# DFA Handle Troubleshooting Guide

## GROUNDING

All proportional controls must have a good battery ground, and the valve must also be properly grounded in order, for the system to operate properly. If the DFA controller on the harness, the proportional modules in the handle or the PVG valve loses ground, even intermittently, the valve and/or the controller will shut down.

Poor grounding has been responsible for over 90% of all reported proportional control problems solved by our applications engineers, yet in every case, the customer initially reported that they had a good ground. Don't assume. Check, and re-check. Proper grounding is critical for reliable operation!

## VOLTAGE MEASUREMENT PROCEDURE FOR ALL TESTS

Always connect the voltmeter ground directly to the machine's battery (the best way), or to a local grounding stud.
**Never use the handle's harness ground as a reference -- you cannot correctly diagnose ground problems by doing this!**

**CAUTION:**

+ Take care to not cause inadvertent short circuits with voltmeter leads during these tests.
+ A short circuit may cause the DFA controller to enter fault mode and instantly shut down.
+ Electronic modules can be damaged by short circuits.

## TEST 1: Variable Voltage Module Tests

### Handle Test Setup

+ Engine off, electrical power turned on.
+ Handle mounted on joystick, with cases opened. (Open by removing the 3 screws from the left handle case.)
+ *Properly ground the voltmeter* (see above).
+ Harness unplugged from the PVE module (solenoid) on the PVG valve.

### 1. Ground Check

Setup

+ Handle Test Setup, plus:
+ Set the voltmeter to a DC millivolt scale.

Tests

+ Connect the voltmeter lead to terminal with the BLACK/WHITE STRIPE wire.
+ Check that the voltmeter reads 0V. Move the joystick around, wiggle the handle harness, and watch that the voltmeter reads 0V all of the time.
+ Start the machine and confirm that the voltmeter remains at 0V.
+ Stop the machine and confirm that the voltmeter remains at 0V.

Pass

+ The handle ground remains at 0 volts with respect to the battery at all times. Proceed with Step 2.

Fail

+ If the handle ground voltage intermittently or permanently registers above 0V, then the handle is improperly grounded. Do not proceed with further testing until this has been repaired and this test has been passed.

### 2. Power Supply Check

Setup

+ Handle Test Setup, plus:
+ Set the voltmeter to a 0-20V DC scale.

Tests

+ Connect the voltmeter lead to a Variable Voltage module terminal with the PINK wire.
+ Confirm that the voltmeter reads 5.0V (+/- 0.2V).
+ Check for proper power supply levels on all Variable Voltage Modules in the handle by measuring the voltage at all module terminals with PINK wires attached.

Pass

+ All Variable Voltage Modules have a 5.0V (+/- 0.2V) power supply attached. Proceed with Step 3.

Fail

+ If 0V is seen, confirm that the machine power is on by checking for machine voltage on any RED wire in the handle.
+ If a voltage other than 5.0V (+/- 0.2)V is seen, call our Technical Help Line at 800-831-2278.

### 3. Handle Module Signal Check

Setup

+ Handle Test Setup, plus:
+ Set the voltmeter to a 0-10V DC scale.

Tests

+ Connect the voltmeter to the middle terminal of a Variable Voltage Module -- observe above cautions regarding short circuits.
+ With the Variable Voltage Module's actuator not pressed, the starting voltage should be 0.75 (+/-0.25)V.
+ With the module's actuator fully pressed, the ending voltage should be 4.25 (+/-0.25)V.
+ Observe that the Variable Voltage Module's output ranges smoothly between the starting and ending voltages as the Module's actuator is pressed and released. This test needs to be performed very slowly on most voltmeters due to their display update speed.
+ Confirm that all of the Variable Voltage Modules in the handle meet the performance specifications.

Pass

+ All Variable Voltage Modules in the handle meet the output specifications. Proceed with testing the DFA Board.

Fail

+ If an output is out the starting and ending voltage specifications, or if the module's output does not change properly as its actuator is pressed, call our Technical Help Line at 800-831-2278.

## TEST 2: DFA Board Tests

These instructions are for testing the wiring end of the harness supplied by Sure Grip Controls below the in-line DFA Board. These tests should be made where the Sure Grip harness connects to the machine's wiring or terminal strips. Do not perform these tests inside the handle as the wire colours quoted in these tests do not carry the same signals above and below the in-line DFA Board.

### Output Test Setup

+ Engine off, electrical power turned on.
+ Closed handle mounted on joystick.
+ *Properly ground the voltmeter* (see page 1).
+ Harness unplugged from the PVE module (solenoid) on the PVG valve.

## 1. Machine Voltage

It is critical to measure the actual machine voltage to one decimal place and to accurately calculate percentages for these tests. The DFA's proportional output is specified as a ratio of its supply voltage to meet the control requirements of a PVG valve, and the absolute output voltage will change if the supply voltage changes.

Setup
+ Output Test Setup, plus:
+ Set the voltmeter to read up to the machine's battery voltage

Test
+ Measure and record the machine voltage supplied to the DFA board on the PINK wire.

## 2. Enable Signal

The DFA supplies a high-current valve enable signal. The recommended way to install the DFA is to use the enable signal to supply power to the PVG valve. This causes the valve to be fully off whenever there is no input from the control handle, and also allows a safe shut-down of the valve if the DFA's detects a fault.

Setup
+ Output Test Setup, plus:
+ Set the voltmeter to read up to the machine's battery voltage
+ Connect the voltmeter to the TAN wire.

Test
+ With none of the proportional modules in the handle pressed, the enable signal should be 0V.
+ Slightlydepressing either proportional module's actuator should cause the Enable Signal to jump up to within 0.2V of the machine voltage measured in Step 1.
+ The Enable Signal should stay on for the entire stroke of the actuator once it is on.
+ Test both proportional modules for proper Enable Signal performance.
+ Record the Enable Signal's 'on' voltage for use in the next step.

Pass
+ The Enable Signal is off when both actuators are not pressed, and pressing either one causes it to jump to the specified voltage. Proceed with Step 3.

Fail
+ The Enable Signal is stuck on or off, or does not reach the specified voltages. Call our Technical Help Line at 800-831-2278.

## 3. DFA Proportional Signal Check

The PVG valve requires a control signal which is proportional to its supply voltage to run. The valve is in neutral if the control signal is 50% of the valve's supply voltage. The valve will be at full flow in one direction at 25% of the supply voltage, and full flow in the other direction at 75% of the supply voltage. For full details on the control of PVG valves, consult the appropriate manuals from Sauer Danfoss.

Setup
+ Output Test Setup, plus:
+ Set the voltmeter to a 0-20V DC scale.
+ Connect the led from the voltmeter to the PINK wire.

Test

Neutral
+ With neither proportional module pressed, the Proportional Signal voltage should be 50% +/- 2% of the Enable Signal 'on' voltage measured in Step 2.

Proportional Control
+ In turn, fully depress each proportional module's actuator.
+ One module must cause the Proportional Signal to rise above 75% of the Enable Signal 'on' voltage. The change in the DFA board's output between 50% and over 75% should track the amount that the proportional module's actuator is pressed.
+ The other module must cause the Proportional Signal to drop below 25% of the Enable Signal 'on' voltage. The change in the DFA board's output between 50% and under 25% should track the amount that the proportional module's actuator is pressed.

Pass

+ The proportional signal is within the performance specifications. All electrical tests have been passed and the controls are working properly.

Fail

+ The Proportional Signal is out of specification or does not change linearly. Call our Technical Help Line at 800-831-2278.

## All Tests Passed, But You Still Have A Problem?

Before you call our Help Line, gather as much information as possible. This will often help us get your control problems diagnosed and solved faster.

+ Know the circumstances which led to the malfunction, what occurs during a malfunction, and how the control returns to operation.
+ Gather as much information about the control's wiring as possible. A rough sketch of the installation wiring noting the location and description of the ground connections for the valve and the controls faxed to Technical Support, 250-374-1099 may be useful.
+ Know about the machine's electrical history:
  - Has there been a recent dead battery?
  - Are there charging system problems?
  - Are there other electrical system components which are not working properly?
  - Have electrical devices been added or changed recently on the machine?
+ Know what make and model of valve is being controlled.
+ Make sure that the problem is not a hydraulic one.
  - Be certain that the valve being controlled is properly grounded.
  - Test the valve for proper function.
  - Make sure the valve is receiving hydraulic oil.
  - Be certain that the device driven by the proportional valve is functioning, and that it does not require an additional electrical or hydraulic enable.

**Sure Grip Controls Technical Help 800-831-2278**
**8:00 AM to 4:30 PM Pacific Time.**