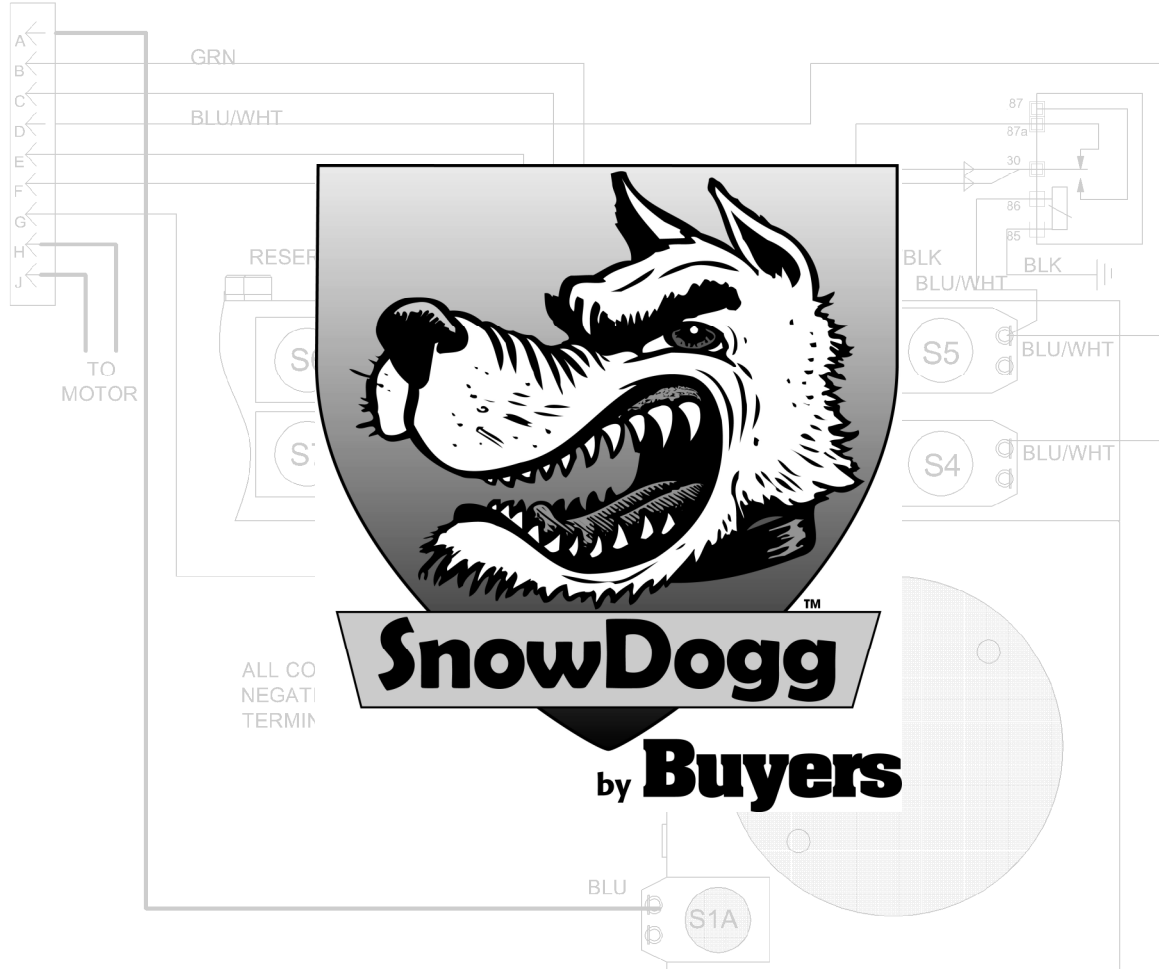


# SNOWDOGG® 16152000B HYDRAULIC REFERENCE VX PLOWS



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## SNOWDOGG 16152000B HYDRAULIC REFERENCE

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### **WARNING**

**ANY TROUBLESHOOTING OF THE PLOW ELECTRICAL OR HYDRAULIC SYSTEM MAY RESULT IN UNINTENDED MOTION OF THE PLOW.  
ENSURE THAT THE AREA AROUND THE PLOW IS CLEAR TO AVOID PROPERTY DAMAGE OR SERIOUS INJURY  
ALL MAINTENANCE MUST BE PERFORMED WITH MOLDBOARD ON THE GROUND**

## GENERAL REFERENCE

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### Note

*The SnowDogg hydraulic control circuit is complete separately from the light control circuit.*

*Any references to wire colors are specific to the control harness.*

## Method of Operation

### ***Starter Relay***

The SnowDogg motor starter relay is the only component of the hydraulic system mounted under the hood and is always connected. Even with the plow disconnected, the starter relay will click if the controller is powered and LIFT, LEFT or RIGHT are pressed.

### ***Hydraulic Solenoids***

Eleven hydraulic poppet solenoid valves are used in the 16152000B power unit. All but one use the same coil – so coils can be swapped to aid in troubleshooting. The solenoid coils act as electromagnets, and pull on an armature and spool or poppet inside the valve. A valve may malfunction due to faulty wiring, a bad coil, or contamination preventing the armature/spool from freely moving inside the valve. If the problem is contamination, it can often be corrected by removing and cleaning the valve. If the issue is electrical, the valve will not energize or shift. If the problem is mechanical, the valve may not shift or may be stuck in the shifted position.

### ***Controller***

The hand held digital controller controls both the starter relay coil and the hydraulic solenoids. It can withstand a continuous short circuit without damage. It has integral diagnostics to aid in troubleshooting and to notify the user of an electrical fault.

### ***Relay Module***

The 16160448 relay module is only used for “straight blade” mode. It can be disconnected for troubleshooting, and all plow functions (other than straight) should work. It controls the S8 valve that connects the bore ends of both cylinders.

## Proper Operation of Power Unit

### **Controller**

*After hitting POWER, the SnowDogg logo should be lit and the controller status light (upper right corner) should be solid GREEN. If the status light is blinking, see troubleshooting.*

### **Lift Button**

*Plow lifts until lift cylinder is at end of stroke and fluid is diverted over the main relief valve at 1900PSI.*

## GENERAL REFERENCE

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### Lower Button

*Plow drops until the blade hits the ground or until the cylinder is fully retracted.*

### Float (hold Lower Button for >.5 seconds)

*Float light is lit and plow drops until the blade hits the ground or until the cylinder is fully retracted – and the drop valve remains energized allowing the blade to follow the ground (depending on how the chain is set).*

### Right Center Button (Straight Blade Right)

*Both wings move together – left wing extends and right wing retracts. When EITHER wing reaches it's end of stroke, motion will stop, and fluid is diverted over the main relief valve at 1900 PSI.*

### Left Center Button (Straight Blade Left)

*Both wings move together – left wing retracts and right wing extends. When EITHER wing reaches it's end of stroke, motion will stop, and fluid is diverted over the main relief valve at 1900 PSI.*

### Right Wing Out Button

*Right wing extends. At end of stroke, motion stops, and fluid is diverted over the main relief valve at 1900 PS.*

### Left Wing Out Button

*Left wing extends. At end of stroke, motion stops, and fluid is diverted over the main relief valve at 1900 PS.*

### Right Wing In Button

*Right wing retracts. At end of stroke, motion stops, and fluid is diverted over the main relief valve at 1900 PS.*

### Left Wing In Button

*Left wing retracts. At end of stroke, motion stops, and fluid is diverted over the main relief valve at 1900 PS.*

### Left Wing In AND Right Wing In (VEE)

*Both Left wing and Right wing fully retract. At end of stroke, motion stops, and fluid is diverted over the main relief valve at 1900 PSI.*

### Left Wing Out AND Right Wing Out (SCOOP)

*Both Left wing and Right wing fully extend. At end of stroke, motion stops, and fluid is diverted over the main relief valve at 1900 PSI.*

## TROUBLESHOOTING

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### Troubleshooting Tips

- **To aid in diagnostics, disconnect the RELAY MODULE prior to troubleshooting.** With the relay module connected the controller will not detect short or open circuits. With the relay module disconnected, Straight blade mode will not work.
- Check for magnetism at the coils with a screwdriver or metal tool. With the coil energized, you should feel a magnetic pull at the top of the coil.
- If the controller is blinking, the problem is electrical – not hydraulic. Do not spend time troubleshooting and cleaning valves if the controller is blinking.
- Use a test light to measure for +12V at coils and connectors.
- Use a multimeter/ohmmeter to measure for continuity.
- Always start troubleshooting with the moldboard straight and on the ground.

### Tools Recommended

- Multimeter (Voltmeter/Ohmmeter)
- Wrenches
- 7/8" deep socket (for solenoid valves)
- Picks (for removing/replacing o-rings)
- SnowDogg High Performance Hydraulic Fluid (P/N 16150010)

## TROUBLESHOOTING

Symptom/Diagnostic	Result	Fix	
<p><i>Disconnect the RELAY MODULE CONNECTOR for the following steps. The controller will not detect most electrical faults with the relay module connected.</i></p>			
<b>Pump motor not running when UP, LEFT or RIGHT pressed</b>			
	Status light blinks ONCE	Continuity Problem	Check <b>RED WIRE/MOTOR RELAY</b>
	Check voltage at <b>MOTOR</b> terminals with UP, LEFT, or RIGHT buttons pressed	If voltage present - <b>MOTOR</b> is bad	Replace <b>MOTOR</b>
	Check cable continuity between <b>MOTOR RELAY</b> and <b>MOTOR</b>	If no continuity, check cable, connections, and replace if necessary	Replace/repair cable or connections
	Check control signal to <b>MOTOR RELAY</b> (small wires to motor relay) with UP, LEFT, or RIGHT buttons pressed	If voltage present and no click is heard when buttons are pressed, <b>MOTOR RELAY</b> is bad	Replace <b>MOTOR RELAY</b>
	Check ground continuity between between control ground at <b>MOTOR RELAY</b> and battery ground	If no continuity, check cable, connections, and replace if necessary	Replace/repair cable or connections
<b>Plow won't move at all, moves "jerkily", very slowly, or chatters</b>			
	Check fluid level in reservoir	Fluid should be visible in elbow fitting.	Add fluid
	Air in fluid	Bleed air from system	Slightly loosen fittings to angle cylinders and move the plow wings. Tighten fittings while fluid is escaping. Do this over an absorbent mat, or hold a rag over fitting to absorb excess fluid.
<b>Oil is leaking from cylinders</b>			
		Packing is loose	Tighten gland until leak stops
		Rods are pitted	Polish rods with fine steel wool
			Replace cylinder

## TROUBLESHOOTING

Symptom/Diagnostic		Result	Fix
<b>Oil sprays out of vent port in power unit</b>			
	Air in Fluid	Bleed air from system	Slightly loosen fittings to angle cylinders and angle the plow. Tighten fittings while fluid is escaping. Do this over an absorbent mat, or hold a rag over fitting to absorb excess fluid.
	Check fluid level	Fluid should be visible in elbow fitting.	Remove fluid if necessary - in most cases the problem will subside as entrapped air dissipates.
<b>Plow won't drop</b>			
	Status light blinks <b>8</b> times	Continuity Problem	Check <b>PURPLE WIRE/S1B COIL</b>
	Check voltage at <b>S1B VALVE</b> coil	If no voltage present, check cable and connections	Replace/repair cable or connections
	Check <b>DROP SPEED</b> control valve	<b>DROP SPEED</b> valve should be several turns from fully closed	Open <b>DROP SPEED</b> valve
	Check <b>S1B VALVE</b> for contamination	Poppet must move freely, and seat area must be clear of any debris	Remove <b>S1B VALVE</b> and check free movement of poppet, clean any chips/debris from poppet seat Replace <b>S1B VALVE</b>
	Check <b>LIFT LOCK</b> valve for contamination	Poppet must move freely, and seat area must be clear of any debris	Remove <b>LIFT LOCK</b> valve and check free movement of poppet, clean any chips/debris from poppet seat
			Replace <b>LIFT LOCK</b> valve
<b>Plow won't lift</b>			
	Status light blinks <b>2</b> times	Continuity Problem	Check <b>BLUE WIRE/S1A COIL</b>
	Check voltage at <b>S1A VALVE</b> coil	If no voltage present, check cable and connections	Replace/repair cable or connections
	Check <b>S1A VALVE</b> for contamination	Poppet must move freely, and seat area must be clear of any debris	Remove <b>S1A VALVE</b> and check free movement of poppet, clean any chips/debris from valve Replace <b>S1A VALVE</b>

## TROUBLESHOOTING

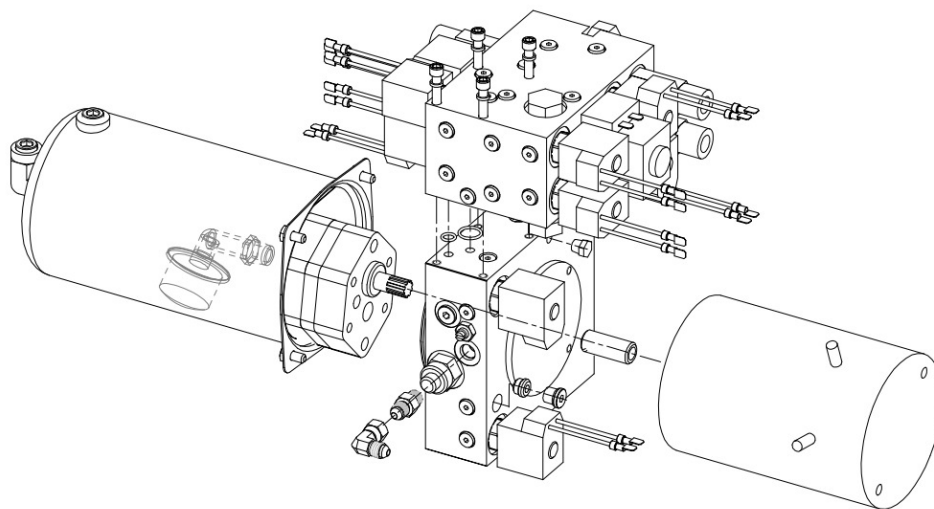
Symptom/Diagnostic		Result	Fix
<b>Left or Right Wing won't extend</b>			
	Status light blinks 5 times	Continuity Problem	<b>Check BLUE/WHT WIRE/S4 and S5 COILS</b>
	Check voltage at <b>S4 (LEFT) or S5 (RIGHT) VALVE</b> coil	If no voltage present, check cable and connections	Replace/repair cable or connections Confirm BLU/WHT wire at <b>S4/S5 VALVES</b>
	Check <b>S4/S5 VALVE</b> for contamination	Poppet must move freely, and seat area must be clear of any debris	Remove <b>S4/S5 VALVE</b> and check free movement of spool, clean any chips/debris from valve Replace <b>S4/S5 VALVE</b>
<b>Left or Right Wing won't retract</b>			
	Status light blinks <b>6</b> times	Continuity Problem	Check <b>GRN/WHT WIRE/S7 VALVE</b>
	Status light blinks <b>7</b> times	Continuity Problem	Check <b>ORG/WHT WIRE/S6 VALVE</b>
	Check voltage at <b>S6 (LEFT) or S7 (RIGHT) VALVE</b> coil	If no voltage present, check cable and connections	Replace/repair cable or connections Confirm <b>ORG/WHT wire at S6 and GRN/WHT wire at S7</b>
	Check <b>S6/S7 VALVE</b> for contamination	Poppet must move freely, and seat area must be clear of any debris	Remove <b>S6/S7 VALVE</b> and check free movement of spool, clean any chips/debris from valve Replace <b>S6/S7 VALVE</b>
<b>"Angle Left" and "Angle Right" don't work</b>			
	Check voltage at <b>S8 VALVE</b> coil	If no voltage present, check cable and connections	Replace/repair cable or connections
			Confirm BLUE/BLK wire at <b>S8 VALVE</b> Replace RELAY MODULE
	Check <b>S8 VALVE</b> for contamination	Poppet must move freely, and seat area must be clear of any debris	Remove <b>S8 VALVE</b> and check free movement of spool, clean any chips/debris from valve Replace <b>S8 VALVE</b>



## TROUBLESHOOTING

Symptom/Diagnostic		Result	Fix
<b>Plow drifts while plowing snow</b>			
	Air in Fluid	Bleed air from system	Slightly loosen fittings to angle cylinders and angle the plow. Tighten fittings while fluid is escaping. Do this over an absorbent mat, or hold a rag over fitting to absorb excess fluid.
	Check <b>CHECK VALVES</b> for contamination	Poppet must move freely, and seat and piston area must be clear of any debris	Remove <b>CHECK</b> valves and clean Replace <b>CHECK</b> valve
	Check <b>RELIEF</b> valves for contamination	Poppet must move freely, and seat must be clear of any debris	Remove <b>RELIEF</b> valves and clean Replace <b>RELIEF</b> valves
<b>Wings SCOOP when RIGHT OUT is pressed</b>			
	Status light blinks <b>3</b> times	Continuity Problem	Check <b>GRN WIRE/S2A AND B COIL</b>
	Check <b>S2A and S2B VALVES</b> for contamination		
	Problem goes away when relay module is disconnected	Relay module is faulty	Replace <b>RELAY MODULE</b>
<b>Wings SCOOP when LEFT OUT is pressed</b>			
	Status light blinks <b>4</b> times	Continuity Problem	Check <b>ORG WIRE/S3A AND B COIL</b>
	Check <b>S3A and S3B VALVES</b> for contamination		
	Problem goes away when relay module is disconnected	Relay module is faulty	Replace <b>RELAY MODULE</b>

### HPU Servicing



#### Fill Procedure

1. Remove the fill plug from the reservoir.
2. Fluid should be visible in 90 degree fitting.

#### Solenoid Valve service/replacement

1. Remove the coil from the solenoid valve.
2. Using a deep socket, remove the solenoid valve from the manifold.
3. Inspect the valve for contamination or damage.
4. Ensure that the poppet or spool travels freely.
5. Flush the valve if necessary to remove contamination.
6. Reinstall valve and tighten to 20 ft-lbs.

#### General valve service/replacement

1. Using a socket, remove the valve from the manifold.
2. Inspect the valve for contamination or damage.
3. Ensure that the poppet or spool travels freely.
4. Flush the valve if necessary to remove contamination.
5. Reinstall valve and tighten to 20 ft-lbs.

*NOTE: Always lubricate components with oil prior to reassembly to prevent damage to the o-rings.*

### WARNING

ANY TROUBLESHOOTING OF THE PLOW ELECTRICAL OR HYDRAULIC SYSTEM MAY RESULT IN UNINTENDED MOTION OF THE PLOW.  
ENSURE THAT THE AREA AROUND THE PLOW IS CLEAR TO AVOID PROPERTY DAMAGE OR SERIOUS INJURY  
ALL MAINTENANCE MUST BE PERFORMED WITH MOLDBOARD ON THE GROUND

#### TS1 HPU Motor not running

1. With controller on, press LIFT, LEFT or RIGHT. Listen for starter relay “CLICK”
  - a. Click not heard
    - i. Check for +12V at relay control terminals (small terminals)
    - ii. Ground for relay should be direct to battery
  - b. Click heard
    - i. Continue
2. Jump the large terminals of the starter relay with a large wire or screwdriver.
  - a. If HPU motor runs
    - i. Replace starter relay
  - b. If HPU motor does not run
    - i. Continue
3. Disconnect plow – check for +12V at large sockets of grill connector (truck side controller harness)
  - a. If +12V is not present
    - i. Check wiring continuity between starter relay and grill connector and battery ground and grill connector
  - b. If +12V is present
    - i. Continue
4. Check continuity between plow side connector and studs on HPU motor
  - a. If continuity is NOT found
    - i. Check wires
  - b. If continuity is found
    - i. Continue
5. Disconnect Red wire from HPU motor, directly apply +12V to HPU motor (from extra battery or using jumper cables)
  - a. If motor runs
    - i. Motor is not defective, check wiring
  - b. If motor does not run

## TROUBLESHOOTING

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- i. Motor is defective, replace

### TS2 General Coil Troubleshooting – Blinking Status Light

1. Turn Controller OFF, waiting five seconds, turn Controller ON
2. Hit UP/LEFT/RIGHT/DOWN in sequence and watch the plow.
  - Plow is operating correctly / status light is not blinking  
Complete
  - Plow is operating correctly / status light IS blinking  
There is an intermittent short/open circuit.  
Clean and check all connection points  
Look for frayed/pinched/damaged wires  
Continue
  - Plow is NOT operating correctly / status light IS blinking  
Continue
3. Check for +12V at coil terminals
  - If +12V is present  
Coil is defective, replace
  - If +12V is not present  
Check ground side wire continuity  
Continue
4. Check for continuity on +12V wire between coil and grill connector (see pinout)
  - If continuity is NOT found  
Repair/replace plow side harness
  - If continuity is found  
Continue
5. Check for continuity between grill connector and controller connector (in cab)
  - If continuity is NOT found  
Repair/replace truck side control harness
  - If continuity is found  
Check controller connector pins and verify everything is seated properly.  
Try a known good controller
6. Contact SnowDogg Tech Support

### TS3 System Pressure Check

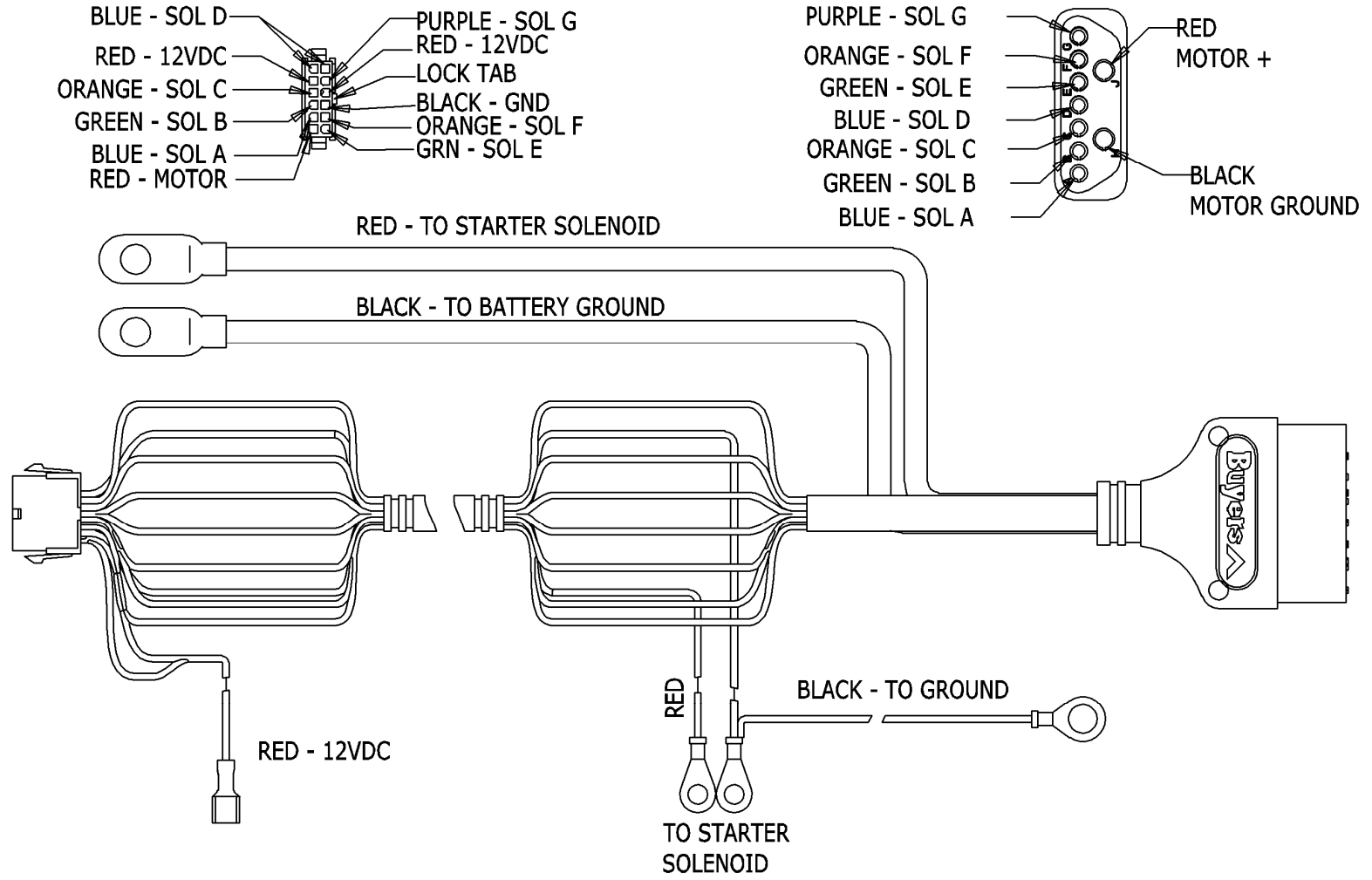
1. Disconnect the lift cylinder hose from the manifold

## TROUBLESHOOTING

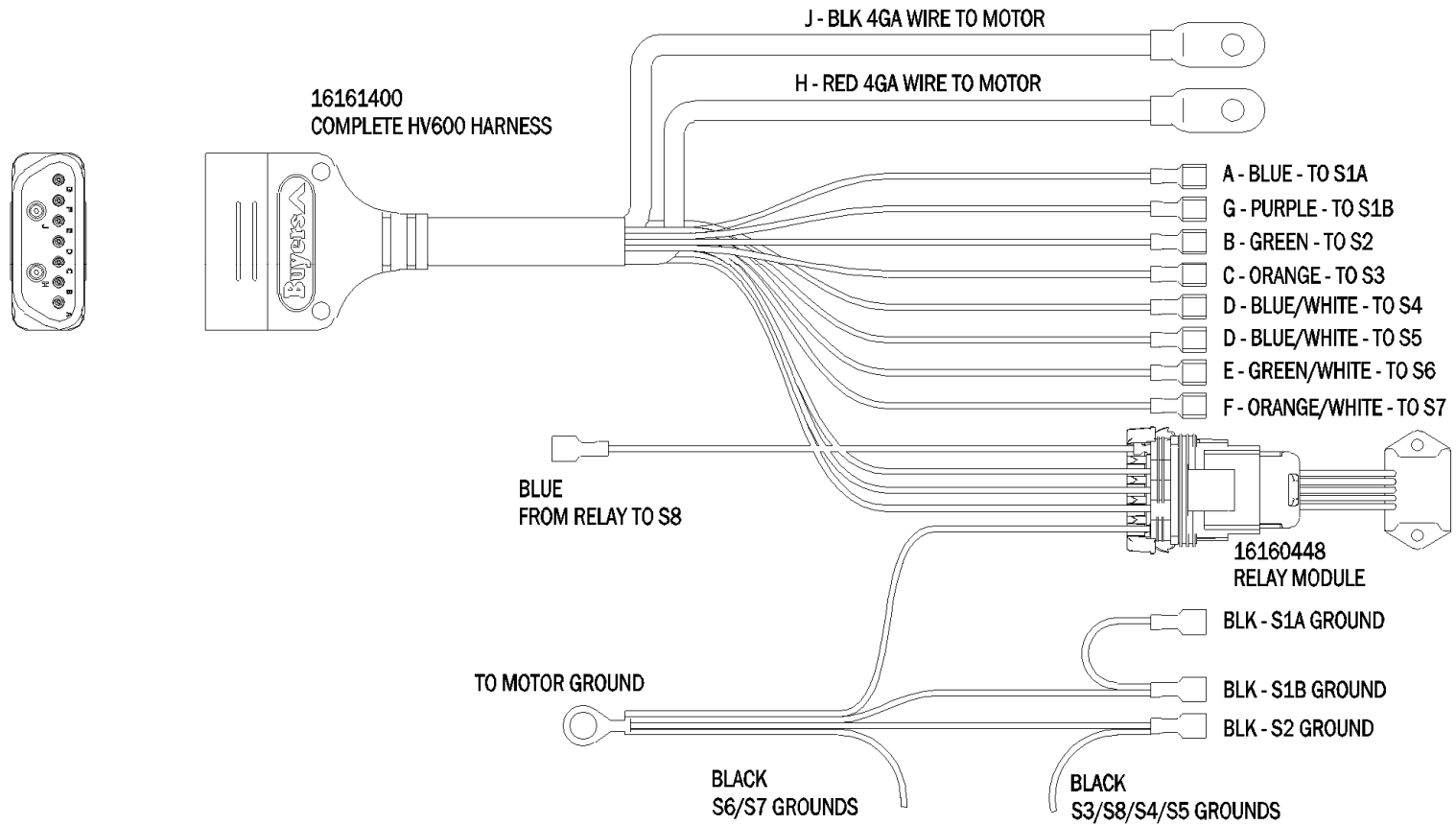
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2. Install a pressure gage on the lift port
3. Energize the LIFT circuit and read the gage pressure
  - a. Pressure is over 1700 PSI
    - i. Pressure is correct
  - b. Pressure is under 1700 PSI
    - i. Replace/clean the Main Relief Valve

TRUCK SIDE HARNESS PINOUT



### PLOW HARNESS PINOUT

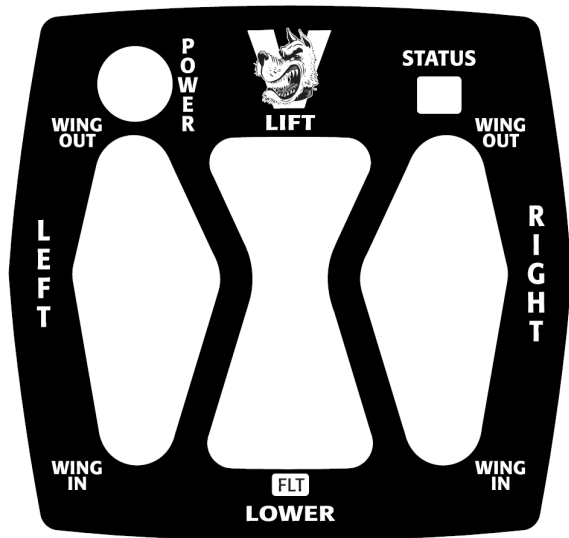


### SNOWDOGG CONTROLLER

The SnowDogg controller uses fault tolerant drivers that can withstand shorts to ground without failure. The failure of a single channel will not affect the performance of the remaining channels.

If the fault is intermittent it will be registered, but will not cause the controller to stop functioning.

Function specific timings have been incorporated into the controller to ensure that no unintended movement takes place.



### CONTROLLER SPECIFICATIONS

- **Electrical**
  - 8 independent channels
  - 5A per channel
  - Digital “Smart Drivers”
  - Reprogrammable
- **Functional**
  - Integral diagnostics
  - “Diagnostic” mode

### CONTROLLER STATES

#### Normal Operation – No Errors

- See the HPU specifications and schematics for a description of the effect of individual buttons
- Controller will time out in 10 seconds if button is not released

#### Normal Operation – With Errors

- Controller continues to operate – “error” channels are shutdown only if in short condition.
- Yellow (Float) light will go solid
- Red (Status) light will blink the channel # in error
- If the fault is momentary the controller will continue to display the fault – the fault can be reset by turning the controller off and back on. This allows intermittent faults (broken wires, worn insulation) to be detected.



**CONTROLLER DIAGNOSTIC MODE**

Enter diagnostic mode with the following sequence.

1. Disconnect the controller from power (turn truck off)
2. Hold down the POWER button and turn truck on
3. Continue holding down POWER button until GREEN status LED begins to blink (10 seconds)
4. You are now in “Diagnostic” mode. All outputs are off.
5. Use the buttons/leds as shown to test each channel

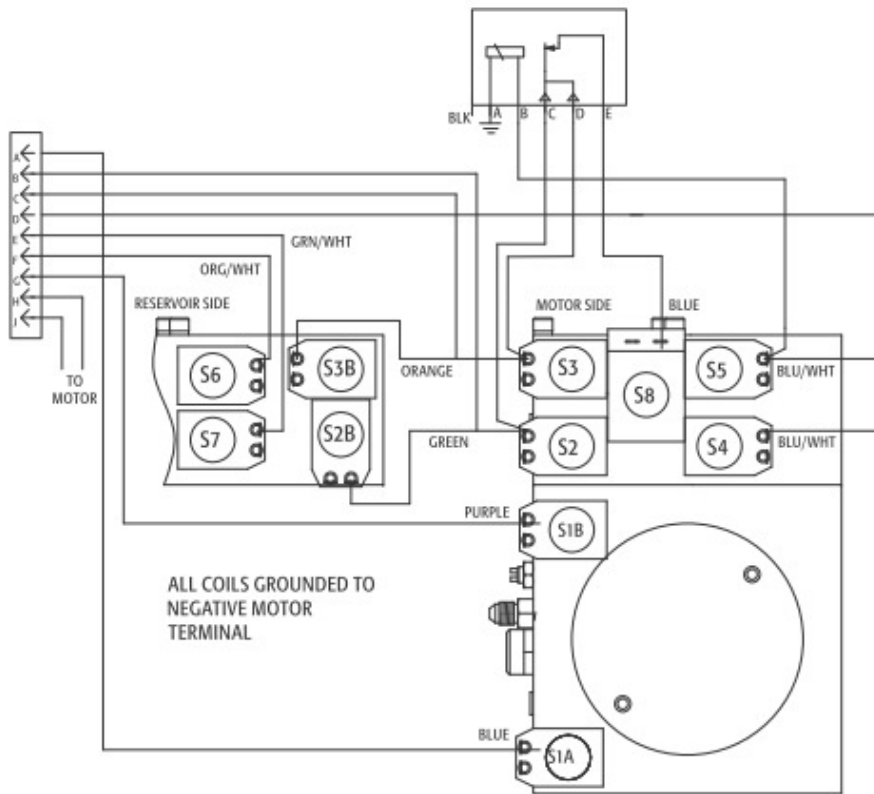
- **GREEN STATUS LED**
  - Blinks the # of the channel currently selected
- **RED STATUS LED**
  - SOLID when selected channel is shorted
  - BLINKS when selected channel is open (broken)
- **YELLOW STATUS LED**
  - SOLID in any error condition in selected channel
- **RIGHT**
  - Increase the channel number being tested
  - This will turn off ALL channels
- **LEFT**
  - Decrease the channel number being tested
  - This will turn off ALL channels
- **UP**
  - Turns ON selected channel
- **DOWN**
  - Turns OFF selected channel

Exit diagnostic mode by turning the controller off and back on.

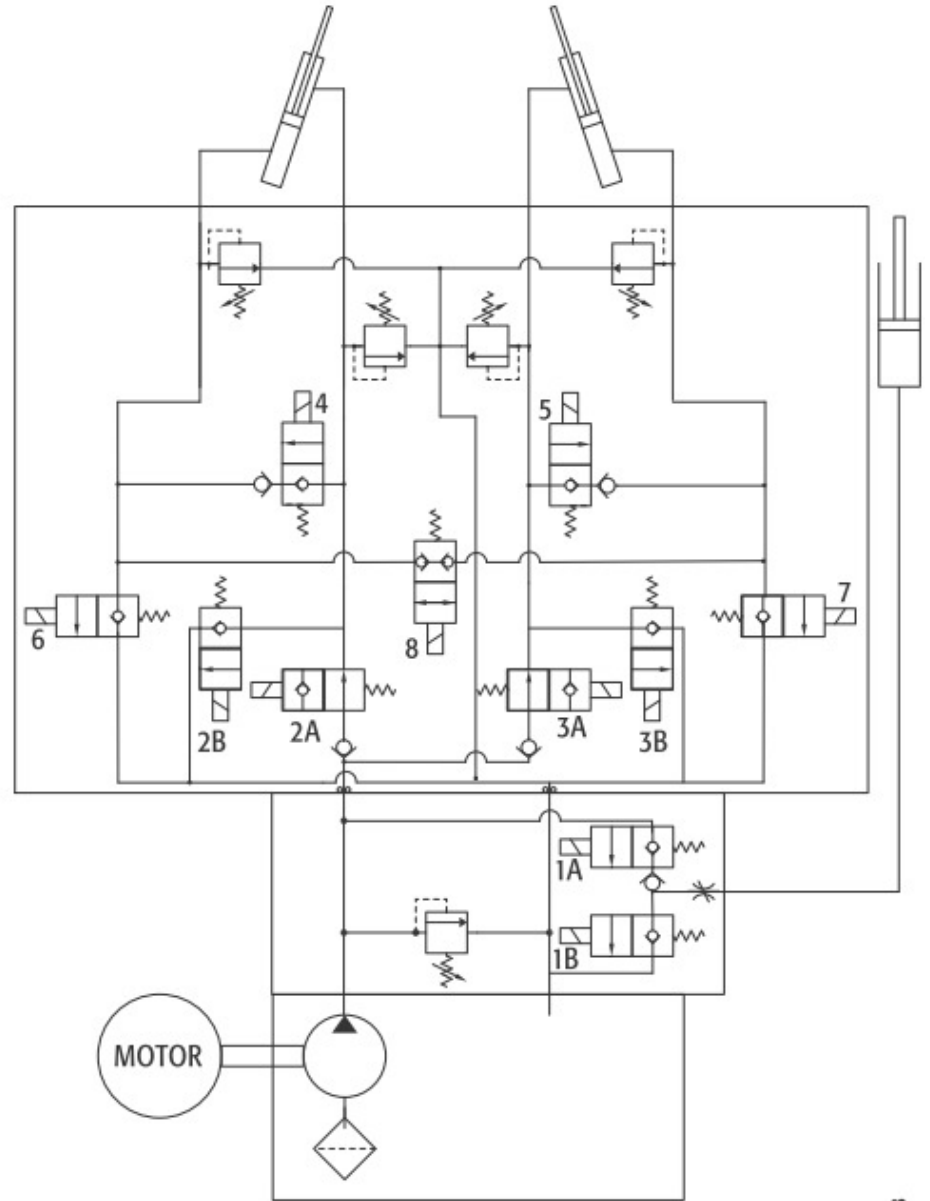
**VX CONTROLLER OUTPUT TABLE**

	LOGIC TABLE							
<b>PIN</b>	<b>MOTOR</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>
<i>CHANNEL</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>VALVE</i>	<i>MOTOR</i>	<i>S1A</i>	<i>S2A/B</i>	<i>S3A/B</i>	<i>S4/S5</i>	<i>S6</i>	<i>S7</i>	<i>S1B</i>
<b>UP</b>	X	X	-	-	-	-	-	
<b>DOWN</b>	-	-	-	-	-	-	-	X
<b>FLOAT</b>	-	-	-	-	-	-	-	X
<b>LEFTIN</b>	X	-	-	-	-	X	-	-
<b>LEFTOUT</b>	X	-	-	X	X	-	-	-
<b>RIGHTIN</b>	X	-	-	-	-	-	X	-
<b>RIGHTOUT</b>	X	-	X	-	X	-	-	-
<b>VEE</b>	X	-	-	-		X	X	-
<b>SCOOP</b>	X	-	-	-	X	-	-	-
<b>ANGLELEFT</b>	X	-	-	X	-	-	-	-
<b>ANGRIGHT</b>	X	-	X	-	-	-	-	-

# HPU LID DECAL / QUICK REFERENCE

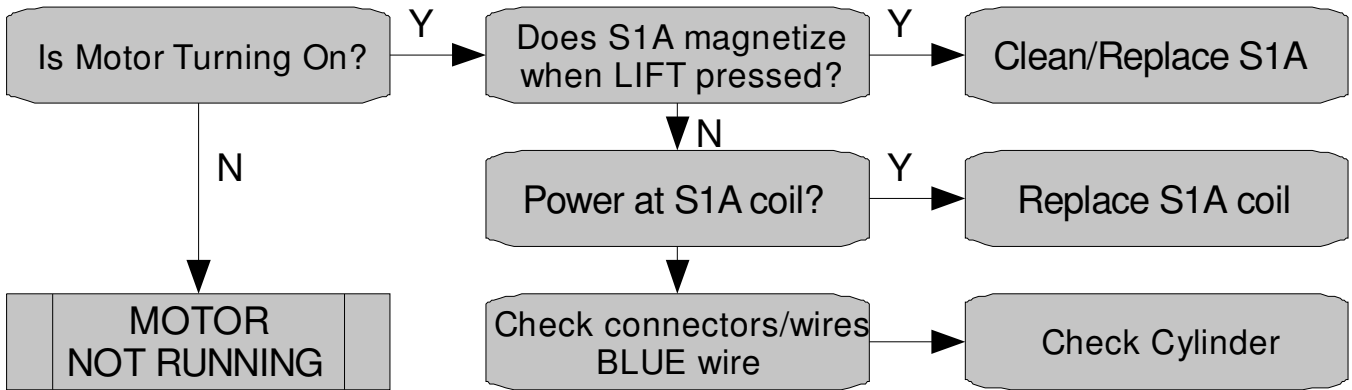


	motor	S1A	S1B	S2	S3	S4	S5	S6	S7	S8
Lift										
Lower										
Float										
Left In										
Left Out										
Right In										
Right Out										
Vee										
Scoop										
Angle Left										
Angle Right										

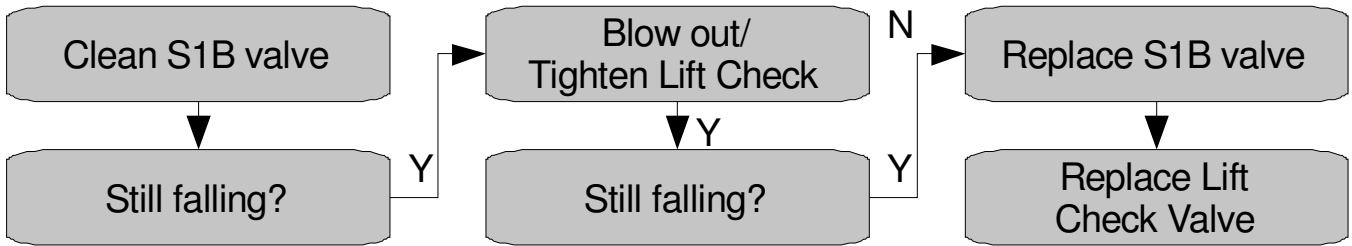


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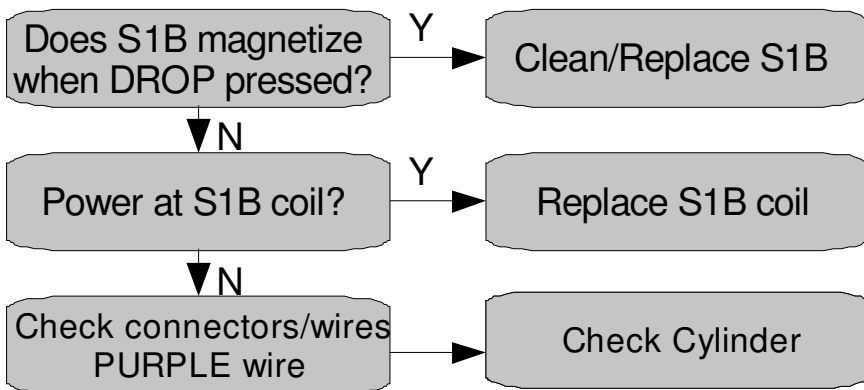
NO LIFT



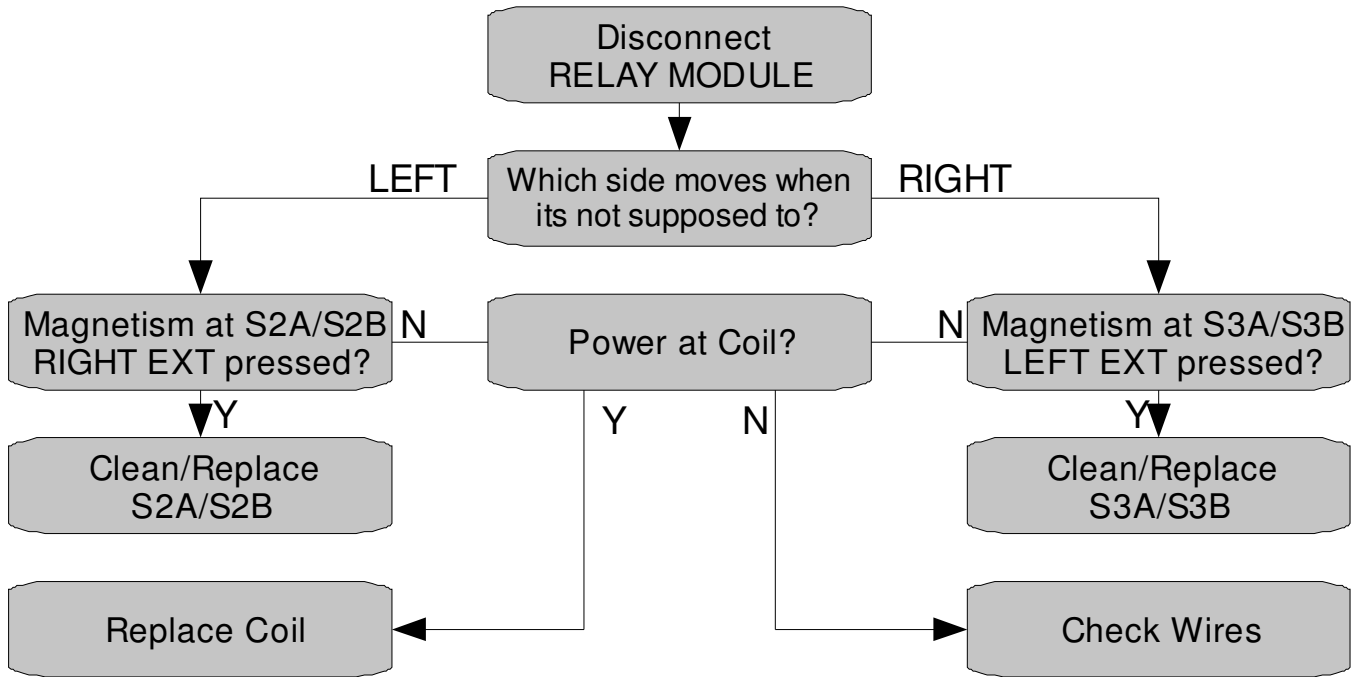
PLOW LEAKS DOWN



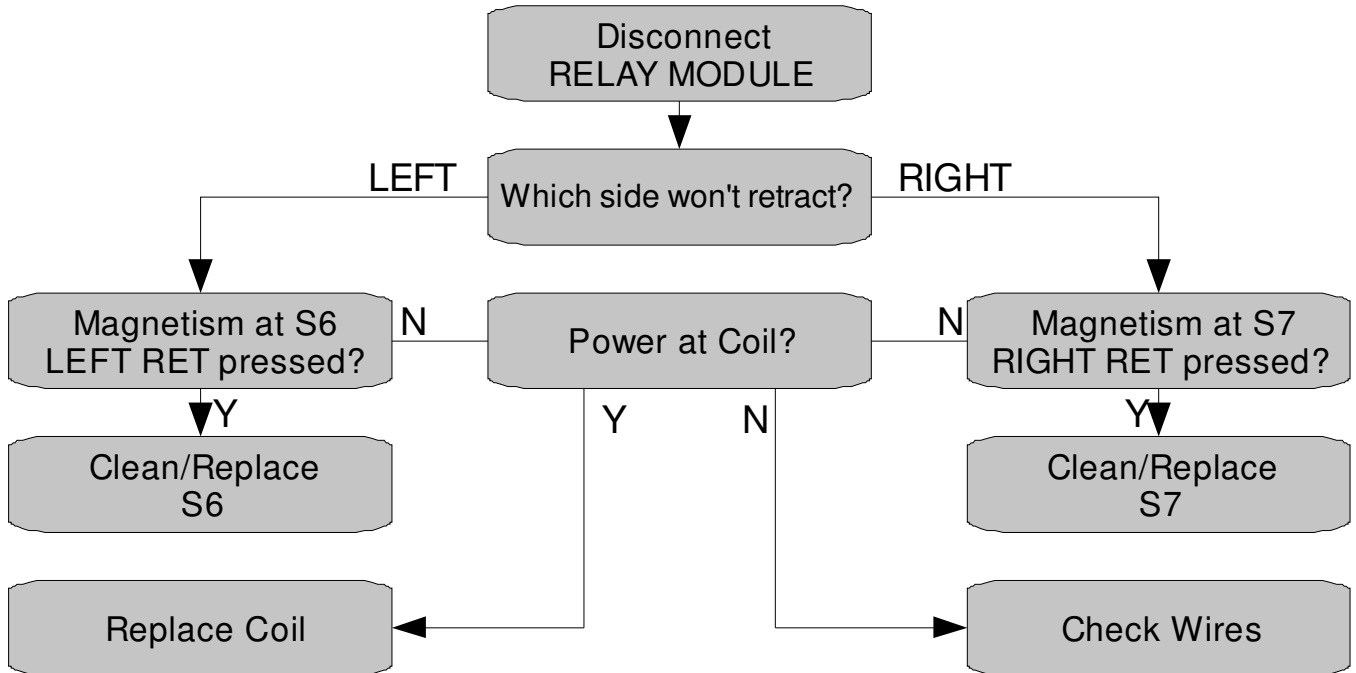
NO DROP



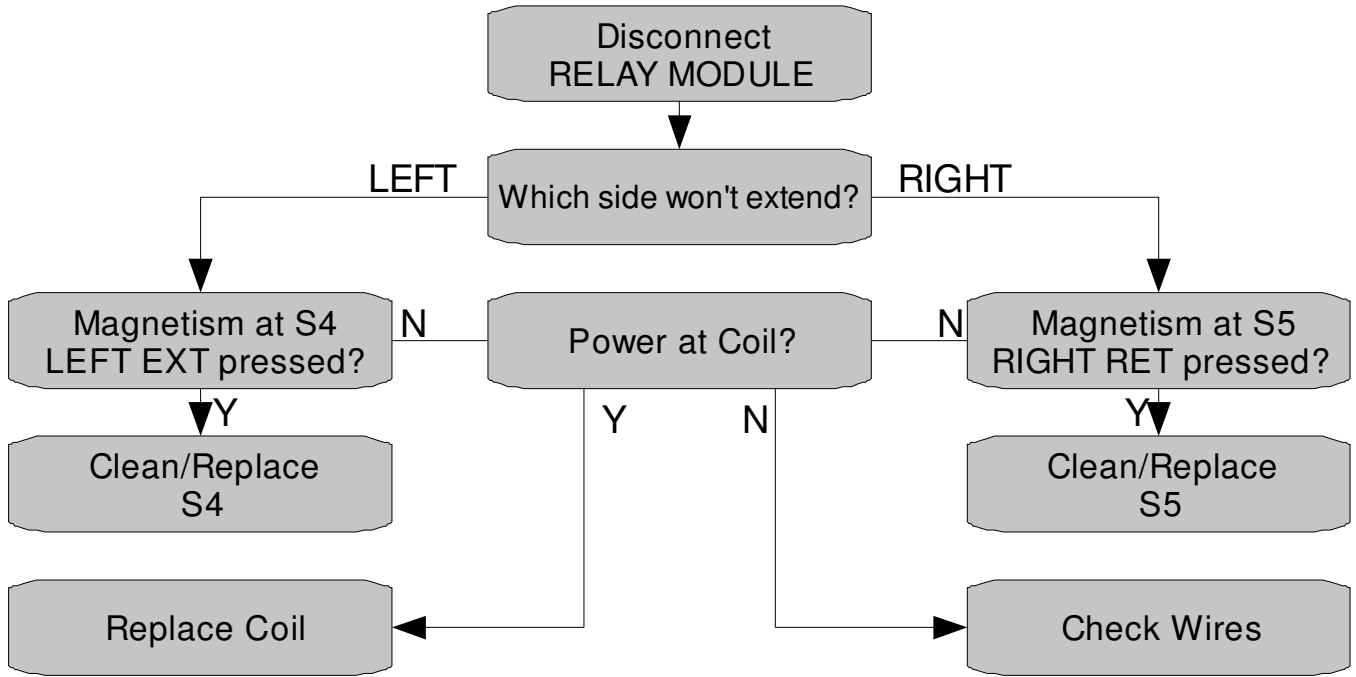
### WINGS NOT MOVING INDEPENDENTLY



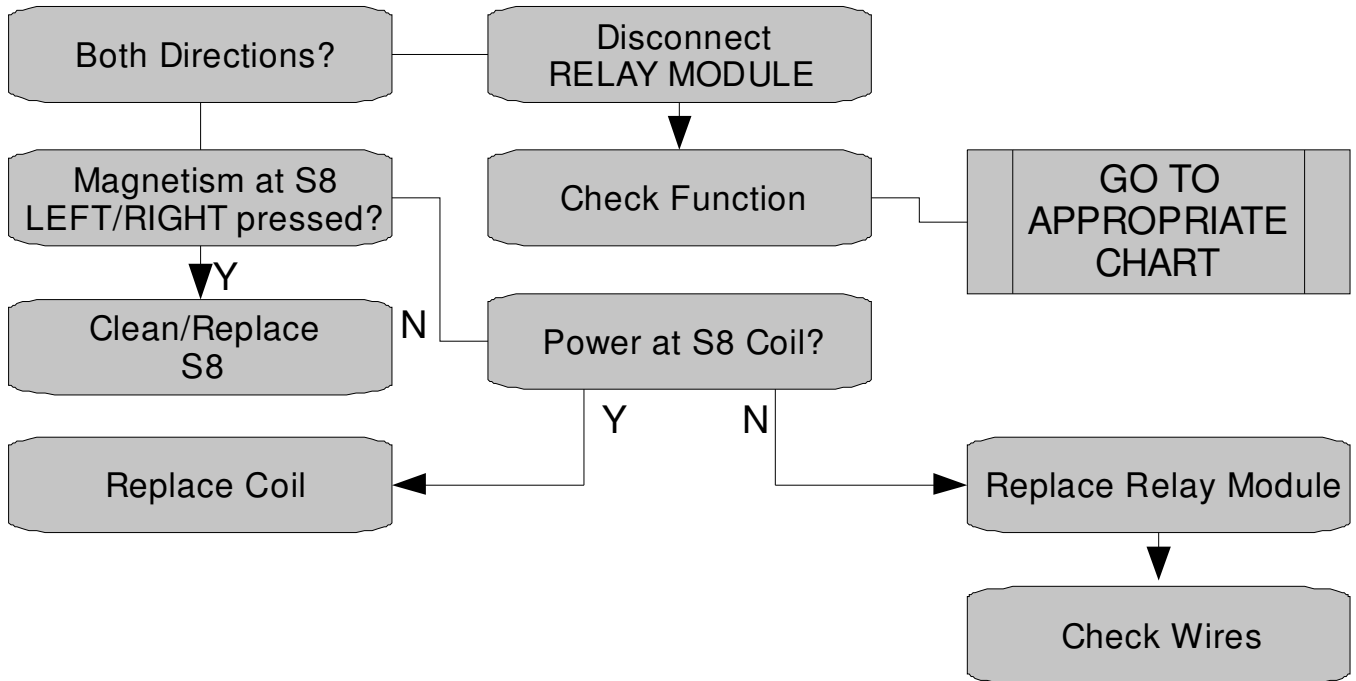
### WINGS WON'T RETRACT



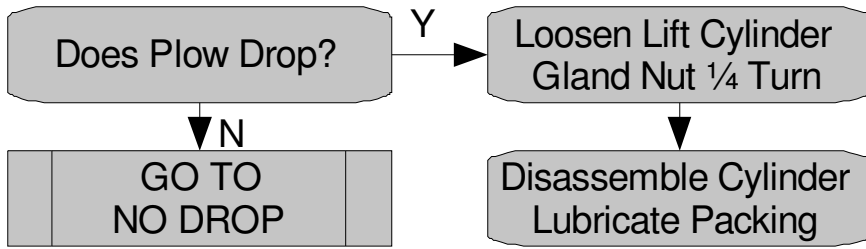
### WINGS WON'T EXTEND



### STRAIGHT BLADE MODE DOESN'T WORK



### NO FLOAT



### CONTROLLER FLASHING

The controller flashes to indicate the channel # that a problem has been detected on. If the plow is functioning normally but the controller is flashing – check all connections for damaged pins, corrosion, or water.

With the VX hydraulics, for the controller diagnostics to function, the RELAY MODULE needs to be disconnected. If the plow is malfunctioning, disconnect the RELAY MODULE to check for electrical faults.

1 Flash	MOTOR SOLENOID	(red wire from controller)
2 Flashes	LIFT	S1A Blue Wire
3 Flashes	RIGHT EXT	S2A/S2B Green Wire
4 Flashes	LEFT EXT	S3A/S3B Orange Wire
5 Flashes	EXTEND	S4/S5 Blue/White Wire
6 Flashes	LEFT RET	S6 Orange/White Wire
7 Flashes	RIGHT RET	S7 Green/White Wire
8 Flashes	DROP	S1B Purple Wire

**NOTES**

