LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

-LIGO-

CALIFORNIA INSTITUTE OF TECHNOLOGY
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LIGO Seismic Coil Driver Test Procedure		
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Distribution of this draft: NSF reviewers, LIGO scientists
This is an internal working note of the LIGO Laboratory

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Performed by: _____
Date: _____
Chassis Serial Number: _____

1. Overview

The Coarse and fine driver chassis consists of 4 driver modules. Coarse is capable of supplying +/- 3.47 amps DC into 4.3 ohms maximum. Fine is capable of supplying +/- 1.45 amps DC into 9.3 ohms maximum when powered from the maximum allowed power supply of +/- 24VDC. This procedure covers the test of the chassis as a whole and each of the four driver modules contained within the chassis.

2. Test Equipment

Power Supply capable of at least +/- 24V at 10 amps
Dynamic signal analyzer SR785, or equivalent
Multi meter
Oscilloscope
5 ohm 50 watt resistor
10 ohm 20 watt resistor

3. Preliminaries

3.1 Set the power supplies to +/-24V.
3.2 Connect the +24V/-24V to the chassis DC IN connector
3.3 Make sure that all of the power jumpers are in place.
3.4 Connect the 5 ohm loads to coarse 1 out and coarse 2 out, and the 10 ohm loads to fine 1 out and fine 2 out.

4. DC Tests

4.1 Turn on the power supplies and check that the total current is within spec.

Supply	Expected Current	Actual Current
+24 Volts	1.2 Amps +/- 100mA	
-24 Volts	0.8 Amps +/- 100mA	

4.2 With nothing connected to the input, record the offset voltage of each driver module in the chassis at TP7. There should be no more than +/- 10mV.

Module	Fine 1	Coarse 1	Fine 2	Coarse 2
Offset Voltage (0 to +/- 10 mV)				

4.3 Verify airflow direction (front panel inlet, rear panel outlet) for each of the two cooling fans, and that each fan is running at approximately the same speed.

Airflow checked?	

5. Current Limit Tests

The following tests are sequentially performed to each of the 4 individual modules. Each module is fuse protected at 15 amps of output current, but should current limit before that.

- Using a voltage calibrator, apply voltage to test points TP21 (+) and TP14 (-) starting at 0V and increasing by 1 volt until you reach 15 volts.
- While increasing the voltage, use your multi meter to read the voltage across the corresponding load resistor. When the voltage stops going up with the input, record the voltage on your meter. Record the values in the table below.
- Repeat the above measurement with the negative lead on your voltage calibrator hooked to TP21 and the positive lead hooked up to TP14. Record the values in the table below.

Module	Fine 1	Coarse 1	Fine 2	Coarse 2
Positive Limit Voltage (13.6V +/- 100 mV/ R)				
Negative Limit Voltage (-13.6V +/- 100 mV/R)				

6. Frequency Response Tests

- Set the dynamic signal analyzer to run a swept sine measurement from 0.1 Hz to 1 KHz with the source set to 1 Volt p-p.

- There should be a pole at 0.4HZ, a zero at 15.9Hz. Record the magnitude values at the frequencies in the table below.

Input	Output	0.1Hz 0dB (+/-0.5dB)	0.4Hz -3dB (+/-0.5dB)	15.9Hz -29dB (+/-0.5dB)	1KHz -32dB (+/- 0.5dB)
Fine 1 TP21(+) and TP14(-)	Across Fine 1 Resistor				
Coarse 1 TP21(+) and TP14(-)	Across Coarse 1 Resistor				
Fine 2 TP21(+) and TP14(-)	Across Fine 2 Resistor				
Coarse 2 TP21(+) and TP14(-)	Across Coarse 2 Resistor				

7. Current and Voltage Monitor Measurements

Using a voltage calibrator, apply 1 volt to the following inputs and read the voltage at the following outputs of the Driver Power & Interface Board (D1900306). To calculate Imon, read the voltage at the appropriate output and divide it by the actual load resistance. The calculated values are for an ideal 5 or 10 Ohm resistor. Unit passes if measured is within 10% of nominal.

Input	Output Vmon	Output Imon	Calculated	Measured
J3 Pins 1&6	(C1) J1 Pins 1(+) and 14(-)	J1 pins 5(+) and 18(-)	Vmon= -0.7V Imon= 24mA	
J3 Pins 2&7	(F1) J1 pins 2(+) and 15(-)	J1 pins 6(+) and 19(-)	Vmon= -0.7V Imon= 60mA	
J3 Pins 3&8	(F2) J1 pins 3(+) and 16(-)	J1 pins 7(+) and 20(-)	Vmon= -0.7V Imon= 60mA	
J3 Pins 4&9	(C2) J1 pins 4(+) and 17(-)	J1 pins 8(+) and 21(-)	Vmon= -0.7V Imon= 24mA	

After taking the measurements, check with an oscilloscope to make sure that there are no oscillations at the output test point TP7.

Fine 1 Output Oscillating?	
Coarse 1 Output Oscillating?	
Fine 2 Output Oscillating?	
Coarse 2 Output Oscillating?	

8. Output Noise Measurements

The output noise voltage of each coil driver should be measured using the dynamic signal analyzer SR785. Short the following inputs to ground and read the noise across the appropriate resistor.

Input	Output	Expected Noise	Actual Noise
Coarse 1 J3 Pins 1&6	**Coarse 1 Resistor**	@80Hz < 30nV @20Hz < 80nV @5Hz < 450nV @1Hz < (450nV/√Hz)*(1/freq)	
Fine 1 J3 Pins 2&7	**Fine 1 Resistor**	@80Hz < 30nV @20Hz < 80nV @5Hz < 450nV @1Hz < (450nV/√Hz)*(1/freq)	
Fine 2 J3 Pins 3&8	**Fine 2 Resistor**	@80Hz < 30nV @20Hz < 80nV @5Hz < 450nV @1Hz < (450nV/√Hz)*(1/freq)	
Coarse 2 J3 Pins 4&9	**Coarse 2 Resistor**	@80Hz < 30nV @20Hz < 80nV @5Hz < 450nV @1Hz < (450nV/√Hz)*(1/freq)	