Artifacts and Software

CMM monitoring ensures the reliability of your measuring results
Artifacts and Software...

...to monitor
- coordinate measuring machines (CMMs),
- articulated arm measuring machines,
- contour measuring machines

...for determination of
- inspection feature oriented measuring uncertainty
- test process applicability

Your benefits
- Reliable measuring results through regular monitoring
- Standard-compliant procedure for coordinate measuring machines in accordance with VDI/VDE 2617 and DIN EN ISO 10360
- Testing in accordance with VDI/VDE directive 2629 for contour measuring machines
- Calibrated and traceable artifacts
- Standard-compliant procedure for determination der test process applicability according to VDA 5 resp. VDI/VDE 2617.
The regularly monitoring of accuracy is the foundation for exact and assured measuring results. For this purpose we offer artifacts for all different fields of application.
CMM-monitoring as Services

If you do not wish to monitor your coordinate measuring machines yourself, we will take care of this for you. If your machine no longer conforms to the specifications, our well versed service technicians will take the appropriate measures to restore the specified accuracy.

We offer the following services
Probe system monitoring
Machine geometry monitoring
Rotary table monitoring (optional)
What does monitoring mean?

**Explication**

Monitoring of a measuring machine enables fast, random checking of the measuring accuracy, without interrupting operations, it is based on the requirements for test equipment monitoring as per DIN ISO 9000 to DIN ISO 9004. The accuracy level to be achieved and the monitoring interval are defined by the user, taking into account the needs of production.

**Acceptance test**

This test is performed in accordance with the stipulations and procedures of the manufacturer.

**Reverification test**

This test is performed in accordance with the stipulations of the user and the procedures of the manufacturer.

**Interim check**

ISO 10360 strongly recommends regular checking of measuring machines during the intervals between the periodic reverification tests. The intervals of the interim checks should depend on the ambient conditions and the required performance. However, measuring machines should immediately be tested after every major incident that may affect machine performance level. The scope of the interim check described in the relevant section of ISO 10360 can be reduced regarding the number of measurements, positions and directions.

Probing point distribution during the determination of the probing error in accordance with DIN EN ISO 10360, Sheets 2 and 4
RESULTS you can trust.
Software

Control and evaluation software

for a fully automatic measuring run followed by the evaluation of the measuring results.

**Description**
- Menu-guided probing to determine the position of the artifact.
- Parametric entry of the artifact’s calibration values and the CMM limit values.
- Data output in measurement logs and graphic evaluation with result logs in a template diagram and roundness deviation plots.
- Clearly structured presentation of results and unambiguous result assessment through the computation and output of monitoring factors $\bar{u}$.
- $\bar{u}$ is the quotient of the actual determined values and the limit values of the CMM’s accuracy characteristics (manufacturer specifications).
- The test has not been passed if $\bar{u} > 1$.
- Interface with qs-STAT for the statistical evaluation of results.

**User support**
Trained staff of Carl Zeiss 3D will install the software on your premises and brief you on how to operate the system.
We will support you in
- defining the test intervals for the individual CMM performance features
- aligning the artifact and the measuring lines.
This permits you to make optimum use of the technical and economic benefits of the artifact.
CMM Check enables you as the user to perform interim checks at regular intervals.

**CMM Check**
CMM Check© can be used to check coordinate measuring machines in accordance with DIN EN ISO 10360 and VDI/VDE 2617.

The following features can be measured with the artifact and subsequently evaluated with the software:
- Probing behavior of the probe system
- Scanning performance of the probe system
- CMM as a form measuring machine inclusive filter characteristics
- Linear measuring errors

**CMM Check option rotary table**
- Four-axis error of the CMM with rotary table

**Disposition possibilities**
The provided accessories allows the most different adjustments on the CMM.

**CMM Check articulated arm measuring machines fields of application**
CMM Check GA enables users to perform interim checks for articulated arm CMMs.

The CMM Check GA CALYPSO measurement plan is used to determine probing errors and linear measurement errors of the articulated arm and to evaluate them through the monitoring factor.
Description
The basis of the universal artifact consists of a bend-resistant carrier on which calibrated, high-precision dimensional and form standards are mounted:
- one setting ring gage, 50 mm diameter
- one ceramic sphere, 30 mm diameter
- one Flick standard (precision cylinder with two flat polished sections of approx. 10 μm and 250 μm)
- two parallel gage blocks, 50 mm and 400 mm

Option rotary table
- two ceramic spheres, 30 mm diameter

Software CMM Check
The artifact can be used on several different coordinate measuring machines, but requires a software license for each machine.
The software contains the test procedure and the evaluation routine that reads out the result in the form of monitoring factors. The monitoring factors directly indicate whether the machine still conforms to the specifications.
- Probing deviations with single points and scanning on ring and sphere to DIN EN ISO 10360 Page 2 and 4.
- Scanning functions and filtering for form measurement on the amplification normal (master cylinder with 2 defined polished sections).
- Length measuring E to DIN EN ISO 10360 page 2. Random sample on gage blocks L = 50mm and L = 400mm.
- 4-axis errors to DIN EN ISO 10360 page 3 for CMM with rotary table.

Artifact calibration
In-house or DKD calibration of the standards is required, depending on the use of the artifact.

Probing with 5 stylus orientations in accordance with VDI/VDE 2617-9
Bridge Check in combination with Probe Check is used to perform reverification tests.

**Bridge Check**
Bridge Check® can be used to monitor the linear measuring errors of CMMs in accordance with VDI/VDE 2617. Checking focuses mainly on the influence of component errors (CMM geometry).
Before the use of Bridge Check, the probe system must also be checked which can be accomplished using Probe Check or CMM Check.

**Disposition possibilities**
By the provided accessories you are able to position the test piece in the most different ways on the CMM without great complexity.

**Probe Check**
Probe Check is a procedure to test the probing and scanning behavior of the probe in combination with the coordinate measuring system in accordance with VDI/VDE 2617.
Description
The two-dimensional artifact (multi-sphere test standard - MSTS) consists of a steel plate featuring 25 inner sphere elements (highly precise ball bearing outer rings) in a regular grid pattern. The MSTS can be used on CMMs from all manufacturers.

Properties of the MSTS
- High information content due to 300 spacings in different positions and orientations on the MSTS.
- Protection against damage and contamination through the use of inner sphere elements.
- Shorter traverse paths than on external spheres reducing the measuring time clearly.
- Fixture system with 3 brackets assures unbraced fixation over 3 spheres which braces themselves on cones, V-stand and plane.
- Insulate elements in brackets reduce the heat transfer between the measuring plate and the CMM.

Artifact calibration
In-house or DKD calibration of the standards is required, depending on the use of the artifact.

Software Bridge Check
The artifact can be used on several different coordinate measuring machines, but requires a software license for each machine.

- Monitoring of the CMM geometry conform to standards according to VDI/VDE 2617 page 5.
- Fully automated measuring run after simple W-layer positioning for internal and external spheres.
- Graphical analysis of all 300 distances in epatternchart.
- Estimation of the CMM geometry with one single number, the so called monitoring factor (VDI/VDE 2617 page 5), long term evaluation in quality control cards.

Software Probe Check
- Monitoring conform to standards and analytical estimation of the CMM probe system.
- Fast probe system monitoring on the sphere according to VDI/VDE 2617 page 5.
- Advanced probe system monitoring on ring and sphere backing to VDI/VDE 2617 page 5 also in scanning operation for CMM with scanning probe head.
- Determination of the one-, two and tridimensional probing uncertainty $V_1$, $V_2$ resp. $V_3$ according to VDI/VDE 2617 page 3 also on applicational specific styli and under the given operating conditions.
- Determination of the probing errors according to DIN EN ISO 10360-2.
- Long term evaluation of the probe system by monitoring factors in quality control card.
- Probe system long term test and CMM drift control.
Monitoring contour measuring machines

Contour Check

Fields of application
Contour Check can be used to test contour measuring machines in accordance with VDI/VDE directive 2629, sheet 1. The use of the contour standard allows the user to regularly verify compliance with the specifications of the contour measuring machine.

Description
The carrier of the standard consists of hard metal, on which calibrated, high-precision dimensional standards and form elements are mounted.
- 185 mm total length with 9 form elements
- 2 x 90° angle, convex
- 2 x 90° angle, concave
- 3 x radius, convex
- 2 x radius, concave
Contour Check is delivered with a fixture that permits measurement of the standard at 0° and 20° inclinations in accordance with the VDI directive.

DKD calibration
The contour standard is always delivered in a DKD-calibrated condition. This calibration procedure determines the measuring uncertainty for each measurable variable on a task-specific basis using the “Virtual CMM” method. The calibration method using the Virtual CMM was developed by the German National Metrology Institute (PTB) in Brunswick.

Contour standard with fixture in 20° inclination

Certified by DQS according to ISO 9001-2000

DEUTSCHER KALIBRIERDIENST
Kalibrierlaboratorium für die Messgröße Länge.
Kalibration laboratory for the measurand Length
Akkreditiert durch die
/ accredited by the
Akkreditierungsstelle des DKD bei der
PHYSIKALISCH-TECHNISCHEN BUNDESANSTALT (PTB)
Carl Zeiss
3D
Metrology Services GmbH
Bereich Kalibrierung
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DKD-K-13601
2006-07
Gegenstand
Object
Konturennormal
Hersteller
Manufacturer
Carl Zeiss 3D Metrology Services GmbH
Robert-Bosch-Strasse 27
73431 Aalen
Typ
Type
Ausführung für die taktile Antastung
Fabrikat/Serien-Nr.
Serial number
02
Auftraggeber
Customer
Carl Zeiss 3D Metrology Services GmbH
Robert-Bosch-Strasse 27
73431 Aalen
Auftragsnummer
Order No.
Anzahl der Seiten des Kalibrierscheines
Number of pages of the certificate
8
Datum der Kalibrierung
Date of calibration
31.10.2006
Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
Der DKD ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Coopera-
tion (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine. Die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.
This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI). The DKD is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Coopera-
tion (ILAC) for the mutual recognition of calibration certificates. The user is obliged to have the object recalibrated at appropriate intervals.
This calibration certificate may not be reproduced other than in full except with the permission of both the Accreditation Body of the DKD and the issuing laboratory. Calibration certificates without signature and seal are not valid.
Mounting work pieces with the CARFIT® CMB building block system
by
Junker & Partner
Inspection feature oriented determination of measuring uncertainty and test process applicability

Multi-Feature-Check
The Multi-Feature-Check is a method for the determination of the task specific measurement uncertainty and of the measurement process suitability for almost all workpiece features including form and position, being found in coordinate metrology. Relating to the particular CMM, measuring uncertainties can be determined and a conclusion about the test process applicability can be deducted.

Application
The following inspection features can be selected depending on the user’s parts spectrum. For these features - related to the CMM used - the measurement uncertainties can be determined and the suitability of the measurements can be stated:
- diameter, length, angle
- straightness, flatness, roundness, cylindricity
- parallelism, squareness, inclination, position, concentricity, coaxiality, symmetry
- radial run-out, axial run-out, total radial run-out, total axial run-out

When using this method the measurement uncertainties and the suitability of the measurements are determined realistically taking into account
- the current on site temperatures
- by means of workpiece-similar material and
- surface properties of the test piece.

Scope of delivery
- testpiece packed in a flightcase
- mounting device and five probe styli
- DKD-calibration
- CALYPSO measurement plan for the measuring run of the test piece
- operating instructions with a practical example of use for the determination of the measurement uncertainty and the suitability of the measurements

On request the test piece can also be made of other materials than aluminum and in other dimensions.

Artifacts calibration
The calibration of the Multi-Feature-Check test piece is carried out in a DKD-calibration laboratory, which is accredited for the measurement of prismatic workpieces according to the PTB-method of the “Virtual CMM”.

Description
Core of the Multi-Feature-Check is a universal test piece consisting of a cylindrical body equipped with various geometric elements, as they occur at typical medium sized workpieces:
- cylindrical boreholes of different diameters and depths
- a hole circle
- a short cone with big aperture angle and a long cone with small aperture angle
- three plane surfaces, of which one is inclined
- front surfaces
- the cylindrical surface of the test piece body itself

The geometric elements are made by ordinary manufacturing methods. Thus their surfaces correspond to those of normal workpieces. The material of the test piece is aluminum. Its surface is hardened for a better wear behaviour.

The length of the test piece is 200 mm and its diameter 100 mm.

Software Multi-Feature-Check
The Multi-Feature-Check will be delivered as standard with a CALYPSO measurement plan and a DKD-calibration protocol.
The calibration certificate includes the measured values with the assigned measuring uncertainties of the inspection features measured in the inspection plan.

Your benefits
- Measurement uncertainty and test process applicability for the most different measurement tasks on CMMs, therefore universally applicable
- Consistent with national and international standards, therefore generally accepted
- Based on test pieces, therefore easily, fast and efficiently applicable
- Test pieces made of workpiece-similar material and surface properties, therefore realistic measurement results
- Calibrated test piece, therefore traceable and accurate measurements
We are happy to support you