

APPLICATION NOTE

mtiinstruments

A worldwide leader in precision measurement solutions

Precision Focus Control Using OEM Capacitance Measurement Equipment

Introduction

Capacitance based measurement probes have long been employed for high precision non-contact measurement. The ability to customize the probe/amplifier configuration makes them a popular choice for measurement applications demanding maximum accuracy and repeatability. One specific area where capacitance systems excel is high resolution focusing of complex lens systems such as those found in atomic force microscopes, vision inspection machines and photolithography tools.

Problem

In a multi-million dollar photolithography tool, high accuracy, nanometer resolution and maximum thermal stability are absolutely critical to maintain proper focus and obtain integrated circuit line widths as small as 45 nanometer. Additionally, most systems demand low power consumption and maximum heat dissipation to eliminate any adverse affects from temperature gradients.

Solution

A leading supplier of photolithography equipment contracted MTII to develop a custom OEM measurement sensor for active feedback control in the lens systems for their latest generation tools. Working closely with our customers engineers, MTII's Application and Design Team developed a multi-channel, capacitance based solution featuring a measurement accuracy of 3 nanometers and astonishing resolution of less than 1 nanometer. MTII designed the probe amplifier for direct integration into the customers control system utilizing the existing power supply and system bus. Special design consideration was given to thermal stability and long term electronic drift to provide years of fault free operation in a production environment.

Results

After extensive laboratory testing prototype units were provided within 3 months of product concept for additional testing in an actual production environment. The results were immediate. Based on customer feedback the sensors were not only integrated into new tools but were also incorporated as part of a field-wide upgrade program to increase the capabilities of existing tools.

Building on the experience gained in supplying measurement solutions for next generation photolithography equipment, MTII has expanded its presence in similar applications involving complex lens focusing systems.

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