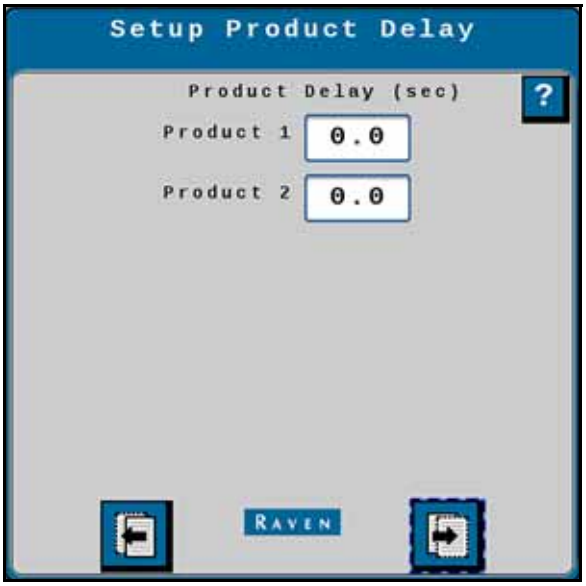


2. Select Precision Farming Setup.
3. Review the information on the Section Setup Wizard screen then press Next.

FIGURE 2. Section Setup Wizard

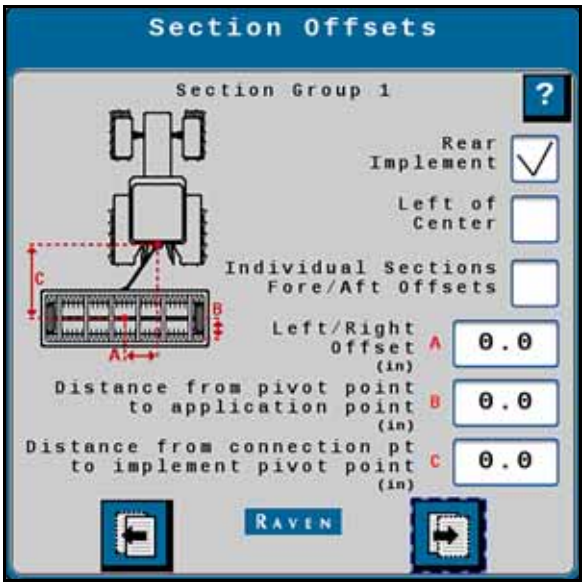
4. Enter a Product Delay value for every product. Product Delay is the amount of time the product needs to adjust when changing rate zones using a prescription map.

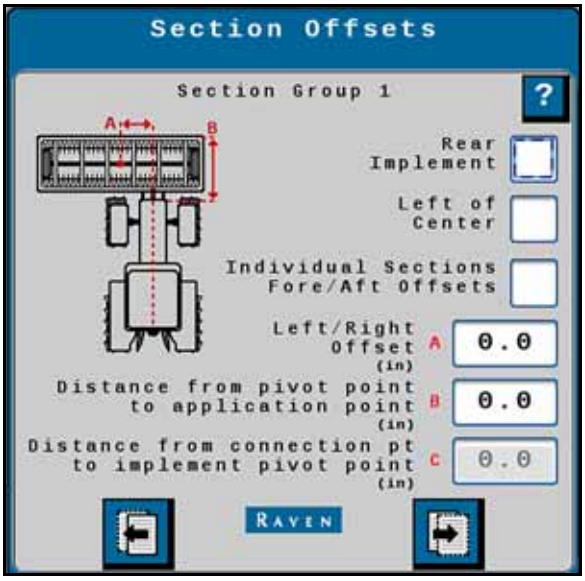
FIGURE 3. Setup Product Delay



5. Press Next.
6. Select Rear Implement if it is a rear mounted implement.

FIGURE 4. Section Offsets





7. Select Left of Center of the implement is mounted left of center.
8. Select Individual Sections Fore/Aft Offsets if different sections for the same product have different fore and aft locations.
9. Enter the value for the Left/Right Offset.

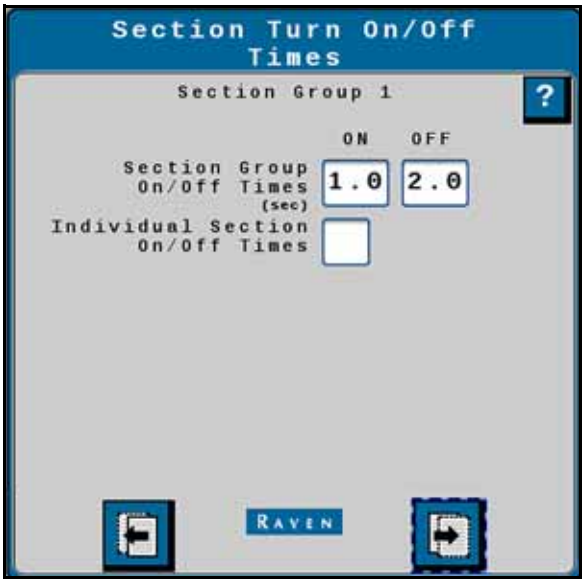
10. Enter the Distance from Pivot Point to Application Point value.

NOTE: The pivot point is the point where the implement turns. Typically this is the wheels.

11. Ender the Distance from Connection point to Implement Pivot Point value.
12. Press Next.
13. If applicable, check Individual Section On/Off Times if different sections will need different look ahead times. For example, the center sections of an air cart will need shorter look ahead times than the outer sections.

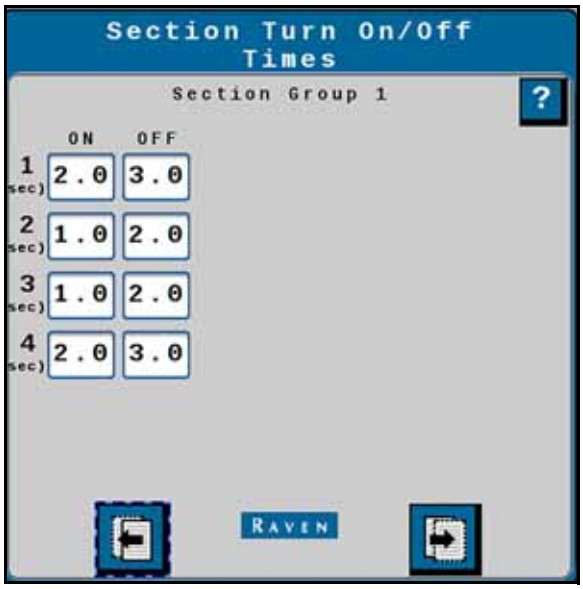
NOTE: Not all field computers support Individual Section On/Off Times.

FIGURE 5. Section Turn On/Off Times



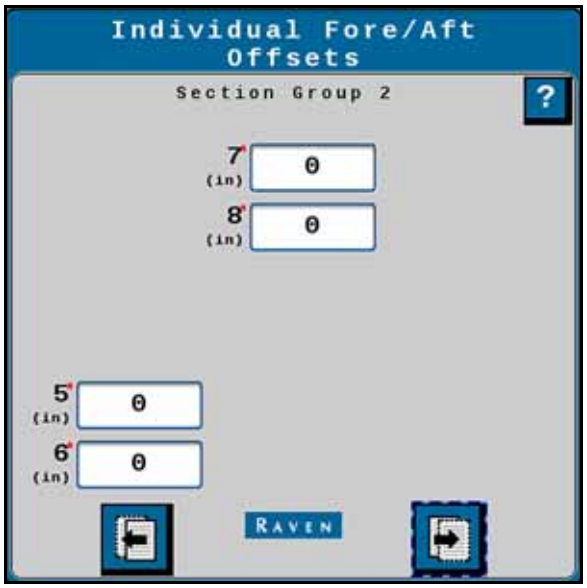
14. Press Next.
15. If Individual Section On/Off Times was selected, configure the Section Turn On/Off Times for the Section Group. If not, skip to step 16.

FIGURE 6. Section Turn On/Off Times



16. Press Next.
17. If applicable, enter the offset values for individual sections. If the section is located in front of the implement pivot point, enter it as a negative value.

FIGURE 7. Individual Fore/Aft Offsets



18. Press Next.
19. Repeat step 6 through step 18 for all section groups.
20. After configuration is complete, press Next and the Application Setup screen will display again.

APPENDIX A

SETTINGS AND HELP SCREEN TERMINOLOGY

TABLE 1. Setting and Help Screen Terminology

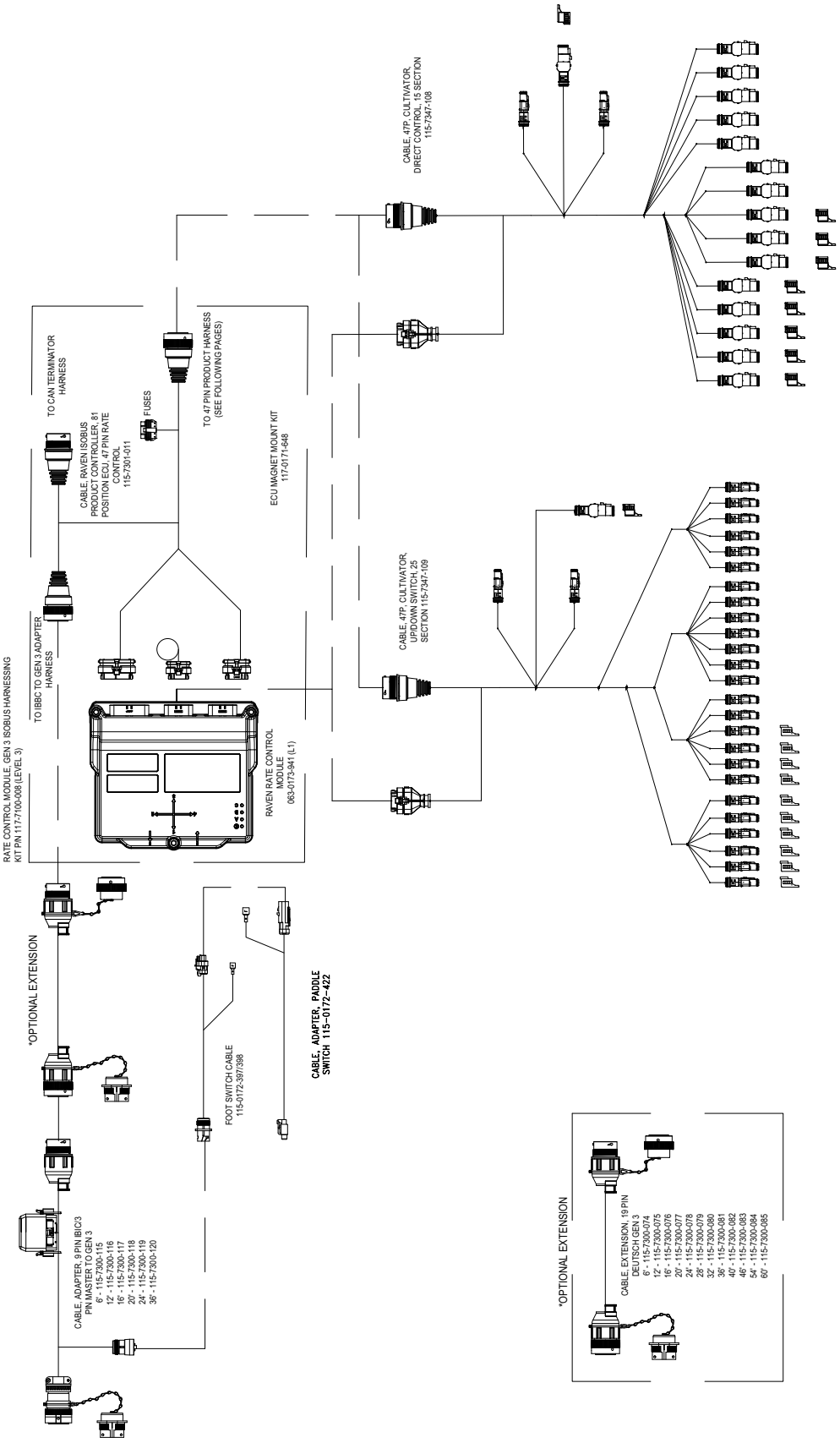
Setting	Help Screen Terminology
Control Deadband	Allowable difference between the target and actual application rate. Rate correction is not performed as long as the application rate is within the allowable range.
Control Valve Type	Select the type of control valve used to control the product application. Valve types include: Standard, Fast, Fast Close, PWM, and PWM Close.
Display Smoothing	Enable the Display Smoothing feature to display target rate as actual rate when rate is within 10% of the target rate. Actual rate will be displayed if rate controller does not reach control deadband within ten seconds.
Enable Fence Rows	Enable Fence Rows if sprayer is equipped. On-screen soft switches or physical switches can be assigned to control fence row valves. Restart the setup wizard to modify this setting.
Fill Flow Meter Cal	The fill flow meter calibration value and units may be found on the tag attached to the flow meter installed in the tank fill system. Select the appropriate units for the flow meter calibration to ensure proper calibration of the tank fill system.
Flow Meter Cal	The flow meter calibration value and units may be found on the tag attached to the flow meter installed in the application system. Select the appropriate units for the flow meter calibration to ensure proper calibration of the application system.
Implement Switch	The implement switch senses the position of the toolbar and turns off application when raised and enables application when lowered.
Low Tank Limit	Enable the Low Tank feature and enter desired volume threshold at which an alert will be displayed for low tank condition. Tank volume must be either manually set upon refilling or tank fill flow meter utilized to automatically monitor tank level.
Max Pump PWM	Enter a maximum PWM duty cycle percent to set the maximum desired output for a pulse width modulated (PWM) hydraulic control valve. This setting limits how far the PWM valve will open.
Maximum Pressure	Enter the maximum desired pressure for the system. Upon exceeding maximum pressure, an alert will be displayed, flow control will be overridden and the rate controller will maintain maximum pressure.
Min Pump PWM	Enter a minimum PWM duty cycle percent to set the minimum desired output (zero point or shutoff point) for a pulse width modulated (PWM) hydraulic control valve).
Minimum Pressure	The minimum pressure feature will allow the operator to set the lowest tolerable pressure during field operations. If the application system reaches the minimum pressure, the UT will display an alert and application system will maintain the flow rate to keep the monitored pressure consistent and to maintain the spray pattern.
Number of Sections	The number of sections is the number of section valves installed on the machine.

Setting	Help Screen Terminology
Pressure Transducer Type	Select the pressure sensor range from the drop down Menu. Refer to OEM for transducer installed, or Raven part numbers.
Pressure Sensor Type	Select the pressure sensor drop down field and select the transducer to be calibrated for operation.
PWM Standby	Enter desired control valve PWM duty cycle percent when all sections are off. This is utilized when standby pressure control is not available (pressure sensor not available or direct injection is installed).
Rate Presets	Enter desired rate presets to allow the operator to quickly switch between target rates during field operation in the automatic rate control mode.
Response Rate	The response rate has a range of 1 to 100 and the setting determines how aggressively the target is controlled to. Increasing this value will cause the system to respond more quickly. Decreasing it will cause a slower response. If the system is slow to reach the target value consider increasing it.
Speed Cal	Enter the Speed Cal value of radar speed sensor (if equipped). Reference radar manufacturer's specification for recommended value and perform distance calibration to ensure accuracy.
Tank Capacity	Enter maximum capacity of the tank.
Tank Volume	Enter the current tank level.

APPENDIX B SYSTEM DIAGRAMS

System Diagrams begin on the next page.

FIGURE 1. Application Drawing Cultivator, Generic (P/N 054-7100-059 Rev. A)



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LIMITED WARRANTY

WHAT DOES THIS WARRANTY COVER?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service when used for intended purpose.

HOW LONG IS THE COVERAGE PERIOD?

Raven Applied Technology products are covered by this warranty for 12 months from the date of retail sale. In no case will the Limited Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology Division. This warranty coverage applies only to the original owner and is non-transferable.

HOW CAN I GET SERVICE?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including completed RMA form, Certificate of Decontamination, and retail proof of purchase) must be included inside the box to be sent to Raven Industries.

WHAT WILL RAVEN INDUSTRIES DO?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace this product or any component of the product found to be defective during the warranty period. Replacement will be made with a new or remanufactured product or component. Standard return freight will be paid, regardless of inbound shipping method. Expedited freight is available at the customer's expense.

WHAT IS NOT COVERED BY THIS WARRANTY?

Raven Industries will not assume any expense or liability for repairs outside our facility without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

- Damages caused by normal wear and tear, misuse, abuse, neglect, accident, improper installation and maintenance are not covered by this warranty.
- Worn/Chafed hoses and cables.
- Items in contact with fluids and chemicals including seals and O-rings.
- Software downloads and updates.
- Tamper-Evident label broken or customer disassembly.
- Any customer modification to the original product outside normal calibration and adjustments, without written approval.
- Intentional modification to cables.
- Failures due to lack of cleaning or preventive maintenance, and any condition, malfunction or damage not resulting from defects in material or workmanship.
- Items in contact with fluids or chemicals, returned without proper cleaning, decontamination and documentation.

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EXTENDED WARRANTY

WHAT DOES THIS WARRANTY COVER?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service when used for intended purpose.

DO I NEED TO REGISTER MY PRODUCT TO QUALIFY FOR THE EXTENDED WARRANTY?

Yes. Products/systems must be registered within 30 days of retail sale to receive coverage under the Extended Warranty. If the component does not have a serial tag, the kit it came in must be registered instead.

WHERE CAN I REGISTER MY PRODUCT FOR THE EXTENDED WARRANTY?

To register, go online to https://portal.ravenprecision.com and select Product Registration.

HOW LONG IS THE EXTENDED WARRANTY COVERAGE PERIOD?

Raven Applied Technology products that have been registered online are covered for an additional 12 months beyond the Limited Warranty for a total coverage period of 24 months from the date of retail sale. In no case will the Extended Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology division. This Extended Warranty coverage applies only to the original owner and is non-transferable.

HOW CAN I GET SERVICE?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including completed RMA form, Certificate of Decontamination, and Extended Warranty Registration Number) must be included inside the box to be sent to Raven Industries. In addition, the words "Extended Warranty" must appear on the box and all documentation if the failure is between 12 and 24 months from the retail sale.

WHAT WILL RAVEN INDUSTRIES DO?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace this product or any component of the product found to be defective during the warranty period. Replacement will be made with a new or remanufactured product or component. Standard return freight will be paid, regardless of inbound shipping method. Expedited freight is available at the customer's expense.

RAVEN

WHAT IS NOT COVERED BY THE EXTENDED WARRANTY?

Raven Industries will not assume any expense or liability for repairs outside our facility without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

- Damages caused by normal wear and tear, misuse, abuse, neglect, accident, improper installation and maintenance are not covered by this warranty.
- Worn/Chafed hoses and cables.
- Items in contact with fluids and chemicals including seals and O-rings.
- Software downloads and updates.
- Tamper-Evident label broken or customer disassembly.
- Any customer modification to the original product outside normal calibration and adjustments, without written approval.
- Intentional modification to cables.
- Failures due to lack of cleaning or preventive maintenance, and any condition, malfunction or damage not resulting from defects in material or workmanship.
- Items in contact with fluids or chemicals, returned without proper cleaning, decontamination and documentation.