LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Photon Calibrator Transmitter Module Maintenance Procedure

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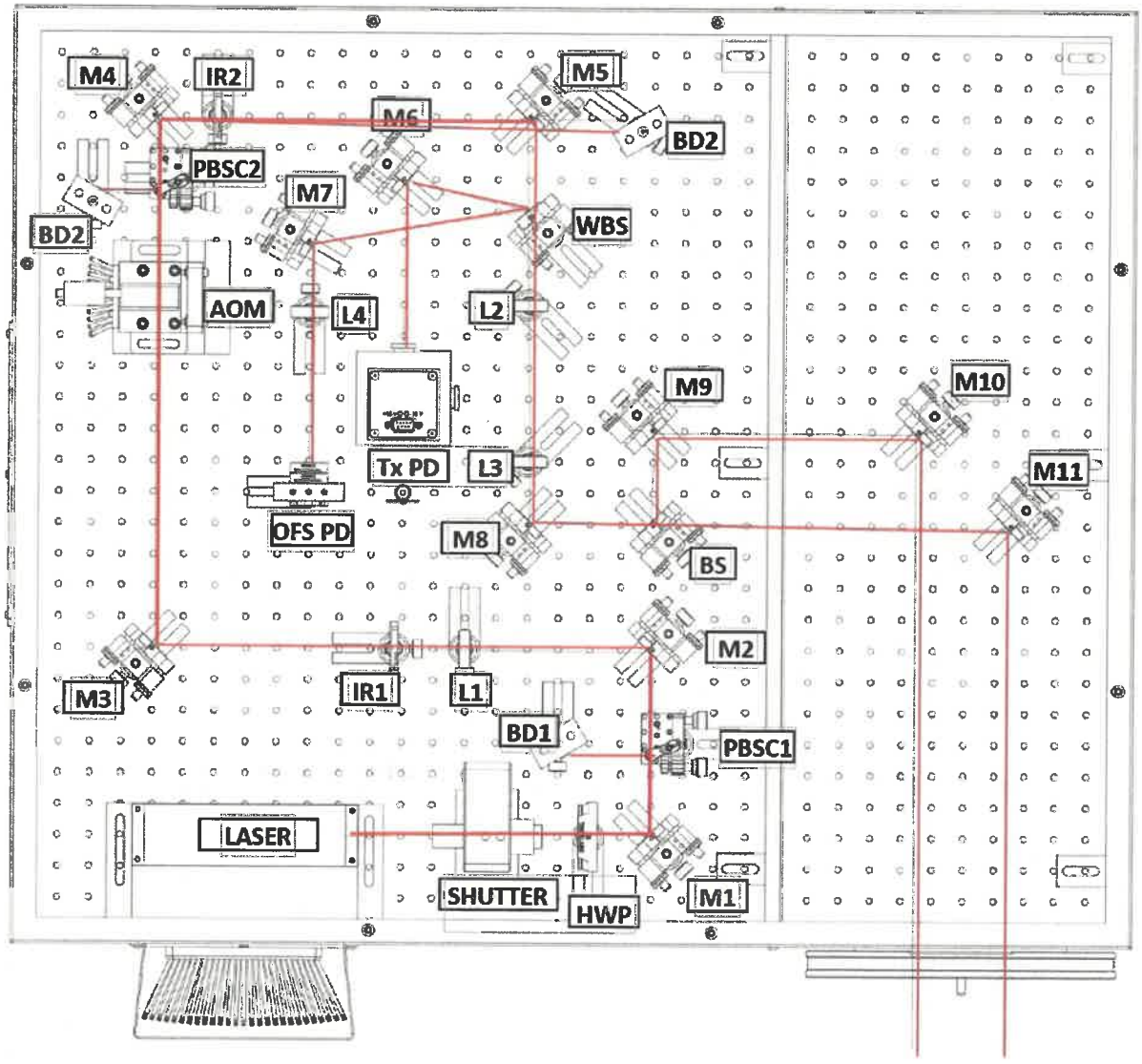

Figure 1 Transmitter module layout and component naming.

5 Laser power and polarization

- With the high-power head located between the **SHUTTER** and **HWP**, measure the laser output power.

  Note the **LASER OUTPUT POWER**: 1.98W

- With the low-power head located between **PBSC1** and **BD1**, measure the rejected (wrong polarization) laser power.

Adjusted the HWP to minimize R.L.P

- Using the high-power head located between downstream of M10, measure the outer beam power level.

  Note the **OUTER BEAM POWER:** 318 mW (50.6%)

- Using the high-power head located between downstream of M11, measure the inner beam power level.

  Note the **INNER BEAM POWER:** 310 mW (49.4%)

- Calculate the output beam power ratio as INNER BEAM POWER divided by OUTER BEAM POWER.

  Note the **OUTPUT BEAM POWER RATIO:** 0.975 100?

- The power of the both the Inner Beam and Outer Beam should be 50±2% of the sum of the Inner and Outer Beam powers.

8 Optical Follower Servo (OFS) Open Loop Transfer Function (OLTF) Measurement

- Measure the OFS open-loop transfer function (see Section 11 for instructions).
- Adjust the OFS gain on the MEDM screen to set the unity gain frequency at 100 kHz.

  Note the **OFS GAIN:** _____

  Note the **OFS PHASE MARGIN:** _____
- OFS Phase Margin should be >50° at 100 kHz.

- Capture the Bode plot of the OLTF from the SR785 so that it can be attached to an aLog entry.

9 Check of beam alignment at RX integrating sphere

- Remove both RX enclosure pieces from the RX pylon.
- Using the IR laser viewing card, take photos of the centering of both Inner and Outer beams independently by blocking one beam at a time with a razorblade beam dump.
- When complete, reinstall both enclosure pieces on the RX pylon.

10 Recording data in aLog and DCC

It is **critical** that the results of these measurements be recorded properly. **Please** make an aLog entry and record them in the DCC.

11.1.2 Step-by-step setup by hand

- Power on SR785 and press the SYSTEM button, select the PRESET menu, press the ENTER button. This will clear any settings stored in the SR785.
- Press the DISPLAY SETUP button
  - Select MEASURE GROUP, select SWEPT SINE, press the ENTER button.
  - Select MEASUREMENT, select FREQ RESP, press the ENTER button.
- Press the ACTIVE DISPLAY button (to switch to the other display)
  - Select MEASUREMENT, select FREQ RESP, press the ENTER button.
- Press the SOURCE button, select AMPLITUDE, enter 10 using the number pad, select mV, press the ENTER button.
- Press the FREQ button
  - select TYPE, select LOG, press the ENTER button.
  - Select START, enter 100 using the number pad, select kHz, press the ENTER button.
  - Select STOP, enter 100 using the number pad, select Hz, press the ENTER button.
- Press 'Active Display' button so that the upper display is highlighted
- (These should be part of the "Preset" configuration, but if not, Press the DISPLAY SETUP button.
  - Press VIEW, select LOG MAG, press the ENTER button.
  - Press UNITS, select dB UNITS, select ON, press the ENTER button.
- Press the ACTIVE DISPLAY button so that the bottom display is highlighted
- Press the DISPLAY SETUP button
  - Press VIEW, select PHASE, press the ENTER button.
- Cable connections
  - From SOURCE OUT on the SR785 to CLTF IN on the Pcal Optical Follower Servo (OFS) chassis (D1300599).
  - From ERR MON on the Pcal OFS chassis to CHANNEL ONE A on the SR785.
  - From PD MON on the OFS chassis to CHANNEL TWO A on the SR785.
- Measuring the OLTF
  - Press the START/RESET button to start the measurement.
- When the sweep has finished
  - Press the AUTO SCALE A button
  - Press the AUTO SCALE B button.
- When you are satisfied with the measurement, you can press the Pause/Continue button to pause the measurement.

11.2 Setting the unity gain frequency

- Press the LINK button to link the cursors on the Upper and Lower displays
- Use the dial to move the cursor to 100 kHz.
  - Note the value on the upper plot. If it is not 0 dB, adjust the OFS gain on the upper display to set the (Unity Gain Frequency – 0 dB) at 100 kHz. Note the gain that results in an OLTF of 100 kHz. This is the OFS GAIN. Enter the value in Section 8, above.
  - Note the phase at 100 kHz on the lower display. 180 deg. minus this value is the OFS PHASE MARGIN. Enter the value in Section 8, above.

OFS → 7.35V
18mdb

OFS Gain → 7.39V