LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

-LIGO-

CALIFORNIA INSTITUTE OF TECHNOLOGY

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Test Procedure	**T1400486**-v2	
PCal Optical Follower Servo Chassis Test Procedure		
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Performed by:_____
Date:_____
Board Serial Number: _____

1. **Overview**
   The PCal Optical Follower Servo Chassis (D1300599-v1) houses an Optical Follower Servo Board (D1300514-V4), and an Optical Follower Back Board (D1300561-v2). The function of this chassis is to drive an AOM with a whatever voltage is necessary in order to make the light coming out of the AOM match the sinusoidal shape of the excitation signal.

2. **Test Equipment**

   2.1 Power Supply capable of +/- 18V
   2.2 Digital Multimeter (DMM)
   2.3 Voltage Calibrator, or adjustable power supply
   2.4 SR785 Network Analyzer, or equivalent
   2.5 Sine Wave Generator
   2.6 Oscilloscope
   2.7 Dsub Breakout boards (9-pin, 15-pin)

3. **Preliminaries**

   3.1 Perform visual inspection of the Chassis to make sure nothing looks overtly broken.
   3.2 Before connecting the power to the box, set power supplies to +/- 18 Volts and then turn them off. Connect the power supplies to the chassis under test at the connector labeled “Power In”.
   3.3 Open the chassis lid, and set (or insert) jumpers such that PDA, PDB, OfA1, and OFB1 are all set to the “positive” position.
   3.4 Connect a 15-pin Dsub Breakout board to the “To/From PCal Interface” connector on the back panel.

4. **DC Tests**

   4.1 Turn on the power supplies, and record the current in the table below.

Voltage	**Current**	**Observed Current**	**FP LEDs On, +/-15 and +/- 12?**
+18V	20mA +/- 5mA		
-18V	19mA +/- 5mA		

4.2 Attach a standard 9-pin breakout board to the Dsub labled "From PCal PD" With a DMM, check the voltages on the pins in the table below:

Pins	Voltage Expected	Voltage Observed
J1 Pin2(+) and 7(GND)	+15V +/- 0.5V	
J1 Pin 3(-) and 7(GND)	-15V +/- 0.5V	

4.3 Loop Switch test: Attach a 15-pin Dsub Breakout board to the "To/From PCal Interface" connector, and short together pins 4&12. Read the voltage at pins 5(+) and 12(GND). You should read +12V +/- 0.5V. At the same time, the green front panel LED labled "Loop Closed" should illuminate.

+12V present on pin 5?_____

"Loop Closed" LED lit?_____

5. Functional Tests:

5.1 PD Signal Tests: With the short for the loop switch still in place, it is possible to test the various signal outputs of the servo electronics. Using a voltage calibrator, put a negative (-) 4.8V level on the servo gain channel (From PCal Interface connector, Pin 1(-4.8V) and Pin 9 (GND)). This should give a gain of 1 (0dB) from the variable Gain amplifier. Input a 100mV signal from the network analyzer into the "From PCal PD" connector Pin 1(+) and Pin 6(-), and sweep from 100Hz to 100KHz. Measure the signals, and fill in the table below:

Output	Expected	Observed
"PD Mon" BNC	0dB +/- 0.5dB Flat	
"Err Mon" BNC	0dB +/- 0.5dB Flat	
"To/From PCal Interface" Pins 6(+) and 14(-)	0dB +/- 0.5dB Flat read differentially(A-B)	
"To/From PCal Interface" Pins 7(+) and 15(-)	0dB +/- 0.5dB Flat read differentially (A-B)	
"Out Mon" BNC	-8.2dB at DC with 2 poles @ 3KHz, and 1 zero@30KHz	
"Out Mon" BNC	-90º of phase at 3KHz +/- 2º	
"Out Mon" BNC	Rising to -125.5º of phase at 30KHz +/- 2º	
"To AOM" BNC	-8.2dB at DC with 2 poles @ 3KHz, and 1 zero@30KHz	
"To AOM" BNC	-90º of phase at 3KHz +/- 2º	
"To AOM" BNC	Rising to -125.5º of phase at 30KHz +/- 2º	

5.2 Excitation Signal test: Move the input signal to the appropriate connector below, and read from the "To AOM" BNC. Record the results in the table below:

Input	Output	Expected	Observed
"From DAC" connector Pins 1(+) and 6(GND)	"To AOM" BNC	-8.2dB at DC with 2 poles @ 3KHz, and 1 zero@30KHz	
"CLTF Test In" BNC	"To AOM" BNC	-8.2dB at DC with 2 poles @ 3KHz, and 1 zero@30KHz	

5.3 Gain tests: With the sine wave generator, input an appropriate amplitude 500Hz sine wave into the "From PCal PD" connector, Pins 1(+) and 6(-) Watch the output signal on the "To AOM" BNC connector on an oscilloscope. Vary the gain voltage level from the voltage calibrator from negative (-)9.6V to positive(+)9.6V (From PCal Interface connector, Pin 1(-4.8V) and Pin 9 (GND)). The visible gain should vary from 0.143V/V to 124 V/V (-14dB to 46dB), Record the results in the table below, either by measuring the p-p signal with cursors, or getting the RMS amplitude from the scope's "measure" function:

Input signal level "From PCal PD" 1(+) and 6(-)	Input Gain Level "To/From PCal Interface" Pin1 and Pin 9(GND)	Expected Output	Observed Output
1 Vp-p	-9.6V	143 mVp-p +/- 10mV or 55 mV rms +/- 10mV	
1 Vp-p	0V	4.12 Vp-p +/- 100mV or 1.48V rms +/- 10mV	
0.03 Vp-p	+9.6V	3.72 Vp-p +/- 10mV or 1.43 V rms +/- 10mV	

5.4 Offset Input Test: With the gain level set to negative (-)1V, Input a 0.1Vp-p, 500Hz Sine wave into the "From PCal PD" connector, Pins 1(+) and 6(-). Next, put a voltage level into the Offset channel, "To/From PCal Interface, Pins 2(+) and 10(-). There should be a gain of ~4.4V/V offset on the observed sine wave on the oscilloscope. Verify this in the table below:

Offset Input	**Offset Expected**	**Offset Observed**
0V	0V +/- 0.2V	
1V	1.5V +/- 0.2V	
2V	3V +/- 0.2V	

5.5 Oscillation Monitor tests: Put a negative (-) 4.8V level on the servo gain channel (From PCal Interface connector, Pin 1(-4.8V) and Pin 9 (GND)). Place a 1Vp-p, sine wave into the "From PCal PD" connector, Pins 1(+) and 6(-). Read the voltage at the "To/From PCal Interface" connector, Pins 3(+) and 11(-) with a DMM. Vary the frequency, and record the results in the table below:

Input Frequency	Output Expected	Output Observed
100Hz	0.826V +/- 0.05V	
1KHz	0.826V +/- 0.05V	
100KHz	0.863V +/- 0.05V	