

Large Holographic Grating Inspection With High Accuracy XY Stages

A Newport customer fabricates large gratings with holographic technique. In the process of grating inspection, high accuracy of motion becomes is of key importance in examining the micro-defect. As the provision of a high precision test report is required on each delivered grating, the customer is challenged to design a new inspection method and tools to improve grating quality. Newport provided the custom XY solution to help meet all the needs.

The high accuracy XY motion system consists of (2) [XML350 stages](#), a granite base plate and 2-D error mapping calibration. The calibration is done under the specific test setting of 300mm*300mm area and 5 kg payload setting to assimilate the customer test conditions. The measured accuracy of the XY system was better than 0.5 μm after the mapping, and it exceeded the original customer requirement of 1 μm global accuracy.

The grating under test is mounted on an XY stage via a special fixture, and the entire system is mounted on the granite base plate. XML350 stages, with their ironless linear motor as the driving element, provide superior sensitivity and repeatability of motion without any backlash or hysteresis. The granite base assembly provides tight flatness tolerance and extreme hardness to complement the performance of XML stages.

Key Specifications:

(2) XML350

Granite Base Plate

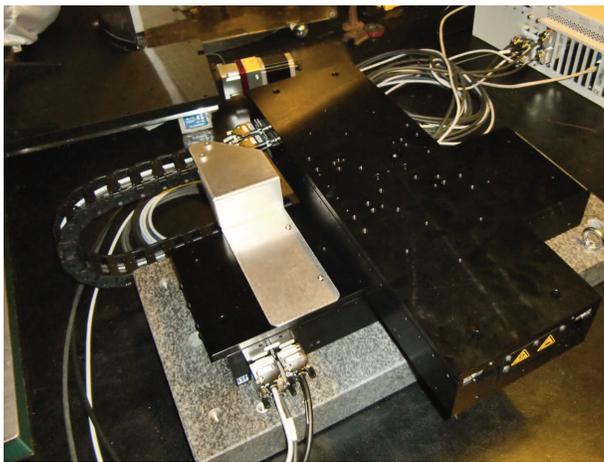
XPS-C2 Controller with (2) XPS-DRV02

Travel: 350mm*350mm

Minimum Incremental Motion (MIM): 10nm

Bi-repeatability: 80nm

Accuracy: < 1 μm over 300mm*300mm area with 2D error mapping



QUALIFICATION REPORT

19/01/2011

XY ACCURACY

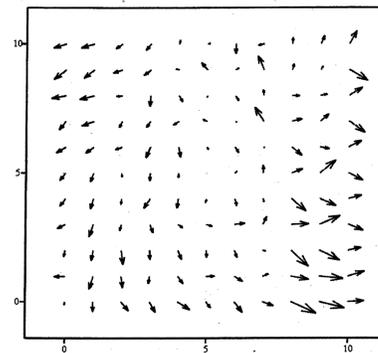
M = LIREPRN("aprec-correction_MappingXY.prt")

Setup :

Measuring system : Renishaw Interferometer, resolution : 10 nm

X step displacement = 30 mm

Y step displacement = 30 mm



(erreurX, erreurY)

X error (nm) : moyX = 0.047- μm 3-sigmaX = 0.490- μm ptpX = 0.736- μm

Y error (nm) : moyY = -0.064- μm 3-sigmaY = 0.379- μm ptpY = 0.603- μm

X mean+3sigma error (nm) : Xerror = 0.537- μm

Y mean+3sigma error (nm) : Yerror = 0.443- μm

* The system qualification report illustrates that 0.5 μm 3-sigma accuracy is achieved in XY, based on the superior performance of XML stages and error mapping calibration.

Newport stage error mapping service and calibration allow compensation for non-linear error sources. Mapping of stage is done by sending a compensation table to the [XPS controller](#) and doing the needed settings in the configuration file. In this particular system, all errors of an XY group with (2) XML350 stages are compensated by sending two compensation tables to the XPS controller. During this process, XY compensation factors are dynamically taken into account on the corrector loop of the XPS controller.

The error mapping calibration service is offered as custom solution for the selected Newport high precision linear and rotary stages, and they must be ordered with an XPS motion controller. For more detailed information, please contact Newport sales and applications engineers.