Mitutoyo CMM accuracy statements

The accuracy statements specified on the following pages for Mitutoyo CMM's are based upon ISO standards, the following is a brief description of these standards.

Performance Assessment Method of Coordinate Measuring Machines

CMM accuracy is specified in accordance to international standards, the ISO 10360 series of standards, and entitled "Acceptance and reverification test for CMMs". ISO 10360 consist of multiple parts, with each part describing test that apply to various configuration and components of CMMs.

Table 1 JIS B 7440 (2003) Series

	Item	JIS Standard No.	Year of issue
1	Terms	ISO 10360-1	2000
2	Dimensional measurement	ISO 10360-2	2009
3	Rotary table-equipped CMM	ISO 10360-3	2000
4	Scanning measurement	ISO 10360-4	2000
5	Probing systems	ISO 10360-5	2010

Maximum Permissible Measuring Error $E_{0,MPE}$ ISO 10360-2:2009

This volumetric test procedure requires that a coordinate measuring machine (CMM) is made to perform a series of five different length measurements in each of seven directions, as shown in Figure 1, to produce a set of 35 measurements. This sequence is then repeated twice more to produce 105 measurements in all. If these test values are equal to or less than the limits specified by the manufacturer then the performance of the CMM has been determined to meet its specification. This test procedure is a part of Mitutoyo America Corporation's A2LA accredited calibration of Mitutoyo CMMs.

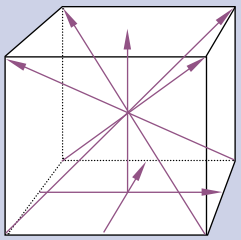

Figure 1 Typical test measurement directions within the CMM measuring volume

Maximum Permissible Measuring Error $E_{150,MPE}$ ISO 10360-2:2009

This test is an extension of the E0 test but uses a probe tip that is offset a default length of 150 mm perpendicular to the ram axis of the CMM (typically the Z-axis). Five different lengths are measured along two different planar diagonals to produce 10 measurements. This sequence is then repeated twice more to produce 30 measurements in all. If these test values are equal to or less than the specified limits then the performance of the CMM has been determined to meet its specification.
This test is not part of Mitutoyo America's standard A2LA accredited CMM calibration procedure and is quoted upon request.

Maximum Permissible Limit Repeatability of the Range $R_{0,MPL}$ ISO 10360-2:2009

This test of repeatability is not a separate test but is determined directly from the E0 test values. For each of the 35 sets of three repeated length measurements, the difference between the maximum and minimum of the three test values is calculated. If these 35 calculated test values are equal to or less than the specified limits, then the CMM has been determined to meet its specification.
This test is not part of Mitutoyo America's standard A2LA accredited CMM calibration procedure and is quoted upon request.

Maximum Permissible Scanning Probing Error MPE_{THP} ISO 10360-4:2000

This is the accuracy standard for a CMM if equipped with a scanning probe. The test procedure under this standard is to perform a scanning measurement of 4 planes on the standard sphere and then, for the least squares sphere center calculated using all the measurement points, calculate the range (dimension 'A' in Figure 2) in which all measurement points exist. Based on the least squares sphere center calculated above, calculate the distance between the calibrated standard sphere radius and the maximum measurement point or minimum measurement point, and take the larger distance (dimension 'B' in Figure 3). If both calculated values are less than the specified limits, this scanning probe test is passed.

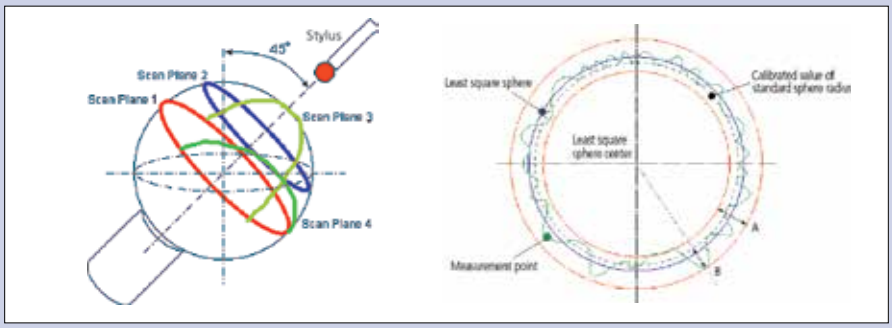

Figure 2 Target measurement planes for the maximum permissible scanning probing error and its evaluation concept

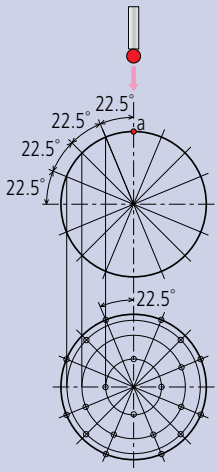

Figure 3 Target points on standard sphere for determining the Maximum Permissible Probing Error

Maximum Permissible Probing Error $P_{FTU,MPE}$ ISO 10360-5:2010

The test procedure under this standard is that a probe is used to measure defined target points on a standard sphere (25 points, as in Figure 3) and the result used to calculate the position of the sphere center by a least squares method. Then the distance R from the sphere center for each of the 25 measurement points is calculated, and the radius difference Rmax - Rmin is computed. If this final calculated value is equal to or less than the specified value, the probe has passed the test.