

ROS Product Control Calibration & Operation Manual

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Calibration Reference Sheet

Record the settings and calibration values used when programming the ROS device and keep this sheet for future reference or when contacting a service technician. Circle the setting selected on the ROS device for the following options:

Units	US ^a		Metric ^b	Turf ^c	
Speed Sensor	Wheel Speed (SP1)	Radar (SP2)	GPS	Speed Cal	

- a. Settings displayed in inches (in), gallons (gal), acres (ac), miles per hour (mph).
- b. Settings displayed in centimeters (cm), liters (L), hectares (ha), kilometers per hour (km/h).
- c. Settings displayed in inches (in), gallons per 1000 square feet (gal/1000 ft²), miles per hour (mph)

Write down the selected settings for each configured control channel in the spaces provided:

	Control Channel 1	Control Channel 2	Control Channel 3	Control Channel 4	Control Channel 5
Control Type					
Valve Type					
Meter Cal					
Valve Cal					
Rate Cal					
Tank Capacity					
Spreader Constant					

	Control Channel 6	Control Channel 7	Control Channel 8	Control Channel 9	Control Channel 10
Control Type					
Valve Type					
Meter Cal					
Valve Cal					
Rate Cal					
Tank Capacity					

Write down the calculated calibration values in the spaces provided:

Section Widths (Boom Cal)			
1.	5.	9.	13.
2.	6.	10.	14.

3.	7.	11.	15.
4.	8.	12.	16.

Unit Definitions and Conversions

Unit of Measure Definitions

Abbreviation	Definition	Abbreviation	Definition
GPM	Gallons per Minute	PPK	Pounds per 1,000 square feet
L/min	Liters per Minute	mm	Millimeters
dL/min	Deciliters per Minute	cm	Centimeters
PSI	Pounds per Square Inch	dm	Decimeters
kPa	Kilopascal	m	Meter
GPA	Gallons per Acre	MPH	Miles per Hour
L/ha	Liters per Hectare	km	Kilometers
mL/ha	Milliliters per Hectare	km/h	Kilometers per Hour
GPK	Gallons per 1,000 Square Feet		
lbs./min.	Pounds per Minute		
kg/min	Kilograms per Minute		
lbs./acre	Pounds per Acre	[]	Metric Conversions
kg/ha	Kilograms per Hectare	{ }	Turf Unit Conversions

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
$\frac{\text{Original METER CAL Number}}{128}$	$\frac{\text{Original METER CAL Number}}{3.785}$	$\frac{\text{Original METER CAL Number}}{\text{Weight of One Gallon of Product}}$

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)

Length

- 1 millimeter (mm) = 0.039 inches
- 1 centimeter (cm) = 0.393 inches

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

-
- Liquid**
- 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**
- Volume**
- 1 kilogram = 2.2 pounds
 - 1 pound = 0.455 kilograms



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 ROS device.

- Follow all safety information in this manual.
- Contact a local Raven dealer for additional assistance or support with any portion of the installation or service of Raven equipment.
- Follow all safety labels affixed to the system components. Keep safety labels in good condition and replace any missing or damaged labels. Contact a local Raven dealer to obtain replacements for missing or damaged safety labels.

When operating the machine after installing the ROS device, observe the following safety measures:

- Be alert and aware of surroundings.
- Do not operate the device while under the influence of alcohol or illegal substances.
- Remain in the operator's position at all times when the ROS device is engaged or operating product control or any additional automated features. Disable control functions or features when exiting the operator's position.
- Determine and remain a safe working distance from other individuals. The operator is responsible for disabling the ROS device or any optional features when the safe working distance has been diminished.
- Ensure the device is disabled prior to starting any maintenance work on the machine.
- Follow all label instructions for proper chemical mixing, handling, and container disposal methods.
- Review procedures for safe handling and use of agricultural chemicals and products with a chemical supplier. Contact a local chemical supplier, or the appropriate agricultural department, for information on obtaining the necessary training.
- Do not attempt to modify or lengthen any of the system cables. Contact a local Raven dealer for available extension cables.

WARNING

Agricultural Chemicals

- 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 storage 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.

CAUTION

Hydraulic Safety

- Wear appropriate protective equipment at all times when working on a hydraulic system.
- Never attempt to open or work on a hydraulic system with the equipment running. Care should always be taken when opening a system that has been previously pressurized.
- Hydraulic fluid may be extremely hot and under high pressure. Caution must be exercised when disconnecting or servicing hydraulic systems, even if the system has not been in use recently.
- Any work performed on the hydraulic system must be done in accordance with the machine manufacturer's approved maintenance instructions.
- When installing hydraulics or performing diagnostics, maintenance, or routine service, ensure precautions are taken to prevent foreign material or contaminants from being introduced into the machine's hydraulic system. Objects or materials that are able to bypass the machine's hydraulic filtration system will reduce performance and may damage valves.

Electrical Safety

- Always verify that the power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the equipment.
- Ensure that the power cable is the last cable to be connected.
- Disconnect the ROS device and all electrical components of the Raven system before jump-starting the vehicle or welding on any component of the equipment.
- Remove rings and other jewelry to prevent electrical shorts or entanglement in moving parts.

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

Chapter 1

- 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
- High pressure wash

Instructions for Hose Routing

The word hoses 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 hoses 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

This document provides information regarding configuration of a Raven CANbus control system using a compatible ROS device:

- Application Types
- Product Control System Configuration and Tuning
- Product Configurations
- Product System Alarms

ROS Product Control Features

The following descriptions offer a brief introduction to the capabilities of a Raven CANbus product control system used with a ROS device and some of the optional features available for use with each of these systems.

Note: *This document provides a discussion and illustration of product control settings, prompts, and features for use with a Raven CANbus control system. Settings and features available on an ISOBUS control system will vary depending upon the ECU and VT capabilities available on the ISOBUS.*

Speed Compensated Product Control

ROS capable devices may be capable of providing multiple channel product control via a CANbus system or network. When connected with the appropriate control hardware via the network, the device will automatically adjust the rate of application for each control channel according to the vehicle speed, active sections, and the monitored flow of product.

The flexibility of CANbus systems and the ROS platform allow the ROS device to be integrated into many existing control systems. Depending upon the device capabilities, the ROS may be used to monitor or control the various optional control systems such as:

- Liquid product application
- Raven Sidekick Pro™ injection
- Raven AccuFlow™ series anhydrous ammonia (NH₃)
- Granular application

- Spinner control

Contact a local dealer for details on compatibility with the specific ROS device.

Variable Rate Applications

With the optional variable rate application (VRA) feature, a ROS device may also be capable of automatic rate control based upon a prescription map stored on the ROS device.

Note: *Single or a multiproduct VRA authorization may be required to unlock variable rate control features for product control channels. A single product VRA must be entered to successfully authorize the device for multiproduct VRA.*

Mapping and Datalogging

During a field operation, or job, ROS will display a real-time, as-applied or coverage map on-screen while application information is logged and saved by the device. This job information may be transferred to a home or office PC via a Slingshot[®] Field Hub or a USB flash drive and used to create printed reports and coverage maps.

Updates

Software and manual updates are available on the Raven Applied Technology website:

www.ravenhelp.com

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

-ROS Product Control Calibration & Operation Manual

-Manual No. 016-0171-552 Rev. E

-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.

Overview

Product control settings for various Raven CANbus control systems may be found within the machine panel. The Product Control module tabs and prompts allow an operator or system administrator to configure available product control channels on the Raven CANbus network to control application of various products on a product control system.

The product control settings prompt provides access to all control channels currently available or configured for the selected machine profile. Review the following sections for assistance with setting up control channels using the ROS device.

Basic Product Control Settings

The following sections are intended to assist with the settings required for basic product control operation via the ROS device. Complete the procedures described in the following sections for assistance with the initial product control system setup and calibration.

Note: Refer to *Product Control Setting Definitions* section on page 14 as instructed in the following procedures for information on additional product control settings and features.

If necessary, see Appendix A, Calculating the Calibration Values, or contact a local Raven dealer for further assistance with system tuning or adjustments for field operations.

Set the Application Type



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Product Settings tab.

4. Select the desired product control channel along the left side of the prompt to view settings for the appropriate control channel.
5. Touch the Application Type drop-down field and select the desired application type for the control channel. Refer to the *Application Type* section on page 14 for additional information on the available application type settings.
6. Touch the tank or bin capacity field and enter the maximum product level for the selected control channel. This value should represent the volume or weight of product used to fill the bin, not the total capacity of the tank or bin.
7. Touch the rate bump field and enter the desired increments by which the target rate will increase or decrease when using the rate bump widget on the guidance screen. Each product node or control channel must be programmed with the desired rate bump value. If no value, or a value of zero, is entered the rate bump buttons will have no affect on the selected product application rate from the guidance screen.

Set the Valve Type



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Valve Control tab.
4. Select the desired product control channel along the left side of the prompt to view settings for the appropriate control channel.
5. Touch the Valve Type drop-down field and select the type of control valve used on the selected control channel.
The recommended valve cal value will automatically be populated in the valve cal field.
6. If a known valve cal adjustment is necessary, touch the valve cal value and enter the adjusted valve cal value.

Note: Touch the reset button to reset the valve cal value to the recommended setting or the valve cal adjustment button to fine tune the valve response. Refer to Valve Calibration section on page 54 for additional assistance with adjusting the valve response.



Set the Meter Cal or Product Density

Note: The meter cal value will be available for channels configured for controlling liquid application systems or controlling a spinner or fan speed. Refer to the Appendix A, Calculating the Calibration Values, for assistance with tuning or adjusting the meter cal value for various application types.



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Product Calibration tab.
4. Select the desired product control channel along the left side of the prompt to view settings for the appropriate control channel.

5. Touch the meter cal field to access the Meter Cal Assistant prompt.
6. Touch the meter cal unit drop-down field and select the desired units for the flow meter calibration.
7. Touch the desired value field and use the displayed keypad to enter the adjusted meter cal value.
The meter cal can be found on the tag attached to the flow meter used to meter product application via the selected control channel. Refer to the *Meter Calibration* section on page 51 for additional assistance with adjusting and tuning the meter cal.
8. Touch the Done icon to return to the Product Calibration prompt.

Spreader Constant

The spreader constant value is used by the ROS device to calibrate the control system for the machine gate height or belt travel measurements. This value is required to accurately monitor and control granular or dry product applications.

To maintain control system accuracy, calibrate the spreader constant value every time machine gate opening dimensions are changed.

Section Assignment Settings

The section assignments settings allow the operator or system administrator to configure the ROS device for the physical configuration of the application equipment or control systems. Use these settings to customize the sections from which products controlled by each channel will be applied.



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Section Settings tab.
4. Select the desired product control channel along the left side of the prompt to view settings for the appropriate control channel.
5. Verify that the correct number of sections are available on the display.

Note: If the appropriate number of sections are not displayed, refer to the ROS Basic Operation Manual for assistance with selecting a different machine configuration or setting up a new section configuration.

6. Select the sections of the boom or implement which will be associated with the selected control channel. This setting will configure the ROS device to map coverage for selected product when the assigned section or sections are toggled on during field operations.



Note: Touch the select all icon to select all available sections or the select none to clear all selections for the selected control channel.

Product Control Setting Definitions

The following sections provide detailed information about the settings and options accessible via the Product Control module within the Machine panel.

Product Settings Tab



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Product Settings tab. The following features and options may be available for configuring or calibrating the product control system.

Application Type

The application type setting configures how the ROS device will interpret information from the CANbus control system and must be set correctly to ensure that the device interfaces with the control hardware correctly. Select one of the following application types for the displayed control channel.

Note: *Some application types may require a specific node firmware version, optional CANbus control hardware, or an optional activation key. If an application type selection is not available, contact a local Raven dealer for assistance.*

Liquid. Application of a liquid product.

Note: *Sidekick Pro injection systems will display application type options for a high volume or low volume pump when the integrated motor control node is detected on the CANbus for the selected control channel. Sidekick motor control nodes for legacy injection systems will be controlled using either the Liquid or Granular application type.*

Granular 1. Dry or granular product application using a single encoder to meter application equipment with a single bed.

Granular 2. Dry or granular product application using a single encoder to meter application from equipment with a dual bed.

Granular 3. Dry or granular product application using a dual encoder configuration to meter application from equipment with a dual bed.

Spinner. Select this option for RPM control of spinner speed during field operations.

Note: *A product control node capable of spinner control is required to control the spinner RPM or speed.*

Liquid Injection. Select this option for Pump RPM control of an injection pump during field operations.

3-Way Valve. Select this option for automated control of a liquid system with a 3-way by-pass or return valve used with the rate control system.

Rate Bump

The rate bump value sets the increment by which the target rate will increase or decrease when using the rate bump features of various rate control widgets during an active application. Each control channel must be

programmed with the desired rate bump value. If a value of zero is entered, the rate bump feature will have no effect on the target application rate for the selected product.

Time to Application

The time to application value is used along with the product chaining feature to advance to the next channel in the chain. Enter the time, in seconds, required for the product to travel from the bin to the point of application. The ROS device will use this value for each control channel to ensure smooth, continuous flow of product when automatically switching between control channels.

Display Smoothing

Enable the display smoothing feature to allow the ROS device to smooth any rate information displayed to the machine operator. With this feature enabled, the device will display the target application rate as long as the actual rate is within 10% of the target during applications.

The actual rate will be displayed if the actual rate does not reach the target rate dead band ($\pm 10\%$) within 10 seconds.

Manual Pump Control

To manually activate and control a pump outside of a job operation:



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Product Settings tab.
4. Touch the Manual Pump Control button in the lower, right corner of the prompt to access the Manual Pump Control prompt.
5. Use the up or down buttons to increase or decrease the pump pressure or PWM cycle.

Note: The pump will shut off when the manual pump control prompt is closed.

Valve Control Tab



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Valve Control tab. The following features and options may be available for configuring or calibrating the product control system.

Valve Type

Select the type of control valve used to control the selected product during a job.

Valve Cal

The valve cal value helps the ROS device adjust the valve control response for slight differences between control valves and is required for product control. Raven Industries recommends the following calibration values for initial system setup.

Control Valve Type	Valve Cal
Standard Valve	2123
Fast (C-F) or Fast Close (C-FC)	743
PWM (C-P) or PWM Close (C-PC)	43

These values are good starting points and will generally yield adequate results, however, the valve cal should be refined for the individual control valves installed on the specific machine. See *Valve Calibration* section on page 54 for additional assistance with tuning the valve cal value.

Valve Cal 2

This value may be used to fine tune control valve response and helps to control application rate oscillations when the ROS device is programmed in PWM mode. When a fast close valve is selected, the valve cal 2 value is utilized to enable a high resolution rate control for lower application rates. Enter a non-zero value for the time, in milliseconds, which the valve will be fully opened before switching into high resolution control.

For Example:

A value of 200 will give the valve a 200 millisecond “burst” at a full 12 V to open the fast valve from the closed position before resuming product rate control. A zero value will disable this feature.

Valve Delay

Use the valve delay option to include a delay in seconds between turning on the control valve (turning on sections) and when the product control nodes begin to control the flow rate.

Note: *A value of zero must be entered when using a close-type valve, such as a Fast Close or PWM Close valve. A zero value must also be entered when programming a standard valve with an injection system.*

PWM Settings

The PWM settings features will be available if the selected control channel is configured with either a PWM or PWM Close type control valve. Refer to *Valve Calibration* section on page 54 for assistance with tuning PWM type control valves.

PWM Smart Control Enable

The PWM smart control feature may be enabled to allow the ROS device to estimate the required PWM duty cycle for changes in vehicle speed, target rate, or when the hydraulic valve is toggled on. When this feature is enabled, control response will be much more aggressive.

Note: *Smart control will be tuned during the PWM calibration.*

Product Calibration Tab



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Product Settings tab. The following features and options may be available for configuring or calibrating the product control system.

Meter Cal

Meter Cal for Liquid Applications. The flow meter calibration number may be found on the tag attached to each flow meter. Copy the information from the tag for future reference as the tags may fade or be lost during equipment operation.

Meter Cal for Spinner Applications. For spinner control applications, the meter cal value is calculated by multiplying the number of pulses per revolution of the spinner by 10.

Meter Cal for Anhydrous Ammonia Applications. Locate the NH₃ cal value on the flow meter. If there is not an NH₃ calibration value on the flow meter.

Spreader Constant

The spreader constant value is used by the ROS device to calibrate the control system for the machine gate height or belt travel measurements. This value is required to accurately monitor and control granular or dry product applications.

To maintain accuracy of the control system, the spreader constant value must be calibrated every time the machine gate opening dimensions are changed.

Fan Cal

Fan cal is used to calibrate the ROS device to the specific fan on the machine. Enter the number of pulses detected per revolution of the fan. The fan cal is for monitoring purposes only. The ROS device will not control based upon these calibration values or the monitored fan speed.

NH₃ Pump Cal

The NH₃ Pump Cal value is used to calibrate the ROS device to the boost pump installed with the AccuFlow system. Enter the number of pulses per one revolution of the pump. These values are for monitoring purposes only. The device does not control the rate based on these values of the monitored pump RPM.

Product Density

Touch the product density and enter the measured density of the product assigned to the control channel for weight and rate calculations during the field operation.

The product density may be located on the product label, using density scale, or may be obtained from the chemical supplier.

Pump Cal

The pump cal is used to calibrate the ROS device to the specific pump on the machine. Enter the number of pulses detected per revolution of the pump. Pump cal is for monitoring purposes only. The ROS device will not control based upon these calibration values or the monitored pump speed.

NH₃ Pump Cal

The NH₃ Pump Cal value is used to calibrate the ROS device to the boost pump installed with the AccuFlow system. Enter the number of pulses sensed per revolution of the pump. These values are for monitoring purposes only. The device does not control rate based on these values or the monitored pump RPM.

Fan Cal

The fan cal is used to calibrate the ROS device to the specific fan on the machine. Enter the number of pulses detected per revolution of the fan. The fan cal is for monitoring purposes only. The ROS device will not control based upon these calibration values or the monitored fan speed.

Pump RPM

The Pump RPM is a display only. The read out displays the pump RPM if a pump sensor is equipped to monitor the pump speed in a liquid application system.

Fan RPM

The Fan RPM is a display only. This read out displays the pump RPM if a pump sensor is equipped to monitor pump speed in a liquid application system.

Spreader Constant

The Spreader Constant value is used by the ROS device to calibrate the control system for the machine gate height or belt travel measurements. This value is required to accurately monitor and control granular or dry product applications.

To maintain accuracy of the control system, the spreader constant value must be calibrated every time the machine gate opening dimensions are changed.

Tier 1 Max

Touch the Tier 1 Max field and use the on-screen keypad to enter the maximum desired flow rate to apply from the first tier sections. When the application approaches the set maximum, the system will engage the second tier sections as necessary to continue to raise the application flow rate.

Tier 2 Max

Touch the Tier 2 Max field and use the on-screen keypad to enter the maximum desired flow rate to apply from the first tier sections. When the application approaches the set maximum, the system will engage both the first and tier sections as necessary to continue to raise the application flow rate.

Tier Disable Percent

The disable percent settings is used to determine the percentage of the maximum tier rate at which tiers are disabled as the required flow rate decreases. Entering a tier disable percent allows the system to adjust the control valves more quickly as the required rate decreases.

Pressure Settings Tab



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Pressure Settings tab. The following features and options may be available for configuring or calibrating the product control system.

The ROS device may be configured to monitor and display up to two system pressures per control channel.

Pressure Transducer Calibration. With no pressure in the machine product lines, enter a pressure cal of '0' to calibrate the pressure display.

Section Settings Tab



The section settings tab allows the machine operator or system administrator to configure the section associations for each control channel on the implement.

The section associations must be configured properly to accurately map field coverage for each control channel as well as to ensure the ROS device calculates the appropriate volume of product for active implement sections during field operations. Select sections for each control channel as necessary to accurately represent the product control system plumbing, clutches, or other control hardware to correctly configure the implement sections to corresponding product application.

Alarm Settings Tab



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Alarm Settings tab. The following features and options may be available for configuring or calibrating the product control system.

Low Tank Volume

Touch the low volume value and use the on-screen keypad to enter the minimum volume at which to alert the operator to a low tank or bin during field applications. This feature requires the operator to enter an initial volume when filling tanks or bins to allow the ROS device to calculate the tank or bin level during the operation.

Low Flow Limit

The low flow limit value sets the minimum volume per minute acceptable during application of a product. If the monitored flow rate drops below the low limit, the ROS device will adjust the control valve to maintain the set limit and display a flow alarm to alert the operator.

The ROS device will automatically adjust the low flow limit value for active sections.

For Example:

If a low flow limit of 4 is entered, but only half of the total implement width is currently applying product, the ROS device will only display a flow alarm if the volume per minute drops below 2.

Off Rate Percent

The off rate percent sets the allowable difference between the target and actual product application rates. If a non-zero value is entered for this setting and the difference between target and actual rate exceeds the set value for longer than five seconds, the ROS device will display an off rate alarm.

Dual Flow Percent

Used with Gran 3 and CAN Motor control systems. This alarm activates for an injection application system when the flow switch monitor and the actual flow readings are out of the specified tolerance. This alarm also activates when Gran 3 is selected as the application type and the rates sensed by the dual encoders are out of the specified tolerance.

Zero Speed Shutoff Feature

Enable the zero speed shutoff feature to allow the ROS device to automatically shut off product application if the vehicle speed is slower than 0.7 mph [1.1 km/h]. If the zero speed shutoff feature is engaged during a job, the device will also display a zero speed alert to the operator.

Note: *The zero speed shutoff feature only affects products set to automatic control. Products controlled manually will continue to be applied even if the zero speed shutoff feature is engaged.*

To restart product application after the zero speed shutoff feature has been engaged, cycle the master switch 'Off' and then back 'On.' The zero speed shutoff feature will reactivate if the vehicle does not achieve a speed greater than 0.7 MPH [1.1 km/h] and maintain that speed for more than 10 seconds.

Note: *If an optional AccuBoom system is detected, the AccuBoom override may be enabled to begin product application from a complete stop. Refer to the ROS AccuBoom Manual for additional assistance with the AccuBoom feature.*

Flow Alarm Enable

Enable the flow alarm to display an alert if the ROS device does not receive a signal from the pump flow switch. This alarm may be used to help troubleshoot flow errors with a CAN motor control node.

Note: *This feature is currently not used with the Raven Sidekick Pro injection system.*

Shaft Alarm Enable

Enable the shaft alarm to display an alert if the ROS device does not detect a signal from the shaft encoder. This alarm may be used to help troubleshoot flow errors with a CAN motor control node or belt encoder.

Note: *This feature is currently not used with the Raven Sidekick Pro injection system.*

Bin Alarm Enable

Enable the bin alarm feature if an optional bin level sensor is installed in the product bin. With this feature enabled, the ROS device will display an alert when the sensor detects the product level if the bin falls below the sensor level.

Note: *Contact a local Raven dealer for additional information on bin level sensors available for use with the ROS device.*

Vacuum Alarm Enable

Enable the vacuum alarm feature if an injection pump is controlled via a CAN product control or motor control node. When enabled, the vacuum alarm will be displayed if the injection pump cannot draw product from the supply tank.

Note: *Contact a local Raven dealer for additional information on injection systems compatible with the ROS device.*

CHAPTER

4

Product Panel and Configurations

Overview

The Product Panel provides access to previously configured control channel assignments or allows an operator or system administrator to enter product information for a field operation.



Product configurations may be set up for various common or recurring field operations. Once saved, the product configuration allows the operator to select the saved product configuration and quickly set up the ROS device for various field operations.

Saved product configurations will be displayed based upon the selected machine configuration to allow the operator to quickly select the appropriate product application and begin the field application.

ROS has the AgX database loaded to allow easy access to many agricultural products currently on the market. If a product is not available in the database, configure the product. All product quantities are based on the Unit of Measure (UOM) they are sold in (gal, oz, lbs).

Product Configurations

Product configurations save information on products assigned to each control channel and may be used to quickly set up the ROS for common or reoccurring field operations. The information entered in the product configuration may be used to enhance job reporting information and allows improved product information to be saved, changed, and used quickly.

Create a New Product Configuration



1. Touch the Product Panel to display available product configurations.
2. Touch the Add button along the left side of the display to create a new product configuration.
3. Use the on-screen keyboard to enter the desired name or description for the product configuration and touch the Done button. The product setup prompt will be displayed.
4. Refer to the *Mix and Control Channel Profiles* section on page 25 to configure the product or mix information for each control channel available in the product configuration.

Edit an Existing Product Configuration



1. Touch the Product Panel to display the available product configurations.
2. If necessary, select the existing product configuration to be modified.
3. Touch the Edit button along the right side of the display to edit the selected product configuration. The product setup prompt will be displayed.
4. Edit the existing information for each control channel as necessary to modify or adjust the configuration for the field operation needs. Refer to *Mix and Control Channel Profiles* section on page 25 for additional information on entering product information for each control channel available in the product configuration.

Delete an Existing Product Configuration



Note: Deleting a product configuration does not delete product information assigned to the configuration.

1. Touch the Product Panel to display the available product configurations.
2. Touch the product configuration to be removed.
3. Touch the Delete button toward the right side of the display.

4. Touch the “Yes” button on the displayed prompt to permanently delete the product configuration.

Mix and Control Channel Profiles

The following sections are intended to assist with entering mix information for each control channel in the current product configuration. The control channel information will be available for job reporting features and provides detailed input or as-applied information for reference after the operation is completed or for archival record keeping.

Mix Profiles



**Edit Product
Configuration**

1. Touch the Edit Product button to access the product configuration prompt for the selected product configuration.

Note: Refer to the *Create a New Product Configuration* section on page 24 or the *Edit an Existing Product Configuration* section on page 24 for additional assistance with creating or editing a product configuration.

2. Select a channel indicator along the left side of the prompt to select the control channel on which to edit product information.
3. Touch the Mix Name drop down to select an existing mix or blend for the control channel or touch within the mix name field to create a new mix or blend.

Note: Selecting an existing mix or blend will automatically enter any information entered previously for the remaining fields. Verify the mix or blend information before proceeding to the next control channel.

Editing existing mix or blend information will replace the existing mix or blend. A new mix or blend will not be created when editing the existing mix or blend information or ingredients.

4. If desired, touch the Display As field and edit the label (up to 4 characters) to be displayed during field operations on user selected widgets.
5. Touch the Current Volume or Current Weight field and set the current tank volume or bin weight available for the mix or blend. This value is the total amount of product (carrier and all ingredients) in the tank or bin.

Note: To refill a tank or bin to the full capacity of the product tank or bin, touch the Refill button. To refill all tanks or bins to full capacity, touch the Refill All button at the top of the prompt.



Refill



Refill All

Mix Ratios and Ingredients



Edit Product Configuration

1. Touch the Edit Product button to access the product configuration prompt for the selected product configuration.

Note: Refer to the *Create a New Product Configuration* section on page 24 or the *Edit an Existing Product Configuration* section on page 24 for additional assistance with creating or editing a product configuration.

Add Ingredients

The lower portion of the Product Configuration prompt allows mix or blend ingredients to be added to the Product Configuration. This information is used to calculate the ratios of product applied during field operations with the mix or blend assigned to the control channel.



Edit Product Configuration



Add

1. Touch the Edit button to access the product configuration prompt for the selected product configuration.

Note: Refer to the *Create a New Product Configuration* section on page 24 or the *Edit an Existing Product Configuration* section on page 24 for additional assistance with creating or editing a product configuration.

2. Touch the Add button at the bottom of the prompt to add a product to the ingredient list. The Favorite Products list will be displayed.

The Favorite Products prompt displays products that have been used for previous product configurations.

3. Select the desired product from the recently used list if available and touch the Done button to add the product to the ingredients list.

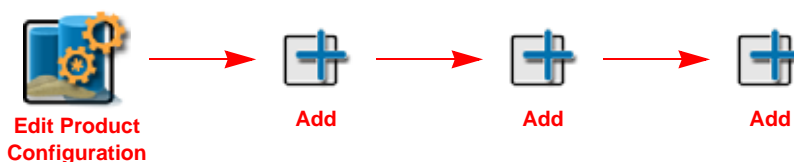
4. To add an ingredient from the product database, touch the Add button at the bottom of the Favorite Products prompt. The Reference Products prompt will be displayed.

The Reference Products database contains thousands of pre-configured agricultural products and information which may be added to the ingredient list.

5. Use the filter options at the top of the Reference Products prompt to help locate and select the desired product for the ingredients list and touch the Done button to add the selected product to the ingredients list.

Note: The selected product will also be added to the Favorite Products list. Refer to the *Create a New Ingredient* section on page 27 for additional assistance with creating a new product for a mix or blend configuration.

Create a New Ingredient



1. Touch the Edit button to access the product configuration prompt for the selected product configuration.

Note: Refer to the *Create a New Product Configuration* section on page 24 or the *Edit an Existing Product Configuration* section on page 24 for additional assistance with creating or editing a product configuration.

2. Select the Add button at the bottom of the Product Configuration prompt to display the Favorite Products list.
3. Touch the Add button again to view the Reference Products database.
4. Touch the Add button once more to access the Product Details prompt.
5. Select the Type drop down list and select the type of product to be added.

Note: Use the *Type filter* option available to the right of the Type drop down to filter the product database information. This feature may be useful when adding a new product based off of a previous product line already in the database.

6. Touch the Manufacturer field or select the drop down option to enter or select a chemical manufacturer.

Note: Use the *Manufacturer filter* option to the right of the Manufacturer drop down list to filter the product database information. This feature may be useful when adding a new product from a manufacturer already in the database.

7. Touch the Name field or select the drop down option to enter or select a product name or description already in the product database.

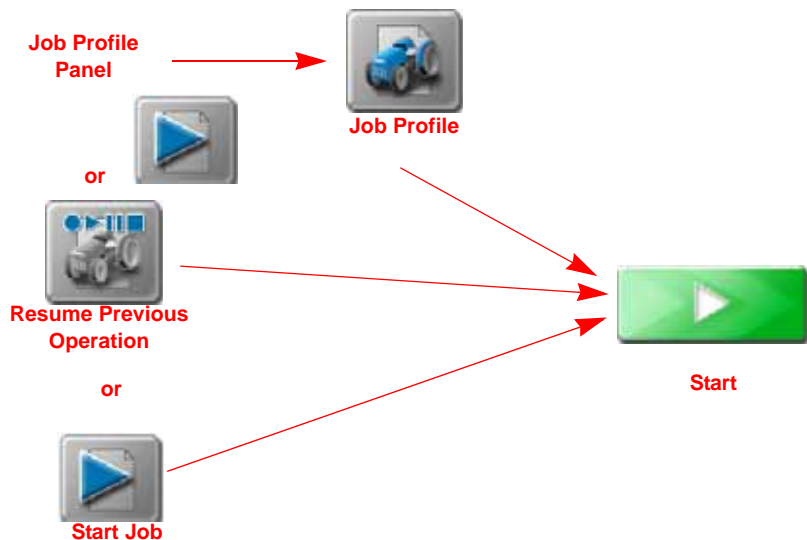
Note: Use the *product Name filter* option to the right of the Name drop down list to filter the product database information. This feature may be useful when adding a new product based upon a product or product line already in the database.

8. Touch the Liquid/Dry drop down and select the application type to be configured.
9. Touch the Units drop down and select the preferred application rate units.
10. Touch the Registration field and enter any registration information as available or necessary for reporting to governmental or environmental agencies.
11. Enter any additional product notes in the Notes area.

Job Profile and Rate Mode Setup

The following sections are intended to describe the rate control mode setup during the job start and validation process. Use the following sections to assist with setting up control channels for liquid, HN_3 , or granular rate control systems.

To begin configuring control channels for a new job or field operation:



1. Review the ROS Basic Operation Manual for assistance with setting or selecting job profile, guidance options or features, or scouting information.
2. Touch the Job Profile panel and select a job profile or a previous operation to resume.
3. In the tank assignment area, verify that the product loaded information is displayed correctly for the products to be applied during the field application.
4. Touch the Rate Mode field for the first control channel and select the appropriate rate control option. The following options will be displayed in this area:

Note: Toggle the product and node views at the bottom of the job start prompt to toggle the displayed information



Fixed Rate. Select the fixed rate mode to apply product at a fixed or straight rate during application. ROS will automatically adjust the control system to maintain the target rate based upon vehicle speed and active section width.

Note: *Fixed rate mode does not automatically adjust the target rate for prescription information or other field conditions. Rate changes may be made by manually changing the target rate or using the rate bump feature during operations.*



Prescription (Rx) Rate. Select the prescription (Rx) rate mode to apply product according to a prescription map stored on the ROS device and loaded into the job profile or active job operation. This mode allows ROS to automatically adjust the target rate for field areas as designated by the prescription map.

Note: *Review the ROS Basic Operation Manual for assistance with using the file maintenance features to copy prescription maps to the ROS device or setting up a job profile or field operation. Refer to the Prescription Rate Mode Setup section on page 31 for assistance with loading a prescription map into a job for use during a field operation.*



GreenSeeker® Rate. Select the GreenSeeker rate mode to allow ROS to automatically adjust the target rate based upon GreenSeeker rate information. Review the documentation provided with the GreenSeeker system for additional assistance with system setup and calibration prior to using this feature during field applications. A GreenSeeker unlock and a single VRA unlock are required for GreenSeeker interface to function on ROS.

Note: *The GreenSeeker system interface only allows one rate control channel to be adjusted automatically.*

5. If all other settings display properly, touch the Start button in the lower, right corner of the job to begin the field operation.

Note: *Refer to Chapter 6, Product Chaining and Linking, for additional assistance with chaining and linking features.*

Fixed Rate Mode Setup

To configure control channels to use the prescription rate mode:



**Fixed Rate
Mode**

Note: *The default selection for control channels in new job profiles is the fixed rate mode.*

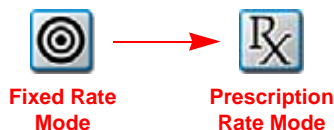
If an injection system is installed with the ROS device, refer to the ROS Injection Control Calibration and Operation manual for additional assistance with setting up and using the ratio rate mode during field applications.

1. Determine which control channels are to be controlled at a fixed target rate during field application.
2. Touch the fixed rate mode icon for the desired channel.
3. Enter the desired fixed target rate in the rate input prompt. Fixed rates are generally set in units of gallons per acre [liters per hectare].

Important: *For systems with injection modules, verify that the ratio rate feature is disabled to set fixed rates for injection control channels. Refer to the Prescription (Rx) Rate section on page 30 or the ROS Injection Control Calibration and Operation manual for additional information and further assistance with the ratio rate feature or operating the injection system during field applications.*

Prescription Rate Mode Setup

To configure control channels to use the prescription rate mode:



1. Determine which control channel to change the rate mode to use a prescription rate.
2. Touch the fixed rate mode icon for the desired channel.
3. Touch the rate input drop down field and select the prescription rate option. The prescription rate input prompt will be displayed.
4. Touch the Prescription (Rx) Map Name drop down field and select the name of the prescription map for the field application.
5. With the prescription (Rx) map selected, touch the rate column drop down field and select the column title or heading containing the rate information for the application.
6. A conversion factor may be set to adjust the prescription rate map as necessary. Touch the Conversion Factor button to access a list of automated conversion factors for use with the prescription map feature.
7. If desired, set a default rate for any areas outside of the prescription map area. Set this value to zero if application is not desired outside of the defined prescription map zones.



Conversion Factors

Note: Zones assigned to zero rate will not be affected by the default rate setting.

A fast close or PWM close type control valve is required to automatically shut off product application in a zero rate zone. Automatic section controls will only shut off individual sections if all active products assigned to the section are inside a zero rate zone. Liquid products must have zero rate shut-off enabled.

8. Select the desired Rate Reference Point:

Boom Center. Select the center option to set the prescription target rate based upon the center of the implement location. This is the default option for most field applications.

Boom Minimum. Select the minimum option to set the prescription rate to the lowest non-zero prescription rate for the current implement position. Select this option if the implement is offset from the vehicle or if prescription rate zones are unavailable at the center of the implement. This can also be used when driving the tractor on the road (which is a no spray zone) but still want the booms on.

GreenSeeker[®] Rate Mode Setup

To configure fixed rate mode control channels:



1. Determine which control channel to change the rate mode to use the GreenSeeker rate.
2. Touch the fixed rate mode icon for the desired channel.
3. Touch the rate input drop down field and select the GreenSeeker rate option. The GreenSeeker rate input prompt will be displayed.
4. Check and verify the current units displayed at the bottom of the GreenSeeker rate input prompt.

5. A conversion factor may be set to adjust the GreenSeeker rate inputs if necessary. Touch the Conversion Factor button to access a list of automated conversion factors for use with the GreenSeeker system.



**Conversion
Factors**

Overview

ROS product chaining and linking features allow the operator to associate product control channels together during an application. These associations allow the operator to utilize the capacities of multiple tanks or bins for single product applications and reduce the number of trips required to refill products.

While applying products assigned to a chain, ROS may be configured to automatically advance to the next control channel when the current tank or bin runs out of product. This feature reduces the number of trips required to refill products and ensures that the equipment continues to meet the application rate desired when switching between control channels.

Note: *Prior to starting a job using the product chaining feature, verify that the control channels to be chained are set correctly for the application. It may be necessary to adjust settings for a specific channel to ensure that products are applied at the correct rate for the chained products.*

Multi-product links allow the operator to apply two or more control channels as a proportion of one product rate. This feature allows multiple control channels to be run simultaneously to utilize available tank or bin capacities on the machine or potentially allow the operator to supplement one control channel with another to apply at a higher rate than a single control channel may be able to achieve independently.

Note: *Multi-product links may be restricted by the control system configuration. Contact a local equipment manufacturer for additional assistance.*

Product Chaining Considerations

The following items are required or recommended when operating a product chain during field applications:

- Control channels used in a product chain require a close type control valve (e.g. fast close or PWM close). Using other control valve types will result in over-application of controlled products during field applications.
- Product tank or bin capacities should be entered before starting a job. Capacities are required to allow ROS to monitor the tank or bin level during application and to utilize either the empty tank or low tank advance options.
- A low bin or tank condition must be entered to allow ROS to automatically advance to the next control channel before the tank or bin is completely empty.
- If a bin level alarm is to be used during field operations, all products in the chain must be equipped with a bin level sensor.

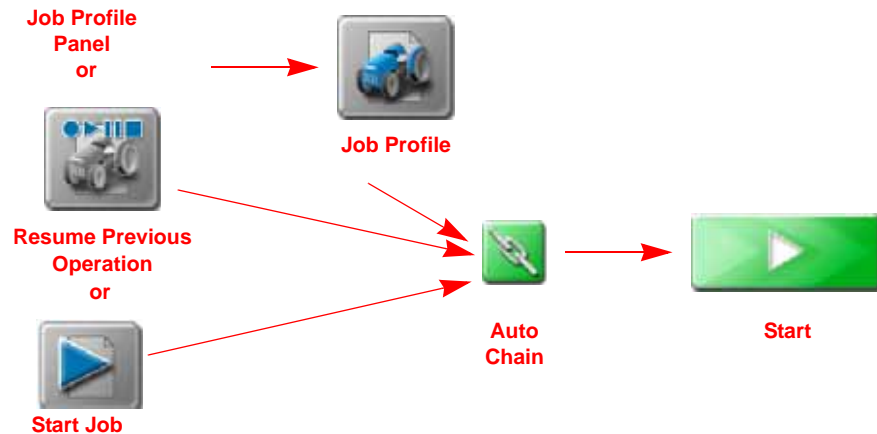
Product Chain Configuration

Note: Review the ROS Basic Operation manual for assistance with creating and managing job profiles.

Automatic Product Chaining Configuration

ROS will automatically create a product chain when setting up a job if the mix or blend names assigned to the active control channels are the same.

To allow ROS to automatically set up a product chain:



1. Touch the Product Configuration panel and select a product configuration with a mix or blend assigned to two or more control channels.

Note: Resume previous operation cannot create a chain if the chain was not set up in the initial job.

Note: Review Chapter 4, Product Panel and Configurations, for additional assistance with creating product configurations.

2. Touch the job profile panel and select a job profile. The job profile prompt will be displayed with the ROS generated product chain. The auto-chain button will be displayed along the right side of the job profile prompt.

FIGURE 1. ROS Automatic Product Chain



Note: Review the ROS Basic Operation manual for additional assistance with creating or editing job profiles.

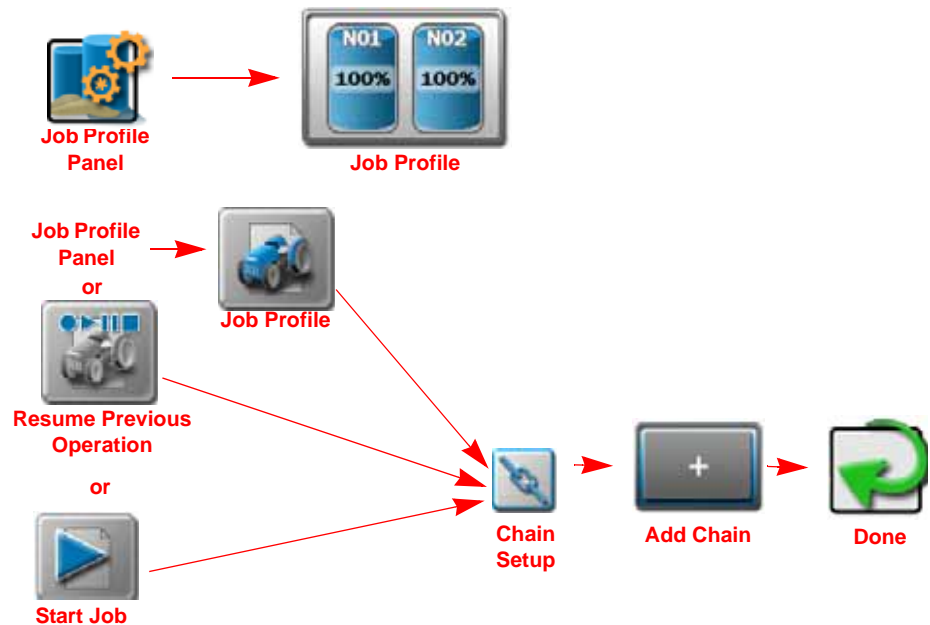
Touch the chain setup button to review the configured product chain or manually edit the chain. Review the Manual Product Chaining Configuration section on page 35 for assistance with manually configuring or editing product chains.

3. Select the Start button to begin the job and access the ROS guidance display.

Manual Product Chaining Configuration

Creating a Product Chain

To manually set up a product chain:

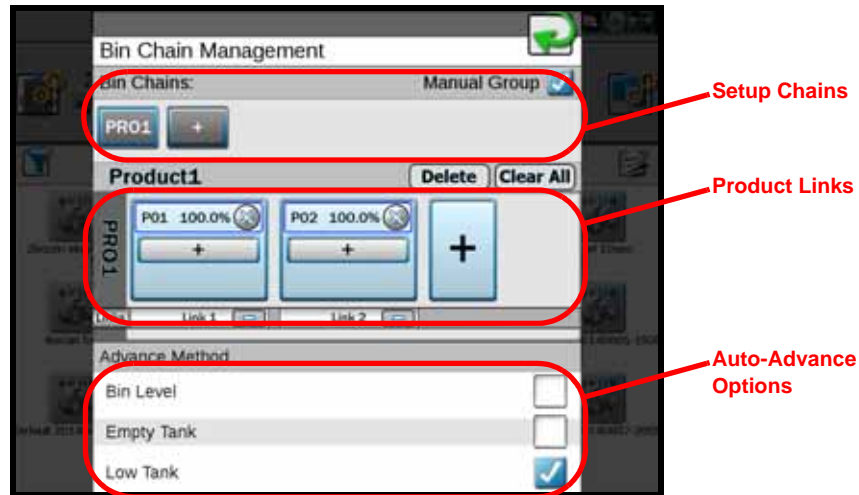



1. Touch the Product Configuration panel and select the product configuration to be chained during the field operation.

Note: Review Chapter 4, *Product Panel and Configurations*, for additional assistance with creating product configurations.

2. Touch the job profile panel and select a job profile. The job profile prompt will be displayed.
3. Touch the chain setup button along the right side of the job profile prompt. The Bin Chaining Management prompt will be displayed.
4. Toggle the Manual Group option in the upper, right corner of the prompt to enable manual set up of product chains.

FIGURE 2. Bin Chain Management Prompt



5. Touch  in the Bin Chain Management area at the top of the prompt to create a new chain. There must be at least four products (nodes) installed on the machine to have multiple chains.
6. Use the primary product drop down to select the initial control channel or product from the list.
7. If desired, change the name or the short name fields for the product chain.

Note: The Rate Information settings will be used with multiple product links in a product chain. Refer to *Adding Links to Chain Profiles* section on page 37 for additional assistance with setting up multiple product links in a product chain.

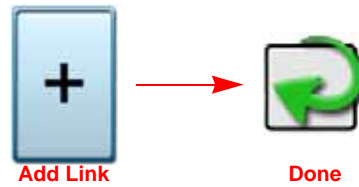
8. Touch the Done button to accept the displayed chain settings and return to the Bin Chain Management prompt.
9. Repeat this procedure to add additional product chains to a job profile.

Note: Refer to the *Auto-Advance Method Definitions* section on page 40 for additional information on the options for advancing product channels in the chain. See the *Bin Cleanout and Chain Complete Definitions* section on page 41 for assistance with the actions to be performed when the product chain is complete.

10. Touch the Done button again to return to the job profile prompt and verify the job profile settings before selecting the Start button to begin the job and access the ROS guidance display.

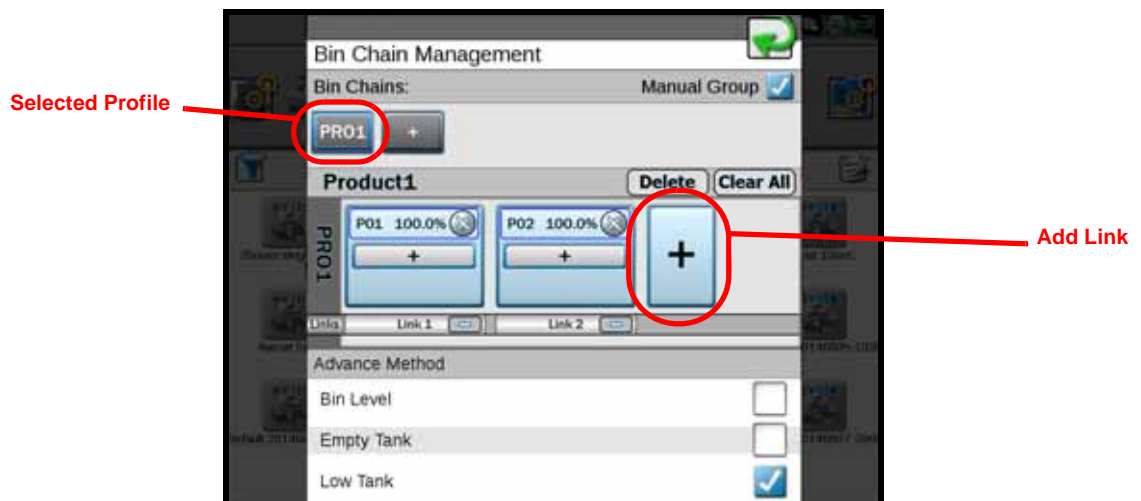
Adding Links to Chain Profiles

To add links to a product chain:



1. Refer to *Creating a Product Chain* section on page 35 to set up a product chain and access the Bin Chain Management prompt.
2. Enable the Manual Group feature in the upper right corner of the Bin Chain Management prompt.
3. Select the 'Add Link' button for the selected product chain profile.

FIGURE 3. Bin Chain Management Prompt



- Use the product drop down field to select the next product or control channel in the chain.

Note: ROS automatically filters the available product information based upon the blend and ingredient information in the product configuration and by the section assignments for each control channel. It may be necessary to de-select these filter options to allow ROS to display additional products or control channels when configuring a product chain profile.

- Touch the Done button. The Bin Chain Management prompt will be displayed with the new product link.

FIGURE 4. Bin Chain Management Prompt



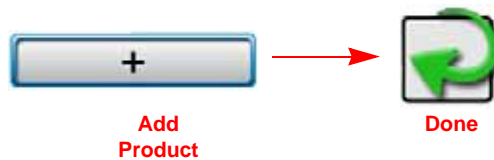
- Repeat this procedure as necessary to add links in the product chain.

Note: Refer to the Auto-Advance Method Definitions section on page 40 for additional information on the options for advancing product channels in the chain. See the Bin Cleanout and Chain Complete Definitions section on page 41 for assistance with the actions to be performed when the product chain is complete.

- Touch the Done button again to return to the job profile prompt and verify the job profile settings before selecting the Start button to begin the job and access the ROS guidance display.

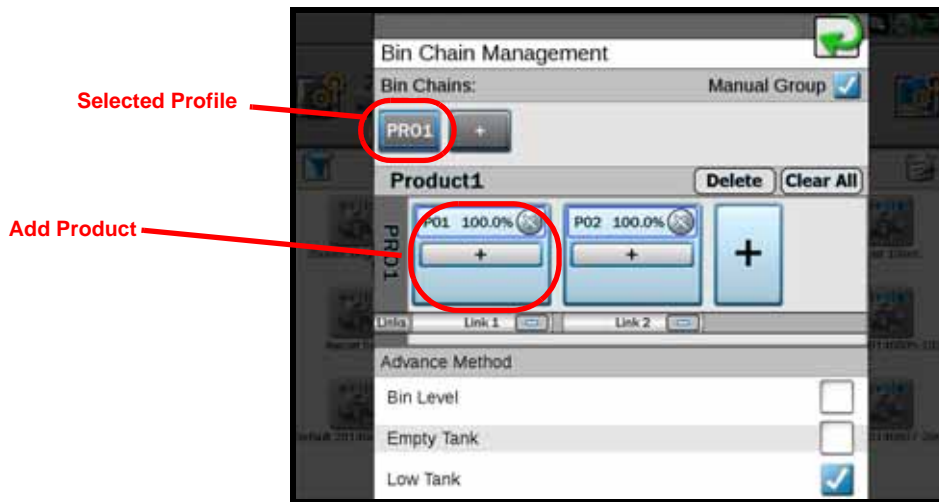
Adding Products to Links

To add a product to a link in a product chain:



- Refer to *Creating a Product Chain* section on page 35 to set up a product chain and access the Bin Chain Management prompt.
- Enable the Manual Group feature in the upper right corner of the Bin Chain Management prompt.
- Select the 'Add Product' button within the desired product link to add another product control channel to the link.

FIGURE 5. Bin Chain Management Prompt



- Use the product drop down field to select the product or control channel to add to the link.

Note: ROS automatically filters the available product information based upon the blend and ingredient information in the product configuration and by the section assignments for each control channel. It may be necessary to de-select these filter options to allow ROS to display additional products or control channels when configuring a product chain profile.

- Touch the Done button. The Bin Chain Management prompt will be displayed with the new product.
- Repeat this procedure as necessary to add additional products to links as necessary in the product chain.

Note: Refer to the Auto-Advance Method Definitions section on page 40 for additional information on the options for advancing product channels in the chain. See the Bin Cleanout and Chain Complete Definitions section on page 41 for assistance with the actions to be performed when the product chain is complete.

- Touch the Done button again to return to the job profile prompt and verify the job profile settings before selecting the Start button to begin the job and access the ROS guidance display.

Editing Product Chains

To edit links in a product chain:

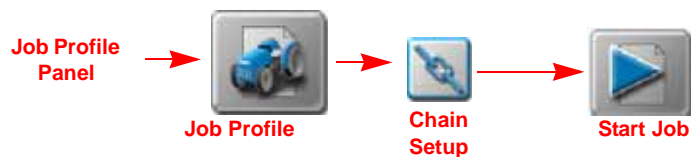
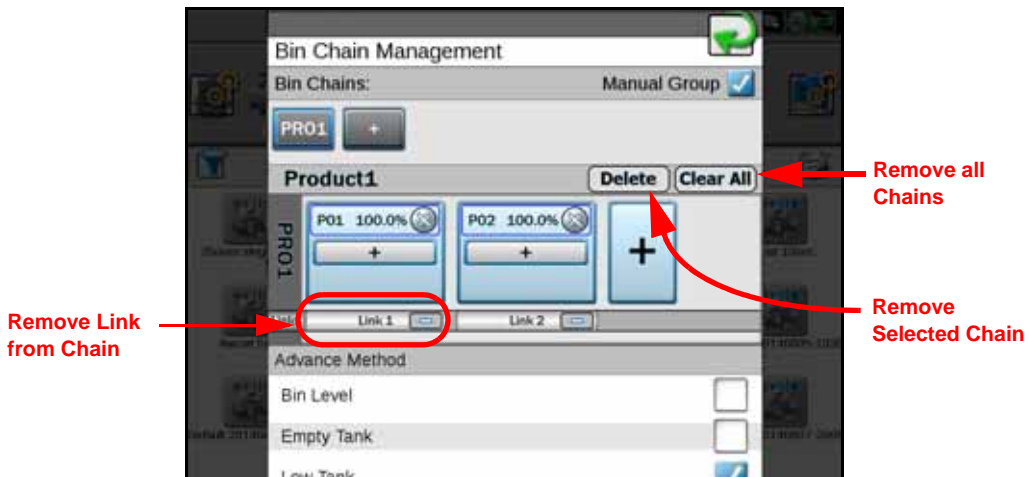


FIGURE 6. Bin Chain Management Screen



1. On the Bin Chain Management prompt, toggle the Manual Group feature.
2. Touch the product chain to be modified. The Bin Chain Management prompt will display the links in the selected chain.
3. Use the following actions to modify the product chains and chain links.
 - **Remove Link** - Removes the selected product link from the product chain.
 - **Delete** - Deletes the selected product chain.
 - **Clear All** - Removes all product chains from the configuration.

Note: Refer to the *Auto-Advance Method Definitions* section on page 40 for additional information on the options for advancing product channels in the chain. See the *Bin Cleanout and Chain Complete Definitions* section on page 41 for assistance with the actions to be performed when the product chain is complete.

4. Touch the Done button to return to the Bin Chain Management prompt.
5. Touch the Done button again to return to the job profile prompt and verify the job profile settings before selecting the Start button to begin the job and access the ROS guidance display.

Auto-Advance and Bin Cleanout Features

Auto-Advance Method Definitions

The following options allow the operator to select the desired conditions for the automatic chain advance features during a field operation. Select the desired method to allow ROS to automatically advance to the next link in the product chain when the current link meets the selected conditions.

Note: Control channels used in a product chain require a close type control valve (e.g. fast close or PWM close). Using other control valve types will result in over-application of controlled products during field applications.

The following options will be accessible during the chain set up as well as during field applications via the bin chaining widget. Refer to *Product Chaining Widgets* section on page 42 for additional information regarding the bin chaining widget.

Bin Level Sensor. Select the bin level sensor option to automatically advance to the next link when the product level in the bin falls below the sensor level.

All products in the chain must be equipped with a bin level sensor to utilize this method for automatic link advance.

Empty Tank. Select the tank empty option to automatically advance when ROS calculates that the tank or bin assigned to the control channel is empty.

To correctly advance using this option, a tank or bin capacity must be configured for each control channel in the chain and the tank or bin volume must be reset when refilling products during field operations.

Low Tank. Select this option to automatically advance to the next link when the low tank volume alert has been triggered. Refer to *Alarm Settings Tab* section on page 19 for assistance with setting a low tank or bin volume.

To properly utilize this advance method, a tank or bin capacity must be configured for each control channel in the chain, the tank or bin volume must be reset when refilling products during field operations, and a non-zero low tank or bin value should be entered to advance to the next link before the tank or bin is completely empty.

Bin Cleanout and Chain Complete Definitions

Bin Cleanout Feature

The bin cleanout feature allows the operator to activate all bins in the chain simultaneously to clear any remaining product from the application equipment. When the cleanout feature is initiated, ROS automatically applies a ratio from each control channel in the chain to equal the target rate for the product.

During bin cleanout, ROS will not provide detailed map of application rates for products or monitor which control channels or bins are empty. ROS will not display low rate areas within the application map.

Note: *The cleanout will not apply in the previously applied area if AccuBoom sectional control is enabled in the job.*

For Example:

If the target rate is set to a value of 50 for a chain of 5 products, ROS will activate each product channel to apply at a rate of 10 to ensure that any field areas covered during the cleanout mode will not be over applied. ROS will not adjust the actual rate of application as control channels run out.

Chain Complete and Cleanout Options

The following actions configure the desired operation of the control system when the last product link in the chain has met the auto-advance condition. During a field operation, select the desired action for ROS to take when the last link in the chain is complete.

Shutdown Chain. Select this option to shut off application for all control channels in the product chain. Any desired cleanout operations will need to be started manually.

Start Cleanout. Select this option to start the bin cleanout feature automatically at the end of the chain. ROS will prompt the operator when the cleanout feature has been initiated.

Delayed Chain Shutdown. Select this option and enter a delay value to allow ROS to continue the application using the last control channel in the chain for the entered delay time. After the time has expired, ROS will shut off all products in the chain. Any desired cleanout operations will need to be started manually.

Widget Catalog Definitions

Product Chaining Widgets

Product Chaining and Bin Cleanout

Add the product chaining widget to the guidance view to display the active control channel during applications using the product chaining feature. This widget also displays the current status of the product chain and allows the operator to initiate the bin cleanout feature from the guidance screen.



Press the left half of the bin chain widget to reset the chain order. Perform this when reloading so the chain will empty all bins. Press the right half of the bin chain widget to start the clean out process.

Note: Refer to the *Product Chain Configuration* section on page 34 for assistance with configuring product chains for field operations.

Chain Active. This status will be displayed in the product chaining widget as long as control channels remain available in the product chain configuration.

Cleanout Ready. After all control channels in the product chain have been depleted, the status display will change to “Cleanout Ready.” Touch the product chaining widget to manually activate the bin cleanout feature.

Cleanout Active. The chaining widget will display “Cleanout Active” while the feature is in operation to empty all chained bins. Touch the chaining widget again to end the cleanout feature and prepare for normal application after the bins are refilled.

Bin Chain Prompt

Touch and hold the product chaining widget to access the Bin Chain prompt during a field operation:

Product. If multiple product chains are configured, use the product drop down field to select which product chain information will be displayed in the widget.

Active Link. Touch the active link drop down field and select a control channel in the product chain. Use this option to manually select or change bins used for application.

Auto Advance Method. Select the control system condition required to advance to the next link in the product chain. Review the *Auto-Advance Method Definitions* section on page 40 for assistance with each of these options.

Action Upon Completion. Select the desired ROS action after the last control channel in the chain has met the auto advance condition. Review the *Bin Cleanout and Chain Complete Definitions* section on page 41 for assistance with these options.

Manual Chain Advance. If Auto Advance is not selected, the user will be notified when the alarm is active. Either manually advance the chain, shut down the chain, or start cleanout.

Overview

ROS features user selectable widgets which allows the ROS operation screens to be configured to display the information necessary for various field operations or customized for operator preferences. Some widgets may be required to perform specific tasks with ROS while others may be used for status or information display if desired. Several widgets will require installation of additional hardware or components to enable use of the widget during a field operation. The following sections are intended to assist with selecting and using various ROS widgets available for use with standard system installations. Please refer to the ROS documentation for each optional system or feature for additional information on using widgets with these systems.

Widget Catalog Definitions

Rate Control Widgets

Individual Product Control

Displays the target and actual application rate for the selected product.


- When multiple individual product control widgets are being used, one short press of the icon toggles the map settings to display the application data for that product.
- One long press of the icon allows the product type to be selected for that widget. This menu also allows the target rate, application mode, and rate to be adjusted.
- Press the arrows on the ends of the widget to increase or decrease the application rate by the value entered into the Rate Bump field in the Product Settings tab during setup.
- Pressing the rate area then the blue arrow displays the meter, valve, and pressure cal settings and the application data values per product.



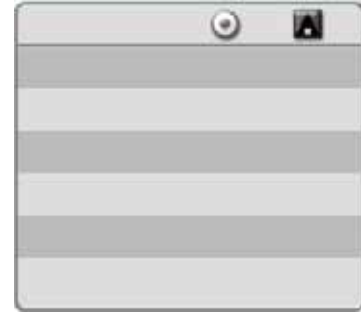
Note: *During application with an ISOBUS application system, the application mode may only be toggled between on and off states.*

- The product name displayed in white indicates that particular widget is selected and the application data is displayed on the map.

Multiple Product Control

Multiple Product Control - Displays the target and actual application rates for multiple products. The  icon next to the product indicates that product is selected and the application data is displayed on the map.

- Toggle between the products with one short press on the product name.
- One long press of the icon allows the product type to be selected for that widget. This menu also allows the target rate, application mode, and rate to be adjusted.
- Pressing the blue arrow displays the meter, valve, and pressure cal settings and the application data values per product.



Tally Registers Widgets

Tally Registers

One long press of the icon displays the application data values per product. These values may be reset either by product or by data type, or all data values may be reset by pressing the double arrow in the upper-left corner of the table. The distance values may be reset by pressing the single arrow in the lower-right corner of the screen.



Field Area

Displays number of acres [hectares] applied for the selected product type. One long press of the icon displays a drop-down box that allows you to choose between the product shown on the map or another product type listed in the menu.



Product Level

Product Level - The product level icon displays the amount of product remaining in the tank based on the amount of product that has been applied according to the flow meter.

- One short press of the icon allows you to select a specific product and change the bin level/capacity. Pressing the fill or empty icons to the right of the capacity value allows the operator to manually indicate that the bin has been filled or emptied.
- One long press of the icon allows the operator to manually adjust the tank level to full.



Note: *When operating with an ISOBUS product control system, the product level widget provides a display of the level configured via the VT working set. Review the operation guide for the VT feature for additional assistance with configuring tank capacity or product levels during field operations.*

Pressure Monitoring Widgets

System Pressure

Displays the pressure level of the selected pressure transducer. One long press of the icon will display up to two pressure transducers for each product. The drop-down box lists the available products.



Pump Monitoring and Control Widgets

Liquid Pump RPM

Displays the pump RPM for the selected pump. One long press of the icon displays the pump RPMs. The drop-down box lists the available products.



Pump Switch

The pump switch turns the pump on and off for the product selected.

- One long press of the icon displays a drop-down box that allows you to choose between the products.
- Once the product has been selected, one short press of the icon toggles the pump for that product on and off.



Fan Speed RPM

Displays the fan RPM.

Bin Chain Widget

Bin Chain Status

Displays the current group associated with the widget and the status. The status will either be active, cleanout ready, and cleanout active.



Prescription Widgets

Prescription (Rx) Map Settings

One long press displays the Rx map settings menu. The left side of the screen displays the products to choose from, while the right side of the screen displays the settings that can be adjusted for the selected product.

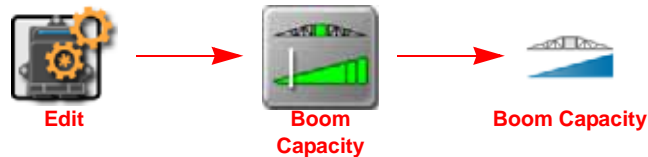


Overview

The boom capacity features of the ROS provides flow capacity of the application system and allows the operator to monitor the current capacity used to ensure the system is meeting the application expectations during field operations. As the system approaches the maximum capacity, the ROS device will provide an alert to the operator to allow the operator to made adjustments to the equipment or application to maintain coverage and rate requirements.

Boom Capacity Configuration

To configure the boom capacity feature for the application equipment:

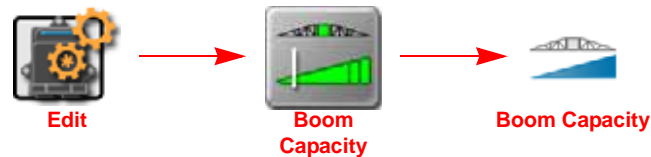


1. Touch the Edit icon in the Machine Panel to view the Machine Devices.
2. Locate and select the Boom Capacity module. The Boom Capacity tab will be displayed.
3. Select the boom section group of which to configure the capacity.

Note: Capacity may be configured for each boom section group to provide customized information during field operations.

4. Select the Enable option to enable the capacity features for the selected boom section group.
5. Select the desired capacity setting for the application equipment. Contact a local equipment dealer or the manufacturer for additional assistance with the maximum capacity of the application system.

Boom Capacity Settings Definitions



1. Touch the Edit icon in the Machine Panel to view the Machine Devices.
2. Locate and select the Boom Capacity module. The Boom Capacity tab will be displayed.
3. Select the boom section group of which to configure the capacity.

Select Boom. Select the section group on which the capacity feature settings will be applied. This selection allows the operator to enable or disable the capacity settings for each configured section group individually.

Capacity Enable. Enable the capacity monitoring feature for the selected section group. Capacity monitoring may be enabled or disabled for each group individually.

Override. The user definable override value is intended to allow the operator to adjust the capacity of the boom configuration for temporary changes, such as product density for a single application, etc. Select and adjust this value for temporary or conditional application requirements.

Custom Default. The custom default value is intended to provide the system administrator or machine operator with a definable value for normal operations. This value is intended to allow the capacity feature to be adjusted for non-standard section configurations or customized booms without modifying the factory recommended capacity value.

Factory Default. The factory default value is the recommended capacity setting from the factory. This value is not user definable and may be selected for standard configurations or to reset the capacity features to the recommended user settings.

Widget Catalog Definitions

Boom Capacity Widgets

Capacity Widget



Use the boom capacity widget during field operations to monitor the capacity of a selected section group. When the application capacity reaches 90% of the entered capacity, the system will provide an operator alert.

Touch and hold the capacity widget to view the section group selection and enable the capacity monitoring feature during the field operation.

Note: *The capacity values cannot be changed during a field operation. To adjust the capacity, close the job and review to the Boom Capacity Configuration section on page 49 for additional assistance with configuring the boom capacity feature.*

Calculating the Calibration Values

Boom and Section Calibration

Refer to the following sections for assistance with calculating the section widths for various implement types. Use the following formulas to help calculate the boom or implement section widths for either broadcast or band applications.


Meter Calibration

The flow meter calibration number may be found on the tag attached to each flow meter. Copy the information from the tag for future reference as the tags may fade or be lost during equipment operation.

Note: Refer to the Verifying Flow Rate Limits section on page 58 to verify that the desired flow rate is within the range specified for the installed flow meter.

Flow Meter Service and Maintenance

Periodic maintenance of the flow meter may help to extend the effective service life of the flow meter or internal components. If the flow meter does not register the applied product volume properly, the following steps will be necessary to service the flow meter:

	<p>WARNING</p> <p>Exposure to agricultural chemicals may be harmful or fatal. Thoroughly bleed and flush the application system lines prior to disassembling fittings, hoses and the flow meter.</p> <p>If the flow meter is used for applying anhydrous ammonia (NH₃), bleed the nurse tank hose and flush the system with water before maintaining the flow meter.</p>
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The following procedure should be performed more frequently if the flow meter is used with harsh chemicals or with anhydrous ammonia (NH₃).

1. Remove the flow meter from the application system and flush with clean water.

2. If necessary, dismantle the flow meter housing.
3. Remove the turbine hub and turbine from the flow meter.
4. Clean the turbine hub and turbine and remove any metal filings or other foreign materials such as wettable powders.
5. Check the turbine blades for wear or damage. Refer to the flow meter replacement parts sheet provided with the flow meter and replace the turbine as necessary.
6. While holding the turbine hub, spin the turbine. The turbine should spin freely with very little drag within the turbine hub. Refer to the flow meter replacement parts sheet provided with the flow meter and replace the turbine hub/turbine assembly as necessary.
7. Reassemble the flow meter.
8. Using a low pressure jet of air (approximately 5 PSI [34 kPa]), verify that the turbine still spins freely after reassembly. If the turbine drags or does not move, loosen the hex stud on the bottom of the turbine hub 1/16 turn until the turbine spins freely.
9. If the flow meter continues to provide inaccurate product volumes, refer to the *Flow Meter/Encoder Extension Cable* section on page 64.

Flow Meter Recalibration

The calibration value for the specific flow meter is printed on the tag attached to the flow meter and will typically provide accurate metering of product application. The following procedure may be used to check the meter calibration or recalibrate the flow meter.

Note: *Performing routine maintenance is recommended to help extend the service life and accuracy of the flow meter. Review the Flow Meter Service and Maintenance section on page 51 to service the flow meter as necessary.*

Before calibrating the flow meter

- Perform flow meter calibration with clean water only. Clean out the supply tank and flush the product lines with clean water. Refill the tank with clean water.
- Close or end any active jobs on the ROS device.
- Toggle all boom section switches and the master section switch to the off position.
- Disconnect one of the section product lines near the spray tips.
- Set a calibrated catch container (i.e. 5 gallon [19 L] bucket) and place the disconnected end of the product line in the container.

To recalibrate the flow meter



1. Touch the Edit icon in the Machine Panel.
2. Touch the Product Control button to access the control settings.
3. Select the Product Calibration tab.
4. Select the desired product control channel along the left side of the prompt to view settings for the appropriate control channel.
5. Select the Meter Cal value and use the on-screen keypad to enter a value of 10 [38].
6. Begin a job and access the tally registers information.

7. Enter a value of 0 for the total volume.
8. While monitoring the Total Volume on the screen and the container, toggle the master switch and the appropriate section switch to the on position.
9. Dispense exactly 10 gallons [38 L] through the flow meter as measured by the calibrated catch container.

Important: Do not rely on graduation markings/numbers molded into the applicator tank.

10. Toggle the section or master switch off.
11. Read the value displayed on the ROS device tally registers display. This value should be within $\pm 3\%$ of the meter cal value printed on the flow meter tag.
12. To confirm accuracy, reset the total volume to 0 and repeat the above process several times. Always 'zero out' the total volume display before toggling the section switch on.

Note: The above process is usually sufficient to check the flow meter calibration. For best results, set the meter cal value to 100 [378] and repeat the above procedure to dispense exactly 100 gallons [378 L] through the flow meter.

To verify the flow meter calibration

1. Fill the applicator tank with a predetermined volume of liquid (i.e. 250 gallons [946 L]).

Important: Do not rely on graduation markings/numbers molded into the applicator tank.

2. Begin a job and access the tally registers information.
3. Empty the applicator tank under normal operating conditions.
4. Return to the tally registers information displayed on the ROS device and read the new value. The total volume value should match the known volume ($\pm 3\%$) used to fill the applicator tank.
5. If the total volume value displayed differs from the known volume by greater than 3%, use the following formula

$$\frac{OMC \times V_m}{V_k} = CMC$$

Where OMC = the Original Meter Cal value used during the test, V_m = the Volume measured by the ROS device, V_k = the known Volume in the applicator tank and CMC = the Corrected Meter Cal.

For Example:

A set meter cal of 720 [190] is used to dispense 250 gallons [946 L] through the flow meter. At the end of the test, the ROS device displays a measured volume of 260 gallons [984 L]:

English	Metric
$\frac{720 \times 260}{250} = 749$	$\frac{[190] \times [984]}{[946]} = [198]$

Therefore, the corrected meter cal is 749 [198].

6. Enter the corrected meter cal value before resuming application.

Spreader Constant Calibration

There are two main methods for calculating the spreader constant using the calibration wizard. The option you choose will depend on the available equipment.

Weigh the Machine With and Without Product

This is the most common, especially when a truck scale is available. Follow the prompts in the Viper 4 calibration wizard to complete this process.

Weigh the Container Before and After Product is Dumped Into It

The container can be anything (cart, skid-loader with bucket, etc.) as long as it is weighed when empty and then weighed when full. An ideal container should be able to hold at least 500 lbs [227 kg], but 1000 lbs [454 kg] or more is preferred.

The calibration wizard will calculate the spreader constant regardless of which option you choose. When dumping product, it is recommended to measure at least 500 lbs [227 kg]. Measuring 1000 lbs [454 kg] or more will yield more accurate results.

To perform a Spreader Constant Calibration:

1. Press Edit, Product Control, Product Control Tab, and Calibration Wizard on the Viper 4.
2. Select the Next arrow.
3. Weigh the machine or container and enter that weight into the Start Weight.
4. Select Dump Product.
5. Turn the Master Switch on. The screen should start displaying the volume dumped. Use the up and down arrows to adjust the valve output to increase/decrease the application rate.
6. Dump approximately 500 lbs [227 kg]. Turn off the master switch when finished.
7. Select End Calibration.
8. Weigh the machine or container and enter the weight into the End Weight field.
9. Select Calculate.
10. Review the information on the screen then select Apply. The new spreader constant will be applied.
11. Repeat this process for each additional product channel/bin being controlled.

Valve Calibration

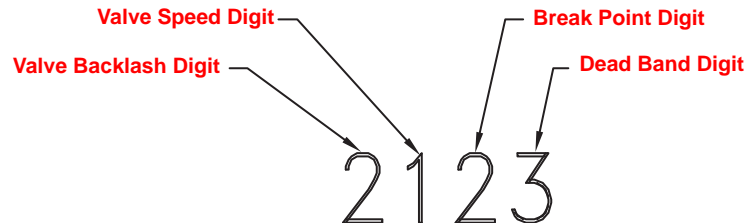
Note: *If the dual loop control feature is enabled, the valve cal value will be replaced by the flow cal value.*

To ensure that the proper amount of product is being applied, the valve cal must be programmed for the type of control valve(s) connected to the control system. The field computer uses the calibration number to adjust the response time of the control valve motor to changes in the vehicle speed.

The following control valve calibration numbers are recommended for the valves listed:

Control Valve Type	Valve Cal
Standard (C-SD)	2123
Fast (C-F) or Fast Close (C-FC)	743
PWM (C-P) or PWM Close (C-PC)	43

Each digit in the calibration number corresponds to a specific function of the valve. The following functions apply to the digits in the valve calibration number:



Valve Backlash Digit

This value controls the time of the first correction pulse after detecting a change in correction direction. The values range from 1 to 9, where 1 is for a short pulse and 9 is for a long pulse.

Note: *The backlash digit is not used with a fast, fast close, PWM, PWM close or standard motor control valve.*

Valve Speed Digit

This value controls the response time of the control valve motor. If the valve speed setting is too fast, the valve will over correct and the system can start to oscillate. The following valves have specific values:

- Standard Control Valve: This valve has a range of values from 1 to 9, with 1 being slow and 9 being fast.
- Fast and Fast Close Control Valve: These valves have a range of values from 0 to 9, with 0 for fast and 9 for slow.

Note: *The speed digit is not used with a PWM or PWM close valve.*

Brake Point Digit

The brake point digit sets the percent away from the target rate at which the control valve starts to turn at a slower rate so that it does not overshoot the target rate. The values range from 0 to 9, where 0 is a 5% rate, 1 is a 10% rate and 90 is a 90% rate.

Dead Band Digit

The dead band digit is the allowable difference between the target rate and the actual application rate. The values range from 1 to 9, where 1 equals 1% difference and 9 equals 9% of the difference.

Valve Cal 2

Note: *If the dual loop control feature is enabled, the valve cal 2 value will be replaced by the Sgain (pressure system gain) value.*

When a fast close valve is selected, the valve cal 2 value is utilized to enable a high resolution rate control for lower application rates.

Enter a non-zero value for the time, in milliseconds, which the valve will be fully opened before switching into high resolution control. For example, a value of 200 will give the valve a 200 millisecond “burst” at a full 12V to open the fast valve from the closed position before resuming product rate control. A zero value will disable this feature.

PWM Control Valve Calibration Settings

PWM and PWM close valves allow the option to modify the PWM settings.

Manual Calibration Mode

Allows the operator to manually enter the PWM minimum, maximum, and preset valves to known values.

Note: *The PWM valve cannot be operated in Manual Calibration mode. Verify that the changes to the settings have the desired effect before controlling product application.*

Calibration Assistant

Allows the operator to increase or decrease the PWM output using on-screen controls and set the PWM minimum, maximum, frequency, and preset values based on observed operation. To use the Calibration Assistant mode, toggle the vehicle’s master switch and at least one section switch on. To stop the PWM output at any time during the calibration process, toggle the vehicle master switch off.

Automatic Calibration

Allows the ROS device to automatically adjust the PWM output and determine the minimum, maximum, and preset values. To use the Automatic Calibration mode, toggle the vehicle’s master switch and at least one section switch on. To stop PWM output at any time during the calibration process, press “Cancel.”

Note: *The Automatic Calibration process may take up to two minutes to complete. Maintain sufficient engine RPM and set the remote hydraulic flow for at least 1 GOM [3.8 L/m] flow for each motor on the control system. The field computer will display a prompt when the calibration process is complete. If the system fails to calibrate properly, press “Re-Calibrate” to restart the calibration process.*

Dual Loop Control Mode Calibration Settings

Flow Cal

The flow cal value has two components which may be used to adjust the response of the application system.



Note: *It is recommended to set the pressure s-gain value prior to making any adjustments to the flow cal value.*

Flow System Gain. The first digit(s) of the flow cal correspond to a flow system gain between 1 and 99. The higher the flow system gain, the more aggressive the system will respond to changes in flow rate.

Note: *When entering a flow gain value from 1 to 9, it is not necessary to enter a zero in front of the value.*

If the system adjusts to rate control changes too slowly, increase the flow gain digit(s) to increase the system response rate. If the system overshoots or oscillates around the desired flow rate, decrease the flow gain digit(s) to help stabilize the system.

Dead Band Digit. The last, or right most, digit in the flow cal value is the dead band digit. The dead band digit is the allowable difference between the target rate and the actual application rate. The values range from 1 to 9, where 1 equals 1% difference and 9 equals 9% of the difference.

Pressure S-Gain (Pressure System Gain)

The default setting for the pressure s-gain value is 100. To adjust the system aggressiveness, enter a value between 1 and 999 as necessary.

Note: *It is recommended to increase or decrease the current value in increments of 10 or less when making adjustments to the pressure s-gain setting. If the new value does not produce significant or notable changes in the system response, increments of 20 may be used.*

Increase the pressure s-gain value if the observed product pressure increases too slowly or if the system takes a long time to reach a set standby pressure or rate input change. If the system is consistently over shooting a set standby pressure or oscillating around a target rate, decrease the pressure s-gain value until the system stabilizes.

Rate Calibration

The following information must be known in order to determine which spray nozzles to use with the sprayer.

- Nominal Application Pressure _____ PSI [kpa]
- Target Application Rate _____ GPA [lit/ha]
- Target Speed _____ MPH [km/h]
- Nozzle Spacing _____ inches [cm]

From this information, calculate the volume per minute per nozzle as follows:

$$NVPM = \frac{Rate \times Speed \times NS}{5,940[60,000]}$$

where NVPM = Nozzle Volume per Minute (Gallons/Acre or [lit/ha]), Rate = Target Application Rate and Speed = Target Speed of Application and NS = Nozzle Spacing.

For Example:

Application Pressure = 30 PSI, Target Application Rate = 20 GPA, Target Speed = 5.2 MPH and Nozzle Spacing = 20 inches

$$NVPM = \frac{20 \times 5.2 \times 20}{5,940} = 0.35$$

Using the calculated Nozzle Volume per Minute of 0.35 at an Application Pressure of 30, select a tip that is capable of these application specifications. Contact a local sprayer supply dealer for available nozzles or spray tips.

Verifying Flow Rate Limits

The target rate for a field application also must be within the specified range of the flow meter measuring flow rate for the control channel.

Flow Meter Model	Flow Range
RFM 5	0.1 - 5 GPM [0.2 - 18.9 L/min]
RFM 15	0.3 - 15 GPM [1.1 - 56.8 L/min]

Flow Meter Model	Flow Range
RFM 60P	1 - 60 GPM [3.8 - 210 L/min]
RFM 100	5 - 100 GPM [11.4 - 380 L/min]
RFM 200/ 200 Poly	15 - 200 GPM [56.8 - 760 L/min]
RFM 400	25 - 400 GPM [94.6 - 1515 L/min]

Additional Calibration Data

Although not required operation, the following values may be programmed to enhance feedback for the operator during field application.

Entering Tank Volume or Bin Level

The tank volume or bin level displayed on the field computer is the calculated estimate of the amount of product remaining in the tank or bin (not the capacity of the tank or bin). The volume or level must be reset when refilling product to allow the field computer to calculate the remaining volume during product application. To reset the tank volume or bin level:

1. Touch the Tank Volume or Bin Level button to display the tank or bin configuration prompt.
2. Touch the Tank or Bin Size button to access the Total Tank Size prompt.
3. Use the on-screen keypad to enter the volume or level of product normally used to fill the tank or bin.
4. Touch the Accept icon to save the entered volume. The entered value will be displayed in the Reset Tank or Reset Bin button.
5. When refilling the tank or bin, touch the reset button to reset the tank or bin level quickly.

Low Tank Alarm

The field computer may be set to display or sound or an alarm when the calculated volume of product remaining in the in the tank falls to a user defined level. To setup the Low Tank Alarm, refer to the *Alarm Settings Tab* section on page 19.

Reset Volume/Area Display Information

The current total area, total volume, field area, and field volume information is displayed as applied information that can be reset at any time. Refer to the *Tally Registers Widgets* section on page 46 to reset these display values.

Reset Display Distance

The current display distance, or odometer, registered by the field computer may be reset at any time. Refer to the *Tally Registers Widgets* section on page 46 for more information.

Tiered Boom Settings

A tiered boom configuration has two or more booms stacked - one directly in front of the other - and may or may not have different sets of nozzles capable of applying at different rates.

Note: *Specialized plumbing, cabling, and a relay box or product controller node are required to utilize a tiered boom configuration. Generally, sprayers are not setup for this feature from the factory.*

The boom tiers are connected to shut-off valves, which are controller by a CANbus product control node. This configuration allows the machine to control a much wider range of application rates than a standard, single boom configuration.

For example, a low application rate may be applied by turning on the first tier sections only. Higher application rates may be applied by switching to the second tier booms with larger nozzles. An even higher rate may be achieved by using both boom tiers in tandem.

Note: *The spray tips used on a tiered boom system must be extended range tips. In addition, the volume per minute of the second tier tips should not exceed 1.5 times the volume of the first tier's tips. The tier switching points should be set to 80% of the full flow volume for the boom tier tips.*

To access the Tiered Boom Settings screen:

1. Touch the Tool Menu icon on the Home Screen.
2. Select the Product Control icon from the System submenu.
3. Press the Calibration Settings button.
4. Select the Tiered Boom Settings.

Note: *The tiered boom feature is not available in a granular control mode. Be sure that the configuration screen is set to a control channel set to control a liquid product application.*

The following settings may be configured on the Tiered Boom Settings screen:

Tier 1 Max. Set the desired maximum rate applied through the first tier boom sections.

Tier 2 Max. Set the desired maximum rate applied through the second tier boom sections.

Percent Tier Disable. The Percent Tier Disable is used to determine the percentage of the maximum tier rate at which tiers are disabled as the required volume per minute decreases. Using a Percentage Tier Disable value allows the control valves to adjust to the target rate more quickly as the required rate decreases.

For Example:

A machine that has a tiered boom configuration with the following capabilities:

- Tier 1 Capacity up to 25 GPM [94.6 L/min]
- Tier 2 Capacity up to 38 GPM [143.8 L/min]

Using the given capacities, enter the following values as the Tiered Boom Settings:

- Tier 1 Max. = 25 GPM [94.6 L/min] x 0.8 = 20 GPM [94.6 L/min]
- Tier 2 Max. = 38 GPM [143.8 L/min] x 0.8 = 30 GPM [143.8 L/min]

Thus, as the volume per minute increases, the following tier switching should occur:

- 10 GPM [37.8 L/min] increasing 20 GPM [75.7 L/min] = only 1 tier enabled

-
- 20 GPM [75.7 L/min] increasing to 30 GPM [113.6 L/min] = only tier 2 enabled
 - 30 GPM [113.6 L/min] increasing the maximum flow rate = tier 1 and tier 2 enabled

Note: *Percent Tier Disable only affects tier switching when the required volume per minute is decreasing.*

As the rates being to decrease for maximum, the Percent Tier Disable value is figured in. Thus, using the Tier 2 Max of 30 GPM [113.6 L/min] previously calculated and with the Percent Tier Disable set to 10%, tier 1 and tier 2 will switch to only tier 2 when the target rate decreases to 27 GPM [102.2 L/min].

So, for rates in gallons per minute:

$$30 \text{ GPM} - (10\% \text{ of } 30 \text{ GPM}) = 30 \text{ GPM} - 3 \text{ GPM} = 27 \text{ GPM}$$

or for rates in liters per minute:

$$113.6 \text{ L/min} - (10\% \text{ of } 113.6 \text{ L/min}) = 113.6 \text{ L/min} - 11.3 \text{ L/min} = 102.3 \text{ L/min}$$

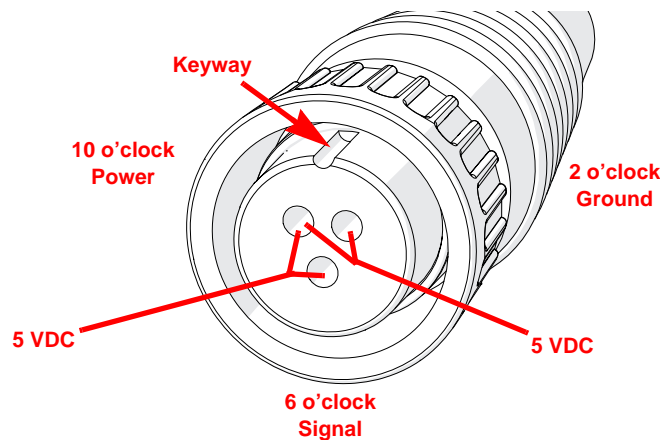
In operation, as the volume per minute decreases, the following boot tier switching should occur.

- Maximum flow rate decreasing to 27 GPM [102.2 L/min] = tier 1 and tier 2 enabled
- 27 GPM [102.2 L/min] decreasing to 18 GPM [68.1 L/min] = only tier 2 enabled
- 18 GPM [68.1 L/min] decreasing to 10 GPM [37.8 L/min] = only tier 1 enabled

Speed Sensor Extension Cable

Disconnect the extension cable from the speed sensor assembly cable. Hold the extension cable connector so that the keyway is pointing in the 12 o'clock position as shown below.

FIGURE 1. Speed Sensor Extension Cable Pin Diagram



Note: *If a radar type speed sensor is used, the voltage between the 10 o'clock and 2 o'clock positions may read 12V DC.*

If a 5V DC voltage reading is not present, disconnect the flow meter cable and re-test the speed sensor cable. If the voltage reads 5V DC when the flow meter cable is disconnected, test the flow meter cable per Testing the Flow Meter/Encoder Cable section on page 64.

Testing the Speed Sensor Extension Cable

1. Enter a speed cal of 9999.
2. Zero the ROS device odometer.
3. With a small jumper wire (or paper clip), short between the 10 o'clock and 6 o'clock sockets with a 'short-no-short' motion. Each time contact is made, the distance total should increase by increments of 1 or more.
4. If the distance total does not increase, remove the section of cable and repeat the test at the connector that is the next closest to the node. If the distance total now increases with the short-no-short test, replace the defective cable as required.

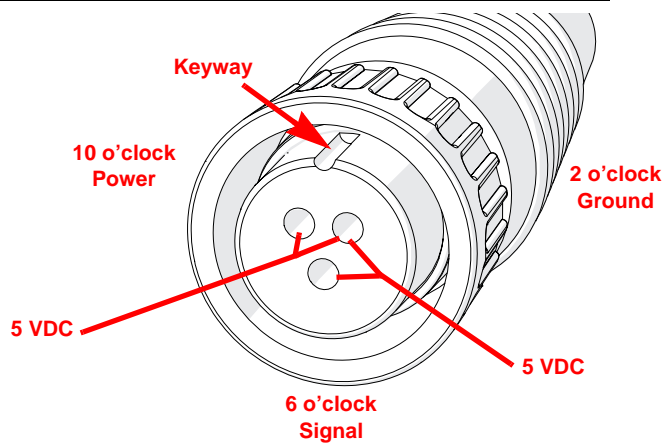
5. If no pulses are registered, perform the above voltage checks.
6. If all of the cables test 'good,' replace the speed sensor.

Note: After testing is complete, re-enter the correct speed cal before starting an application.

Flow Meter/Encoder Extension Cable

Before starting this test, disconnect the flow meter cable from the flow meter. Hold the flow meter cable so that the keyway is pointing in the 12 o'clock position as shown below.

FIGURE 2. Flow Meter Extension Cable Pin Diagram



Testing the Flow Meter/Encoder Cable

1. Enter a meter cal of 1 in liquid or direct injection modes, or density of 1 and spreader constant of 0 in granular mode.
2. Note the total volume for each product node connected to the CANbus.
3. Turn the boom and master switch On.
4. With a small jumper wire (or paper clip), short between the 2 o'clock and 6 o'clock sockets with a 'short-no-short' motion. Each time contact is made, the total volume number should increase by increments of 1 or more.
5. If the total volume value does not increase, remove the section of cable and repeat the test at the connector that is the next closest to the node. Replace the defective cable as required.
6. Verify the pin connection and voltage from the previous chart.
7. If all of the cables test 'good,' replace the rate sensor.

Note: After testing is complete, re-enter the correct cal values before starting an application.

RAVEN

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.