

# MEASURING TOOLS COORDINATE MEASURING MACHINES

## **MICROCORD (CMM)**

CRYSTA-Apex S500/700/900 Series	Q-002
CRYSTA-Apex S1200/1600/2000 Series	Q-003
CRYSTA-Apex EX 500T/700T/900T Series	Q-004
CRYSTA-Apex EX 1200R Series	Q-005
STRATO-Apex Series	Q-006-007
FALCIO-Apex 2000/3000 Series	Q-008
LEGEX Series	Q-009
CARBstrato	Q-010
CARBapex	Q-010
MACH-3A 653	Q-011
MACH-V 9106	Q-011
MACH Ko-ga-me	Q-011
Crysta-Plus M Series	Q-012
SpinArm-Apex	Q-013
MCOSMOS	Q-014-015
MiCAT Planner	Q-016
SurfaceMeasure	Q-017
MSURF	Q-018
Probe	Q-019-020
Clamping System	Q-020

# COORDINATE MEASURING MACHINES

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**Standard CNC CMM**

**MICROCORD CRYSTA-Apex S500/700/900 Series**

**MeasurLink<sup>®</sup> ENABLED**  
Data Management Software by Mitutoyo

- The CRYSTA-Apex S500/700/900 series, CNC CMMs deliver high accuracy (1.7  $\mu$ m), high speed, and high acceleration. This series offers flexibility with a wide range of models to suit practically any size workpiece.
- All CRYSTA-Apex S CMMs are equipped with temperature compensation and therefore do not require a temperature controlled room. Accuracy is guaranteed within the range of 16 °C to 26 °C.



CRYSTA-Apex S 544



CRYSTA-Apex S 776



CRYSTA-Apex S 9106

Order No.	CRYSTA-Apex S 544	CRYSTA-Apex S 574	CRYSTA-Apex S 776	CRYSTA-Apex S 7106	CRYSTA-Apex S 9106 (Z600) / 9108 (Z800)	CRYSTA-Apex S 9166 (Z600) / 9168 (Z800)	CRYSTA-Apex S 9206 (Z600) / 9208 (Z800)
Measuring range	500mm		700mm		900mm		
X axis	500mm		700mm		900mm		
Y axis	400mm	700mm	700mm	1000mm	1000mm	1600mm	2000mm
Z axis	400mm		600mm		600mm/800mm		
Maximum measuring speed	8mm/s		8mm/s		8 mm/s (3 mm/s for Type Z800)		
Drive speed	Each axis 8 to 300mm/s (CNC Mode), Maximum combined speed 519mm/s 0 to 80mm/s (J/S Mode: High Speed) 0 to 3mm/s (J/S Mode: Low Speed) 0.05mm/s (J/S Mode: Fine Speed)		8-300 mm/s (CNC mode), max. speed: 519 mm/s 0 - 80 mm/s (J/S Mode: High Speed) 0 - 3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)		8 - 300 mm/s (CNC mode), max. speed: 519 mm/s 0 - 80 mm/s (J/S Mode: High Speed) 0 - 3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)		
Max. drive acceleration	Each axis: 1,333 mm/s <sup>2</sup> , max. combined acceleration: 2,309 mm/s <sup>2</sup>		Each axis: 1,333 mm/s <sup>2</sup> , max. combined acceleration: 2,309 mm/s <sup>2</sup>		Each axis: 1,333 mm/s (1,000 mm/s <sup>2</sup> Type Z800), max. combined acceleration 2,309 mm/s <sup>2</sup> (1,732 mm/s <sup>2</sup> Type Z800)		
Resolution	0.0001mm (0.1 $\mu$ m)		0.0001mm (0.1 $\mu$ m)		0.0001mm (0.1 $\mu$ m)		
Guide method	Air bearings on each axis		Air bearings on each axis		Air bearings on each axis		
Maximum measurable height	545mm		800mm		800mm (Z=600mm)/1000mm (Z=800mm)		
Maximum table loading	180kg		800kg	1000kg	1200kg	1500kg	1800kg
Mass (including the control device and installation platform)	515kg	625kg	1675kg	1951kg	2231kg (Z=600mm) 2261kg (Z=800mm)	2868kg (Z=600mm) 2898kg (Z=800mm)	3912kg (Z=600mm) 3942kg (Z=800mm)
Air supply	Pressure: 0.4MPa Consumption: 50 L/min under normal conditions (air source: 100 L/min)		Pressure: 0.4MPa Consumption: 60L/min under normal conditions (air source: 120L/min)		Pressure: 0.4MPa Consumption: 60 L/min under normal conditions (air source: 120 L/min)		

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

## ●CRYSTA-Apex S 500/700/900 Series Accuracy

Unit:  $\mu$ m

Probe used	Max. permissible length measurement error**2	Repeatability range of E0	Max. permissible single stylus form error
	ISO 10360-2:2009		ISO 10360-5: 2010
SP25M	E0, MPE=1.7+3L/1000 (Temperature environment 1) E150, MPE=1.7+3L/1000 (Temperature environment 1)	RO, MPL=1.3	PFTU, MPE=1.7
	E0, MPE=1.7+4L/1000 (Temperature environment 2) E150, MPE=1.7+4L/1000 (Temperature environment 2)		
TP200	E0, MPE=1.9+3L/1000 (Temperature environment 1) E150, MPE=2.4+3L/1000 (Temperature environment 1)	RO, MPL=1.9	PFTU, MPE=1.9
	E0, MPE=1.9+4L/1000 (Temperature environment 2) E150, MPE=2.4+4L/1000 (Temperature environment 2)		
TP20	E0, MPE=2.2+3L/1000 (Temperature environment 1) E150, MPE=2.7+3L/1000 (Temperature environment 1)	RO, MPL=2.2	PFTU, MPE=2.2
	E0, MPE=2.2+4L/1000 (Temperature environment 2) E150, MPE=2.7+4L/1000 (Temperature environment 2)		

\* L=Measuring length (unit: mm)

\*\* Table at right defines temperature environments 1 and 2

## ●CRYSTA-Apex S 500/700/900 Series Accuracy

Unit:  $\mu$ m

Probe used	Max. permissible scanning probing error (MPETHP) ISO 10360-4: 2000
SP25M (Stylus: $\phi$ 4 50 mm)	2.3 (50s) [2.3 (60s) for Z800 model]
MPP310Q (Stylus: $\phi$ 4 X 18 mm)	1.8 (80s)
SP80 (Stylus: $\phi$ 4 X 50 mm)	2.0 (50s) [2.3 (60s) for Z800 model]

## ●CRYSTA-Apex S 500/700/900 Series Installation Temperature

	Temperature environment 1	Temperature environment 2
Limits within which accuracy is guaranteed	20 $\pm$ 2 °C	16 - 26 °C
Temperature Range	2 °C per hour or less 2 °C in 24 hours or less	2 °C per hour or less 5 °C in 24 hours or less
Rate of change	2 °C per hour or less 2 °C in 24 hours or less	2 °C per hour or less 5 °C in 24 hours or less
Gradient	1 °C or less per meter	1 °C or less per meter

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## Standard CNC CMM

### MICROCORD CRYSTA-Apex S1200/1600/2000 Series

• The CRYSTA-Apex S1200/1600/2000 Series are large-sized CNC CMMs developed for supporting quality evaluation of large parts.

• All CRYSTA-Apex S1200/1600/2000 high precision series CMMs are equipped with temperature compensation and therefore do not require a temperature controlled room. Accuracy is guaranteed within a wide range from 16 °C to 24 °C.



CRYSTA-Apex S122010



CRYSTA-Apex S163012

Order No.	CRYSTA-Apex S 121210	CRYSTA-Apex S 122010	CRYSTA-Apex S 123010	CRYSTA-Apex S 162012(Z1200)/162016(Z1600)	CRYSTA-Apex S 163012(Z1200)/163016(Z1600)	CRYSTA-Apex S 164012(Z1200)/164016(Z1600)	CRYSTA-Apex S 203016	CRYSTA-Apex S 204016
Measuring range	X axis 1200mm Y axis 2000mm Z axis 1000mm	1200mm 2000mm 3000mm	3000mm	2000 mm 3000 mm 4000 mm	2000 mm 3000 mm 4000 mm	2000 mm 3000 mm 4000 mm	3000mm 4000mm	4000mm
Maximum measuring speed	5mm/s	5mm/s	5mm/s	3mm/s	3mm/s	3mm/s	3mm/s	3mm/s
Drive speed	8 - 400 mm/s (CNC mode), max. speed: 693 mm/s 0 - 80 mm/s (J/S Mode: High Speed) 0 - 3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)	8 - 400 mm/s (CNC mode), max. speed: 693 mm/s 0 - 80 mm/s (J/S Mode: High Speed) 0 - 3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)	8 - 400 mm/s (CNC mode), max. speed: 693 mm/s 0 - 80 mm/s (J/S Mode: High Speed) 0 - 3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)	8 - 400 mm/s (CNC mode), max. speed: 693 mm/s 0 - 80 mm/s (J/S Mode: High Speed) 0 - 3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)	8 - 400 mm/s (CNC mode), max. speed: 693 mm/s 0 - 80 mm/s (J/S Mode: High Speed) 0 - 3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)	8 - 400 mm/s (CNC mode), max. speed: 693 mm/s 0 - 80 mm/s (J/S Mode: High Speed) 0 - 3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)	8-400 mm/s (CNC Mode), max. speed: 693 mm/s 0-80 mm/s (J/S Mode: High Speed) 0-3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)	8-400 mm/s (CNC Mode), max. speed: 693 mm/s 0-80 mm/s (J/S Mode: High Speed) 0-3 mm/s (J/S Mode: Low Speed) 0.05 mm/s (J/S Mode: Fine Speed)
Maximum acceleration	Each axis: 1,000 mm/s <sup>2</sup> , max. combined acceleration 1,732 mm/s <sup>2</sup>	Each axis: 1,000 mm/s <sup>2</sup> , max. combined acceleration 1,732 mm/s <sup>2</sup>	Each axis: 1,000 mm/s <sup>2</sup> , max. combined acceleration 1,732 mm/s <sup>2</sup>	Each axis 800mm/s <sup>2</sup> , Maximum combined speed 1386mm/s <sup>2</sup>	Each axis 800mm/s <sup>2</sup> , Maximum combined speed 1386mm/s <sup>2</sup>	Each axis 800mm/s <sup>2</sup> , Maximum combined speed 1386mm/s <sup>2</sup>	Each axis 800mm/s <sup>2</sup> , Maximum combined speed 1386mm/s <sup>2</sup>	Each axis 800mm/s <sup>2</sup> , Maximum combined speed 1386mm/s <sup>2</sup>
Resolution	0.0001 mm	0.0001 mm	0.0001 mm	0.0001 mm	0.0001 mm	0.0001 mm	0.0001 mm	0.0001 mm
Guide method	Air bearings on each axis	Air bearings on each axis	Air bearings on each axis	Air bearings on each axis	Air bearings on each axis	Air bearings on each axis	Air bearings on each axis	Air bearings on each axis
Maximum measurable height	1200mm	1200mm	1200mm	55.11" (1400mm) / [70.86" (1800mm)]	55.11" (1400mm) / [70.86" (1800mm)]	55.11" (1400mm) / [70.86" (1800mm)]	1800mm	1800mm
Maximum table loading	2000kg	2500kg	3000kg	3000kg	3500kg	4500kg	4000kg	5000kg
Mass (including the control device and installation platform)	4050kg	6150kg	9110kg	9300kg (Z=1200mm) 9350kg (Z=1600mm)	10600kg (Z=1200mm) 10650kg (Z=1600mm)	14800kg (Z=1200mm) 14850kg (Z=1600mm)	14100kg	19400kg
Pressure	0.4MPa	0.4MPa	0.4MPa	0.4MPa	0.4MPa	0.4MPa	0.4MPa	0.4MPa
Air supply Consumption	100 L/min under normal conditions (air source: 150 L/min)	100 L/min under normal conditions (air source: 150 L/min)	100 L/min under normal conditions (air source: 150 L/min)	150L/min under normal conditions (air source: 200L/min)	150L/min under normal conditions (air source: 200L/min)	150L/min under normal conditions (air source: 200L/min)	150L/min under normal conditions (air source: 200L/min)	150L/min under normal conditions (air source: 200L/min)

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

#### ●CRYSTA-Apex S 1200 Series Accuracy

Unit: μm

Probe used	Max. permissible length measurement error ISO 10360-2:2009 (JIS B 7440-2:2013)
SP25M	E0, MPE=2.3+3L/1000 (Temperature environment 1)
	E150, MPE=2.3+3L/1000 (Temperature environment 1)
	E0, MPE=2.3+4L/1000 (Temperature environment 2)
	E150, MPE=2.3+4L/1000 (Temperature environment 2)

\* L=Measuring length (unit: mm)  
\* Table below describes temperature environments 1 and 2.

#### ●CRYSTA-Apex S 1600 Series Accuracy

Unit: μm

Probe used	Max. permissible length measurement error ISO 10360-2:2009 (JIS B 7440-2:2013)
SP25M	E0, MPE=3.3+4.5L/1000 (4.5+5.5L/1000) (Temperature environment 1)
	E150, MPE=3.3+4.5L/1000 (4.5+5.5L/1000) (Temperature environment 1)
	E0, MPE=3.3+5.5L/1000 (4.5+6.5L/1000) (Temperature environment 2)
	E150, MPE=3.3+5.5L/1000 (4.5+6.5L/1000) (Temperature environment 2)

\* L=Measuring length (unit: mm)  
\* Table below describes temperature environments 1 and 2.  
\* ( ) indicates Z: 1600 mm specification

#### ●CRYSTA-Apex S 2000 Series Accuracy

Unit: μm

Probe used	Max. permissible length measurement error ISO 10360-2:2009 (JIS B 7440-2:2013)
SP25M	E0, MPE=4.5+8L/1000 (Temperature environment 1)
	E150, MPE=4.5+8L/1000 (Temperature environment 1)
	E0, MPE=4.5+9L/1000 (Temperature environment 2)
	E150, MPE=4.5+9L/1000 (Temperature environment 2)

\* L=Measuring length (unit: mm)  
\* Table below describes temperature environments 1 and 2.

#### ●CRYSTA-Apex S 1200 Series Installation Temperature

Limits within which accuracy is guaranteed	Temperature Range	Temperature environment 1	Temperature environment 2
		20±2 °C	16 - 26 °C
		Rate of change 2 °C per hour or less 2 °C in 24 hours or less	2 °C per hour or less 5 °C in 24 hours or less
Gradient	1 °C or less per meter	1 °C or less per meter	

#### ●CRYSTA-Apex S 1600 Series Installation Temperature

Limits within which accuracy is guaranteed	Temperature Range	Temperature environment 1	Temperature environment 2
		20±2 °C	20±4 °C
		Rate of change 1 °C per hour or less 2 °C in 24 hours or less	1 °C per hour or less 5 °C in 24 hours or less
Gradient	1 °C or less per meter	1 °C or less per meter	

#### ●CRYSTA-Apex S 2000 Series Installation Temperature

Limits within which accuracy is guaranteed	Temperature Range	Temperature environment 1	Temperature environment 2
		20±2 °C	20±4 °C
		Rate of change 1 °C per hour or less 2 °C in 24 hours or less	1 °C per hour or less 5 °C in 24 hours or less
Gradient	1 °C or less per meter	1 °C or less per meter	

# COORDINATE MEASURING MACHINES

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**Standard CNC CMM**

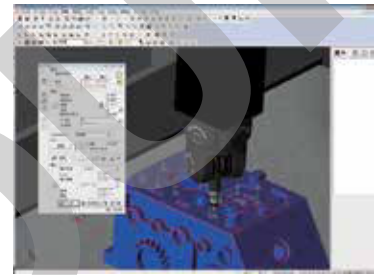
**MICROCORD CRYSTA-Apex EX 500T/700T/900T Series**

**MeasurLink<sup>®</sup> ENABLED**

Data Management Software by Mitutoyo

- The **CRYSTA-Apex EX 500T/700T/900T** series CNC CMMs are equipped with the **PH20** probe head to provide 5-axis touch-trigger operation for significantly higher productivity.
- 5-axis operation reduces the time required for probe rotational movements and allows more flexible positioning. This also ensures easy access to complex workpieces and saves time during both programming and measurement.

- In addition to 3-axis point measurement similar to conventional coordinate measuring machines, the **PH20** probe head also supports 'head touch' operation for rapid measurement using the two rotational axes of the probe head only, with no movement required along the CMM axes.
- PH20** incorporates a TP20 probe and allows use of modules designed for the TP20. Automatic probe changeover with a module changer is also supported.
- Even without the workpiece to be measured, a measurement program can be created on a PC using 3D CAD data. Compared to joystick operation, this makes for more efficient programming and also allows interference checking.



Programming with a 3D CAD model



CRYSTA-Apex EX 544T



### Specification of PH20

Rotation angle (Resolution)	Vertical (A-axis)	-115° to +115° (0.08sec)
	Horizontal (B-axis)	∞ (0.08sec)
Maximum stylus length		50mm

Order No.		CRYSTA-Apex EX 544T	CRYSTA-Apex EX 574T	CRYSTA-Apex EX 776T	CRYSTA-Apex EX 7106T	CRYSTA-Apex EX 9106T	CRYSTA-Apex EX 9166T	CRYSTA-Apex EX 9206T
Measuring range	X axis	500mm		700mm		900mm		
	Y axis	400mm	700mm	700mm	1000mm	1000mm	1600mm	2000mm
	Z axis	400mm		600mm		600mm		
Drive speed	CNC MODE	Drive speed 8 - 300mm/s		Drive speed 8 - 300mm/s		Drive speed 8 - 300mm/s		
	J/S MODE	Measuring Speed 1 - 10mm/s		Measuring Speed 1 - 10mm/s		Measuring Speed 1 - 10mm/s		
Resolution		0 - 80mm/s		0 - 80mm/s		0 - 80mm/s		
		0.0001mm (0.1μm)		0.0001mm (0.1μm)		0.0001mm (0.1μm)		
Guide method		Air bearings on each axis		Air bearings on each axis		Air bearings on each axis		
		Air bearings on each axis		Air bearings on each axis		Air bearings on each axis		
Table loading	Maximum height	545mm		800mm		800mm		
	Maximum mass	180kg		800kg	1000kg	1200kg	1500kg	1800kg
Mass (including the control device and installation platform)		536kg	646kg	1696kg	1972kg	2252kg	2889kg	3933kg
		536kg	646kg	1696kg	1972kg	2252kg	2889kg	3933kg
Air supply	Pressure	0.4MPa		0.4MPa		0.4MPa		
	Consumption	50 L/min under normal conditions (air supply: 100 L/min)		60 L/min under normal conditions (air supply: 120 L/min)		60 L/min under normal conditions (air supply: 120 L/min)		

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

### CRYSTA-Apex EX 500T/700T/900T Series Accuracy

Unit: μm

Probe used	Max. permissible length measurement error ISO 10360-2:2009 (JIS B 7440-2:2013)
PH20+TP20	E0, MPE=2.2+3L/1000 (Temperature environment 1)
	E0, MPE=2.2+4L/1000 (Temperature environment 2)

\* L=Measuring length (unit: mm)

\* Table at right defines temperature environments 1 and 2

### CRYSTA-Apex EX 500T/700T/900T Series Installation Temperature

		Temperature environment 1	Temperature environment 2
Limits within which accuracy is guaranteed	Temperature Range	18 - 22°C	16 - 26°C
	Rate of change	2°C per hour or less 2°C in 24 hours or less	2°C per hour or less 5°C in 24 hours or less
	Gradient	1°C or less per meter	1°C or less per meter

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## Standard CNC CMM

### MICROCORD CRYSTA-Apex EX 1200R Series

Helical scan



Gasket scan



Sweep scan



Airfoil section scan



- CRYSTA-Apex EX 1200R series products are advanced CNC CMMs equipped with the REVO 5-axis scanning probe head.
- 5-axis operation reduces the time required for probe repositioning movements and allows more flexible positioning. This also facilitates access to complex workpieces and saves time both during programming and measurement.
- Allows ultra-high-speed 5-axis scanning (max. 500 mm/s), far surpassing conventional 3-axis control. Support for high speed sampling of up to 4,000 points per second allows acquisition of densely spaced measurement points, even during fast scanning.
- Internal implementation of laser sensing technology ensures high accuracy measurement, even with long styli (up to 500 mm\*).
- \* Distance from probe rotation center to stylus tip

- Two types of probes supported: RSP2 for 5-axis scanning and SP25M type RSP3 probe allowing use of a cranked stylus. Automatic changeover of these probes with an auto probe changer is possible, enabling fully automated measurement of parts with diverse shapes.
- Probe calibration of RSP2 requires only about 20 minutes to enable use of the full angular range. Compared to conventional scanning probes, which notably reduces preparation time.



CRYSTA-Apex EX 123010R

Order No.		CRYSTA-Apex EX 121210R	CRYSTA-Apex EX 122010R	CRYSTA-Apex EX 123010R
Items	X axis		1200mm	
	Y axis	1200mm	2000mm	3000mm
	Z axis	960mm		
Drive speed	CNC MODE	Drive speed 8 - 300mm/s		
	J/S MODE	Measuring Speed 1 - 5mm/s 0 - 80mm/s (J/S Mode: High Speed) 0 - 3mm/s (J/S Mode: Low Speed) 0 - 3mm/s (J/S Mode: Touch Speed)		
Drive acceleration	375mm/s <sup>2</sup>			
Resolution	0.0001mm (0.1µm)			
Guide method	Air bearings on each axis			
Table loading	Maximum height	1160mm		
	Maximum mass	2000kg	2500kg	3000kg
Mass (including the control device and installation platform)	4050kg		6150kg	9110kg
Air supply	Pressure	CMM: 0.4MPa REVO: 0.5MPa		
	Consumption	150 L/min under normal conditions (air source: 230 L/min or more), 0.6MPa or more		

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

#### CRYSTA-Apex EX 121210R/122010R/123010R Series Accuracy Unit: µm

Probe used	Max. permissible length measurement error ISO 10360-2:2009 (JIS B 7440-2:2013)
REVO+RSP2+RSH250	E 0, MPE=2.9+4L/1000 (Temperature environment1) E250, MPE=2.9+4L/1000 (Temperature environment1) E 0, MPE=2.9+5L/1000 (Temperature environment2) E250, MPE=2.9+5L/1000 (Temperature environment2)
REVO+RSP3-3+RSH-3	E 0, MPE=2.5+3L/1000 (Temperature environment1) E150, MPE=2.5+3L/1000 (Temperature environment1) E 0, MPE=2.5+4L/1000 (Temperature environment2) E150, MPE=2.5+4L/1000 (Temperature environment2)

#### CRYSTA-Apex EX 121210R/122010R/123010R Series Installation Temperature

		Temperature environment 1	Temperature environment 2
Limits within which accuracy is guaranteed	Temperature Range	18 - 22°C	16 - 26°C
	Rate of change	2°C per hour or less 2°C in 24 hours or less	2°C per hour or less 5°C in 24 hours or less
	Gradient	1°C or less per meter	1°C or less per meter

\* L=Measuring length (unit: mm)

\* Table at right defines temperature environments 1 and 2

#### Specification of REVO Scanning Probe

Rotation angle (Resolution)	Vertical (A-axis)	-5° to +120°(0.08sec)
	Horizontal (B-axis)	∞ (0.08sec)
Maximum stylus length	500mm (Distance from probe rotation center to stylus tip)	

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## High Accuracy CNC CMM MICROCORD STRATO-Apex Series

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Data Management Software by Mitutoyo

- The STRATO-Apex series is high-accuracy CNC CMMs. The series guarantees high accuracy and also high moving speed and acceleration achieved with improved rigid air bearings on all axial guideways.
- The scale systems on Mitutoyo high-precision models utilizes a high-performance linear encoder (manufactured by Mitutoyo), for detecting axis position. In addition, various technologies have been utilized in the structure, part processing, and assembly to provide high accuracy measurement.

- Floor vibration at the installation location, can be a source of variations in measured values. The autoleveling air spring vibration isolator is equipped as standard for 700 Series and an option for model 574. The vibration isolator insulates the main unit from floor vibrations and can quickly levels the CMM main unit, using a sensor that detects load fluctuations caused by axis movement of the CMM or workpiece loading.
- All STRATO-Apex high-precision series CMM's are equipped with temperature compensation and therefore do not require a temperature controlled room. Accuracy is guaranteed within the range of 19 to 21°C for 700 Series and the range of 18 to 22°C for 574 model.



### STRATO-Apex 574 Length measurement error

Unit:  $\mu\text{m}$

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	E0, MPE=0.7+2.5L/1000
		E150, MPE=0.7+2.5L/1000

### STRATO-Apex 700 Series Length measurement error

Unit:  $\mu\text{m}$

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	E0, MPE=0.9+2.5L/1000
		E150, MPE=0.9+2.5L/1000

\* L=Measuring length (unit: mm)

Order No.		STRATO-Apex 574	STRATO-Apex 776	STRATO-Apex 7106
Items				
Measuring range	X axis	500mm	700mm	
	Y axis	700mm	700mm	1000mm
	Z axis	400mm	600mm	
Guide method		Air bearings on all axes (static pressure air bearings)		
Drive speed	CNC MODE	Drive speed: From 8 to 300 mm/s for each axis (maximum combined speed: 519 mm/s)		
		Measuring Speed 1 – 3 mm/s		
	J/S MODE	Drive speed 0 to 80mm/s		
		Measuring speed 0 to 3mm/s		
		Fine-positioning speed 0.05mm/s		
Drive acceleration		1,330 mm/s <sup>2</sup> for each axis (maximum combined acceleration: 2,310 mm/s <sup>2</sup> )	1,500mm/s <sup>2</sup> for each axis (maximum combined speed: 2,598mm/s <sup>2</sup> )	
Measuring method		Linear encoder		
Resolution		0.0005mm	0.0002mm	
Work table	Material	Granite		
	Size (table surface)	676 x 1420 mm	862 x 1420 mm	862 x 1720 mm
	Tapped inserts	M8 x 1.25 mm		
Workpiece	Maximum height	560 mm	770 mm	
	Maximum mass	180 kg	500 kg	800 kg
Machine mass (includes the vibration-damping platform and controller, but not workpiece)		1530 kg	1895 kg	2180 kg
Power supply specifications (including the probe option interface)		Power supply voltage: AC100-120/200-240 V $\pm$ 10%; power supply capacity: 700 W (of which 170 W is used for the probe option interface)		
Air supply	Pressure	0.4 MPa		
	Consumption	60 L/min under normal conditions (air source: At least 120 L/min)		
	Temperature range	18 to 22°C	19 to 21°C	
Guaranteed accuracy temperature environment	Temperature change	Per hour	1.0°C	
		In 24 hours	2.0°C	
	Temperature gradient	vertical/ horizontal	1 °C/m	

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

เครื่องวัดขนาดสามมิติ

## High Accuracy CNC CMM MICROCORD STRATO-Apex 900/1600 Series

• Floor vibration at the installation location, can be a source of variations in measured values. The autoleveling air spring vibration isolator is included as standard. The vibration isolator insulates the main unit from floor vibrations and can quickly levels the CMM main unit, using a sensor that detects load fluctuations caused by axis movement of the CMM or workpiece loading.

• All STRATO-Apex high-precision series CMM's are equipped with tempera ture compensation and therefore do not require a temperature controlled room. Accuracy is guaranteed within the range of 19 to 21°C for 900 Series

### STRATO-Apex 900 Series Length measurement error

Unit:  $\mu\text{m}$

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	E0, MPE=0.9+2.5L/1000
		E150, MPE=0.9+2.5L/1000

### STRATO-Apex 162012/163012 Length measurement error

Unit:  $\mu\text{m}$

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	E0, MPE=2.5+4.0L/1000
		E150, MPE=2.5+4.0L/1000

### STRATO-Apex 162016/163016 Length measurement error

Unit:  $\mu\text{m}$

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	E0, MPE=3.0+4.0L/1000
		E150, MPE=3.0+4.0L/1000

\* L=Measuring length (unit: mm)



STRATO-Apex 9106

STRATO-Apex 163012

Order No.		STRATO-Apex 9106	STRATO-Apex 9166	STRATO-Apex 162012	STRATO-Apex 162016	STRATO-Apex 163012	STRATO-Apex 163016
Measuring range	X axis	900mm		1600mm			
	Y axis	1000mm	1600mm	2000mm		3000mm	
	Z axis	600mm		1200mm	1600mm	1200mm	1600mm
Guide method		Air bearings on all axes (static pressure air bearings)					
Drive speed	CNC MODE	Drive speed: From 8 to 300mm/s for each axis (maximum combined speed: 519mm/s)		Drive speed: From 8 to 350mm/s for each axis (maximum combined speed: 606mm/s)			
	J/S MODE	Measuring speed 1 to 3mm/s		Measuring speed 0 to 3mm/s			
Drive acceleration		1500mm/s <sup>2</sup> for each axis (maximum combined speed: 2598mm/s <sup>2</sup> )		780mm/s <sup>2</sup> for each axis (maximum combined speed: 1350mm/s <sup>2</sup> )			
Measuring method		Linear encoder					
Resolution		0.0002mm		0.0005mm			
Work table	Material	Granite					
	Size (table surface)	1062 x 1720 mm	1062 x 2320 mm	1850 x 3280 mm		1850 x 4280 mm	
Tapped inserts		M8 x 1.25 mm					
Workpiece	Maximum height	770 mm		1350 mm	1750 mm	1350 mm	1750 mm
	Maximum mass	800 kg	1200 kg	3500 kg		4000 kg	
Machine mass (includes the vibration-damping platform and controller, but not workpiece)		2410 kg	3085 kg	11150 kg	11200 kg	15300 kg	15350 kg
Power supply specifications (including the probe option interface)		Power supply voltage: AC100-120/200-240 V $\pm$ 10%; power supply capacity: 700 W (of which 170 W is used for the probe option interface)		Power supply voltage: AC100-120/200-240 V $\pm$ 10%; power supply capacity: 1500 W (of which 170 W is used for the probe option interface)			
Air supply	Pressure	0.4 MPa					
	Consumption	60 L/min under normal conditions (air source: At least 120 L/min)		100 L/min under normal conditions (air source: At least 250 L/min)			
Guaranteed accuracy temperature environment	Range		19 to 21°C		18 to 22°C		
	Rate of change	Per hour	1.0°C				
		In 24 hours	2.0°C				
Gradient	vertical/horizontal	1°C/m					

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

# COORDINATE MEASURING MACHINES

เครื่องวัดขนาดสามมิติ

# Mitutoyo

เครื่องวัดขนาดสามมิติ

## High-accuracy Separate Guide Type MICROCORD FALCIO-Apex 2000/3000 Series

**MeasurLink** ENABLED  
Data Management Software by Mitutoyo

- These series are equipped with a system to automatically restore accuracy deterioration (MOVAC) caused by foundation deformation as a standard feature.
- All FALCIO Apex 2000G/3000G series high-precision series CMMs are equipped with temperature compensation and therefore do not require a temperature controlled room. Accuracy is guaranteed within the range of 18 °C to 22 °C.
- Safety devices such as a Z-axis beam sensor, tape switch, and area sensor are available as options.
- The FALCIO Apex 2000G/3000G series are CNC CMMs that use Mitutoyo's standard structure for large machines which are designed to be used for measuring large and heavy workpieces with high accuracy. The picture below gives a good idea of how large the machine is. The measuring accuracy and drive speed are the world's highest in the X-axis measuring range of 2000 mm and 3000 mm.



FALCIO-Apex 305015G

Items		Order No.	FALCIO-Apex203015G	FALCIO-Apex204015G	FALCIO-Apex205015G	FALCIO-Apex305015G
		Measuring range	X axis	2000mm	2000mm	2000mm
	Y axis	3000mm	4000mm	5000mm	5000mm	
	Z axis	1500mm	1500mm	1500mm	1500mm	
Maximum drive speed		300mm/s for each axis (maximum combined speed: 520mm/s)				
Resolution		0.0001mm (0.1μm)				
Measuring error (When using SP25M)		MPEE = (3.5+4L/1000)μm				
Guaranteed accuracy temperature range		18 to 22°C				
Guide method		Air bearings on each axis				
Machine dimensions	W		4430mm			5430mm
	D	5950mm	6950mm	7950mm		7950mm
	H	4690mm				
Mass (main unit)		12000kg	14000kg	15000kg		16000kg
Safety device (optional)		A tape switch and a beam sensor are mounted on the tip of the spindle.				

\* L=Measuring length (unit: mm)

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

# COORDINATE MEASURING MACHINES

เครื่องวัดขนาดสามมิติ

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Coordinate Measuring Machines  
เครื่องวัดขนาดสามมิติ

เครื่องวัดขนาดสามมิติ

## Ultra-high Accuracy CNC CMM MICROCORD LEGEX series

- The LEGEX series is an ultra-high precision CNC CMM with the world's highest level of accuracy, made possible by rigorous analysis of all possible error-producing factors and the elimination or minimization of their effects.
- The fixed bridge structure and precision air bearings running on highly rigid guideways ensure superior motion stability and ultra-high geometrical accuracy. Thorough testing, using FEM structure analysis simulation, guarantees geometric motion accuracy with minimal errors due to fluctuations in inertial loading and other variables. In addition, other technologies have been utilized in the structure of the drive unit, minimizing vibration, etc., to provide ultra-high accuracy
- The combination of a Mitutoyo ultrahigh accuracy crystallized glass scale with a coefficient of thermal expansion of almost zero and a high resolution, high-performance reflection type linear encoder provides excellent position detection for premium performance
- All LEGEX high-precision series CMMs are equipped with temperature compensation and therefore do not require a temperature controlled room.
- Many optional systems are available, including probes (contact and non-contact types), data processing units, and many other items to support the ultra-high accuracy measurement of a wide variety of workpieces.



Order No.		LEGEX 574	LEGEX 774	LEGEX 776	LEGEX 9106
Items					
Measuring range	X axis	500mm	700mm		900mm
	Y axis	700mm			1000mm
	Z axis	450mm		600mm	
Measurement method	Ultrahigh-precision linear encoder				
Maximum measuring speed	200mm/s				
Maximum acceleration	980mm/s <sup>2</sup>				
Resolution	0.00001mm (0.01μm)				
Guide method	Air bearing				
Measuring table	Material	Cast iron*			
	Size	550x750mm	750x750mm		950x1050mm
	Tapped insert	M8x1.25mm (for workpiece clamping)			
Table loading	Maximum workpiece height	695mm		860mm	
	Maximum table loading	250kg	500kg		800kg
Mass (main unit)		3500kg	5000kg	5100kg	6500kg
Air supply	Pressure	0.5MPa			
	Consumption	120L/min under normal conditions (air source: 160L/min or more)			

\*Ceramic coated type is also available as an option.

### Main unit accuracy

Unit: μm

Probe used	Length measurement error ISO 10360-2:2009 (JIS B 7440-2:2013)
MPP310Q	E0,MPE = (0.28+L/1000)μm (Temperature environment 1) E0,MPE = (0.3+L/1000)μm (Temperature environment 2)

\* L=Measuring length (unit: mm)

\* Table at right defines temperature environments 1 and 2

### Installation temperature environment

	Temperature environment 1	Temperature environment 2
Temperature range	19 - 21°C	18 - 22°C
Rate of change	0.5°C	
Gradient	1.0 °C	

# COORDINATE MEASURING MACHINES

เครื่องวัดขนาดสามมิติ

## Mitutoyo

เครื่องวัดขนาดสามมิติ

### Car Body Measuring System MICROCORD CARBstrato Series

**MeasurLink** ENABLED  
Data Management Software by Mitutoyo

• **The world's largest class of CMM**

The CARBstrato series is a lineup of horizontal-ram type CNC CMMs, offering the world's largest measurement range that even makes it possible to measure car bodies.

• **Single- & Dual-ram systems**

Single- and dual-ram types are available to suit the intended use.

Single-ram type: Measures a workpiece using single ram

Dual-ram type: Measures a workpiece placed between two simultaneously controlled rams



CARBstrato 601624D(Dual type)

\*The bellows shown in the photo are optional.

เครื่องวัดขนาดสามมิติ

### Car Body Measuring System MICROCORD CARBapex Series

**MeasurLink** ENABLED  
Data Management Software by Mitutoyo

• **The world's largest class of CMM**

The CARBapex series is a lineup of cost-effective horizontal-ram type, large CNC CMMs, and offers the world's largest measurement range that even makes it possible to measure car bodies.

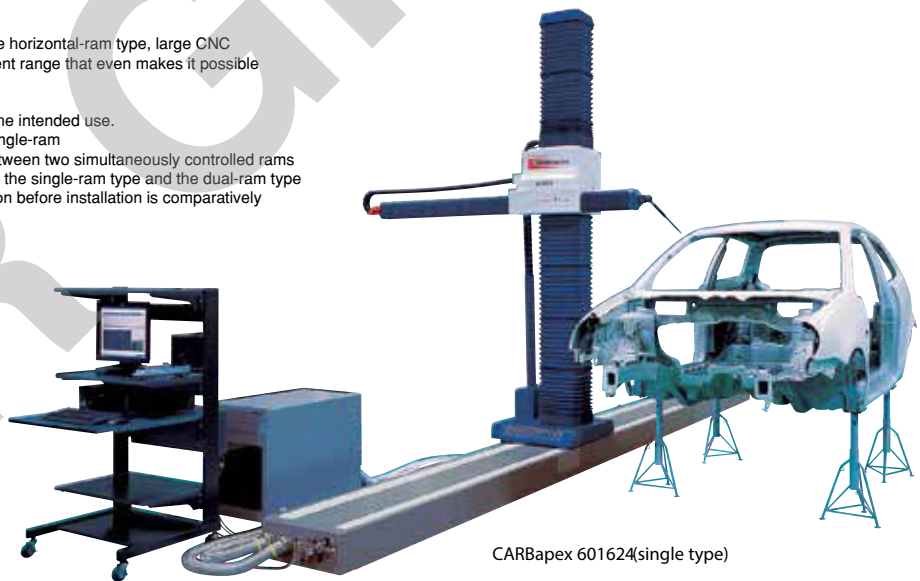
• **Single- & Dual-ram systems**

Single- and dual-ram types are available to suit the intended use.

Single-ram type: Measures a workpiece with a single-ram

Dual-ram type: Measures a workpiece placed between two simultaneously controlled rams

Also, since the height of the X-axis bases of both the single-ram type and the dual-ram type are set lower, the required depth for the foundation before installation is comparatively shallow.



CARBapex 601624(single type)

\*The bellows shown in the photo are optional.

## เครื่องวัดขนาดสามมิติ

### In-line Type CNC CMM MICROCORD MACH-3A 653

- In-line type CNC CMM (Horizontal type)  
Incorporating the CMM controller and the host computer in the main unit results in a compact spacing saving footprint for the shop floor. This series is designed for 24 hour operation resulting in stable operation and remarkable durability.

Items	Order No.	MACH-3A 653
Measuring range	X axis	600mm
	Y axis	500mm
	Z axis	280mm
Maximum drive speed		1 to 30mm/s (for TP7M)
Maximum drive speed		each axis 8 to 700mm/s; all axes 1212mm/s
Maximum acceleration		each axis 6860mm/s <sup>2</sup> ; all axes 11882mm/s <sup>2</sup>
Air supply <sup>*1*2</sup>	19 to 21°C	MPEE = 2.5+3.5L/1000µm <sup>*3</sup>
	5 to 40°C	MPEE = 3.9+6.5L/1000µm <sup>*3</sup>

\*1: Specifications vary by configuration, size, and thermal environment.

\*2: Using a TP7M (Stylus: ø4x20mm)

\*3: L = Measuring length (unit: mm)

For information about guaranteed accuracy within a temperature range other than 5 to 40 °C, contact your local Mitutoyo sales office.

MACH-3A 653



\*The indexing table is optional.

## เครื่องวัดขนาดสามมิติ

### In-line Type CNC CMM MICROCORD MACH-V9106

The MACH-V has been refined and has evolved over time maximizing machining operations by performing in-line or near-line, high speed coordinate measuring in concurrence with CNC machine tools. These high throughput machines can be incorporated within the manufacturing line and can provide pre/post machining feedback to your machine tool for machining adjustments.

Items	Order No.	MACH-V9106
Measuring range	X axis	900mm
	Y axis	1000mm
	Z axis	600mm
Maximum drive speed		1 to 20mm/s (for TP7M)
Maximum drive speed		each axis 8 to 500mm/s; all axes 866mm/s
Maximum acceleration		each axis 4900mm/s <sup>2</sup> ; all axes 8480mm/s <sup>2</sup>
Air supply <sup>*1*2</sup>	19 to 21°C	E0, MPE = 2.5+3.5L/1000µm <sup>*3</sup>
	5 to 40°C	E0, MPE = 3.6+5.8L/1000µm <sup>*3</sup>

\*1: Specifications vary by configuration, size, and thermal environment.

\*2: Using a TP7M (Stylus: ø4x20mm)

\*3: L = Measuring length (unit: mm)

For information about guaranteed accuracy within a temperature range other than 5 to 35 °C, contact your local Mitutoyo sales office.

MACH-V9106  
\*Sub-plate is optional.



## เครื่องวัดขนาดสามมิติ

### Agile Measuring System MACH Ko-ga-me

- Can be used in standalone applications or integrated into work cells.
- If required, the system can measure workpiece features that exceed the Ko-ga-me's X stroke by mounting the workpiece, or the Ko-ga-me, on an auxiliary X stroke.
- Ideal for inspection of large or small workpieces and offers a wide choice of measuring probes including touch-trigger and scanning types.  
(Note: Probe choice may be restricted, depending on the application.)

Items	Order No.	KGM888-B	KGM12128-B
Measuring range	X axis	80 mm	120 mm
	Y axis	80 mm	120 mm
	Z axis	80 mm	80 mm
Drive speed		Max. 200 (1 axis) / Max. 340 (Composition of 3 axes)	
Drive acceleration		Max. 3900 (1 axis) / Max. 6750 (Composition of 3 axes)	
Air supply <sup>*1*2</sup>	19 to 21 °C	E0, MPE = 2.0+5.0L/1000 µm <sup>*3</sup>	
	15 to 25 °C	E0, MPE = 2.3+5.7L/1000 µm <sup>*3</sup>	
	10 to 30 °C	E0, MPE = 2.7+6.5L/1000 µm <sup>*3</sup>	
	10 to 35 °C	E0, MPE = 3.0+7.2L/1000 µm <sup>*3</sup>	

\*1: Specifications vary by configuration, size, and thermal environment.

\*2: Using a TP200 or SP25M

\*3: L = Measuring length (unit: mm)

#### Standalone system

MACH Ko-ga-me

Stand (Option)



# COORDINATE MEASURING MACHINES

เครื่องวัดขนาดสามมิติ

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เครื่องวัดขนาดสามมิติ

**Manual Type CMM**

**MICROCORD Crysta-Plus M Series**

**MeasurLink<sup>®</sup> ENABLED**

Data Management Software by Mitutoyo

- Manual floating type CMMs developed in quest for high-accuracy, low-cost and easy operation. The Crysta-Plus M is suitable to measure a wide range of applications from a simple dimension to complex form.
- The scale systems on Mitutoyo high-precision models utilizes a high-performance linear encoder (manufactured by Mitutoyo), for detecting axis position. In addition, various technologies have been utilized in the structure, part processing, and assembly to provide high accuracy measurement.

- The Crysta-Plus M700 series has a large main unit, and is equipped with a mobile clamp so that onetouch clamping on each axis can be performed by hand. Continuous fine feed over the entire measuring range can be performed.
- Crysta high-precision series CMM's are equipped with temperature compensation and therefore do not require a temperature controlled room. Accuracy is guaranteed within the range of 15 to 30°C.
- Available options include the auto-leveling air spring vibration isolator and the illuminator unit for the probe.



Crysta-Plus M443with MCOSMOS



Crysta-Plus M574with MCOSMOS



Crysta-Plus M7106

**Guaranteed accuracy temperature limits for Crysta-Plus M Series**

Range	15 to 30°C
Rate of change	2°C per hour or less, 5°C in 24 hours or less
Gradient	1°C or less per meter (both horizontal and vertical direction)

Order No.		Crysta-Plus M443	Crysta-Plus M544	Crysta-Plus M574	Crysta-Plus M776	Crysta-Plus M7106
Measuring range	X axis	400mm	500mm		700mm	
	Y axis	400mm	400mm	700mm	700mm	1000mm
	Z axis	300mm	400mm		600mm	
Resolution		0.0005mm (0.5μm)			0.0005mm (0.5μm)	
Accuracy <sup>*1, *2</sup> (at 20 °C)	Measuring error (E)	E= (3.0+4L/1000) μm <sup>*3</sup>		E= (3.5+4L/1000) μm <sup>*3</sup>		E= (4.5+4.5L/1000) μm <sup>*3</sup>
	Probing error (R)	4.0μm			5.0μm	
Temperature compensation function		Standard				
Length standard		Linear encoder				
Guide method		Air bearings on each axis				
Clamping of each axis		One-touch air clamp (mobile clamp switch BOX)				
Fine feed of each axis		Continuous fine feed over the entire measuring range				
Measuring table	Effective size	624mmx805mm	764mmx875mm	764mmx1175mm	900mmx1440mm	900mmx1740mm
	Material	Granite				
Workpiece	Maximum height	480mm	595mm		800mm	
	Maximum mass	180kg			500kg	800kg
Z-axis balancing method		Counterweight (adjustable by 1.5kg)			Counterweight (adjustable by 1.7kg)	
Machine dimensions	Width	981mm	1122mm		1460mm	
	Depth	1047mm	1099mm	1434mm	1717mm	2017mm
	Height	1967mm	2267mm		2840mm	
Mass of main unit (including machine stand)		410kg	512kg	646kg	1560kg	1800kg
Air supply	Pressure	0.35MPa (air source: 0.5 to 0.9MPa)			0.4MPa (air source: 0.5 to 0.9MPa)	
	Consumption (Under normal conditions)	50L/min under normal conditions (air source: 100L/min)				

\*1: According to ISO 10360-2 methods

\*2: When using the touch-trigger probe MH20/MH20/TP20 and stylus (L10mm)

\*3: L=Measured length (mm)

Note: When the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

## แขนวัดขนาดสามมิติ

### Multi-axis Portable Coordinate Measuring System SpinArm-Apex



- SpinArm-Apex is a fully articulated coordinate measuring system featuring a wide range of measurement. The highly portable design of SpinArm-Apex enables the system to be positioned at any point within reach of the workpiece.
- Enables measurement of workpieces of complex shape in any direction.
- Brake mechanism greatly enhances usability.
- Counterbalance for easier operation.
- Supports both non-contact line laser probes and contact probes concurrently.



SpinArm-Apex 186H

SpinArm-Apex 367H

#### SpinArm-Apex H series (High accuracy, 6-axis model)

Model No.	SpinArm-Apex 186H	SpinArm-Apex 246H	SpinArm-Apex 306H	SpinArm-Apex 366H
Measuring envelop (Probe reaching diameter)*1	1800 mm	2400 mm	3000 mm	3600 mm
Repeatability *2*4	±0.021 mm	±0.026 mm	±0.044 mm	±0.060 mm
Accuracy (Arm type) *2*4	±0.028 mm	±0.035 mm	±0.058 mm	±0.072 mm
Mass (main unit)	15.0 kg	15.2 kg	15.7 kg	16.1 kg

#### SpinArm-Apex H series (High accuracy, 7-axis model)

Model No.	SpinArm-Apex 247H	SpinArm-Apex 307H	SpinArm-Apex 367H
Measuring envelop (Probe reaching diameter)*1	2400 mm	3000 mm	3600 mm
Repeatability *2*4	±0.0031 mm	±0.051 mm	±0.071 mm
Accuracy (Arm type) *2*4	±0.042 mm	±0.072 mm	±0.103 mm
Mass (main unit)	15.6 kg	16.1 kg	16.5 kg

#### SpinArm-Apex S series (Standard, 6-axis model)

Model No.	SpinArm-Apex 186S	SpinArm-Apex 246S	SpinArm-Apex 306S	SpinArm-Apex 366S
Measuring envelop (Probe reaching diameter)*1	1800 mm	2400 mm	3000 mm	3600 mm
Repeatability *2*4	±0.040 mm	±0.050 mm	±0.080 mm	±0.100 mm
Accuracy (Arm type) *2*4	±0.055 mm	±0.065 mm	±0.100 mm	±0.135mm
Mass (main unit)	15.0 kg	15.2 kg	15.7 kg	16.1 kg

#### SpinArm-Apex S series (Standard, 7-axis model)

Model No.	SpinArm-Apex 247S	SpinArm-Apex 307S	SpinArm-Apex 367S
Measuring envelop (Probe reaching diameter)*1	2400 mm	3000 mm	3600 mm
Repeatability *2*4	±0.055 mm	±0.090 mm	±0.110 mm
Accuracy (Arm type) *2*4	±0.080 mm	±0.135 mm	±0.165 mm
Mass (main unit)	15.6 kg	16.1 kg	16.5 kg

\*1 Measurement range is expressed as a diameter value at the maximum reach using software with the Sφ10mm standard probe mounted.  
 \*2 According to Mitutoyo's acceptance procedure. The accuracy guaranteed value above is determined when MS5-5R11G probe is mounted.  
 \*3 Guaranteed accuracy temperature: 16°C - 24°C (temperature gradient: 2 °C per hour)  
 \*4 Guaranteed accuracy temperature: 18°C - 22°C (temperature gradient: 2 °C per hour)

# COORDINATE MEASURING MACHINES

เครื่องวัดขนาดสามมิติ

# Mitutoyo

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## Software for Manual / CNC Coordinate Measuring Machines MCOSMOS

### MCOSMOS software modules

	GEOPAK	CAT1000P	CAT1000S	SCANPAK
MCOSMOS-1	○	—	—	—
MCOSMOS-2	○	○	○	—
MCOSMOS-3	○	○	○	○

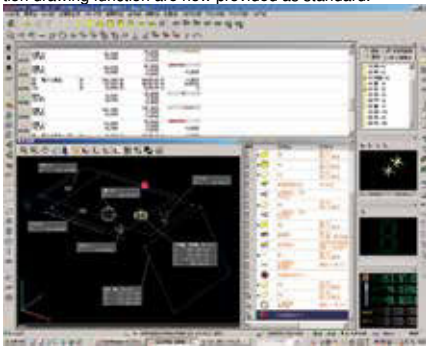
**MICAT**  
Mitutoyo Intelligent Computer Aided Technology  
the standard in world  
metrology software  
**cmm**

- MCOSMOS is the data processing program family for the CMM that runs on Windows.
- It is unnecessary to learn any special code since measurement can be performed by selecting the icons or the pull-down menu to select functions in the same manner as for Windows OS operation.

#### GEOPAK

[General purpose measurement program]

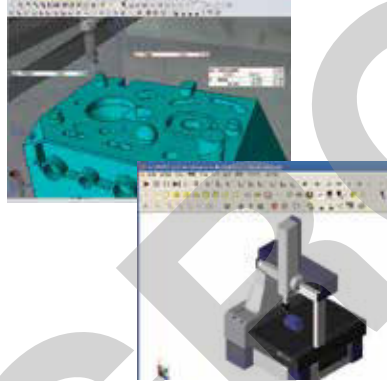
This is the basic software for dimension measurement. The enhanced graphic functionality allows real time drawing of the measurement result, and the best-fit function, previously optional, and even the geometrical deviation drawing function are now provided as standard.



#### CAT1000P

[On-/Off-line teaching program]

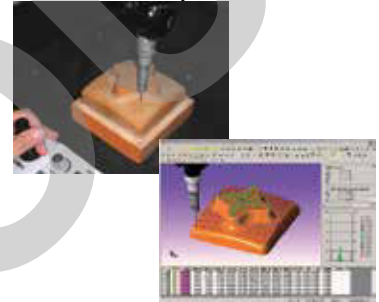
This software is used for on-/off-line teaching. The interference check function is also added so that programming error when off-line can be prevented. In addition to SAT and STEP, (standard function) as CAD data that can be imported, CATIA V4/V5, PARASOLID, Creo, etc. are supported. (optional)



#### CAT1000S

[Curved surface evaluation program]

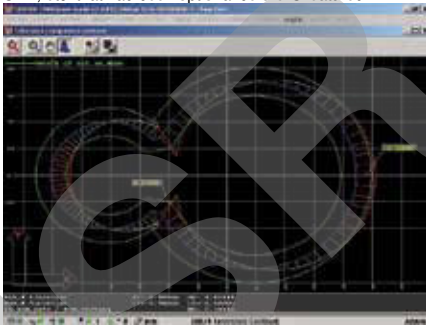
This software is used for free-form surface evaluation and on-/offline teaching. It is possible to display measurement results on CAD data in various ways.



#### SCANPAK

[Contour measurement program]

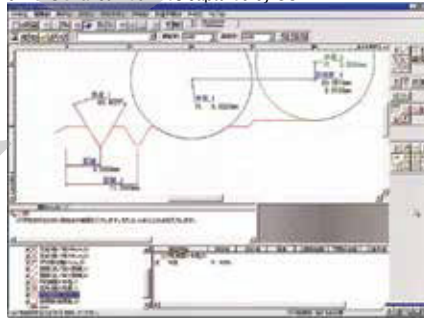
This software enables measurement/ evaluation of two-dimensional sectional contours. The data output function to CAD, etc. that had been optional before is featured.



#### FORMTRACEPAK-AP

[Analysis program]

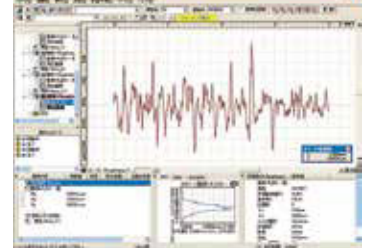
This program is used for minutely analyzing two-dimensional curved lines captured by SCANPAK.



#### SURFPAK-SP

[Analysis program]

This is a software program as used for the roughness probe "SURFTEST PROBE" for a CMM. With this program, surface roughness analysis conforming to standards such as ISO, JIS, ANSI, and VDA are available. Cooperation with MCOSMOS enables full-automatic dimensional measurement and surface roughness measurement.



#### MAFIS

[Blade evaluation program]

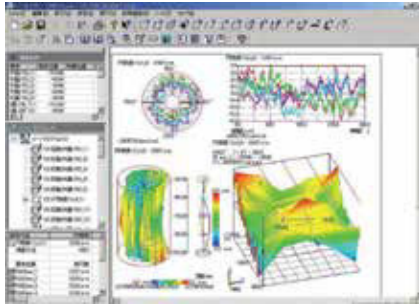
This software is used for evaluation of sectional contours of blades to be used in jet engines for aircraft.



## ROUNDPAK-CMM

The function of analysis software as used for roundness measuring machines is now available on MCOsmOS.

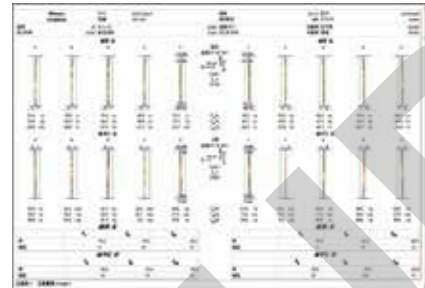
As well as roundness and cylindricity evaluation, various filters are also available.



## GEARPAK-Cylindrical

[Gear evaluation program]

This is a program for evaluation of involute gear teeth obtained from CNC CMMs, and tooth profile or tooth trace based on cylindrical gear measurement data.



## GEARPAK-Worm

[Gear evaluation program]

This is a program for evaluation of tooth form, tooth trace, etc., based on worm measurement data obtained from CNC CMMs.

## GEARPAK-Bevel/Hypoid

[Gear production support/evaluation program]

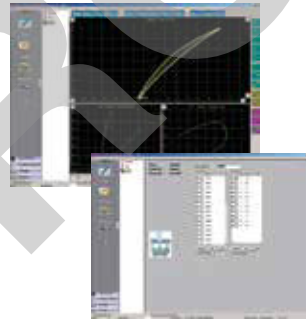
This is a program for evaluation of tooth form, pitch error, etc., based on measurement data from bevel or hypoid gears obtained by CNC CMM.



## MAFIS Express

[Blade measurement/Evaluation program]

This software program enables creation of measurement programs and measurement and analysis of blades and blisks. A part program for measurement can be automatically created just by selecting required contents and evaluation conditions. The measurement results will be displayed in a report including 2D graphics.



# COORDINATE MEASURING MACHINES

เครื่องวัดขนาดสามมิติ

# Mitutoyo

ซอฟต์แวร์ เครื่องวัดขนาดสามมิติ

## Automatic measurement program generation software MiCAT Planner

**One-click programming that changes the relationship between people and precision measurement**

- Identifies tolerance information included in 3D models with Product and Manufacturing Information (PMI), defines measurement locations and creates a measurement program fully automatically.
- Through its optimization function, the software estimates the shortest route for measurement with the minimum of probe repositioning and tool changing, and creates a program that enables measurement in the minimum possible time.
- Utilizing the rule editor function to set the measurement rules prevents variation in measurement quality between program writers.

- Identifies tolerance information included in 3D models with Product and Manufacturing Information (PMI), defines measurement locations and creates a measurement program fully automatically. Also, even with the 3D CAD model without tolerance information, the measurement program can be created automatically just by adding tolerance information on the MiCAT Planner. This is more efficient than the conventional teaching model.

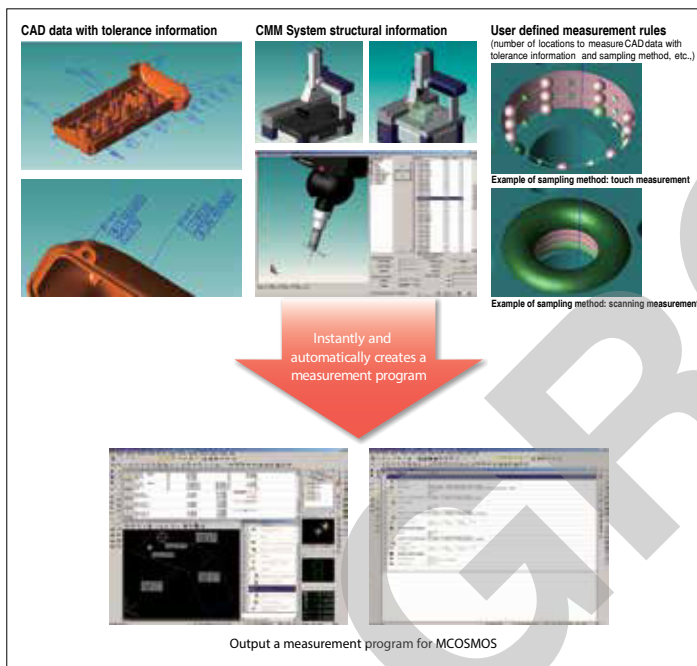
Note: To use a measuring program created by the MiCAT Planner you will need a special "right to execute". A "right to execute" for one 3D measuring machine is included in the MiCAT Planner.

### Tolerance information add function

Lets you add tolerances in the software even for 3D CAD models containing no tolerance information. Automatically create optimal measuring programs based on the added tolerance specifications.

### Supported languages

Available in 15 languages (Japanese, English (US, UK), German, French, Spanish, Portuguese, Italian, simplified Chinese, traditional Chinese, Korean, Polish, Czech, Dutch, and Turkish)



### Case study

Compare the measurement part-programming time for a test piece.

- 1: Programming in 2D drawing: **45-60 minutes**
- 2: Programming using 2D drawing + 3D CAD: **15-20 minutes**
- 3: Create with MiCAT Planner (using 3D CAD model + PMI): **approx. 3 minutes!**

Note: The measurement rules are defined in advance.



Part-programming time  
**Reduced by up to 95% !!**

Guarantee a **dramatically reduced development phase** and at the same time improve product quality.

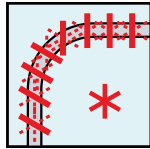
## เครื่องวัดขนาดสามมิติ

### Non-contact Line Laser Probe for SpinArm-Apex SurfaceMeasure

- Three lasers used with the cross type line laser enable batch scanning. Complicated form can be measured efficiently (in the case of SurfaceMeasure 606T). Less changing of the probe orientation contributes to the improvement of measurement efficiency

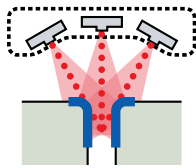


No change of probe attitude



Individual beam selectable

Scanning from three directions enables simultaneous measurement of the top surface and inner surface



The laser light is emitted from three oblique directions.

- The flying spot type is capable of scanning difficult parts, such as this impeller, precisely and achieves highest scanning accuracy in the class (in the case of SurfaceMeasure 201FS).



#### Ultra-high speed data collection

- SurfaceMeasure is a laser probe that collects coordinate values of the surface of the workpiece by moving and irradiating laser light over the workpiece.  
\* When using SurfaceMeasure 606/610/1010

#### Advantages of non-contact type

- Non-contact measurement enables measurement of materials that can be easily-deformed by contact measurement, including resin or thin, elastic parts.

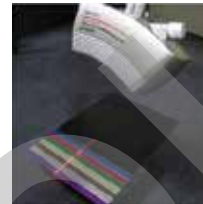


#### Powder-less measurement

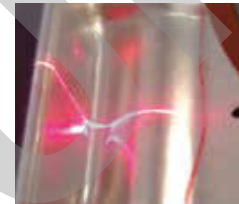
- Automatic configuration of the camera sensitivity and the laser intensity settings according to the environment and materials enable establishing a simple and comfortable laser-scanning environment since measurement is now powder and spray free.

#### Evaluation cases

- The collected point cloud data can be used by various optional software in a wide range of applications, such as editing, plane creation, comparison using CAD data and more.



Measuring a color sample plate



Measuring a glossy object



606/610/1010



606T

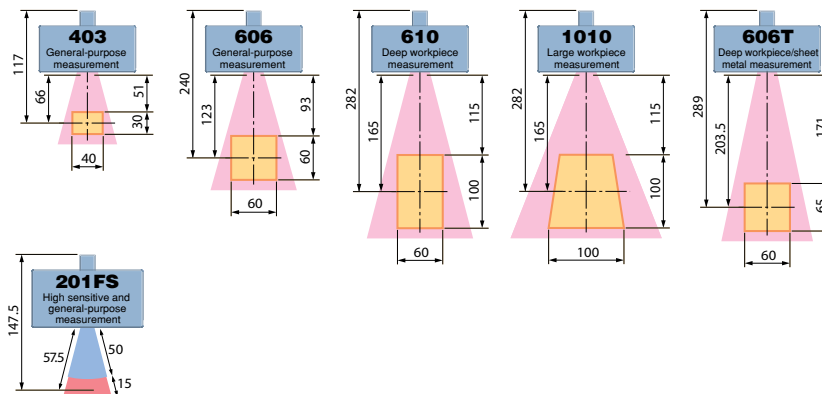


201FS

Order No.	Surface Measure 403*1	Surface Measure 606	Surface Measure 610	Surface Measure 1010	Surface Measure 606T	Surface Measure 201FS
Items						
Laser irradiation method	Line Laser (single)				Line Laser (cross)	Flying spot
Max. scan width	40mm	60mm	60mm	Max. 100mm	3x65mm	Max. 23mm
Max. scan depth	30mm	60mm	100mm	100mm	65mm	15mm
Stand-off	66mm	240mm	282mm	282mm	203.5mm	57.5mm
Scanning error*2	8µm	12µm	15µm	18µm	17µm	1.8µm
Max. Acquisition rate	60,000 points/sec	75,000 points/sec		3x25,500 points/sec		25,000 points/sec.
Mass	430g	430g	400g	400g	480g	500g
Laser Class	EN/IEC	Class2 [ EN/IEC 60825-1(2007) ]				
	JIS	Class2 [ JIS C 6802 : 2011 ]				
	Laser type	Red semiconductor				Semiconductor
Line Laser	Wavelength	660nm				670nm
	Output	4mW				1mW
Point Laser	Wavelength	635nm				—
	Output	1mW				—

\*1: Made-to-order models

\*2: According to Mitutoyo's acceptance procedure. (1σ/sphere measurement, probe alone)



# COORDINATE MEASURING MACHINES

เครื่องวัดขนาดสามมิติ



ซอฟต์แวร์ เครื่องวัดขนาดสามมิติ

## Point Cloud Processing Software for Coordinate Measuring Machines MSURF V5.1

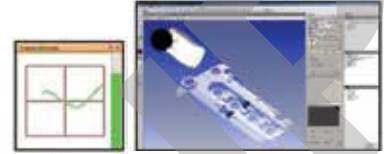


### MSURF V5.1 software modules

Software package	On-line				Off-line			
	MSURF-S RUN	MSURF-S 1	MSURF-S 2	MSURF-S 3	MSURF-G 1	MSURF-G 2	MSURF-G 3	MSURF-I PRO
MSURF-S	√	√	√	√				
MSURF-G					√	√	√	
MSURF-I								√
MSURF-I Option			√	√	√	√		
MSURF-MESH PRO			√	√	√	√	√	√
MSURF-PLANNER*		√		√	√		√	
MSURF-PLANNER RUN*	√							

\* To run a measurement macro created by MSURF-PLANNER, the module "MSURF-PLANNER RUN" is required separately.

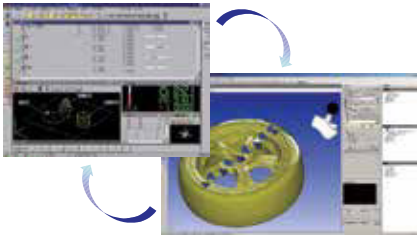
• **MSURF** is a software program that enables users to perform operations from measurement to evaluation on the same platform when the non-contact line laser probe, SurfaceMeasure, is used. Eight software modules are provided according to the task.



Note: If not using the ACR3 probe changer, probe replacement is performed manually.

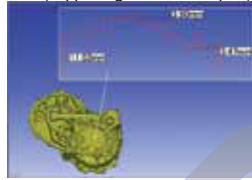
#### MSURF-S

Calculates point cloud data measured by CNC CMM with SurfaceMeasure. It generates scanning paths by defining the scanning start position, length, and width.

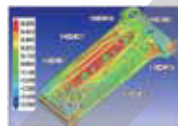


#### MSURF-I

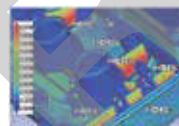
Conducts analysis or comparison verification of measured point cloud data in reference to nominal data (supporting CAD data import).



Section evaluation (dimensional calculation)



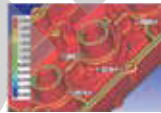
Error color-coded map



Thickness color-coded map



Evaluation of step/clearance



Surface curvature evaluation

#### MSURF-MESH PRO

This software is provided with various functions such as filtering point cloud data and mesh data. The software is enhanced by adding functions to standard ones. It also enables functions such as mesh data thinning-out, highlighting, interpolation and outlier removal that are unavailable as standard.

Note: MSURF-MESH PRO has the optional functions of MSURF-I.

#### MSURF-PLANNER RUN

MSURF-PLANNER RUN is optional software required to execute and edit measurement macros created by MSURF-PLANNER.

Note 1: MSURF-PLANNER RUN is optional software added to MSURF-S or MSURF-G.

Note 2: This optional software is not required for a PC with MSURF-PLANNER installed.

#### MSURF-PLANNER

MSURF-PLANNER is software to automatically create measurement macros (surface form, feature form) for the line laser probe from 3D CAD data.

Optimized data (travel path, number of probe head revolutions, etc.) of a measurement path will contribute to improvements in productivity.



Automatic z of measurement macros by MSURFPLANNER

#### MSURF-G

MSURF-G is the off-line version of MSURF-S. It allows users to create measurement programs in advance of actual measurements on a CMM by using CAD data. Therefore, users can start measurement immediately at the time a real workpiece is ready. Since MSURF-S is a standalone PC application, only requiring installation by the user, it helps preserve valuable CMM time exclusively for productive measurement.

Note: MSURF-G cannot be combined with MSURF-S.

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## ACCESSORIES PROBE / CLAMPING SYSTEM

### Scanning probe

#### MPP-310Q

**Ultra-high accuracy and low measuring force scanning probe**  
This ultra-high precision scanning probe incorporates built-in XYZ scales for highest accuracy performance. The compact size of this probe is ideal for low measuring force and high speed scanning. Data collection can be performed by scanning measurement, ultrahigh precision point measurement and center alignment measurement.



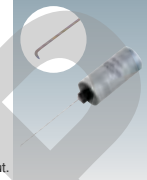
#### SP80

**High accuracy scanning probe (long stylus supported)**  
A highly accurate stylus up to 500mm in length (both horizontally and vertically) can be installed on this probe. This ultra-high precision scanning probe allows data collection by scanning measurement, ultra-high precision point measurement and center alignment point measurement.



#### SP25M

**Compact high accuracy type scanning probe**  
This compact, multifunctional and highly accurate scanning probe is only 25mm in diameter, which enables it to access shrouded workpiece features. Data collection is by scanning measurement, ultra-high precision point measurement and center alignment point measurement. The probe can be attached to a probe head (PH10M/10MQ) to automatically change the orientation allowing for maximum flexibility in measurement.



#### MPP-10

**Probe for effective thread-depth measurement**  
This is the only probe in the world that is dedicated to measure effective screw-thread depth on a CNC CMM. The probe can also attach to a probe head (PH10M/10MQ) to change the orientation to measure bores in various directions.



#### REVO-2

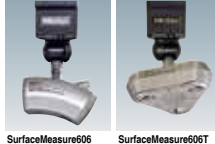
**High speed 5-axis scanning head**  
This high-speed scanning head delivers high accuracy measurement while delivering high throughput. Contact measurement with a stylus that can be up to 500mm in length increases flexibility and makes simultaneous 5-axis measuring with non-step indexing possible.



### Non-contact probe

#### SurfaceMeasure

**Non-contact type laser probe**  
This compact, high accuracy, non-contact type laser probe is designed for use with CNC CMMs. The scanning probe automatically adjusts to workpiece surface characteristics to deliver highly efficient measurements. Automatic laser intensity and camera sensitivity adjust according to the environment and the workpiece material, for simpler and more comfortable laser scanning.



#### QVP

**QUICK VISION probe**  
This CNC CMM Quick Vision Probe utilizes Mitutoyo's technology in a vision measuring machine for totally automated video measurement.



#### CF20

**Centering microscope for CMMs**  
This centering microscope enables measurement of small holes or elastic bodies that are very difficult to measure using a contact measurement method such as with a touch-trigger probe. It also allows a CMM to be used as a very large microscope.



### A probe for roughness measurement

#### SURFTEST PROBE

**Probe for surface roughness measurement**  
Mounting this probe on a CMM enables surface roughness measurement and analysis to be included in fully automatic CNC measurement cycles. This probe is compatible with an automatic probe changer, and therefore can be automatically replaced with another type of probe for 3D coordinate measurement. A wide variety of roughness analyses can be performed using the dedicated evaluation program.



### Touch-trigger probe

#### TP7M



**High accuracy touch-trigger probe**  
This high-accuracy touch-trigger probe has a high repeatability figure of  $2 \leq 0.25 \mu\text{m}$ . A long stylus, up to 150mm in length, can be installed.

#### TP200



**Compact high-accuracy touch-trigger probe**  
This compact, high accuracy, touch-trigger probe is only 13.5mm in diameter, making it an ideal choice where high-accuracy measurement inside narrow or shrouded workpiece features is needed. Stylus auto-changing (optional) is supported.

#### TP20



**Compact touch-trigger probe**  
This compact touch-trigger probe is only 13.5mm in diameter, making it an ideal choice for probing deep inside narrow or shrouded workpiece features. Stylus auto-changing (optional) is supported when mounted on a CNC CMM.

#### MH20i

#### Touch-trigger probe equipped with manual probe head

This touch-trigger probe equipped with a manual probe head is designed for use with manual CMMs. The probe head can be manually indexed to 168 positions.



#### MH20

#### Touch-trigger probe equipped with manual probe head

This touch-trigger probe equipped with a manual probe head is designed for use with manual CMMs. The probe head can be manually positioned to the desired orientation.



#### UMAP-CMM

#### Micro touch probe

A stylus with an ultra-small diameter of 0.1mm or 0.3mm can be used. Measurement of minuscule form is possible by mounting on the PH10MQ.



#### PH20

**5-axis control touch-trigger system**  
Thanks to unique "head touches", it is possible to measure by movement of the probe head itself instead of moving the CMM elements. Also, measuring time can significantly be shortened by means of 5-axis concurrent control and stepless positioning angle.



# COORDINATE MEASURING MACHINES

เครื่องวัดขนาดสามมิติ

# Mitutoyo

## Probe head

### PH10M/10MQ Motorized probe head

The probe allows automatic control of positioning (up to 720 directions) of the mounted probe. It is possible to mount not only a touch-trigger probe but also any scanning probe, vision probe, laser probe, screw thread depth probe, etc. Auto-changing is available (optional).



▲ Mounting example of touch-trigger probe

### MIH

#### Mounting example of touchtrigger probe

This probe head allows manual positioning (up to 720 directions) of the mounted probe (for TP200/ TP20/ TP2-5W). A probe extension up to 300mm can be attached.



▲ Mounting example of touch-trigger probe

### PH1

#### Mounting example of touch-trigger probe

This manual probe head is designed for use with the TP200/ TP20. It is possible to manually change positioning of the attached probe to the desired orientation.



▲ Mounting example of touch-trigger probe



## Clamping System

• A workpiece can be mounted on a CMM's measuring table using a variety of combinations of Eco-Fix clamping components. A dedicated fixturing jig isn't necessary.

• Starter kits "Eco-fix Kit S" and "Eco-fix Kit L" are available.

### Eco-fix Kit S

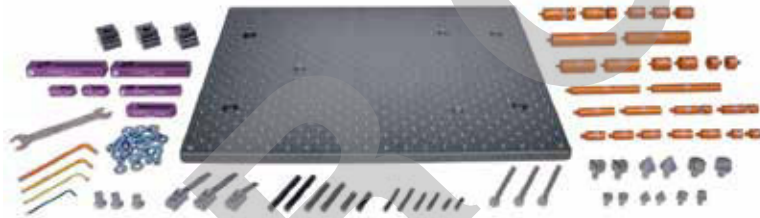


A kit includes a 250mm x 250mm base plate and a variety of clamping components.

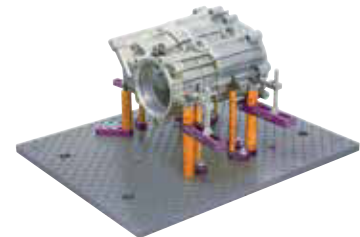


Usage example of Eco-fix Kit S

### Eco-fix Kit L



A kit includes a 500mm x 400mm base plate and a variety of clamping components.



Usage example of Eco-fix Kit L

Note: Individual clamping components are not available for sale. A component extension kit is available for partial replacement. Due to a probe contact or vibration of the measuring instrument, a measurement error may occur if the fixing is insufficient.