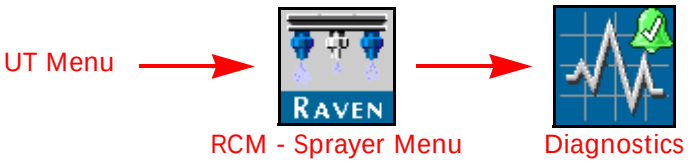
CHAPTER 8 DIAGNOSTICS

System and NCV information, diagnostics, and tests are accessible via the Diagnostics softkey displayed along the right side of the page.

To access System or NCV Diagnostics:



1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey.

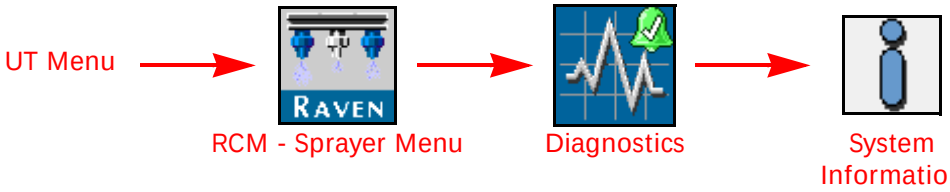
Refer to the following sections for additional system or NCV diagnostics information:

- *System Diagnostics* section on page 61
- *NCV Diagnostics* section on page 82
- *NCV Updates* section on page 85

SYSTEM DIAGNOSTICS

SYSTEM INFORMATION

To review information about the RCM - Sprayer:



1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey along the right side of the page.
3. Select the System Information button. The following information is displayed on the page:

Hardware/Software. Displays hardware and software information for the ECU.

Delivery System. Displays application information for the product when active and applying.

System Voltages. Displays voltage and current information for the ECU and attached sensors.

Speed Source. Displays any detected speed sources and options to select. “Auto” is recommended for most applications.

Switch Box. Displays detected section control switch status information.

Section Status. Displays section driver status information.

Working Parameters. Displays the implement width, current speed, speed source, speed source ISO name, and address.

Pressure Sensors. Displays voltages and pressure information for each pressure sensor.

Task Totals. Displays the area covered and volume applied for the current task.

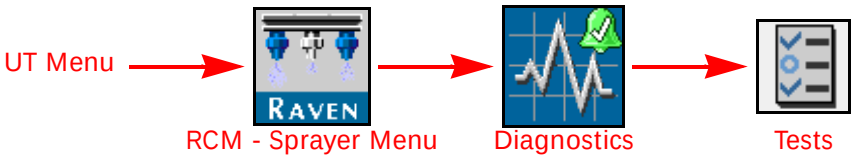
Inertial Sensors. Displays the detected ECU yaw rate and downward direction.

CAN Network. Displays Busload for ISO CAN network and NCV CAN network, which can be helpful to identify excessive CAN traffic. Also displays status of CAN 3 and CAN 4.

TESTS

Run diagnostic tests to check system operation, for help locating components requiring service or replacement, and other information to assist with keeping the Hawkeye® 2 working at maximum efficiency.

To access available tests:



1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey.
3. Select the Tests Tab at the top of the page. The following diagnostic tests are available:

NCV Communication Test. Scans the NCV CANbus communication and assists in locating where issues may be present. Boom graphics show indexing order from leftmost to rightmost NCVs. No Communication After and Communication Resumes At values will be shown. When only a few NCVs are noted, inspect nearby NCVs, connections, pins, and cabling for corrosion, visible damage, or pinching between those NCVs. In some instances, splices or wiring may be damaged underneath cable sheathing. Inspect those items along with fuses, 19-pin connections, and terminators when large sections of NCVs are not communicating.

NOTE: Refer to Chapter 9, *Troubleshooting*, for additional assistance with NCV

Controller Statistics. This process allows you to view detailed product controller performance and health statistics including Boom Pressure, Target Pressure, Pump Control Effort, Actual Flow per Area, and Target Flow per area over a user-defined amount of time. You may start the test immediately or press delayed start to start the test later. The test will record up to two parameters, and provide a graph of performance.

NCV Statistics. Allows access to view NCV statistics including Driver Temperature, Logic Temperature, Open Hold Current, Powered Time, and HC Voltage Minimum. Press Start Data Visualization to generate an on-screen graph of each NCV. Arrow over to see data for a specific NCV.

NCV Updates. Scans all NCVs for potential updates. If an update is detected, an option will be given to update the software. This test requires the engine to be running and the NCV bus to be communicating and properly terminated.

Calibrate NCVS. This test will allow you to recalibrate your NCVs. This process is recommended after replacing one or more NCVs.

Reboot Product Controller. Allows you to reboot the product controller ECU. This will reset the controller and re-initialize communication with the CANbus without resetting controller parameters.

Boom Pressure Relief. This procedure will activate the NCVs or section valves or open the recirculation valve for 10 seconds to relieve pressure to the product tank when the product pump is turned off. System pressure may be monitored on the screen. Ensure the machine is in a safe area and the master switch is on prior to beginning this procedure.

NOTE: When recirculation is configured, Boom Pressure relief will relieve pressure to the product tank through the recirculation valve instead of dispensing product through the NCVs.

⚠ CAUTION

Some residual pressure may exist in the boom or other plumbing circuits after this action is performed. Always wear proper personal protective equipment and slowly open any plumbing components when performing system maintenance.

Boom Prime. This procedure will prime the boom with product by opening the section valves and NCVs. Each section valve switch must be on, and the master switch must be turned on. The product pump will turn on and product will dispense out the boom for the entered Section Auto-Operation Times, beginning from the outermost and progressing inward.

NOTE: If boom recirculation is enabled, the Boom Prime test will be unavailable.

⚠ WARNING

Chemical will be discharged during the boom prime procedure. Be sure the boom is fully unfolded and in a location safe for chemicals to be dispensed.

PWM Health Test. This test analyzes the performance and control range of the PWM pump control valve when equipped.

During the test, the system will automatically increase PWM duty cycle and monitor system boom pressure and provide the control range and system output parameters. The minimum and maximum control effort values will be calculated, and overall health will be determined. For best control, the PWM control range should be greater than 20% and the graphed line should not have large steps where the displayed pressure is constant during the test.

NOTE: A narrow overall range, large steps in control, or high response hysteresis (significant differences between increasing and decreasing duty cycle performance) may result in erratic system performance. Consult with the sprayer manufacturer if the test repeatedly shows these types of errors.

Demonstration Mode. Allows you to simulate typical operating pressure and system flow. This is only intended for bench-top simulation and not for use on a machine while actively spraying. Failure to comply may result in product being dispensed as the control valve may be actuated based on the simulation conditions.

Service Menu. Allows access to enhanced diagnostics and features.

PERFORM THE PWM HEALTH TEST

⚠ WARNING

Chemical will be discharged during the test procedure. Be sure the boom is fully unfolded and in a location safe for chemicals to be dispensed.

NOTE: For this test, park the sprayer in a safe area. The test can be run without turning on the master switch and spraying product for systems that do not have injection systems installed. Product should be in the tank, and the sparge should be closed to prevent system flow losses. Engine RPM should be at least 1800. Ensure system plumbing is not pinched and strainers are clean. If the system has a check valve for direct injection, the system must spray product to determine valve performance. Park the system in a safe area and turn on master switch and all boom switches while performing this test.

To perform the test:

1. Ensure there is product in the main product tank.
2. Close all open agitation or sparge lines.
3. Ensure all machine control valves are directed to the spray position.
4. Press Begin under the PWM Health test.
5. Set engine RPM to approximately 1800 during the test.

NOTE: If the test cancels due to system over-pressure, you may need to slightly decrease engine RPM and run the test again.

6. Turn on the system master spray switch.
7. Press the Next button to start the test.

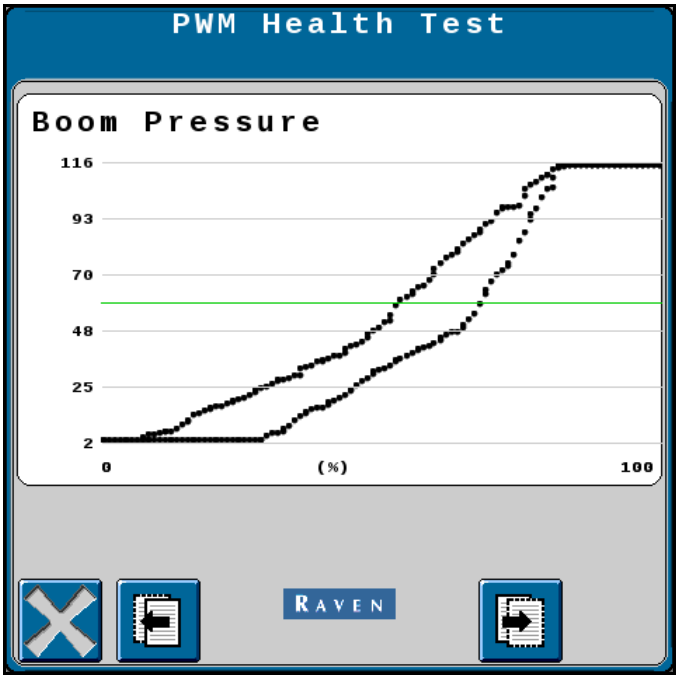
   The test will start running the product PWM control valve at the minimum duty cycle, up to the maximum duty cycle, and back to the minimum. The system flow and pressure will change while this test is happening and product will spray out of the nozzles.

NOTE: Press the Cancel button to stop the test at any time.

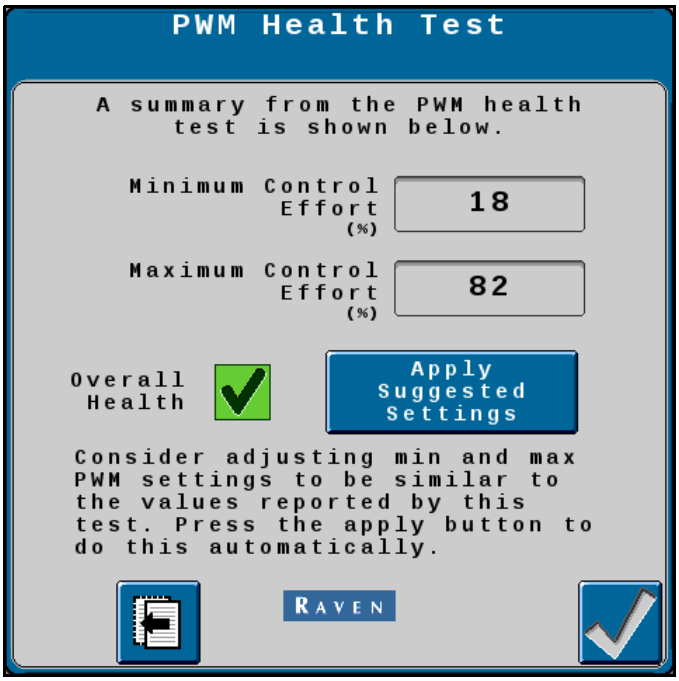
8. Once the test is complete, the PWM valve will turn off.
9. Turn off the master spray switch and return the engine RPM to idle. If the PWM cartridge has sufficient range, a green check mark will display on the page.
10. Press Apply Suggested Settings to accept the suggested changes to the PWM range or Ignore to keep the previous values.
11. Press the Accept button to return to the previous page.

PMW HEALTH TEST - EXAMPLE RESULTS

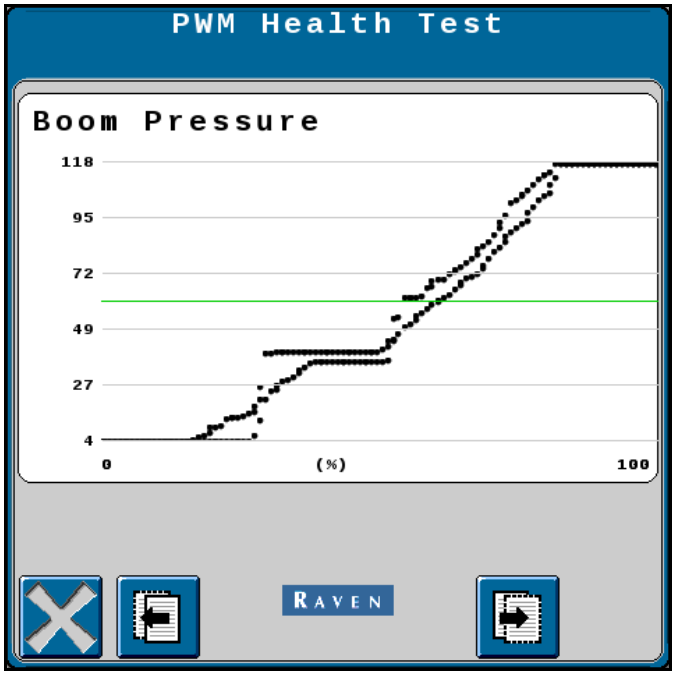
Good Control Performance. Example of pwm control valve performing well with good response hysteresis. Curves do not have significant areas of flat spots, and go over a large portion of the Control Effort Duty Cycle % range.



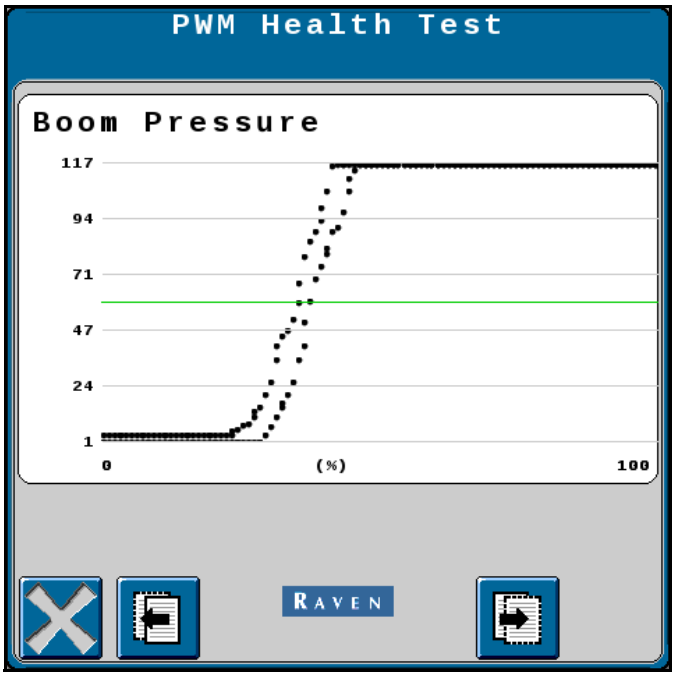
Good Control Range. Example of pwm valve having good overall control range and a large difference (>20% overall range) between minimum and maximum Control Effort Duty Cycle %. Apply suggested changes to optimize control range for the system.



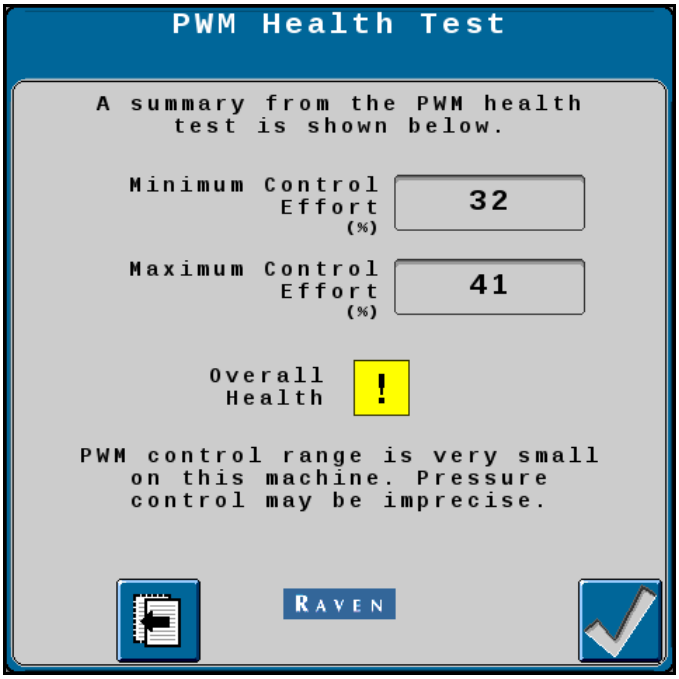
Poor Performance - Steps in Control. Example of poorly performing pwm control valve. Curves have large control steps, which will result in unresponsive control and poor system performance. PWM control valve may need to be cleaned or replaced.



Poor Performance - Narrow Control Range. Example of very narrow pwm valve control range. Pressure reaches maximum in a very narrow Control Effort Duty Cycle % range (<20% overall range). Target Rate, Pressure, Speed, and Tip selection must be carefully chosen to ensure control is adequate. Increasing agitation may help in some cases if possible.

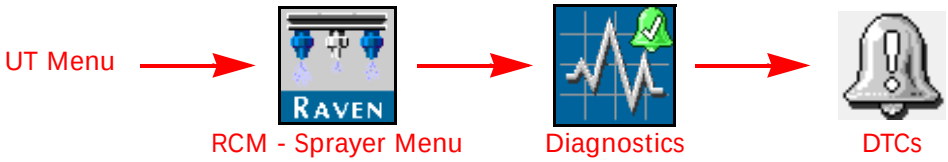


Poor Performance - Narrow Control Range. Example of very narrow pwm valve control range. Pressure reaches maximum in a very narrow Control Effort Duty Cycle % range (<20% overall range).



DIAGNOSTIC TROUBLE CODES (DTCS)

Displays active and inactive diagnostic trouble codes and provides the ability to clear inactive codes:



1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey along the right side of the page.
3. Select the Diagnostic Trouble Codes (DTCs) tab.
    - Current trouble codes are displayed in the Active table. The DTC Identification number and occurrence count is listed.
    - Resolved trouble codes are displayed in the Inactive table. The DTC Identification number and occurrence count is listed.
4. Use the up and down arrows to scroll through the list of trouble codes. A description of the highlighted code is shown below each table.
5. If desired, press the Clear button to erase all the trouble codes listed in the Inactive table.

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

NOTE: Before taking any of the following Recommended Actions, it is suggested to cycle machine power, reboot the controller, or check ECU or boom wiring for damage, as these are common remedies and can potentially solve several issues. If none of the following Recommended Actions solve the issue(s), it is recommended to replace the RCM-S ECU or NCV(s) affected.

Code ID		Description	Recommended Actions
4985	.13	Yaw sensor calibration error	• Park machine on level ground and disable any boom height controls. Go to *Tools -> System Settings -> User Settings -> Calibrate Turn Compensation* and verify the detected orientation is accurate, and ensure Yaw Rate is not varying by +/-.5 deg/sec while the engine is running. If needed, select Redetect Orientation to recalibrate. • Cycle power to RCM-S ECU by going to Diagnostics -> Tests -> Reboot Product Controller.
	.2	Yaw sensor erratic	
520194	.3	Supply voltage high	• Go to *Diagnostics -> System Information -> System Voltages* drop-down and verify RCM-S ECU Power is between 8V and 16V with engine running. • Cycle power to RCM-S ECU by going to *Diagnostics -> Tests -> Reboot Product Controller*. • Check power and ground at RCM-S ECU connections. (Grey connector pins PWR 1 - 3, GND 4 - 6). Repair or replace as necessary. • Check power and ground on chassis cable connectors. Repair or replace as necessary. • Check RCM-S ECU power at fuse panel. Repair or replace as necessary. • Check RCM-S ECU cables and connections for damage. Repair or replace as necessary. • Check power and ground at battery terminals and connections. Repair or replace as necessary. • Check machine battery and charging system. Repair or replace as necessary.
	.4	Supply voltage low	
520453	.31	FPGA error	• Cycle power to RCM-S ECU by disconnecting and reconnecting RCM-S ECU gray connector. • Update or re-load RCM-S ECU software and create a new machine profile.

Code ID		Description	Recommended Actions
520454	.31	NCV subnet offline	• Go to *Diagnostics -> Tests -> NCV Communication Test* and perform NCV Communication test to determine if any NCVs are communicating. • Inspect NCV lights for power. If all NCV lights are off on one or both sides, check power circuit. If all on, check NCV CAN circuits. • Cycle power to RCM-S ECU by going to *Diagnostics -> Tests -> Reboot Product Controller*. • Check power to NCV relays at RCM-S RCM-S ECU connections. (Black center connector pins 7 LT and 8 RT). Repair or replace as necessary. • Check power and ground at left and right NCV relays and connectors. Repair or replace as necessary. • Check HC power and ground on NCV boom cables (round 19-pin connector pins PWR 8, 12, 16, GND 10, 14, and 18). Repair or replace as necessary. • Check NCV power across NCV fuses. Repair or replace as necessary. • Check NCV power at fuse box panel. Repair or replace as necessary. • Check NCV chassis and boom cables and connections for damage. Repair or replace as necessary. • Check NCV chassis cable power and ground at battery. Repair or replace as necessary. • Check NCV CAN circuits at RCM-S RCM-S ECU connections (black center connector pins 11 LO and 12 HI). • Check NCV CAN circuits at boom cables (round 19-pin connector pins 4 LO and 6 HI).
520455	.31	Left boom NCV subnet offline	
520456	.31	Right boom NCV subnet offline	
523008	.13	No tip size selected	• Go to *Tools -> Applicator Setup -> Select Tip* and verify a tip size other than “NA” is selected for either NCV or Bypass or both, depending on mode. Select a tip size again, even if the same. • Cycle power to RCM-S ECU by going to *Diagnostics -> Tests -> Reboot Product Controller*.

Code ID		Description	Recommended Actions
522941	.31	NCV missed status message - single	• Go to *Diagnostics -> Diagnostic Trouble Codes -> NCV Errors -> NCV Heat Map* and locate the NCV(s) that are not green. Their numerical locations are labeled referencing the forward travel direction, from leftmost to rightmost NCV along the boom. Note their location for future reference and troubleshooting as necessary. • Cycle power to RCM-S ECU by going to *Diagnostics -> Tests -> Reboot Product Controller*. • Check NCV software by going to *Diagnostics -> Tests -> NCV Updates* to scan and update software on affected NCVs. • Replace affected NCV's. Then recalibrate NCV's by going to *Diagnostics -> Tests -> Calibrate NCVs*. If necessary, check NCV software by going to *Diagnostics -> Tests -> NCV Updates* to scan and update software on affected NCV's.
522942	.31	NCV missed status message - multiple	
522943	.31	NCV corrupt message contents - single	
522944	.31	NCV corrupt message contents - multiple	
523014	.13	NCV requires message	
523016	.31	Inconsistent nozzle control valve software version	
523017	.31	NCV programming out of date (NCV update)	
523128	.0	High NCV temperature - single	• May result from high ambient temperature or running NCVs without flowing liquid. Allow NCVs to cool. • Replace NCV and Recalibrate NCVs by going to *Diagnostics -> Tests -> Calibrate NCVs*
523129	.0	High NCV temperature - multiple	
523136	.4	NCV voltage low single	• Check wiring, fuses, and connections before the left and right cable circuit branches. When only a few NCVs are noted, inspect nearby NCVs, connections, pins, and cabling for corrosion, visible damage, or pinching between those NCVs. In some instances, splices or wiring may be damaged underneath cable coverings. Repair or replace as necessary. • Check power and ground on chassis cable connectors. Repair or replace as necessary. • Check power and ground at battery terminals and connections. Repair or replace as necessary. • Check machine battery and charging system. Repair or replace as necessary.
523137	.4	NCV voltage low multi	
523147	.13	Switch box not detected	• Check power and CAN cabling and connections to switch box. Repair or replace if necessary. • Edit existing profile or create a new machine profile as required. • Cycle system power.
523151	.31	Switch box has gone offline	

Code ID		Description	Recommended Actions
523076	.31	NCV offline - single	• Go to *Diagnostics -> Diagnostic Trouble Codes -> NCV Errors -> NCV Heat Map* and locate the NCV(s) that are not green. Their numerical locations are labeled referencing the forward travel direction, from leftmost to rightmost NCV along the boom. Note their location for future reference and troubleshooting as necessary. • Go to *Diagnostics -> Tests -> NCV Communication Test*. Displayed NCVs are numbered on screen from left to right. These are referenced from the left side of the machine, facing the normal forward direction of travel. If No CAN Error Detected is displayed, that means that the test has found no detectable communication errors. Left, right, and tip-to-tip latency times will be displayed. If an error occurs, note the “No Communication After NCV” number, and the “Communication Resumes At NCV” number. The issue is likely between, and possibly includes, these NCVs. Inspect NCVs on the boom, wiring, connections, or fuses related to the circuit between and including these NCVs. If there is no communication after the #1 NCV, there may be a power loss between the battery connection and the NCV cable connections, or a CAN communication problem between the RCM - Sprayer RCM-S ECU and the NCV cable connections. Inspect wiring, fuses, and connections before the left and right cable circuit branches. When only a few NCVs are noted, inspect nearby NCVs, connections, pins, and cabling for corrosion, visible damage, or pinching between those NCVs. In some instances, splices or wiring may be damaged underneath cable coverings. When large sections of NCVs are not communicating, inspect those items along with fuses and large electrical connections. If intermittent power to the NCVs is the cause of the issue, or if NCVs are disconnected and re-connected during the troubleshooting process, NCVs will appear back online after repairing the system, but DTC errors will still exist until the system power is cycled off then back on. • Cycle power to RCM-S ECU by going to *Diagnostics -> Tests -> Reboot Product Controller*. • Replace NCV and Recalibrate NCV's by going to *Diagnostics -> Tests -> Calibrate NCVs*
523077	.31	NCV offline - multiple	
523078	.2	NCV invalid index single	
	.31	NCV not indexed single	
523079	.2	NCV invalid index multiple	
	.31	NCV not indexed multiple	
523082	.2	NCV CAN error limit - single	
523083	.2	NCV CAN error limit multiple	
523084	.31	NCV unexpected reset - single	
523085	.31	NCV unexpected reset - multiple	
523138	.31	NCV bus shutdown - single	
523139	.31	NCV bus shutdown - multiple	

Code ID		Description	Recommended Actions
523140	.13	NCV poppet health limit - single	• Check NCV for debris, damaged or worn poppet or spring, corrosion, and any sort of contamination. Clean or rebuild NCV as necessary. • Check system strainer size. Ensure a 80 mesh or finer is being used. • Check plumbing system and strainers for debris, particle deposits, metal filings or any material that may cause plugging. Clean out system plumbing or strainer. • Check that correct tip size is selected and installed. Consider increasing tip size. • Check for error to extinguish at different NCV duty cycles or product flow rates
	.31	Stuck poppet - single	
523141	.13	NCV poppet health limit - multiple	
	.31	Stuck poppet - multiple	
523142	.31	Unexpected system flow decrease	• Check sprayer plumbing for any major blockage in system or a major leak ahead of flowmeter. • Check that any sump, master valves, electric boom valves, hand valves, throttling valves, check valves, and drain valves are open, not obstructed, or in correct positions. • Check for pinched hoses. • Check strainers for obstructions. Clean if necessary. • Check that correct tip size is selected and installed. • Check for empty product tank. • Check for correct flowmeter calibration value. • Check system pump for proper operation.
523143	.31	Unexpected system flow increase	• Check sprayer plumbing for a major leak downstream of flowmeter. • Check that correct tip size is selected and installed on all tips and fence row nozzles. • Check that electric or manual valves are in correct positions. • Check for correct flowmeter calibration value.
523192	.13	Sparge pressure sensor not calibrated	• Select correct sparge pressure sensor calibration value.
	.4	Sparge pressure sensor not detected	• Check the sparge transducer connection and cabling for damage. If necessary, replace the cable or pressure sensor.

Code ID		Description	Recommended Actions
523193	.16	High NCV efficiency	• Means that NCV duty cycle is LOWER [<90%] than expected for entered tip size, current flow, and pressure. • Check that correct tip size is selected and installed. Decrease tip size if needed. • Check if NCVs are sticking open. Clean if open • Check flowmeter calibration. May need to increase flowmeter calibration number. • Check if fencerows, boom sections, flush or drain valves are open by mistake. • Go to *Diagnostics -> System Information -> Delivery System* and check actual amount sprayed against amount reported by flowmeter or tank level. • Go to *Tools -> Applicator Setup -> Section Setup Summary* and verify that section and tip spacing calibration values are correct. Adjust if necessary by editing the machine profile. • Check sprayer plumbing for major leak downstream of flowmeter. • Check NCV efficiency alarm limit. • Check if boom transducer is functioning correctly in pressure sensor readings.
	.18	Low NCV efficiency	• Means that NCV duty cycle is HIGHER [>105%] than expected for entered tip size, current flow, and pressure. • Check that correct tip size is selected and installed. May need to increase tip size. • Check if spray tips or NCVs are partially blocked. Clean if blocked. • Check flowmeter calibration or possible blockage. May need to decrease flowmeter calibration number. • Go to *Diagnostics -> System Information -> Delivery System* and check actual amount sprayed against amount reported by flowmeter or tank level. • Go to *Tools -> Applicator Setup -> Section Setup Summary* and verify that section and tip spacing calibration values are correct. Adjust if necessary by editing the machine profile. • Check sprayer plumbing for major leak between pump and flowmeter or a blockage past flowmeter. • Check strainers for blockage. Clean if needed. • Check NCV efficiency alarm limit. • Check if boom transducer is functioning correctly in pressure sensor readings. • Check system pump for proper operation.

Code ID		Description	Recommended Actions
523232	.4	Boom pressure sensor not detected	• Check the boom pressure transducer connection and cabling for damage. If necessary, replace the cable or replace pressure sensor.
523252	.13	New injection pump detected	• Edit existing or create a new profile and calibrate injection pump. • Cycle system power.
	.31	Injection pump lost communication	• Cycle system power. • Check fuses and cabling and power, ground and CAN to injection pumps. Repair or replace as necessary. • Replace injection pump ECU.
523234	.13	Pump pressure sensor not calibrated	• Select correct pump pressure sensor calibration value. • Check the pump pressure transducer connection and cabling for damage. If necessary, repair or replace cable or replace pressure transducer.
	.16	Pump/boom pressure differential	• Check strainers between pump and boom pressure sensor for blockage. Clean if necessary. • Check for electric or manual valves between pump and boom pressure sensors opening properly. • Check if pump transducer is functioning correctly in pressure sensor readings. • Check if boom transducer is functioning correctly in pressure sensor readings. • Check the pressure transducer connections and cabling for damage. If necessary, replace the cable or replace pressure sensor.
	.4	Pump pressure sensor not detected	• Check the pump pressure transducer connection and cabling for damage. If necessary, replace the cable or replace pressure sensor.
523338	.31	Tip blockage	• Check tip for any blockage and clean tip. • Check for error to extinguish at different NCV duty cycles or product flow rates. • Check plumbing system and strainers for debris, particle deposits, metal filings or any material that may cause plugging. • Clean out system plumbing or strainer.
523339	.31		
524082	.31	UT display is offline	• Cycle system power. • Check cabling and power, ground, and CAN connections to UT. Repair or replace if necessary.

Code ID		Description	Recommended Actions
524083	.31	AUX-N Input Offline	• Cycle system power. • Check cabling and power, ground, and CAN connections to AUX-N device. Repair or replace if necessary.

NOTE: If any DTC or of the following Notifications appear and are not expected during normal operation, follow the listed Recommended Actions.

Type	Description	Recommended Actions
Notification	Activation required	• Cycle power to system and check unlocked features. • Consult dealer for desired unlock. • Replace ECU.
	Boom purge in progress	• Check boom purge status. • Cycle system power.
	Boom rinse in progress	• Check boom rinse status. • Cycle system power.
	Diagnostic application control	• Go to *Tools -> System Settings -> User Settings -> Wireless Control Mode* and set to "Off." • Turn off wireless remote by pressing and holding Red 0 button for 3 seconds on handheld remote. • Cycle power to RCM-S ECU by going to *Diagnostics -> Tests -> Reboot Product Controller.*
	Fill in progress	• Check fill switch position.
	Hardware init error - multiple	• Cycle power to system. • Replace affected NCVs.
	Hardware init error - single	
	Low recirculation flow	• Check for pinched boom supply or recirculation hoses. • Check that any sump, master valves, electric boom valves, hand valves, throttling valves, check valves, and drain valves are open, not obstructed, or in correct positions. • Check strainers for obstructions. Clean if necessary. • Check that recirculation valve is opening. • Check for empty product tank. • Check that pump is on and standby PWM is >30. • Check that low flow limit is <10 gpm. • Check for obstructions in strainers, flowmeter, and check valves. • Check for correct flowmeter calibration value.

Type	Description	Recommended Actions
Notification	Low pressure shutdown	• Check if tank sump is closed. Open if closed. • Check if tank is empty. • Check if master valve by flowmeter is opening. Open if closed. • Check if pump transducer is functioning correctly in pressure sensor readings. • Check if boom transducer is functioning correctly in pressure sensor readings. • Check wiring to pump pwm valve. Make sure connections are secure. • Check to see if pump is turning on when product turns on. (Go to manual mode and ramp up DC to see if pump is working and pressure builds with increasing control effort.) • Check PWM MAX value is >30. • Check PWM control range using PWM Health Test. Overall range should be >20%.
	Low tank	• Check actual vs displayed Current Tank Level. Adjust if necessary. • Check Low Tank Level limit and alarm value. Adjust if necessary. • Check Flow Meter operation, Calibration value, and Meter Pulse/Units. Repair or recalibrate if necessary. • Check Fill Flow Meter or Fill Level Sensor operation, Calibration value, and Units if installed. Repair or recalibrate if necessary.
	NCV high flow limit - multiple	• Decrease operation or turning speed. • Check for correct target rate and pressure. • Check for low NCV efficiency number. - Should normally be between 90 and 105. • Check for correct tip size for desired rate, speed, and pressure. • Check flowmeter calibration value, as it may be too low. • Check poppets for obstructions. • Ensure all boom valves or electronic valves are opening correctly. • Check strainer for plugging. • Check for leaks. • Check for pinched hoses.
	NCV high flow limit - single	• Decrease operation or turning speed. • Check for correct target rate.

Type	Description	Recommended Actions
Notification	NCV low flow limit - multiple	• Increase operation speed or turning rate. • Check for correct target rate and pressure. • Check for high NCV efficiency number. Should normally be between 90 and 105. • Check for correct tip size for desired rate, speed, and pressure. • Check flowmeter calibration value, as it may be too high. • Check poppets for excessive wear.
	NCV low flow limit - single	• Increase operation speed or turning rate. • Check for correct target rate.
	NCV retransmission - multiple	• Go to *Diagnostics -> Diagnostic Trouble Codes -> NCV Errors -> NCV Heat Map* and locate the NCV(s) that are not green. Their numerical locations are labeled referencing the forward travel direction, from leftmost to rightmost NCV along the boom. Note their location for future reference and troubleshooting as necessary. • Cycle power to RCM-S ECU by going to *Diagnostics -> Tests -> Reboot Product Controller*. • Replace affected NCVs. Then recalibrate NCVs by going to *Diagnostics -> Tests -> Calibrate NCVs*. If necessary, check NCV software by going to *Diagnostics -> Tests -> NCV Updates* to scan and update software on affected NCVs.
	NCV retransmission - single	
	NCV zero flow target - multiple	• Check for correct target rate.
	NCV zero flow target - single	
	Off pressure high	• Check for correct target pressure. • Check for electric or manual valves are opening correctly. • Check strainers and check valves for obstructions. • Check for damaged pressure sensor or cabling. • Check for correct tip size. • Check pump for proper operation. • Check Off Pressure Alarm % value.

Type	Description	Recommended Actions
Notification	Off pressure low	• Check for low tank level. • Check for correct target pressure. • Check for electric or manual valves and sump are opening correctly. • Check strainers and check valves for obstructions. • Check for damaged pressure sensor or cabling. • Check for correct tip size. • Check for system leak. • Check pump for proper operation. • Check Off Pressure Alarm % value.
	Off rate high	• Increase operation speed. • Check for correct target rate. • Check NCV efficiency number. - Should be between 90 and 105. • Check for correct tip size for desired rate, speed, and pressure. • Check flowmeter calibration value. - May be too low. • Check poppets for excessive wear. • Check for leaks. • Turn on more sections. • Check Off Rate Alarm % value.
	Off rate low	• Decrease operation speed. • Check for correct target rate. • Check NCV efficiency number. - Should be between 90 and 105. • Check for correct tip size for desired rate, speed, and pressure. • Check flowmeter calibration value. - May be too high. • Check poppets for obstructions. • Ensure all boom valves or electronic valves and sump are opening correctly. • Check strainer for plugging. • Check for pinched hoses. • Turn off more sections. • Check Off Rate Alarm % value.

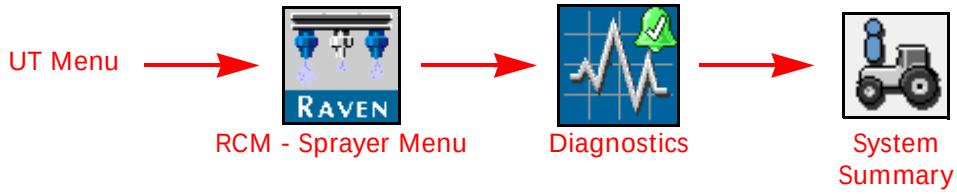
Type	Description	Recommended Actions
Notification	Product 1: valve PWM max	• Check for electric or manual valves and sump opening properly. • Check tip sizes and target rates and pressures. • Increase engine RPM. • Decrease operation speed. • Check pressure and flow sensor operation. • Check sparge or recirculation system valve positions. • Check PWM MAX value. • Check PWM control range using PWM Health Test. Overall range should be >20%. • Check target flow or pressure against machine pump and delivery system specifications.
	Product 1: valve PWM min	• Check for electric or manual valves opening properly. • Check tip sizes and target rates and pressures. • Decrease engine RPM. • Increase operation speed. • Check pressure and flow sensor operation. • Check sparge or recirculation system valve positions. • Check PWM MIN value. • Check PWM control range using PWM Health Test. Overall range should be >20%. • Check target flow or pressure against machine pump and delivery system specifications.
	Road mode active	• Check road position switch for “On” condition.
	Tank rinse in progress	• Check tank rinse status. • Cycle system power.
	Zero speed shutoff	• Increase vehicle speed and cycle master switch.
	Tank level sensor not calibrated	• Calibrate tank level sensor. • Cycle system power.
	Tier overlap error	• Check target rates and pressure. Adjust if necessary. • Check installed and recommended tip sizes. Adjust if necessary.

Type	Description	Recommended Actions
Notification	Pump RPM above maximum	• Check Engine RPM. Increase if necessary. • Check Max Pump RPM value. Increase if necessary. • Check Target Rate and Pressure. Decrease if necessary. • Check Max Pump PWM value. Decrease if necessary. • Check if tank is empty. • Check if pump is primed with product. • Check if tank sump is closed. Open if closed. • Check Pump Health and operation using PWM Health Test. Additionally troubleshoot pump or PWM valve if necessary.
	Pump RPM below minimum	• Check Pump RPM sensor and cabling. Repair or replace if necessary. • Check Engine RPM. Increase if necessary. • Check Target Rate and Pressure. Increase if necessary. • Check Min Pump PWM value. Increase if necessary. • Check Pump Health and operation using PWM Health Test. Additionally troubleshoot pump or PWM valve if necessary.
	Minimum pressure	• Check if tank is empty. • Check if strainer is blocked. Clean if necessary. • Check for system leak. Repair as needed. • Check target pressure and rate. Increase if necessary. • Increase travel speed. • Check if tank sump is closed. Open if not. • Check if master valve is closed. Open if not. • Check Minimum Pressure setting. Decrease if necessary. Value should be >6psi. • Check if boom transducer is functioning correctly in pressure sensor readings. • Check the boom pressure transducer connection and cabling. If necessary, replace cable or pressure sensor. • Check wiring to pump pwm valve. Make sure connections are secure. • Go to manual mode and increase DC to see if pump is working and pressure builds with increasing control effort. • Check PWM MAX value is >30. • Check PWM control range using PWM Health Test. Overall range should be >20%.

Type	Description	Recommended Actions
Notifications	Maximum pressure	• Check entered and installed spray tip size and target rate, pressure, and desired speed. Adjust any parameters as necessary. Consult tip manufacturer for sizing proper spray tip. • Check recommended PWM control range using PWM Health Test. • Check that PWM MAX <=82%, Tank Fill and Standby PWM <=75%. Decrease PWM setting or engine RPM during pump operation for spraying, filling, or standby as needed. • Check strainers for blockage. Clean if necessary. • Check for electric or manual valves between pump and spray tips are opening properly. • Check if pump transducer is functioning correctly in pressure sensor readings. • Check if boom transducer is functioning correctly in pressure sensor readings. • Check the pressure transducer connections and cabling for damage. If necessary, replace the cable or replace pressure sensor. • Check Maximum Pressure setting against desired operating or target pressure. Increase if necessary. Maximum recommended operating pressure is 120 psi. System will shut down if pressure exceeds 150 psi. • Check standby pressure setting. Decrease if necessary.
	Pump/boom pressure differential	• Check strainers between pump and boom pressure sensor for blockage. Clean if necessary. • Check for electric or manual valves between pump and boom pressure sensors opening properly. • Check if pump transducer is functioning correctly in pressure sensor readings. • Check if boom transducer is functioning correctly in pressure sensor readings. • Check the pressure transducer connections and cabling for damage. If necessary, replace the cable or replace pressure sensor.

SYSTEM SUMMARY

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

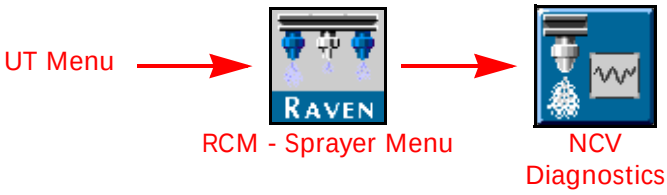


1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey along the right side of the page.
3. Select the System Summary tab.

NCV DIAGNOSTICS

NOTE: NCV Diagnostics are not available in Bypass NCV operation mode.

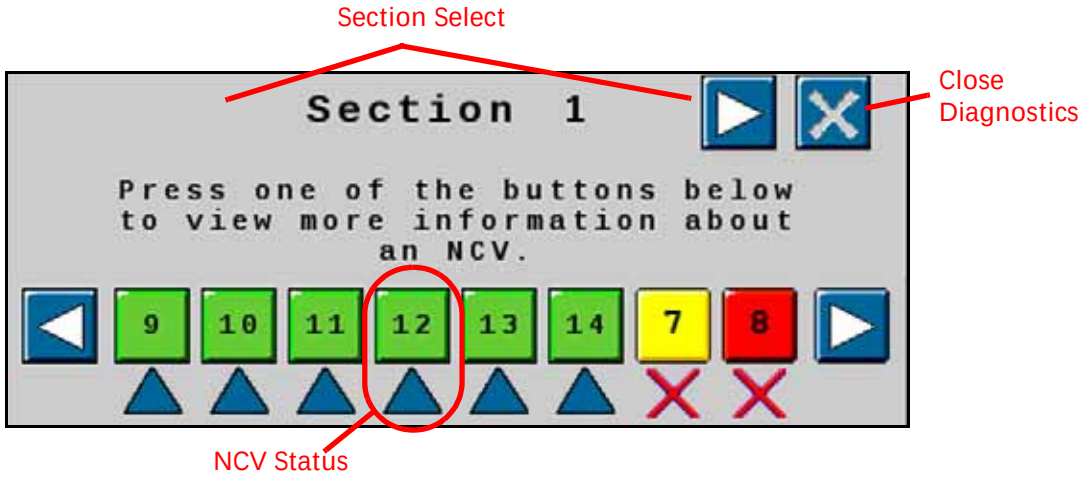
To access Hawkeye® 2 nozzle control valve diagnostics information by configured section:



1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. From the home screen, select the NCV Diagnostics button in the lower portion of the screen. The following settings and information may be displayed for each configured section:

NOTE: The NCV Diagnostics button is displayed on the Home page in the lower portion of the page. It may be necessary to toggle the lower display to either the tank level or analog gauge view.

FIGURE 1. NCV Diagnostics Display



NOTE: Selecting an NCV with a green or yellow status will display the NCV Readings page while selecting an NCV with a red status will display the NCV Errors page.

NCV SELECT

Press the NCV select arrow to cycle through each individual NCV status.

CURRENT SECTION DISPLAY

The current section for which diagnostic information is being displayed is shown at the top of the NCV diagnostics prompt. Select the left or right section select arrow buttons to cycle through sections configured for use with the Hawkeye® 2 nozzle control system.

SECTION NCV STATUS

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

Normal. The NCV is functioning normally and no alarm conditions are currently present.

Caution. A minor NCV alert condition has been detected. The control system and NCV PWM is operating normally, however, the system has detected that a condition exists which could impact the current application.

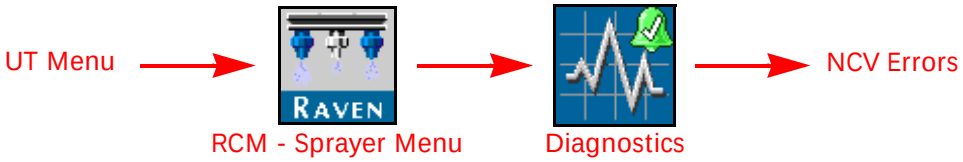
Critical. A critical NCV condition has caused the NCV to shut down. The NCV is not responding as expected and the operator should cease application and troubleshoot the issue before resuming operations.

Not Calibrated. The NCV section is not calibrated.

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

INDIVIDUAL NCV DIAGNOSTICS

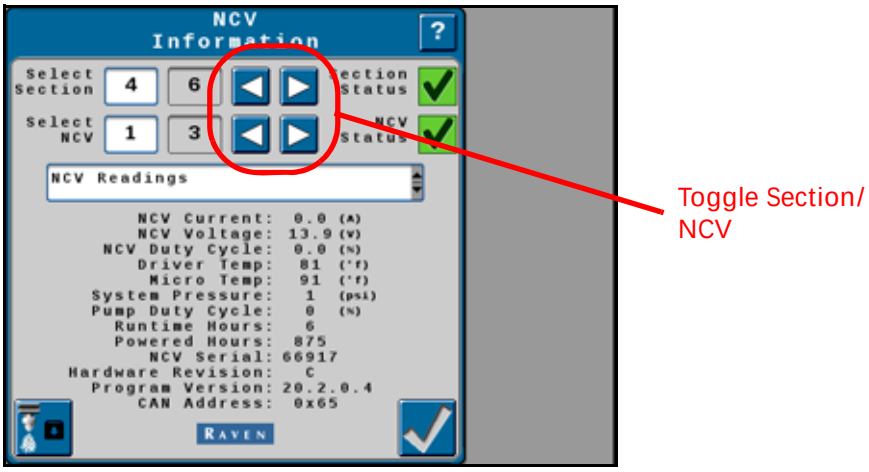
To access individual Hawkeye® 2 NCV diagnostic information:



1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey.

3. Select the NCV Errors button in the lower, right corner of the page to access the following diagnostic information for each NCV:

FIGURE 2. NCV Information



NOTE: Use the section and NCV left and right arrow buttons at the top of the NCV Diagnostics page to view different NCVs.

NCV READINGS

Current and Voltage. Each nozzle control valve provides the measured current, in amperes, and voltage at the NCV to the RCM - Sprayer ECU for display. The NCV Current should display as 0.0 Amps when the selected NCV is not operating and should be 0.3 - 0.7 Amps during normal operation. Voltage should be 10.5 - 16.0 V during normal operation.

NCV Duty Cycle. Each NCV reports the current NCV duty cycle over the communication network. Values should increase or decrease as expected for changes in speed, target rate, in a turn, and when a flow offset is enabled. Values go to zero when master switch or all boom switches are off.

Driver Temp and Micro Temp. Component temperatures on the Hawkeye® 2 nozzle control valve circuit board.

System Pressure. The monitored system pressure reported by the Hawkeye® 2 spray boom pressure transducer.

Pump Duty Cycle. The current pump effort.

Runtime Hours. The total time which the NCV has been active.

Powered Hours. Total time the NCV has been powered on.

NCV Serial. Serial number of the NCV for which the information is being displayed.

Hardware Rev. This is the PCB hardware revision level of the NCV. This is not the same as the assembly revision level which is shown on the NCV label.

NOTE: The PCB hardware revision may differ from the revision displayed on the NCV assembly. The NCV assembly revision shown on the NCV label will be most helpful when seeking technical support.

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

CAN Address. The unique location of the NCV on the nozzle bus.

NCV UPDATES

To update Hawkeye® 2 NCVs on the nozzle bus:

1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey.
3. Select the Tests tab along the top of the page.
4. Select the NCV Updates in the drop down list and follow the on-screen instructions to update NCVs on the nozzle bus.

CHAPTER 9 TROUBLESHOOTING

RCM - SPRAYER STATUS LED

There are four LEDs on the front of the ECU. Each LED color and flash rate indicates different information as detailed in the table below. If multiple states are true for a given LED the first active state listed in the table will be the state displayed. After addressing the displayed state (if needed), the next LED state will be indicated.

FIGURE 1. RCM - Sprayer LEDs

TABLE 1. RCM - Sprayer LED Status

LED Indicator			State
LED	**Color**	**Flash Rate**	
Power	Green	Solid	ECU is powered on.
A	Off	Solid	Microprocessor is not powered.
	Any	Solid	Microprocessor has stopped functioning.
	Yellow	1	Active when the boot loader enters boot hold mode.
	Red	5	Active when the microprocessor is being programmed.
		1	Active if the ISOBUS is offline.
	White	1	Active if the UT is offline.
	Purple	1	Loop back test mode enabled.
	Green	1	Active when linked with UT and system is normal.
B	Red	Solid	PCB subsystem not running (FPGA).
		1	System has lost ECU power.
	Blue	1	Signal is present on 1 or more rate sensors.
	Yellow	1	One or more DTCs are active.
	White	1	System voltage is below 11.5 volts.
	Purple	1	System voltage is above 16 volts.
	Blue	Solid	One or more product switches have been set to On.
	Purple	Solid	Signal is present on one or more RPM sensors.
	Green	Solid	All product switches have been set to Off.
	Red	Solid	One or more loop back subtests failed in this current test sequence.
	Yellow	Solid	One or more loop back subtests failed in the previous test sequence.
	Green	Solid	No loop back subtests have failed.
C	Red	Solid	PCB subsystem not running (FPGA).
	Blue	1	Bluetooth command has been received.
	Blue	Solid	Bluetooth communication is active.
	Green	1	The Auxiliary CAN channel is active.
	Red	1	Active if the Auxiliary CAN channel was active and is now offline.
	Green	Solid	LED C is functional and there are no other LED C states to report.
	Purple	Solid	A loop back test is in progress.
	Green	Solid	A loop back test is not in progress.

NCV TECHNICAL SPECIFICATIONS

TABLE 2. Hawkeye® 2 Nozzle Control Valve Technical Specifications

		U.S.	Metric
Dimensions	Height	2.9 in.	7.32 cm
	Width	2.7 in.	6.73 cm
	Depth	1.6 in.	40 cm
	Weight	approximately 8.0 oz.	approximately 0.225 kg
Power	Operating Voltage	10.5 to 36 VDC nominal	
Input/Output	Max. Operating Pressure	120 PSI	827.4 kPa
Environmental	Operating Conditions	14° to 167° F	-10 to 75° C
	Storage Conditions	-40° to 185° F	-40° to 85° C
	Relative Humidity	10 to 95%	

HAWKEYE® 2 NOZZLE CONTROL VALVE STATUS

FIGURE 2. Nozzle Control Valve LED

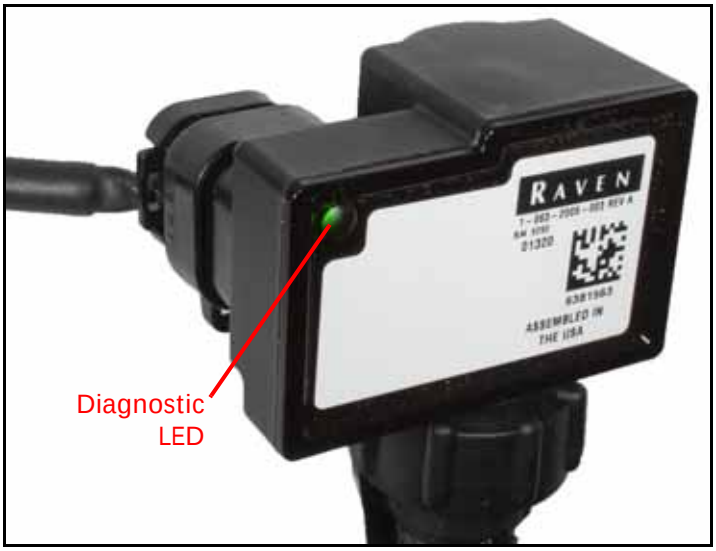


TABLE 3. Hawkeye® 2 NCV LED Status

LED Indicator	Rate	Color	State	Before Calibration	After Calibration	Profile Detected, Not Calibrated	Note
Flashing	1 Hz	Green	NCV Ready to Apply		X		Normal State - Will flash when system is fully calibrated.
		Yellow	NCV Missing Calibration or Active DTC		X	X	Normal State - Will flash after NCVs have been indexed, but calibration is not complete. Error State - Active DTC for the system.
		Red	Lost communication between RCM-S ECU and NCV or NCV has < 9V HC power.	X	X	X	Normal State - Will flash when NCVs are not calibrated or when editing a profile until the NCVs have been detected.
		Blue	NCV has not claimed a CAN address or no CAN communication received by NCV.	X	X	X	Normal State - Quick blue flash after calibration has been initiated, then will start flashing red. Error State -Will flash slow blue if it has lost communication with upstream NCV.
	4 Hz	Green	NCV Commanded to Apply		X		Normal State - Will flash when NCV is commanded to apply or when active width is non-zero.
		Blue	NCV CAN Channel Errors		X		Error State - Will flash fast blue if it has lost communication with downstream NCV.
	5 Hz	Red	NCV in Bootloader Mode		X		Normal State -Flashes during software update.
Solid	-	Blue	CAN Pass-Through Disabled		X		Error State - Will be solid blue for a short time, then will begin flashing to indicate a communication error with a nearby NCV.
		White	NCV Selected on UT info Page		X		Normal State - Solid when a specific NCV is selected on the UT screen.
Off	-	-	No Power		X		Normal State - Will be off when NCV is not powered or speed is greater than 2mph [3.22 km/h]

NCV OFFLINE TROUBLESHOOTING

If an NCV Offline error occurs with the system, there are several ways to diagnose where the problem may exist.

Always have the engine running when performing the NCV diagnostic tests to ensure there is sufficient electrical power available to the system. If NCVs are moved around, disconnected, or replaced, it may be necessary to cycle power to the system and recalibrate to clear any errors and properly reestablish communication.

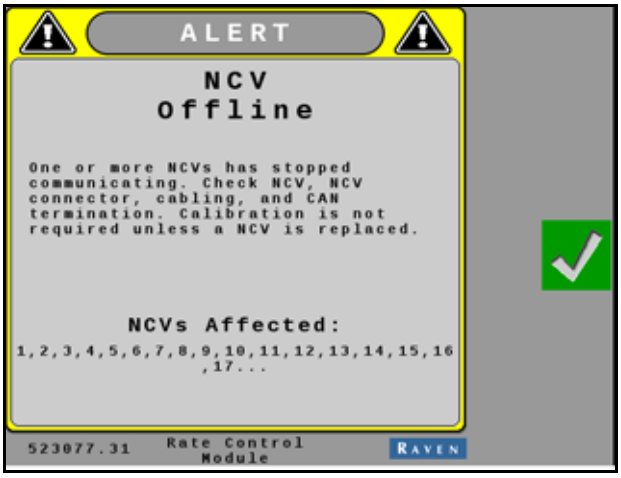
When making wiring or connection repairs, turn off the engine and disconnect battery power to safely work on the equipment. When wiring repairs are completed, it may be necessary to cycle power or recalibrate the system to ensure communication is reestablished properly to the system.

NCV ALARMS

When an NCV Offline alarm happens, whether due to loss of power, loss of communication, or another error, an alarm will display on screen.

Select the Accept (check) button to accept the error and return to the previous screen.

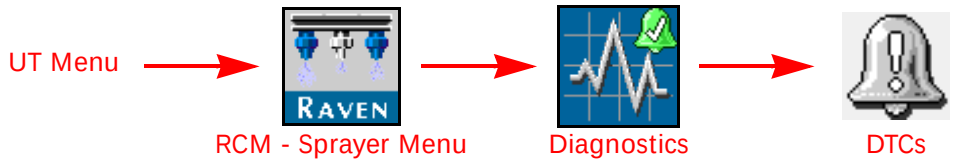
FIGURE 3. Example On-Screen Alarm



Note that the NCVs affected by the alarm are displayed on the alarm prompt. An ellipsis (...) is displayed if more NCVs are affected by the alarm condition. In this instance, just note the range of NCV IDs visible (e.g. 1-17, etc.).

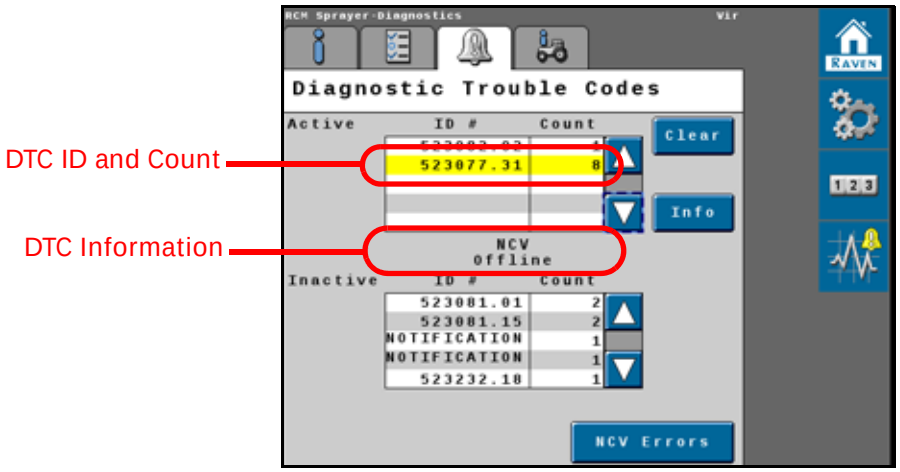
NCV DIAGNOSTICS

To display active and inactive diagnostic trouble codes code information:



1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey along the right side of the page.
3. Select the Diagnostic Trouble Codes (DTCs) tab.
    - Current trouble codes are displayed in the Active table. The DTC Identification number and occurrence count is listed.
    - Resolved trouble codes are displayed in the Inactive table. The DTC Identification number and occurrence count is listed.
4. Use the up and down arrows to scroll through the list of trouble codes. A description of the highlighted code is shown below each table.
5. If desired, press the Clear button to erase all the trouble codes listed in the Inactive table.
6. Select the Info button to review available diagnostic information for the code.

FIGURE 4. Diagnostic Information Display



OTHER RELATED ERRORS

NCV UNEXPECTED RESET

An NCV Unexpected Reset error is encountered when an NCV was offline, then came back online.

This may be due to an intermittent power connection to NCV(s) from intermittent power or fuse connection, intermittent 19-pin connection, loose NCV connection or an NCV that is failing.

NOTE: Once the issue is resolved, the system may require a power cycle to clear this error.

NCV CAN ERROR LIMIT

This error is encountered when CAN communication is poor.

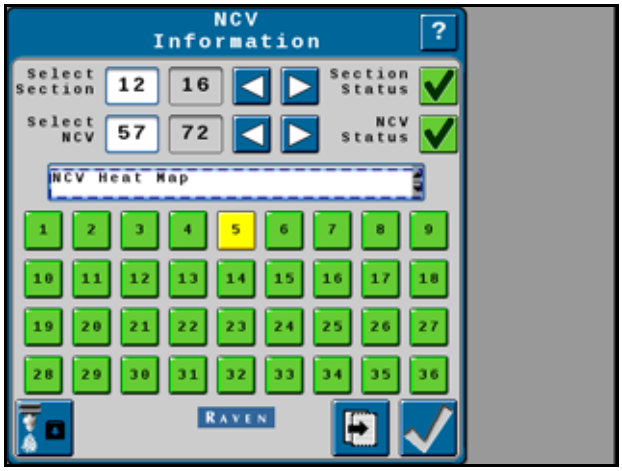
If many NCVs are affected, the problem may be with intermittent connections at 19-pin connectors, corrosion, or damage to splices or wiring harnesses where several circuits come together which would affect more than one NCV.

If only a few NCVs are affected, the issue is likely with a single NCV, NCV connection, or section of wiring in between NCVs.

NCV ERRORS AND NCV INFORMATION MENU

Select the NCV Errors button to view the NCV Information menu where other active errors for selected NCVs may be viewed.

FIGURE 5. NCV Information Heat Map



In the NCV Errors menu, select any section or specific NCVs to inspect. The drop down menu allows the operator to select the following information displays:

- NCV Readings
- NCV Settings

NOTE: NCV Settings is only available if HD Individual Nozzle Control is unlocked.

- NCV Errors
- NCV Heat Map
- Section Heat Map

Heat Map. The Heat Map selections will show you if there are any active errors for specific NCVs or sections.

Green NCV buttons represent no error for that NCV.

Yellow or Red NCV buttons represent an error.

Touch on the NCV button of interest to see NCV readings for that specific NCV. In some cases, several red buttons may precede a yellow NCV. In that case, the red NCVs are likely not communicating with the system, and the first yellow NCV is the first NCV recognized by the system. This condition may be due to an issue between the last red and first yellow NCV, such as an NCV failure, wiring issue, or fuse issue affecting the red section of NCVs.

NCV COMMUNICATION DIAGNOSTIC TEST

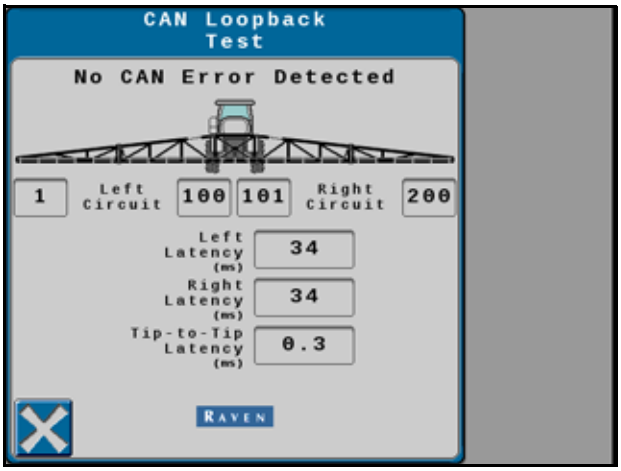
The NCV Communication Test can be used to locate the area of the system to inspect. To run the communication test:

1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. Select the Diagnostics softkey.
3. Select the Tests tab along the top of the page.
4. Select the NCV Communication Test test in the drop down list.
5. Select the Begin button to start the test. The system will attempt to find CAN Communication Errors on the NCV CAN bus.

   Displayed NCVs are numbered on screen from left to right. These are referenced from the left side of the machine, facing the normal forward direction of travel.

   If No CAN Error Detected is displayed, that means that the test has found no detectable communication errors. Left, right, and tip-to-tip latency times will be displayed

FIGURE 6. NCV Communication Test No CAN Error Detected



If an error occurs, note the “No Communication After NCV” number, and the “Communication Resumes At NCV” number. The issue is likely between, and possibly includes, these NCVs. Inspect NCVs on the boom, wiring, connections, or fuses related to the circuit between and including these NCVs.

If there is no communication after the #1 NCV, there may be a power loss between the battery connection and the NCV cable connections, or a CAN communication problem between the RCM - Sprayer ECU and the NCV cable connections. Inspect wiring, fuses, and connections before the left and right cable circuit branches.

GENERAL TROUBLESHOOTING

When only a few NCVs are noted, inspect nearby NCVs, connections, pins, and cabling for corrosion, visible damage, or pinching between those NCVs. In some instances, splices or wiring may be damaged underneath cable coverings.

When large sections of NCVs are not communicating, inspect those items along with fuses and large electrical connections.

If intermittent power to the NCVs is the cause of the issue, or if NCVs are disconnected and re-connected during the troubleshooting process, NCVs will appear back online after repairing the system, but DTC errors will still exist until the system power is cycled off then back on.

OTHER USEFUL TESTS

Calibrate NCVs should be used after swapping NCVs around to locate problems, or after replacing NCVs. This will ensure the NCVs are properly numbered in the system for turn compensation, section shutoff, and error detection.

Reboot Product Controller can be used instead of cycling key power to reboot and reinitialize communication to the RCM - Sprayer ECU and NCV bus.

CABLE TROUBLESHOOTING

TROUBLESHOOTING NCV CABLE CONNECTIONS

Nozzle control valve cable troubleshooting may require the system to be powered on and the NCVs disconnected.

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

FIGURE 7. NCV Cable Connector

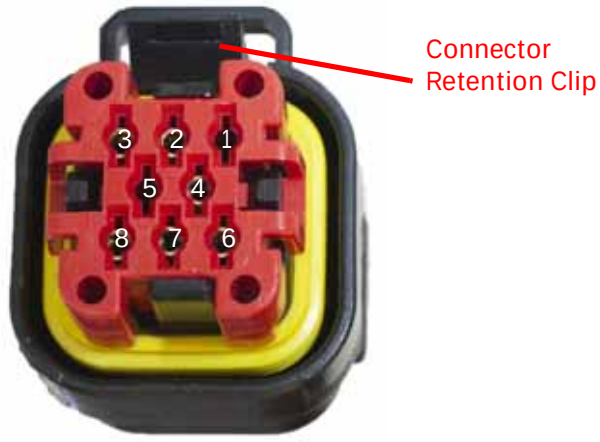


TABLE 4. NCV Cable Connector Pins

Pin	Description
1	Aux Device Output (High Flow Cables Only)
2	CAN Lo Out
3	CAN Hi Out
4	Chassis Ground (0 VDC)

Pin	Description
5	Aux Device Input (High Flow Cables Only)
6	Chassis Power (12 VDC Nominal)
7	CAN Hi In
8	CAN Lo In

TROUBLESHOOTING 19-PIN BOOM CABLE CONNECTIONS

Boom connection cables alternate NCV power and ground circuits within the cable for banks of NCVs. Adjacent NCVs may not necessarily not be on the same HC power and ground circuit. Look at the end of the plug to locate the pin numbers.

TABLE 5. Boom Cable Connection Pins

Pin	Description
1	-
2	-
3	CAN Hi Return
4	CAN Lo
5	-
6	CAN Hi
7	CAN Lo Return
8	HC Circuit 1 Power
9	-
10	HC Circuit 1 Ground

Pin	Description
11	-
12	HC Circuit 2 Power
13	-
14	HC Circuit 2 Ground
15	-
16	HC Circuit 3 Power
17	Fence Row
18	HC Circuit 3 Ground
19	-

TROUBLESHOOTING TERMINATOR CONNECTIONS NEAR THE RCM

Terminator connection referenced from cable side.

TABLE 6. Terminator Connection Pins

Pin	Description
A	CAN Hi
B	CAN Lo
C	-

TROUBLESHOOTING 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 8. Flow Meter Extension Cable Pin Diagram (Con-X-All)

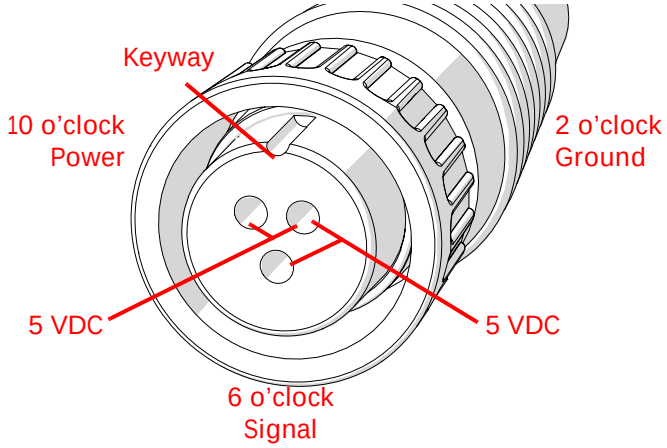


TABLE 7. Flow Meter with Deutsch DT Connector

Pin	Function
A	Power
B	Ground
C	Signal

TABLE 8. Flow Meter with Deutsch DTM Connector

Pin	Function
1	Signal
2	Ground
3	Power

TEST THE FLOW METER CABLE

To test the flow meter cable:

1. Open the UT Menu and select the RCM - Sprayer Menu button.
2. From the home screen, change the product Rate Control Mode to Manual.

NOTE: Ensure the control valve output is zero.

3. Access the Tools Menu and select the Rate Setup and set the Flow Meter Calibration value to 1.
4. Change the Flow Meter Pulse/Units to 1 (not 10 pulses per unit).

5. Return to the Home page and note the existing volume in the tank.
6. Toggle at least one section switch and the master switch to the on position.
7. Use a small jumper wire (e.g. paper clip) to short the ground and signal sockets with a “short-no short” motion. Each time the short is made, the total tank volume value should change by increments of one or more.
8. If the tank level does not decrease, disconnect the flow meter extension cable if installed and repeat this test at the next connector closest to RCM - Sprayer ECU. Replace defective cable as required.
9. If all cables test good, replace the flow meter.
10. After testing is complete, re-enter correct meter cal value, units, and tank level.

GENERAL TROUBLESHOOTING

Problem	Action
Adjacent nozzle control valves pulsing at same time.	• Check cabling connections. • Check NCV diagnostics and DTC list for nozzle control valve errors. • Perform the Calibrate NCVs test or Edit Profile to reindex the nozzle control valves across the implement width. • Contact a local Raven dealer for additional assistance.
Rate reads “0.”	• Verify SPEED is registering accurately. If SPEED is zero, refer to the UT display troubleshooting procedure. • Verify TOTAL VOLUME is registering flow. • Confirm the boom section status shows on the display changes when section switches are activated in manual operation.
Cannot connect to wireless remote for diagnostics	• Verify desired Wireless Control Mode is selected. • Verify wireless remote is within line of sight to the RCM - Sprayer ECU. • Verify wireless remote is turning on and batteries are charged. • Verify a Device Passcode entered into wireless remote matches passcode shown on System Alert.
Intermittent connection to BLE wireless remote	• Verify wireless remote is within line of sight to RCM - Sprayer ECU. • Verify the batteries in the wireless remote are charged.
Cannot control with the wireless remote	• Verify the wireless remote is connected to RCM - Sprayer ECU. • Verify the desired wireless control mode is selected in User Settings screen on RCM - Sprayer ECU. • Verify all boom section switches and master switch are toggled “ON” on the machine control panel or joystick.

Problem	Action
Pressure or rate inaccurate or unstable.	• Verify that all calibration numbers and settings are correct. Verify SPEED is registering accurately. If SPEED is inaccurate, refer to the UT display troubleshooting procedure. • Verify that all air has been removed from the boom by priming the boom or recirculating. See “Automated Boom Prime” on page 57 or “Boom Recirculation” on page 40 for more information. • Verify the pressure transducer is selected correctly. • Verify Flow Meter calibration value and target rate is within overall flow range. • Verify control valve is operating correctly. Perform the PWM health test described in “Perform the PWM Health Test” on page 64 to inspect control range. • In MAN (manual) operation, verify that Pressure and Rate display holds constant. • Confirm that boom section status shown on the display is not changing. • Verify ECU Inertial sensors are calibrated and performing correctly. Refer to “Enable Turn Compensation” on page 39 or “Turn Compensation Feature Inspection” on page 133 for more information. Disable Turn Compensation if necessary to see if pressure or rate stabilizes. • Perform a self-test with boom master switches on to verify the rate, pressure, and area/hour are steady while sitting still. • In MAN (manual) operation, check low end and high end pressure and flow range. • In the Control Valve menu, decrease the Valve Response Rate if pressure and rate oscillate greatly in AUTO mode. Increase the valve response rate if control is unresponsive. • In the Control Valve Settings menu, decrease the NCV response sensitivity if system pressure and rate oscillate slightly in AUTO mode. Increase if the system is unresponsive. Avoid setting both the Valve Response Rate and NCV Response Sensitivity above 70.
Cannot adjust rate or pressure in automatic or manual operation.	• Verify the pump switch is turned on in the UT or machine console. • Verify the pump and NCV PWM values are increasing or decreasing in the diagnostic screen. • Check cabling to 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 change pump PWM and verify voltage changes at the valve. • If voltage to the valve is changing smoothly when actuating in Manual mode, but the control valve or pump are not adjusting pressure, inspect or replace the control valve or pump.

Problem	Action
Sprayer pressure is correct but RATE is low.	• Verify that strainer screens or check valves are not plugged. • Verify that pressure at each boom is the same. • Verify all spray tips are correctly sized on the sprayer and entered correctly in the Select Tip menu. • Verify correct flow meter and pressure transducer calibration values.
Total volume does not register or registers flow inaccurately.	• Check flow meter cable for damaged wires or corroded connections. See the *Cable Troubleshooting* section on page 95. • Check the internal components of the flow meter; clean and adjust. *Flow Meter Maintenance* section on page 125 for flow meter cleaning and adjustments. • Replace flow meter. • Verify that arrow on flow meter is pointing in direction of flow. • Verify the flow meter calibration value and units and adjust as necessary. Refer to the *Flow Meter Maintenance* section on page 125 for additional flow meter calibration information.
Boom valve(s) will not operate.	• Check boom valve cables and connections for damaged wires or corroded connections. • Check boom valve fuses. • Verify the switches and boom valves are mapped correctly. • Check connectors near the center rack and at the RCM - Sprayer ECU for cleanliness or corrosion. • Check BOOM switch and MASTER switch for operation. • Replace boom valve(s).
Pressure inaccurate or unstable.	• Verify the correct pressure for the transducer is selected. • In the Control Valve Settings, lower the Valve Response Rate to stabilize the system. • Verify the pressure on UT matches separate external mechanical gauge.
Individual NCV will not communicate with Raven Service Tool Action	• Verify power to the NCV. • Verify the NCV cable connection voltages fall within the desired range. • Cycle power to the system. • Recalibrate the system. • Replace the NCV.
Cannot detect BLE (Blue-tooth low energy) device for diagnostics	• Verify Bluetooth functionality is turned on for mobile device. • Verify another mobile device isn't already connected to the RCM - Sprayer ECU. • Verify that the mobile device is BLUETOOTH® Low Energy compatible running ISO version 8.1 or newer or Android Version 5 or newer. • Verify the mobile device is within line of sight to the RCM - Sprayer ECU.