

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY  
-LIGO-  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Technical Note	LIGO-E0900019	07/29/2008
<b>Test procedure for the Clock, Gate, and DuoTone Signal Interface Advanced LIGO</b>		
Imre Bartos, Rolf Bork, Maxim Factourovich, Jay Heefner, Szabolcs Márka, Zoltán Raics, Paul Schwinberg and Daniel Sigg		

This is an internal working note  
of the LIGO Project.

**California Institute of Technology**  
**LIGO Project – MS 51-33**  
**Pasadena CA 91125**  
Phone (626) 395-2129  
Fax (626) 304-9834  
E-mail: [info@ligo.caltech.edu](mailto:info@ligo.caltech.edu)

**Massachusetts Institute of Technology**  
**LIGO Project, MIT NW22-295,**  
**185 Albany St., Cambridge, MA 02139 USA**  
Phone (617) 253 4824  
Fax (617) 253 7014  
E-mail: [info@ligo.mit.edu](mailto:info@ligo.mit.edu)

**Columbia University**  
**Columbia Astrophysics Laboratory**  
**Pupin Hall - MS 5247**  
**New York NY 10027**  
Phone (212) 854-8209  
Fax (212) 854-8121  
E-mail: [geco.cu@gmail.com](mailto:geco.cu@gmail.com)

WWW: <http://www.ligo.caltech.edu>



Board document LIGO DCC #                   **070071**

Board Revision                                   **B**

Board Serial #                                   \_\_\_\_\_

Board Type                                       **Slave**

Test Engineer                                   \_\_\_\_\_

Test Date:                                       \_\_\_\_\_

Overall MFO board testing:                   **PASSED**                   **FAILED**

Signature:                                       \_\_\_\_\_

*The following Test Procedure is to test the functioning of the DuoTone board. Take a working Master-Fanout-Slave board system. Place a DuoTone board on the Slave board. Load the FPGADuoTone\_TEST program onto the Slave board. Make sure the boards work correctly and have a synchronized 1PPS signal. In this Test Procedure, ground will be denoted with GND.*

**1) Verify that the power supply rails are at the correct voltage.** Measure the voltage at the following test points compared to GND (TP1). If any of the indicators of proper operation are not present the problem must be fixed before proceeding with the Test. A sign of proper operation is the three LEDs DS1, DS2 and DS3. They should be on all the time if the power supply rails operate properly.

TP2,	+12V	+/- 5%	Measured_____	V	Pass	Fail
TP3,	+5V	+/- 5%	Measured_____	V	Pass	Fail
TP4,	-5V	+/- 5%	Measured_____	V	Pass	Fail
TP5,	+3.3V	+/- 10%	Measured_____	V	Pass	Fail



DS1, DS2 and DS3 work properly. Yes No

*The following tests will include the measurement of different inputs and outputs.*

**2) Verify that P3 (RS 485) works properly.** Measure the outputs of ports 3, 4, 5, 6, 9 and 10 on P3 with a Voltmeter. Ports 3, 4, 9 and 10 should be toggling between HI and LOW every second with ports 4 and 10 being in anti-phase, while ports 5 and 6 should be GND. Now take wires and connect port 1 with port 3, port 2 with port 4, port 7 with port 9 and port 8 with port 10. Turn on the digital I/O unit U\_Test in Altium Designer. The digital inputs RX0 and RX1 should be toggling between HI and LOW every second.

RS485 (P3) works properly. Yes No

**3) Verify that P4 (DO) works properly.** Measure each output ports with a Voltmeter. Ports 2, 4, 5, 6, 8 and 10 should be GND, while ports 1, 3, 7 and 9 should be toggling between HI and LOW every second.

DO (P4) works properly. Yes No

**4) Verify the proper operation of the header P6 (LCD).** Measure the outputs of ports 1, 3, 4 and 5 with a Voltmeter. Port 1 should be +5V, port 3 should be toggling between HI and LOW every second, while ports 4 and 5 should be GND. Now take a wire and connect ports 2 and 3. Turn on the digital I/O unit U\_TEST\_DuoTone in Altium Designer. The digital input LCD should be toggling between ON and OFF every second.

LCD (P6) works properly. Yes No

**5) Verify the proper operation of the header P5.** Measure the outputs of ports 2, 4, 6, 8, 9, 10, 12 and 14 with a Voltmeter. All should be GND. Now take a wire and connect ports 1, 3, 5, 7, 11 and 13 with port 3 of P6 (LCD) (one can connect them one after another and measure then separately). Turn on the digital I/O unit U\_TEST\_Duotone in Altium Designer. The digital inputs DI0, DI1, DI2, DI3, DI4 and DI5 should be toggling between ON and OFF every second.

P5 works properly. Yes No

**6) Verify the proper operation of the header P7 (Header 10X2).** Connect the outputs to an oscilloscope and terminate the lines with 50 Ohm (one can connect them one after another and measure then separately). Measure the output of each port. Ports 1, 3, 5, 7, 9, 11, 13 and 15 should be toggling with 65,536 Hz, ports 3, 7, 11 and 15 being in anti-phase. All other ports should be GND.

P7 works properly. Yes No

**7) Verify the proper operation of the header P8.** Take an oscilloscope and measure the output of each port referenced to GND. Port 1 should be constant +3.3V, port 3 and 5 should be toggling with 16384 Hz. Ports 9 and 11 should be DuoTone signals (with 960 and 961 Hz components). Ports 2, 4, 6, 7, 8, 10, 12, 13 and 14 should be GND.



