

# E-710.SCN Option: Dynamic Digital Linearization

## Dynamic Digital Linearization Improves Scanning Linearity up to 3 Orders of Magnitude

Control theory predicts that conventional PID (proportional integral derivative) servo motion controllers exhibit phase lag and tracking errors in dynamic operation (due to the fact that a PID controller needs to see an error first before a reaction occurs, and also due to the nonlinear nature of PZT material). Depending on the controller settings and specs of the

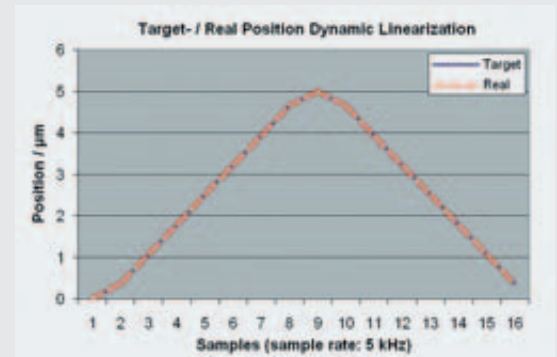
nanopositioning system driven, tracking errors (the difference between the commanded position and actual position) can reach double-digit percentage values even at moderate scanning rates. Consequently, scanning stages often cannot be driven at the desired rates, or the acquired data has poor linearity.

The new E-710.SCN Dynamic Digital Linearization upgrade (standard for the E-710.6CD 6-axis controller, optional for the 3- and 4-channel versions)

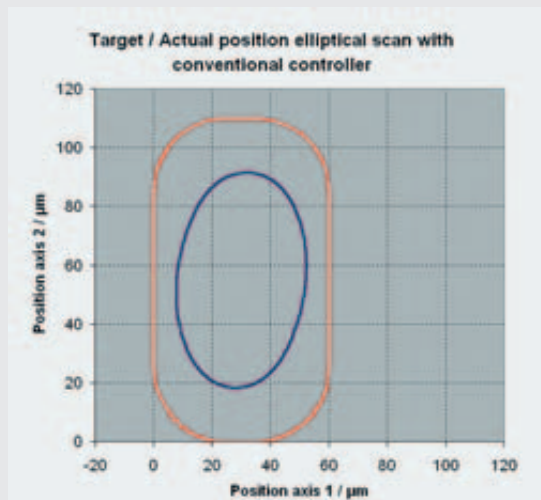
solves this problem. This PI-exclusive technology is a breakthrough for scanning applications, reducing phase lag and nonlinearity to indiscernible levels, even with high-frequency dynamic actuation under load. The effect is an improvement in linearity (and usable bandwidth) of up to three orders of magnitude, resulting in significantly increased throughput. Dynamic Digital Linearization works both in single-axis and multi-axis applications (see graphs).



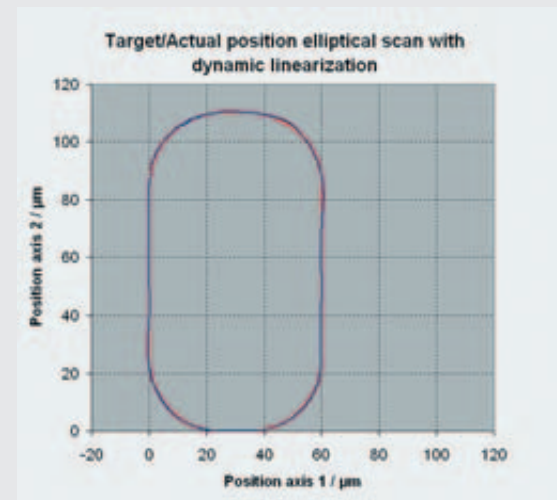
Triangular scanning signal at 312 Hz. There is a significant difference (2.6 μm max.) between target and real position with the conventional PID motion controller.



Triangular scanning signal at 312 Hz, with the E-710 with dynamic digital linearization. The difference between the target position and the actual motion is indiscernible. The maximum error is only 7 nanometers.



Elliptical scan in a laser micro-drilling application with XY piezo scanning stage, conventional controller, 60 msec/rev. The outer curve ellipse describes the actual motion at the stage.



Same scan as before, with dynamic digital linearization. Target and actual data can hardly be discerned.

## Extensive Software Support

The E-710 controller comes with a variety of software tools as well as LabView™ drivers and DLL's for easy setup, system analysis and integration.