



LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Test Procedure for Slow Controls Concentrator Demodulator

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1 Overview

Multiple demodulators can be connected to the concentrator and will be connected to the EtherCAT system with a single cable. There are variants for ASC and LSC. Both have a DB37 connection to the EtherCAT chassis; in the case of the ASC variant there are 2 identical interfaces mounted inside one enclosure. The connection to the ASC demodulator is made through 4 DB9 connectors for 2 channels each. With 2 identical interfaces this gives a total of 16 channels per enclosure. For the LSC variant each of the 4 DB9 connectors is in parallel to a DB15 connector. The DB15 connectors has additional digital status lines indicating OK and 2 sign bits. The DB9 connectors are used for the 4-channel demodulators, whereas the DB15 connectors are used for the 2-channel demodulators and 2-channel phase-frequency discriminators.

2 Test Equipment

- Oscilloscope
- Function generator
- Tester for demodulator concentrator
- DC power supplies

3 Documentation

- Schematic—[D1100691-v1](#) (LSC) and [D1100696-v1](#) (ASC)
- Tester—D1101141-v1

4 Tests

Power up the measurement equipment and connect the Tester to the DUT. One DB37 cable is permanently attached, whereas the DB9 and DB15 cables are switch from port 1 through 4 on the concentrator. For the ASC variant the procedure is repeated for the second interface.

4.1 Power

Check the VCC voltage on the concentrator port. The voltage should be within 5% of nominal.

TP6 (+ 5V)_____

4.2 Testing

4.2.1 LSC variant

Connect $\pm 18V$ to the LSC demodulator concentrator. Check that the LED on the front panel is lit.

Front panel LED_____

Connect up the first demodulator using the DB9 connector as well as the DB37 for the EtherCAT side. Set the function generator to a 20Vpp sine wave at 1kHz. Connect it to the first BNC of the first demodulator of the tester. Connect the oscilloscope to the first BNC of the EtherCAT side of the tester. Make sure that all the other BNCs on the EtherCAT side are terminated by 50Ω. Check that the sine wave propagates through the box unaltered. Repeat this test for the remaining 3 BNCs of the first demodulator by moving to the next EtherCAT BNC. Now disconnect the DB9 and connect the DB15 to the first demodulator. Repeat the previous step by going through the 4 BNCs again. Now, exercise the OK switch on the first demodulator of the tester and watch the corresponding LED on the EtherCAT side. Make sure only one LED is changing. Note the status. Repeat this for the 2 sign switches.

Now move to the second demodulator and repeat the above measurements. For the second demodulator only the OK switch will work. When done move to the third and fourth demodulator repeating the above measurements. Neither the OK or sign switches will be active.

Demodulator	Signal	Pass/Fail
1/DB9	BNC 1 / LO1 (half amplitude)	
1/DB9	BNC 2 / RF1	
1/DB9	BNC 3 / LO2	
1/DB9	BNC 4 / RF2	
1/DB15	BNC 1 / RF1 (full amplitude)	
1/DB15	BNC 2 / LO1	
1/DB15	BNC 3 / RF2	
1/DB15	BNC 4 / LO2	
1/DB15	OK switch / OK12 LED (LED1)	
1/DB15	SGN1 switch / SGN1 switch (LED2)	
1/DB15	SGN2 switch / SGN2 switch (LED3)	
2/DB9	BNC 1 / LO3	
2/DB9	BNC 2 / RF3	
2/DB9	BNC 3 / LO4	
2/DB9	BNC 4 / RF4	
2/DB15	BNC 1 / RF3	
2/DB15	BNC 2 / LO3	
2/DB15	BNC 3 / RF4	
2/DB15	BNC 4 / LO4	

2/DB15	OK switch / OK34 LED (LED4)	
2/DB15	SGN1 switch / —	
2/DB15	SGN2 switch / —	
3/DB9	BNC 1 / LO5	
3/DB9	BNC 2 / RF5	
3/DB9	BNC 3 / LO6	
3/DB9	BNC 4 / RF6	
3/DB15	BNC 1 / RF5	
3/DB15	BNC 2 / LO5	
3/DB15	BNC 3 / RF6	
3/DB15	BNC 4 / LO6	
3/DB15	OK switch / —	
3/DB15	SGN1 switch / —	
3/DB15	SGN2 switch / —	
4/DB9	BNC 1 / LO7	
4/DB9	BNC 2 / RF7	
4/DB9	BNC 3 / LO8	
4/DB9	BNC 4 / RF8	
4/DB15	BNC 1 / RF7	
4/DB15	BNC 2 / LO7	
4/DB15	BNC 3 / RF8	
4/DB15	BNC 4 / LO8	
4/DB15	OK switch / —	
4/DB15	SGN1 switch / —	
4/DB15	SGN2 switch / —	

4.2.2 ASC variant

Start with the lower interface. Connect up the first demodulator using the DB9 connector as well as the DB37 for the EtherCAT side. Set the function generator to a 20Vpp sine wave at 1kHz. Connect it to the first BNC of the first demodulator of the tester. Make sure that all the other BNCs on the EtherCAT side are terminated by 50Ω. Connect the oscilloscope to the first BNC of the EtherCAT side of the tester. Check that the sine wave propagates through the box unaltered. Repeat this test for the remaining 3 BNCs of the first demodulator by moving to the next EtherCAT BNC.

Now move to the second, third and fourth demodulator of the bottom interface and repeat the above measurements. After done, repeat the whole process for the top interface.

Bottom Interface:

Demodulator	Signal	Pass/Fail
1/DB9	BNC 1 / LO1 (half amplitude)	
1/DB9	BNC 2 / RF1	
1/DB9	BNC 3 / LO2	
1/DB9	BNC 4 / RF2	
2/DB9	BNC 1 / LO3	
2/DB9	BNC 2 / RF3	
2/DB9	BNC 3 / LO4	
2/DB9	BNC 4 / RF4	
3/DB9	BNC 1 / LO5	
3/DB9	BNC 2 / RF5	
3/DB9	BNC 3 / LO6	
3/DB9	BNC 4 / RF6	
4/DB9	BNC 1 / LO7	
4/DB9	BNC 2 / RF7	
4/DB9	BNC 3 / LO8	
4/DB9	BNC 4 / RF8	

Top Interface:

Demodulator	Signal	Pass/Fail
1/DB9	BNC 1 / LO1 (half amplitude)	
1/DB9	BNC 2 / RF1	
1/DB9	BNC 3 / LO2	
1/DB9	BNC 4 / RF2	
2/DB9	BNC 1 / LO3	
2/DB9	BNC 2 / RF3	
2/DB9	BNC 3 / LO4	
2/DB9	BNC 4 / RF4	
3/DB9	BNC 1 / LO5	
3/DB9	BNC 2 / RF5	
3/DB9	BNC 3 / LO6	
3/DB9	BNC 4 / RF6	
4/DB9	BNC 1 / LO7	
4/DB9	BNC 2 / RF7	
4/DB9	BNC 3 / LO8	
4/DB9	BNC 4 / RF8	