Micron Optics, Inc.
Os5100 Optical Displacement Gage
Long Term Test Summary

Preliminary

The following tests have been performed on the os5100 Optical Displacement Gage to confirm the long term reliability of the product under extreme environmental conditions. These tests include temperature cycling, high temperature and humidity, fatigue and monitoring in an outdoor test bed.

Wavelength/Position Relationship

To establish a baseline criteria for the displacement gage, each gage is individually calibrated to determine a gage factor and offset. These parameters are unique for each gage and are provided on the sensor information sheet included with the gage. The calibration process produces a linear relationship between the wavelength of the two gratings and the probe position that takes the form:

$$D = m(\lambda_2 - \lambda_1) + b$$

Where: D is the displacement in millimeters
m - Gage factor
λ_2 - Wavelength of FBG 1(nanometers)
λ_1 - Wavelength of FBG 2 (nanometers)
b – Offset (millimeters)

Calibration is performed on a high precision calibration fixture with an accuracy of 2.5µ over 60 mm. The displacement gage is calibrated over the entire 50mm range. To insure a precision calibration, the r^2 correlation coefficient between wavelength and position is checked for each gage and must exceed 0.999975.

Temperature Cycling

Three displacement gages were temperature cycled for 500 cycles over the range of -40 to +80°C. The gages were mounted to test fixtures fabricated from a cold rolled steel base with a CTE (coefficient of thermal expansion) of 10.7 µ/m-°C. The fixtures are designed to maintain constant probe position simulating zero displacement. While the gages were tested for variation at the center and at both extreme ends of travel, the center position was used for both temperature cycling and humidity soak. See test fixture in figure 1 below.

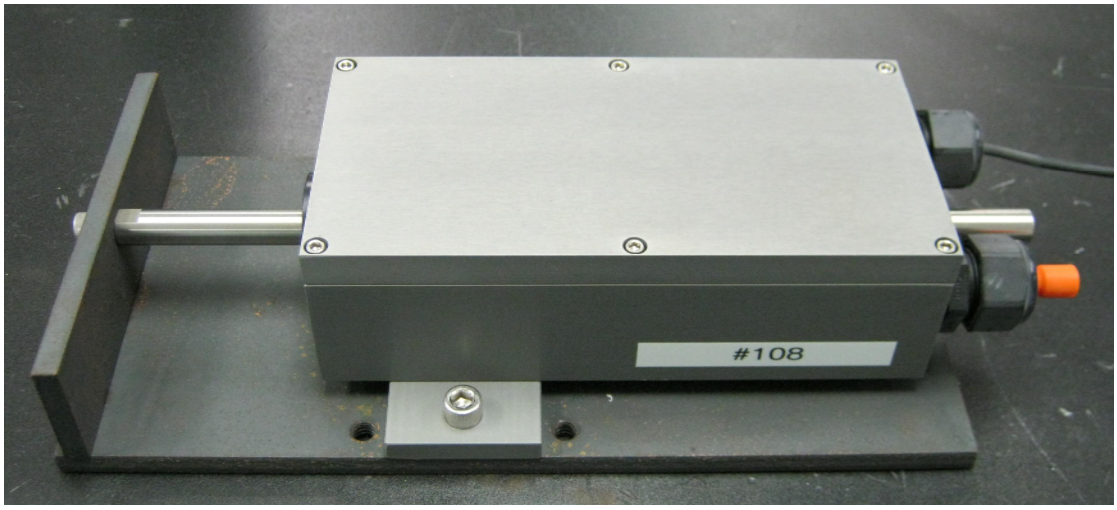

Figure 1 – Gage setup for temperature and humidity tests

The graph in Figure 2 shows the position measurement for the first 29 temperature cycles for each of the gages. Due to the thermal mass of the gage and test bed, the position variation does not produce a linear relationship during the minimum to maximum temperature change. The chamber was ramped at a rate of 1.2°/minute with a dwell of 15 minutes at 80°C and a dwell of 60 minutes at -40°C.

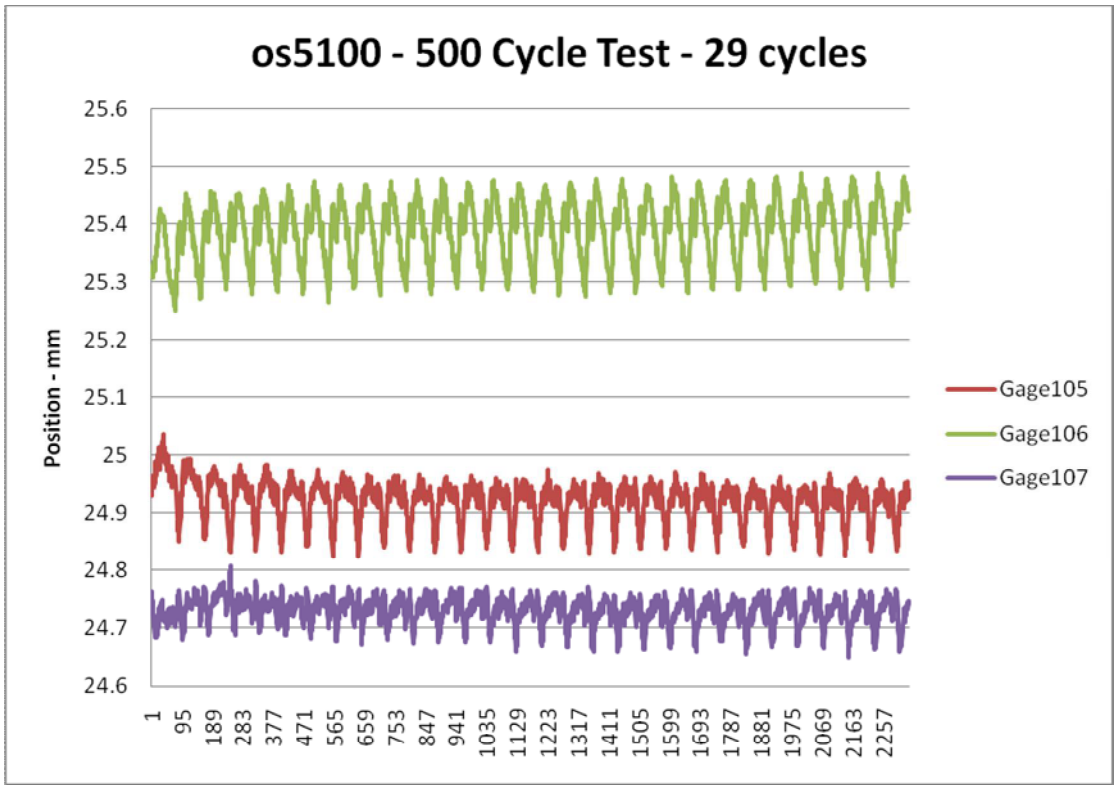

Figure 2 – Temperature Cycle – First 29 Cycles

Figure three is the graph of the same sensors for the last 20 cycles of the test.