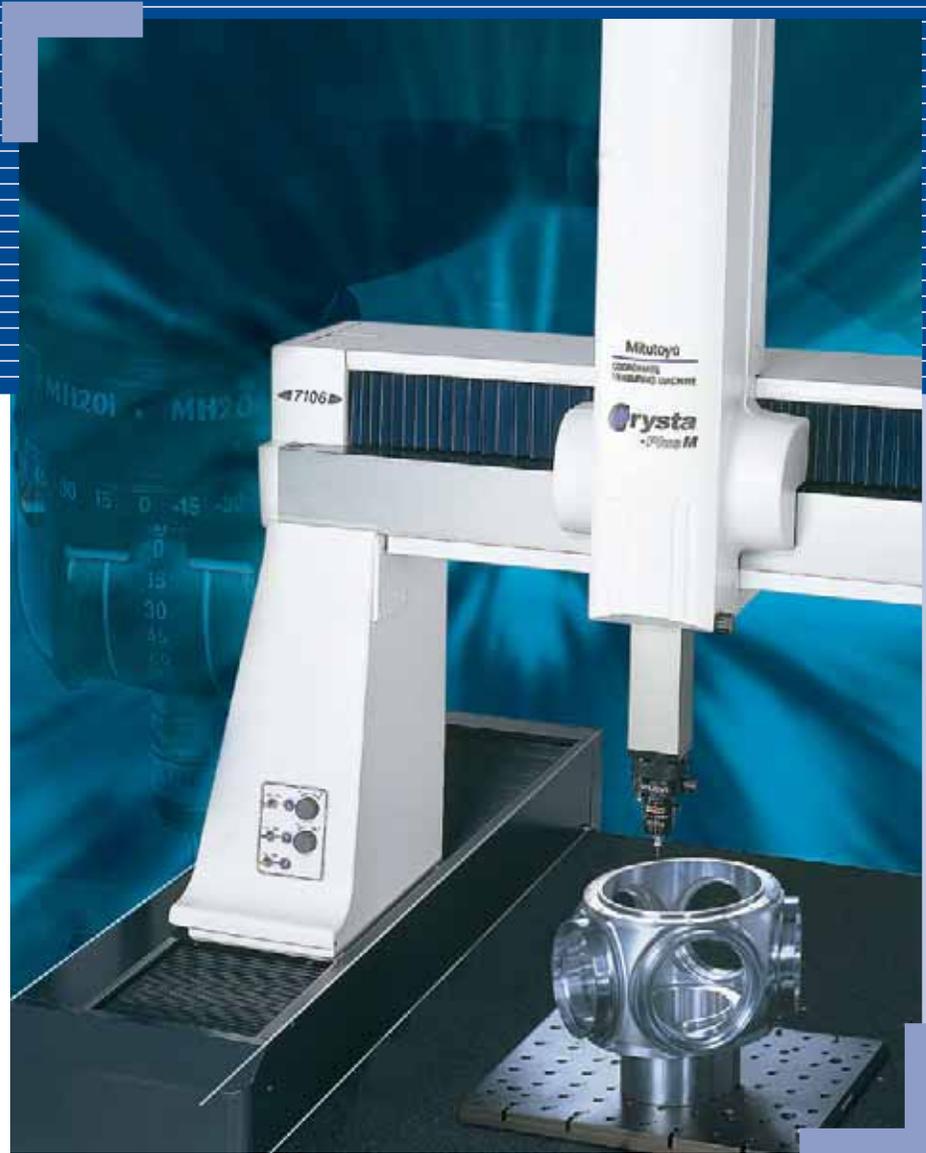# CRYSTA-PLUS M

Bulletin No. 1957

A low cost, highly accurate, compact and easy-to-operate measuring instrument featuring frictionless air-bearing suspension

Mitutoyo

CRYSTA-PLUS M:
Precision that couldn't be clearer

Welcome to the world of 3D coordinate measuring technology! CRYSTA-PLUS M is the intelligent alternative to complex and cost-intensive measuring machines or conventional measuring tools. As a high-performance manual 3D coordinate measuring instrument, CRYSTA-PLUS M comes into its own wherever constantly changing measuring tasks, many different types of workpiece and random sampling is the order of the day.

Manual

Mitutoyo

CRYSTA-PLUS M

CRYSTA-PLUS M:
All-in-all the most economical solution

Measuring work is a highly individual matter - particularly where measurements cannot always be made in seconds. Spot-checking in production or special tasks, for instance, or pre-setting tools in diesinking EDM. Here, and in all other special measurement tasks, CRYSTA-PLUS M is the ideal solution for performance- and cost-conscious users. CRYSTA-PLUS M combines the capabilities of many individual measuring and test instruments in a single, economical, all-round system - making enormous savings possible from purchase and use all the way through to long-term maintenance.

Economical

CRYSTA-PLUS M is ready for any new challenge. For example, it is capable of integration with optical sensors, including the appropriate image processing software.

CRYSTA-PLUS M comes with high-end MCOSMOS software with Mitutoyo Intelligent Computer Aided Technology (MiCAT) as standard, the user-friendly command center for professional measuring and evaluation. Combined with numerous optional application-specific modules, MCOSMOS will rise with ease to any challenge, however demanding the specification.

Add to that a highly versatile, use-specific range of accessories from specially designed sensor systems through to a flexible clamping system.

With CRYSTA-PLUS M, a whole world of high-performance manual 3D coordinate measuring will open up to you. The plus in performance will soon pay for itself.

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CRYSTA-PLUS M:
Higher quality, point for point

- Length measuring accuracy 3.5 µm*: impressively accurate for manual 3D coordinate measurement
- High-precision (resolution: 0.5 µm), dustproof glass scales on all axes
- High-end software as standard
- Voice guidance for operator through use of MCOSMOS software
- Self-adjusting air bearings on all axes
- FEM-aided design ensures geometric accuracy and vibration resistance
- 2 series with 4 variants
- CCD camera compatible
- Space saving and light, compact design built with high quality materials
- Outstanding price/performance ratio
- White LED illumination of the working field to help position the probe and locate test features (option)
- Integrated thermal-effect and volumetric-error compensation for instrument and workpiece in the temperature range 16 °C to 26 °C (option)

Versatile

* For models with 500 mm X-axis travel:
  MPEE = (3.5+0.45L/100) µm with TP20/MH20I probes in the temperature range 19 °C to 21 °C (or 16 °C to 26 °C using the optional thermal-effect compensation).

CRYSTA-PLUS M:
Simply the best ideas

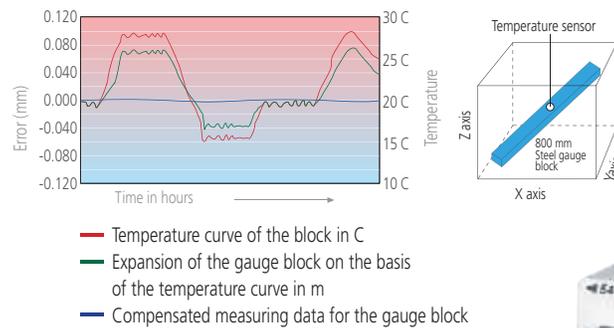Temperature sensor

Control unit

Workpiece

Thermo-meter
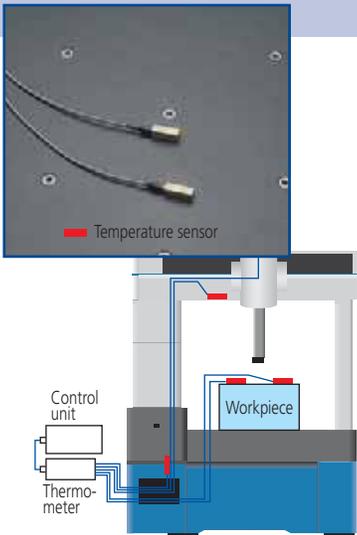
The measuring results are stable even when temperatures fluctuate (option)

Even with the machine environment and the workpiece temperature fluctuating between 16 °C and 26 °C, CRYSTA-PLUS M measures as if thermal conditions were stable. Sensors on the CRYSTA-PLUS M and workpiece record temperature variations and feed the information to the automatic thermal-effect compensation system, which then corrects all measurements back to 20 °C in real time. This results in shop floor measurements being made to a level of accuracy only otherwise possible in thermally stable measurement laboratories.

Corrections made clear

Temperature-dependent correction using an 800 mm steel gauge block as an example - measured with alternating environmental temperatures diagonally in the room.

Intelligent

Temperature sensor

800 mm Steel gauge block

Z axis
X axis
Y axis

Error (mm)
0.120
0.080
0.040
0.000
-0.040
-0.080
-0.120

Temperature
30 C
25 C
20 C
15 C
10 C

Time in hours

— Temperature curve of the block in C
— Expansion of the gauge block on the basis of the temperature curve in m
— Compensated measuring data for the gauge block

Rapid positioning

Rapid traverse in the X, Y and Z axes and central, fine adjustment for the X and Y axes.

Uncomplicated

Voice guidance

CRYSTA-PLUS M provides voice guidance for the user throughout the MCOSMOS Software. This prevents misunderstandings and directs full concentration on guiding the instrument. This enables even less-experienced operators to carry out complex measuring tasks safely and without error.
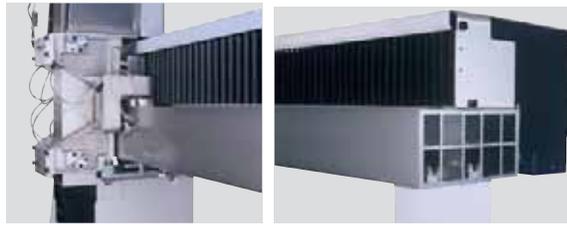
Mitutoyo

Mitutoyo
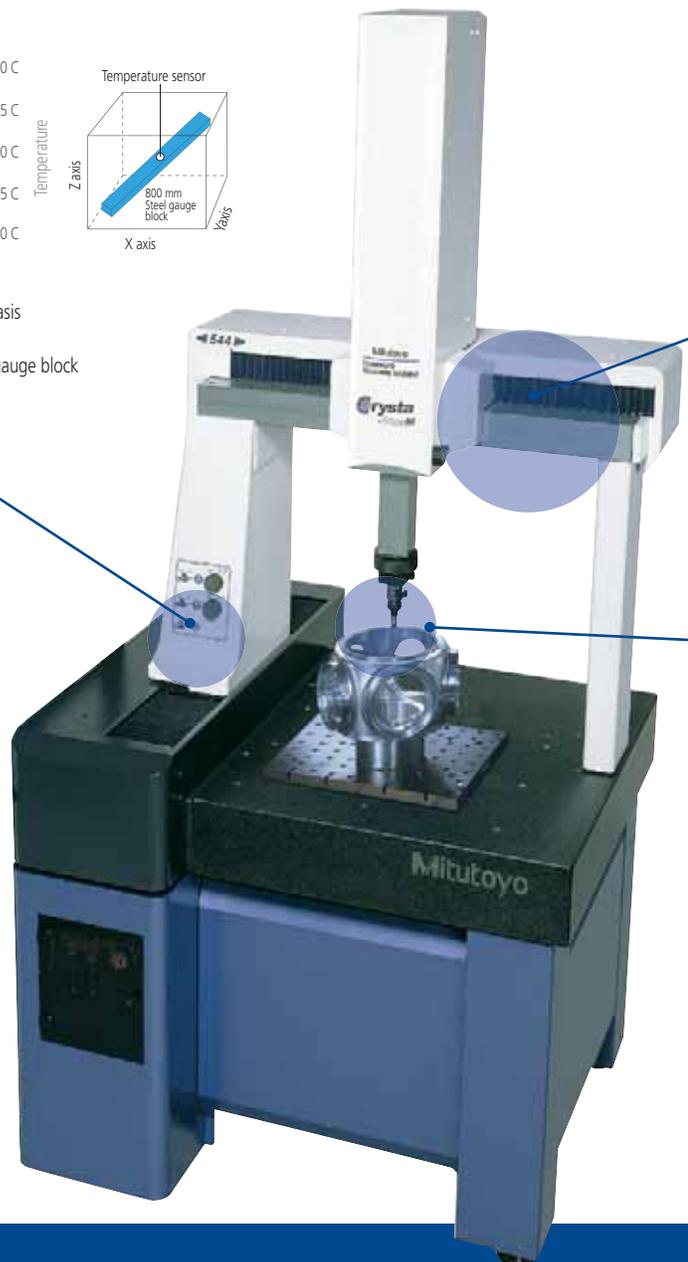
Dustproof glass scales
CRYSTA-PLUS M uses high-precision dustproof glass scales with a resolution of 0.5 μm. Optional sensors on the instrument scales provide temperature compensation. This makes CRYSTA-PLUS M particularly suitable for use in a harsh production environment.

Air bearings on all axes
Self-adjusting air bearings on all axes allow CRYSTA-PLUS M to move the probe with outstanding smoothness, speed and precision. They form the basis for absolute measuring accuracy.

Modern technology for accurate guidance
Finite element method (FEM) analysis was used to achieve a highly rigid bridge structure design that ensures exceptional guideway straightness and good suppression of vibrations. The high thermal conductivity of the aluminium guideways helps prevent deflection and twisting due to thermal-gradient effects.

Scale with optional sensor

Superior

Compact

Space-saving and light
CRYSTA-PLUS M does not require any special constructual 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.

Stable
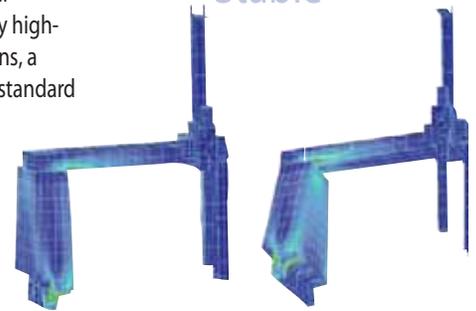
Uncomplicated

Focused

Illuminated working field (option)
To make positioning the probe easier, CRYSTA-PLUS M can be fitted with a white LED illuminator on the spindle. This illuminates the probe styli directly and also brightens the working field. A very convenient feature, especially when measuring bores.

Constant

Constant measurement
The ergonomically designed guide grip on the Z axis helps prevent measurement inaccuracies due to any unsteadiness in manual operation.

Quality with complete versatility
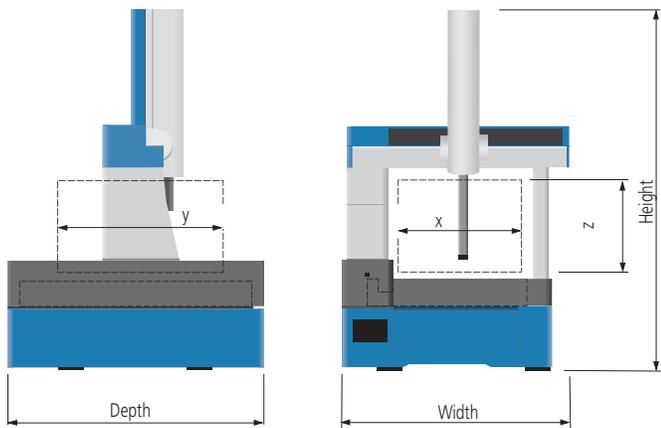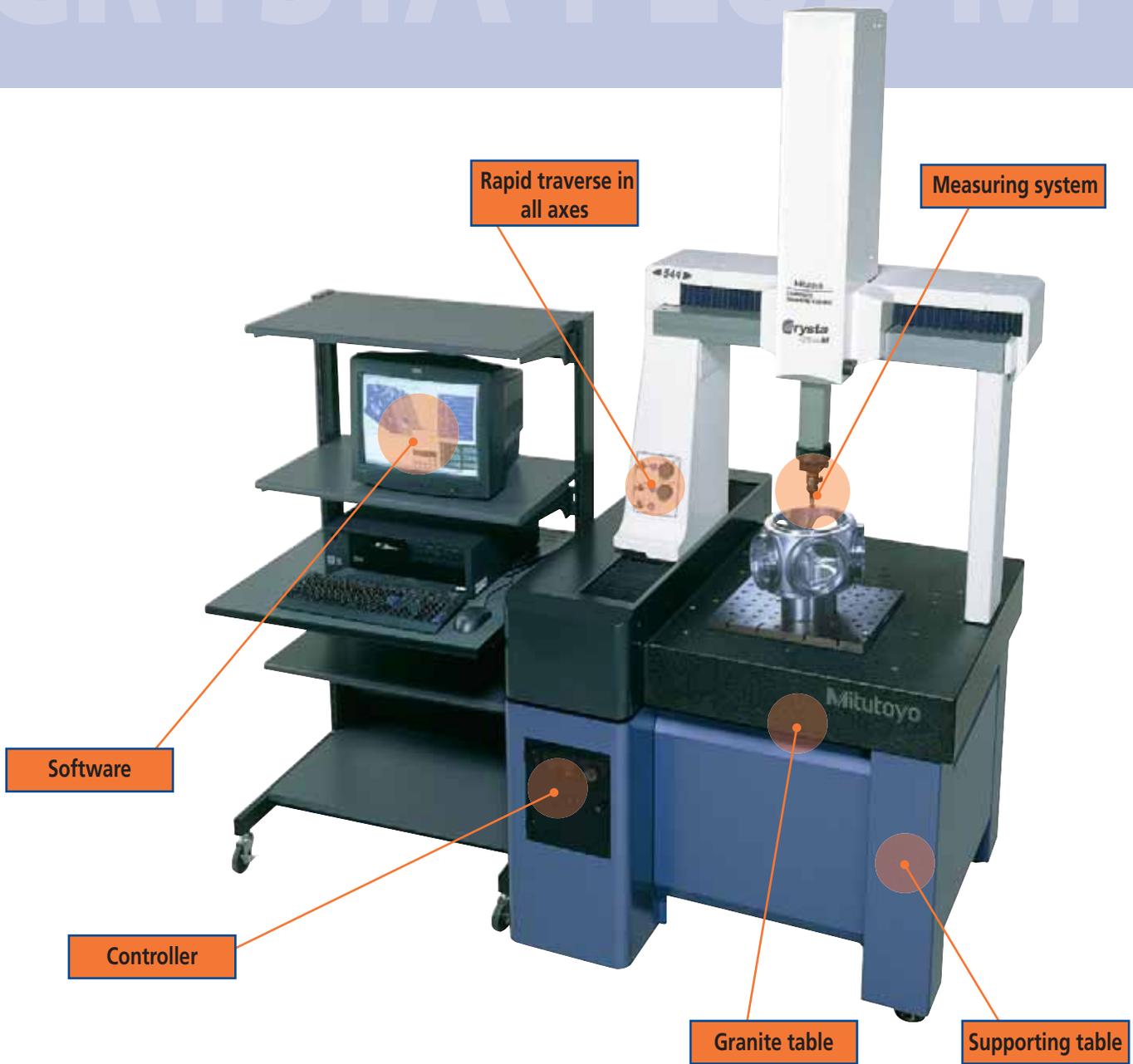
Series M443

Series M500

Series M700

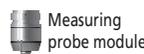| Model		Crysta-Plus M443	Crysta-Plus M574	Crysta-Plus M7106
Measuring Range	X axis	15.75″ (400 mm)	19.69″ (500 mm)	27.56″ (700 mm)
	Y axis	15.75″ (400 mm)	27.56″ (700 mm)	39.37″ (1000 mm)
	Z axis	11.81″ (300 mm)	15.75″ (400 mm)	23.62″ (600 mm)
Workpiece	Max. workpiece height	18.9″ (480 mm)	20.08″ (510 mm)	31.50″ (800 mm)
	Max. table loading	396 lbs (180 kg)	396 lbs (180 kg)	1760 lbs (800 kg)
Workpiece Clamping	No. of M8 x 1.25″ Threaded Holes	13	13	13
Machine Accuracy	ISO 10360-2 (20 °C ±1 °C)	E=(3.0+4.0L/100)µm	E=(3.5+4.5L/100)µm	E=(4.5+4.5L/100)µm
Probe Repeatability	ISO 10360-2	R=4.0µm (TP20)	R=4.0µm (TP20)	R=5.0µm (TP20)
Environmental temperature		20 °C ±1 °C	20 °C ±1 °C	20 °C ±1 °C
Resolution	Length measuring system	.00002″ (0.5µm)	.00002″ (0.5µm)	.00002″ (0.5µm)
Guidance		Air bearings on all axes	Air bearings on all axes	Air bearings on all axes
Measuring Table	Material	Granite	Granite	Granite
	Dimensions	33.07″ x 51.97″ (624 x 805mm)	25.12″ x 45.67″ (638 x 1160mm)	34.65″ x 67.72″ (880 x 1720mm)
Air supply	Consumption/air pressure	ca. 50 l/min at 0.35 MPa	ca. 50 l/min at 0.35 MPa	ca. 50 l/min at 0.4 MPa
Dimensions	Width	38.62″ (981 mm)	42.60″ (1082 mm)	57.87″ (1470 mm)
	Depth	41.22″ (1047 mm)	57.40″ (1458 mm)	76.77″ (1950 mm)
	Height	77.44″ (1967 mm)	89.96″ (2285 mm)	111.42″ (2830 mm)
Mass	(with supporting table)	904 lbs (410kg)	1353 lbs (615kg)	3586 lbs (1630kg)

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Rapid traverse in all axes

Measuring system

Software

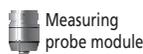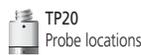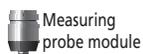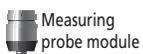Controller

Granite table

Supporting table

Depth

Width

Height

x

y

z

Quality and versatility in every case: Mitutoyo measuring systems

Leaving nothing to chance in your measuring tasks, Mitutoyo offers an extremely wide range of contact and non-contact measuring systems. Each part is carefully coordinated with the multisensor capability of the CRYSTA-PLUS M.

Contact measuring systems				Non-contact measuring systems	
Manual, stepless, rotating measuring systems		Manual rotating, indexable measuring systems		CCD camera	Centering microscope
Measuring head with separate measuring probe	Measuring head with separate measuring probe	Measuring head with separate measuring probe (indexable)	Measuring head with separate measuring probe (indexable)	Measuring head linked to CCD camera	Located via spindle

PH1	MH20	MH8	MH20i	PH6M	Centering microscope CF20
PEL Extensions 50 - 300 mm		PEL Extensions 50 - 300 mm		PEM Extensions 50 - 300 mm	
TP20 Probe locations		TP20 Probe locations			
Measuring probe module	Measuring probe module	Measuring probe module	Measuring probe module	QVP	
Styli M2 thread	Styli M2 thread	Styli M2 thread	Styli M2 thread		

Probe exchange system
Manual rack MSR1

MCOSMOS

Applications that support your measurement tasks

MiCAT

Mitutoyo Intelligent Computer Aided Technology

the standard in world
metrology software
CMM

MCOSMOS Manual (GEOPAK)
High Performance General-Purpose Measurement Program

This module is the heart of the MCOSMOS software system and is used to measure and analyze geometric elements. All the functions are provided by icons or pull-down menus for quick and seamless operation. It is unnecessary to switch windows for operations, so even novices can promptly select desired functions. Its main features include easier viewing of measuring procedures and results such as realtime graphic display of measurement results and a function for direct callup of elements from results graphics.

Resin molded or plastic formed products

CAT1000S
Optional Free Curved Surface Evaluation Program

Checks and compares the workpiece with the CAD data and directly outputs the results in the form of CAD data in various formats. It supports IGES/VDAFS CAD data as standard, and software to directly convert from/to various types of CAD data is available as an option.
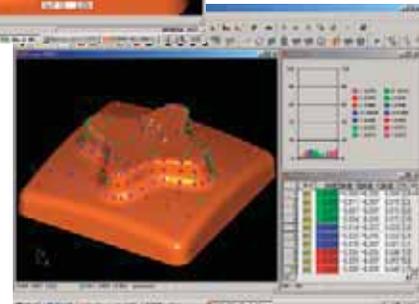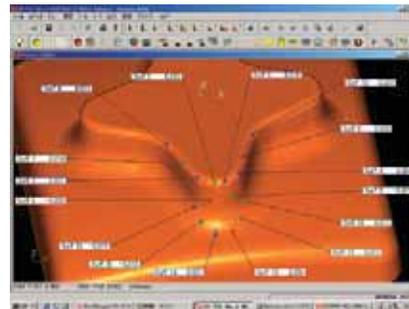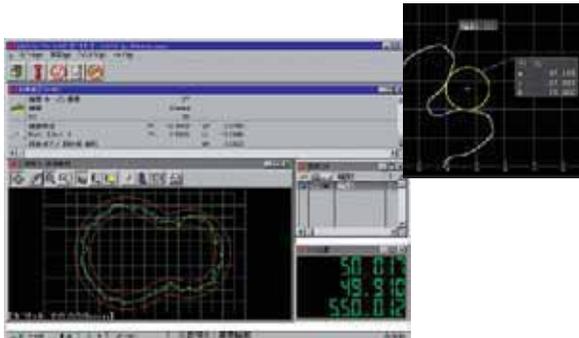
Small parts

SCANPAK
Optional Contour Measurement Program

Measures two-dimensional unfiltered profiles and performs various evaluations. It can evaluate profile measurement data, based on design data, and calculate various elements and inter-elements by specifying a range from the measurement data.

Mitutoyo

Touch Trigger Probe

This is a sensor that collects the coordinate values of the surface of a workpiece which the stylus contacts. Various interchangeable styli are available to suit the task in hand: such as ball styli with various diameters, and others with specially shaped tips to best meet the requirements of a large variety of workpiece shapes and evaluation methods.

Centering Microscope

This microscope can measure delicate, easily deformed objects which are difficult to measure by contact-type methods. Observation and measurement are possible through an optional TV monitor.
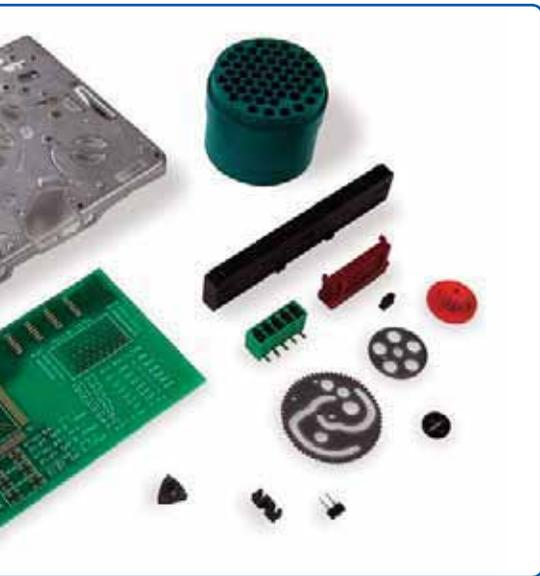
MeasurLink STATmeasure Plus
Optional Statistical Processing, Process Control Program

This program can process various statistical analyses based on the measurement results. A real time display of a control chart allows earlier detection of potential defects such as wear or damage to cutting tools. This allows implementation of effective countermeasures including changes in cutting depth and working conditions. Using this program as a terminal, it is also possible to connect to a higher network environment for integrated control.

Cutting finished products
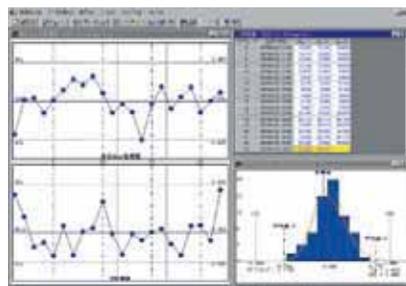
QM-Data 300
"Gage-like" Operation and Flexibility

QM-Data 300

With QM-Data 300 you can complete the 3-D measurement process simply by following the messages displayed onscreen. A special Gage-like measurement menu makes it fast and accurate...and you won't need a math degree to do it.

Gage-like Measurement Menu

The coordinate system setup is indispensable when a conventional CMM is used. However, this can be lead to the impression that "CMM operation is difficult". But QM-Data 300 provides a gage-like measurement menu that frees you from such concerns. Simply touch the features of the workpiece with a touch-trigger probe, following the interactive graphic display. The measured geometry is immediately calculated and displayed. It's so easy, even a beginner can perform complex measurements.

Gage-like measurement menu 1/5
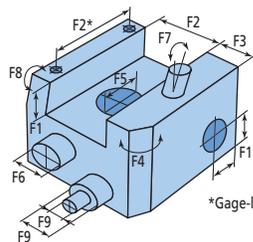A measurement menu that's as easy to use as a hand tool.

Gage-like measurement menu 2/5
For standard measurements.

Gage-like measurement menu 3/5
For standard measurement.

*Gage-like menu 3/5

Gage-like measurement menu 4/5
For advanced measurement.

Gage-like measurement menu 5/5
For advanced measurements.

Mitutoyo's "AI" Function

Mitutoyo's exclusive "AI" function even frees you from the need to select geometric features*. Based on input data, the QM-Data 300 identifies which geometric feature has been measured, then shows the appropriate graphic display and calculates the dimensions automatically. This lets the operator continue the process without interruption using simple keystrokes.
*Geometric features of Point, Line, Plane, Circle, Cylinder, Cone and Sphere are supported.

How does the AI function simplify key operation?

Parallelism of cylinder axes
Step 1: Probe the workpiece to measure the first cylinder, then press F4 key to complete the measurement. The QM-Data 300 automatically identifies first "Cylinder" from the input data.
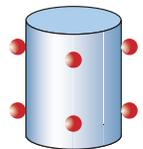
Step 2: Probe the workpiece to measure the second cylinder, then press the F4 key to complete the measurement. The QM-Data 300 automatically identifies the second "Cylinder" from the input data.

Step 3: Press the F8 key three times to begin the parallelism calculation.

Step 4: Press the F4 key to show the calculated angle between the axes.

Mitutoyo

For Measurement Efficiency

1-Key function for rapid access

The QM-Data 300's unique 1-Key function lets you call a desired menu display* with a single press of an alphabetic key. If you have a frequently-used menu display, simply assign it to one of the alphabetic keys (A to Z). The registered menu display can then be called up instantly at any time.

*All the menu displays in the main menu category, user menu displays (page 1 to 4) and 1-Key list display are available for assignment except for the gage-like measurement menu displays.

"Learn and Repeat" function

This function is particularly convenient for the repetitive measurement of identical workpieces, such as when sampling for quality control. Using the Learn mode, a sequence of key operations is stored in the internal memory as a part program. It can be executed in the Repeat mode to reproduce the measurement routines without your having to input key operations at each step of the measurement.

Macro function

This function lets you create and register macros comprising sequential multiple commands converted from a part program. Moreover, your macros can be assigned to icons in the user menu, thereby automating your combined calculations and otherwise complicated measurements.

Allocation-free user menu displays

The QM-Data 300 lets you design an original menu display (user menu). Simply choose a desired icon from the main menu category* and copy it to a blank icon (F1 to F12) in the User Menu display. The registered macro and part program will then be assigned to the blank icon.

*Excludes gage-like measurement menu displays.

Sample of User Menu

Icons copied from other menu display

Original icons
Bitmap images (16-color, 64 x 64 pixel) can be stored as icons for the user menu.

Macro icons   Icon for part program execution
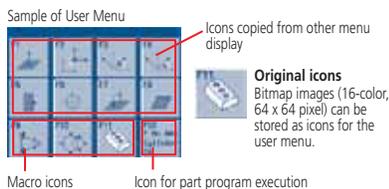
For Advanced Measurement

In addition to gage-like measurement menus, the QM-Data 300 provides the experienced operator with a host of advanced functions equal to those of standard CMM software.

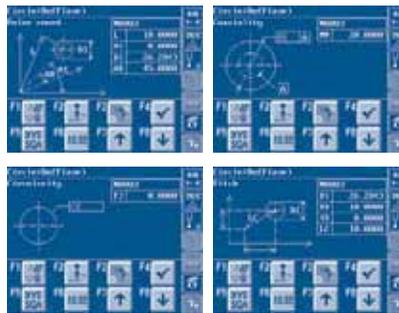### Coordinate System Setup

Twelve handy macro icons predefined

Measurement menu

Feature-feature calculation menu

### Sample display of measurement result

Multiple Language Support

Several operating languages are available: English, Japanese, German, French, Italian, Spanish and Portuguese

Optional Programs

### QMFit - best fit of coordinate system

QMFit translates and rotates the part coordinate system so that the measurement results of workpiece features most closely match their nominal values using the "least squares" algorithm. This is highly suitable for measuring parts having low dimensional accuracy, such as pressed and injection-molded components.
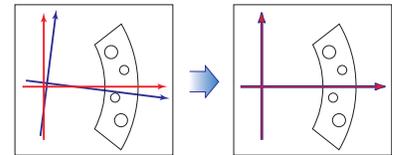
QMGraph - visualizing measurement results

QMGraph shows the calculated results of geometrical deviations and tolerance assessments with easy-to-understand drawings.
- Geometrical deviation:
  Straightness, flatness, roundness
- Tolerance assessment:
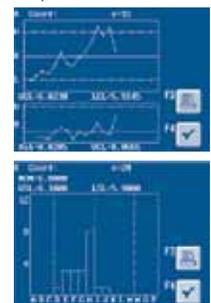 Positional deviation, XYZ coordinate value
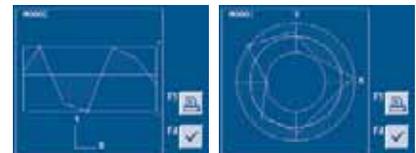
QMScan - digitizing 3-D contour

The QMScan uses a contact probe to scan and digitize workpiece contours. The contour-point clouds thus obtained can then be transferred to an external contour modeling system via portable storage media or the RS-232C interface.

QMStat - evaluating SPC parameters

The QMStat features a comprehensive selection of SPC parameters:
- Average, Max., Min., Sigma, Cp/Cpk
- Histogram
- X-Rs control chart
- Run chart

15

Coordinate Measuring Machines

Vision Measuring Systems

Form Measurement

Optical Measuring

Sensor Systems

Testing Equipment and Seismometer

Digital Scale and DRO Systems

Small Tool Instruments and Data Management

With Mitutoyo's coordinate measuring machines, you can be sure of gaining the competitive edge provided by the experience and expertise of the world's leading specialist in production measurement technology. You are also benefiting from knowledge accumulated over decades for the tasks of tomorrow. Setting the highest standards in quality, and performance.

Mitutoyo America Corporation
www.mitutoyo.com

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1-888-MITUTOYO (1-888-648-8869)

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Aurora, Illinois
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Mason, Ohio

Plymouth, Michigan

City of Industry, California

Mitutoyo

Precision is our Profession