**LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY**

**-LIGO-**

**CALIFORNIA INSTITUTE OF TECHNOLOGY**

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| **Flipper Mirror and RTD Breakout Box Test Procedure** | | |
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Performed by:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

Board Serial Number:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Overview**

The Thermal Compensation System (TCS) Flipper Mirror and RTD Breakout Box is a hub for signals and power to and from Flipper Mirrors, a FLIR camera, a temperature sensor and an aiming laser. This document will describe how to test each box, to ensure proper functionality.

**2. Test Equipment**

**2.1** Power Supply capable of +/- 24V

**2.2** Power Supply capable of +5V

**2.3** Digital Multimeter (DMM)

**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 supply to +/- 24 Volts, then turn off. Connect the power supply to the chassis under test at the back panel 3-pin power connector labeled “24 Volts In”, paying attention to the value and polarity on the panel.

**4. DC Tests**

**4.1** Turn on the power supplies to the system under test and record the total current.

|  |  |  |
| --- | --- | --- |
| **Measure** | **Voltage Read at Output** | **Current** |
| +24V Supply | To Rotation Controller V  (-24V +/- 0.5) | 230mA +/- 20mA |
| -24V Supply | To Rotation Controller V  (+24V +/- 0.5) | 230mA +/- 20mA |

**4.2** Using a digital multimeter to verify that 12V is outputted to the “CO2 Laser RF Distr.” Output header.

|  |  |  |
| --- | --- | --- |
| **OUTPUT** | **Expect**  **Value** | **Function**  **Correct?** |
| CO2 Laser RF Distr.  (J11-9 / J11-6) | +12V |  |

**5. Dynamic Tests**

**5.1 RTD Continuity Checks :** Use a digital multimeter to verify continuity between each RTD input below and the corresponding output pin on the EtherCAT output. Make sure that the resistance between the pins is < 0.2 Ohm

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RTD** | | **Temp Sensor to EtherCAT** | **Function Correct?** |  | **RTD** | | **Temp Sensor to EtherCAT** | **Function Correct?** |
|  |
| RTD 1 | J8T-1 | J9-21 |  |  | RTD 2 | J8B-1 | J9-23 |  |
| J8T-6 | J9-2 |  |  | J8B-6 | J9-4 |  |
| J8T-2 | J9-20 |  |  | J8B-2 | J9-22 |  |
| J8T-7 | J9-1 |  |  | J8B-7 | J9-3 |  |
|  |  |  |  |  |  |  |  |  |
| **RTD** | | **Temp Sensor to EtherCAT** | **Function Correct?** |  | **RTD** | | **Temp Sensor to EtherCAT** | **Function Correct?** |
|  |
| RTD 3 | J7T-1 | J9-25 |  |  | RTD 4 | J7B-1 | J9-27 |  |
| J7T-6 | J9-6 |  |  | J7B-6 | J9-8 |  |
| J7T-2 | J9-24 |  |  | J7B-2 | J9-26 |  |
| J7T-7 | J9-5 |  |  | J7B-7 | J9-7 |  |
|  |  |  |  |  |  |  |  |  |
| **RTD** | | **Temp Sensor to EtherCAT** | **Function Correct?** |  | **RTD** | | **Temp Sensor to EtherCAT** | **Function Correct?** |
|  |
| RTD 5 | J6T-1 | J9-29 |  |  | RTD 6 | J6B-1 | J9-31 |  |
| J6T-6 | J9-10 |  |  | J6B-6 | J9-12 |  |
| J6T-2 | J9-28 |  |  | J6B-2 | J9-30 |  |
| J6T-7 | J9-9 |  |  | J6B-7 | J9-11 |  |

**5.2 Camera and Link digital power switch test:** Apply 5V at the input pins below. Observe the change of voltage at the output, making sure that the observed value matches the expected value. Also observe whether the corresponding LED turns on.

|  |  |  |  |
| --- | --- | --- | --- |
| **INPUT**  EtherCAT | **OUTPUT**  Laser or FLIR Connections | **Expect**  **Value** | **Function**  **Correct?** |
| Laser-enable  (+)(J9-17 / J9-18)(-) | 5 Volts Out Aiming LASER  (J6T-4 / GND) | +5V |  |
| FLIR-enable  (+)(J9-35 / J9-18)(-) | 22 Volts Out FLIR  (J6B-6 / GND) | +14V |  |

**5.3 Camera and Link manual power switch test:** Toggle the corresponding rocker switch below to remotely enable each output. Observe the change of voltage at the output, making sure that the observed value matches the expected value. Also observe whether the corresponding LED turns on.

|  |  |  |  |
| --- | --- | --- | --- |
| **Toggle Switch** | **OUTPUT**  Laser or FLIR Connections | **Expect**  **Value** | **Function**  **Correct?** |
| LASER ON  Remote | 5 Volts Out Aiming LASER  (J6T-4 / GND) | +5V |  |
| FLIR ON  Remote | 22 Volts Out FLIR  (J6B-6 / GND) | +14V |  |

**5.4 Flipper Control Output Switching: A**pply 5V to the corresponding pin on the EtherCAT connector. Observe the output voltage change at the corresponding “Flipper Control” SMA Connector

|  |  |  |  |
| --- | --- | --- | --- |
| **Apply 5V** | **OUTPUT**  SMA Connector | **Expect**  **Value** | **Function**  **Correct?** |
| Flip\_1\_Act  (J9-34)(+)/(J9-18)(-) | Flipper Control #1 | +5V |  |
| Flip\_2\_Act  (J9-16)(+)/(J9-18)(-) | Flipper Control #2 | +5V |  |

**5.5 Flipper Sensor Readback Switching** Apply 5V to the “EtherCAT 5V” input on the EtherCAT connector. Then apply 5V to each of the “Flipper Sensor” pins listed below and observe the output voltage change at the corresponding pins on the EtherCAT connector.

**EtherCAT 5V Input: (J9-15)(+) / (J9-18)(-)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Apply 5V** | **OUTPUT**  SMA Connector | **Expect**  **Value** | **Function**  **Correct?** |
| Flipper Sensor 1  (J5T-6)(+)/(J5T-7)(-) | EtherCAT (Flip\_1\_Mon)  (J9-33)(+)/(J9-18)(-) | +5V |  |
| Flipper Sensor 2  (J5B-6)(+)/(J5B-7)(-) | EtherCAT (Flip\_2\_Mon)  (J9-14)(+)/(J9-18)(-) | +5V |  |