

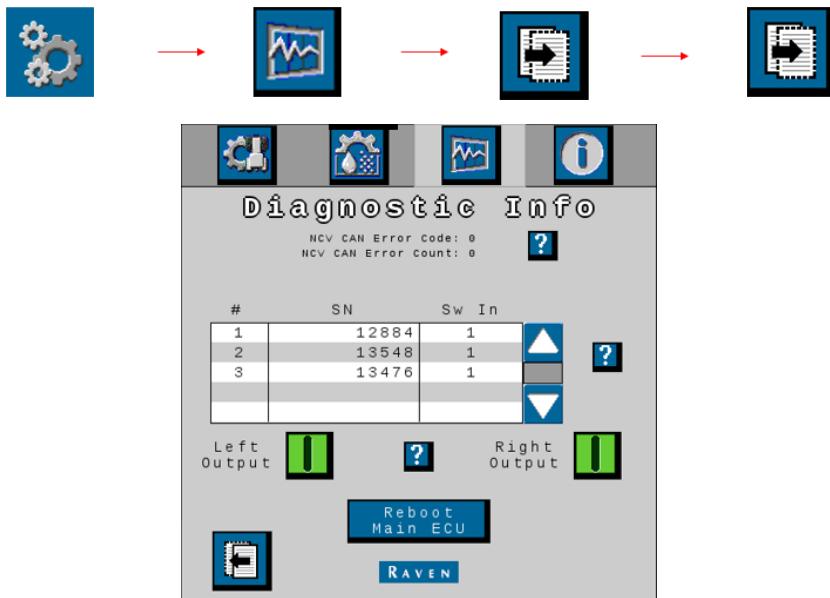
# NOZZLE TROUBLESHOOTING BEST PRACTICES

## WHEN TO POWER CYCLE, RECALIBRATE NCV, OR RESET DEFAULTS

The operator should always keep two things in mind. First, is always trying to keep the system in an indexed state and second is to only unplug the Nozzle Control Valves (NCVs) when necessary. Keeping the system in an indexed state will ensure that the most thorough troubleshooting can be done.

### POWER CYCLE

The first line of defense for a Nozzle Offline alarm is to reboot the Hawkeye ECU. With 2.4 software, a new button has been added to the diagnostic info screen (picture below). This is the best first step to regain communication between the nozzles and the Hawkeye ECU. The benefit of using this button is the reduced downtime compared to traditionally restarting the machine engine and regaining GPS signal. If you do a machine power down, and have an automatic battery disconnect, ensure that you allow a minimum of 5 minutes for the battery disconnect to take hold before a reboot. If you have a manual battery disconnect, use that and allow enough time before you engage it again.



### RECALIBRATE NCV

A recalibration of Hawkeye NCVs may be necessary in a few circumstances. One instance would be if 2 power cycles prove to be insufficient. Another need for a recalibration would only be if a nozzle has been replaced with new or changed locations on the boom. It would not be necessary to recalibrate if the same NCV has remained in the same location. For example, if a harness is replaced but the same NCVs remain installed, recalibration is not necessary. Troubleshooting should always be the first step before recalibration is started.



## RESET DEFAULTS

If a traditional NCV calibration doesn't pass, there could be an issue with the NCV, terminator or cabling. Troubleshooting tips and steps below may help. A last resort would be to reset defaults and continue through the complete calibration wizard. Keep in mind with this, you will need to know your boom setup, meter calibration values and more to complete the calibration wizard. It may be best practice to get a visual of the summary screen before resetting defaults. If resetting defaults is still unsuccessful and it is necessary to continue spraying before more troubleshooting can be done, you can continue with a secondary set of nozzle bodies (if equipped). You would skip NCV indexing and continue in Bypass mode. This will allow you to operate as a traditional flow-based product control system.

## GENERAL TROUBLESHOOTING TIPS

Any time you have nozzle offline issues, indexing failures or DTC (diagnostic trouble code) related to a specific NCV, it is best to do a visual check and take note of what issues you are seeing and where they are located.

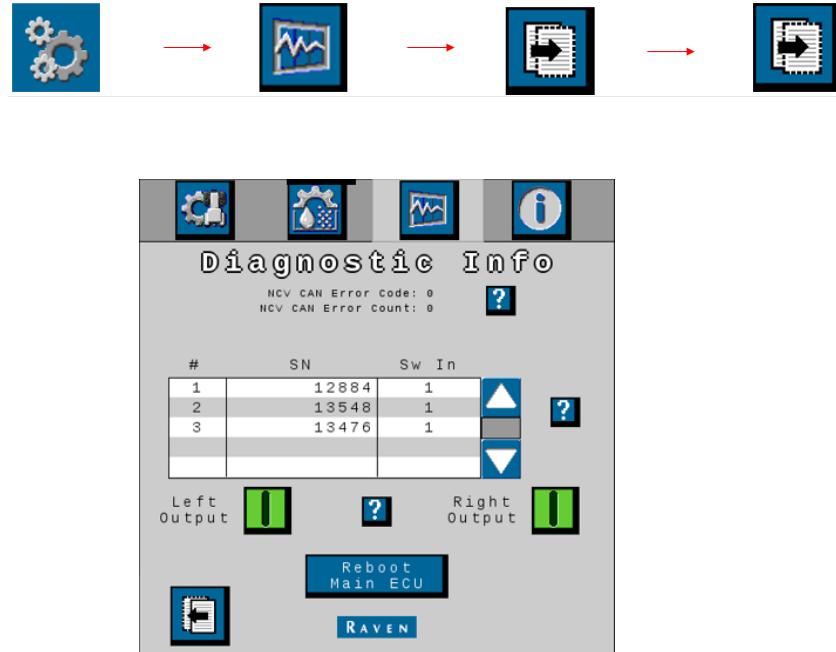
- Note any DTCs associated with the NCVs. This will help you locate it more easily on the boom.
- Locate the problematic NCV and where it is located on the boom
- Verify LED color and blinking frequency
- Cycle through each individual nozzle diagnostics screen and verify if there are active DTCs for a specific NCV
  - Once in the individual nozzle diagnostics, use the left and right arrows to cycle between nozzles.
  - The NCV Errors button only comes up if there is an active alarm code for the selected NCV



- Do a hardware inspection of the following pieces for physical damage, water, corrosion and any other anomalies.
  - Cabling
  - Terminators
  - Relays
  - NCVs
- Only unplug the NCV when necessary. Unplugging unnecessarily can introduce water or other contaminants into the nozzle connector.
- Only swap an NCV when necessary. It needs to be certain first that there is an issue with the nozzle and not cabling or termination.

## INDEXING FAILURE – BEST PRACTICE

- Make sure vehicle is supplying adequate power to Hawkeye ECU.
  - Low voltage may cause indexing issues. Best practice is to have engine running.
- **2.4.0.89** software requirement on the Hawkeye ECU for full diagnostic abilities
- If indexing fails the first time, press the retry icon to make a second attempt.
- If it fails a second time, note which NCV it has failed on and locate it on boom harness.
  - The indexing wizard will indicate the last successful nozzle indexed on the UT (universal terminal) screen. An example would be "Indexing left nozzle 17 of 36". This means when working from the innermost NCV on the left boom cable (#1) towards the left tip (#36), it has successfully indexed 17 of the nozzles and had failed on #18.
  - Note LED color of the failed NCV and surrounding NCV LEDs.
- Navigate to the diagnostic menu for troubleshooting



- Within the "Sw In" (Switched In) column, locate any nozzles that have a '0' instead of a '1'. A '0' indicates it may not have Switched In voltage and a '1' would indicate that it does have Switched In voltage. Switched In voltage is essential for proper indexing.
- Record the serial number of any NCV that displays a '0'. Keep in mind the list is in no particular order since indexing has not been completed.

**NOTE: After successful indexing, the list of NCVs is sorted from left to right (#1 is far left)**

- Return to the auto-indexing screen but wait to index.
- On the boom, locate the serial numbers of any NCV that reported a 0 value for the "Sw In" column. A good place to start looking would be where indexing has failed or any NCV with an irregular LED color/sequence compared to most of the boom.
- Once the NCV serial numbers are found on the boom:
  - Verify switched in voltage. Switched in voltage would be pin 5 and ground pin 6. At the very first nozzle at the center of the boom, switched in voltage could be 8-13VDC but every other NCV will be 3VDC. If switched in voltage is zero:
    - Inspect upstream NCV connection and cabling between them. Verify that switched out voltage (3 vdc between pins 3 and 6) is present. Test while NCV is plugged in.
    - Inspect cabling drop for damage, corrosion or water ingress and then plug it back into the NCV.
- Return to the nozzle diagnostic info page and verify that all NCVs are showing a 1 for their value. This would include the previous nozzles that were showing a 0. If any still show 0, repeat the process of a voltage check and visual check as stated above. If an NCV will not return to a value of 1 after two successful voltage checks, replace the nozzle.
- Once all nozzles have a 1 for their 'Sw In' value, continue with the auto indexing.

## HOW TO TROUBLESHOOT - 4 COMMON NCV OFFLINE SCENARIOS

### SINGLE NCV OFFLINE (CONSISTENT ALARM REPORTED FOR A SPECIFIC NCV)

- Note any consistent DTC/warning message.

- Note LED color of the problematic NCV and its location on the boom. Also note the LED color of several surrounding NCVs.
- Power cycle
  - This could be through the Reboot ECU button on the UT or a complete power cycle of the machine.
- If nozzle is still offline:
  - Do a visual check on the nozzle electrical connection. Check for
    - Water ingress
    - Corrosion on NCV pins and on cabling drop
    - Physical damage
  - Check voltage
    - CAN voltages
    - High Current voltage
    - Switched In voltage
- Verify the LED color of the problematic NCV once again:
  - If blank – Verify high current power and Switched In power
    - If power is good, replace NCV and index
  - If solid any color – Replace NCV and index
  - If blinking red – Possible back feed of voltage from the downstream (towards boom tip) NCV. Could be faulty downstream NCV or cabling between them.

## SINGLE OR MULTIPLE OFFLINE (SEEMINGLY RANDOM LOCATIONS)

### MULTIPLE RANDOM OFFLINE - POSSIBILITY OF POOR TERMINATION

- Diagnostic screen will give NCV CAN errors. It is normal to have 1 NCV error per nozzle installed. This number should not increase. If this number does increase the CAN bus circuit should be inspected for proper termination and for cabling defects.



- Check Terminators and cabling near terminators
  - Each boom tip has one terminator
  - Check for broken, bare or damaged wires
  - Unplug terminator and check for:
    - Corrosion
    - Water intrusion
    - Pushed back pins
    - Verify proper voltages with diagnostic cables
  - Plug back in and secure with zip ties

### SINGLE RANDOM OFFLINE - POSSIBILITY OF SINGLE PROBLEMATIC NCV

- Verify LED color of all NCVs on boom
  - Typically, there will be one that is different from the rest.
    - No LED
    - Solid LED

- You can also go to the individual NCV diagnostics and use the left/right arrows to check for error codes on each NCV. A problematic NCV may have a specific error code associated only to it.



- The NCV error button only displays if an active error exists
- Possibility of a high temperature DTC and/or be physically warmer than others
- Verify voltage going to the NCV. If proper, replace and index NCVs.
- If no NCV error or odd LED color is found:
  - Use the Hawkeye Diagnostic kit and cabling to shorten up the boom. This is done by connecting a terminator adapter between the primary/mid cable and the secondary boom harness.
  - Repeat steps for "Single offline - consistent NCV" section above.

## MULTIPLE OFFLINE (NCVS IN SEQUENCES)

- When nozzles are offline and bunched together it is typically a power issue.
  - The NCV may exhibit no LED light
- Check the following components:
  - Fuses
    - Check for water ingress
    - Check for blown fuse
      - A blown fuse could cause just one side of the boom to have a series of nozzles offline
  - Relays
    - Check for water ingress
    - Malfunctioning relay
      - A relay that is not working could cause nozzles offline to both sides of the boom and they would be mirrored.
  - 19 pin bulkheads
    - Check for water ingress
    - Check for corrosion within pins and wires
  - Cabling near effected NCVs
    - Check for water ingress within cabling
    - Check for corrosion within wiring

## ALL NCVS OFFLINE (ALL NCVS FLASHING AMBER – NO COMMUNICATION)

- Both terminators are missing or damaged
  - Check terminators
- Single problematic NCV is preventing all CAN communications
  - Use the Hawkeye Diagnostic kit and cabling to shorten up the boom. This is done by connecting a terminator adapter between the primary/mid cable and the secondary boom harness. If NCVs flash code is not calibrated problematic NCV is not in this portion of harness. Once narrowed down to a smaller segment of boom disconnect all NVCs and plug in one at a time noting flash code. When problematic NCV is plugged in, all NCVs will begin to flash amber. Replace this NCV.
- Cabling issue
  - Inspect cable for defects on CAN circuit.

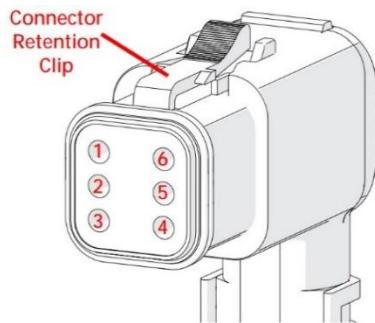
## REFERENCES

### LED DIAGNOSTIC LIGHTS AND DESCRIPTIONS



LED Indicator	Rate	Color	State
Flashing	1 Hz	Green	Ready. If in actuating mode, the NCV is ready but requires calibration.
		Blue	Actuating Mode (Auto)
		Red	Loading New Software
		Amber	Alarm Active
	5 Hz	Amber	No ISOBUS Communication
Alternating	1 Hz	Blue/Green	Actuating Mode (Manual)
		Green/Magenta	Not Calibrated - Switch Input High
		Red/Magenta	Not Calibrated - Switch Input has not Changed
		Amber/Red	No Product Controller II 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

### NCV CONNECTION PINOUT



Pin	Description	Pin	Description
1	Chassis Power (10.5 - 16.0 VDC)	6	Chassis Ground (0 VDC)
2	CAN High (2.0 - 2.7 vdc)	5	SWITCH IN (8.0 - 13.0 VDC COMING FROM THE PRODUCT CONTROLLER ON THE FIRST NCV's of the primary cable and 2.5 - 3.2 vdc from previous ncv on all other)
3	Switched out (2.5 - 3.2 vdc if NCV is connected)	4	CAN low (2.0 - 2.7 vdc)