

OPTRA can provide software and hardware engineering support services to assist our customers to design, develop, and integrate a complete metrology solution utilizing OPTRA's Nano products into their systems in order to provide a cost effective system that meets the customer's specifications.

For example, Delphi Automotive Systems in Cleveland, Ohio asked OPTRA to provide a complete metrology system based on the OPTRA NanoGrid sensor product for their component insertion machines. These machines are designed to move a 150mm x 150mm component carrier through a predetermined sequence of positions inserting components at each position. Each component takes ~7ms to place and 6-7 components are placed per second (~350 components/minute). The motion and accuracy of the table must be such that the components are correctly placed at each insertion position with tolerances of less than 30um. Errors, either accumulated or instantaneous, can cause the machine to malfunction and produce a potentially inferior or bad product. Delphi utilized OPTRA hardware and software engineering services to design and develop a system that calibrates the accuracy of the table motion using the NanoGrid system in response to the motion of a predetermined component layout pattern.

Movement of the machine is detected by the OPTRA NanoGrid system, a 2-dimensional ultra-precise planar displacement measurement system providing sub-nanometer position accuracy and area coverage up to 213mm x 213 mm. NanoGrid is an XY grid based encoder system that avoids the turbulence effects, which are commonly encountered with laser interferometers or the Abbe errors associated with separate linear scales. NanoGrid captures the precision of laser interferometry within the manufacturing of the grid and packages it in a lower cost, more usable, and rugged format. The system outputs a full 32-bit position update at a 750 KHz per axis rate (375 KHz dual axis) with a 0.3 nm LSB (A Quad B also available).

The resulting Dynamic Position Deviation Test (DPDT) suite was designed and developed by OPTRA Inc. at its engineering facilities in Topsfield, MA and integrated in just a few days at the customer site. The system consisted of: an OPTRA's NanoGrid sensor system with accompanying optical grid and standard PC ISA bus interface card, a COTS data acquisition card to acquire the component insertion "in progress" pulse, and a standard desktop PC hosting a user-friendly Graphical Interface software for DPDT test execution. This system is utilized as a "passive observer" of table motion during the component layout process. The DPDT test is merely analyzing the motion of the table during a table motion cycle.

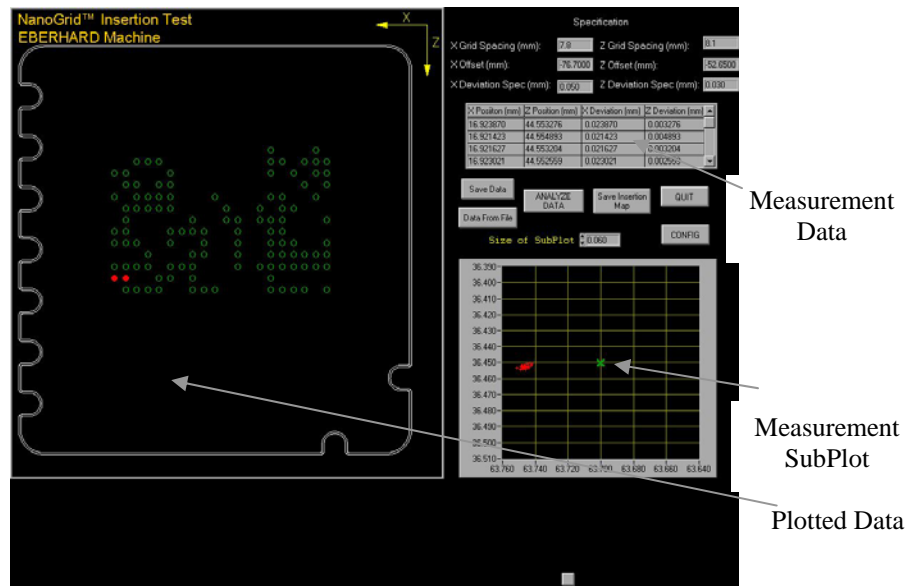


Figure 1. DPDT Graphical User Interface Screen Example. Notes: 1) Plotted Data: **Green**=Insertion Position OK, **Red**=Insertion Point Failed 2) Measurement SubPlot: Each insertion point's data displayed by clicking on the insertion point of interest in the Plotted Data area. **Green** Center Point=Target Insertion Point, **Red** Data=Actual position as read by the OPTRA NanoGrid system 3) Measurement Data: tabular data for all insertion points

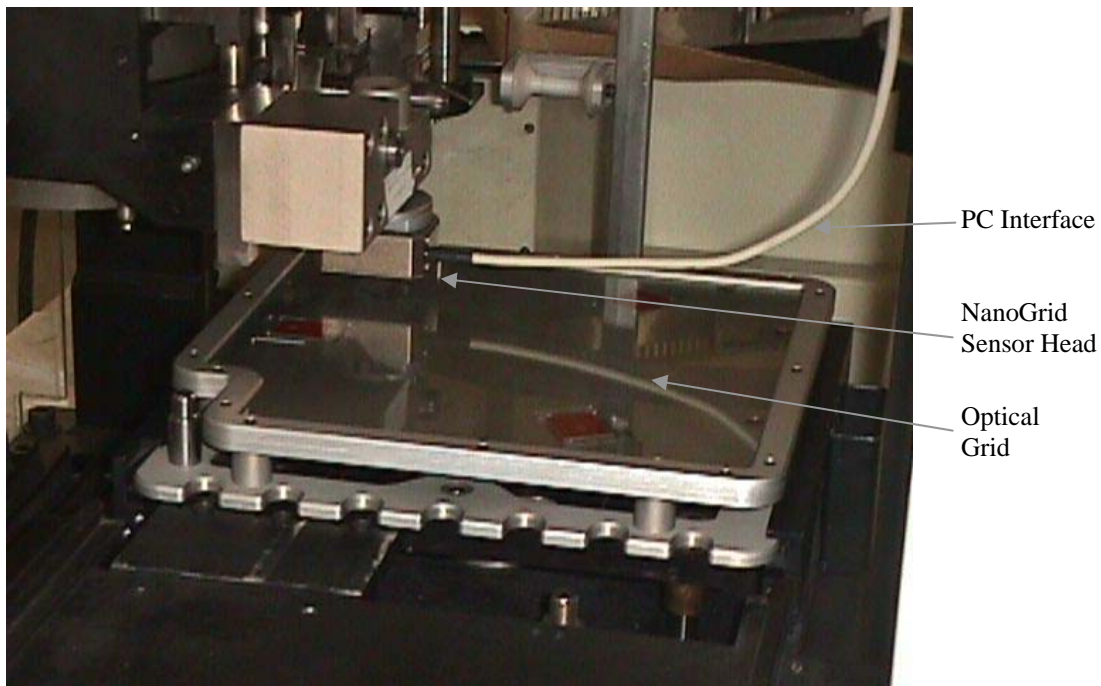


Figure 2: OPTRA NanoGrid sensor system installed on the Delphi Anatol Insertion machine.