WeedSeeker®

Troubleshooting Manual

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Troubleshooting Guidelines

The first step in troubleshooting the *WeedSeeker*® Selective Spray System is to do a visual inspection. Check all cables for cuts or pinches. Ensure that all Light Source and Detector Windows are clean and clear.

- Troubleshooting the *WeedSeeker*® system can be divided into Controller, Cable, Sensor, or Valve Cartridge faults.
- If the entire system will not turn on, then troubleshoot the Controller and the Cables.
- If the Controller turns on, but one or more Sensors do not operate properly, trouble shoot the Sensors and Valve Cartridges.
- Faults that affect both sides or all the Sensors on one side are usually in the Controller.
- Faults that affect individual Sensors are usually associated with the Sensors themselves or the Valve Cartridges.

CAUTIONARY NOTES

To avoid damage due to voltage spikes, turn the power off before connecting or disconnecting Cables or Valve Cartridges.

- Before starting to troubleshoot the *WeedSeeker*® Selective Spray System, flush all the hoses and Valve Cartridges with fresh water.
- Ensure the pump is turned off and the pressure has been released before disconnecting any hoses.
- Use fresh water when testing the spraying capabilities of the system.
- Wear the appropriate Personal Protection Equipment as necessary.

This troubleshooting guide will not cover pump or other plumbing related issues.

Controller

- The Controller should be connected directly to a fully charged 12 volt battery, or the Power Cable quick-disconnect can be plugged into a reliable convenience outlet.
- The Controller has internal circuits that will prevent the system from turning on if the power source is too high, (19 volts or more), too low, (10 volts or less), or if the current draw is too great, such as a short in the system.

Permanent Crop Systems

The Controller distributes the power directly to the Sensors through the Controller Cables and the Daisy Cables.

Row Crop Systems

The power is distributed from the Switch Panel (CSP) located in the tractor's cab, through the Controller Logic (CL) box(es) located on the tool bar, and then to the Sensors through the Controller Cables, the Hood-to-Hood Connecting Cables and the Daisy Cables. Both cables between the CSP and CL box must be connected before power will be available to the system.

If the system will not turn on:

1. Ensure that the Power Cable is connected properly and that there are at least 12 volts at the Power Cable quick disconnect socket.
2. For Row Crop systems, ensure that both cables are connected between the CSP and the CL.
3. Disconnect one Controller Cable from the CL and turn the **Power** Switch to **ON**. If the system does not turn on, turn the **Power** Switch to **OFF** and, if applicable, disconnect another Controller Cable.
4. If the system will turn on when one or all cables are disconnected, the fault is not with the CL/CSP, but with the Controller Cables, Hood-to-Hood Cables, Daisy Cables or the Sensors.
5. If the system will not turn on with all Controller Cables disconnected, the fault is with the CL/CSP. Double check that the power is connected as per the Instruction Manual. If the problem persists, the Controller should be repaired or replaced.
6. For Row Crop systems, to isolate a fault to either a CSP or a CL, one or the other component must be replaced since both components must be connected for them to operate.

If the system switches into the Standby Mode by itself:

1. Ensure that the battery is fully charged, the alternator is charging properly, and all cable connections are tight and secure.
2. If an electric pump is used, drawing most of the power, add an additional heavy-duty, deep-cycle battery to the electrical system.

Cables

- Power and the Control Signals are distributed to the Sensors through the Controller, Hood-to-Hood, and Daisy Cables.
- The cable plugs are a 12 pin, keyed connector.
- The two bumps in the cable plug fit into the two notches in the Sensor connector jack.
- It is not easy to do, but it is possible to force a cable plug into a sensor cable connection jack so that the connection is backwards. When this happens, the Controller will not turn on.
- The circuit boards will not be damaged if the cable connection is reversed since they are protected by internal safety components.

If the system will not turn on:

1. Ensure that the Power Cable connections at the battery are not reversed.
2. Ensure that all cable connections are correct.
3. On large systems, it is easier to isolate the fault by dividing the group in half and checking for the symptom.
4. Depending on the size of the system, continue to divide the group until the fault is found.
5. It is possible to have more than one reversed cable connection.
6. If all cable connections are correct, then the fault is with a Sensor or a Valve Cartridge.

WeedSeeker® Sensors

- The Sensors have an internal light source that shines on the ground.
- A beam of red light will project from the rectangular window. It is safe to look into the window to check for the light source since the light is produced by Light Emitting Diodes, (LEDs.)
- The reflected light is collected by the detector and the signal is processed by a mini-computer.
- If a weed is detected, the computer energizes the solenoid valve in the Valve Cartridge and the weed is sprayed with herbicide.
- When the **Flush** Switch on the Controller is turned on, the Sensor will energize the Valve Cartridge.

If a Sensor is not operating properly:

1. Determine if it is one unit, a group of units, or all the units.
2. Ensure that the Light Source and Detector windows are clean.
3. Ensure that the Sensor's light source is energized.
4. If there is no Light Source, but the Valve Cartridge sprays when the **Flush** Switch is turned on, look for a broken pin on the Cables or the socket on the Sensor.
5. If the Valve Cartridge does not react properly when plant material is placed in the field of view, but does when the **Flush** Switch is turned on, then the fault could be with the Sensor or the Valve Cartridge. Further testing is required.

- To determine if the Sensor is faulty: Step One;

    a) turn the **Power** Switch to **OFF**,
    b) remove the Valve Cartridge,
    c) install a different Valve Cartridge that is known to be good,
    d) turn the **Power** Switch to **ON** and allow the system to warm up,
    e) if the cartridge reacts properly, the original Valve Cartridge is probably faulty. Further testing of the original Valve Cartridge is required.
    f) if the cartridge still doesn't react properly, the Sensor is probably faulty. Further testing is required. See Step Two.

- To determine if the Sensor is faulty: Step Two;

    a) turn the **Power** Switch to **OFF**,
    b) replace the unit with a known good Sensor,
    c) turn the **Power** Switch to **ON** and allow the system to warm up,
    d) if the symptom remains, the fault is in another component. Further testing is required.
    e) if the symptom disappears, then the original Sensor is faulty.

Valve Cartridges

- When the Sensor detects a weed or the Flush Switch is turned on, the Valve Cartridge is energized.
- When the cartridge is energized, the internal solenoid valve will open to spray herbicide and the LED above the serial number label will turn on.

If the LED turns on, but the cartridge does not spray, ensure that the nozzle tip is clear, otherwise the cartridge is probably plugged. Back flush the Valve Cartridge and if that doesn't clear the valve, follow the Valve Cartridge Refurbishment instructions or replace the cartridge. See Back Flush Procedure below.

If the Valve Cartridge sprays continuously when the system is in the Standby mode and the LED is off, the valve is stuck open. Back flush the Valve Cartridge and if that doesn't clear the valve, replace the cartridge.

If the Cartridge does not spray and the LED does not turn on when plant material is placed in the field of view, or when the **Flush** Switch is turned on, the fault could be with the Valve Cartridge or the Sensor. Further testing is required.

To determine if a Valve Cartridge is bad,

a) turn the **Power** Switch to **OFF,**
b) remove the Valve Cartridge,
c) install the suspected bad cartridge into another Sensor that is known to be good,
d) turn the **Power** Switch to **ON** and the allow the system to warm up,
e) if the cartridge still doesn't react properly, the Valve Cartridge is faulty,
f) if the cartridge does react properly, the original Sensor is probably bad. Further testing of the original Sensor is required.

Back Flush Procedure

- System should be on, warmed up and in the Standby mode.
- Pump should be off and the pressure in the hoses released.
    1. Turn the **FLUSH** switch to **ON**.
    2. Remove the inlet hose and nozzle tip from the plugged cartridge.
    3. Connect a clean water line to the nozzle connection. **(50 p.s.i. maximum)**
    4. Turn the fresh water supply on.
    5. Allow the fresh water to flow through the cartridge and out the brass inlet for two minutes.
    6. Turn the water off.
    7. Turn the **FLUSH** switch to **OFF**.
    8. Replace the nozzle tip and connect the hose back to the brass inlet.
    9. Return the system to the normal operating condition.

Valve Cartridge Refurbishment

Purpose

A Valve Cartridge will need to be refurbished when the internal 160 mesh filter becomes so plugged with material that back flushing will not clear it.

Refurbishment will involve cleaning the Valve Cartridge and cleaning, or replacing, the internal filter while re-using all other parts. If it is necessary to replace any parts, refer to the Parts list, Table 1, at the end of this section. Contact your Dealer for Part Orders or a Valve Cartridge (VC01) Refurbishment Kit.

Caution

- Before removing any Valve Cartridges, flush the system with fresh water.
- Turn the pump off and relieve the pressure in the hoses.
- Use fresh water when testing the spraying capabilities of the system.
- Wear the appropriate Personal Protection Equipment as necessary.

Procedure

1. Remove the Nozzle Tip and inspect. Ensure that it is clear and not the cause of the reduced flow rate. If necessary, clean with a soft bristle brush.

2. Turn the *WeedSeeker*® System power off.

3. Disconnect the hose, loosen the two captive screws, and remove the Valve Cartridge from the Housing.

4. Clean the outside of the Valve Cartridge with fresh water to remove as much contamination as possible.

5. <u>Disassemble the Valve Cartridge</u> **3/32" Allen wrench**

   5.61. Remove the four 2.5" 4-40 screws and lock washers. The Valve Cartridge is composed of three sections: Lid, Body, and Base. There are no serviceable parts in the Lid or Body. The solenoid valve is screwed into the body with an precise torque setting to prevent leakage and stripping of the threads.

   5.62. Carefully remove the Base from the Body. Use only your hands. Do not pry the sections apart with any tool.

   5.63. Disassemble the internal pieces for cleaning. (See Figure 1 for component identification)

large o-ring	small o-ring	**NOTE: do not remove if it stayed in place.**
washer	magnet	
spacer	filter	

5.64. Clean all parts including the Base and the external portion of the Body. Use a soft bristle brush to clean the filter. Be careful not to puncture, tear, or bend the filter. Use the brush and a pick to completely remove any contamination from the other parts.

5.65. Inspect the filter and replace it if there are any cracks or holes.

6. Assemble the Valve Cartridge

6.61. Assemble the filter, spacer, magnet, washer and o-rings, as shown in Figure 1. This is best accomplished by holding the Body with the long shaft upwards.

6.62. Set the filter down over the shaft.

6.63. Set the spacer over the shaft onto the filter.

6.64. Set and visually center the magnet on the filter. Note that the magnet can shift around on the filter and must be visually centered by hand.

Item	Part Number	Part Name	Qty
1	900-1-005	Valve Cartridge (VC01)	A/R
2	350-1-038	Screw, Captive - #6 x ¾"	2
3	010-1-081	Lid	1
4	350-2-004	Washer, Lock - #4	4
5	010-1-082	Body	1
6	350-1-037	Screw - 4-40 x 2.5"	4
7	010-1-089	Filter Disk	1
8	010-1-085	Spacer	1
9	330-1-002	Magnet	1
10	350-2-013	Washer	1
11	350-4-022	O-ring, Small - 007-S-70	1
12	350-4-021	O-ring, Large - 028-S-70	1
13	010-1-083	Base	1
14	350-5-023	Nozzle Tip - 6502	1
15	350-5-022	Nozzle Cap - 8027-NYB	1

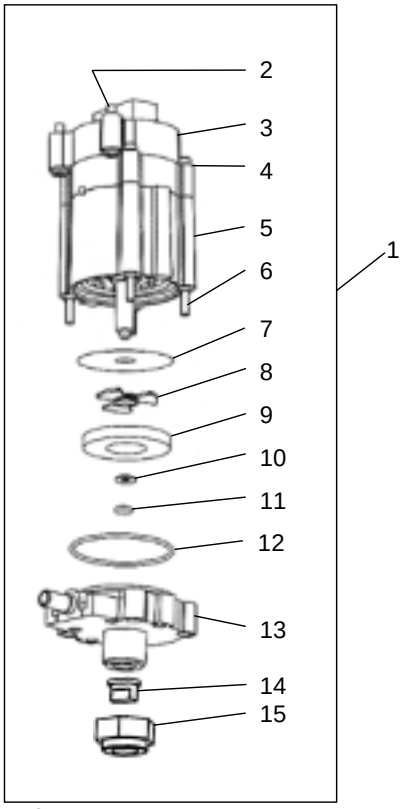

Figure 1: Internal Filter Assembly Order

6.5. Set the small washer on the end of the shaft.

6.6. If necessary, assemble the small o-ring on the end of the shaft.

6.7. Assemble the large o-ring on the Base. Carefully pull the o-ring over the edge. Do not roll the o-ring over the edge as this will twist the o-ring and it will not seal properly.

6.8. Align the Lid, Body, and Base and carefully assemble the Base over the shaft of the Body and squeeze gently to compress the two o-rings together. Ensure that the magnet stays in the correct position.

6.9. Hold everything together while installing the four 2.5" 4-40 screws with their lock washers.

6.10. Tighten the four screws to a torque limit of 50 oz ft • in. (Snug, but do not distort the plastic guide holes in the Lid.)

6.11. Apply Loctite Prism 401 to the four 4-40 brass threaded inserts. (Do this **after** the screws are in place and tightened.)

7. Install the Valve Cartridge into the housing and secure with the two captive screws.

8. Turn the *WeedSeeker*® System power on.

9. Flow Test the Valve Cartridge

9.6. Remove the Nozzle Tip from the Valve Cartridge.

9.7. Flush the plumbing system with fresh water.

9.8. Connect the hose to the brass inlet.

9.9. Pressurize the hoses, ensuring that the plumbing system is operating between 35 and 40 p.s.i.

9.10. Turn the Flush (Purge) Switch on.

9.11. Catch the water flow in a graduated container for **exactly** 30 seconds.

9.12. Turn the Flush (Purge) Switch off.

9.13. Normal flow rates will produce volumes between 24 ounces and 32 ounces, (720 - 960 milliliters). Refer to Tables 2 and 3 for more detailed flow rates.

10. If the Valve Cartridge produces a satisfactory flow rate, it is ready to be returned to service.

11. Assemble the Nozzle Cap and Nozzle Tip onto the Valve Cartridge.

12. If the Valve Cartridge **does not** produce a satisfactory flow rate, the solenoid valve or circuit board has failed. Replace the Valve Cartridge. Keep the Nozzle Tip if it is different than the standard 6502 tip.

13. Table 1: Parts List

Item	Part Number	Part Name	Qty
1	900-1-005	Valve Cartridge (VC01)	A/R
2	350-1-038	Screw, Captive - #6 x ¾"	2
3	010-1-081	Lid	1
4	350-2-004	Washer, Lock - #4	4
5	010-1-082	Body	1
6	350-1-037	Screw - 4-40 x 2.5"	4
7	010-1-089	Filter Disk	1
8	010-1-085	Spacer	1
9	330-1-002	Magnet	1
10	350-2-013	Washer	1
11	350-4-022	O-ring, Small - 007-S-70	1
12	350-4-021	O-ring, Large - 028-S-70	1
13	010-1-083	Base	1
14	350-5-023	Nozzle Tip - 6502	1
15	350-5-022	Nozzle Cap - 8027-NYB	1

Table 2: Ounces per 30 second, (+/- 2 ounces)

Nozzle Tip	30 p.s.i.	35 p.s.i.	40 p.s.i.
6502	10	11	13
6503	14	17	19
6504	19	22	26
None	24	28	32

Table 3: Milliliters per 30 second, (+/- 60 milliliters)

Nozzle Tip	30 p.s.i.	35 p.s.i.	40 p.s.i.
6502	290	340	390
6503	430	500	580
6504	580	670	770
None	720	840	960

Sensitivity

- The Sensitivity Knob determines what size weed will be sprayed.
- Several small weeds are equal in chlorophyll content to one large weed.
- Moss is a plant, so a small patch of moss will be detected as if it were a large weed.
- When pointing straight down, each Sensor will have a Field of View of 13” +/- 1/2”.
- When set at an angle, the Field of Field of View will be larger, depending on the angle.

If the system, as a whole, is missing some smaller weeds:

- Increase the Sensitivity by setting the adjustment to a smaller number. Make the adjustment in 1/2 increment steps until the desired sensitivity is reached.

If the system, as a whole, is spraying more than it should:

- Press and release the **Soil Base** Switch to re-calibrate. Do this over weed free soil!
- Decrease the Sensitivity by setting the adjustment to a larger number. Make the adjustment in 1/2 increment steps until the desired sensitivity is reached.

If one Sensor is missing some smaller weeds or is spraying more than it should:

- Ensure that the Light Source and Detector windows are clean and clear.
- The Soil Base might have been set while over a different sample of soil than the rest of the system, such as a small weed, a puddle of water, or a dry spot.
- Reset the Soil Base with the entire system over weed free soil.
- Ensure that the Field of View is the correct width.

Field of View Test Procedure

- System should be on, warmed up and in the Standby mode.
- Pump should be off and the pressure in the hoses released.
    1. position the Sensor over dry, and weed free soil,
    2. set the **Soil Base**,
    3. set the **Sensitivity** to maximum sensitivity, (fully counter-clockwise),
    4. switch the system out of the Standby mode,
    5. use a piece of healthy plant material that is one inch wide to test the reaction of the Sensor,
    6. find and mark the limits of the Sensor’s Field of View by observing when the Valve Cartridge LED turns on and off.

Soil Base

- Set the Soil Base over weed free soil.
- Since a dry, sandy soil has a different reflectance value than moist, loamy soil, the Soil Base will have to be changed after the system has been moved to a different type of soil.
- Set the soil base in the field and not on the road at the end of the rows.
- At the instant when the Soil Base Switch is released, whatever reflectance value is being detected by each Sensor becomes that Sensor's new background value.
- Each Sensor constantly compares the reflectance value to the background value it has stored in memory.
- The background value represents a certain amount of chlorophyll.
- An object must have a chlorophyll reflectance value greater than what is in memory in order to be sprayed.
- If the Soil Base was set while a Sensor was over a weed,
    a) smaller weeds will not be sprayed,
    b) only weeds larger than the initial weed will be sprayed.

If a Sensor is spraying areas where no weeds are present, i.e."phantom spraying":

- Press the **Soil Base** Switch to re-calibrate the background value. Do this over weed free soil!
- If the problem persists, use a lower the **Sensitivity** setting.

If a Sensor is not spraying areas where weeds are present:

- Press the **Soil Base** Switch to re-calibrate the background value. (Do this over weed free soil.)
- If the problem persists, increase the **Sensitivity** setting.

Speed

- To properly spray a weed, the time delay before the Valve Cartridge opens and the duration that it stays open must match the vehicle's speed.
- Since the system does not use a speed sensing device, the **Speed** Switch selects a range of speeds to control the timing.
- The system has an operating range between 3 and 10 miles per hour.
- When properly set, the spray will turn on slightly before the weed and stay on until slightly after the weed.

- **LO** 3 - 5 mph
- **MED** 5 - 7 mph
- **HI** 7 - 10 mph

If the Sensor is spraying before the weed:

- Reduce the Speed setting.

If the Sensor is spraying after the weed:

- Increase the Speed setting.

Avoid changing the vehicle's speed, as it would require a recalculation of the nozzle flow rates.

Speed Setting Test Procedure

- System should be on, warmed up and in the Standby mode.
- Pump should be on and the hoses pressurized.
- Conduct the test on a dry, weed free road.
- Use of a larger than normal nozzle tip may be necessary in order to observe the spray pattern on the ground.
    1. set the **Soil Base**,
    2. set the **Sensitivity** to maximum sensitivity (fully counter-clockwise),
    3. select the desired **Speed** setting,
    4. place a target weed on the road ahead of the vehicle,
    5. leave enough space between the vehicle and the target so that the vehicle will be able to reach the correct speed,
    6. switch the system out of the Standby mode,
    7. at the correct speed, drive the vehicle so that the target weed is detected and sprayed,
    8. observe the spray pattern on the ground,
    9. if necessary, change the **Speed** setting and repeat the test.