

RCM-Sprayer Ratio Rate (without Boom Control) Calibration and Operation Manual

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CHAPTER

IMPORTANT INFORMATION

1

SAFETY

NOTICE

Follow the operation and safety instructions included with the implement and/or controller and read this manual carefully before installing or operating this Raven system.

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

Observe the following safety measures when operating the implement after installing this Raven system:

- Do not operate this Raven system or any agricultural equipment while under the influence of alcohol or an illegal substance.
- Be alert and aware of surroundings and remain in the operator seat at all times when operating this Raven system.
 - Do not operate the implement on any public road with this Raven system enabled.
 - Disable this Raven system before exiting the operator seat.
 - Determine and remain a safe working distance from obstacles and bystanders. The operator is responsible for disabling the system when a safe working distance has diminished.
 - Disable this Raven system prior to starting any maintenance work on the implement or components of this Raven system.
- Do not attempt to modify or lengthen any of the system control cables. Extension cables are available from a local Raven dealer.



WARNING

AGRICULTURAL CHEMICAL SAFETY

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 properly disposing of them. Contact a local environmental agency or recycling center for additional information.

- 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.
- Follow all label instructions for chemical mixing, handling, and disposal.
- Avoid direct contact with agricultural chemicals or inhaling chemical dust or spray particulate. Seek immediate medical attention if symptoms of illness occur during, or soon after, use of agricultural chemicals or products.
- After handling or applying agricultural chemicals:
 - Thoroughly wash hands and face after using agricultural chemicals and before eating, drinking, or using the restroom.
 - 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.



ELECTRICAL SAFETY

- Always verify that power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the Raven system or other components.
- To prevent personal injury or fire, replace defective or blown fuses with only fuses of the same type and amperage.
- Do not connect the power leads to the battery until all system components are mounted and all electrical connections are completed.
- Always start the machine before initializing this Raven system to prevent power surges or peak voltage.
- To avoid tripping and entanglement hazards, route cables and harnesses away from walkways, steps, grab bars, and other areas used by the operator or service personnel when operating or servicing the equipment.

RECOMMENDATIONS AND BEST PRACTICES

HOSE ROUTING

The word “hose” is used to describe any flexible, fluid carrying components. Use the following guidelines and recommendations when connecting and routing hoses while installing or maintaining this Raven system:

- Leave protective caps/covers over hose ends until connecting the end into the hydraulic system to help prevent contaminants from entering the system.
- Follow existing hose runs already routed on the implement as much as possible. Proper hose routing should:
 - Secure hoses and prevent hoses from hanging below the implement.
 - Provide sufficient clearance from moving components and operational zones around shafts; universal joints and suspension components; pulleys, gears, belts, and chains; moving linkages, cylinders, articulation joints, etc.
 - Protect hoses from field debris and surrounding hazards (e.g. tree limbs, fence posts, crop stubble, dirt clumps or rocks that may fall or be thrown by the implement).
 - Protect hoses from sharp bends, twisting, or flexing over short distances and normal implement operation.
 - Ensure sufficient length for free movement of the implement during normal operation and prevent pulling, pinching, catching, or rubbing, especially in articulation and pivot points. Clamp hoses securely to force controlled movement of the hose.
 - Avoid abrasive surfaces and sharp edges such as sheared or flame cut corners, fastener threads or cap screw heads, hose clamp ends, etc.
 - Avoid areas where the operator or service personnel might step or use as a grab bar.
- Do not connect, affix, or allow hoses to come into contact with components with high vibration forces, hot surfaces, or components carrying hot fluids beyond the temperature rating of hose components.
 - Hoses should be protected or shielded if routing requires the hose to be exposed to conditions beyond hose component specifications.
- Avoid routing hoses in areas where damage may occur due to build up of material (e.g. dirt, mud, snow, ice, etc.).

HARNESS ROUTING

The word “harness” is used to describe any electrical cables and leads, both bundled and unbundled. Use the following guidelines and recommendations when connecting and routing harnesses while installing or maintaining this Raven system:

- Leave protective caps/covers over harness connectors until needed to avoid dirt and moisture from contaminating electrical circuits.
- Secure the harness to the frame or solid structural members at least every 12 in [30 cm].
- Follow existing harness runs already routed on the implement as much as possible. Proper harness routing should:
 - Secure harnessing and prevent the harness from hanging below the implement.
 - Provide sufficient clearance from moving components and operational zones around shafts; universal joints and suspension components; pulleys, gears, belts, and chains; moving linkages, cylinders, articulation joints, etc.
 - Protect harnessing from field debris and surrounding hazards (e.g. tree limbs, fence posts, crop stubble, dirt clumps or rocks that may fall or be thrown by the implement).

- Protect harnessing from sharp bends, twisting, or flexing over short distances and normal implement operation.
- Connectors and splices should not be located at bending points or in harness sections that move.
- Ensure sufficient length for free movement of the implement during normal operation and prevent pulling, pinching, catching, or rubbing, especially in articulation and pivot points. Clamp harnessing securely to force controlled movement of the harness.
- Avoid abrasive surfaces and sharp edges such as sheared or flame cut corners, fastener threads or cap screw heads, hose clamp ends, etc.
- Do not connect, affix, or allow harnessing to come into contact with components with high vibration forces, hot surfaces, or components carrying hot fluids beyond the temperature rating of harness components.
 - Harnessing should be protected or shielded if routing requires the hose to be exposed to conditions beyond harnessing component specifications.
- Avoid routing harnesses in areas where damage may occur due to build up of material (e.g. dirt, mud, snow, ice, etc.).
- Avoid routing harnesses in areas where the operator or service personnel might step or use as a grab bar.

IMPORTANT: Avoid applying direct spray or pressure washing of electrical components and connections. High pressure streams and sprays can penetrate seals, cause corrosion, or otherwise damage electrical components.
When performing maintenance:

- Inspect electrical components and connectors for corrosion, damaged pins or housings, etc. Repair or replace components or harnessing as necessary.
- Ensure connectors are kept clean and dry. Apply dielectric grease to the sealing surfaces of all connections exposed to moisture, dirt, debris, and other contaminants. Repair or replace harnessing as necessary.
- Clean electrical components with pressurized air, aerosol electrical cleaning agent, or low pressure rinse.
- Remove visible surface water from electrical components and connections using pressurized air or an aerosol cleaning agent. Allow components to dry thoroughly before reconnecting cables.

CHAPTER

INTRODUCTION

2

This system is designed to provide Raven Rate Control Module - Sprayer (RCM-Sprayer) Sidekick Pro™ direct injection ratio rate product control without control of boom sections. The following chapters cover the calibration and operation of the RCM-Sprayer and Sidekick Pro in this application.

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

- RCM-Sprayer Ratio Rate (without Boom Control) Calibration and Operation Manual
- 016-7100-072 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 INITIAL CALIBRATION

3

CREATE PROFILE SETUP WIZARD

To access the RCM-Sprayer operation features and functions, a profile must be created the first time which the ECU is powered up after installation.

NOTE: Refer to the RCM-Sprayer and Hawkeye® 2 Calibration and Operation Manual (P/N 016-0171-638) for additional assistance with available RCM-Sprayer settings and options.

PROFILE

1. Open the working set menu on the ISO VT.
2. Select the RCM-Sprayer working set icon.

FIGURE 1. RCM-Sprayer Create New Profile Page



3. Use the drop-down list to select New Profile.
4. Touch the Accept icon in the lower, right corner of the page to proceed with the Setup Wizard.
5. Use the on-screen keyboard to name the profile. For example, the name of the machine or current configuration of the system which the RCM-Sprayer will be used to control.

FIGURE 2. Profile Name Page

The screenshot shows the 'Name Profile' screen. On the left is a sidebar with two 'RAVEN' logos, one with a green checkmark. The main area has a blue header 'Name Profile' and a lock icon in the top right. Below the header, there are fields for 'Profile Name' (containing 'EXAMPLE SRAYER'), 'Machine Type' (a dropdown menu showing 'Pull-Behind Sprayer'), 'Software Version Number' (21.1.0.32), and 'Hardware Serial Number' (1032). At the bottom are a red 'X' button, a blue 'X' button, a 'RAVEN' logo, and a blue button with a right-pointing arrow.

6. Use the Machine Type drop-down list to select the type of equipment, tractor, or vehicle on which the RCM-Sprayer is installed. For example, a pull-type or a self-propelled sprayer.
7. Touch the Next Page button to proceed with the profile wizard.

ECU SETUP

8. The RCM-Sprayer ECU is hard-coded to product number 1. Set the Sidekick Pro™ injection pump as product 2.

FIGURE 3. ECU Product Assignment Page

The screenshot shows the 'System Setup' screen. On the left is a sidebar with two 'RAVEN' logos, one with a green checkmark. The main area has a blue header 'System Setup' and a lock icon in the top right. Below the header, there are two rows of data: 'RCM-1032' with a dropdown menu showing '1', and 'INJ-1321' with a dropdown menu showing '2'. At the bottom are a red 'X' button, a blue 'X' button, a 'RAVEN' logo, and a blue button with a right-pointing arrow.

NOTE: Any additional injection pumps connected to the ISOBUS network will be assigned to product 3 and higher.

9. Touch the Next Page button.

BOOM AND SECTION SETUP

10. In this configuration, the RCM-Sprayer ECU will not control the complete product application system. Touch the Next Page button to skip the Tip Setup page.

FIGURE 4. Tip Setup Page



11. In the Ratio Rate mode, the RCM-Sprayer will not control sections of the boom, enter a value of 1 for the Number of Sections field.

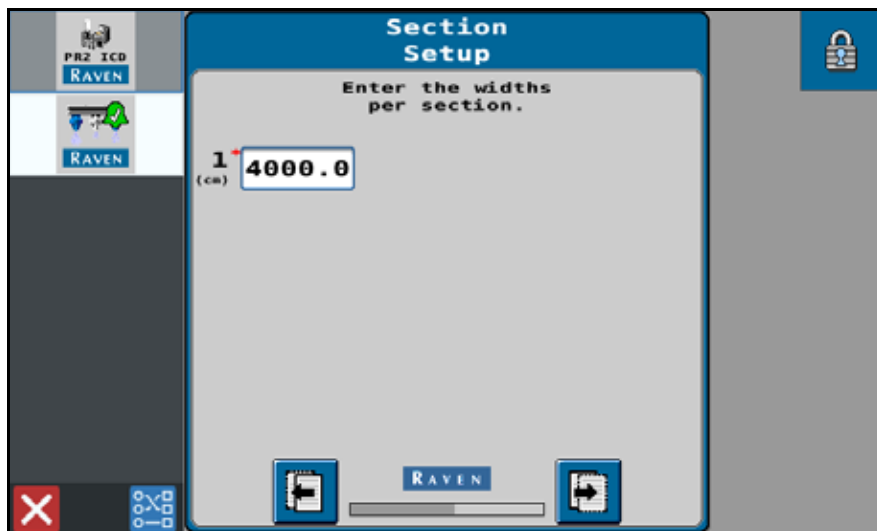
FIGURE 5. Section Setup Page



12. Set the Fence Row Type option to None.
13. Touch the Next Page button.

14. Enter the full width of the boom for the Section 1 value. For example, a boom width of 40 m [130 ft].

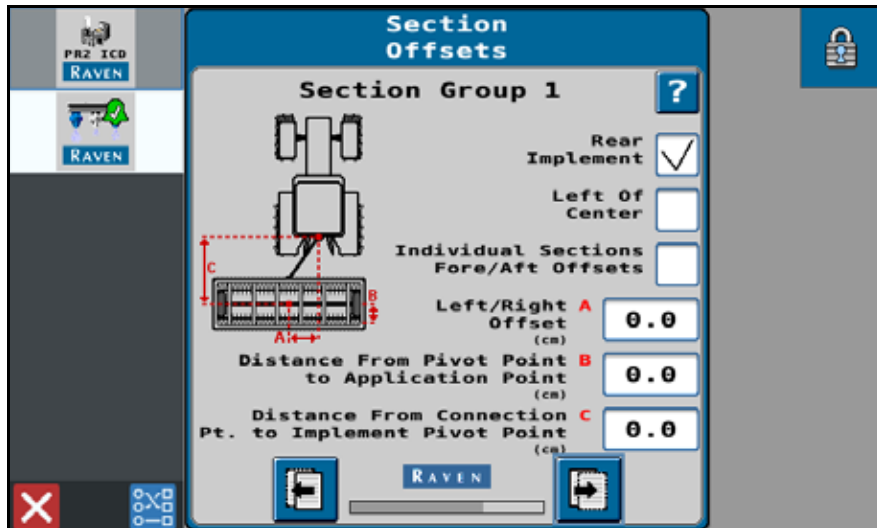
FIGURE 6. Section Width Setup Page



15. Touch the Next Page button.

16. Boom section configurations will not be used in this configuration of the RCM-Sprayer. Touch the Next Page button to skip the Section Offsets settings page.

FIGURE 7. Section Offsets Page



MAIN PRODUCT SETUP

17. Use the Boom Pressure drop-down options to select the range of the pressure sensor which is installed at the spray boom.

FIGURE 8. Product 1 Pressure Sensor Setup Page



18. When the pressure sensors are configured properly, touch the Next Page button.
19. In this configuration, the RCM-Sprayer will not be used to adjust or stop product application. Set the Control Valve Type drop-down option to None.

FIGURE 9. Product 1 Control Valve Setup Page



20. Touch the Next Page button.

21. Enter calibration value for the flow meter into the Flow Meter Calibration field. This value can be found on the label found on the flow meter installed on the sprayer and is typically a value between 1400 and 1600 per 10 gallons.

FIGURE 10. Product 1 Rate Sensor Setup Page

Rate Sensor Setup

Product 1 Liquid ?

Flow Meter Calibration: 1440

Flow Meter Pulse/Units: 10 gal

Flow Meter Low Limit (L/min): 4.0

Tank Fill/Level Sensor: None

Navigation: [Red X] [RAVEN] [Blue Arrow]

22. Enter the Meter Cal value found on the label on the flow meter installed on the sprayer into the Flow Meter Calibration field.
23. Set the Flow Meter Low Limit between 1 L/min [0.26 gal/min.] and 4 L/min [1.06 gal/min.].
24. The Tank Fill/Level Sensor option may be set to None.
25. Touch the Next Page button.
26. In the Ratio Rate mode, the RCM-Sprayer will not monitor or provide information based upon the main tank capacity. Touch the Next Page button to skip the tank fill and capacity settings for the RCM-Sprayer Product 1 tank.

FIGURE 11. Product 1 Tank Fill Setup Page

Tank Fill Setup

Product 1 Liquid ?

Tank Capacity (L): 5000

Current Tank Level (L): 2500

Low Tank Level (L): 0

Max Tank Fill PWM (%): 75

Alarm? ☐

Navigation: [Red X] [RAVEN] [Blue Arrow]

CHEMICAL INJECTION PRODUCT SETUP

27. On the Product 2 Injection page, enter the capacity of the chemical or injection tank in the Tank Capacity field.

NOTE: The standard chemical or injection tank supplied by Raven Industries is 90 L [24 gal.].

FIGURE 12. Product 2 Chemical Injection Tank Fill Setup Page

The screenshot displays the 'Tank Fill Setup' interface for 'Product 2 Injection'. The title bar at the top reads 'Tank Fill Setup' and 'Product 2 Injection'. Below the title, there are three input fields: 'Tank Capacity (L)' with the value '100', 'Current Tank Level (L)' with the value '94', and 'Low Tank Level (L)' with the value '1'. To the right of the 'Low Tank Level' field is a checkbox labeled 'Alarm?' which is checked. The interface includes a 'RAVEN' logo at the bottom center, a 'PR2 ICD' label at the top left, and navigation buttons (Previous and Next) at the bottom. A red 'X' button is also visible in the bottom left corner.

28. Set a Low Tank Level value and enable the Alarm option if desired. If a non-zero value is entered in the Low Tank Level field, and the chemical or injection tank level falls to the set value, the system will provide an alert or warning.

29. Touch the Next Page button to continue with the profile wizard.

RATE PRESET SETUP

30. In a Ratio Rate application mode, the RCM-Sprayer will not use product application rates for product 1 or the main tank. Enter a non-zero value in the Preset 1 field and touch the Next Page button to skip the remaining settings.

FIGURE 13. Product 1 Rate Presets Page

The screenshot shows the 'Rates Setup' screen for 'Product 1 Liquid'. The interface includes a sidebar on the left with icons for 'PR2 ICD RAVEN' and 'RAVEN'. The main area has a title bar 'Rates Setup' and a sub-header 'Product 1 Liquid'. Below this, there are three input fields for 'Preset 1', 'Preset 2', and 'Preset 3', all showing '0.0'. A 'Rate (L/ha)' field shows '250.0'. A 'Rate Selection' dropdown menu is set to 'Predefined or Rx'. A 'Display Smoothing' checkbox is checked. At the bottom, there are navigation buttons: a red 'X' button, a 'RAVEN' button, and a 'Next Page' button (represented by a right arrow icon).

31. On the Product 2 Injection page, enable the Ratio Rate option at the bottom of the page.

FIGURE 14. Product 2 Rate Presets Page

The screenshot shows the 'Rates Setup' screen for 'Product 2 Injection'. The interface is similar to Figure 13, but the sub-header is 'Product 2 Injection'. The 'Preset 1', 'Preset 2', and 'Preset 3' fields show '5.0', '10.0', and '15.0' respectively. The 'Rate (mL/L)' field shows '5.0'. The 'Rate Selection' dropdown menu is set to 'Predefined or Rx'. Both the 'Display Smoothing' and 'Ratio Rate' checkboxes are checked. The navigation buttons at the bottom are the same as in Figure 13.

32. Enter rate presets in the Preset 1, Preset 2, and Preset 3 fields. These values allow the machine operator to quickly adjust the target rate of the injected chemical during field operations.

NOTE: For the Squall brand chemical, it is recommended to set rate presets in increments of 5 mL/L.

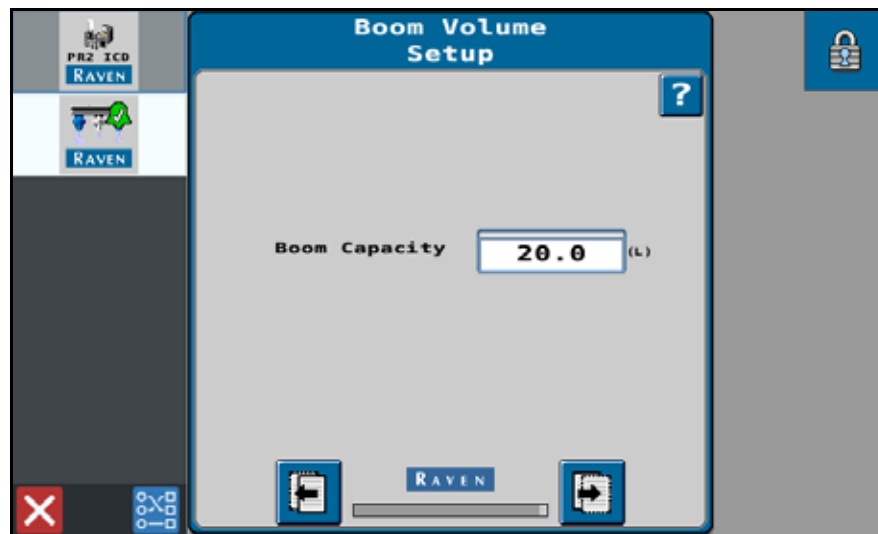
33. Touch the Next Page button.

BOOM CAPACITY

34. When boom recirculation capabilities are installed on the spray boom, enter the volume contained in the spray boom sections in the Boom Capacity field.

NOTE: By default, the Boom Capacity is set to 0.5 L [0.13 gal.] per meter of boom. For example, a 40 m boom has a boom capacity around 20 L of water.

FIGURE 15. Boom Capacity



35. Touch the Next Page button to complete the Profile Setup Wizard.

CHAPTER OPERATION

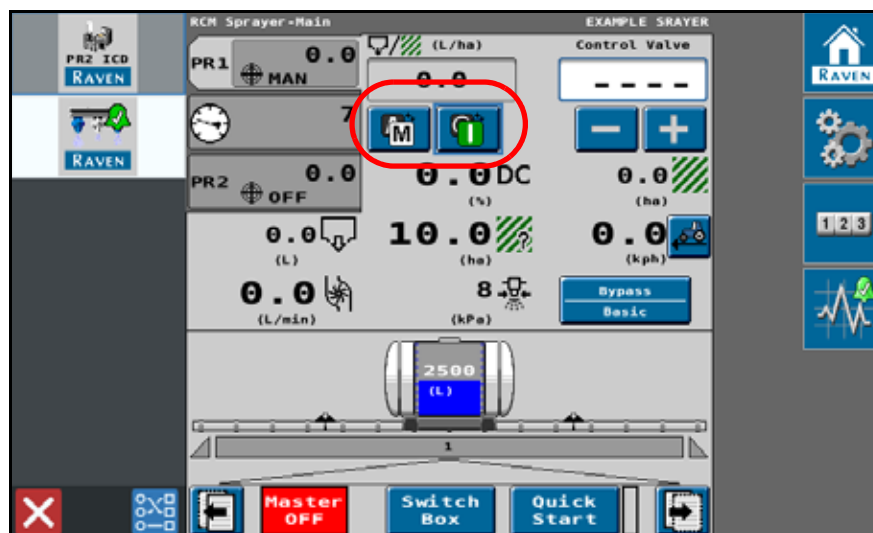
4

RCM-SPRAYER OPERATION SETTINGS

PRODUCT 1 SETTINGS

- Toggle product control to Manual mode
- Toggle the product on.

FIGURE 1. Product 1 Operation Page

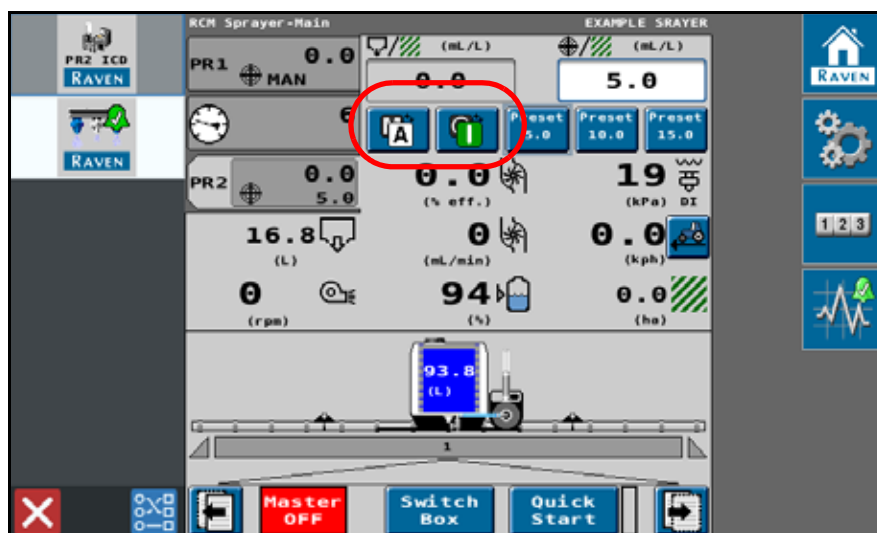


PRODUCT 2 SETTINGS

- Toggle product control to Automatic mode
- Toggle the product on
- Set the target rate to 5.0

NOTE: The rate preset buttons may be used to set the target rate.

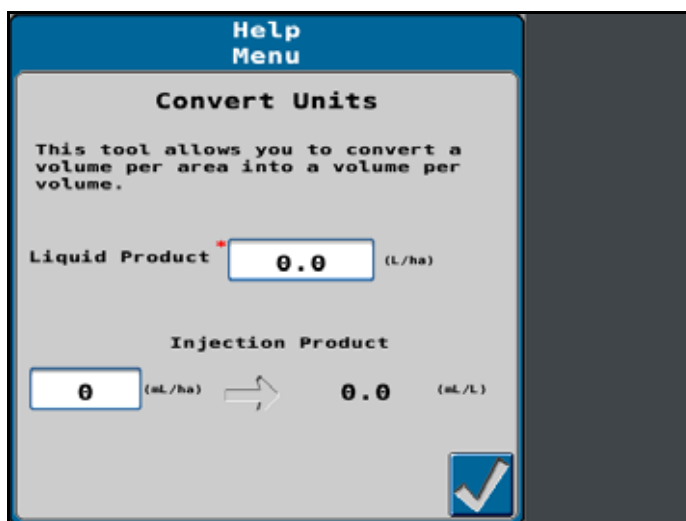
FIGURE 2. Product 2 Operation Page



NOTE: The values from PR1 will be displayed in L/min.

NOTE: Touch the Settings menu followed by the Rate Setup tab and then select the ? icon in the upper, right corner of the page. Select the Rate Calculation option for assistance with calculating unit conversions.

FIGURE 3. Help Menu Convert Units Page



CHAPTER

5

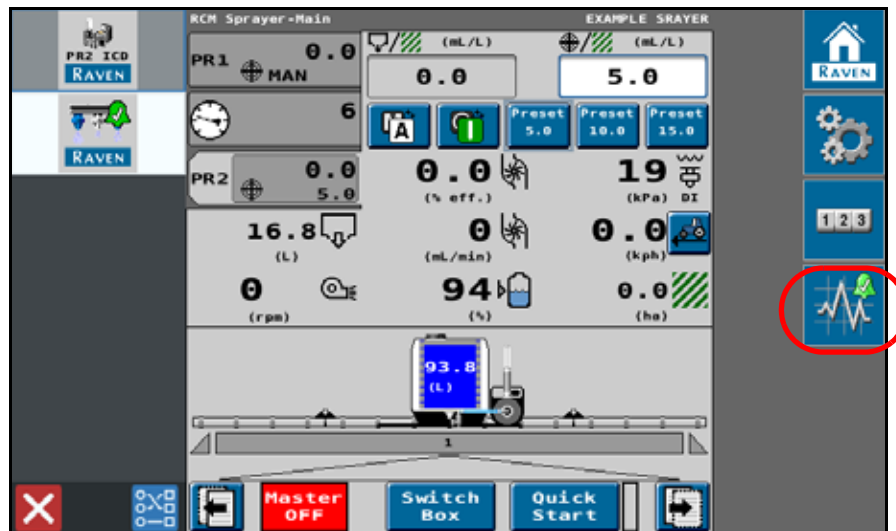
DIAGNOSTICS AND TROUBLESHOOTING

VISUALIZE SPRAY DATA

To visualize data for field operations what is injected the last hour in case of the main flow.

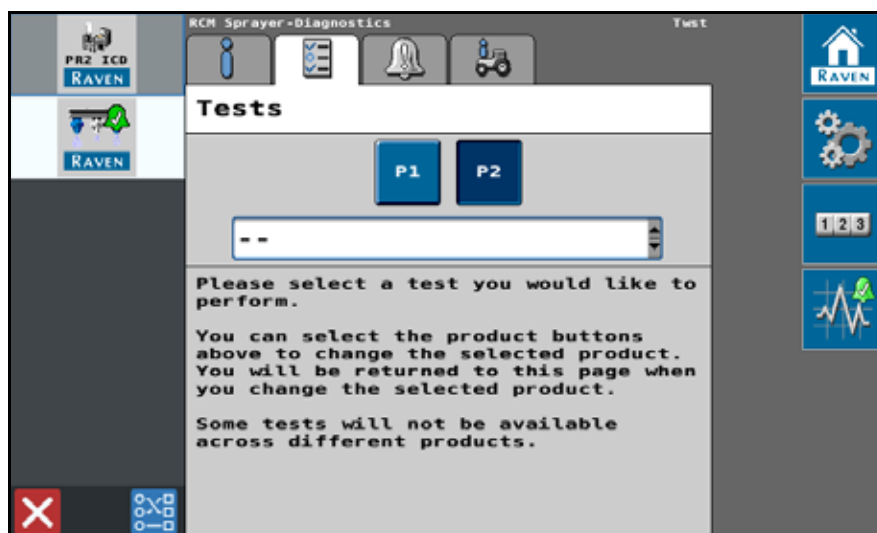
1. From the RCM-Sprayer main page, select the Diagnostics softkey.

FIGURE 1. Product 2 Operation Page



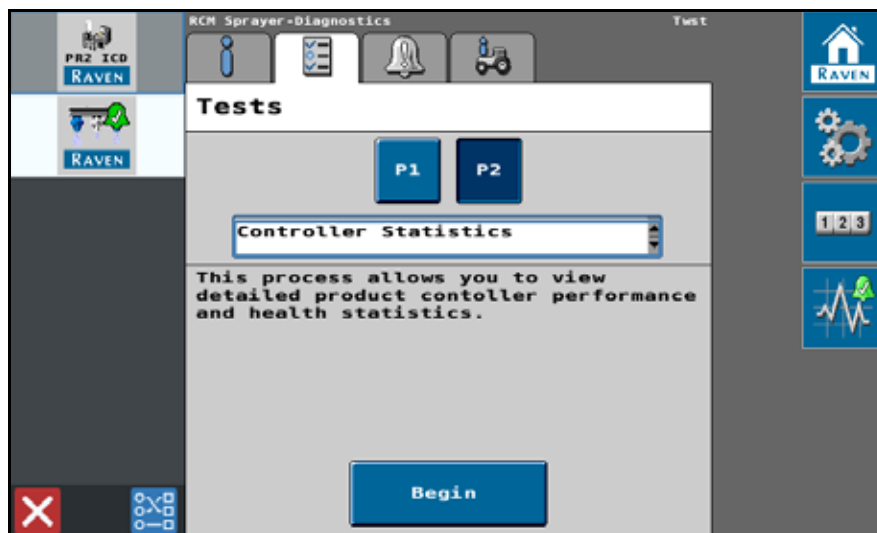
2. Select the Tests tab, select the product 2 (P2) button.

FIGURE 2. Diagnostic Tests Tab



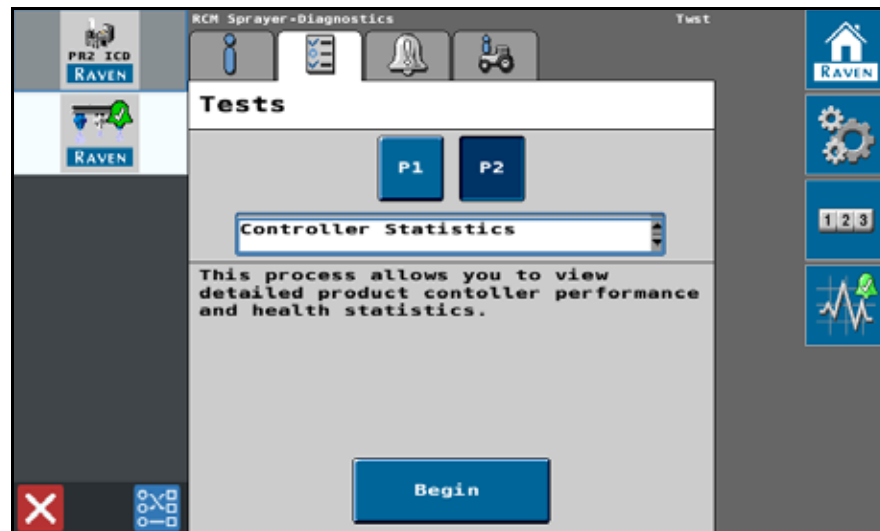
3. Use the drop-down list to select the Controller Statistics option.

FIGURE 3. Controller Statistics Test



4. Touch the Begin button to start the test.

FIGURE 4. Begin Controller Statistics Test



5. On the Controller Statistics page, use the Data Item 1 and Data Item 2 drop-down options to set which data to visualize.

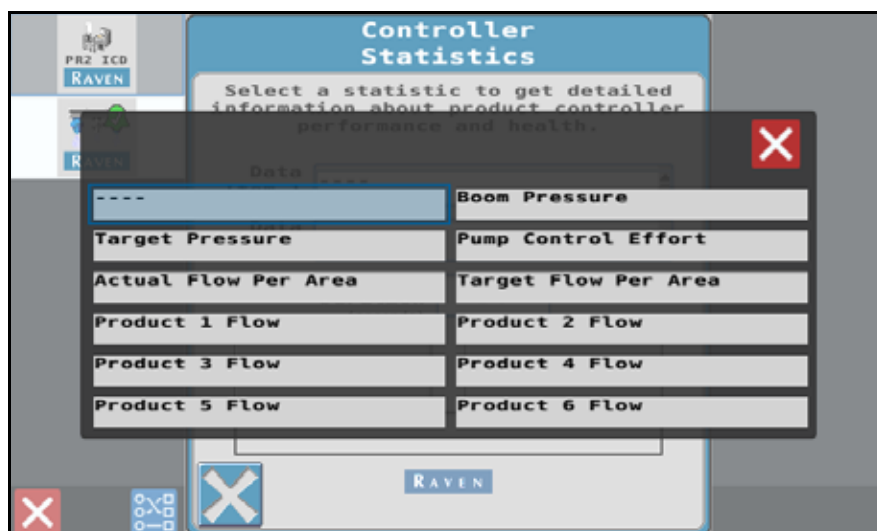
FIGURE 5. Controller Statistics Data Visualization Setup



6. For an RCM-Sprayer with one injection pump, set Data Item 1 to Product 1 Flow to show the main product flow and Data Item 2 to Product 2 Flow to show the injection pump flow.

NOTE: If there are more injection pumps on the system, the machine operator may select Product Flow 1 and Product Flow 3 to view flow from different injection pumps.

FIGURE 6. Data Visualization Options



7. When the desired data items are set, select the Start Data Visualization button to begin viewing flow charts.

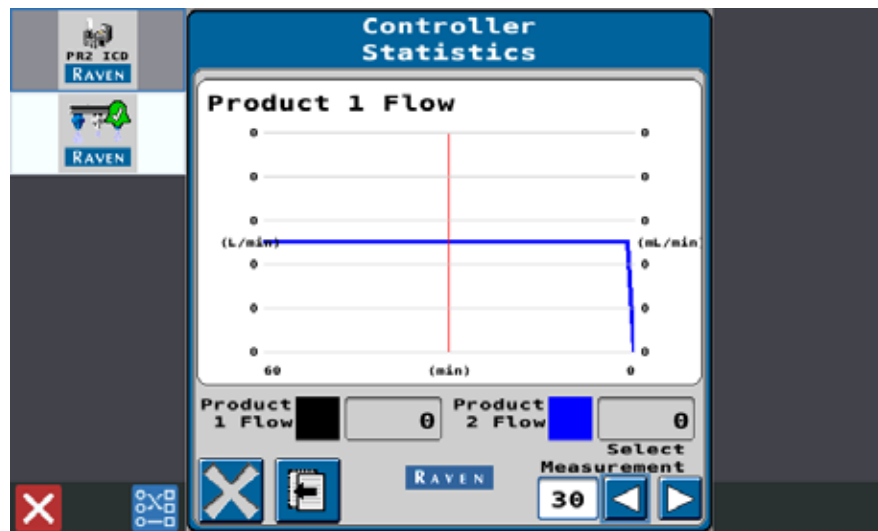
FIGURE 7. Controller Statistics Data Visualization Setup



NOTE: Figure 8 on page 23 shows an example of a data visualization. The display shows data from 1 hour spraying. The latest data is shown at the right side of the graph. Data moving to the left is older up to the 1 hour mark.

A key is displayed at the bottom of the chart for the data shown on the page.

FIGURE 8. Data Visualization

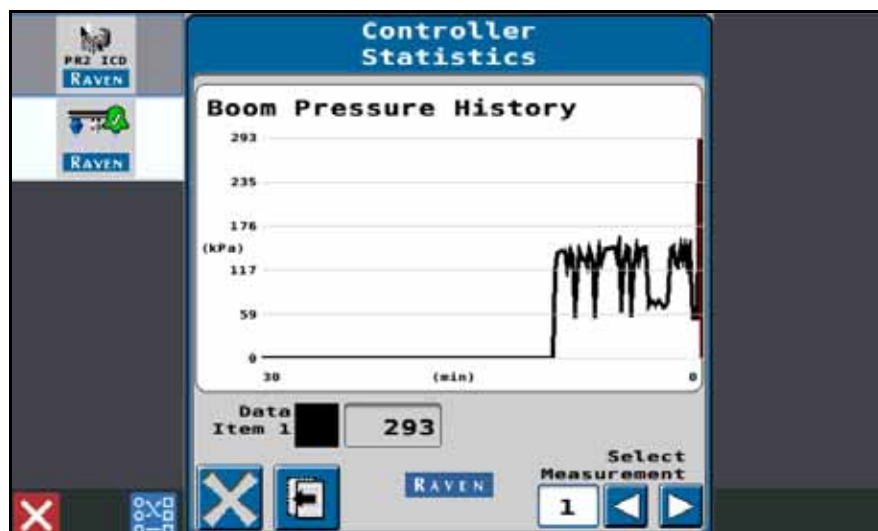


Use the Select Measurement arrows in the lower, right corner of the page to adjust the data range. The red line displays the sample time for the volume injected and applied through the boom. When no flow is detected, the visualization line will pass through the center of the chart.

NOTE: Touch the Previous Page button to return to the Controller Statistics data setup page to select other data variables to visualize. Touch the X in the lower, left corner of the Controller Statistics page to return to the RCM-Sprayer main page.

Alternatively, select the Boom Pressure History option to visualize boom pressure for up to 1 hour spraying with samples from every 10 seconds.

FIGURE 9. Data Visualization



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 24 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 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 the defective product and pay for the standard return freight, regardless of the 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 made outside our facilities 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, or improper installation and maintenance are not covered by this warranty.

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 www.ravenhelp.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 proof of purchase) 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 product's registration for the Extended Warranty and the claim itself, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

WHAT IS NOT COVERED BY THE EXTENDED WARRANTY?

Raven Industries will not assume any expense or liability for repairs made outside our facilities 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. Cables, hoses, software enhancements, and remanufactured items are not covered by this Extended Warranty. 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, or improper installation and maintenance are not covered by this warranty.