



## **Artifacts**

Measuring machine monitoring to ensure the reliability of your measuring results



## Artifacts and software...

### ...for the in-process inspection of

- coordinate measuring machines (CMMs)
- contour measuring machines

### ...for determining the

- measurement uncertainty for certain characteristics
- test process suitability

### How you benefit

- 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 to determine test process suitability in accordance with VDA 5 and VDI/VDE 2617

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### Multisensor coordinate measuring machines

Such as the O-INSPECT

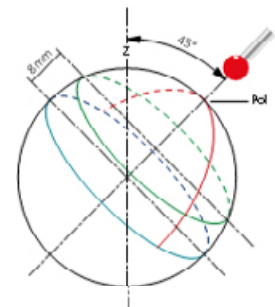
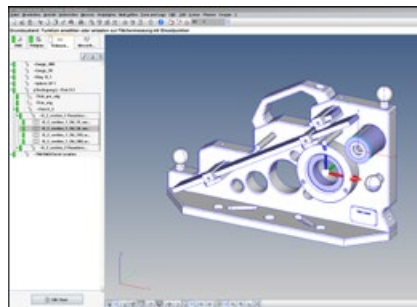
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Such as the CONTOURECORD or SURFCOM

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# ZEISS CMM Check

The ZEISS CMM Check enables you as the operator to perform an in-process inspection at regular intervals.

The artifact can be used to inspect coordinate measuring machines in accordance with DIN EN ISO 10360 and VDI/VDE 2617.

The following properties can be captured with the artifact and then analyzed using the software:

- Probing behavior of the probe system
- Scanning performance of the probe system
- CMM as a form measuring machine, incl. filter characteristics
- Linear measuring errors

### Setup possibilities

The accessories included enable diverse configurations on the measuring machine.

### Description

The base of the universal artifact consists of a bend-resistant base plate onto which precise, calibrated measurement standards and form standards are mounted:

- One setting ring gage, 50 mm diameter
- One ceramic sphere, 30 mm diameter
- Gain standard, 50 mm diameter (precision cylinder with two ground sections)
- Two parallel gage blocks, 50 mm and 400 mm
- With rotary table option:  
Two additional ceramic spheres (optional), 30 mm diameter

The necessary calibration of the CMM Check is performed as a DAkkS calibration at our calibration lab accredited in accordance with DIN EN ISO/IEC 17025.



### Software

Machine-dedicated control and evaluation software is available for coordinate measuring machines operated using ZEISS CALYPSO.

The following functions are available:

- Probing errors with single points and with scanning on a ring and sphere in accordance with DIN EN ISO 10360, sheets 4 and 5.
- Scanning functions and filtering for form measurements on the gain standard (measurement cylinder with two defined ground sections).
- Length measurement error E as per testing on gage block L = 50 mm and L = 400 mm.
- Four-axis errors in accordance with DIN EN ISO 10360, sheet 3 for a CMM with rotary table.
- The measuring capability factor enables customized modifications to the inspection criteria.

# ZEISS CMM Check ultra

The ZEISS CMM Check ultra was developed specifically for highly precise ZEISS coordinate measuring machines. Extremely exact form normals and measurement standards, combined with minuscule measuring errors with the DAKKS calibration of these normals, set this artifact apart. It is recommended for CMMs in the MICURA, PRISMO ultra and XENOS lines.

The artifact can be used to inspect coordinate measuring machines in accordance with DIN EN ISO 10360 and VDI/VDE 2617.

The following properties can be captured with the artifact and then analyzed using the software:

- Probing behavior of the probe system
- Scanning performance of the probe system
- CMM as a form measuring machine, incl. filter characteristics
- Linear measuring errors

## Setup possibilities

The accessories included enable diverse configurations on the measuring machine.

## Description

The base of the universal artifact consists of a bend-resistant base plate onto which calibrated, high-precision measurement standards and form standards are mounted:

- Parallel gage block, 50 mm, class 0
- 400 mm parallel gage block, class 0, including CTE calibration
- Precision ring, 50 mm diameter (form error  $\leq 0.2 \mu\text{m}$  on an average measuring plane)
- Precision sphere, 30 mm diameter (form error  $\leq 0.1 \mu\text{m}$ )
- Gain standard, 50 mm diameter (precision cylinder with two ground sections)
- With rotary table option:  
Two additional ceramic spheres (optional), 30 mm diameter

The required calibration for the CMM Check ultra is performed as a DAKKS calibration in our accredited calibration lab in accordance with DIN EN ISO/IEC 17025.



## Software

Machine-dedicated control and evaluation software is available for coordinate measuring machines operated using ZEISS CALYPSO.

The following functions are available:

- Probing errors with single points and with scanning on a ring and sphere in accordance with DIN EN ISO 10360, sheets 4 and 5.
- Scanning functions and filtering for form measurements on the gain standard (measurement cylinder with two defined ground sections).
- Length measurement error E as per testing on a gage block L = 50 mm and L = 400 mm.
- Four-axis errors in accordance with DIN EN ISO 10360, sheet 3 for a CMM with rotary table.
- The measuring capability factor enables customized modifications to the inspection criteria.

# ZEISS Multisensor Check

The ZEISS Multisensor Check is a procedure for the standard-compliant inspection of coordinate measuring machines (CMMs) with contact/optical sensors.

The universal, calibrated artifact comes with the corresponding control and evaluation software. This artifact can be used with the entire ZEISS O-INSPECT series.

## Application

The ZEISS Multisensor Check can be used to inspect coordinate measuring machines in accordance with DIN EN ISO 10360-2, 10360-4 and VDI/VDE 2617, sheet 6.1:

- Probing error of the probe system
- Scanning error of the probe system
- Length measurement error

Probing error and length measurement error are inspected using both contact and optical methods.



## Description

The base of the artifact is a bend-resistant base plate onto which highly precise, calibrated measurement standards are mounted:

- A special adjusting ring for contact and optical measurements, 16 mm diameter
- A precision ceramic sphere, 25 mm diameter
- Two parallel gage blocks, 50 mm and 200 mm long
- A glass scale, 200 mm long
- The required calibration of the ZEISS Multisensor Check is performed as a DAkkS calibration in our calibration lab accredited in accordance with DIN EN ISO/IEC 17025.

The glass scale features precise, circular markings to inspect the probing error and a division scale to inspect the length measurement error.

## Software

Machine-specific control and evaluation software is available for coordinate measuring machines operated using ZEISS CALYPSO.

The following functions are available:

- CNC run of the measurements
- Standard-compliant analysis
- Additional analysis of the measurement results based on monitoring factors

# ZEISS DuraMax Check

The ZEISS DuraMax Check is a procedure for the standard-compliant testing of ZEISS DuraMax coordinate measuring machine with contact sensors.

The artifact can be used for inspection in accordance with DIN EN ISO 10360-2, 10360-4 and VDI/VDE 2617, sheet 6.1.

The following properties can be captured with the artifact and then analyzed using the software:

- Probing error of the probe system
- Scanning error of the probe system
- Length measurement error

The errors are tested using contact measurements.

## Description

The base of the nickel-plated artifact is a rigid base plate onto which high-precision, calibrated measurement standards are mounted:

- A special adjusting ring, 30 mm diameter
- A precision ceramic sphere, 25 mm diameter
- Two parallel gauge blocks, 50 mm and 300 mm long

The necessary calibration of the ZEISS DuraMax Check is performed as a DAkkS calibration in our calibration lab accredited in accordance with DIN EN ISO/IEC 17025.

The magnetic fastenings of the parallel gauge blocks and adjusting ring make it possible to set up and dismantle the artifact in just a few simple steps. Special tools for mounting the sphere are included.

All accessories are neatly stowed away in a case for optimal storage and protection.



## Software

Machine-dedicated control and evaluation software is available for coordinate measuring machines operated using ZEISS CALYPSO. The following functions are available:

- CNC run of the measurements
- Standard-compliant analysis
- Additional analysis of the measurement results based on monitoring factors
- The measuring capability factor enables customized modifications to the inspection criteria.

# ZEISS Bridge Check

The ZEISS Bridge Check in combination with the ZEISS Probe Check is used to perform reverification tests and can be used for monitoring the CMM length measurement errors in accordance with VDI/VDE 2617.

Monitoring primarily tests the influence of the component errors (CMM geometry).

Before using the ZEISS Bridge Check, the probe system must also be inspected. This can be performed using the ZEISS Probe Check or the ZEISS CMM Check.

## Setup possibilities

The accessories included enable you to position the artifact quickly and easily in various configurations on the measuring machine.

## Description

The two-dimensional artifact (multi-sphere test standard) consists of a steel plate.

25 inner sphere elements (highly precise outer rings consisting of ball bearings) arranged in a regular grid pattern are integrated into this plate.

- Large information content due to 300 spacings in different positions and orientations on the multi-sphere test standard.
- The use of inner sphere elements protects against damage and contamination.
- Shorter travel paths than with external spheres significantly reduce the measuring times.
- Clamping device with three supports ensures fastening without a brace across three spheres supported on a sphere, V mount and a plane.
- Insulating elements in the supports prevent heat exchange between the plate and the CMM.

The required calibration of the artifact is conducted as a DAkkS calibration in our calibration lab accredited in accordance with DIN EN ISO/IEC 17025.



## Software

Machine-dedicated control and evaluation software is available for coordinate measuring machines operated using ZEISS CALYPSO.

The following functions are available:

- Standard-compliant monitoring of the CMM geometry in accordance with VDI/VDE 2617, sheet 5.
- Fully automated measurement run following a simple W-position qualification for interior and exterior spheres.
- Graphic analysis of all 300 symmetry distances in a template diagram.
- Evaluation of the CMM geometry using a single number, the so-called monitoring factor (VDI/VDE 2617 sheet 5), long-term monitoring in quality control charts.



# ZEISS Probe Check

The ZEISS Probe Check is a procedure for testing the probing and scanning behavior of the probe in combination with the coordinate measuring system in accordance with VDI/VDE 2617.

## Description

The artifact base consists of a bend-resistant carrier onto which the following are mounted:

- A ceramic sphere (30 mm diameter)
- A setting ring (50 mm diameter)
- The required calibration of both standards is performed as a DAkkS calibration in our calibration lab accredited in accordance with DIN EN ISO/IEC 17025.



## Software

Machine-dedicated control and evaluation software is available for coordinate measuring machines operated using ZEISS CALYPSO.

The following functions are available:

- Standard-conform monitoring and analytical analyses of the CMM stylus system.
- Fast stylus system monitoring on the sphere in accordance with VDI/VDE 2617, sheet 5.
- Enhanced stylus system monitoring on the ring and sphere in accordance with VDI/VDE 2617, sheet 5; also during scanning operation for CMMs with a measuring probe.
- The one-, two- and three-dimensional probing uncertainty V1, V2 or V3 in accordance with VDI/VDE 2617, sheet 3 can also be determined on user-specific styli and in line with the existing operating instructions.
- Probing error determination in accordance with DIN EN ISO 10360-5.
- Long-term evaluation of the probing system using monitoring factors in quality control cards.
- Long-term probing system testing and CMM drift monitoring.

# Multi-Feature Check

The Multi-Feature Check is a procedure used to determine characteristic-based measuring uncertainty and test process suitability for nearly all size, form and position errors which arise in coordinate metrology.

## Application

Depending on the operator's parts spectrum, the following characteristics of the universal artifact can be selected.

Based on the particular measuring machine, the measurement uncertainties can be determined and information on the test process suitability can be derived:

- Diameter, length, angle
- Straightness, flatness, roundness, cylindricity
- Parallelism, perpendicularity, angularity, position, concentricity, coaxiality, symmetry
- Circular radial runout, circular axial runout, total radial runout, total axial runout

When using this procedure, the measurement uncertainties and the test process suitability are determined in as realistic a manner as possible by considering:

- The current on-site temperatures
- Material similar to the workpiece
- Surface influences similar to the workpiece

Based on the particular coordinate measuring machine, measuring uncertainties can be determined and information derived concerning process suitability.



## Description

The core of the Multi-Feature Check is a universal artifact consisting of a cylindrical aluminum base plate with different geometrical features such as those on typical mid-sized workpieces:

- Cylindrical boreholes with different diameters and depths
- A hole circle
- A short cone with a large aperture angle and a long cone with a small aperture angle
- Three flat surfaces, one of which is sloped
- Stepped and face surfaces
- Cylindrical surface of the base plate

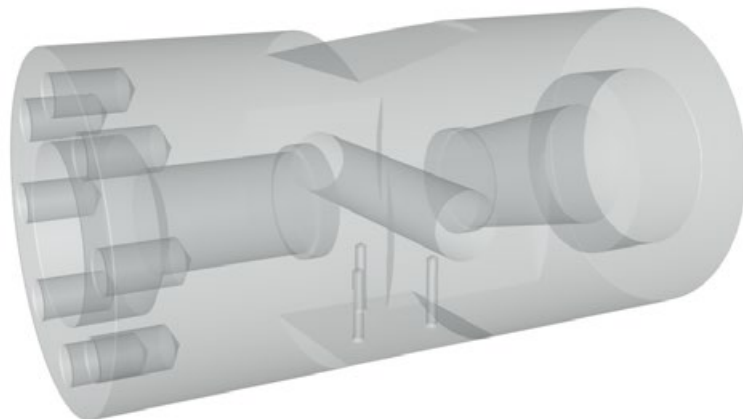
The geometric features are created using standard manufacturing methods so that their surfaces correspond to those of the workpieces. Its surface is hardened to ensure better wear resistance. The length of the artifact is 200 mm and the diameter is 100 mm. Upon request, the artifact can also be manufactured using other materials and with other dimensions.

### **Software**

The Multi-Feature Check comes standard with a ZEISS CALYPSO measurement plan and a DAkkS calibration certificate. The calibration certificate contains the measuring values with the assigned measurement uncertainties for the characteristics measured in the measurement plan. It also provides you with a practical example to serve as a template for determining measuring uncertainty and test process suitability.

### **Artifact calibration**

Calibrating the Multi-Feature Check artifact is performed in a DAkkS calibration lab which is accredited for the measurement of prismatic workpieces in accordance with the "Virtual CMM" PTB method.



# ZEISS Contour Check

The ZEISS Contour Check is used to inspect contour measuring machines in accordance with VDI/VDE directive 2629, sheet 1. Using the contour standard enables the operator to regularly verify compliance with the contour measuring machine specifications.

## Description

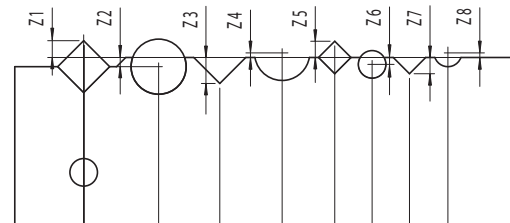
The base plate of the measurement standard is made of hard metal onto which highly precise, calibrated measurement standards and form features are attached.

- Total length: 185 mm with 9 form features
- 2 x 90° angle, convex
- 2 x 90° angle, concave
- 3 x radius, convex
- 2 x radius, concave

Contour Check comes with a fixture for measuring the standard at 0° and 20° inclinations in accordance with the VDI directive.

## DAkKS Calibration

The contour standard is always delivered in a DAkKS-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 Virtual CMM was developed by the German National Metrology Institute (*Physikalisch-Technische Bundesanstalt*, abbr. PTB) in Brunswick.



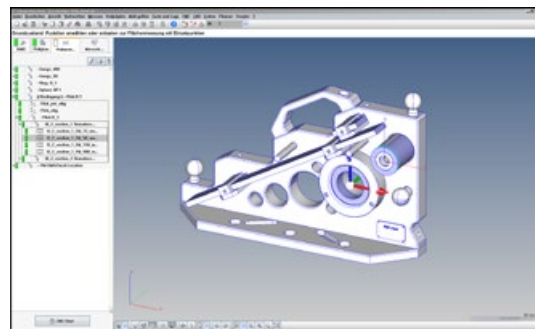
# Control and Evaluation Software

For a fully automated measuring run and subsequent evaluation of the measuring results

The software contains the test procedure and the evaluation routine that outputs the result in the form of monitoring factors. Using the monitoring factors, you can see immediately whether the machine still conforms to the specifications.

The artifacts can be used on multiple coordinate measuring machines. However, a ZEISS CALYPSO software license is required for each machine.

They can also be used on non-ZEISS coordinate measuring machines if these are operated using ZEISS CALYPSO software.



## 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 thanks to the computation and output of monitoring factors  $U$ .
- $U$  is the quotient consisting of measuring errors which have actually been determined and those limits stipulated by the operator. The manufacturer's limit values are used as a starting point.
- The test has not been passed if  $U > 1$ .

## User support

You have the option of having our trained personal install the software for you on your premises and brief you on how to operate the system.

We support you by:

- Defining the test intervals for the individual CMM performance features.
  - Aligning the artifact and the measuring lines.
- This enables you to make optimum use of the various technical and economic benefits of the artifact.

# DAkKS Calibration of Reference Workpieces

We use Virtual CMM to calibrate complex workpieces with direct output of the measurement uncertainty for various measuring tasks.

This is required for measurement traceability in industry.

## Measuring method

The reference workpieces are measured in our calibration lab accredited in accordance with DIN EN ISO/IEC 17025 on our highly accurate, calibrated coordinate measuring machine.

Virtual CMM is used to determine the task-specific measuring uncertainties for the measured values. A simulation of the measuring process which considers influencing parameters of CMM geometry errors, probing system errors and the ambient conditions is used to determine uncertainty. This method was developed by the German National Metrology Institute (*Physikalisch-Technische Bundesanstalt*, abbr. PTB) in Brunswick and is accepted around the world.

## How you benefit

- DAkKS calibration certificate with traceability of the measured values to national standards
- DAkKS calibration certificate accepted around the world
- Monitoring of the measuring process with calibrated master parts or reference workpieces
- Accredited in accordance with DIN EN ISO/IEC 17025
- Evaluation of your measuring process

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Kalibrierschein Calibration certificate		9876 DAK- 15007-00-00 2014-01
Gegenstand Object	<b>Konturennormal</b> Contour Standard	Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Die DAkKS ist Unterzeichner der multilateralen Übereinkommen der European Cooperation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich. This calibration certificate documents the traceability to national standards, which makes the units of measurement according to the International System of Units (SI). The DAkKS is signatory to the multilateral agreements of the European Cooperation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates. The user is obliged to have the object recalibrated at appropriate intervals.
Hersteller Manufacturer	<b>Carl Zeiss Industrielle Messtechnik GmbH</b> <b>Robert-Bosch-Straße 27</b> <b>73431 Aalen</b>	
Typ Type	<b>Contour-Check CC185</b>	
Fabrikat/Serien-Nr. Serial number	<b>2602640822</b>	
Auftraggeber Customer	<b>Carl Zeiss Industrielle Messtechnik GmbH</b> <b>Carl-Zeiss-Straße 22</b> <b>73447 Oberkochen</b>	
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08.01.2014	Matthias Harsch	Michael Gary

# What does monitoring mean?

## Terms and definitions

Monitoring a measuring machine enables fast, random inspection of the measuring accuracy without interrupting operations and is based on the requirements for test equipment monitoring as per DIN ISO 9000 through 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 operator's stipulations and the manufacturer's procedures.

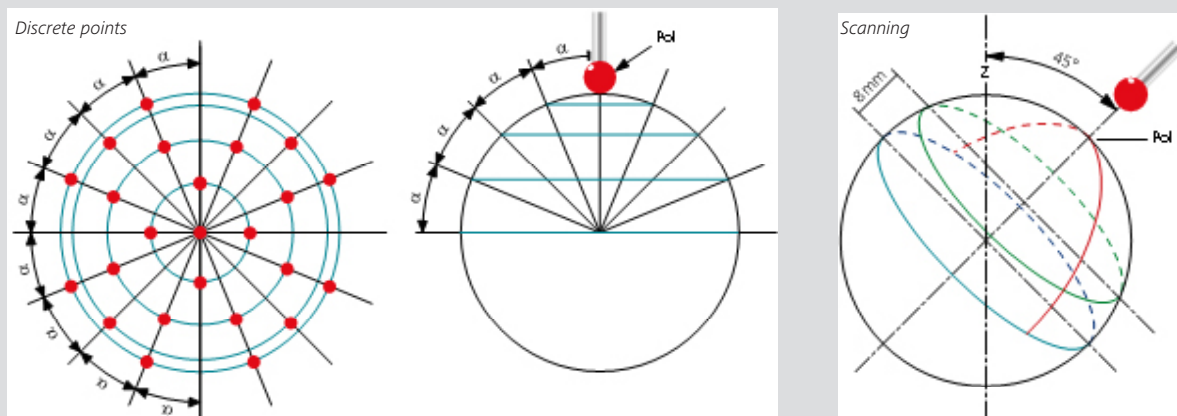
### In-process inspection

Regular monitoring of measuring machines between scheduled recertification tests is strongly recommended in ISO 10360

The intervals of the in-process inspection are dependent on the ambient conditions and the required performance.

However, measuring machines should immediately be tested after every major incident that may affect machine performance.

The scope of the in-process inspection described in the relevant section of ISO 10360 can be reduced in the number of measurements, positions and directions.



Probing point distribution for determining the probing error in accordance with DIN EN ISO 10360, sheets 4 and 5

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