LIGO Laboratory / LIGO Scientific Collaboration

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Dual PD Amp Circuit Board Test Procedure

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1 Introduction

This document contains information about the Dual PD Amp circuit board proto-type that was put together by Alexa. Ultimately, five of these boards will be made and placed inside the ALS Fiber Distribution box (wiki).

2 Test Equipment

1. Voltmeter
2. ±15V, 5V DC power supply
3. Stanford Research Systems Model SR785
4. LED
5. Si Photodiode (as inside ALS Fiber Distribution chassis)
6. Oz optics fiber-coupled laser (OZ-2000-1064-6/125-S-40-3A-3-1-10)
7. Board Schematics, LIGO D1200543-v1

3 Tests

1) **Check connections:** Using a bench DC supply apply +- 15Volts and + 5Volts to P2 (from right to left: 15V, GND, -15V, 5V). Confirm that R1 reads -10Volts, U3 pin 7 reads -5Volts, and U5 pin 3 reads -3.3Volts. With no input source, J1 and J3 should read -5V while J2, J4 should read 0Volts. J2 and J4 will increase according to gain switch with an input source.

2) **Electric Transfer Function.** Using a bench DC supply apply +- 15Volts and + 5Volts to P2. The same procedure will be done for side A and side B. Connect input and outputs of circuit board to SR785 (3) accordingly to take a transfer function.
    a. Set the group measurement to swept sine curve.
    b. Set the measurement to frequency response.
    c. Set the frequency to range from 10Hz to 102.4kHz.
    d. Set the amplitude at 10mV with a -4900mV offset.
    e. Use a dual screen, with one screen reading the Log Mag in dB and the other reading Phase in degree. Make sure both read freq. response.
    f. Examine different gain settings and ensure it matches with the gain settings inscribed on the board.

3) **Electric Noise signal.** Using a bench DC supply apply +- 15Volts and + 5Volts to P2. The same procedure will be done for side A and side B. Connect input and outputs of circuit board to SR785 (3) accordingly to take a noise reading.
    a. Set the group measurement to FFT
    b. Set the view and x-axis to Log Mag and Log respectively
    c. Set the number of averages to 10-1000 (depending on time)
    d. Set the FFT to 800 lines
    e. Set the display to single screen
    f. Set the units to Vrms/√Hz
    g. Make sure coupling is set to AC
    h. Set the amplitude at 10mV with a -4900mV offset.
    i. Collect data with scan range at 102.4kHz, 12.8kHz, 1.6kHz, 200Hz for different gain settings.

4) **Shot noise.** Using a bench DC supply apply +- 15Volts and + 5Volts to P2. The same procedure will be done for side A and side B. Connect outputs of circuit board to SR785 (3) accordingly to take a noise reading. Connect inputs of circuit board to photodiode (5), which should be set to shine on an LED (4).
    a. Set the group measurement to FFT
    b. Set the view and x-axis to Log Mag and Log respectively
    c. Set the number of averages to 10-1000 (depending on time)
    d. Set the FFT to 800 lines
    e. Set the display to single screen
    f. Set the units to Vrms/√Hz
    g. Make sure coupling is set to AC
    h. Set the amplitude at 10mV with a -4900mV offset.
    i. Collect data with scan range at 102.4kHz, 12.8kHz, 1.6kHz, 200Hz for different gain settings.
    j. Collect data with no light on, and then with the LED light on (ensure that the DC offset remains at 10V for each gain setting).

5) **Optical Transfer Function.** Using a bench DC supply apply +- 15Volts and + 5Volts to P2. The same procedure will be done for side A and side B. Connect outputs of circuit board to SR785 (3) accordingly to take a transfer function. Connect input to fiber-coupled laser (6).
    a. Set the group measurement to swept sine curve.

b. Set the measurement to the frequency response.

c. Set the frequency to range from 100Hz to 100kHz.

d. Set the amplitude at 200mV with a 4000mV offset.

e. Use a dual screen, with one screen reading the Log Mag in dB and the other reading Phase in degree. Make sure both read freq. response.

f. Examine different gain settings and ensure it matches with the gain settings inscribed on the board.