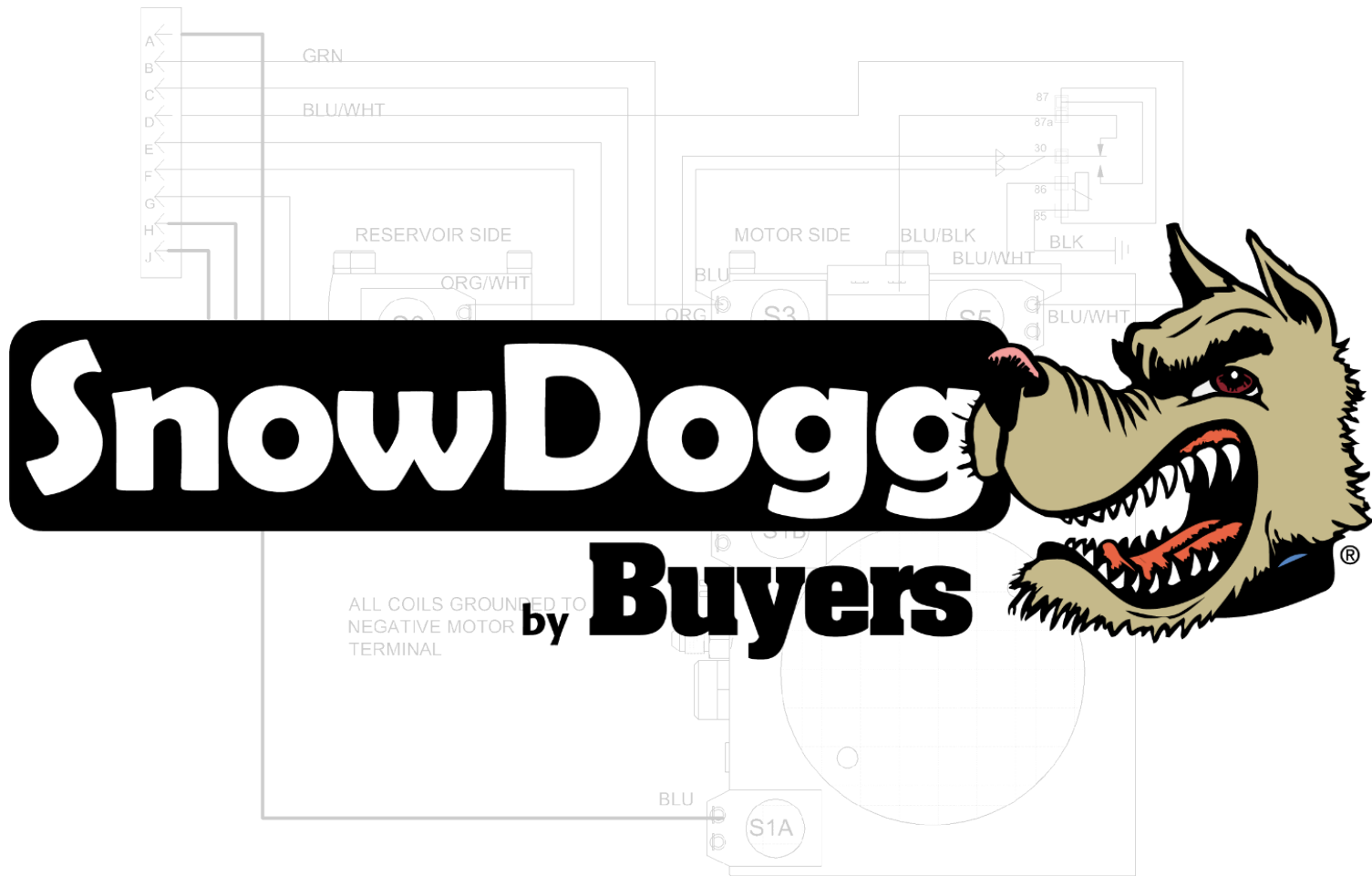

SNOWDOGG® 16152000B HYDRAULIC REFERENCE
VMD/VXF/VXX/VUT PLOW



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VMD/VXF/VXX/VUT PLOW

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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

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

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

What is different between G1 and G2?

G2 plows use the same hydraulic power units as G1, but have a new controller (16161601B) that works with the Rapidlink mount system. This controller can be used with all SnowDogg vee plows. G1 plows (prior to 2017) will require a 16160370 adapter to connect to the G1 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 controlling “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.

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 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 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

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 16150010/16150020)

TROUBLESHOOTING

| Symptom/Diagnostic | | Result | Fix |
|--|--|---|--|
| Disconnect the RELAY MODULE CONNECTOR for the following steps. The controller will not detect most electrical faults with the relay module connected. | | | |
| Pump motor not running when UP, LEFT or RIGHT pressed | | | |
| | Status light blinks 1 or 3 times | Continuity Problem | Check RED WIRE/MOTOR RELAY |
| | Check voltage at MOTOR terminals with UP, LEFT, or RIGHT buttons pressed | If voltage present - MOTOR is bad | Replace MOTOR |
| | Check cable continuity between MOTOR RELAY and MOTOR | If no continuity, check cable, connections, and replace if necessary | Replace/repair cable or connections |
| | Check control signal to MOTOR RELAY (small wires to motor relay) with UP, LEFT, or RIGHT buttons pressed | If voltage present and no click is heard when buttons are pressed, MOTOR RELAY is bad | Replace MOTOR RELAY |
| | Check ground continuity between control ground at MOTOR RELAY and battery ground | If no continuity, check cable, connections, and replace if necessary | Replace/repair cable or connections |
| Plow won't move at all, moves "jerkily", very slowly, or chatters | | | |
| | 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. |
| Oil is leaking from cylinders | | | |
| | | Packing is loose | Tighten gland until leak stops |
| | | Rods are pitted | Polish rods with fine steel wool |
| | | | Replace cylinder |

TROUBLESHOOTING

| Symptom/Diagnostic | | Result | Fix |
|---|---|--|---|
| Oil sprays out of vent port in power unit | | | |
| | 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. |
| Plow won't drop | | | |
| | Status light blinks 3 or 8 times | Continuity Problem | Check PURPLE WIRE/S1B COIL |
| | Check voltage at S1B VALVE coil | If no voltage present, check cable and connections | Replace/repair cable or connections |
| | Check DROP SPEED control valve | DROP SPEED valve should be several turns from fully closed | Open DROP SPEED valve |
| | Check S1B VALVE for contamination | Poppet must move freely, and seat area must be clear of any debris | Remove S1B VALVE and check free movement of poppet, clean any chips/debris from poppet seat Replace S1B VALVE |
| | Check LIFT LOCK valve for contamination | Poppet must move freely, and seat area must be clear of any debris | Remove LIFT LOCK valve and check free movement of poppet, clean any chips/debris from poppet seat |
| | | | Replace LIFT LOCK valve |
| Plow won't lift | | | |
| | Status light blinks 3 or 2 times | Continuity Problem | Check BLUE WIRE/S1A COIL |
| | Check voltage at S1A VALVE coil | If no voltage present, check cable and connections | Replace/repair cable or connections |
| | Check S1A VALVE for contamination | Poppet must move freely, and seat area must be clear of any debris | Remove S1A VALVE and check free movement of poppet, clean any chips/debris from valve Replace S1A VALVE |

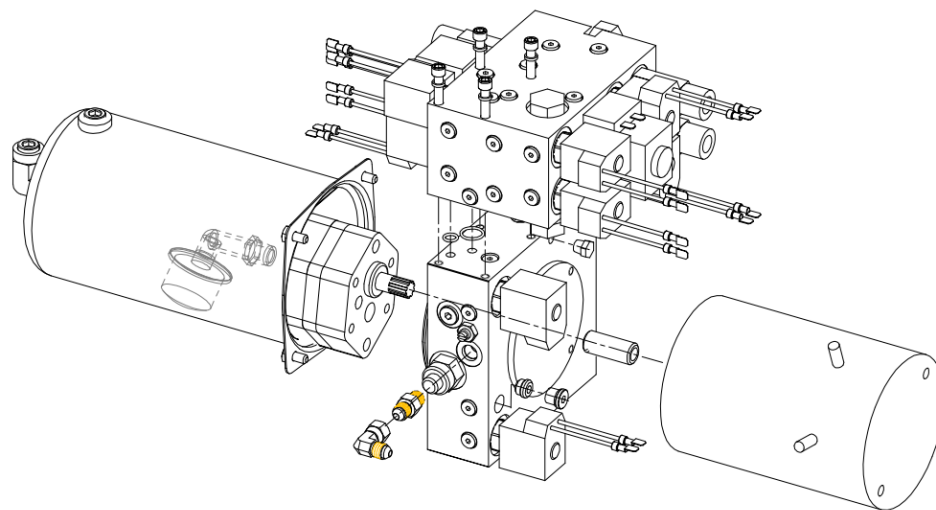
TROUBLESHOOTING

| Symptom/Diagnostic | | Result | Fix |
|---|---|--|---|
| Left or Right Wing won't extend | | | |
| | Status light blinks 3 or 5 times | Continuity Problem | Check BLUE/WHT WIRE/S4 and S5 COILS |
| | Check voltage at S4 (LEFT) or S5 (RIGHT) VALVE coil | If no voltage present, check cable and connections | Replace/repair cable or connections Confirm BLU/WHT wire at S4/S5 VALVES |
| | Check S4/S5 VALVE for contamination | Poppet must move freely, and seat area must be clear of any debris | Remove S4/S5 VALVE and check free movement of spool, clean any chips/debris from valve Replace S4/S5 VALVE |
| Left or Right Wing won't retract | | | |
| | Status light blinks 3 or 6 times | Continuity Problem | Check GRN/WHT WIRE/S7 VALVE |
| | Status light blinks 3 or 7 times | Continuity Problem | Check ORG/WHT WIRE/S6 VALVE |
| | Check voltage at S6 (LEFT) or S7 (RIGHT) VALVE coil | If no voltage present, check cable and connections | Replace/repair cable or connections Confirm ORG/WHT wire at S6 and GRN/WHT wire at S7 |
| | Check S6/S7 VALVE for contamination | Poppet must move freely, and seat area must be clear of any debris | Remove S6/S7 VALVE and check free movement of spool, clean any chips/debris from valve Replace S6/S7 VALVE |
| "Angle Left" and "Angle Right" don't work | | | |
| | | | |
| | Check voltage at S8 VALVE coil | If no voltage present, check cable and connections | Replace/repair cable or connections Confirm BLUE/BLK wire at S8 VALVE Replace RELAY MODULE |
| | Check S8 VALVE for contamination | Poppet must move freely, and seat area must be clear of any debris | Remove S8 VALVE and check free movement of spool, clean any chips/debris from valve Replace S8 VALVE |

TROUBLESHOOTING

| Symptom/Diagnostic | | Result | Fix |
|---------------------------------------|---|---|---|
| Plow drifts while plowing snow | | | |
| | 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 CHECK VALVES for contamination | Poppet must move freely, and seat and piston area must be clear of any debris | Remove CHECK valves and clean Replace CHECK valve |
| | Check RELIEF valves for contamination | Poppet must move freely, and seat must be clear of any debris | Remove RELIEF valves and clean Replace RELIEF valves |
| Wings SCOOP when RIGHT OUT is pressed | | | |
| | Status light blinks 3 times | Continuity Problem | Check GRN WIRE/S2A AND B COIL |
| | Check S2A and S2B VALVES for contamination | | |
| | Problem goes away when relay module is disconnected | Relay module is faulty | Replace RELAY MODULE |
| Wings SCOOP when LEFT OUT is pressed | | | |
| | Status light blinks 3 or 4 times | Continuity Problem | Check ORG WIRE/S3A AND B COIL |
| | Check S3A and S3B VALVES for contamination | | |
| | Problem goes away when relay module is disconnected | Relay module is faulty | Replace RELAY MODULE |

HPU Servicing



Fill Procedure

1. Remove the fill plug from the reservoir.
2. Fill reservoir to fill port

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

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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

TROUBLESHOOTING

- i. Motor is not defective, check wiring
- b. If motor does not run
 - 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

TROUBLESHOOTING

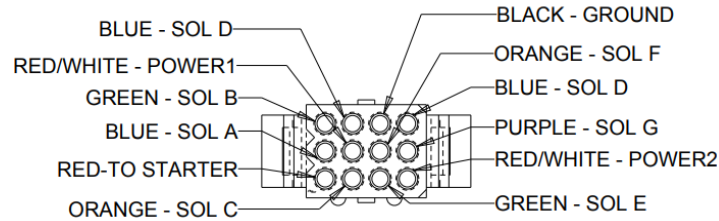
6. Contact SnowDogg Tech Support

TS3 System Pressure Check

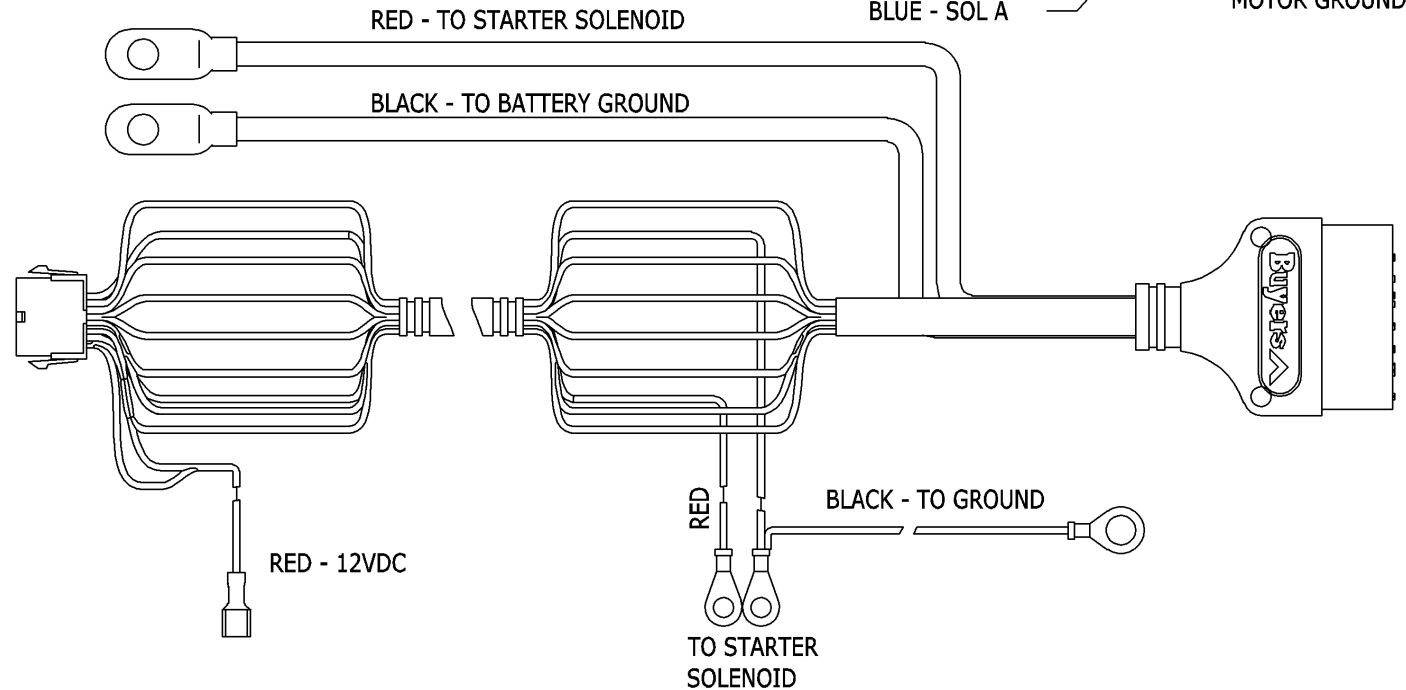
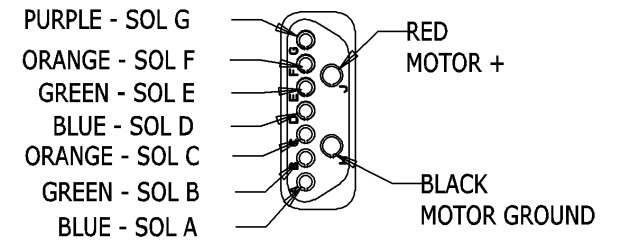
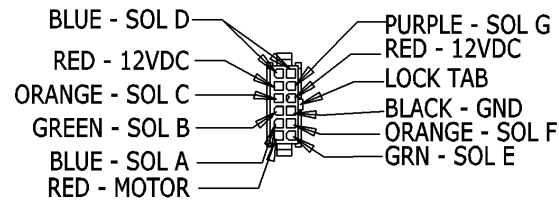
1. Disconnect the lift cylinder hose from the manifold
2. Install a pressure gage on the lift port
3. Energize the LIFT circuit and read the gage pressure
 - a. Pressure is over 1700 PSI
 - i. Pressure is correct
 - b. Pressure is under 1700 PSI
 - i. Replace/clean the Main Relief Valve

TRUCK SIDE HARNESS PINOUT

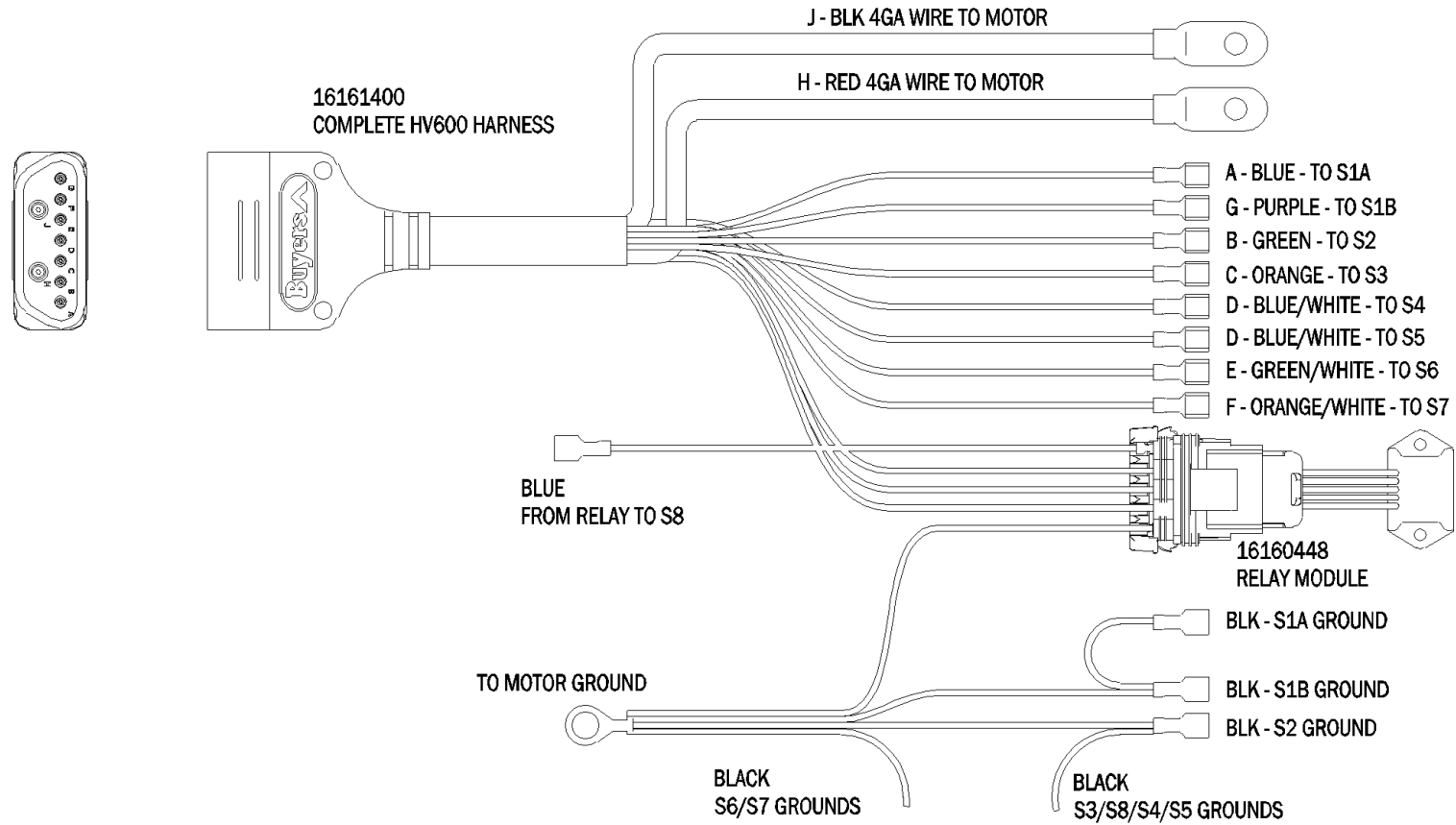
16160302 TRUCK HARNESS TO
16161601B G2 CONTROLLER
(HARNESS SIDE)



16160300 TRUCK HARNESS TO
16161600 G1 CONTROLLER
(HARNESS SIDE)



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.

There are two controllers that have been used with SnowDogg vee plows.

16161600 – G1 V Controller

16161601B – G2 V Controller w/Rapidlink

The 16161601B can be used with any Vee blade SnowDogg. G1 plows will require use of a 16160370 adapter. Both controllers behave similarly with the exception of the integral diagnostics.

VX CONTROLLER OUTPUT TABLE

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

16161600 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.

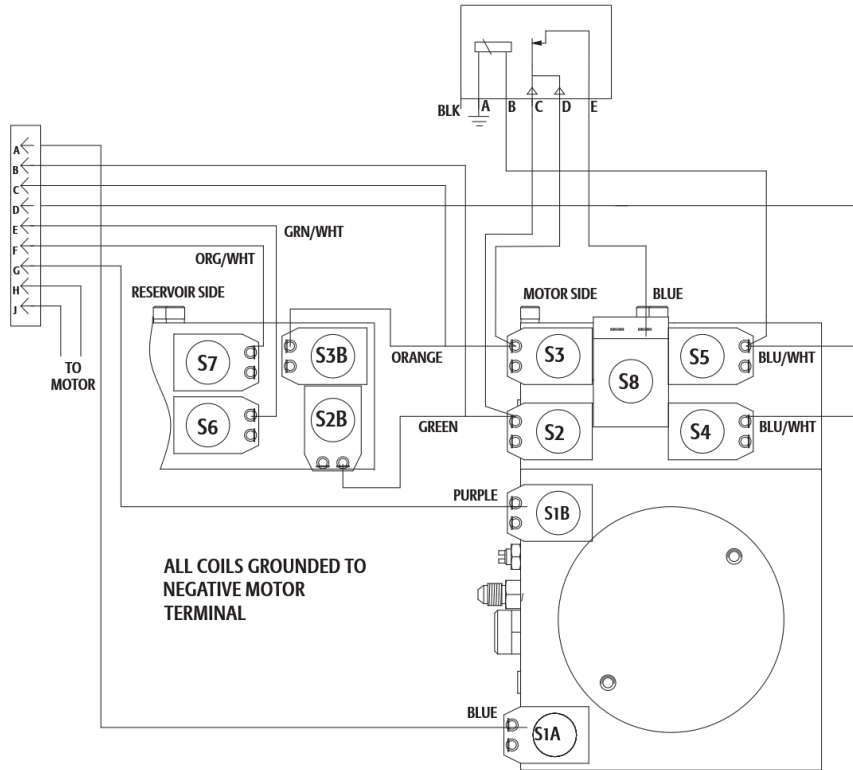
16161601B CONTROLLER DIAGNOSTIC MODE

Enter diagnostic mode with the following sequence.

1. Turn the controller off
 2. Press and hold the UP button while pressing the ON/OFF button.
 3. Release the UP button.
 4. You are now in "Diagnostic" mode. All outputs are off.
 5. Select the channel to test using the LEFT and RIGHT buttons.
 6. Use the buttons/leds as shown to test each channel
- RIGHT/LIGHT
 - Increase the channel number being tested
 - This will turn off ALL channels
 - UP
 - Turns ON selected channel (PLOW MAY MOVE)
 - GREEN STATUS LED
 - Blinks the # of the channel currently selected
 - RED STATUS LED
 - SOLID when activated channel is shorted
 - BLINKS 4 times if activated channel is open (broken)

Exit diagnostic mode by turning the controller off and back

TROUBLESHOOTING



| | 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 | | | | | | | | | | |

