

R A V E N

Calibration & Operation Manual

Hawkeye™

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RAVEN

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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.

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Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.

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Calibration Reference Sheet

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

General Implement Information

| | | | | |
|------------------|------------|---------------|-----------------------|--|
| UNITS | US (Acres) | SI (Hectares) | Nozzle Spacing | |
| Speed Cal | | | Tip Size | |

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

Tank Fill Settings

| | | | |
|----------------------|--|------------------------|--|
| Meter Cal | | Meter Cal Units | |
| Tank Capacity | | Max. Pressure | |

Product Control Settings

| | | | |
|----------------------|--|------------------------|--|
| PWM Min. | | PWM Max. | |
| Meter Cal | | Meter Cal Units | |
| Response Rate | | Nozzle Minimum | |
| Deadband | | PWM Frequency | |

Pressure Settings

| | | | |
|----------------------|--|----------------------|--|
| Response Rate | | Min. Pressure | |
| Sensitivity | | Max. Pressure | |

Unit Definitions and Conversions

Unit of Measure Definitions

| Abbreviation | Definition | Abbreviation | Definition |
|--------------|-------------------------------|--------------|------------------------------|
| GPM | Gallons per Minute | dm | Decimeters |
| lit/min | Liters per Minute | m | Meter |
| dl/min | Deciliters per Minute | MPH | Miles per Hour |
| PSI | Pounds per Square Inch | km | Kilometers |
| kPa | Kilopascal | km/h | Kilometers per Hour |
| GPA | Gallons per Acre | US | Volume per Acre |
| lit/ha | Liters per Hectare | SI | Volume per Hectare |
| ml/ha | Milliliters per Hectare | TU | Volume per 1,000 Square Feet |
| GPK | Gallons per 1,000 Square Feet | [] | Metric Numbers |
| mm | Millimeters | lb/acre | Pounds per Acre |
| cm | Centimeters | kg/ha | Kilograms per Hectare |

Unit of Measure Conversions

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

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

| Liquid | Area |
|--------|------|
|--------|------|

- | | |
|---|--|
| <ul style="list-style-type: none"> • 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) | <ul style="list-style-type: none"> • 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 |
|---|--|

| Length | Pressure |
|--------|----------|
|--------|----------|

- | | |
|--|---|
| <ul style="list-style-type: none"> • 1 millimeter (mm) = 0.039 inches • 1 centimeter (cm) = 0.393 inches • 1 meter (m) = 3.281 feet • 1 kilometer (km) = 0.621 miles • 1 inch = 25.4 mm or 2.54 cm • 1 mile = 1.609 km | <ul style="list-style-type: none"> • 1 psi = 6.89 kPa • 1 kPa = 0.145 psi |
|--|---|

CHAPTER

1

Important Safety Information

NOTICE

Read this manual and the operation and safety instructions included with the implement and/or controller carefully before installing the Raven Hawkeye™ control system.

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

When operating the machine after installing the Raven Hawkeye control system, observe the following safety measures:

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

WARNING

Agricultural Chemical Safety

- Always follow safety labels and instructions provided by the chemical manufacturer or supplier.
- Always wear appropriate personal protective equipment as recommended by the chemical and/or equipment manufacturer.
- When storing unused agricultural chemicals:
 - Store agricultural chemicals in the original container and do not transfer chemicals to unmarked containers or containers used for food or drink.
 - Store chemicals in a secure, locked area away from human and livestock food.
 - Keep children away from chemical storage areas.

- Fill, flush, calibrate, and decontaminate chemical application systems in an area where runoff will not reach ponds, lakes, streams, livestock areas, gardens, or populated areas.
- Avoid inhaling chemical dust or spray particulate and avoid direct contact with any agricultural chemicals. Seek immediate medical attention if symptoms of illness occur during, or soon after, use of agricultural chemicals, products, or equipment.
- After handling or applying agricultural chemicals:
 - Thoroughly wash hands and face after using agricultural chemicals and before eating, drinking, or using the rest room.
 - Thoroughly flush or rinse equipment used to mix, transfer, or apply chemicals with water after use or before servicing any component of the application system.
- Follow all federal, state, and local regulations regarding the handling, use, and disposal of agricultural chemicals, products, and containers. Triple-rinse and puncture or crush empty containers before disposing of them properly. Contact a local environmental agency or recycling center for additional information.

CAUTION

Electrical Safety

- Always make sure that the power leads are connected to the correct polarity as marked. Reversing the lead wires could cause severe damage to electrical components and equipment.
- Ensure that the power cable is the last cable to be connected.
- Disconnect the Hawkeye nozzle control system from the vehicle battery before jump-starting the vehicle.
- Disconnect the Hawkeye nozzle control system from the vehicle battery before welding any component of the implement.

Thank you for purchasing the Raven Hawkeye™ nozzle control system. The Hawkeye control system is designed to provide PWM product rate and nozzle control via an ISOBUS virtual terminal (VT). Adding the Hawkeye control system to an existing ISOBUS product control system will allow a machine operator to monitor and control product application and nozzle control systems directly from the VT without additional displays, controllers, or consoles.

This document is intended to provide information regarding the following aspects of the Raven Hawkeye nozzle control system:

- Initial setup and navigation
- Calibration
- Operation
- Updating Hawkeye components

Note: *Prior to using the Hawkeye control features with any VT display, the Hawkeye electronic control unit (ECU) must be calibrated for the control system. Refer to Chapter 4, Initial Calibration, for assistance with completing the initial calibration wizard.*

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

Hawkeye™ Features

Pressure Nozzle Control

The Hawkeye nozzle control system provides the same spray pattern and coverage as conventional spray systems. Pressure based nozzle control allows the operator to control the droplet size during field applications to manage spray drift and allows the equipment to operate in higher winds. Better droplet control also provides more accurate field application and allows better rate control at lower target flow rates.

Turn Compensation

Conventional application systems provide a uniform rate across the boom or implement width. This functionality works well in large field areas with straight swaths to ensure even coverage during application.

But what if the field you are working is not square? What if the field you are working has numerous waterways, tree lines, terraces, or other obstacles that require the equipment operator to follow the curvature of the feature during application? When applying around curves and corners, traditional application systems do not compensate for the speed variance observed at the inner and outer ends of the boom or implement. The difference in coverage across the large and ever expanding sizes of application equipment on the market today can result in large areas of under or over application and will reduce the application efficiency, and negatively impact yields.

The turn compensation feature, standard with the Hawkeye nozzle control system, helps to ensure an even flow rate while applying around curves and corners, even when operating with the largest of application equipment sizes on the market. Hawkeye turn compensation automatically reduces or stops the flow rate of nozzles toward the inside of the curve, while increasing the flow rate at the outside, to help ensure an even, efficient application to address crop conditions, minimize crop damage, and ultimately improve yields.

Care and Use

Always follow equipment manufacturer's recommended maintenance procedures for storing equipment. The following maintenance procedures are generally recommended for storing equipment with the Hawkeye nozzle control system:

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

Note: Refer to Appendix C, *Maintenance and Replacement Parts*, for additional assistance with maintaining the Hawkeye nozzle control valves.

Updates

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

www.ravenhelp.com

The Raven Service Tool is required to perform software updates of the Hawkeye nozzle control system. Refer to the Raven Service Tool Operation manual for additional assistance with updating the Hawkeye nozzle control valves or the product controller II ECU.

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

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

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

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

techwriting@ravenind.com

- Hawkeye™ Nozzle Control Operation Manual
- Manual No. 016-0171-584 Rev. A
- Any comments or feedback (include chapter or page numbers if applicable).
- Let us know how long have you been using this or other Raven products.

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

Thank you for your time.

Technical Specifications

TABLE 1. Hawkeye Nozzle Control Valve Technical Specifications

| | | U.S. | Metric |
|----------------------|----------------------|---|----------------------|
| Dimensions | Height | 3.8 in. | 9.65 cm |
| | Width | 1.39 in. | 3.53 cm |
| | Depth | 1.35 in. | 3.43 cm |
| | Weight | approximately 7.1 oz. | approximately 0.2 kg |
| Power | Operating Voltage | 13.6 V DC nominal (10 V drop-out to 16 V spike tolerant) | |
| Input/Output | CAN | CANBUS 2.0 Compliant | |
| | Switched (In/Out) | 3V | |
| Environmental | Operating Conditions | -22° to 140° F | -30 to 60° C |
| | Storage Conditions | -40° to 158° F | -40° to 70° C |
| | Relative Humidity | 10 to 95% relative | |

Hawkeye Nozzle Control Valve Connection

FIGURE 1. Hawkeye Nozzle Control Valve Cable Connector

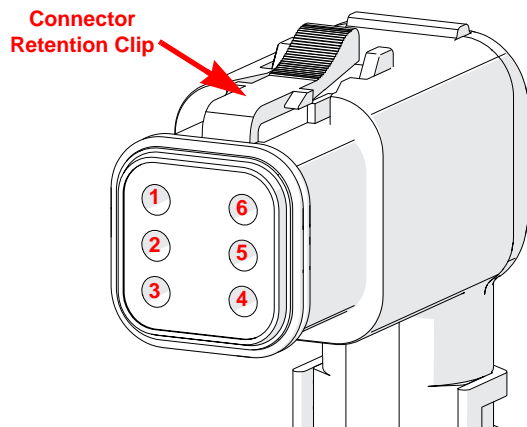


TABLE 2. Nozzle Control Valve Cable Connector Pins

| Pin | Description | Pin | Description |
|-----|---------------|-----|----------------|
| 1 | Chassis Power | 6 | Chassis Ground |
| 2 | CAN High | 5 | Switch In |
| 3 | Switch Out | 4 | CAN Low |

CHAPTER

3

*Avoiding Skips with
Hawkeye™ Nozzle
Control System*

Overview

The Hawkeye nozzle control system is designed to pulse each spray tip using an alternating pattern across the implement width. This alternating nozzle spray pattern relies upon an overlapping spray tip pattern and droplet dispersion to achieve complete and even coverage during field applications.

Recommendations for Hawkeye Nozzle Control Operation

Maintaining the following application system conditions will help to ensure consistent, even coverage during field applications using the Hawkeye nozzle control system:

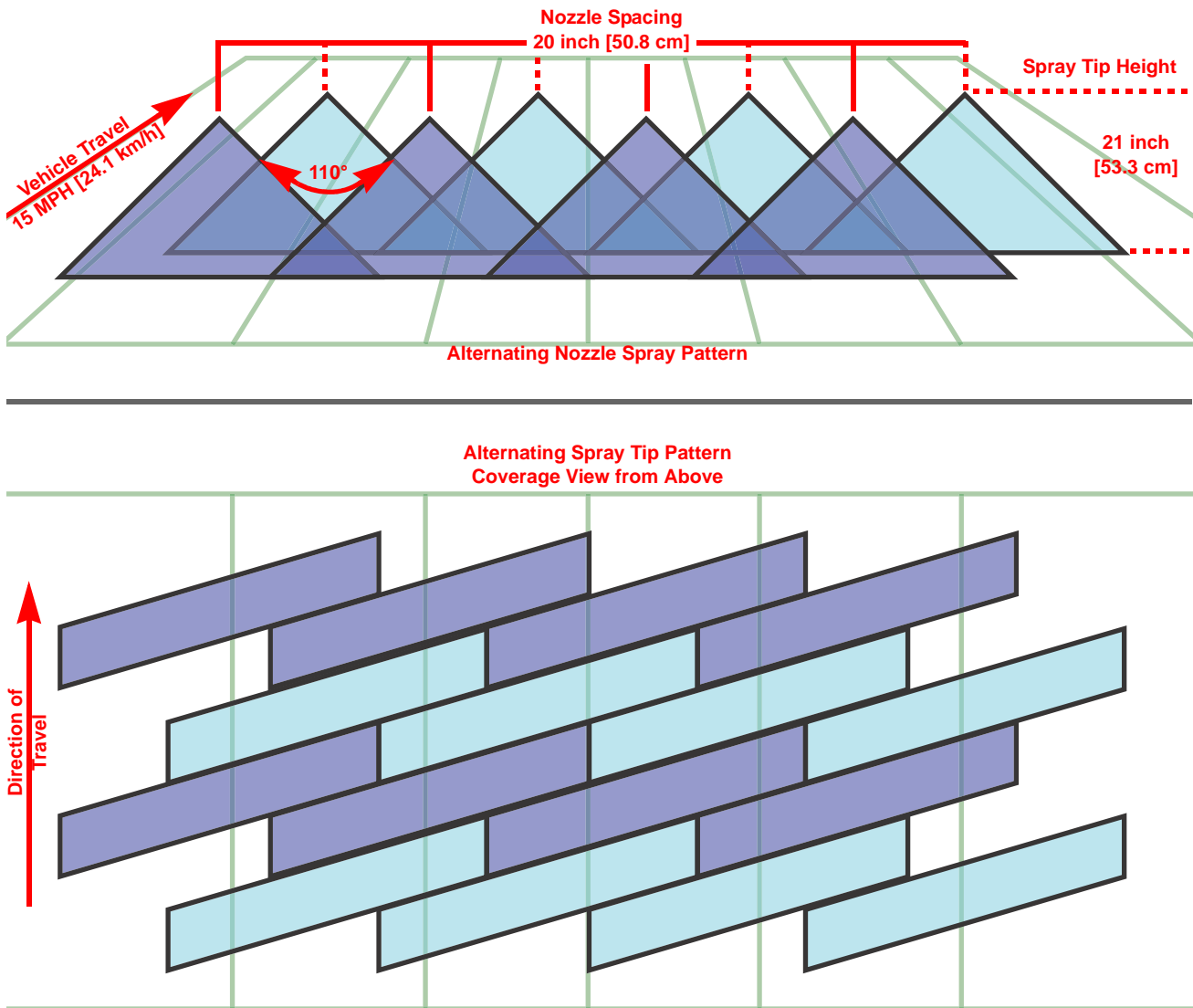
1. Use the appropriate tip size for the desired application speeds, target rates, and system pressures. Refer to the tables in the *Tip Selection and Application Speed Guide* section on page 11.
2. Use wide-angle spray tips and appropriate spray tip height to achieve approximately 150% pattern overlap.
 - a. When using 80° spray tips, maintain a tip height of 36 inches [91.4 cm] or higher.
 - b. When using 110° spray tips, maintain a tip height of 21 inches [53.3 cm] or higher.
3. Maintain a system pressure sufficient to fully develop the intended tip spray pattern.
4. Avoid nozzle control valve duty cycles below 25%.
 - a. Avoid application speeds in the bottom 1/3 of the recommended speed range.
 - b. Avoid target flow rates in the bottom 1/3 of the recommended application rate range for each spray tip.

For Example:

Consistent and even field coverage should result under the following application conditions:

- applicator with 20 inch [50.8 cm] nozzle spacing
- 110° fan spray tips at 50 PSI [344.7 kPa]
- application speed of 15 mph [24.1 km/h]
- spray tip height of 21 inches [53.3 cm]

FIGURE 1. Alternating Spray Pattern and Even Area Coverage



Note: *In Automatic control mode, the Hawkeye nozzle control system will adjust the system to maintain the optimal application coverage within the operational ranges provided in the Tip Selection and Application Speed Guide section on page 11.*

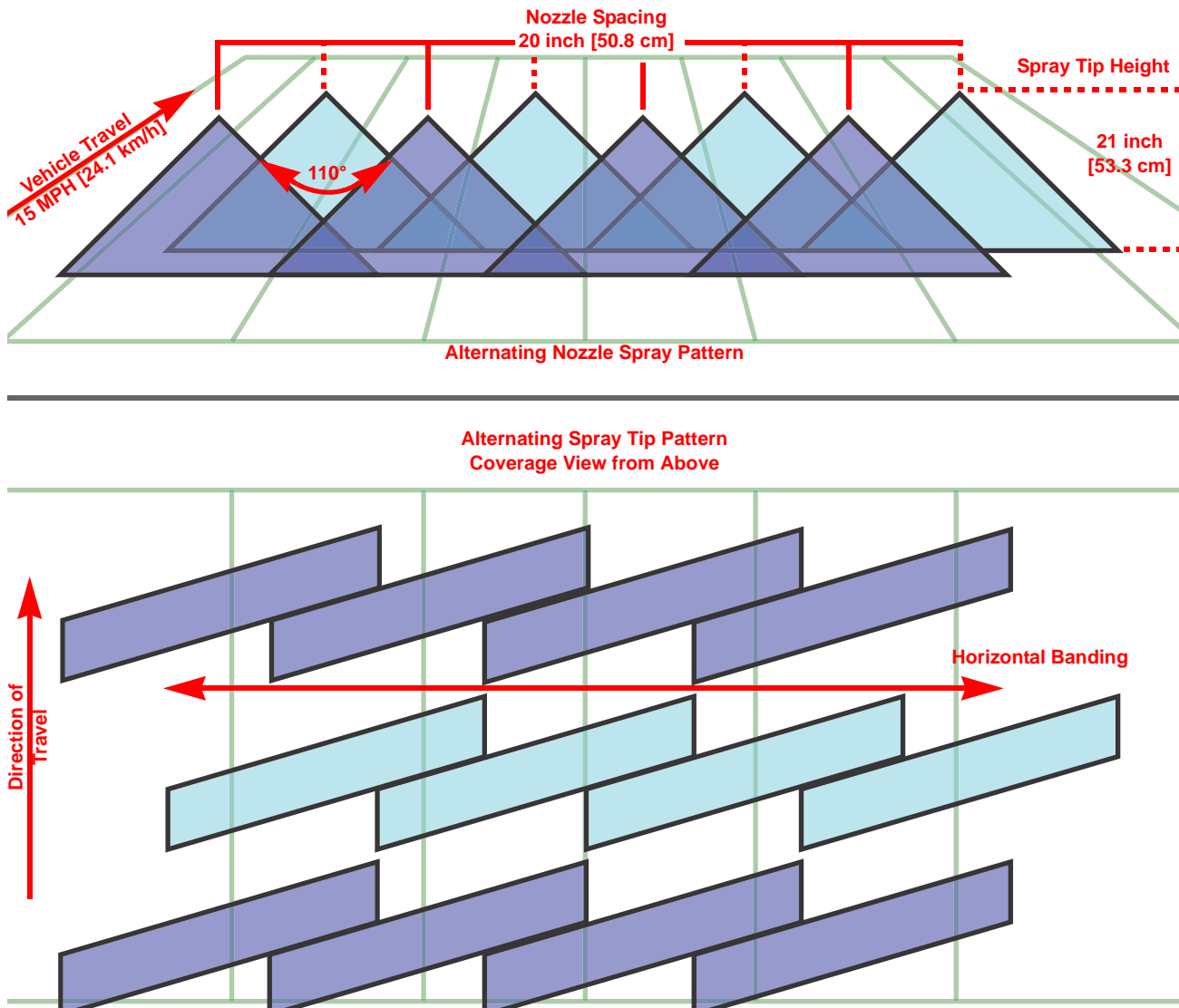
Causes of Skips using Hawkeye Nozzle Control

Operating the Hawkeye nozzle control system at or outside of the recommended operational ranges may result in under-application or banding.

For Example:

Under-application or horizontal banding may be observed if the operator from the previous example were to toggle the application mode from Automatic to Manual and then increase the application speed from 15 mph [24.1 km/h] to 22 mph [35.4 km/h] without manually increasing the nozzle control valve duty cycle.

FIGURE 2. Conditions Resulting in Under-Application and Horizontal Banding



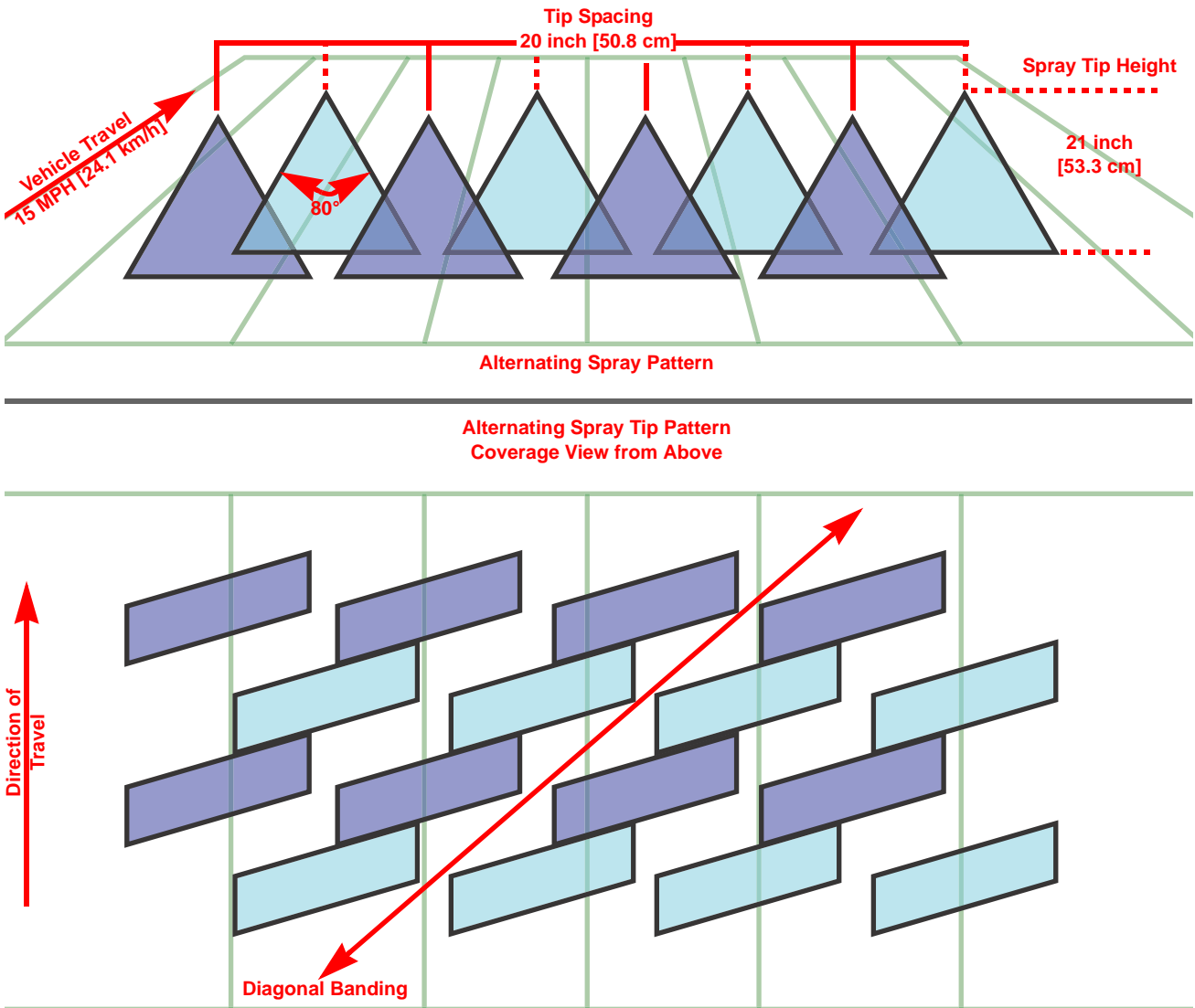
For Example:

Under-application with diagonal banding may be observed if the following modification to the initial example are made:

- Using 80° fan spray tips at a height of 21 inches [53.3 cm].
- Boom pressure is too low resulting in the nozzle tip not being able to achieve full spray pattern.

Note: Refer to Recommendations for Hawkeye Nozzle Control Operation section on page 7 and recall the recommended spray height for 80° spray tips. Refer to Tip Selection and Application Speed Guide section on page 11 for boom and spray tip pressure recommendations.

FIGURE 3. Conditions Resulting in Under Application and Diagonal Banding



Tip Selection and Application Speed Guide

Drift Control

The table below shows the drift control specifications for different nozzle manufacturers. Use this information when selecting the appropriate nozzles for your application.

TABLE 1. Nozzle Drift Control by Manufacturer.

| Tip Info | PSI | Wilger (www.wilger.net) | | | | TeeJet (www.teejet.com) | | | Hypro (www.hypropumps.com) | | | | | | |
|--------------|-------|----------------------------|-----|-----|-----|----------------------------|---------|-------|-------------------------------|-----|-----|-----|-----|-----|-----|
| | | ER | SR | MR | DR | XR/XRC | TT/2XTT | TTJ60 | TR | F | VP | AXI | GRD | LD | VPt |
| Orifice Size | Gauge | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 120 | 110 | 110 |
| 03 | 20 | M | - | C | - | M | VC | VC | M | - | M | M | M | C | M |
| | 30 | M | C | VC | XC | F | C | C | M | M | F | M | M | C | F |
| | 40 | F | C | VC | XC | F | C | C | F | F | F | M | M | M | F |
| | 50 | F | C | C | VC | F | M | C | F | F | F | F | M | M | F |
| | 60 | F | C | C | VC | F | M | C | F | F | F | F | M | M | F |
| 04 | 20 | C | - | - | - | M | VC | VC | M | - | M | M | C | C | M |
| | 30 | C | C | VC | XC | M | C | C | M | M | M | M | C | C | M |
| | 40 | M | C | VC | XC | M | C | C | F | M | F | M | C | M | F |
| | 50 | M | C | C | XC | F | M | C | F | F | F | M | M | M | F |
| | 60 | M | C | C | VC | F | M | C | F | F | F | M | M | M | F |
| 05 | 20 | C | - | - | - | M | VC | VC | C | - | M | M | C | C | M |
| | 30 | C | VC | XC | XC | M | VC | C | M | M | M | M | C | C | M |
| | 40 | M | C | XC | XC | M | C | C | F | M | F | M | C | C | F |
| | 50 | M | C | VC | XC | F | C | C | F | M | F | M | M | M | F |
| | 60 | M | C | VC | XC | F | M | C | F | M | F | M | M | M | F |
| 06 | 20 | C | - | - | - | M | VC | XC | C | - | M | C | VC | VC | M |
| | 30 | C | VC | XC | XC | M | VC | VC | C | M | M | M | C | C | M |
| | 40 | C | VC | XC | XC | M | VC | C | M | M | M | M | C | C | M |
| | 50 | C | C | XC | XC | M | C | C | M | M | F | M | C | C | F |
| | 60 | C | C | VC | XC | F | C | C | M | M | F | M | C | C | F |
| 08 | 20 | C | - | - | - | C | VC | - | C | - | C | - | VC | VC | - |
| | 30 | C | XC | XC | XC | C | VC | - | C | C | M | - | C | C | - |
| | 40 | C | VC | XC | XC | M | C | - | M | C | M | - | C | C | - |
| | 50 | C | VC | XC | XC | M | C | - | M | C | M | - | C | C | - |
| | 60 | C | C | VC | XC | M | C | - | M | C | M | - | C | C | - |
| 10 | 30 | C | XC | XC | UC | C | - | - | C | C | C | - | - | - | - |
| | 40 | C | VC | XC | UC | M | - | - | M | C | M | - | - | - | - |
| | 50 | C | VC | XC | XC | M | - | - | M | C | M | - | - | - | - |
| | 60 | C | VC | VC | XC | M | - | - | M | C | M | - | - | - | - |

| | | | | | | | | | | | | | | | |
|------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 12.5 | 40 | XC | VC | XC | XC | - | - | - | - | - | - | - | - | - | - |
| | 50 | XC | VC | XC | XC | - | - | - | - | - | - | - | - | - | - |
| | 60 | VC | VC | XC | XC | - | - | - | - | - | - | - | - | - | - |
| 15 | 40 | XC | XC | XC | XC | C | - | - | C | C | C | - | - | - | - |
| | 50 | XC | XC | XC | XC | C | - | - | C | C | C | - | - | - | - |
| | 60 | VC | XC | XC | XC | C | - | - | M | C | M | - | - | - | - |

Drift Control Table Key

Refer to this key while using the drift control table:

TABLE 2.

| Drift Category | Symbol and Color |
|------------------|------------------|
| Very Fine | VF |
| Fine | F |
| Medium | M |
| Coarse | C |
| Very Coarse | VC |
| Extremely Coarse | XC |
| Ultra Course | UC |

Application Speed Guide

The ranges for speed and flow rate provided in this section are for reference purposes only. Observed ranges may vary depending upon application system plumbing and hardware. It is recommended to avoid operating at, or close to, the upper and lower limits of the speed or flow rate ranges shown for each spray tip.

Standard Style Nozzle Bodies

TABLE 3. Speed Table for Standard (Straight) Style Nozzle Bodies (Imperial)

| Tip Size | Flow (US G.P.M.) | Pressure (PSI) | | Speed Range (MPH) | | | | | | | | | | | |
|----------|------------------|----------------|------|-------------------|------|-------|------|-------|------|--------|-----|--------|-----|--------|-----|
| | | Boom | Tip | 3 GPA | | 5 GPA | | 8 GPA | | 10 GPA | | 15 GPA | | 20 GPA | |
| 015 | 0.107 | 20.0 | 19.8 | 5.4 | 10.6 | 3.2 | 6.3 | 2.0 | 4.0 | 1.6 | 3.2 | 1.1 | 2.1 | 0.8 | 1.6 |
| | 0.131 | 30.0 | 29.8 | 6.0 | 12.9 | 3.6 | 7.8 | 2.2 | 4.8 | 1.8 | 3.9 | 1.2 | 2.6 | 0.9 | 1.9 |
| | 0.151 | 40.0 | 39.7 | 6.5 | 14.9 | 3.9 | 9.0 | 2.4 | 5.6 | 1.9 | 4.5 | 1.3 | 3.0 | 1.0 | 2.2 |
| | 0.169 | 50.0 | 49.6 | 6.9 | 16.7 | 4.1 | 10.0 | 2.6 | 6.3 | 2.1 | 5.0 | 1.4 | 3.3 | 1.0 | 2.5 |
| | 0.185 | 60.0 | 59.5 | - | - | 4.4 | 11.0 | 2.7 | 6.9 | 2.2 | 5.5 | 1.5 | 3.7 | 1.1 | 2.7 |
| 02 | 0.139 | 20.0 | 19.7 | 6.2 | 13.7 | 3.7 | 8.2 | 2.3 | 5.1 | 1.8 | 4.1 | 1.2 | 2.7 | 0.9 | 2.1 |
| | 0.170 | 30.0 | 29.6 | 6.9 | 16.8 | 4.2 | 10.1 | 2.6 | 6.3 | 2.1 | 5.0 | 1.4 | 3.4 | 1.0 | 2.5 |
| | 0.196 | 40.0 | 39.5 | - | - | 4.5 | 11.7 | 2.8 | 7.3 | 2.3 | 5.8 | 1.5 | 3.9 | 1.1 | 2.9 |
| | 0.219 | 50.0 | 49.3 | - | - | 4.9 | 13.0 | 3.1 | 8.1 | 2.4 | 6.5 | 1.6 | 4.3 | 1.2 | 3.3 |
| | 0.240 | 60.0 | 59.2 | - | - | 5.2 | 14.3 | 3.3 | 8.9 | 2.6 | 7.1 | 1.7 | 4.8 | 1.3 | 3.6 |
| 025 | 0.176 | 20.0 | 19.6 | - | - | 4.2 | 10.4 | 2.7 | 6.5 | 2.1 | 5.2 | 1.4 | 3.5 | 1.1 | 2.6 |
| | 0.215 | 30.0 | 29.3 | - | - | 4.8 | 12.8 | 3.0 | 8.0 | 2.4 | 6.4 | 1.6 | 4.3 | 1.2 | 3.2 |
| | 0.248 | 40.0 | 39.1 | - | - | 5.3 | 14.8 | 3.3 | 9.2 | 2.7 | 7.4 | 1.8 | 4.9 | 1.3 | 3.7 |
| | 0.278 | 50.0 | 48.9 | - | - | 5.8 | 16.5 | 3.6 | 10.3 | 2.9 | 8.2 | 1.9 | 5.5 | 1.4 | 4.1 |
| | 0.304 | 60.0 | 58.7 | - | - | 6.2 | 18.1 | 3.8 | 11.3 | 3.1 | 9.0 | 2.1 | 6.0 | 1.5 | 4.5 |

| Tip Size | Flow (US G.P.M.) | Pressure (PSI) | | Speed Range (MPH) | | | | | | | | | | | |
|----------|------------------|----------------|------|-------------------|---|-------|------|-------|------|--------|------|--------|------|--------|------|
| | | Boom | Tip | 3 GPA | | 5 GPA | | 8 GPA | | 10 GPA | | 15 GPA | | 20 GPA | |
| 03 | .209 | 20.0 | 19.4 | - | - | 4.7 | 12.4 | 3.0 | 7.7 | 2.4 | 6.2 | 1.6 | 4.1 | 1.2 | 3.1 |
| | .255 | 30.0 | 29.1 | - | - | 5.4 | 15.2 | 3.4 | 9.5 | 2.7 | 7.6 | 1.8 | 5.1 | 1.4 | 3.8 |
| | .295 | 40.0 | 38.8 | - | - | 6.0 | 17.5 | 3.8 | 11.0 | 3.0 | 8.8 | 2.0 | 5.8 | 1.5 | 4.4 |
| | .330 | 50.0 | 48.5 | - | - | 6.35 | 19.6 | 4.1 | 12.2 | 3.3 | 9.8 | 2.2 | 6.5 | 1.6 | 4.9 |
| | .361 | 60.0 | 58.2 | - | - | 7.0 | 21.5 | 4.4 | 13.4 | 3.5 | 10.7 | 2.3 | 7.2 | 1.7 | 5.4 |
| 04 | .275 | 20.0 | 19.0 | - | - | 5.7 | 16.3 | 3.6 | 10.2 | 2.9 | 8.2 | 1.9 | 5.4 | 1.4 | 4.1 |
| | .337 | 30.0 | 28.5 | - | - | 6.6 | 20.0 | 4.1 | 12.5 | 3.3 | 10.0 | 2.2 | 6.7 | 1.7 | 5.0 |
| | .389 | 40.0 | 38.0 | - | - | - | - | 4.6 | 14.4 | 3.7 | 11.5 | 2.5 | 7.7 | 1.9 | 5.8 |
| | .435 | 50.0 | 47.5 | - | - | - | - | 5.1 | 16.1 | 4.0 | 12.9 | 2.7 | 8.6 | 2.0 | 6.5 |
| | .476 | 60.0 | 57.0 | - | - | - | - | 5.4 | 17.7 | 4.4 | 14.1 | 2.9 | 9.4 | 2.2 | 7.1 |
| 05 | .338 | 20.0 | 18.5 | - | - | 6.7 | 20.1 | 4.2 | 12.6 | 3.3 | 10.1 | 2.2 | 6.7 | 1.7 | 5.0 |
| | .415 | 30.0 | 27.8 | - | - | - | - | 4.9 | 15.4 | 3.9 | 12.3 | 2.6 | 8.2 | 1.9 | 6.2 |
| | .479 | 40.0 | 37.0 | - | - | - | - | 5.5 | 17.8 | 4.4 | 14.2 | 2.9 | 9.5 | 2.2 | 7.1 |
| | .535 | 50.0 | 46.3 | - | - | - | - | 6.0 | 19.9 | 4.8 | 15.9 | 3.2 | 10.6 | 2.4 | 7.9 |
| | .586 | 60.0 | 55.5 | - | - | - | - | 6.5 | 21.8 | 5.2 | 17.4 | 3.4 | 11.6 | 2.6 | 8.7 |
| 06 | .399 | 20.0 | 18.0 | - | - | - | - | 4.7 | 14.8 | 3.8 | 11.9 | 2.5 | 7.9 | 1.9 | 5.9 |
| | .489 | 30.0 | 27.0 | - | - | - | - | 5.6 | 18.1 | 4.4 | 14.5 | 3.0 | 9.7 | 2.2 | 7.3 |
| | .564 | 40.0 | 36.0 | - | - | - | - | 6.3 | 21.0 | 5.0 | 16.8 | 3.3 | 11.2 | 2.5 | 8.4 |
| | .631 | 50.0 | 44.9 | - | - | - | - | 6.9 | 23.4 | 5.5 | 18.7 | 3.7 | 12.5 | 2.8 | 9.4 |
| | .691 | 60.0 | 53.9 | - | - | - | - | - | - | 5.9 | 20.5 | 4.0 | 13.7 | 3.0 | 10.3 |
| 08 | .511 | 20.0 | 16.9 | - | - | - | - | 5.8 | 19.0 | 4.6 | 15.2 | 3.1 | 10.1 | 2.3 | 7.6 |
| | .626 | 30.0 | 25.3 | - | - | - | - | 6.8 | 23.2 | 5.5 | 18.6 | 3.6 | 12.4 | 2.7 | 9.3 |
| | .723 | 40.0 | 33.8 | - | - | - | - | - | - | 6.2 | 21.5 | 4.1 | 14.3 | 3.1 | 10.7 |
| | .808 | 50.0 | 42.2 | - | - | - | - | - | - | 6.8 | 24.0 | 4.5 | 16.0 | 3.4 | 12.0 |
| | .885 | 60.0 | 50.7 | - | - | - | - | - | - | - | - | 4.9 | 17.5 | 3.7 | 13.1 |
| 10 | .745 | 30.0 | 23.8 | - | - | - | - | - | - | 6.3 | 22.1 | 4.2 | 14.7 | 3.2 | 11.1 |
| | .860 | 40.0 | 31.7 | - | - | - | - | - | - | - | - | 4.8 | 17.0 | 3.6 | 12.8 |
| | .962 | 50.0 | 39.7 | - | - | - | - | - | - | - | - | 5.3 | 19.0 | 4.0 | 14.3 |
| | 1.053 | 60.0 | 47.6 | - | - | - | - | - | - | - | - | 5.8 | 20.9 | 4.3 | 15.6 |
| 12.5 | .869 | 30.0 | 22.1 | - | - | - | - | - | - | - | - | 4.8 | 17.2 | 3.6 | 12.9 |
| | 1.003 | 40.0 | 29.5 | - | - | - | - | - | - | - | - | 5.5 | 19.9 | 4.1 | 14.9 |
| | 1.121 | 50.0 | 36.9 | - | - | - | - | - | - | - | - | 6.1 | 22.2 | 4.6 | 16.7 |
| | 1.228 | 60.0 | 44.3 | - | - | - | - | - | - | - | - | 6.6 | 24.3 | 5.0 | 18.2 |
| 15 | .970 | 30.0 | 20.8 | - | - | - | - | - | - | - | - | 5.3 | 19.2 | 4.0 | 14.4 |
| | 1.120 | 40.0 | 27.7 | - | - | - | - | - | - | - | - | 6.1 | 22.2 | 4.6 | 16.6 |
| | 1.252 | 50.0 | 34.7 | - | - | - | - | - | - | - | - | 6.7 | 24.8 | 5.1 | 18.6 |
| | 1.372 | 60.0 | 41.6 | - | - | - | - | - | - | - | - | - | - | 5.5 | 20.4 |
| 20 | 1.115 | 30.0 | 18.9 | - | - | - | - | - | - | - | - | 6.1 | 22.1 | 4.5 | 16.6 |
| | 1.288 | 40.0 | 25.2 | - | - | - | - | - | - | - | - | 6.9 | 25.5 | 5.2 | 19.1 |
| | 1.440 | 50.0 | 31.5 | - | - | - | - | - | - | - | - | - | - | 5.8 | 21.4 |
| | 1.577 | 60 | 37.9 | - | - | - | - | - | - | - | - | - | - | 6.3 | 23.4 |

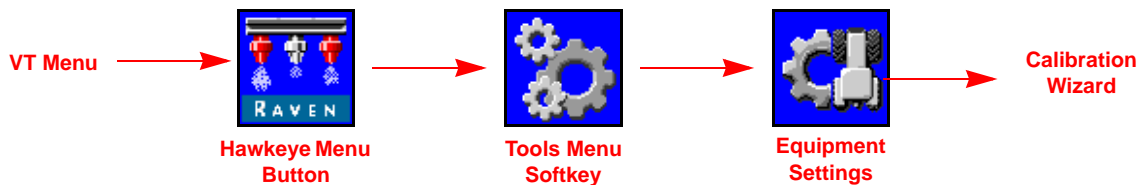
TABLE 4. Speed Table for Standard (Straight) Style Nozzle Bodies (Metric)

| Tip Size | Flow (L/m) | Pressure (kPa) | | Speed Range (km/h) | | | | | | | | | | | |
|----------|------------|----------------|-----|--------------------|--|---------|------|---------|------|----------|-----|----------|-----|----------|-----|
| | | Boom | Tip | 30 L/ha | | 50 L/ha | | 75 L/ha | | 100 L/ha | | 150 L/ha | | 175 L/ha | |
| 015 | 0.41 | 140 | 139 | 8.1 | | 4.9 | 9.6 | 3.2 | 6.4 | 2.4 | 6.7 | 1.6 | 3.2 | 1.4 | 2.7 |
| | 0.49 | 200 | 198 | 8.9 | | 5.3 | 11.5 | 3.6 | 7.7 | 2.7 | 5.7 | 1.8 | 3.8 | 1.5 | 3.3 |
| | 0.57 | 275 | 273 | 9.7 | | 5.8 | 13.5 | 3.9 | 9.0 | 2.9 | 6.7 | 1.9 | 4.5 | 1.7 | 3.8 |
| | 0.64 | 350 | 348 | 10.4 | | 6.3 | 15.2 | 4.2 | 10.1 | 3.1 | 7.6 | 2.1 | 5.1 | 1.8 | 4.3 |
| | 0.69 | 400 | 397 | 10.9 | | 6.5 | 16.2 | 4.3 | 10.8 | 3.3 | 8.1 | 2.2 | 5.4 | 1.9 | 4.6 |

| Tip Size | Flow (L/m) | Pressure (kPa) | | Speed Range (km/h) | | | | | | | | | | | |
|----------|------------|----------------|-----|--------------------|------|---------|------|---------|------|----------|------|----------|------|----------|------|
| | | Boom | Tip | 30 L/ha | | 50 L/ha | | 75 L/ha | | 100 L/ha | | 150 L/ha | | 175 L/ha | |
| | | | | | | | | | | | | | | | |
| 02 | 0.53 | 140 | 138 | 9.3 | | 5.6 | 12.5 | 3.7 | 8.3 | 2.8 | 6.2 | 1.9 | 4.2 | 1.6 | 3.6 |
| | 0.63 | 200 | 197 | 10.3 | | 6.2 | 14.9 | 4.1 | 10.0 | 3.1 | 7.5 | 2.1 | 5.0 | 1.8 | 4.3 |
| | 0.74 | 275 | 271 | 11.4 | | 6.8 | 17.5 | 4.6 | 11.7 | 3.4 | 8.8 | 2.3 | 5.8 | 2.0 | 5.0 |
| | 0.84 | 350 | 346 | - | - | 7.4 | 19.7 | 4.9 | 13.2 | 3.7 | 9.9 | 2.5 | 6.6 | 2.1 | 5.6 |
| | 0.90 | 400 | 394 | - | - | 7.7 | 21.1 | 5.2 | 14.1 | 3.9 | 10.6 | 2.6 | 7.0 | 2.2 | 6.0 |
| 025 | 0.67 | 140 | 137 | 10.7 | | 6.4 | 15.8 | 4.3 | 10.5 | 3.2 | 7.9 | 2.1 | 5.3 | 1.8 | 4.5 |
| | 0.80 | 200 | 195 | 12.0 | | 7.2 | 18.9 | 4.8 | 12.6 | 3.6 | 9.4 | 2.4 | 6.3 | 2.1 | 5.4 |
| | 0.94 | 275 | 269 | - | - | 8.0 | 22.2 | 5.3 | 14.8 | 4.0 | 11.1 | 2.7 | 7.4 | 2.3 | 6.3 |
| | 1.06 | 250 | 343 | - | - | 8.7 | 25.0 | 5.8 | 16.7 | 4.4 | 12.5 | 2.9 | 8.3 | 2.5 | 7.1 |
| | 1.13 | 400 | 391 | - | - | 9.1 | 26.7 | 6.1 | 17.8 | 4.6 | 13.4 | 3.0 | 8.9 | 2.6 | 7.6 |
| 03 | .80 | 140 | 136 | 11.9 | 31.3 | 7.1 | 18.8 | 4.8 | 12.5 | 3.6 | 9.4 | 2.4 | 6.3 | 2.0 | 5.4 |
| | .95 | 200 | 194 | - | - | 8.1 | 22.4 | 5.4 | 15.0 | 4.0 | 11.2 | 2.7 | 7.5 | 2.3 | 6.4 |
| | 1.12 | 275 | 267 | - | - | 9.0 | 26.3 | 6.0 | 17.5 | 4.5 | 13.2 | 3.0 | 8.8 | 2.6 | 7.5 |
| | 1.26 | 350 | 339 | - | - | 9.9 | 29.7 | 6.6 | 19.8 | 4.0 | 14.8 | 3.3 | 9.9 | 2.8 | 8.5 |
| | 1.35 | 400 | 388 | - | - | 10.4 | 31.7 | 6.9 | 21.2 | 5.2 | 15.9 | 3.5 | 10.6 | 3.0 | 9.1 |
| 04 | 1.05 | 140 | 133 | - | 41.2 | 8.6 | 24.7 | 5.8 | 16.5 | 4.3 | 12.4 | 2.9 | 8.2 | 2.5 | 7.1 |
| | 1.25 | 200 | 190 | - | - | 9.8 | 29.6 | 6.6 | 19.7 | 4.9 | 14.8 | 3.3 | 9.9 | 2.8 | 8.4 |
| | 1.47 | 275 | 261 | - | - | 11.1 | 34.7 | 7.4 | 23.1 | 5.6 | 17.3 | 3.7 | 11.6 | 3.2 | 9.9 |
| | 1.66 | 350 | 332 | - | - | - | - | 8.2 | 26.1 | 6.1 | 19.6 | 4.1 | 13.0 | 3.5 | 11.2 |
| | 1.77 | 400 | 379 | - | - | - | - | 8.6 | 27.9 | 6.5 | 20.9 | 4.3 | 13. | 3.7 | 11.9 |
| 05 | 1.29 | 140 | 130 | - | - | 10.1 | 30.5 | 6.7 | 20.3 | 5.0 | 15.2 | 3.4 | 10.2 | 2. | 8.7 |
| | 1.54 | 200 | 185 | - | - | 11.6 | 36.4 | 7.7 | 24.3 | 5.8 | 18.2 | 3.9 | 12.1 | 3.3 | 10.4 |
| | 1.81 | 275 | 255 | - | - | - | - | 8.8 | 28.5 | 6.6 | 21.3 | 4.4 | 14.2 | 3.8 | 12.2 |
| | 2.04 | 350 | 324 | - | - | - | - | 9.7 | 32.1 | 7.2 | 24.1 | 4.8 | 16.1 | 4.1 | 13.8 |
| | 2.18 | 400 | 369 | - | - | - | - | 10.2 | 34.3 | 7.7 | 25.7 | 5.1 | 17.2 | 4.4 | 14.7 |
| 06 | 1.51 | 140 | 126 | - | - | 11.4 | 35.9 | 7.6 | 24.0 | 5.7 | 18.0 | 3.8 | 12.0 | 3.3 | 10.3 |
| | 1.82 | 200 | 179 | - | - | - | - | 8.8 | 28.6 | 6.6 | 21.5 | 4.4 | 14.3 | 3.8 | 12.3 |
| | 2.14 | 275 | 247 | - | - | - | - | 10.0 | 33.6 | 7.5 | 25.2 | 5.0 | 16.8 | 4.3 | 14.4 |
| | 2.41 | 350 | 315 | - | - | - | - | 11.1 | 37.9 | 8.3 | 28.4 | 5.6 | 18.9 | 4.8 | 16.2 |
| | 2.58 | 400 | 358 | - | - | - | - | 11.8 | 40.5 | 8.8 | 30.4 | 5.9 | 20.2 | 5.0 | 17.4 |
| 08 | 1.95 | 140 | 119 | - | - | - | - | 9.3 | 30.7 | 7.0 | 23.0 | 4.7 | 15.3 | 4.0 | 13.1 |
| | 2.33 | 200 | 168 | - | - | - | - | 10.8 | 36.7 | 8.1 | 27.5 | 5.4 | 18.3 | 4.6 | 15.7 |
| | 2.74 | 275 | 232 | - | - | - | - | - | - | 9.3 | 32.2 | 6.2 | 21.5 | 5.3 | 18.4 |
| | 3.09 | 350 | 296 | - | - | - | - | - | - | 10.3 | 36.4 | 6.9 | 24.2 | 5.9 | 20.8 |
| | 3.30 | 400 | 336 | - | - | - | - | - | - | 10.9 | 38.9 | 7.3 | 25.9 | 6.3 | 22.2 |
| 10 | 2.78 | 200 | 157 | - | - | - | - | - | - | 9.4 | 32.7 | 6.3 | 21.8 | 5.4 | 18.7 |
| | 3.25 | 275 | 218 | - | - | - | - | - | - | 10.8 | 38.4 | 7.2 | 25.6 | 6.2 | 21.9 |
| | 3.67 | 350 | 278 | - | - | - | - | - | - | - | 8.0 | 28.8 | 5.9 | 24.7 | |
| | 3.93 | 400 | 314 | - | - | - | - | - | - | - | 8.5 | 30.8 | 7.3 | 26.4 | |
| 12.5 | 3.24 | 200 | 146 | - | - | - | - | - | - | 10.8 | 38.1 | 7.2 | 25.4 | 6.2 | 21.8 |
| | 3.80 | 275 | 203 | - | - | - | - | - | - | - | 8.3 | 29.8 | 7.1 | 25.6 | |
| | 4.28 | 350 | 259 | - | - | - | - | - | - | - | 9.2 | 33.6 | 7.9 | 28.8 | |
| | 4.58 | 400 | 292 | - | - | - | - | - | - | - | 9.8 | 36.0 | 8.4 | 30.8 | |
| 15 | 3.61 | 200 | 137 | - | - | - | - | - | - | 11.9 | 42.6 | 7.9 | 28.4 | 6.8 | 24.3 |
| | 4.24 | 275 | 191 | - | - | - | - | - | - | - | 9.1 | 33.3 | 7.8 | 28.6 | |
| | 4.78 | 350 | 244 | - | - | - | - | - | - | - | 10.2 | 37.6 | 8.8 | 32.2 | |
| | 5.11 | 400 | 273 | - | - | - | - | - | - | - | 10.9 | 40.2 | 9.3 | 34.4 | |
| 20 | 4.16 | 200 | 124 | - | - | - | - | - | - | - | 9.0 | 32.6 | 7.7 | 28.0 | |
| | 4.87 | 275 | 173 | - | - | - | - | - | - | - | 10.4 | 38.3 | 8.9 | 32.8 | |
| | 5.50 | 350 | 222 | - | - | - | - | - | - | - | 11.6 | 43.2 | 10.0 | 37.0 | |
| | 5.88 | 400 | 247 | - | - | - | - | - | - | - | - | - | 10.6 | 39.6 | |

Restart Calibration Wizard

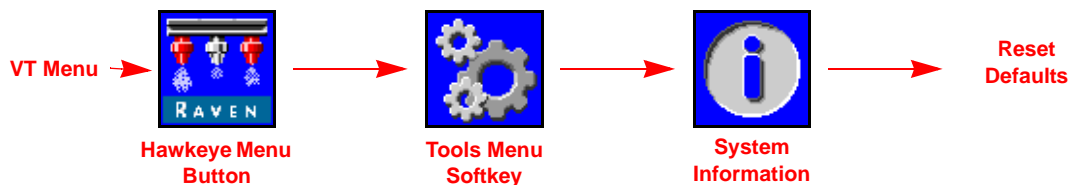
To restart the calibration wizard without resetting the system:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the Equipment Settings tab along the top of the display.
4. Select the cal wizard button to restart the calibration wizard with all current settings and calibration values.

Restore Default Settings

To reset all user entered values and revert to the original system default settings:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Information tab along the top of the display.
4. Select the Reset Defaults button at the bottom of the System Information prompt.

Note: *All user settings will be reset and the initial calibration wizard must be completed before the Hawkeye system can be used during field operations.*

Initial Start Up and Calibration Wizard

The calibration wizard must be completed the first time that the Hawkeye system is powered up on the ISOBUS network or if the default system settings are reset. The calibration wizard allows the operator to quickly configure the required Hawkeye system and nozzle control valves detected by the Hawkeye electronic control unit (ECU).

Review the following sections for assistance with completing the calibration wizard for the Hawkeye nozzle control system.

Note: *Refer to the VT operation manual for other necessary setup or calibration required before operating the Hawkeye control system or features.*

Calibration Wizard

To access the Hawkeye calibration wizard during the initial system start up:

1. Toggle power to the VT on and allow the display to power up and initiate the ISOBUS system.

Note: *If properly connected and powered, the VT will automatically detect the Raven Hawkeye ECU.*

If the ECU is not detected by the display terminal, troubleshoot the Hawkeye ECU and restart the system. Refer to Chapter 6, Troubleshooting, for assistance with connection issues. Contact a local Raven dealer for additional troubleshooting assistance if the ECU is still not detected.

2. Once the Hawkeye ECU is detected, the Hawkeye menu button will display in the VT menu.



**Hawkeye Menu
Button**

3. Touch the Hawkeye menu button icon to access the Hawkeye nozzle control system user interface.
4. The first time that the Hawkeye system is started on the VT, or if the default settings have been reset, the first calibration wizard prompt will be displayed.

Nozzle Setup, Spacing, and Tip Size Prompts

The following steps are intended to assist with entering the nozzle calibration information required for the Hawkeye system.

1. Verify the total number of nozzles on the Hawkeye system matches the nozzles detected by the Product Controller II (PCII) ECU.

Note: *If the total number of nozzles does not match the expected number of nozzle control valves connected to the system, refer to Chapter 9, Troubleshooting, for assistance with the Hawkeye nozzle control valve circuit.*

2. The Hawkeye ECU will attempt to detect the number of nozzle control valves connected to the left boom (center of the boom to the tip of the left boom) circuit. Check the displayed value against the expected number of nozzles on the left circuit. If necessary, select the Nozzle Count field and enter the appropriate number of nozzle control valves connected to the left boom circuit.
3. Select the Next button to continue to the Nozzle Spacing prompt.
4. Select the Nozzle Spacing field and enter the distance between nozzle control valves.

5. Select the Next button to continue to the Tip Size prompt.
6. Select the Tip Size field and use the available options to select the orifice size of the tips currently installed on the nozzle bodies.
7. Select the Next button to proceed to the Nozzle Indexing prompt.

Automatic Nozzle Indexing Prompts

The automatic nozzle indexing process allows the Hawkeye system to automatically configure the location of each nozzle control valve on the left and right boom circuits and may detect issues with system connection or nozzle setup.

1. When prompted, select the Next button to begin the auto-indexing process.
2. Hawkeye will begin indexing nozzle control valves from the left end of the implement boom. If an error is detected on either the left or right boom circuits, the PCII ECU will halt the indexing process and prompt the machine operator to correct the error before continuing with the calibration wizard.

Fence Row Setup Prompt

1. The Fence Row Setup prompt will display if the automatic indexing process completes without errors.
2. Enable the fence rows option if section valves are connected to the 3-pin connectors at the ends of the boom circuits to control left and right fence row nozzles. Leave this option disabled if valves are not installed for control of fence rows.
3. Select the Next button to continue to the Section Setup prompt. If a switch box or boom sense node is detected, three options will display.

Section and Switch Setup Prompts

1. Select the Number of Sections field and enter the number of sections available for Hawkeye section control.
 - a. If section valves are installed, enter the number of section on/off control valves.
 - b. If section valves are not installed on the equipment, the nozzle control valves may be configured to control up to 16 virtual sections across the implement width.
2. Select the Next button to display the Section Width Setup prompt.
3. Select the Section Width fields and enter the width of each section across the implement.
 - a. Section 1 is always the farthest left section on the implement and the highest section number is always the farthest right section.
 - b. If section valves will be used with the Hawkeye system, measure the width of the boom controlled by each section valve and enter the section measurements to ensure that the system accurately records section coverage during field applications.
 - c. If using virtual sections, calculate the section widths by multiplying the nozzle count by the nozzle spacing.
4. Touch the Next button to proceed to the Switch Mapping prompt if a switchbox or boom sense node is detected.
5. For each configured section, use the drop down field to select the desired switch number to assign each configured section to a switch.
6. When all section switches are configured for the desired operation, select the Next button to proceed to the Meter Cal prompt.

Advanced Pressure Calibration

1. Select either Boom or Sparge from the Pressure Type dropdown.
2. Select the Transducer Type. Available options are 0-250, 0-150, and custom (for transducers that are not manufactured by Raven). If you select custom you will see additional calibration options.
3. Select Voltage Calibration.

4. Enter the millivolts per unit of pressure. This is the slope of the voltage signal. Refer to the transducer manufacturer for voltage signal slope information.
5. If desired, you can enter the Transducer Max. This is the maximum pressure the transducer can read. Refer to the transducer manufacturer for this information.
6. Select Operational Calibration.
7. Follow the on screen instructions to turn on the pump and enter the pressure readings.
8. If desired, you can enter the Transducer Max. This is the maximum pressure the transducer can read. Refer to the transducer manufacturer for this information.

Meter Cal and Units

1. Select the Meter Cal field and enter the calibration value for the flow meter used to monitor the Hawkeye system product flow.
2. Select the units field and select the units used by the flow meter to monitor flow.

Note: *Raven flow meters use a meter cal in pulses per 10 gallons [37.9 L].*

3. Select the Next button to proceed to the Target Rate prompt.

Target Rate

1. Select the Target Rate field and enter the desired target rate for applications in the units displayed.
2. Select the Next button to proceed to the Target Pressure prompt.

Target Pressure

1. Select the Target Pressure field and enter the desired target pressure during field applications in the units displayed.
2. Select the Next button to complete the calibration wizard and access the Hawkeye calibration summary prompt.

Functional Inspection

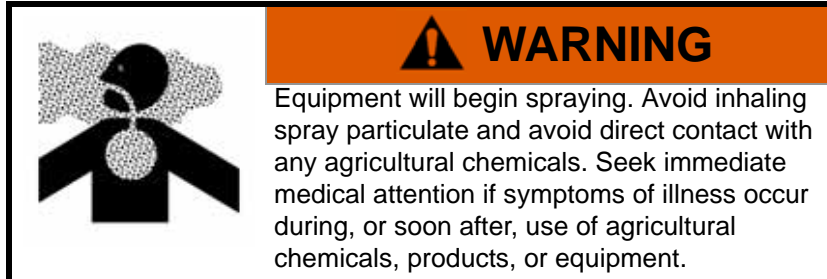
Refer to the following sections for assistance with validating that the Hawkeye nozzle control system has been installed properly:

Nozzle Control Valve Function

To verify that the Hawkeye nozzle control system is functioning properly after installation:

1. Flushed the main product tank and boom plumbing with clean water, and verify the tank contains at least 100 gallons [379 L] of clean water.
2. Park the equipment in an area with enough space to unfold the booms and allows for visual inspection of the spray pattern from a moderate distance (e.g. 20 ft [6.1 m]).
3. Set the Hawkeye nozzle control system to manual mode, and set both the pump PWM and nozzle PWM to 50%. Refer to the *Manual Pump Control Buttons* section on page 40 or the *Manual Nozzle Control Buttons* section on page 40 for assistance with adjusting the PWM percent values in the manual control mode.

- Toggle all section switches and the master switch.



- While maintaining a safe distance away from any spray drift, visually check that all nozzle control valves are pulsing with a uniform pattern. Adjacent nozzle control valves should alternate pulsing. If adjacent spray tips are pulsing at the same time, refer to Chapter 9, *Troubleshooting*, for additional assistance.
- On the VT, set nozzle PWM to 0% to close the nozzle control valves.
- Visually check that none of the nozzles are spraying or dripping. Refer to *Testing for Leaks* section on page 64 for additional assistance and troubleshooting if leaks are observed.

Turn Compensation Feature

To verify the Turn Compensation feature is enabled and operating as anticipated:

Note: Complete the procedure outlined in the *Nozzle Control Valve Function* section on page 18 to validate the nozzle control valve function prior to performing the following procedure.

Refer to the *Turn Compensation Calibration* section on page 22 for assistance with calibrating the turn compensation feature if necessary.

- Move the implement to an open area where the equipment may be driven in quick, tight turns.
- Verify that the turn compensation feature is enabled.
- Set the system to automatic mode and toggle the section and master switches to the on positions. Refer to Chapter 6, *Hawkeye Operation*, for additional assistance with operation of the nozzle control system.
- While driving at a speed between 5 and 10 mph [8 and 16 km/h] and maintaining a safe working distance, observe the inner-most and outer-most spray tips while the implement is turning sharply.

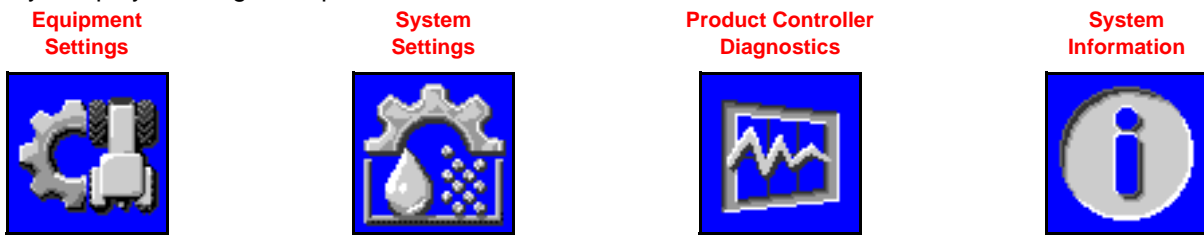
Note: The nozzle PWM percent value may also be used to monitor the operation of nozzle control valves across the spray boom. Refer to Chapter 8, *Hawkeye Nozzle Control Valve Diagnostics*, for additional assistance with on-screen nozzle control valve diagnostics.

While turning, the nozzle control valves toward the outside of the corner should begin to output a higher flow rate (higher PWM percent), while valves toward the inside of the corner should begin to output a reduced flow rate (lower PWM percent) or may shut off. The difference between inner and outer flow rates will vary depending on machine speed, turn rate, and implement width.

- If the operator is able to observe a difference in the spray pulsing, or the on-screen PWM percent, the turn compensation feature is working correctly. If there is no difference between the PWM percent values across the implement width, recalibrate the turn compensation feature and repeat this test.

Calibration Menu Overview

System settings and information are displayed in four categories which may be viewed by selecting the softkeys displayed along the top of the screen.



Equipment Settings. Access the vehicle or implement settings to change the tip size used with the Hawkeye system, toggle the nozzle control system on or off, or to rerun the calibration wizard.

System Settings. Adjust the following setting and feature categories:

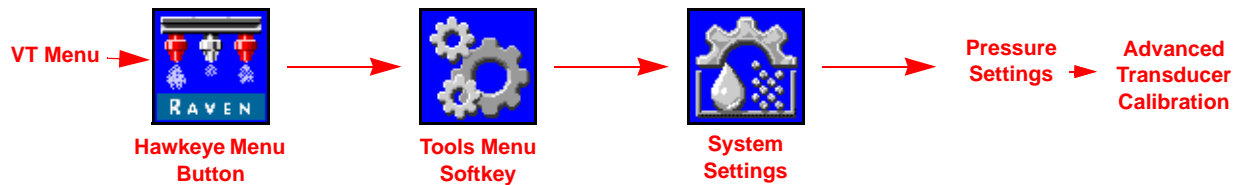
- User Settings
- Tank Fill Settings
- Alarm Settings
- Presets Setup
- Product Control Settings
- Pressure Settings

Product Controller Diagnostics. access system information which may provide advanced diagnostic and control function information for the Hawkeye system.

System Information. Select to view details of the Hawkeye ECU such as hardware and software version numbers, run-time, or task controller connectivity.

Pressure Transducer Calibration

To calibrate the Hawkeye system pressure transducers:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display.
4. Select the Pressure Settings button.
5. Verify the pressure type and transducer type selections.
6. Zero the transducer at ambient air pressure. Refer to the Advanced Transducer documentation provided with the equipment, or contact the equipment manufacturer, for assistance with bleeding pressure from the application system.

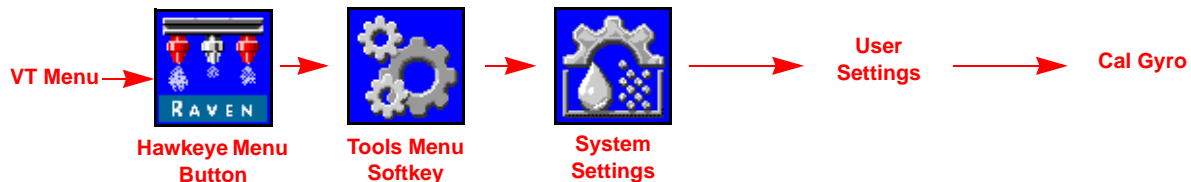
Note: *If the Hawkeye system came installed on the equipment from the equipment manufacturer, or if a sparge pressure transducer is installed with the Hawkeye control system, check the transducer specifications and refer to the Advanced Transducer Calibration section on page 34 to verify transducer settings before operating the Hawkeye nozzle control system during field applications.*

Turn Compensation Calibration

If the product controller II ECU mounting position is modified or adjusted, recalibrate turn compensation to ensure the feature correctly adjusts nozzle rates during applications and ensure that the ECU orientation is configured properly.

Note: *The ECU orientation is calibrated during the initial system calibration wizard. To recalibrate the ECU gyro, restart the calibration wizard or perform the following procedure.*

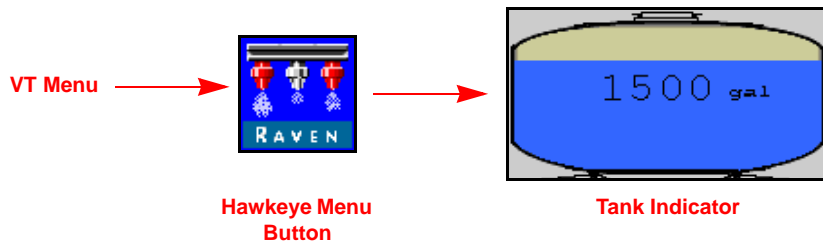
To recalibrate the turn compensation feature:



1. Move the equipment to a known level location.
2. Open the VT menu and select the Hawkeye menu button.
3. From the home screen, select the Tools Menu softkey along the right side of the display.
4. Select the System Settings tab along the top of the display.
5. Select the User Settings button and then select the Cal Gyro button. The system will recalibrate the product controller II ECU gyro and set the node orientation.

Tank Calibration

To configure the Hawkeye system to monitor the calculated volume of product remaining in the tank:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the tank indicator in the center of the display to access the Tank Fill Config prompt.
3. Select Tank Capacity field and enter the normal volume of product used to fill the tank.
4. If a tank fill monitoring system is installed, select the fill meter cal and set the fill meter calibration value.
5. Set the fill meter units to ensure proper metering of product being added to the tank.

Alarms Configuration

To access and setup the Hawkeye system alarm features:

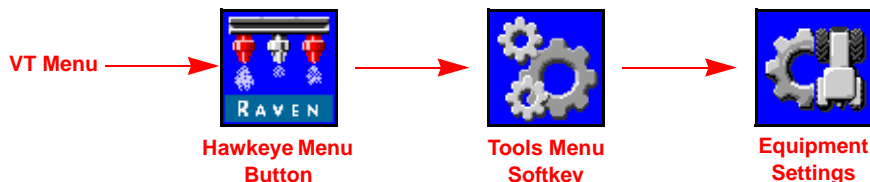


1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display.
4. Select the Alarm Settings button to access the Alarms Setup prompt.
5. Select the Enable option for the Low Tank, Off Rate, or Off Pressure alarm features as desired. Refer to *System Settings Tab - Alarm* section on page 29 for additional assistance with these alarm features and setting the thresholds for the alarm conditions.
6. Enter the appropriate values for each alarm condition.
7. Enable the minimum pressure alarm feature to prompt the operator if the monitored system pressure reaches the minimum pressure value. Refer to *System Settings Tab - Pressure* section on page 33 for additional assistance with setting the minimum desired system pressure.

Tools Menu Settings Definitions

Equipment Settings Tab

To access the Equipment Settings menu:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the Equipment Settings tab along the top of the display. The following settings may be viewed or modified:
 - Total and Section Width
 - Total Nozzle Count
 - Nozzle Spacing
 - Calibration Wizard
 - Tip Size
 - Enable Nozzle Control
 - Fence Rows
 - Switch Mapping

Total and Section Width Displays

Total Width. The total width value displays the sum of the currently programmed section widths.

Section Widths. The widths of individual sections configured for the Hawkeye nozzle control system will be displayed below the total width.

Note: *Restart the calibration wizard to adjust or modify the section widths or the total width of the implement.*

Switch Mapping. Sections mapped to a compatible switch box for manual section control will display using different color section width displays. Touch the Help icon on the Equipment Settings prompt to view a switch map legend.



Help Icon

Note: *To configure section switch mapping, an ISOBUS boom interface/speed sense ECU, Raven ISOBUS switch box, or a bridge ECU must be connected with the Hawkeye system. To configure switch mapping, restart the calibration wizard and refer to the Section and Switch Setup Prompts section on page 17 for assistance with mapping sections to switch box functions during the calibration wizard.*

Total Nozzle Count Display

The number of nozzles detected on the Hawkeye nozzle control bus during the calibration wizard will be displayed in this field. If the nozzle count does not match the expected number of nozzles connected to the system, troubleshoot the nozzle control valve bus and restart the calibration wizard. Refer to Chapter 9, *Troubleshooting*, for additional troubleshooting assistance.

Nozzle Spacing Display

The nozzle spacing measurement set during the calibration wizard is displayed in this field. This value, multiplied by the total nozzle count should equal the total width value.

Tip Size Option

Use the tip size drop down field to select the size of orifice on the spray boom. This setting is used to assist with the application information displayed for the equipment operator during field applications. This setting will affect the speed range, the rate and pressure gauge displays, and ensure the nozzle control system accurately monitors the application of product during field operations.

Enable Nozzle Control Option (Conventional Spray Mode)

Select the enable check box option to toggle between Hawkeye nozzle control features or the conventional spray mode.

Note: Nozzle control features should only be disabled if the nozzle bodies on the implement are set to by-pass the Hawkeye nozzle control valves during operation. Refer to Toggle Nozzle Control section on page 38 for additional assistance with using a conventional application mode with the Hawkeye system installed.

Fence Rows Display

If this option is enabled, the operator may use the Hawkeye switch box, or on-screen section controls, to toggle fence rows valves on or off during field applications. Restart the calibration wizard to change this setting.

Note: To allow the Hawkeye system to control of fence row valves, the valves must be connected to the nozzle control valve bus. Refer to the Hawkeye installation manual provided with the nozzle control kit for additional assistance with the system installation and connection.

Calibration Wizard

Select the Calibration Wizard button to restart the calibration wizard. Refer to Chapter 4, Initial Calibration, for additional assistance with completing the initial calibration of the Hawkeye nozzle control system.

Note: Restarting the calibration wizard does not reset the Hawkeye system default settings. Refer to System Information Tab section on page 36 for assistance with restoring default system settings.

System Settings Tab - User

To access the User Settings menu:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display.
4. Select the User Settings button. The following settings may be viewed or modified:
 - Display Smoothing
 - Zero Speed Shutoff
 - Prescription (Rx) Control
 - Override Seconds
 - Section Control
 - Enable Turn Compensation

Display Smoothing

Enable the Display Smoothing feature to allow the device to smooth the rate display during field operations. When enabled, the target rate will be displayed as the actual rate as long as the actual rate is within $\pm 10\%$ of the desired target rate. If the actual rate does not reach $\pm 10\%$ of the target rate within 10 seconds, the actual rate will be displayed. This only smooths the value displayed in the object pool and not anything displayed by the task controller.

Zero Speed Shutoff

Note: *The zero speed shutoff feature is only available if the nozzle control system is disabled for conventional spray mode. Refer to the Toggle Nozzle Control section on page 38 for assistance switching between Hawkeye nozzle control and a conventional spray mode.*

Enable the zero speed shutoff feature to allow the Hawkeye system to automatically shut off product application if the vehicle speed is slower than 0.5 mph [0.8 km/h]. If the zero speed shutoff feature is engaged during a job, a zero speed alert will be displayed for 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 0.5 mph [0.8 km/h] and maintain that speed for more than 10 seconds.

Section Control

Allows Hawkeye to automatically control sections in reference to coverage maps. When enabled, section control will automatically turn off an active section as it enters an area where product has been previously applied. As the section leaves the previously applied area, the section control feature turns the section back on.

Note: *A task controller or VT capable of automatic section control is required to allow the Hawkeye system to control sections automatically. Refer to the manufacturer operation guides and materials for information on utilizing this feature.*

- If the VT is capable of automatic section control and the section control feature is available in the Raven ISOBUS product control screen, select the feature to place a check mark in the corresponding box to enable the feature.
- If the VT is capable of automatic section control, but the section control feature is not available in the Raven Hawkeye Tools Menu, the feature must be enabled from a different VT menu. Review the VT operation manual for assistance with the section control or task controller options.
- If the VT is not capable of automatic section control, Raven Hawkeye will not automatically control sections regardless of the state of the section control feature on this screen. It is recommended to de-select or disable this feature when operating the Hawkeye system.

Prescription (Rx) Control

Enable the Rx control option to allow the task controller to send prescription rate information to the Hawkeye system for automatic rate control according to a prescription map available on the VT.

Refer to the VT operation manual for assistance with loading and selecting prescription rate information for field applications.

Enable Turn Compensation

The turn compensation feature allows Hawkeye to automatically adjust the application rate across the implement width when applying through curves and corners in the field area.

Select the Turn Compensation option to allow Hawkeye to automatically adjust the application rate during field applications.

Turn Compensation Calibration. If the product controller II ECU mounting position is modified or adjusted, the Hawkeye turn compensation feature should be recalibrated to ensure the turn compensation feature correctly adjusts nozzle rates during applications and ensure that the ECU orientation is configured properly. Refer to the *Turn Compensation Calibration* section on page 22 for additional assistance with calibrating the gyro and ECU orientation.

Override Seconds

Use the override seconds value to set the time which the system should override automatic section commands and keep sections on. This feature may be used when starting application with the equipment at a complete stop, or to manually override all sections on for the set number of seconds.

Note: *The default on override value is five seconds.*

The override will only activate sections set for automatic section control. Any sections configured for manual control, or set on or off manually, will not be affected by the AccuBoom Override feature.

Refer to the *Activate the Hawkeye Section Override Feature* section on page 38 for assistance with enabling the section override using an optional Raven ISO Switch Box or the on-screen override button.

System Settings Tab - Tank Fill

To access the Tank Fill Settings menu:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display.
4. Select the Tank Fill Settings button. The following information will be available:
 - Refill Button
 - Current Tank Volume
 - Fill Meter Calibration Value
 - Fill Volume Display
 - Tank Capacity
 - Low Tank Threshold
 - Flow Rate Display

Note: *The tank fill prompt is also accessible by selecting the tank indicator on the Hawkeye home screen.*

Refill Button

Select to reset the current tank volume to the configured tank capacity. Use this button to quickly reset the tank volume when refilling tanks during field operation.



Tank Capacity

The tank capacity should be entered as the normal volume of product used to fill the tank. Using the tank capacity and current tank volume values, the tank indicator on the home screen will display the level of product remaining for the current application.



Current Tank Volume

Enter the product level to manually set or adjust the tank level during field applications. This feature may be used to manually set the tank level at a level different from the capacity value, adjust the product volume if products are added through the top of the tank, or to correct the tank volume for a known volume of product added to the tank.

Low Tank Threshold

Note: *To provide low tank alarms during field applications, ensure the Low Tank option is enabled on the Alarms Setup screen. Refer to the System Settings Tab - Alarm section on page 29 for additional assistance with enabling the low tank alarm.*

The low tank threshold value may be adjusted on the Tank Fill Config prompt if desired. Refer to the *Low Tank Threshold* section on page 29 for additional information on the low tank alert condition and setting the alarm condition.

Fill Meter Calibration Value and Units

The fill meter calibration, or meter cal, value and units may be found on the tag attached to the flow meter installed in the tank fill system. Be sure to select the appropriate units for the flow meter calibration to ensure proper calibration of the tank fill system.

Note: *Raven flow meters use a meter cal in pulses per 10 gallons [37.9 L].*

Copy the information from the tag for future reference as tags may fade or be lost during operation.

Flow Rate Display

The metered rate of product transfer into the tank is displayed in this field and may be used to assist with refilling operations.

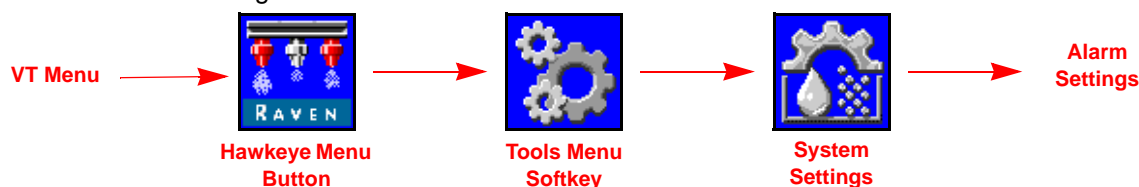
Fill Volume Display

The metered volume of product pumped into the applicator tank is displayed in this field.

Note: *The metered volume will not include any product added through the top of the tank. The fill volume display will automatically clear after 2 minutes of fill meter inactivity. Refer to the Current Tank Volume section on page 28 for assistance with manually setting or adjusting the current tank or product volume.*

System Settings Tab - Alarm

To access the Alarm Settings menu:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display.
4. Select the Alarm Settings button. The following information will display:
 - Low Tank Threshold
 - Off Rate Percent
 - Off Pressure Percent

Low Tank Threshold

Enable the Low Tank feature and enter a non-zero value to set the volume threshold at which to alert the operator to a low tank condition during field applications. This feature requires the operator to enter a product volume when refilling tanks to allow the Hawkeye system to calculate the remaining tank level during the operation.

Off Rate Percent

The off rate percent sets the allowable difference between the target and actual product application rates. Enable the off rate feature and enter a non-zero value to set the allowable difference between target and actual rates during field operations. If the difference between the actual and target rate exceeds the set percentage for more than five seconds, the system will display an off rate alarm.

Off Pressure Percent

The off pressure percent sets the allowable difference between the target and actual pressures. Enable the off pressure feature and enter a non-zero value to set the allowable difference between target and actual pressures during field operations. If the difference between the actual and target pressure exceeds the set percentage for more than five seconds, the system will display an off pressure alarm.

System Settings Tab - Presets

To access the Preset Setup menu:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display.
4. Select the Preset Setup button. The following information will be available:
 - Rate 1 and 2
 - Rate \pm Bump
 - Quick Key Enable
 - Use Gauges as Preset Rate/Pressure Buttons
 - Pressure 1 and 2
 - Pressure \pm Bump
 - Use Buttons for Rate/Pressure \pm

Rate 1 and 2 Presets

Enter non-zero rate presets to allow the equipment operator to quickly switch between the set rates during field operations in the automatic product control mode.

Note: Refer to the *Softkeys and Quick Access Buttons* section on page 39 for additional assistance with using the rate preset and \pm bump buttons during field operations. In manual control mode, the rate preset and \pm bump buttons will be replaced with the pump PWM percent \pm bump buttons.

Pressure 1 and 2 Presets

Enter non-zero pressure presets to allow the equipment operator to quickly switch between the set pressures during field operations in the automatic product control mode.

Note: Refer to the *Softkeys and Quick Access Buttons* section on page 39 for additional assistance with using the pressure preset and \pm bump buttons during field operations. In manual control mode, the pressure preset and \pm bump buttons will be replaced with the nozzle PWM percent \pm bump buttons.

Rate and Pressure \pm Bump Values

Sets the increment by which either the target rate or target pressure will increase or decrease when using the bump softkeys during an active application.

A separate bump value may be set for the rate and pressure control features. Refer to the *Use Gauges to Toggle Rate/Pressure Softkeys* section on page 31 for assistance with toggling between rate and pressure bump displays on the home screen.

Note: Review the *Quick Key Setup Options* section on page 31 and enable the \pm option in the *Quick Keys* area to display the rate or pressure bump softkeys when viewing the home screen.

Quick Key Setup Options

Select the following quick key options to set the softkey options available during operation:

Rate. Toggle the quick key option to “Rate” to display the Rate preset softkeys when viewing the home screen.

± (Bump). Enable the ± bump softkeys when viewing the home screen.

Pressure. Toggle the quick key option to “Pressure” to display the Pressure preset softkeys when viewing the home screen.

Use Gauges to Toggle Rate/Pressure Softkeys

Enable this option to use the rate or pressure gauges displayed on the home screen to toggle between the ± bump and preset softkeys when viewing the home screen. This option allows the operator to quickly toggle between softkey functions without leaving the main operation display.

Note: The default selection for this feature is disabled.

System Settings Tab - Product Control

To access the Product Control Settings menu:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display.
4. Select the Product Control Settings button. The following information will be available:
 - Valve Type
 - Nozzle Min PWM
 - Deadband
 - PWM Min and Max
 - Response Rate
 - Meter Cal and Units

Valve Type

A PWM type control valve is required for proper operation of the Hawkeye nozzle control system. When operating with the Hawkeye system, the valve type setting cannot be modified.

Min PWM Percent

Enter a minimum PWM percent to set the minimum desired output (zero point or shutoff point) for a pulse width modulated (PWM) hydraulic control valve.

With the machine master switch in the on position, decrease this value until the minimum desired pressure is reached in a liquid system.

PWN Frequency

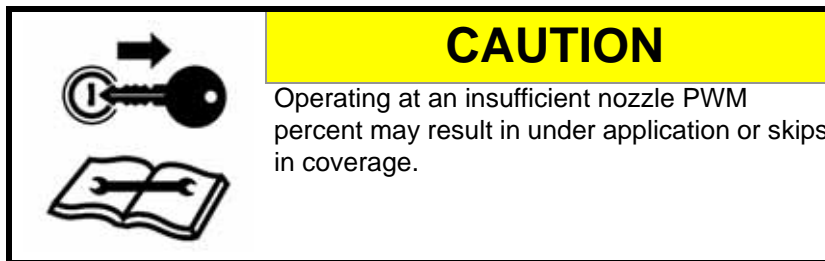
Used to set the coil frequency of the PWM valve (default is 122 Hz). Refer to the PWM control valve manufacturer specifications for recommended PWM frequency.

Max PWM Percent

Enter a maximum PWM percent to set the maximum desired output for a pulse width modulated (PWM) hydraulic control valve. This setting limits how far the PWM valve will open. The maximum pressure the Hawkeye nozzles can withstand is 80 PSI.

With the machine master switch in the on position, increase this value until the maximum desired pressure is reached in a liquid system.

Nozzle Minimum



Enter a minimum PWM percent to set the minimum desired output (zero point or shutoff point) for the Hawkeye nozzle control valves. With the machine master switch in the on position, decrease this value until the minimum desired pressure is reached in a liquid system.

Note: To help avoid under application or skips in coverage, review Chapter 3, *Avoiding Skips with Hawkeye™ Nozzle Control System*, and maintain the recommended application conditions.

Response Rate

Set to calibrate how aggressively the system will adjust to achieve or maintain the target rate. Higher response rates will cause the system to react quickly while lower values will slow the system response. The default product control response rate is 90.

If the system overshoots or oscillates around the desired target rate, decrease the response rate to help stabilize the system.

Deadband

Sets the allowable tolerance between the target rate and the actual application rate. Enter a value between 1 and 9. A value of 1 equals a $\pm 1\%$ tolerance between the target and actual application rates where a value of 9 equals a $\pm 9\%$ tolerance.

Meter Calibration Value and Units

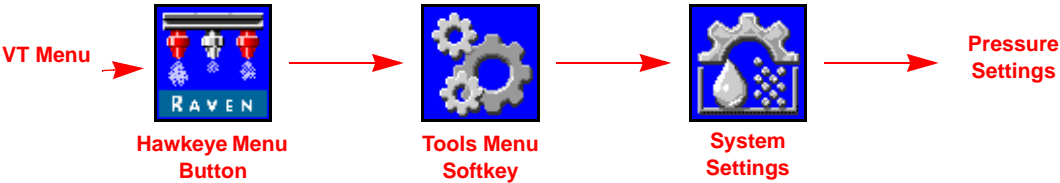
Enter the calibration value for the flow meter used to monitor the Hawkeye system product flow. This value is generally available on the flow meter.

Be sure to select the units used by the flow meter to monitor flow.

Note: Raven flow meters use a meter cal in pulses per 10 gallons [37.9 L].

System Settings Tab - Pressure

To access the Pressure Settings menu:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display.
4. Select the Pressure Settings button. The following information will be available:
 - Response Rate
 - Sensitivity
 - Boom Pressure Calibration*
 - Advanced Pressure Calibration
 - Minimum Pressure
 - Maximum Pressure
 - Sparge Pressure Calibration*

* Will only show when a transducer is connected.

Response Rate

Set to calibrate how aggressively the system will adjust to achieve or maintain the target pressure. Higher response rates will cause the system to react quickly while lower values will slow the system response. The default product control response rate is 35.

If the system overshoots or oscillates around the desired target pressure, decrease the response rate to help stabilize the system.

Sensitivity

Enter the desired pressure transducer sensitivity to changes in the flow system. If this value is too high, the operator may observe unstable pressure displays during operation.

Minimum Pressure

The minimum pressure feature requires a pressure transducer to monitor product pressure during application and will allow the operator to set the lowest tolerable pressure during field operations. If the application system reaches the minimum pressure, the VT will display an alert and application system will maintain the flow rate to keep the monitored pressure consistent and to maintain the spray pattern.

The minimum pressure feature may result in higher than desired application rates. If the minimum pressure feature will be used during field operations, be sure to enter a value that will not interfere with normal target rates during field application.



Maximum Pressure

Enter the minimum desired pressure at the pressure transducer location. If the monitored pressure falls below the set value, the VT will display an alert for the equipment operator.

Note: *The product control valve will stop opening when the maximum pressure setting is reached.*

The maximum pressure feature requires a pressure transducer to monitor product pressure during application and will allow the operator to set the highest allowable pressure during field operations. If the application system reaches the maximum pressure, the VT will display an alert and application system will maintain the flow rate to keep the boom pressure consistent.

The maximum pressure feature will result in lower than desired application rates. If the maximum pressure feature will be used during field operations, be sure to enter a value that will not interfere with normal target rates during field application.

Boom Pressure Calibration

This option will only appear if a transducer is detected. A boom pressure transducer is required for Hawkeye system operation. Refer to the *Pressure Transducer Calibration* section on page 22 for assistance with calibrating the pressure transducer.

Sparge Pressure Calibration

This option will only appear if a transducer is detected. An optional sparge transducer may be installed to monitor the sparge or agitation system. Refer to the *Pressure Transducer Calibration* section on page 22 for assistance with calibrating the pressure transducer.

Advanced Transducer Calibration

Select the Advanced Pressure Cal button to access the following settings:

Note: *Refer to the Pressure Transducer Calibration section on page 22 for additional assistance with calibrating the transducer.*

Pressure Type. Select the pressure type drop down field and select the boom or sparge transducer to be calibrated for Hawkeye operation.

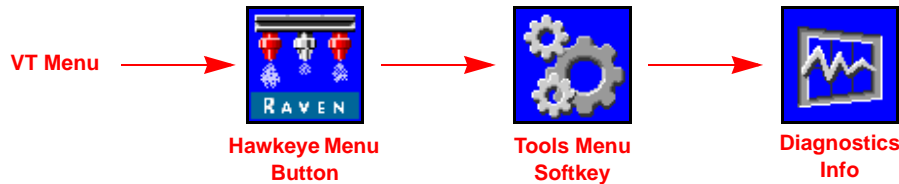
Transducer Type. Select the transducer type drop down field and select the range for the transducer used with the Hawkeye system. The following options are available for calibrating the Hawkeye nozzle control system:

- Raven (0-250) - pressure transducer supplied with after-market Hawkeye kits. This option is the default transducer type setting.
- Other (0-150) - carrier transducer available on several OEM installations of the Hawkeye nozzle control system. Before selecting this option, check the specifications of the pressure transducer used to monitor application with the Hawkeye nozzle control system.
- Custom (set custom transducer limits) - if neither of the above options match the transducer specifications, select the custom option to set the limits for the pressure transducer used with the Hawkeye nozzle control system.

Pressure Calibration. Enter the gauge pressure or recalibrate the transducer for ambient air pressure.

Controller Diagnostics Information Tab

The controller diagnostics tab provides status information for the Hawkeye ECU and may be helpful when troubleshooting the system. To access Hawkeye system Diagnostic Information:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the Diagnostics Info tab along the top of the display. The following controller information will be displayed:

- HC Voltage
- Flow Pulses
- Logic Voltage
- DTC List
- Orifice Constant
- Duty Cycle
- ECU Yaw Rate
- Pressure Signal
- Service Menu
- Orientation

System Voltages and Currents

The Hawkeye ECU is capable of monitoring and supplying the voltage (V) and current (A) for the following system connections:

HC Voltage. The voltage and amperes for the high current bus circuit. High current power is provided system components to actuate control features such as opening valves or nozzles.

Logic Voltage. Internal ECU voltage used for processing application data and rate control commands. The logic voltage value should display TBD for normal operation of the product controller II ECU and the Hawkeye nozzle control system.

Duty Cycle

Displays on the Diagnostics Info prompt. Use this value to monitor the current carrier pump output percentage.

ECU Yaw Rate

Represents the physical orientation of the product controller II ECU.

DTC List

The diagnostic trouble code (DTC) list provides a list of recent errors for the equipment operator. Access the DTC list to review previous error conditions, as well as a tally of each condition, during operation of the Hawkeye nozzle control system.

Refer to Chapter 9, *Troubleshooting*, for additional assistance with diagnostic trouble codes and using the DTC list.

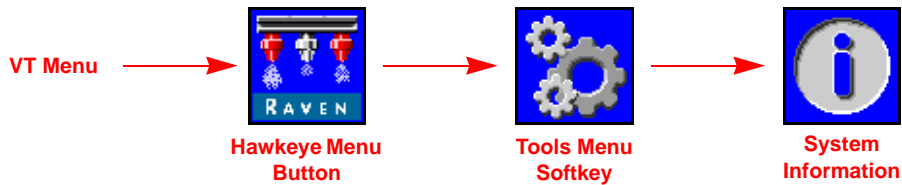
Service Menu

Provides advanced features and options to assist with systems diagnostics or tuning the Hawkeye nozzle control system. The service menu should only be used by a trained Raven service technician.

Contact a local Raven dealer for assistance with the Hawkeye nozzle control system if necessary.

System Information Tab

To access the System Information menu:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Information tab along the top of the display. The following information will be available:
 - Hardware Part Number
 - Hardware Serial Number
 - Software Version
 - Version Hours
 - Task Controller
 - Hardware Revision
 - Software Part Number
 - Bootloader Version
 - Total Hours
 - CAN Address

This information is for display purposes only and may be useful when contacting technical support.

Reset Defaults

Select the reset defaults button to restore the default system settings. All user settings will be reset and the initial calibration wizard must be completed before operating the Hawkeye nozzle control system.

Operation Checklist

To begin applying product using the Hawkeye nozzle control system:

1. Check the target rate is set to the desired rate. Refer to the *Rates Area* section on page 41.
2. Check the target pressure is set to the desired pressure. Refer to the *Pressure Area* section on page 42.
3. Verify the nozzle tips installed on the boom and tip size selection for the Hawkeye nozzle control system. Refer to the *Section Diagnostics Prompt* section on page 47.
4. Select the product pump softkey to toggle the product pump on. Refer to the *Pump Status and Switch* section on page 39.
5. Toggle the equipment master switch to the on position.

Tip Size Selection

The tip size selection must be set for the tips installed during Hawkeye field operations to maintain system accuracy during application. To select or modify the tip size selection:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Nozzle Diagnostics softkey along the right side of the display.
3. Select the Tip Size drop down and select the appropriate tip size from the options available.

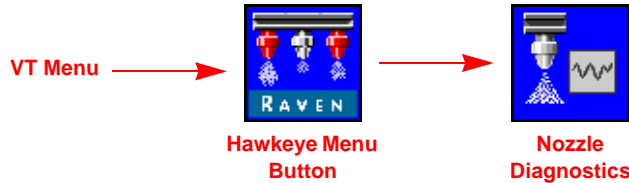
Toggle Nozzle Control

The Hawkeye nozzle control system allows the operator to disable the nozzle control system during an operation to switch nozzle tips during field applications if necessary.

Note: When nozzle control is disabled, the Hawkeye nozzle control valves will remain closed.

Be sure to open manual shut off valves on each nozzle body for the appropriate tip when Hawkeye nozzle control features are disabled.

To access the additional Hawkeye nozzle control valve diagnostics information:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Nozzle Diagnostics softkey along the right side of the display.
3. Select the Enable Nozzle Control option on the nozzle prompt to toggle Hawkeye nozzle control features on or off from the VT.

Activate the Hawkeye Section Override Feature

Note: If a Raven ISOBUS switch box is installed with the Hawkeye nozzle control system, momentarily toggle the master switch to the override position to activate the section override feature. Refer to *Override Seconds* section on page 27 to adjust the time for the manual override feature or the *ISOBUS switch box operation guide* for additional assistance with switch box operation.

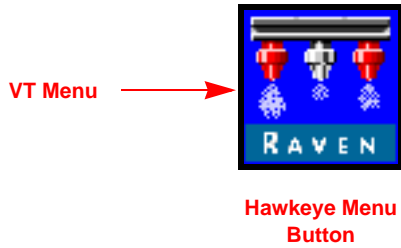
To manually override all sections on for the configured override time from the Hawkeye home screen:



1. Open the VT menu and select the Hawkeye menu button.
2. Select the Override button along the bottom of the home screen display.

Hawkeye Home Screen Definitions

To access the Hawkeye home screen, select the Hawkeye button from the VT menu.



Depending upon the mode and system options, the following display areas, information prompts, and features may be accessible via the Hawkeye home screen:

| | | | |
|-----------------------------|-----------------------------------|------------------------------|--------------------------------|
| • Softkeys Area | • Rate and Pressure Target Values | • Rate and Pressure Gauges | • Master Switch Status Display |
| • Application Mode Selector | • Alarm Status Display | • Volume Applied Tally | • Area Covered Tally |
| | • Tank and Section Status Display | • On-Screen Section Controls | |

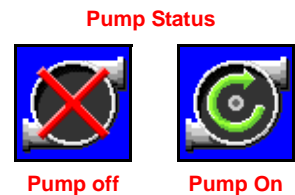
Softkeys and Quick Access Buttons

The quick access softkeys allows the operator to quickly access frequently used functions, calibration settings, and status displays during operation. Review the following sections for additional information on softkey functions.

Pump Status and Switch

The status of the product pump is displayed in the softkeys area. Select the pump status indicator to toggle the product pump on or off during field applications.

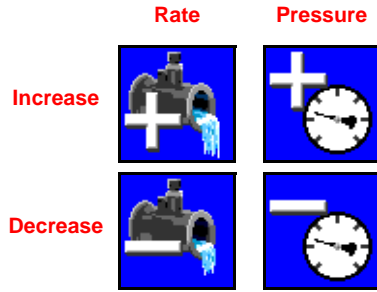
Note: Both the master switch and the product pump must be toggled on to apply product. See the Master Switch Status section on page 41 for additional assistance with the master switch status display if available.



± Bump Buttons

While applying in the automatic control mode, the operator may elect to display the ± rate or pressure bump buttons in the softkeys area. Select these buttons to manually increase or decrease the target rate or pressure settings by the ± value set on the presets settings prompt.

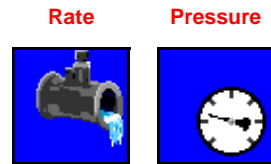
Refer to the *System Settings Tab - Presets* section on page 30 for additional assistance with the rate and pressure ± values and using the rate or pressure gauges on the home screen to toggle between the rate and pressure ± softkeys.



Preset Buttons

While applying in the automatic control mode, the operator may select to display the rate or pressure preset buttons in the softkeys area. Select these buttons to manually toggle between two preset rates or pressures set using the presets settings prompt.

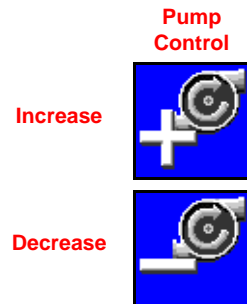
Refer to the *System Settings Tab - Presets* section on page 30 for additional assistance with the rate and pressure preset values and using the rate or pressure gauges on the home screen to toggle between the rate and preset softkeys.



Manual Pump Control Buttons

In the manual control mode, the rate ± bump and preset buttons are replaced with manual pump ± buttons. Select these buttons to manually increase or decrease the pump output during a field application.

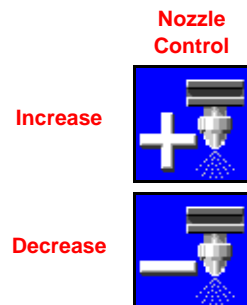
The Hawkeye system will continue to monitor and display the actual application rate on the home screen.



Manual Nozzle Control Buttons

In the manual control mode, the pressure ± bump and preset buttons are replaced with manual nozzle ± buttons. Select these buttons to manually increase or decrease the nozzle control valve pulse rate during a field application.

The Hawkeye system will continue to monitor and display the actual system pressure on the home screen.



Tools Menu

Select the Tools Menu button to access the calibration prompts. See Chapter 5, *Hawkeye™ Nozzle Control Calibration*, for additional assistance with system calibration, features, and settings.



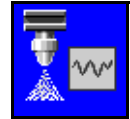
Tally Registers

Select the tally registers button to view the volume and area tallies since the register was last reset. See Chapter 7, *Tally Registers*, for additional assistance with the tally registers features.



Nozzle Diagnostics

Select the Nozzle Diagnostics button in the softkeys area to access nozzle diagnostic information and settings such as nozzle control valve status or selecting the tip size for Hawkeye operation. Refer to Chapter 8, *Hawkeye Nozzle Control Valve Diagnostics*, for additional assistance with the Hawkeye Nozzle diagnostics prompts.



Nozzle Diagnostics

Rates Area

The rates area displays the actual and target rate information as well as the units in which the information is displayed. Review the following sections for assistance with the rates information and display on the Hawkeye home screen.

Target Rate

Select the target value to enter the desired target rate for product application (e.g. 15 gallons per acre [140 liters per hectare]).

Rate Gauge

The rate gauge provides a visual representation of the actual application rate and displays the allowable rate deadband during field applications.

Note: Refer to the *Off Rate Percent* section on page 29 for assistance with setting the rate gauge deadband or the *Flow Meter Maintenance* section on page 65 for additional assistance with calibrating the flow meter.

If the *Use Gauges to Toggle Rate/Pressure Softkeys* option is enabled, touch the rate gauge to toggle between the rate preset and rate \pm bump buttons in the softkeys area. Refer to the *System Settings Tab - Presets* section on page 30 for additional assistance with the rate and pressure presets options.

Application Mode (Auto/Manual) Area

Application Mode

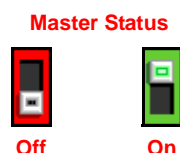
The control mode indicator displays the selected mode for pressure or product control. Select the “Auto/Manual” button to toggle the application mode between automatic (Auto) and manual (Manual). The active mode will be displayed.

Manual. Allows the operator to manually adjust the pump and nozzle PWM output to control the system rate and pressure. Select the pump increase or decrease buttons while viewing Hawkeye home screen to manually increase or decrease the pressure.

Automatic. Allows the product control system to automatically acquire and maintain the set target application rate and pressure. Use the \pm bump or preset buttons to adjust the target rate or pressure during field applications.

Master Switch Status

If a Raven ISOBUS switch box, or another compatible master switch, is connected to the Hawkeye nozzle control system, the current status of the master switch will be displayed in the control mode area. This is a display only and the physical switch must be used to toggle the system master on or off during field applications.



Application Speed and Range Display




Hawkeye displays the current vehicle speed on the Hawkeye home screen. Above the vehicle speed display, Hawkeye provides the operator with the application speed range. This range is provided as the optimal range to maintain the target rate and pressure settings. If the application speed exceeds this range, alarm conditions may occur and the Hawkeye nozzle control system may be unable to maintain the desired application rate or pressure. Refer to Chapter 3, *Avoiding Skips with Hawkeye™ Nozzle Control System*, for additional information about maintaining coverage during application with the Hawkeye nozzle control system.

Note: *The ranges for speed and flow rate provided in the Tip Selection and Application Speed Guide section on page 11 are for reference purposes only.*

A 10% buffer is applied to the upper and lower speed limits provided in the Tip Selection and Application Speed Guide for the speed range limits displayed on the Hawkeye home screen.

Alarms Status Indicator

The alarm indicator provides a visual status of the Hawkeye nozzle control system during field applications. The alarm status indicator provides the following display states:

| | |
|---|--|
|  | OK. The system status is normal and no alarm conditions are currently present. |
|  | Caution. A minor alarm condition has been detected. The control system and nozzle PWM is operating normally, however, the system has detected that a condition exists which could impact the current application. |
|  | Critical. A critical system condition has been encountered. The control system is not responding as expected and the operator should cease application and troubleshoot the issue before resuming operations. |

Note: *Touch the Alarms Status indicator to quickly access the diagnostic trouble code (DTC) List and review any current or previous alarm condition information. Refer to Chapter 9, Troubleshooting, for additional assistance with diagnostic trouble codes and using the DTC list.*

Pressure Area

The pressure area displays the actual and target pressure information as well as the units in which the information is displayed. Review the following sections for assistance with the pressure information and display on the Hawkeye home screen.

Target Pressure

Select the target value to enter the desired target pressure for product application (e.g. 45 PSI [310 kPa]).

Pressure Gauge

The pressure gauge provides a visual representation of the actual boom or sparge pressure and displays the allowable pressure deadband during field applications.

Note: *Refer to the Pressure Transducer Calibration section on page 22 for additional assistance with calibrating the pressure transducer or configuring the pressure deadband.*

If the *Use Gauges to Toggle Rate/Pressure Softkeys* option is enabled, touch the pressure gauge to toggle between the pressure preset and pressure \pm bump buttons in the softkeys area. Refer to the *System Settings Tab - Presets* section on page 30 for additional assistance with the rate and pressure presets options.

Application Information Area

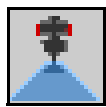
The bottom portion of the Hawkeye home screen provides on-screen indicators for the section status, the remaining tank volume, the volume of product applied and the area covered during the field operation. Refer to the following sections for additional information regarding the information provided in this area of the Hawkeye home display.

Tank Volume Indicator

Hawkeye provides a calculated volume of product remaining in the tank as a tank indicator in the application information area. Select this indicator to access the Tank Fill Config prompt.



Note: A tank capacity value must be entered to allow the tank volume indicator to display the tank level.



Volume Applied

The field volume tally is displayed in the application area for quick reference of the volume of product dispensed during a field operation.

Note: Select the tally registers button from the softkeys area and refer to Chapter 7, Tally Registers, for additional assistance with using the field and total volume registers.



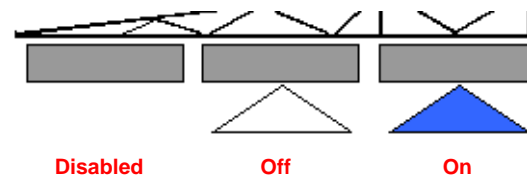
Area Covered

The field area covered tally is displayed in the application area for quick reference of the area covered during the current operation.

Note: Select the tally registers button from the softkeys area. Refer to Chapter 7, Tally Registers, for additional assistance with using the field and total area covered registers.

Section Status Display

The Hawkeye system provides the status of each configured section on the home display.



Note: Refer to Chapter 4, Initial Calibration, and restart the calibration wizard to configure implement sections.

- Manually disabled sections will be displayed without a section status indicator below the section.

Note: See the *On-Screen Manual Section Controls* section on page 44 for assistance with using manual section controls.

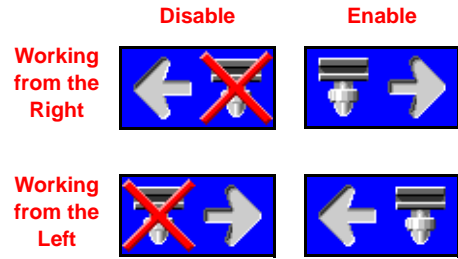
Sections enabled for product application will display a status below the section.

- Sections automatically controlled off according to task controller commands will display with an empty status indicator. The task controller will automatically enable the section when the section returns to an unapplied area in the field application.

- When the application system is enabled, the indicator for each section actively applying will be filled in. Task controller may automatically shut off the section based upon the application coverage map.

On-Screen Manual Section Controls

Note: The on-screen manual section controls will only be displayed if an optional Raven ISO Switch Box, or another compatible switch interface, is not available via the ISOBUS. If a switch box is detected, use the switch box to control implement sections or to enable the override feature. Review the Raven ISOBUS Switch Box Operation Guide for additional assistance with the Raven ISO Switch Box.



Use the manual section control buttons at the bottom of the Hawkeye home screen to manually enable or disable sections moving from left to right or from right to left depending upon the selection.

For Example:

Select the disable option with the arrow pointing to the left to disable the first enabled sections, starting from the right end of the implement width. Each time this disable option is selected, the next active section to the left will be disabled, moving from right to left across the implement width.

To enable these sections again for application, touch the enable option with the arrow pointing right to re-enable sections moving from left to right across the implement width, starting with the last section previously disabled.

On-Screen Fence Row Status and Control

If fence row control is enabled during the initial calibration wizard, the left and right fence row controls will be available in the lower corners of the Hawkeye main screen. The following status indicators may be displayed on the home screen during illustrate examples of the status.

| | |
|--|--|
| | On. Fence rows are on and applying product. |
| | Off. Section switch assigned to fence row is off. Toggle the section switch to enable application. |
| | Master Off. The section switch assigned to the fence row is on, but the master switch is off. Toggle the master switch to enable application. |

On-Screen Override

Note: The override button will only be displayed if an optional Raven ISO Switch Box is not detected on the ISOBUS. If a switch box is detected, use the switch box to manually control implement sections or to enable the override feature.

Use the override button at the bottom of the Hawkeye home screen to override all sections on for the configured override time. After the override time expires, the task controller will resume automatic control operations based upon previous section coverage.

Note: Refer to the System Settings Tab - User section on page 25 for additional assistance with the override seconds setting if necessary.

Using the Tally Registers

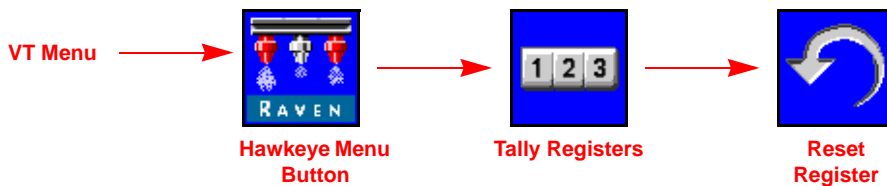
To access the Hawkeye tally registers prompt:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tally Registers softkey along the right side of the display.

Resetting a Register

To reset a register:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tally Registers softkey along the right side of the display.
3. On the Totals Data tab, select the Reset button for the register to be reset.
4. Accept the confirmation prompt to reset the select register.
5. Repeat the above process to reset other tally registers as desired.

Tally Register Definitions

The Raven Hawkeye system provides the following registers:

- Field Area and Volume
- Distance
- Total Area and Product
- Lifetime Area and Product

In addition to the area and volume tallies, the tally registers screen also displays the distance traveled and the current volume per minute and area per hour.

Field Tallies

The field area and volume registers are intended to allow the operator to keep a running tally of product application in a specific field or over a short duration of application such as a day or week.

Total Tallies

The total area and volume registers are intended to keep a running tally of a longer term of application data (i.e. product application over a week, month, or season).

Lifetime Stats

The lifetime area and volume statistics register keeps a running tally of the operating life of the Hawkeye system. This tally cannot be reset by the machine operator.

Distance

The distance register functions as a Hawkeye system odometer and provides a distance traveled since the last time the distance register was cleared. The distance register display may also be helpful when fine tuning the Hawkeye system or to assist with troubleshooting procedures.

Flow Rate Display

During product application, the current volume of product applied per minute is displayed on the Totals Data tab. This value may be helpful when fine tuning the Hawkeye system or to assist with troubleshooting procedures.

Area/Hour Display

The current area covered per hour is available on the Totals Data tab. This value may be helpful to check the Hawkeye system calibration or to assist with troubleshooting procedures.

Hawkeye Nozzle Control Valve Diagnostics

Nozzle Control Valve Diagnostic Definitions

Section Diagnostics Prompt

To access Hawkeye nozzle control valve diagnostics information by configured section:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Nozzle Diagnostics softkey along the right side of the display. The following settings and information may be displayed for each configured section:
 - Section
 - Tip Size
 - Section Nozzle Status
 - Nozzle Spacing
 - Enable Nozzle Control

Current Section Display

The current section for which diagnostic information is being displayed is shown at the top of the nozzle diagnostics prompt. Select the left or right arrow buttons to cycle through sections configured for use with the Hawkeye nozzle control system.

Nozzle Spacing

The nozzle spacing value set during the calibration wizard is displayed on the diagnostics prompt. Verify this value matches the tip spacing on the equipment to ensure accurate application of products during field operations.

Tip Size

Displays the currently selected nozzle orifice size. Select this option and use the drop down list to change the tip size as necessary to ensure accurate application during field operations.





Enable Nozzle Control

Select the enable nozzle control option to toggle the nozzle control feature on or off if necessary during field operations. Ensure this option is enabled to use the Hawkeye nozzle control system.

When nozzle control is disabled, the Hawkeye nozzle control valves will remain closed. Be sure to adjust nozzle bodies as required to switch between tips.

Section Nozzle Status

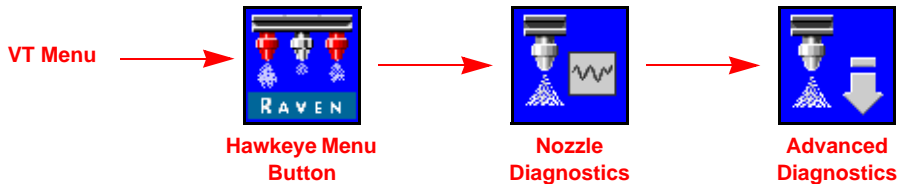
The status of each nozzle configured for control on the section is displayed at the bottom of the section diagnostics prompt. The following nozzle statuses may be displayed while viewing the section diagnostics prompt:

| | |
|---|---|
|  | Normal. The nozzle is functioning normally and no alarm conditions are currently present. |
|  | Caution. A minor nozzle alert condition has been detected. The control system and nozzle PWM is operating normally, however, the system has detected that a condition exists which could impact the current application. |
|  | Critical. A critical nozzle condition has caused the nozzle to shut down. The nozzle is not responding as expected and the operator should cease application and troubleshoot the issue before resuming operations. |
|  | Not Calibrated. The nozzle section is not calibrated. |

Note: Refer to Chapter 9, *Troubleshooting*, for additional assistance with diagnostic trouble codes and using the DTC list.

Individual Nozzle Diagnostics

To access individual Hawkeye control nozzle diagnostic information:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Nozzle Diagnostics softkey along the right side of the display.

3. Select the Advanced Diagnostics button in the upper, left corner of the Nozzle Diagnostics prompt to access the following diagnostic information for each nozzle:

- Current
- Voltage (V)
- Duty Cycle
- Estimated Flow
- Target Flow
- Runtime Hours
- Driver Temp
- System Pressure
- Hardware Rev
- Nozzle
- Program
- CAN Address
- Duty Cycle Percent
- Micro Temp

Note: Use the left or right arrow buttons at the top of the Nozzle Diagnostics prompt to cycle through the configured sections. Use the left and right arrow buttons at the bottom of the nozzle prompt to view different nozzles.

Nozzle Operation Information

Current and Voltage. Each nozzle control valve provides the measured current, in milliamperes, and voltage at the nozzle to the Hawkeye main ECU for display. Use this information to assist with troubleshooting the nozzle control valve bus if necessary or to check the integrity of the Hawkeye nozzle control system.

Duty Cycle. Each nozzle reports the current nozzle duty cycle over the communication network for display to the operator. Use this value to monitor the work load placed upon each nozzle.

Estimated Flow. The estimated flow rate through each nozzle is reported to the Hawkeye main ECU.

Target Flow. The target flow rate per nozzle for the current application.

System Pressure. The monitored system pressure reported by the Hawkeye system pressure transducer.

Runtime Hours. The runtime tally for each nozzle. Use this information to log the hours run and to help schedule and track maintenance on each nozzle on the Hawkeye control system.

Duty Cycle Percent. Select the Nozzle Duty Cycle Percent field and enter a desired duty cycle to test individual nozzles on the system.

Nozzle Hardware Information

Hardware Rev. Hardware revision information may be important for troubleshooting system issues or to update nozzles. Review this information if necessary to ensure system functionality.

Nozzle. The nozzle serial number for each nozzle is available on the nozzle diagnostics prompt. This information may be used to help locate specific nozzles on the implement.

Program. The version of software loaded on each nozzle. This information may be helpful to troubleshoot individual nozzles or to ensure proper operation of the nozzle control system.

CAN Address. The unique identifier assigned to each nozzle for communicating on the nozzle system is displayed on the diagnostics prompt.

Hawkeye Nozzle Control Valve Status

FIGURE 1. Nozzle Control Valve LED



TABLE 1. Nozzle Control Valve LED Status Indicator

| LED Indicator | Rate | Color | State |
|---------------|------|-------------|---------------------------------------|
| Flashing | 1 Hz | Green | Ready |
| | | Blue | Actuating Mode (Auto) |
| | | Red | Loading New Software |
| | | Amber | Shutdown Alarm Active |
| | 5 Hz | Amber | No ISOBUS Communication |
| Alternating | 1 Hz | Blue/Green | Actuating Mode (Manual) |
| | | Red/Green | Not Calibrated |
| | | Amber/Red | No ECU Detected or Invalid ISO Name |
| | | Amber/Green | Ready - Warning Alarm Active |
| | | Amber/Blue | Actuating Mode - Warning Alarm Active |
| Solid | - | Any | Nozzle Control Valve Failure |

Diagnostic Trouble Code (DTC) List

The following trouble codes may be displayed by the Hawkeye nozzle control system and should help the operator to identify and correct issues with system during field operations:

| Code ID | | Description | Recommended Actions |
|---------|-----|--|--|
| 10 | .13 | VT display is not on-line | 1. If this error occurs frequently, check the ISOBUS connections and review the VT display troubleshooting procedures. |
| 630 | .13 | System calibration required | 1. Complete the calibration wizard to configure all required Hawkeye system settings. Refer to Chapter 4, <i>Initial Calibration</i> for additional assistance with the calibration wizard. |
| 1563 | .2 | Nozzle control valves incompatible with product controller/Hawkeye ECU | 1. Check for product controller ECU software updates. 2. Check for nozzle control valve software updates. |
| | .31 | Inconsistent nozzle control valve software version | 1. Update nozzle control valves to a consistent software version. Refer to the Raven Service Tool Operation manual for assistance with the nozzle update procedure. |
| 3130 | .17 | Low tank volume remaining | 1. Refill product to continue field applications. |
| 3132 | .1 | System pressure not detectable. | 1. Activate product pump. 2. Check for system leaks. 3. Increase pump output to maintain a boom pressure above 2 PSI [13.8 kPa]. |
| | .4 | Pressure transducer not detected | 1. Check the pressure transducer connection. 2. Check the transducer cabling for damage and replace the cable if necessary. |
| | .13 | Pressure transducer not calibrated | 1. Refer to the <i>Pressure Transducer Calibration</i> section on page 22 for assistance with the pressure transducer calibration. |
| | .16 | Monitored system pressure higher than the target pressure deadband | 1. Reduce the equipment speed. 2. Refer to the <i>Pressure Area</i> section on page 42 for assistance with setting or adjusting the target pressure. 3. Refer to the <i>System Settings Tab - Pressure</i> section on page 33 for assistance with setting or adjusting the off pressure percent. |
| | .18 | Monitored system pressure lower than the target pressure deadband | 1. Increase the equipment speed. 2. Refer to the <i>Pressure Area</i> section on page 42 for assistance with setting or adjusting the target pressure. 3. Refer to the <i>Pressure Area</i> section on page 42 for assistance with setting or adjusting the off pressure percent. |

| Code ID | | Description | Recommended Actions |
|---------|-----|--|---|
| 3132 | .15 | Monitored system pressure higher than maximum pressure set-point | <ol style="list-style-type: none"> 1. Reduce the equipment speed. 2. Refer to the <i>System Settings Tab - Pressure</i> section on page 33 for assistance with adjusting the maximum pressure set-point. |
| | .17 | Monitored system pressure lower than minimum pressure set-point | <ol style="list-style-type: none"> 1. Increase the equipment speed. 2. Refer to the <i>System Settings Tab - Pressure</i> section on page 33 for assistance with adjusting the minimum pressure set-point. |
| 4305 | .2 | Equipment speed is below operational range | <ol style="list-style-type: none"> 1. Increase vehicle speed above 0.5 mph [0.8 km/h]. |
| 4985 | .9 | No yaw rate | <ol style="list-style-type: none"> 1. Recalibrate the ECU gyro. Refer to the <i>Turn Compensation Calibration</i> section on page 22 for assistance with calibration of the gyro. 2. Contact a local Raven dealer for additional assistance. |
| 5200 | .2 | Nozzle indexing error | <ol style="list-style-type: none"> 1. Check that all nozzle control valves are connected to the boom harness. 2. Verify nozzle counts on left and right booms. 3. Check nozzle control valve diagnostics or status LEDs to identify valve is causing error. 4. Restart the calibration wizard and complete the nozzle indexing to properly set the nozzle control valve locations across the implement. |
| | .3 | Nozzle indexing incomplete | <ol style="list-style-type: none"> 1. Restart the calibration wizard and complete the nozzle indexing to properly set the nozzle control valve locations across the implement. |
| | .16 | Too many nozzles detected | <ol style="list-style-type: none"> 1. Restart the calibration wizard and verify the number of nozzle control valves connected to the Hawkeye nozzle control system. |
| 523008 | .2 | Nozzle calibration tip mismatch/error | <ol style="list-style-type: none"> 1. Select the appropriate tip type. Refer to the <i>Tip Size Selection</i> section on page 37 for additional assistance. 2. Restart the calibration wizard to reset the tip type setting for the nozzle control system. |
| 523009 | .2 | Nozzle calibration spacing mismatch/error | <ol style="list-style-type: none"> 1. Restart the calibration wizard to re-enter the tip spacing measurement. |
| 523010 | .18 | Some nozzles were not detected during nozzle calibration | <ol style="list-style-type: none"> 1. Check that all nozzle control valves are connected to the boom harness. 2. Check the nozzle control valve diagnostics or status LED. |
| 523090 | .1 | Nozzle calibration error (single) | <ol style="list-style-type: none"> 1. Restart the calibration wizard to recalibrate the nozzle control system. |
| 523091 | .1 | Nozzle calibration error (multiple) | <ol style="list-style-type: none"> 1. Restart the calibration wizard to recalibrate the nozzle control system. |

| Code ID | | Description | Recommended Actions |
|---------|-----|---|---|
| 523092 | .31 | No tip information entered for nozzle control valve (single) | <ol style="list-style-type: none"> 1. Select the appropriate tip type. Refer to <i>Tip Size Selection</i> section on page 37 for additional assistance. 2. Restart the calibration wizard to reset the tip type setting for the nozzle control system. |
| 523093 | .31 | No tip information entered for nozzle control valves (multiple) | <ol style="list-style-type: none"> 1. Restart the calibration wizard to configure tip information for the Hawkeye nozzle control valves. |
| 523126 | .13 | Unable to detect Hawkeye ECU orientation | <ol style="list-style-type: none"> 1. Check the ECU mounting position and verify the ECU is securely mounted. 2. Recalibrate the ECU gyro. Refer to the <i>Turn Compensation Calibration</i> section on page 22 for additional assistance. |
| 523136 | .16 | Monitored flow rate is higher than the target rate deadband | <ol style="list-style-type: none"> 1. Reduce the equipment speed. 2. Review Chapter 3, <i>Avoiding Skips with Hawkeye™ Nozzle Control System</i>. 3. Refer to the <i>Rates Area</i> section on page 41 for assistance with setting or adjusting the target rate. 4. Refer to the <i>System Settings Tab - Alarm</i> section on page 29 for assistance with setting or adjusting the off rate percent. |
| | .18 | Monitored flow rate is lower than the target rate deadband | <ol style="list-style-type: none"> 1. Increase the equipment speed. 2. Refer to the <i>Rates Area</i> section on page 41 for assistance with setting or adjusting the target rate. 3. Refer to the <i>System Settings Tab - Alarm</i> section on page 29 for assistance with setting or adjusting the off rate percent. |
| 523137 | .18 | Minimum flow not met | <ol style="list-style-type: none"> 1. Activate product pump. 2. Review Chapter 3, <i>Avoiding Skips with Hawkeye™ Nozzle Control System</i>. 3. Increase pump output to maintain the minimum recommended flow rate for each nozzle control valve. |
| 523088 | .12 | Nozzle memory error (single) | <ol style="list-style-type: none"> 1. Restart the calibration wizard. 2. Contact a local Raven dealer for additional assistance. |
| | .31 | Nozzle memory warning (single) | <ol style="list-style-type: none"> 1. Restart the calibration wizard. 2. Contact a local Raven dealer for additional assistance. |
| 523089 | .12 | Nozzle memory error (single) | <ol style="list-style-type: none"> 1. Restart the calibration wizard. 2. Contact a local Raven dealer for additional assistance. |
| | .31 | Nozzle memory warning (multiple) | <ol style="list-style-type: none"> 1. Restart the calibration wizard. 2. Contact a local Raven dealer for additional assistance. |

| Code ID | | Description | Recommended Actions |
|---------|-----|--|--|
| 523906 | .17 | Equipment speed below the speed range (single nozzle) | 1. Increase equipment speed to the range displayed on the Hawkeye home screen. Refer to the <i>Hawkeye Home Screen Definitions</i> section on page 39 for assistance with the information provided on the home screen. |
| 523907 | .17 | Equipment speed below the speed range (multiple nozzles) | 1. Increase equipment speed to the range displayed on the Hawkeye home screen. Refer to the <i>Hawkeye Home Screen Definitions</i> section on page 39 for assistance with the information provided on the home screen. |
| 523908 | .15 | Equipment speed above the speed range (single nozzle) | 1. Reduce equipment speed to the range displayed on the Hawkeye home screen. Refer to the <i>Hawkeye Home Screen Definitions</i> section on page 39 for assistance with the information provided on the home screen. |
| 523909 | .15 | Equipment speed above the speed range (multiple nozzles) | 1. Reduce equipment speed to the range displayed on the Hawkeye home screen. Refer to the <i>Hawkeye Home Screen Definitions</i> section on page 39 for assistance with the information provided on the home screen. |
| 523910 | .1 | Nozzle power/temperature error (single) | 1. Nozzle control valve has exceeded safe operating temperature threshold. Check for clogs in valve or associated plumbing. |
| 523911 | .1 | Nozzle power/temperature error (multiple) | 1. Nozzle control valve has exceeded safe operating temperature threshold. Check for clogs or restrictions in valves or associated plumbing. |
| 524080 | .31 | Lost communication with switch box | 1. Check Raven ISOBUS switch box connections. |

General Troubleshooting

| Problem | Action |
|---|---|
| 1. Adjacent nozzle control valves pulsing at same time. | <ul style="list-style-type: none"> • Check cabling connections. • Check nozzle diagnostics and DTC list for nozzle control valve errors. • Restart the calibration wizard to reindex the nozzle control valves across the implement width. Contact a local Raven dealer for additional assistance with |
| 1. Rate reads "0." | <ul style="list-style-type: none"> • Verify SPEED is registering accurately. If SPEED is zero, refer to the VT display troubleshooting procedure. • Verify TOTAL VOLUME is registering flow. If not, refer to problem 6. |

| Problem | Action |
|---|--|
| 2. Rate inaccurate or unstable. | <ul style="list-style-type: none"> • Verify that all calibration numbers and settings keyed into the console are correct. Verify SPEED is registering accurately. If SPEED is inaccurate, refer to the VT display troubleshooting procedure. • In MAN (manual) operation, verify that RATE display holds constant. If not, refer to problem 7. • Confirm that boom section status shown on the display is not changing. • In MAN (manual) operation, check low end and high end pressure range. If pressure cannot be adjusted manually, refer to problem 6. |
| 3. Cannot verify rate in automatic or manual operation. | <ul style="list-style-type: none"> • Check cabling to motorized control valve for breaks. • Check connections in cabling for cleanliness. • Verify that there is voltage at the valve connector by toggling master switch on and setting the system to manual. Manually operate enter a pump PWM to verify voltage. • Verify that valve is turning, if not, replace control valve. |
| 4. Sprayer pressure is correct but RATE is low. | <ul style="list-style-type: none"> • Verify that nozzle strainer screens or check valves are not plugged. • Verify that pressure at each boom is the same. • Verify all nozzles are of proper and same orifice size. See Appendix B, <i>Deadband Calculating the Calibration Values</i>. |
| 5. Total volume does not register. | <ul style="list-style-type: none"> • Check flow meter/encoder cable for breaks and shorts. See the <i>Test the Flow Meter Cable</i> section on page 66. • Check the internal components of the flow meter/encoder; clean and adjust. Appendix C, <i>Maintenance and Replacement Parts</i> for flow meter cleaning and adjustments. • Replace flow meter transducer/encoder. |
| 6. Total volume registers flow inaccurately. | <ul style="list-style-type: none"> • Verify that arrow on flow meter is pointing in direction of flow. |
| 7. Boom valve(s) will not operate. | <ul style="list-style-type: none"> • Check cable for wires with breaks. • Check connectors for cleanliness. • Check BOOM switch and MASTER switch for operation. • Replace boom valves. |

A

The following diagrams illustrate the proper installation of the Raven Hawkeye ECU with various VT displays. These generic diagrams are good examples for both factory and after market installations. Refer to equipment specific drawings and installation manual for precise details for your equipment.

FIGURE 1. Generic Hawkeye Nozzle Control System Connection Diagram

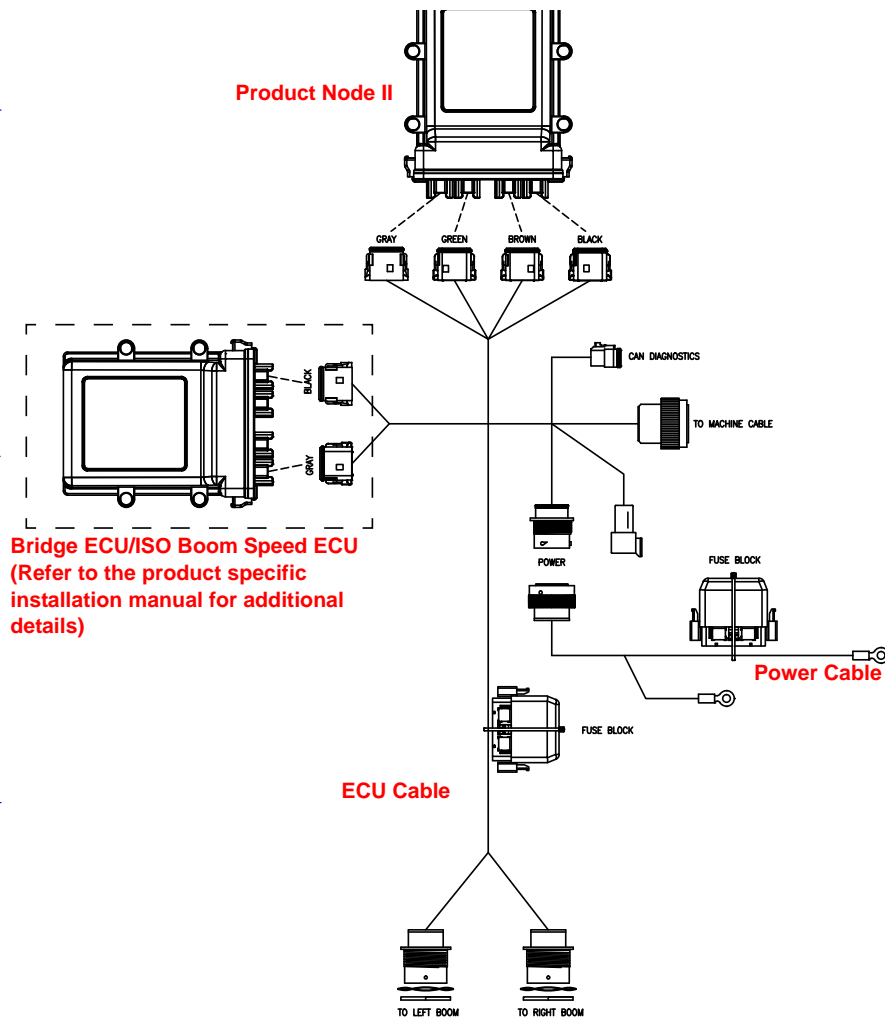
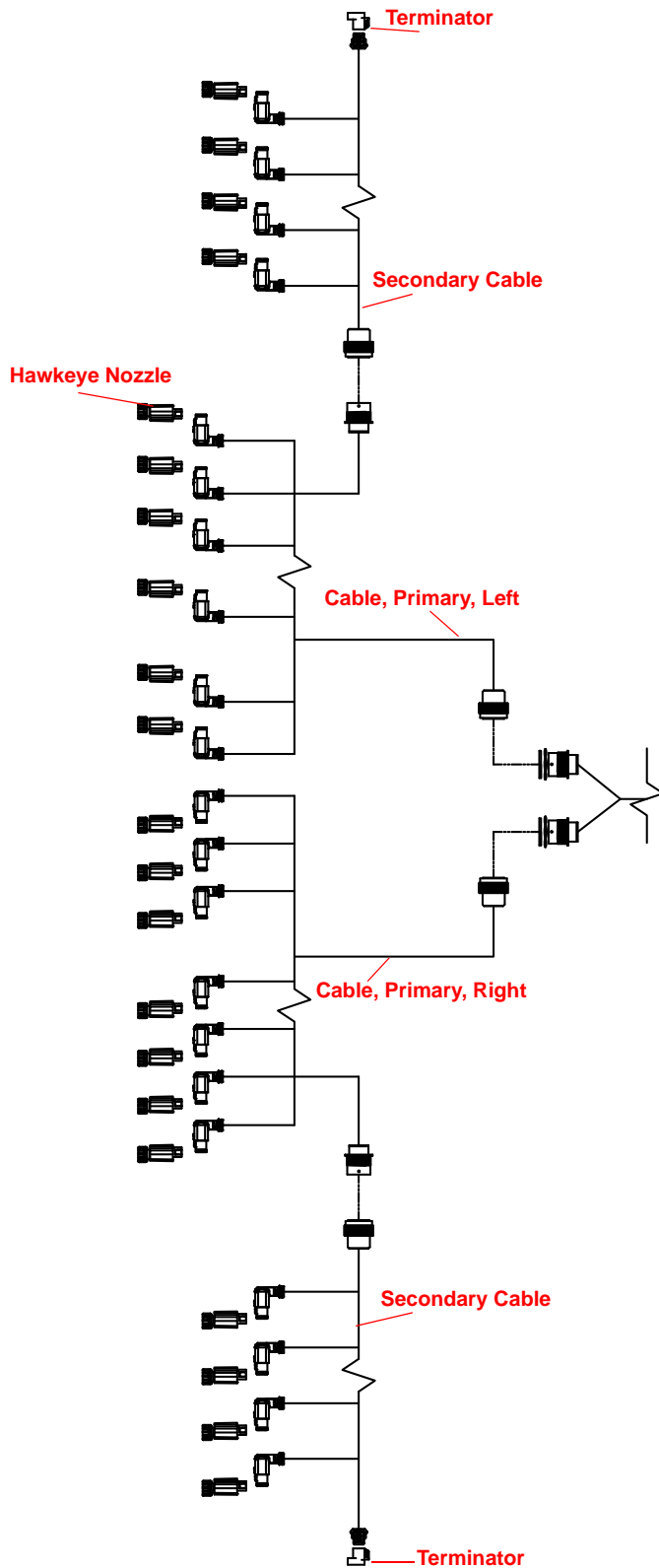


FIGURE 2. Generic Hawkeye Nozzle Control System Connection Diagram



Deadband Calculating the Calibration Values

Section Widths

Use the following formulas to help calculate the section widths.

Calculate the section width with the formula:

$$T \times S = SW$$

Where T = the number of Tips in each section, S = the Spacing between tips, and SW = the Section Width.

For Example:

20 tips in a section with spacing of 40 inches [50.8 cm] would yield:

$$20 \times 40 = 800$$

or a Section Width of 800 inches [2032 cm] (approximately 67 feet [20 m]). Enter 800 [2032] as the width for this section.

Target 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:

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

NVPM = Nozzle Volume per Minute (gallons/acre [lit/ha]), Rate = target application Rate, 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 boom nozzle which comes closest to providing the desired output.

Product Calibration Settings

Response Rate

This value controls the response time of the nozzle control valves. If the response rate is too fast, the valves will over correct and the system may start to oscillate around the target rate. Set a value between 0 to 100, with 0 for fast response rate and 100 for slow.

Deadband

The deadband value is the allowable difference between the target rate and the actual application rate. The values range from 1 to 9, where 1 equals a 1% difference and 9 equals 9% difference.

Pressure Control Settings

Response Rate

This value controls the response time of the nozzle control valves. If the response rate is too fast, the valves will over correct and the system may start to oscillate around the target pressure. Set a value between 0 to 100, with 0 for fast response rate and 100 for slow.

Sensitivity

The sensitivity value sets the sensitivity of the pressure readings into the product controller. The values range from 1 to 9, with 1 the most sensitive and 9 the least sensitive. If the value is set too low, the pressure reading could be unstable. The default value is 2.

APPENDIX

C

Maintenance and Replacement Parts

Hawkeye Nozzle Control Valve Maintenance

TABLE 1. Nozzle Control Valve Seal Replacement Kit Components

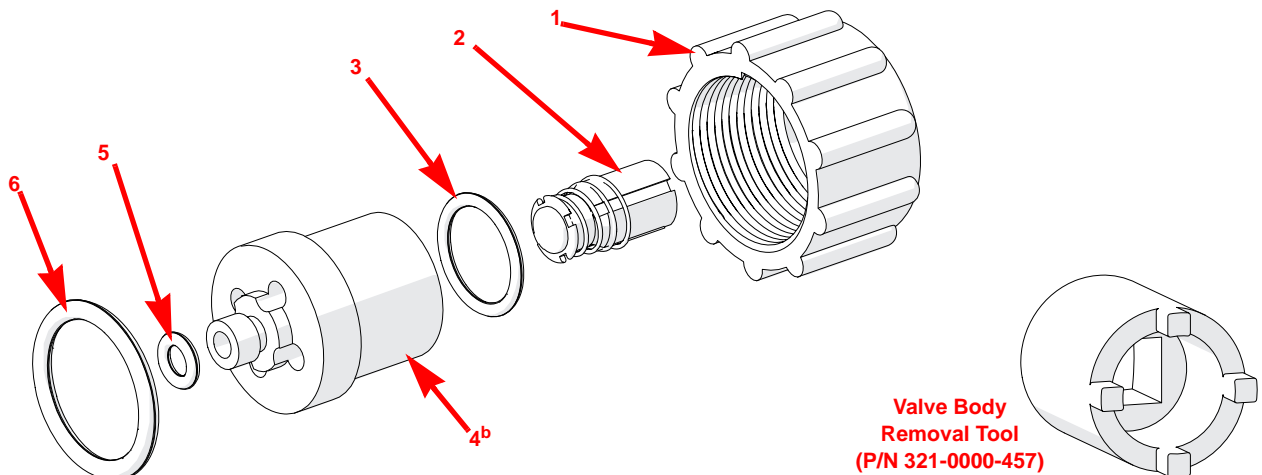
| Item | Seal Replacement Kits |
|------|---|
| | TeeJet (P/N 117-1005-050) Hypro/Arag (P/N 117-1005-051) Wilger (P/N 117-1005-052) |
| 1. | Fly Nut ^a |
| 2. | Plunger Assembly |
| 3. | O-Ring |
| 4. | Valve Body ^{ab} |
| 5. | O-Ring |
| 6. | O-Ring |

| Valve Body Replacements ^{ab} | |
|---------------------------------------|---|
| Part Number | Description |
| 107-1005-001 | Valve Body - TeeJet |
| 107-1005-002 | Valve Body - Wilger |
| 107-1005-003 | Valve Body - Hypro/Arag |
| Additional Tools | |
| 321-0000-457 | Tool - Hawkeye Valve Body Removal Tool (1/4" Drive) |

a. Appearance may vary.

b. Valve body replacements not included in seal replacement kits - sold separately.

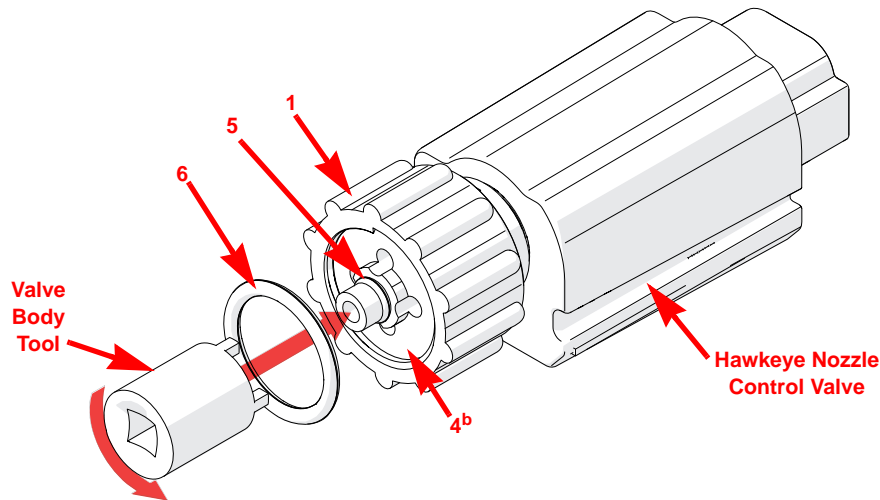
FIGURE 1. Seal Replacement Kits and Valve Body Assembly



Nozzle Control Valve Maintenance Procedure

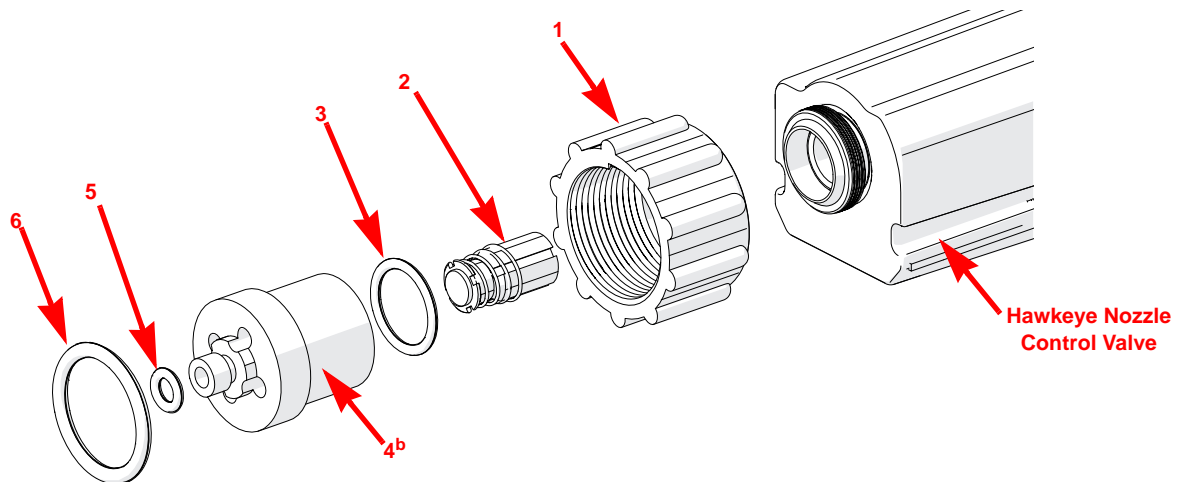
The Hawkeye nozzle control valves are designed to provide up to 1,000 hours maintenance free operation with proper equipment maintenance as recommended by the equipment or chemical manufacturer. The following nozzle control valve maintenance procedures should be performed on the nozzle control system or on individual nozzles if leaks are observed at a specific spray tip.

FIGURE 2. Nozzle Control Valve Maintenance Detail



1. Loosen the fly nut (item 1) and remove the Hawkeye nozzle control valve from the nozzle body.
2. Inspect the large o-ring (item 6) on the face of the valve body (item 4). Replace if necessary.
3. Inspect the small o-ring (item 5) on the tip of the valve body. Replace if necessary.
4. Using a valve body removal tool (P/N 321-0000-457), loosen and remove the valve body (item 4) from the Hawkeye nozzle control valve.

FIGURE 3. Hawkeye Nozzle Control Valve Exploded View



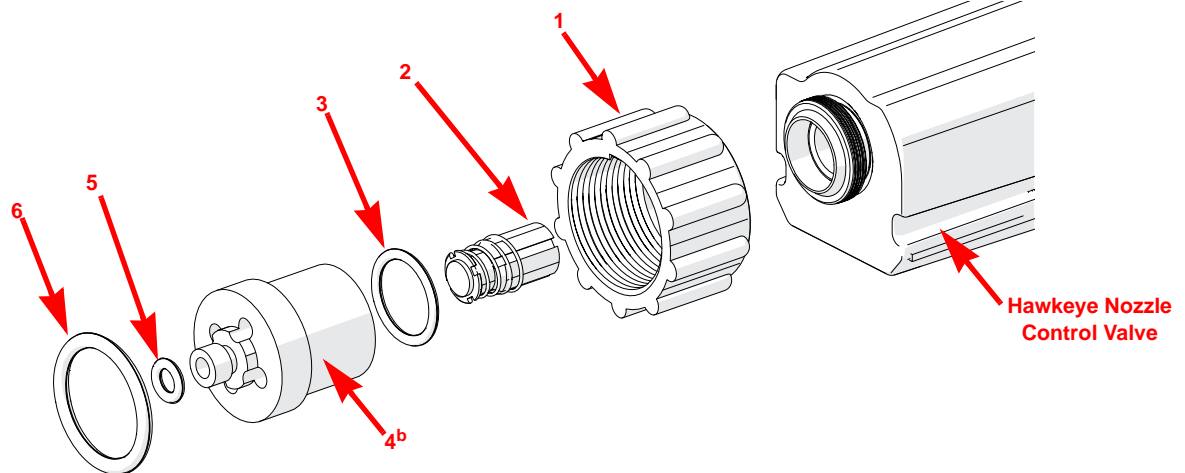
5. Inspect the o-ring (item 3) on the inside of the valve body. Replace if necessary.
6. Clean and inspect the plunger assembly (item 2). Replace the plunger assembly if the rubber seal is worn or damaged. Refer to Figure 4 on page 63 for reference to plunger seal condition.
7. Inspect fly nut (item 1). Replace if worn or damaged.

FIGURE 4. Plunger Inspection Detail



Hawkeye Nozzle Control Valve Assembly Procedure

To reassemble a nozzle control valve after inspection and maintenance:



1. Replace fly nut (item 1) over valve body (item 4).
2. Replace o-ring (item 3) inside valve body.
3. Place plunger assembly (item 2) into nozzle control valve cavity.
4. Thread the valve body onto the nozzle control valve and finger tighten.
5. Using a valve body removal tool (P/N 321-0000-457), turn valve body 1/4 to 1/3 turn to secure to the valve body.
6. Verify small o-ring (item 5) is seated into groove on valve body tip.
7. Place large o-ring (item 6) onto valve body face.
8. Thread fly nut onto nozzle body on equipment spray boom.
9. Hand tighten the fly nut to the nozzle body to prevent over tightening.
10. Prior to filling the tank with chemical or starting a field application, refer to the *Testing for Leaks* section on page 64 to test the Hawkeye system.

System Testing Procedures

Testing for Leaks

1. Fill the applicator tank with clean water.
2. Toggle the implement master switch to the on position.
3. Select the pump softkey to activate the product pump.
4. Toggle one section switch to the on position.
5. Inspect the Hawkeye nozzle control valves for leaks around the fly nut.
6. If leaks are observed:
 - a. Toggle the section and master switches to the off position.
 - b. Use a channel lock or large pliers to carefully tighten the fly nut until leaking ceases.
 - c. If leaking continues after tightening the fly nut more than half a turn, perform the procedures outlined in the *Hawkeye Nozzle Control Valve Maintenance* section on page 61 to inspect the nozzle control valve, o-rings, and plunger assembly.
 - d. Repeat this procedure to verify leak has stopped. Contact a local Raven dealer for additional assistance if leaks persist.
7. Repeat this process to check nozzle control valves on each section of the equipment.

Testing Nozzle Control Valve Cable Connection

Disconnect the boom cable from the nozzle control valve. Hold the connector so that the retention clip is facing toward the 12 o'clock position.

FIGURE 5. Hawkeye Nozzle Control Valve Cable Connector

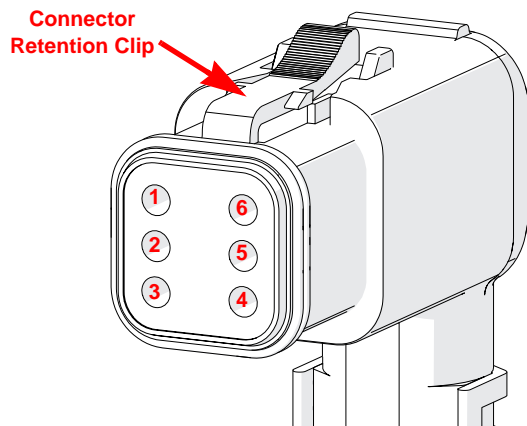


TABLE 2. Nozzle Control Valve Cable Connector Pins

| Pin | Description | Pin | Description |
|-----|----------------------|-----|----------------|
| 1 | Chassis Power (+12V) | 6 | Chassis Ground |
| 2 | CAN High (<xxx>V) | 5 | Switch In (3V) |
| 3 | Switch Out | 4 | CAN Low |

Flow Meter Maintenance

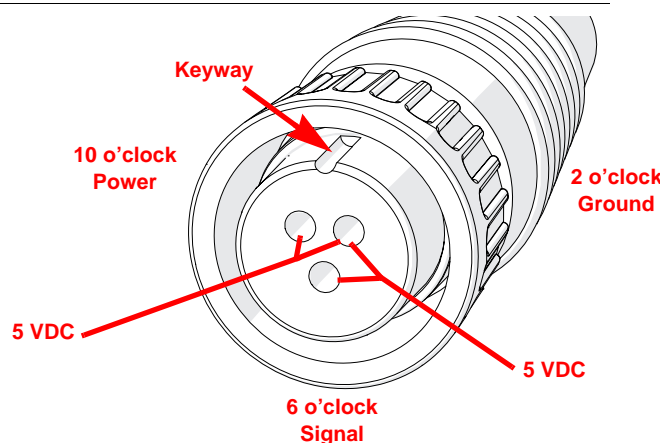
Note: Thoroughly bleed nurse tank hose and all other system lines prior to disassembling the flow meter, fittings, or hoses.

1. Remove flow meter from the equipment and flush with clean water to remove any chemicals.
2. Remove flange bolts or clamp from the flow meter.
3. Remove the turbine hub and turbine from inside flow meter.
4. Clean turbine and turbine hub of metal filings or any other foreign material, such as wettable powders. Confirm that the turbine blades are not worn. While holding the turbine hub in your hand, spin turbine. The turbine should spin freely with very little drag inside the hub.
5. If transducer assembly is replaced or if turbine stud is adjusted or replaced, verify the turbine fit before reassembling. Hold turbine hub with turbine on transducer. Spin turbine by blowing on it. Tighten turbine stud until turbine stalls. Loosen turbine stud 1/3 turn. The turbine should spin freely.
6. Re-assemble flow meter.
7. Using a low pressure (approximately 5 PSI [34.5 kPa]) jet of air, verify the turbine spins freely. If there is drag, loosen hex stud on the bottom of turbine hub 1/16 turn until the turbine spins freely.
8. If the turbine spins freely and cables have been checked per *Testing Flow Meter Cables* section on page 65, but flow meter still is not metering properly, replace flow meter transducer.

Testing Flow Meter Cables

Disconnect the extension cable from the flow meter. Hold the extension cable so that the keyway is facing toward the 12 o'clock position.

FIGURE 6. Flow Meter Extension Cable Pin Diagram



Test the Flow Meter Cable

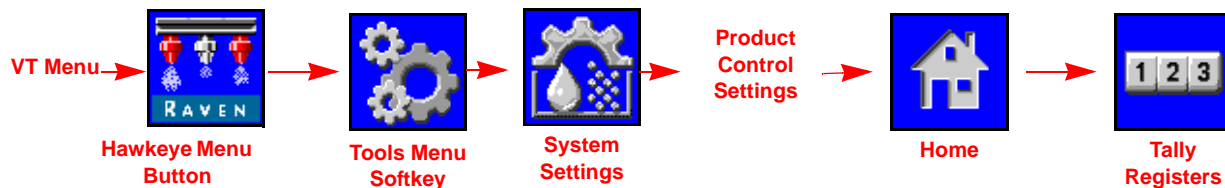
To test the flow meter cable:



1. Open the VT menu and select the Hawkeye menu button.
2. From the home screen, select the Tools Menu softkey along the right side of the display.
3. Select the System Settings tab along the top of the display and select the Product Control Settings button.
4. Enter a value of 1 for the Meter Cal value.
5. Select the Home softkey along the right side of the display and then select the Tally Registers softkey.
6. Monitor the Total Volume value while testing the cable.
7. Toggle at least one section switch and the master switch to the on position.
8. Use a small jumper wire (e.g. paper clip) to short the 2 o'clock and 6 o'clock sockets with a "short-no short" motion. Each time the short is made, the total volume value should change by increments of 1 or more.
9. If the total volume does not increase, disconnect this section of flow meter extension cable and repeat this test at the next connector closest to ECU. Replace defective cable as required.
10. If all cables test good, replace the flow meter.
11. After testing is complete, re-enter correct meter cal value and units.

Procedure to Recalibrate Flow Meter

To calibrate the flow meter:



1. Fill the applicator tank with clean water.
2. Open the VT menu and select the Hawkeye menu button.
3. From the home screen, select the Tools Menu softkey along the right side of the display.
4. Select the System Settings tab along the top of the display and select the Product Control Settings button.
5. Enter a value of 10 [38] for the meter cal.
6. Select the Home softkey along the right side of the display and then select the Tally Registers softkey.
7. Enter a value of 0 for the total volume value.
8. Toggle the master switch and all boom sections to the off positions.
9. Remove a section hose and place it into a calibrated 5 gallon [19 liter] container.
10. Toggle the master switch and the boom switch corresponding to the hose that was placed in the container.
11. Pump exactly 10 gallons [38 liters] of water to fill the container twice.
12. Check the total volume registered on the VT tally registers prompt. The reading displayed is the new meter cal value. This value should be within $\pm 3\%$ of the calibration number stamped on the tag of the flow meter.

13. Repeat this procedure several times to confirm accuracy. Always “zero out” the total volume display before retesting.

Note: For increased precision, set meter cal to 100 [378] and pump 100 gallons (378 liters) of water.

14. To verify the flow meter calibration, the fill applicator tank with a predetermined amount of measured liquid (i.e. 250 gallons [946.4 L]).

Note: Do not rely on graduation marks molded into the applicator tank.

15. Empty the applicator tank under normal operating conditions.

If the total volume displayed is different from the predetermined amount of measured liquid by more than ± 3%, complete the following calculation:

$$CMC = \frac{MC \times V_M}{V_A}$$

Where CMC = the Corrected Meter Cal, MC = the Meter Cal used to apply the known volume, and VM = the Volume measured by the VT tally registers prompt, and VA = the predetermined volume applied.

For Example:

The VT displays a Total Volume of 260 [984] when a Meter Cal of 720 [190] was used to apply a measured volume of 250 gallons [946 liters]. Therefore:

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

the Corrected Meter Cal is 749 [198]

16. Return to the Product Control Settings prompt and enter a value of 749 [198] for the meter cal.

Storage and Start-Up Checklist

Hawkeye Storage and Start-Up Checklist

This section provides procedures to maintain the Hawkeye system. There are checks to perform before storing the equipment and also starting the equipment after long periods without use.

Preseason Cleaning and Flushing

The Hawkeye system requires a few steps in addition to your sprayer manufacturer's recommended preseason maintenance and inspection. To prepare the Hawkeye system:

1. Remove and clean all of the product strainers.
2. Replace the strainers after they are clean and dry.
3. Fill the product tank with at least 200 gallons of clean water.
4. If the boom tubes have a flush valve at the end, open the flush valves and flush the boom tubes with 100 gallons of clean water.
5. Remove or open the spray tips and flush the booms with the remaining water.

Functional Inspection

Refer to the following sections for assistance with validating that the Hawkeye nozzle control system has been installed properly:

Nozzle Control Valve Function

To verify that the Hawkeye nozzle control system is functioning properly after installation:

1. Flush the main product tank and boom plumbing with clean water, and verify the tank contains at least 100 gallons [379 L] of clean water.
2. Park the equipment in an area with enough space to unfold the booms and allows for visual inspection of the spray pattern from a moderate distance (e.g. 20 ft [6.1 m]).
3. Set the Hawkeye nozzle control system to manual mode, and set both the pump PWM and nozzle PWM to 50%. Refer to the *Manual Pump Control Buttons* section on page 40 or the *Manual Nozzle Control Buttons* section on page 40 for assistance with adjusting the PWM percent values in the manual control mode.

4. Toggle all section switches and the master switch.



5. While maintaining a safe distance away from any spray drift, visually check that all nozzle control valves are pulsing with a uniform pattern. Adjacent nozzle control valves should alternate pulsing. If adjacent spray tips are pulsing at the same time, refer to Chapter 9, *Troubleshooting*, for additional assistance.
6. On the VT, set nozzle PWM to 0% to close the nozzle control valves.
7. Visually check that none of the nozzles are spraying or dripping. Refer to *Testing for Leaks* section on page 64 for additional assistance and troubleshooting if leaks are observed.

Turn Compensation Feature Inspection

To verify the Turn Compensation feature is enabled and operating as anticipated:

Note: Complete the procedure outlined in the *Nozzle Control Valve Function* section on page 69 to validate the nozzle control valve function prior to performing the following procedure.

Refer to the Turn Compensation Calibration section on page 22 for assistance with calibrating the turn compensation feature if necessary.

1. Move the implement to an open area where the equipment may be driven in quick, tight turns.
2. Verify that the turn compensation feature is enabled.
3. Set the system to automatic mode and toggle the section and master switches to the on positions. Refer to Chapter 6, *Hawkeye Operation*, for additional assistance with operation of the nozzle control system.
4. While driving at a speed between 5 and 10 mph [8 and 16 km/h] and maintaining a safe working distance, observe the inner-most and outer-most spray tips while the implement is turning sharply.

Note: The nozzle PWM percent value may also be used to monitor the operation of nozzle control valves across the spray boom. Refer to Chapter 8, *Hawkeye Nozzle Control Valve Diagnostics*, for additional assistance with on-screen nozzle control valve diagnostics.

5. While turning, the nozzle control valves toward the outside of the corner should begin to output a higher flow rate (higher PWM percent), while valves toward the inside of the corner should begin to output a reduced flow rate (lower PWM percent) or may shut off. The difference between inner and outer flow rates will vary depending on machine speed, turn rate, and implement width.
6. If the operator is able to observe a difference in the spray pulsing, or the on-screen PWM percent, the turn compensation feature is working correctly. If there is no difference between the PWM percent values across the implement width, recalibrate the turn compensation feature and repeat this test.

Winterizing and Storing the System

Refer to the sprayer manufacturer winterizing and storing procedure for information on preparing equipment for storage.



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.

RAVEN

Hawkeye™
Calibration & Operation Manual
(P/N 016-0171-584 Rev A 11/14 E23260)



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