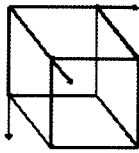


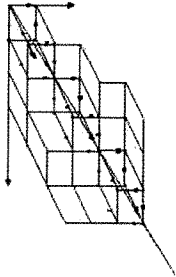
# MAXIMIZE YOUR MACHINE'S PERFORMANCE!

What are the volumetric positioning errors?



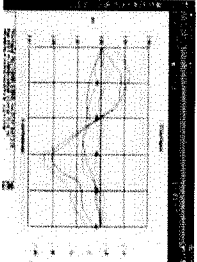
A linear displacement error is the positioning error in the same direction as the axis direction. The volumetric positioning error is the positioning error in a spatial direction not necessarily in the direction of the axis motion. Hence this error is a vector and its three components are the linear displacement error, the vertical straightness and horizontal straightness.

Why do you need to calibrate and compensate your machine volumetrically?



Competition in the global manufacturing market today requires improving the CNC machine tool performance to achieve higher productivity, better quality and less downtime. With ShadowMap, it is now possible for all generations of CNC controls to achieve higher accuracy even on a lower cost machine. To do this it is important to measure the volumetric errors of the machine and to compensate these errors. The key is how to measure all these errors accurately and quickly. Using a conventional laser interferometer to measure these errors is very complex, time consuming, and costly. These are the major reasons these errors are not usually compensated. Another reason is time: most companies are not willing to invest the 16 to 20 hours required to measure all of these errors in that manner. The Optodyne 3D Laser solves the problem by utilizing very accurate laser technology and their laser vector measurement technique (patent pending), all in a portable kit that can be moved from machine to machine, or easily taken on an airplane!

How to compensate the volumetric positioning errors?



Some modern controllers have the capability of storing and utilizing data for volumetric compensation (or sometimes called sag compensation, or cross compensation), but most controllers have no means to implement the error information. Now, with the combination of ShadowMap and the Optodyne 3D laser, this process can be used on any CNC milling machine to reduce repeatable errors and achieve higher volumetric accuracy!

What are the volumetric positioning errors?

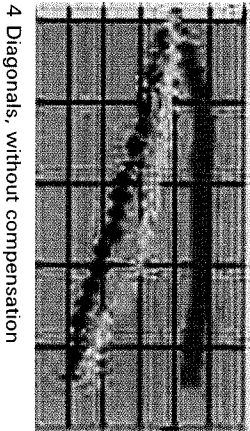
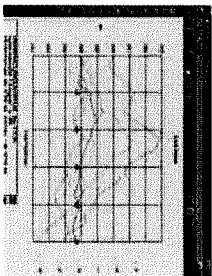
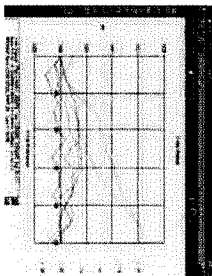
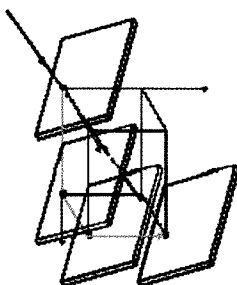
The key to the laser vector measurement technique is that the measurement direction, or the laser beam direction, is not parallel to the displacement direction. Hence, the measured displacement errors are sensitive to the errors both parallel and perpendicular to the direction of the linear axis. One way to implement this technique is to perform the sequential step diagonal measurement, discussed below.

What is the body diagonal measurement?

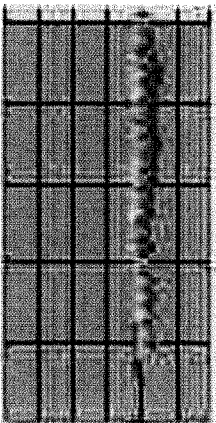
The ASME B5.54 standard section 5.9.2 Volumetric Performance Using Diagonal Displacement Measurements section states that "The volumetric accuracy may be rapidly estimated by measuring the displacement accuracy of the machine along body diagonals". This is because the diagonal displacement error is sensitive to all the error components. However, if the measured errors are large, there is not enough information to identify the error sources.

What is sequential step diagonal measurement?

Similar to the diagonal measurement, the laser beam is pointing in the diagonal direction, instead of moving x-, y- and z- axis continuously in the diagonal direction, the machine is now programmed to move x-axis, stop, collect data, then move y-axis, stop, collect data, then move z-axis, stop, collect data. The process is continued till the opposite corner is reached. Hence it is called sequential step diagonal measurement. The major advantages are (1) 3 times more data are collected, (2) x, y, and z motions are separated, and (3) all error components can be measured. With 4 setups (4 body diagonals), all 3 displacement, 6 straightness and 3 squareness errors can be determined. On a machine with a work volume of 1 cubic meter (40"x20" machine), all four diagonals can be measured in 2 to 4 hours.



4 Diagonals, without compensation



4 Diagonals with compensation





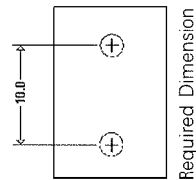
SHADOW AUTOMATION, INC.

# REPEATABLE ERRORS?

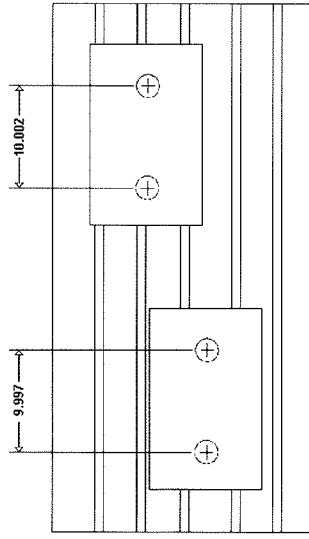
Are your machines imperfect, but repeatable? Do you fine-tune your CNC machine-tool programs by adding or subtracting a few thousandths of an inch to the programmed coordinates?

Now you can have this done for you automatically, reliably, and consistently with ShadowMap. With an independent laser measurement, your computer can quickly adjust every part program to reduce the errors of every machine.

ShadowMap reads industry standard APT CL machining programs, along with the error map of the machine to run the program, and then a new APT CL program is created with all of the coordinates adjusted correctly. Use your existing post-processors and communications methods.



Required Dimension



Different errors in different areas of the work envelope

AUTHORIZED DEALER



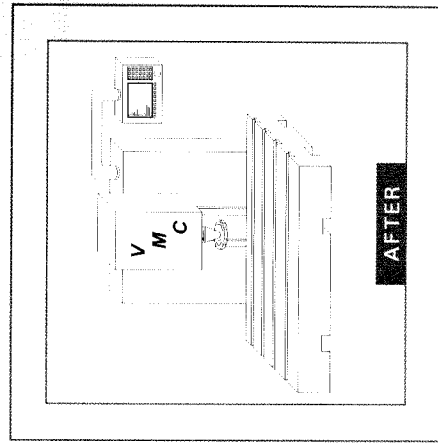
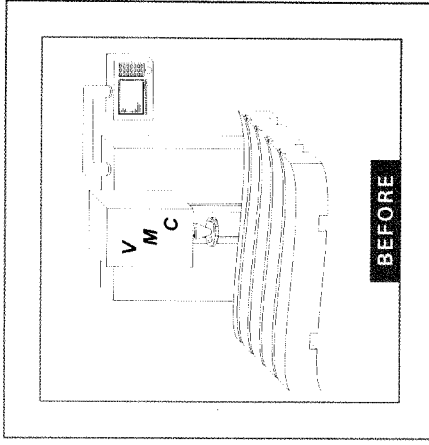
SHADOW AUTOMATION, INC.  
1-949-388-2310  
www.metrolosys.com

# SHADOW MAP

CNC MACHINE-TOOL

ERROR REDUCTION SYSTEM

## REPEATABLE ERRORS?



d e m o n s t r a t i o n

- 01 METROLOSYS PADAL OUTPUT
- #SPRINT "FLUAM/METROLOSYS"
- M19
- G00G0E20
- M08M04
- G49P00
- #SPRINT "C:\Gcode\01\\*OPERD\Done"
- G01X1.1816Y1.8208Z1.3208E5
- #SPRINT "FATOPPLANE0101-HEAT/POINT,
- CART,S"
- G103I2.2918F100.
- G3I2.412
- G3I1.12.2918F2.
- #SPRINT AX,"A","AZ,"S"
- G1X1.1816Y1.8208Z.2918F100
- #SPRINT "O.C.-1206"
- #SPRINT "FATOPPLANE0102-HEAT/POINT,
- CART,S"
- G3I2.412
- G3I1.12.2918F2.
- #SPRINT AX,"A","AZ,"S"
- G1X1.2116Y1.5128Z.2918F100.