COORDINATE MEASURING MACHINES

Premium technology for maximum precision
3D coordinate measuring machines from Mitutoyo: the new dimension of quality assurance.

Today’s manufacturing demands more accuracy, speed and functionality from measuring technologies. Here, 3D coordinate measuring machines from Mitutoyo reveal their full potential, demonstrating absolute precision, ground-breaking innovation and high efficiency.

This brochure presents an overview of Mitutoyo’s current range of 3D coordinate measuring technology to help you choose the system that best meets your needs. It shows instrument specifications, configurations, additional equipment options and software solutions.

Single product brochures are also available to provide detailed information on the 3D CMM of your choice.

Whichever model you choose, with a coordinate measuring machine from Mitutoyo you can trust in the experience, competence and high performance of a world leader in measurement technology and be assured of first-class, customer-oriented service.
3D coordinate measuring machines from Mitutoyo: advanced technology for custom-made solutions.

<table>
<thead>
<tr>
<th>Model</th>
<th>Profile</th>
<th>Accuracy* (ISO 10360-2)</th>
</tr>
</thead>
</table>
| CRYSTA-PLUS M    | Manually operated, the CRYSTA-PLUS M is the smallest model in the series. It requires the minimum of floor space while delivering high accuracy and affordability right to the shop floor. | Series 500 models $MPE_{\varepsilon}=(3.5+0.45L/100) \mu m$  
Series 700 models $MPE_{\varepsilon}=(4.5+0.45L/100) \mu m$  |
| Manual           |                                                                         | Series 500 models $MPE_{\varepsilon}=(1.7+0.3L/100) \mu m$  
Series 700 models $MPE_{\varepsilon}=(1.7+0.3L/100) \mu m$  
Series 900 models $MPE_{\varepsilon}=(1.7+0.3L/100) \mu m$  
Series 1200 models $MPE_{\varepsilon}=(2.3+0.3L/100) \mu m$  |
| CRYSTA-APEX C    | CNC instrument for the fulfilment of demanding tasks in laboratory and production. A series particularly rich in variants with a broad selection of measuring ranges. |                                                                                       |
| CNC              |                                                                         | Series 500 models $MPE_{\varepsilon}=(1.2+0.3L/100) \mu m$  
Series 700 models $MPE_{\varepsilon}=(1.3+0.3L/100) \mu m$  
Series 900 models $MPE_{\varepsilon}=(1.3+0.3L/100) \mu m$  
Series 1600 models $Z=1000$ $MPE_{\varepsilon}=(3.8+0.4L/100) \mu m$  
$Z=1500$ $MPE_{\varepsilon}=(4.8+0.5L/100) \mu m$  |
| STRATO CNC       | High-precision CNC system for performance-oriented use in the quality control room and the production environment. With integrated active vibration damping. |                                                                                       |
| CNC              |                                                                         | Series 700 model $MPE_{\varepsilon}=(0.48+0.1L/100) \mu m$  
Series 900 model $MPE_{\varepsilon}=(0.48+0.1L/100) \mu m$  |
| LEGEX CNC        | CNC instrument with an impressive accuracy of 0.48 µm. The ultimate in CMM accuracy, suitable for complex, small- to medium-size workpieces. |                                                                                       |
| CNC              |                                                                         | Series 400 model $15 ^\circ C$ to $25 ^\circ C$ $MPE_{\varepsilon}=(3.5+0.4L/100) \mu m$  
$15 ^\circ C$ to $35 ^\circ C$ $MPE_{\varepsilon}=(5.0+0.5L/100) \mu m$  
Series 800 model $15 ^\circ C$ to $25 ^\circ C$ $MPE_{\varepsilon}=(3.5+0.4L/100) \mu m$  
$15 ^\circ C$ to $35 ^\circ C$ $MPE_{\varepsilon}=(5.0+0.5L/100) \mu m$  |
| MACH CNC         | CNC instrument with the extremely high drive speed of up to 1,800 mm/sec. Designed for use in a production line. |                                                                                       |

*within temperature range 18 °C to 22 °C (except for MACH)
### Measuring ranges X:Y:Z (mm)

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
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<tbody>
<tr>
<td>500</td>
<td>400 : 400</td>
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<tr>
<td>700</td>
<td>1000 : 600</td>
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<td>505</td>
<td>405 : 405</td>
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<td>1205</td>
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<td>1605</td>
<td>4005 : 1505</td>
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<td>705 : 455</td>
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<td>905</td>
<td>1005 : 605</td>
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<tr>
<td>460</td>
<td>460 : 300</td>
</tr>
<tr>
<td>1021</td>
<td>818 : 615</td>
</tr>
</tbody>
</table>

### Highlights

- Compact design with excellent performance to cost ratio
- Retrofittable to CNC operation
- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 16 °C to 26 °C possible as an option
- High drive speed up to 520 mm/sec
- Compatible with multiplex measuring systems
- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 18 °C to 22 °C
- High drive speed up to 430 mm/sec
- Compatible with multiplex measuring systems
- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 18 °C to 22 °C
- High drive speed up to 200 mm/sec
- Integrated active vibration damping
- Outstanding rigidity
- Very high drive speed with extreme precision
- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 15 °C to 35 °C
- High measuring speed up to 30 mm/s
- Enormous stability and loading capacity
CRYSTA-PLUS M
Compact and economical.

Designed and constructed with all Mitutoyo’s experience in CNC CMM technology, the CRYSTA-PLUS M features lightweight materials and an innovative machine structure. Requires minimum floor space and provides high accuracy and affordability.

- Retrofittable to CNC operation
- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 16 °C to 26 °C possible as an option
- Optional measuring stand illumination on the Z axis to simplify positioning
- Designed for low maintenance and continuous, long-term operation
- High-precision, dust-resistant glass scales on all axes
- Self-adjusting air bearings on all axes
- Compact dimensions
- Premium software supplied as standard for user-friendly measurement and evaluation
- Excellent performance to cost ratio

<table>
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<th>Model</th>
<th>Measuring range X : Y : Z (mm)</th>
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<tbody>
<tr>
<td>CRYSTA-PLUS M544</td>
<td>500 : 400 : 400</td>
<td>MPE_L=(3.5+0.45L/100) µm</td>
</tr>
<tr>
<td>CRYSTA-PLUS M574</td>
<td>500 : 700 : 400</td>
<td>MPE_L=(3.5+0.45L/100) µm</td>
</tr>
<tr>
<td>CRYSTA-PLUS M776</td>
<td>700 : 700 : 600</td>
<td>MPE_L=(3.5+0.45L/100) µm</td>
</tr>
<tr>
<td>CRYSTA-PLUS M7106</td>
<td>700 :1000: 600</td>
<td>MPE_L=(3.5+0.45L/100) µm</td>
</tr>
</tbody>
</table>

*within temperature range 19 °C to 21 °C
3.5 and 4.5 µm accuracy

Manual adjustment of probe holder and stylus

Individual axis locks and fine adjusters
Stable, accurate measuring results even while temperature is changing

Even while the temperature of the machine or the workpiece is changing, Mitutoyo coordinate measuring machines perform just as superbly as they do under thermally stable conditions. Sensors attached to the CMM and workpiece detect temperature variations and transfer this information to the controller so it can apply the appropriate corrections to the system in real time. This guarantees shop floor measurements to an accuracy that can otherwise only be obtained in a thermally stable quality control room.

Thermal compensation in action

The graph shows thermal-effect compensation in action during measurement of an 800 mm steel gauge block mounted diagonally on the CMM table. The nominal length of the gauge block (as at 20 °C) is maintained very accurately by the CMM while the block expands and contracts as its temperature varies.

Higher accuracy from new construction principles

Higher stability and guideway accuracy through state-of-the-art technologies: the bridges of Mitutoyo’s coordinate measuring machines are designed using a finite element method (FEM) analysis that guarantees high rigidity and straightness of the guideways as well as effective vibration damping. The high heat conductivity of the aluminium-alloy guideways prevents linear or torsional deflection through thermal influences.

Dust-resistant glass scales

Mitutoyo coordinate measuring machines employ high precision dust-resistant glass scales. Temperature sensors on the scales provide the drive signals for the integrated thermal-effect compensation system.
**Space saving and light weight**

3D coordinate measuring machines from Mitutoyo do not require any special constructional prerequisites at the installation site. Thanks to particularly high-quality lightweight materials and space-saving dimensions, a hard and stable mounting surface with normal machine-standard foundations is quite sufficient.

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**Air-bearings on all axes**

Self-adjusting air bearings on all axes allow particularly smooth, fast and precise movements, a basic prerequisite for high-precision.

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**Practical measuring ranges**

The user defines the task spectrum, Mitutoyo supplies the solution. Generous measuring ranges allow a greater variety in the shape of workpiece that can be handled, opening up an extraordinarily wide field of application for the CMM.

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**High dynamic performance and flexibility through digital drive**

Mitutoyo’s coordinate measuring machines use an extremely powerful 32-bit digital signal processor (DSP) in the control function. This processor ensures all movements, coordinate positioning and speed are perfectly controlled for maximum measuring performance. A major advantage of this approach is that control programs for accessory devices are quickly and easily installed.
Today’s manufacturing demands more accuracy, speed and functionality from 3D coordinate measuring machines. The CRYSTA-APEX C delivers all this, and more, giving you all the benefits of a highly functional and productive tool.

- High-precision, dust-resistant glass scales on all axes
- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 16 °C to 26 °C
- High drive speed of up to 520 mm/sec
- Self-adjusting air bearings on all axes
- Fully digital servo control for low-vibration movements
- Compact dimensions
- Premium software supplied as standard for user-friendly measurement and evaluation

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<tr>
<td>CRYSTA-APEX C544</td>
<td>505: 405 : 405</td>
<td>MPE= (1.7+0.3L/100) μm</td>
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<td>CRYSTA-APEX C574</td>
<td>505: 705 : 405</td>
<td>MPE= (1.7+0.3L/100) μm</td>
</tr>
<tr>
<td>CRYSTA-APEX C76</td>
<td>705: 705 : 605</td>
<td>MPE= (1.7+0.3L/100) μm</td>
</tr>
<tr>
<td>CRYSTA-APEX C7106</td>
<td>705:1005: 605</td>
<td>MPE= (1.7+0.3L/100) μm</td>
</tr>
<tr>
<td>CRYSTA-APEX C9106</td>
<td>905:1005: 605</td>
<td>MPE= (1.7+0.3L/100) μm</td>
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<tr>
<td>CRYSTA-APEX C9108</td>
<td>905:1005: 805</td>
<td>MPE= (1.7+0.3L/100) μm</td>
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<td>CRYSTA-APEX C9166</td>
<td>905:1605: 605</td>
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<td>MPE= (1.7+0.3L/100) μm</td>
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<tr>
<td>CRYSTA-APEX C9206</td>
<td>905:2005: 605</td>
<td>MPE= (1.7+0.3L/100) μm</td>
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<tr>
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<td>905:2005: 805</td>
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<td>CRYSTA-APEX C122010</td>
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<td>MPE= (2.3+0.3L/100) μm</td>
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<td>CRYSTA-APEX C123010</td>
<td>1205:3005:1005</td>
<td>MPE= (2.3+0.3L/100) μm</td>
</tr>
</tbody>
</table>

*within temperature range 18 °C to 22 °C
1.7 and 2.3 µm accuracy

Self-adjusting air bearings on all axes
Dust-resistant high-precision glass scale
Using powerful 3D CNC measuring concepts, STRATO provides high accuracy and fast measuring speed right on the production line. Thanks to innovative technologies, STRATO easily masters changing temperatures, heavy vibration and a less-than-ideal environment.

- Integrated active vibration damping
- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 18 °C to 22 °C
- High drive speed of up to 430 mm/sec
- High-precision, dust-resistant glass scales on all axes
- Self-adjusting air bearings on all axes
- Fully digital servo control for low-vibration movements
- Vibration-damping ball-screw nut bearing
- Compact dimensions
- Premium software supplied as standard for user-friendly measurement and evaluation

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<tr>
<td>STRATO 776</td>
<td>705: 705: 605</td>
<td>MPEE=(3.2+0.3L/100) µm</td>
</tr>
<tr>
<td>STRATO 7106</td>
<td>705:1005: 605</td>
<td>MPEE=(1.2+0.3L/100) µm</td>
</tr>
<tr>
<td>STRATO 9106</td>
<td>900:1005: 605</td>
<td>MPEE=(1.3+0.3L/100) µm</td>
</tr>
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<td>STRATO 9166</td>
<td>900:1605: 605</td>
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<tr>
<td>STRATO 162012</td>
<td>1605:2005:1205</td>
<td>MPEE=(3.8+0.4L/100) µm</td>
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<tr>
<td>STRATO 162015</td>
<td>1605:2005:1505</td>
<td>MPEE=(4.8+0.5L/100) µm</td>
</tr>
<tr>
<td>STRATO 163012</td>
<td>1605:3005:1205</td>
<td>MPEE=(3.8+0.4L/100) µm</td>
</tr>
<tr>
<td>STRATO 163015</td>
<td>1605:3005:1505</td>
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<td>1605:4005:1505</td>
<td>MPEE=(4.8+0.5L/100) µm</td>
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*within temperature range 19 °C to 21 °C
1.2 and 1.3 μm accuracy
3.8 and 4.8 μm accuracy

01 STRATO
02 CNC
03 Floating ball-screw and nut drive system
04 Dust-resistant high-precision glass scale
Time is money: more speed, less time. An extremely high drive speed of up to 1,800 mm/sec means the MACH is fast enough to be built directly into a production line. High-speed drive is matched by an impressive measuring speed of up to 30 mm/sec, smoothly coordinated by the fully digital servo control with 32-bit digital signal processor.

- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 15 °C to 35 °C
- High drive speed up to 1,800 mm/sec
- Measuring speed up to 30 mm/sec
- 1.8 g maximum acceleration
- High-precision, dust-resistant glass scales on all axes
- Self-adjusting air bearings on all axes
- Fully digital servo control
- Optimised workpiece handling on CNC production lines
- Premium software supplied as standard for user-friendly measurement and evaluation

<table>
<thead>
<tr>
<th>Model</th>
<th>Measuring range X : Y : Z (mm)</th>
<th>Accuracy (ISO 10360-2)</th>
<th>Temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACH 403</td>
<td>460: 460: 300</td>
<td>MPEE= (3.5+0.4L/100) µm</td>
<td>15°C to 35°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MPEE= (5.0+0.5L/100) µm</td>
<td></td>
</tr>
<tr>
<td>MACH 806</td>
<td>1021: 818: 615</td>
<td>MPEE= (3.5+0.4L/100) µm</td>
<td>15°C to 35°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MPEE= (5.0+0.5L/100) µm</td>
<td></td>
</tr>
</tbody>
</table>

This option is available to integrate the MACH 806 into a production line.
3.5 and 5.0 µm accuracy
Designed for premium performance and exceptional measurement accuracy, the LEGEX defines the limit of what is technically feasible today in 3D coordinate measurement. With LEGEX, Mitutoyo has achieved an unmatched accuracy and set a new standard in quality assurance, worldwide. For precision beyond imagination, for challenges beyond the usual.

- High precision for the quality control room
- Fixed bridge structure with moving measuring table on the Y axis
- Integrated active vibration damping
- Extraordinary geometric and kinematic accuracy
- Zerodur® ultra-stable glass scales with an expansion coefficient of 0.01 x 10⁻⁶ per K
- Ultra-high scale resolution of 0.01 μm
- Integrated thermal-effect compensation for instrument and workpiece temperature variation within the range 18 °C to 22 °C
- High drive speed up to 200 mm/sec
- Self-adjusting air bearings on all axes
- Vibration-damping ball-screw nut bearing
- Fully digital servo control for low-vibration movements
- Premium software supplied as standard for user-friendly measurement

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<td>LEGEX 774</td>
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<td>LEGEX 9106</td>
<td>905 : 1005 : 605</td>
<td>MPE = (0.48 + 0.1 L/100) μm</td>
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</tbody>
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*within temperature range 18 °C to 22 °C
0.48 µm accuracy

- Newly developed scanning sensors for maximum resolution
- Actively controlled, integrated, vibration-damping measuring table
- Fixed-bridge structure with moving measuring table
- Unique working range from 18°C to 22°C with constantly high accuracy
To ensure you find the best solution for any of your measuring tasks, Mitutoyo offers a comprehensive range of contact and non-contact measuring systems. These widely expandable systems are supported by stationery and motorised swivelling probe heads, electric probes, extensions and probe inserts for use in conjunction with efficient probe-changing systems.
Fixture system.

Gripping subject: the flexible REPRO-FIX fixture system for even more time saving, efficiency, economy and precision in shop floor measurements.

Perfectly matched to Mitutoyo’s coordinate measuring machines, REPRO-FIX solves any task however individual. Through simple-to-handle standard fixture technology, REPRO-FIX is easily disassembled completely or in modules. With the supplementary QUICK-RAIL kit for positioning the REPRO-FIX elements, this can be done even more efficiently.
**Powerful software to meet every requirement**

The high-end MiCAT software suite developed by Mitutoyo puts the capabilities of a variety of powerful software packages at your fingertips. Available to suit any purpose, from basic geometry measurement to digitising complex profiles and surfaces, measurement results can be presented in a professional manner using a powerful protocol design function to give concise reports in a variety of adaptable formats.

MiCAT promotes real cost-effectiveness by allowing you to purchase only the software functionality you want. M-COSMOS 1 is supplied as standard equipment with all coordinate measuring machines and you have the choice of using the product as is, upgrading with optional modules or buying extra functionality from the outset with M-COSMOS 2 or M-COSMOS 3, both of which can be upgraded to suit your needs.

<table>
<thead>
<tr>
<th>Module features</th>
<th>M-COSMOS 1</th>
<th>M-COSMOS 2</th>
<th>M-COSMOS 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PartManager</strong></td>
<td><img src="image" alt="M-COSMOS 1" /></td>
<td><img src="image" alt="M-COSMOS 2" /></td>
<td><img src="image" alt="M-COSMOS 3" /></td>
</tr>
<tr>
<td>The command centre that manages the M-COSMOS software modules.</td>
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</tbody>
</table>

**Geometry (GEOPAK)**

For easy part-program generation (online/offline) and measurement of geometric components combined with flexible protocol reporting.

**Online/Offline Programming (CAT 300)**

Allows easy part-program generation (online/offline) supported by the use of CAD data for rapid programming and collision detection.

**3D Freeform Surface Analysis (3D-TOL)**

Enables automatic analysis of surface form using CAD data to provide nominal/actual comparisons.

**2D Profile Evaluation and 3D Digitising (SCANPAK)**

Combines automatic scanning of workpiece profiles and 3D surface digitising capabilities.
**Statistical Evaluation**
Allows real-time data acquisition, SPC analysis and integrated networking

**2D Profile Evaluation and 3D Digitising**
Combines automatic scanning of workpiece profiles and 3D surface digitising capabilities

**Airfoil Contour Evaluation**
Provides measurement and analysis of airfoil contours in terms of selected characteristics

**Gear Profile Evaluation**
Designed to measure and compare all types of gear-tooth profiles against in-house or international tolerance standards

**Standard Measuring Instruments Interface**
Supports interoperability between different CMMs and systems

**NC Program Feedback and Adjustment**
Enables process centering from between-cycle measurement and analysis

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**M-COSMOS** is the MiCAT CMM software system for professional measurement and evaluation in coordinate inspection.
Choose a coordinate measuring machine from Mitutoyo and put your trust in the competence and cutting-edge technology of the international leader in production measurement technology. Take advantage of Mitutoyo’s decades of experience to help achieve your goals. In Mitutoyo you have a partner who sets the highest standards for quality, performance and progressiveness in business.