

**LASER INTERFEROMETER GRAVITATIONAL WAVE
OBSERVATORY**

-LIGO-

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Trillium 240 Interface Chassis Test Procedure		
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Performed by: _____
 Date: _____
 Board Serial Number: _____

1. Overview

The Trillium-240 Seismometer Interface Chassis provides power and control channels for a single T-240 seismometer. The chassis receives 3 differential, and 3 single-ended signals from the seismometer that are sent as outputs to the AdL Anti-Alias Chassis for ultimate transmission to the ADCs. A summary of functions for the T-240 Seismometer Interface are:

- 1.1 DC power to the remotely located T-240 seismometer
- 1.2 Receives 3 channels of differential signals (X, Y, and Z), and 3 single-ended signals (Upos, Vpos, and Wpos) from the T-240 seismometer.
- 1.3 Interfaces analog signals to the AdL Anti-Alias Chassis by differential interface
- 1.4 Provides local front panel switches, USB-to-RS-232, and remote PCIX based control of T-240 functions

The function of this procedure is to check each channel from its input to the respective output, test binary controls and to verify proper DC power consumption.

2. Test Equipment

- 2.1 Power Supply capable of +/- 18 volts
- 2.2 Function generator (Stanford Research DS360 or the like)
- 2.3 Oscilloscope

3. Preliminaries

- 3.1 Perform visual inspection on board to check for missing components or solder deficiencies
- 3.2 Before connecting the power to the chassis, set power supplies to +/- 18 Volts, and then turn them off. Connect the power supplies to the chassis under test at the back panel 3-pin power connector.

4. DC Tests

- 4.1 Turn on the power supplies to the system under test and record the total current. The specification assumes all inputs are not driven and the front panel switches are clicked down.

Total Current	Specification	Observation
+18V Supply	Less than or equal to 300mA	
-18V Supply	Less than or equal to 300mA	
Power LEDs	Lit with equal brightness?	

5. Dynamic Tests

5.1 The following tests verify the proper gain for each signal channel. The test consists of applying a 100 Hz signal to test the channel gains.

5.2 Using a function generator and an oscilloscope, enter **0.1V** p-p sine wave on the function generator and apply to the prescribed input and observe the amplitude at the designated output (at the Anti Alias Output signals on J1, or the front panel BNC). For differential outputs, use two scope probes in “differential mode” that is probe 1 minus probe 2. Next repeat the above measurements with the gain channel grounded, either with a clip lead, or a Binary Switch Board D1100955, **S6**. Report these measurements in the second table.

T-240 Response Data, Gain = 1

INPUT (+, -)	OUTPUT POINTS	NOMINAL MAG (100HZ)	MEAS. MAG. (100HZ)
25 pin D-sub “From Trillium Flange” pins 1/14	J1 pins 4&12 & XMon BNC	Pins 4&12: 0.4V p-p +/- 0.05V BNC: 0.2V p-p +/- 0.05V	Pins 4&12: BNC:
25 pin D-sub “From Trillium Flange” pins 2/15	J1 pins 5&13 & YMon BNC	Pins 5&13: 0.4V p-p +/- 0.05V BNC: 0.2V p-p +/- 0.05V	Pins 5&13: BNC:
25 pin D-sub “From Trillium Flange” pins 12/25	J1 pins 6&14 & ZMon BNC	Pins 6&14: 0.4V p-p +/- 0.05V BNC: 0.2V p-p +/- 0.05V	Pins 6&14: BNC:

T-240 Response Data, Gain =110 (GND “From Binary Out” Pin 8, or switch S6 on Binary Switch Board)

INPUT (+, -)	OUTPUT POINTS	NOMINAL MAG (100HZ)	MEAS. MAG. (100HZ)
25 pin D-sub “From Trillium Flange” pins 1/14	J1 pins 4&12 & XMon BNC	Pins 4&12: 22V p-p +/- 0.5V BNC: 11V p-p +/- 0.5V	Pins 4&12: BNC:
25 pin D-sub “From Trillium Flange” pins 2/15	J1 pins 5&13 & YMon BNC	Pins 5&13: 22V p-p +/- 0.5V BNC: 11V p-p +/- 0.5V	Pins 5&13: BNC:
25 pin D-sub “From Trillium Flange” pins 12/25	J1 pins 6&14 & ZMon BNC	Pins 6&14: 22V p-p +/- 0.5V BNC: 11V p-p +/- 0.5V	Pins 6&14: BNC:

5.3 Enter **5V** p-p on the function generator and use only the positive output relative to GND. This requires referencing the common of the function generator to T-240 GND.

INPUT (+, -)	OUTPUT POINTS	NOMINAL MAG (100HZ)	MEAS. MAG. (100HZ)
25 pin D-sub pin 3/GND	MASSPOS-U J1 pins 1&9	Pins 1&9: 40v p-p +/- 1.5v	Pins 1&9:
25 pin D-sub pin 11/GND	MASSPOS-V J1 pins 2&10	Pins 2&10: 40v p-p +/- 1.5V	Pins 2&10:
25 pin D-sub pin 24/GND	MASSPOS-W J1 pins 3&11	Pins 3&11 40v p-p +/- 1.5V	Pins 3&11:

5.4 With a voltage calibrator, or equivalent voltage source, put 7 volts into the “pressure in” pins (Pin 4 (+) and pin 16 (gnd)) of the flange connector, J5. The output should be read on the back panel. To make sure both legs of the differential drive are working, take the measurements from each output to ground (AA Chassis Output J1 pins 7(+) and 15(-). If the box is closed, GND can be found on pin 5 of the “To Binary In Chassis” connector, J2.

INPUT	OUTPUT	Expected Voltage	Actual Voltage
J5, pin 4(+7V) / pin16 (gnd)	J1, Pin 7	+14 V +/- 200mV	
J5, pin 4(+7V) / pin 16 (gnd)	J1, Pin 15	-14V +/- 200mV	

5.5 Using a clip lead, or Binary Switch Board (D1100955) to short the indicated pins together, or by actuating the front panel switches, verify the operation of the following binary functions (**FP** indicates Front Panel, **RP** indicates Rear Panel, and the switch number on the Binary Switch Board is called out as “**or S1, or S2,** etc.). **For the rear panel (Binary I/O) functions to operate normally, it is necessary to have all the front panel toggle switches toggled down:**

INPUT	OUTPUT	EXPECTED RESPONSE	ACTUAL RESPONSE
Push AZ button FP	AZ LED, J5	LED is lit, J5 pin 18 = 15V, “To Binary In”, Pin 6 = 15V	
VCAL switch ON FP	VCAL LED, J5	LED is lit, J5 pin 8 = 15V, “To Binary In”, Pin 7 = 15V	
WCAL switch ON FP	WCAL LED, J5	LED is lit, J5 pin 22 = 15V, To Binary In, Pin 3 = 15V	
UCAL switch ON FP	UCAL LED, J5	LED is lit, J5 pin 21 = 15V, “To Binary In”, Pin 2 = 15V	
SigSel Switch to UVW	UVW LED, J5	UVW LED on, J5 pin 5 = 15V, To Binary In, Pin 1 = 15V	
“From Binary Out” pin 6 to 5 RP or S2	AZ LED, J5	LED is lit, J5 pin 18 = 15V, “To Binary In”, Pin 6 = 15V	
“From Binary Out” pin 7 to 5 RP or S4	VCAL LED, J5	LED is lit, J5 pin 8 = 15V, “To Binary In”, Pin 7 = 15V	
“From Binary Out” pin 3 to 5 RP or S5	WCAL LED, J5	LED is lit, J5 pin 22 = 15V, “To Binary In”, Pin 3 = 15V	
“From Binary Out” pin 2 to 5 RP or S3	UCAL LED, J5	LED is lit, J5 pin 21 = 15V, “To Binary In”, Pin 2 = 15V	
“From Binary Out” pin 1 to 5 RP or S1	UVW LED, J5	UVW LED on, J5 pin 5 = 15V, “To Binary In”, Pin 1 = 15V	

6. USB to RS232 tests

- 6.1** Download the FTDI chip Installation Guide here:
http://www.ftdichip.com/Support/Documents/AppNotes/AN_119_FTDI_Drivers_Installation_Guide_for_Windows7.pdf and follow the instructions on installing the drivers and programming the chip.
- 6.2** Download and install the Programming guide here:
http://www.ftdichip.com/Support/Documents/AppNotes/AN_124_User_Guide_F_or_FT_PROG.pdf
- 6.3** Using the above reference, change the
- 6.4** Have Daniel Clark at Stanford email you the Multi-Threaded TTY program, and launch it. The settings at the top of the GUI should be set to the following:

Port	COM1
BAUD	9600
PARITY	NONE
Data Bits	8
Stop Bits	1

The following check boxes should all be checked:

- √ Local Echo
- √ Display Errors
- √ CR=> CR/LF
- √ Autowrap

- 6.5** The XYZ/UVW switch on the STS2-toT240 Interface Chassis (D0901489) should be set to XYZ. If it is set to UVW, it sets the RS232 TX line high, and you cannot communicate.

- 6.6** Click in the command line space, and write the following (<cr> means carriage return (Enter)):
tx <cr>

it should respond: Serial Transmit enabled.

help <cr>

it should print a list of useful commands like this:

```

Nanonetrics Trillium User Menu (Version 3.33) Program A
*****
Help - Repeat this menu (also turns on Serial TX)
Tx - Enable the Serial Transmit Signal
TxOff - Disable the Serial Transmit Signal
Upload - Upload software to the alternate program
Switch - Switch to the alternate program
Default - Set the current program as default
Reboot - Reboot the instrument
GetInfo - Get factory configuration information
ReadFC - Read factory calibration parameters
WriteUC - Write user calibration parameters
ReadUC - Read the user calibration parameters
Soh - Report state-of-health
ShortPer - Set sensor to short period mode
LongPer - Set sensor to long period mode
SetXYZ - Set sensor to XYZ mode
SetUVW - Set sensor to UVW mode
Center - Center all masses or (u/v/w)
Checksum - Print checksum value for both program A and B
*****
Please type a command and hit return:
setuvw
setxyz
txoff
Serial Transmit disabled.
█

```

txoff
it should respond: Serial Transmit disabled

always disable the serial transmit after communicating if the instrument is being used as a sensor, as we don't know if the transmitter would inject noise if it was left on.

7. Noise Measurements

Ground the following inputs and verify that the noise is below nominal at the outputs specified. Write the noise at 20Hz in the actual box.

Input	Output	Nominal	Actual
J5 Pins 1&14	J1 Pins 4&12	75nV	
J5 Pins 2&15	J1 Pins 5&13	75nV	
J5 Pins 12&25	J1 Pins 6&14	75nV	

7.1 Repeat the measurements above with pin 5 grounded to pin 8 on J3.

Input	Output	Nominal	Actual
J5 Pins 1&14	J1 Pins 4&12	650nV	
J5 Pins 2&15	J1 Pins 5&13	650nV	
J5 Pins 12&25	J1 Pins 6&14	650nV	