# LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

# -LIGO-

**CALIFORNIA INSTITUTE OF TECHNOLOGY**

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

| Document Type | DCC Number | May 27, 2016 |
|---|---|---|
| T - Technical notes | T1600185-v2 | |

## aLIGO L4C Interface Chassis Test Plan

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Distribution of this draft:
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Chassis S/N: s1600256 Date: 6/2/16

Tech: David McManus

# 1. Introduction

The tests described below are required to verify the correct operation of the aLIGO L4C Interface Chassis electronics. These tests should verify the correct operation of all four boards internal to this chassis. There are three L4C interface boards, and a Back Board in each chassis.

# 2. Test Equipment

Network Analyzer
Oscilloscope
Digital Multimeter (DMM)
Triple Power Supply (+/- 18V, 5V Fixed)
One 25-pin Dsub Breakout
One 9-pin Dsub Breakout

# 3. Serial Numbers

Input the internal board serial numbers below:

| L4C Interface Board (1) | L4C Interface Board (2) | L4C Interface Board (3) | Back Board |
|---|---|---|---|
| | | | |

# 4. Tests

## 4.1. Input Power

Hook up power to the back panel of the chassis with +18V going to pin 1, -18V to pin 3, and GND going to pin 2. Turn on all of the power switches, and record the current being drawn. The nominal current is ~320mA +/- 10mA.

+18V 320 mA -18V 330 mA

At this point, all of the front and back panel power LEDs should be lit.
LEDs Lit? YES

Chassis S/N: s1600256 Date: 6/2/16

Tech: David McManus

## 4.2. Voltage Output

The following tests make sure that the chassis is supplying the correct voltages to the L4Cs. On the appropriate connector, verify that the correct voltages are present in the table below. Use the appropriate switch on the back panel to turn on and off the power to the specific device to verify switch operation. Watch the front panel LEDs to verify the correct switch operation.

| Connector | Pin | Voltage expected | Present and switchable? |
|---|---|---|---|
| L4Cs 1&2 | Pin 3(+) to Pin 16(GND) | +15V | YES |
| L4Cs 1&2 | Pin 4(-) to Pin 17(GND) | -15V | YES |
| L4Cs 1&2 | Pin11(+) to Pin 24(GND) | +15V | YES |
| L4Cs 1&2 | Pin 12(-) to Pin 25(GND) | -15V | YES |
| L4Cs 3&4 | Pin 3(+) to Pin 16(GND) | +15V | YES |
| L4Cs 3&4 | Pin 4(-) to Pin 17(GND) | -15V | YES |
| L4Cs 3&4 | Pin11(+) to Pin 24(GND) | +15V | YES |
| L4Cs 3&4 | Pin 12(-) to Pin 25(GND) | -15V | YES |
| L4Cs 5&6 | Pin 3(+) to Pin 16(GND) | +15V | YES |
| L4Cs 5&6 | Pin 4(-) to Pin 17(GND) | -15V | YES |
| L4Cs 5&6 | Pin11(+) to Pin 24(GND) | +15V | YES |
| L4Cs 5&6 | Pin 12(-) to Pin 25(GND) | -15V | YES |

## 4.3. Channel Tests

### 4.3.1. L4C Channel Tests

To test the gain of the L4C channels, float channel 1 and 2 and input a 50mV p-p signal from 1Hz to 10kHz in the pins specified below, and read the appropriate outputs.

Chassis S/N: s1600256 Date: 6/2/16

Tech: David McManus

### 4.3.2.1 No Binary In pins Grounded

| Input Connector | Signal Out | Expected transfer function | Function correct? |
|---|---|---|---|
| L4Cs 1&2 pins 1(+) and 14(-) | AA Out 1 pins 1(+) and 6(-) | DC Gain of 23.5 dB | YES |
| L4Cs 1&2 pins 9(+) and 22(-) | AA Out 1 pins 2(+) and 7(-) | DC Gain of 23.5 dB | YES |
| L4Cs 3&4 pins 1(+) and 14(-) | AA Out 2 pins 1(+) and 6(-) | DC Gain of 23.5 dB | YES |
| L4Cs 3&4 pins 9(+) and 22(-) | AA Out 2 pins 2(+) and 7(-) | DC Gain of 23.5 dB | YES |
| L4Cs 5&6 pins 1(+) and 14(-) | AA Out 3 pins 1(+) and 6(-) | DC Gain of 23.5 dB | YES |
| L4Cs 5&6 pins 9(+) and 22(-) | AA Out 3 pins 2(+) and 7(-) | DC Gain of 23.5 dB | YES |

### 4.3.2.2 Ground “From Binary Out” connector pins listed in the “Ground” column to “From Binary Out” pin 5.

| Input Connector | Ground | Signal Out | Expected transfer function | Function correct? |
|---|---|---|---|---|
| L4Cs 1&2 pins 1(+) and 14(-) | Pin 1 | AA Out 1 pins 1(+) and 6(-) | DC Gain of 12.5 dB | YES |
| L4Cs 1&2 pins 9(+) and 22(-) | Pin 6 | AA Out 1 pins 2(+) and 7(-) | DC Gain of 12.5 dB | YES |
| L4Cs 3&4 pins 1(+) and 14(-) | Pin 2 | AA Out 2 pins 1(+) and 6(-) | DC Gain of 12.5 dB | YES |
| L4Cs 3&4 pins 9(+) and 22(-) | Pin 7 | AA Out 2 pins 2(+) and 7(-) | DC Gain of 12.5 dB | YES |
| L4Cs 3&4 pins 1(+) and 14(-) | Pin 3 | AA Out 3 pins 1(+) and 6(-) | DC Gain of 12.5 dB | YES |
| L4Cs 3&4 pins 9(+) and 22(-) | Pin 8 | AA Out 3 pins 2(+) and 7(-) | DC Gain of 12.5 dB | YES |

**Unground “From Binary Out” connector pins from pin 5.**

Chassis S/N: s1600256 Date: 6/2/16

Tech: David McManus

### 4.3.2. L4C Channel Noise Tests

To test the noise of the L4C channels, ground the appropriate pins on the input connector, and do a noise measurement from 0.1 Hz to 10KHz on the output connector pins specified below. Read the noise at 1Hz and 10Hz. Ground the appropriate pins on the From Binary Out connector. The observed numbers should be below the specification to pass this test.

| L4C Channel | Ground the follow-ing | Expect-ed Noise @1Hz | Actual Noise @1Hz | Expect-ed Noise @10Hz | Actual Noise @10Hz |
|---|---|---|---|---|---|
| L4C 1<br>GND pins 1 and 14<br>Measure AA Out 1<br>pins 1 and 6 | Nothing | 270nV | 338nV | 157nV | 142nV |
| | Pin 1 (Gain) | 190nV | 185nV | 88nV | 63nV |
| L4C 2<br>GND pins 9 and 22<br>Measure AA Out 1<br>pins 2 and 7 | Nothing | 270nV | 259nV | 157nV | 165nV |
| | Pin 6 (Gain) | 190nV | 201nV | 88nV | 63nV |
| L4C 3<br>GND pins 1 and 14<br>Measure AA Out 2<br>pins 1 and 6 | Nothing | 270nV | 322nV | 157nV | 82nV |
| | Pin 2 (Gain) | 190nV | 150nV | 88nV | 81nV |
| L4C 4<br>GND pins 9 and 22<br>Measure AA Out 2<br>pins 2 and 7 | Nothing | 270nV | 303nV | 157nV | 101nV |
| | Pin 7 (Gain) | 190nV | 200nV | 88nV | 51nV |
| L4C 5<br>GND pins 1 and 14<br>Measure AA Out 3<br>pins 1 and 6 | Nothing | 270nV | 173nV | 157nV | 112nV |
| | Pin 3 (Gain) | 190nV | 149nV | 88nV | 82nV |
| L4C 6<br>GND pins 9 and 22<br>Measure AA Out 3<br>pins 2 and 7 | Nothing | 270nV | 159nV | 157nV | 116nV |
| | Pin 8 (Gain) | 190nV | 207nV | 88nV | 88nV |

Chassis S/N: s1600256 Date: 6/2/16

Tech: David McManus

## Reference L4C Channel Transfer Functions