

**One-day Quick-check System**

**I. What is the problem?**

When it is desirable to estimate machine performance within one day, the ASME B5.54 standard recommended a sets of comprehensive tests including linear displacement accuracy (LDA) measurement, bi-directional repeatability measurement, volumetric performance using laser diagonal displacement measurement and contouring performance using telescoping ball bars.

**II. How the one-day quick-check system solves the problem.**

The one-day quick-check system includes a MCV-500 laser system, SD-500 volumetric calibration package (patent pending) and LB-500 laser/ballbar package (patent pending). The MCV-500 laser system can be used to perform the LDA measurement, bi-directional repeatability measurement and volumetric performance tests. The LB-500 together with the MCV-500 can be used to perform the circular contouring measurement. The one-day quick-check provides a full comprehensive measurement of linear, volumetric and contouring performance in accordance with the standard and the ISO 9000 requirements.

Furthermore, the combined system, MCV-500 and SD-500, provides a rapid and efficient way of measuring a machine's volumetric accuracy, including 3 LDA, 6 straightness and 3 squareness, over the working volume.

Additional capabilities:

1. Automatically generates the pitch error compensation files for controllers such as Fanuc, Siemens, Giddings & Lewis, Milltronics, etc.
2. Measures the linear, vertical and horizontal straightness, and squareness errors with four easy setups.
3. Automatically generates the volumetric positioning error compensation files (sometimes called straightness compensation, sag compensation, droop compensation or cross compensation) for advanced controllers, such as Fanuc, Siemens, Giddings & Lewis, etc. for compensation of linear, straightness and squareness errors.
4. Feed rate, acceleration, and absolute radius of a circular contour can be measured.
5. The laser circular contouring measurement is non-contact and the radius can be varied continuously from 3" to 0.001".

### III. How it works.

A unique property of the MCV-500 laser calibration system is the single aperture optical arrangement. Since both the outgoing laser beam and the return laser beam are using the same aperture, it is possible to use a flat-mirror as the target. By aligning the flat-mirror to be perpendicular to the laser beam, the mirror motion along the laser beam direction can be measured. The mirror motion perpendicular to the laser beam will not displace the laser beam, hence not effecting the alignment on the measurement. Therefore, the displacement of a circular path along the beam direction can be measured.

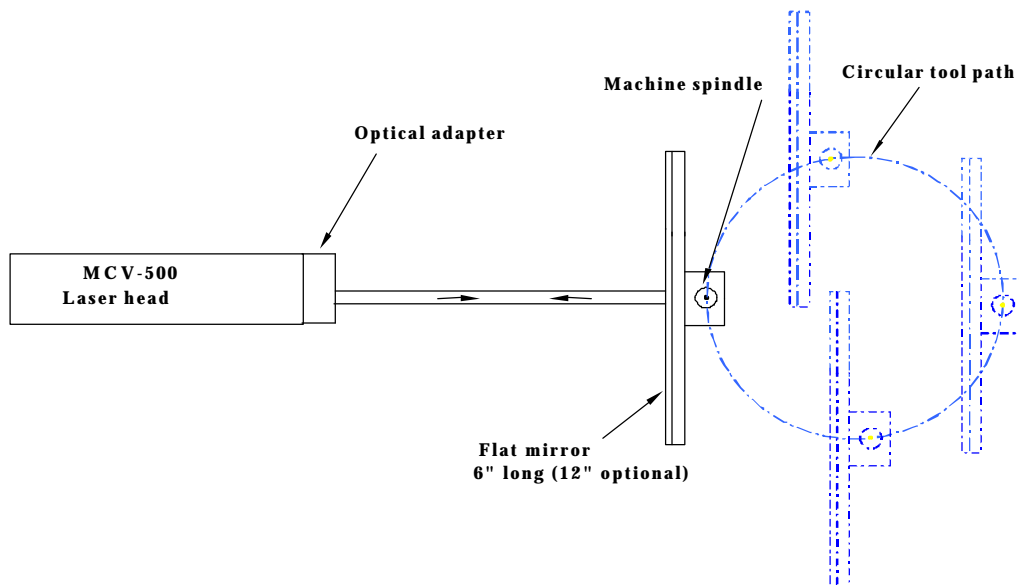


FIG. 1 SCHEMATIC OF LASER CIRCULAR CONTOURING TEST

A typical setup is shown in Fig. 1. The laser beam is pointing perpendicular to the flat-mirror, and an optical adapter is used to reduce the alignment requirement of the flat-mirror. As the machine spindle moves along a circular path, the flat-mirror remains perpendicular to the laser beam and the displacement along the laser beam direction is measured. Repeat the same measurement along a direction 90 degrees from the previous measurement with the same spindle motion. Combining the data of these two measurements, the measured circular path can be generated (see AP-1108).

Conventional laser diagonals require measurements moving all three axes simultaneously along a body diagonal and collecting data at each preset increment. The new sequential diagonal measurement method, suggest moving the X, Y and Z-axis in sequence and collecting data after each axis is moved as shown in Fig. 2. Hence three times more data are collected and the position errors

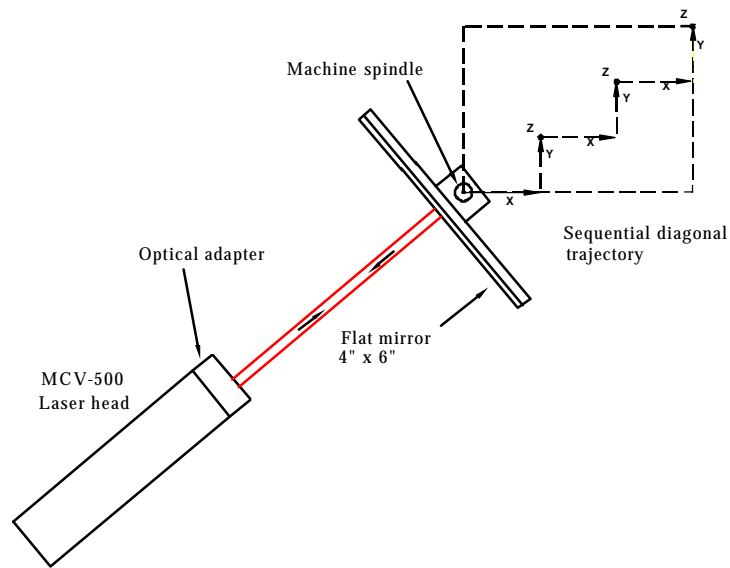


FIG. 2 SCHEMATICS OF SEQUENTIAL DIAGONAL MEASUREMENT

due to the movement of each axis can also be separated. Based the "Vector method", the collected data can be processed and the linear displacement errors, the straightness errors of all three axes and the squareness errors can all be determined (see AP-1109).

**IV. Need more information.**

Please call Optodyne, Inc. at 310-635-7481 or your local representative