

**LASER INTERFEROMETER GRAVITATIONAL WAVE  
OBSERVATORY**

**-LIGO-**

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<b>LASTI Timing Slave Test Procedure</b>		
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## 1 Overview

The following procedure refers to D050442-A, the LASTI Timing Slave.

### 1.1 Test Equipment

The following test equipment is necessary:

Triple Output DC power supply (capable of +5VDC, +12VDC, and -12VDC)  
Oscilloscope  
Universal Timer Counter  
Functioning Master Timing Synchronizer with multimode outputs or MTS and  
STG Fanout to provide input timing signals

### 1.2 Test Setup

Connect the triple output DC power supply that has been previously adjusted to the board. +5 to TP26, +12VDC to TP23, -12VDC to TP24 and GND to TP25.

### 1.3 Test Overview

The test procedure is divided into the following sections:

- DC power current draw checks
- DC power voltage regulator checks
- Transceiver Output
- PLL Verification
- 1PPS Synchronization
- 1PPS Output Verification
- Frequency Output Verification
- Channel Output Verification

## 2 DC Power Supply Checks

### 2.1 DC Power Current Draw

Turn on the power supply and record the following data in the table below. For this test, only power should be connected to the board.

Supply	Nominal Current	Actual Current	Check if OK
+5VDC	550 mA ( $\pm 50$ mA)		
+12VDC	80 mA ( $\pm 10$ mA)		
-12VDC	20 mA ( $\pm 10$ mA)		

### 2.2 DC Power Voltage Regulator Outputs

Measure the output of the voltage regulators U26, U27, and U28. Record the values in the table below.

Test Point	Nominal Output	Actual Output	Check if OK
TP15	$3.3 \pm 0.16$ VDC		
TP12	$+5 \pm 0.2$ VDC		
TP14	$-5 \pm 0.2$ VDC		

## 3 PLL and 1PPS Verification

### 3.1 Transceiver Output

Loop the output of the transceiver back to the input using a single multi-mode fiber and verify the following. Disconnect the fiber when this test is completed.

Monitor Point	J1 Looped?	Nominal Value	Actual Value	Check if OK
SD LED, DS2	No	Off		
1PPS LED, DS1	No	Off		
SD LED, DS2	Yes	On		
1PPS LED, DS1	Yes	Flashing at 1PPS		

### 3.2 PLL Verification

Connect the control monitor point, J6, to an oscilloscope with the incoming fiber from the MTS/STGFO disconnected from J1. Record the values in the table below. Connect the fiber to J1 and record the new values. Leave the fiber connected for the remainder of the tests.

Monitor Point	J1 Connected?	Nominal Value	Actual Value	Check if OK
J6	No	> +4 or < -4		
SD LED, DS2	No	Off		
1PPS LED, DS1	No	Off		
J6	Yes	< +4 or > -4		
SD LED, DS2	Yes	On		
1PPS LED, DS1	Yes	Flashing at 1PPS		

### 3.3 1PPS Synchronization Verification

Install a jumper on JP10, position 47-48, JP1, position 1-2, and JP6 position 1-2, and connect output J7 to an oscilloscope. Also connect the 1PPS Monitor of the MTS to the oscilloscope. Measure the difference in time between the rising edge of the two pulses.

Monitor Point	Nominal Difference	Actual Difference	Check if OK
J7 and MTS 1PPS Mon	< 1 us		

## 4 Output Verification

### 4.1 1PPS Output Verification

Install a jumper on JP10, position 47-48, JP1, position 2-3, and JP6 position 1-2, and connect output J7 to an oscilloscope. Measure the width of the output pulse and record it below.

Monitor Point	Nominal Width	Actual Width	Check if OK
J7	1 ms $\pm$ 0.1 ms		

## 4.2 Frequency Output Verification

Move the jumper on JP10 to position 45-46 and use an oscilloscope or preferably a timer/counter to measure the output frequency and record it in the table below. Move the jumper on JP10 successively down the row, measuring each frequency and recording it below.

Jumper Position	Nominal Frequency	Actual Frequency	Check if OK
45-46	1 Hz $\pm$ 0.01 Hz		
43-44	2 Hz $\pm$ 0.01 Hz		
41-42	4 Hz $\pm$ 0.01 Hz		
39-40	8 Hz $\pm$ 0.01 Hz		
37-38	16 Hz $\pm$ 0.01 Hz		
35-36	32 Hz $\pm$ 0.01 Hz		
33-34	64 Hz $\pm$ 0.01 Hz		
31-32	128 Hz $\pm$ 0.01 Hz		
29-30	256 Hz $\pm$ 0.01 Hz		
27-28	512 Hz $\pm$ 0.01 Hz		
25-26	1024 Hz $\pm$ 0.01 Hz		
23-24	2048 Hz $\pm$ 0.01 Hz		
21-22	4096 Hz $\pm$ 0.01 Hz		
19-20	8192 Hz $\pm$ 0.01 Hz		
17-18	16384 Hz $\pm$ 0.01 Hz		
15-16	32768 Hz $\pm$ 0.1 Hz		
13-14	65536 Hz $\pm$ 0.1 Hz		
11-12	131072 Hz $\pm$ 0.1 Hz		
9-10	262144 Hz $\pm$ 0.1 Hz		
7-8	524288 Hz $\pm$ 1.0 Hz		
5-6	1048576 Hz $\pm$ 1.0 Hz		
3-4	2097152 Hz $\pm$ 1.0Hz		
1-2	4194304 Hz $\pm$ 2.0Hz		

### 4.3 Channel Output Verification

Install jumpers on position 23-24 on JP2\_x, JP3\_x, JP4\_x, JP5\_x, JP10, JP11, JP12, and JP13. Using the frequency counter measure the frequency of each output and record the values in the table below.

Output Connector	Nominal Frequency	Actual Frequency	Check if OK
J2_3	2048 Hz $\pm$ 0.01 Hz		
J3_3	2048 Hz $\pm$ 0.01 Hz		
J4_3	2048 Hz $\pm$ 0.01 Hz		
J5_3	2048 Hz $\pm$ 0.01 Hz		
J2_4	2048 Hz $\pm$ 0.01 Hz		
J3_4	2048 Hz $\pm$ 0.01 Hz		
J4_4	2048 Hz $\pm$ 0.01 Hz		
J5_4	2048 Hz $\pm$ 0.01 Hz		
J2_5	2048 Hz $\pm$ 0.01 Hz		
J3_5	2048 Hz $\pm$ 0.01 Hz		
J4_5	2048 Hz $\pm$ 0.01 Hz		
J5_5	2048 Hz $\pm$ 0.01 Hz		
J2_6	2048 Hz $\pm$ 0.01 Hz		
J3_6	2048 Hz $\pm$ 0.01 Hz		
J4_6	2048 Hz $\pm$ 0.01 Hz		
J5_6	2048 Hz $\pm$ 0.01 Hz		
J7	2048 Hz $\pm$ 0.01 Hz		
J8	2048 Hz $\pm$ 0.01 Hz		
J9	2048 Hz $\pm$ 0.01 Hz		
J10	2048 Hz $\pm$ 0.01 Hz		