COORDINATE MEASURING MACHINES

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Coordinate Measuring Machines

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CONTENTS

Mitutoyo

MACH-Ko-Ga-Me

SERIES 357 – The Agile CNC CMM

- Compact, 3D CNC measuring system that can flexibly configure to almost any process.
- Small-sized, requiring only a minimal installation envelope of 440 x 410 x 120 mm.
- Agile and easy for a customer to mount using either an available fixed base or mounting system of your own design.
- Can be used in stand-alone applications or integrated into work cells.
- Ideal for inspection of small workpieces and offers a wide range of measurement probes including touch trigger, optical and contact scanning types.

MACH-Ko-Ga-Me

Technical Data

Length standard:	Linear encoder
Guide system:	Straight-motion hard bearing
Max. drive speed:	340 mm/s
Max. acceleration:	6750 mm/s^2

Fixed-base installation.

Optional stand.

SPECIFICATIONS

Model		MACH-Ko-Ga-Me
		12128-3V
Measuring range*1	X	120 mm (125 mm)
	Y	120 mm (125 mm)
	Z	80 mm (85 mm)
Resolution		0.02 µm
Accuracy*2	19°C - 21°C	±(2.0+0.5L/100) µm
	15°C - 25°C	±(2.3+0.57L/100) µm*3
	10°C - 30°C	±(2.7+0.65L/100) µm*3
	10°C - 35°C	±(3.0+0.72L/100) µm*3
Mass (main unit)		29 kg

*1 Values in parentheses show range of movement of centre of probe tip.
*2 TP200 stylus: Ø3 mm x L10 mm, SP25M stylus: Ø4 mm x L50 mm.
*3 With thermal compensation function in operation.

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MACH-3A

SERIES 360 – In-Line Type CNC CMM

- High speed for manufacturing. The ideal replacement for your mechanical gauges.
- Designed for shopfloor conditions 5°C - 40°C.
- Touchscreen for easy operation.
- High-speed measurements: drive speed (max.) = 1212 mm/s.
- Accuracy up to 2.5 µm.
- Designed for automated processes.
- Choose from the full range of Mitutoyo CMM products including styli, jigs, loading systems, indexing heads.

Technical Data

Length standard:	High-accuracy linear encoder
Guide system:	Linear guide
Max. drive speed:	1212 mm/s
Max. acceleration:	11880 mm/s^2

Guaranteed accuracy temperature environment

Temperature range		5°C - 40°C
Temperature change	Per hour	2.0 K
	Per 24 hours	10.0 K
Temperature gradient	Vertical	1.0 K/m
	Horizontal	1.0 K/m

Main Unit Startup System

A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

MACH-3A 653

SPECIFICATIONS

Model			MACH-3A 653
Measuring range	X		600 mm
	Y		500 mm
	Z		280 mm
Resolution			0.1 µm
Accuracy*	$E_{0,MPE}$	19°C - 21°C	±(2.5+0.35L/100) µm
		15°C - 25°C	±(2.8+0.42L/100) µm
		10°C - 30°C	±(3.2+0.50L/100) µm
		5°C - 35°C	±(3.5+0.57L/100) µm
		5°C - 40°C	±(3.9+0.65L/100) µm
	$P_{FTU,MPE}$		±2.5 µm

* The machine is equipped with a thermal compensation system.
According to ISO 10360-2/4/5 methods when using the TP7M probe system with a ø4 x 20 mm stylus. L: measuring length (mm).

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MACH-V

SERIES 360 – In-Line Type CNC CMM

- The MACH-V maximizes machining performance by performing in-line, high-speed coordinate measuring in conjunction with your CNC machine tools.
- These high-throughput machines can be incorporated right into the manufacturing line and can provide pre/post-machining feedback to your machine tool for process adjustments.

MACH-V9106

Technical Data

Length standard:	High-accuracy linear encoder
Guide system:	Linear guide
Max. drive speed:	866 mm/s
Max. acceleration:	8480 mm/s^2

Guaranteed accuracy temperature environment

Temperature range		5°C - 35°C
Temperature change	Per hour	2.0 K
	Per 24 hours	10.0 K
Temperature gradient	Vertical	1.0 K/m
	Horizontal	1.0 K/m

Main Unit Startup System

A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

SPECIFICATIONS

Model			MACH-V	
			565	9106
Measuring range		X	500 mm	900 mm
		Y	600 mm	1000 mm
		Z	500 mm	600 mm
Resolution			0.1 µm	
Accuracy*	$E_{0,MPE}$	19°C - 21°C	±(2.5+0.35L/100) µm	
		18°C - 22°C	±(2.7+0.38L/100) µm	
		15°C - 25°C	±(2.9+0.43L/100) µm	
		5°C - 35°C	±(3.6+0.58L/100) µm	
	$P_{FTU,MPE}$		±2.5 µm (±2.2 µm: using SP25M)	

* The machine is equipped with a thermal compensation system.
According to ISO 10360-2/4/5 methods when using the TP7M probe system with a ø4 x 20 mm stylus. L: measuring length (mm)

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CRYSTA-Plus M

SERIES 196 – Manual-Floating Type CMM

- Manual floating type CMMs developed in the quest for high accuracy, low cost and easy operation.
- The CRYSTA-Plus M is applicable to a wide range of applications from simple dimension to complex form measurement.
- Smooth operation due to high-precision air bearings and lightweight moving members.
- Continuous fine feed over the entire measuring range.

Technical Data

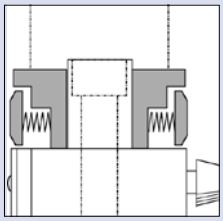
Length standard:	High-accuracy linear encoder
Guide system:	Air bearing
Axis clamp:	One-touch air clamp (screw clamp: M776, M7106)
Fine feed range:	Entire range
Air pressure:	0.4 MPa (0.35 MPa: M443, M544, M574)
Air consumption:	50 L/min

Guaranteed accuracy temperature environment

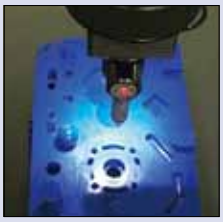
Temperature range		19°C - 21°C	**15°C - 30°C**
Temperature change	Per hour	—	**2.0 K**
	Per 24 hours	—	**5.0 K**
Temperature gradient	Vertical	0.5 K/m	**1.0 K/m**
	Horizontal	0.5 K/m	**1.0 K/m**

* The values shown in Bold in the table above apply to the case when using a thermal compensation system (Option).

One-touch air clamp and fine feed for rapid and easy positioning



Ergonomically designed guide grip on Z-axis for reliable measurement (only for Crysta-Plus M776 and M7106).



Probe illumination (optional) to illuminate the probe and styli directly and brighten the working field.

CRYSTA-Plus M574

CRYSTA-Plus M7106

SPECIFICATIONS

Model		CRYSTA-Plus M				
		443	**544**	**574**	**776**	**7106**
Measuring range	X	400 mm	500 mm		700 mm	
	Y	400 mm		700 mm		
	Z	300 mm	400 mm		600 mm	
Resolution		0.5 µm				
Accuracy*	E	±(3.0+0.4L/100) µm	±(3.5+0.4L/100) µm		±(4.5+0.45L/100) µm	
	R	±4.0 µm			±5.0 µm	
Work table	Material	Granite				
	Size	624 x 805 mm	764 x 875 mm	764 x 1175 mm	900 x 1440 mm	900 x 1740 mm
	Tapped insert	M8 x 1.25 mm				
	Max. loading	180 kg			500 kg	800 kg
Max. workpiece height		480 mm	590 mm		800 mm	
Mass (main unit)		360 kg	450 kg	575 kg	1451 kg	1697 kg

* The thermal compensation system is optionally available.
According to ISO 10360-2 methods when using the TP20 probe system. L: measuring length (mm)

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CRYSTA-Apex

SERIES 191 – Standard CNC CMM

- Designed and constructed using Mitutoyo's many years of experience in CNC CMM technology, CRYSTA-Apex features lightweight materials and an innovative machine structure, providing high motion stability, high accuracy, and affordability.
- The thermal compensation function (16°C to 26°C) can yield accurate measurements even on the shop floor.
- In addition to contact measurement, the MPP-310Q and SMP laser probes provide a contact/non-contact scanning function.

CRYSTA-Apex S544

CRYSTA-Apex S776

CRYSTA-Apex S122010

Technical Data

Length standard:	High-accuracy linear encoder
Guide system:	Air bearing
Max. drive speed:	519 mm/s
Max. acceleration:	2309 mm/s^2 (1732 mm/s^2 Type Z800)
Air pressure:	0.4 MPa
Air consumption:	50 L/min (500 series) 60 L/min (700, 900 series)

Guaranteed accuracy temperature environment

Temperature range		18°C - 22°C	16°C - 26°C
Temperature change	Per hour	1.0 K	
	Per 24 hours	2.0 K	5.0 K
Temperature gradient	Vertical	1.0 K/m	
	Horizontal	1.0 K/m	

Main Unit Startup System

A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

Workpiece thermal compensation system temperature sensors.

The machine structure has been optimized using FEM (Finite-Element Method) and modal analysis.

Controllers are equipped with one or two joysticks, according to model of CMM.

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SPECIFICATIONS

Model		CRYSTA-Apex			
		S544	**S574**	**S776**	**S7106**
Measuring range	X	500 mm		700 mm	
	Y	400 mm	700 mm	700 mm	1000 mm
	Z	400 mm		600 mm	
Resolution		0.1 µm			
Accuracy*1	$E_{0,MPE}$	±(1.7+0.3L/100) µm, ±(1.7+0.4L/100) µm*2			
	$P_{FTU,MPE}$	±1.7 µm			
	MPE_{THP}	±2.3 µm (50 s)			
Work table	Material	Granite			
	Size	638 x 860 mm	638 x 1160 mm	880 x 1420 mm	880 x 1720 mm
	Tapped insert	M8 x 1.25 mm			
	Max. loading	180 kg		800 kg	1000 kg
Max. workpiece height		545 mm		800 mm	
Mass (main unit)		515 kg	625 kg	1675 kg	1951 kg

Model		CRYSTA-Apex					
		S9106 [S9108]	**S9166 [S9168]**	**S9206 [S9208]**	**S121210**	**S122010**	**S123010**
Measuring range	X	900 mm			1200 mm		
	Y	1000 mm	1600 mm	2000 mm	1200 mm	2000 mm	3000 mm
	Z	600 mm [800 mm]			1000 mm		
Resolution		0.1 µm					
Accuracy*1	$E_{0,MPE}$	±(1.7+0.3L/100) µm, ±(1.7+0.4L/100) µm*2			±(2.3+0.3L/100) µm, ±(2.3+0.4L/100) µm*2		
	$P_{FTU,MPE}$	±1.7 µm			±2.0 µm		
	MPE_{THP}	±2.3 µm (Z_{600} = 50 s, Z_{800} = 90 s)			±2.8 µm (50 s)		
Work table	Material	Granite					
	Size	1080 x 1720 mm	1080 x 2320 mm	1080 x 2720 mm	1420 x 2165 mm	1420 x 2965 mm	1420 x 3965 mm
	Tapped insert	M8 x 1.25 mm					
	Max. loading	1200 kg	1500 kg	1800 kg	2000 kg	2500 kg	3000 kg
Max. workpiece height		800 mm [1000 mm]			1200 mm		
Mass (main unit)		2231 kg [2261 kg]	2868 kg [2898 kg]	3912 kg [3942 kg]	4050 kg	6150 kg	9110 kg

Model		CRYSTA-Apex				
		C163012 [C163016]	**C164012 [C164016]**	**C165012 [C165016]**	**C203016**	**C204016**
Measuring range	X	1600 mm			2000 mm	
	Y	3000 mm	4000 mm	5000 mm	3000 mm	4000 mm
	Z	1200 mm [1600 mm]			1600 mm	
Resolution		0.1 µm				
Accuracy*1	$E_{0,MPE}$	±(3.3+0.45L/100) µm, ±(3.3+0.55L/100) µm*2, [±(4.5+0.55L/100) µm, ±(4.5+0.65L/100) µm*2]			±(4.5+0.8L/100) µm, ±(4.5+0.9L/100) µm*2	
	$P_{FTU,MPE}$	±5.0 µm [±6.0 µm]			±6.0 µm	
	MPE_{THP}	±6.0 µm [±7.0 µm] (150 s)			±6.0 µm (150 s)	
Work table	Material	Granite				
	Size	1800 x 4205 mm	1800 x 5205 mm	1800 x 6205 mm	2220 x 4205 mm	2220 x 5205 mm
	Tapped insert	M8 x 1.25 mm				
	Max. loading	3500 kg	4500 kg	5000 kg	4000 kg	5000 kg
Max. workpiece height		1400 mm [1800 mm]			1800 mm	
Mass (main unit)		10600 kg [10650 kg]	14800 kg [14850 kg]	19500 kg [19550 kg]	14100 kg	19400 kg

*1 The machine is equipped with a thermal compensation system.
According to ISO 10360-2/4/5 methods when using the SP25M probe system with a ø4 x 50 mm stylus. L: measuring length (mm)
*2 Guaranteed accuracy temperature range: 16°C - 26°C.

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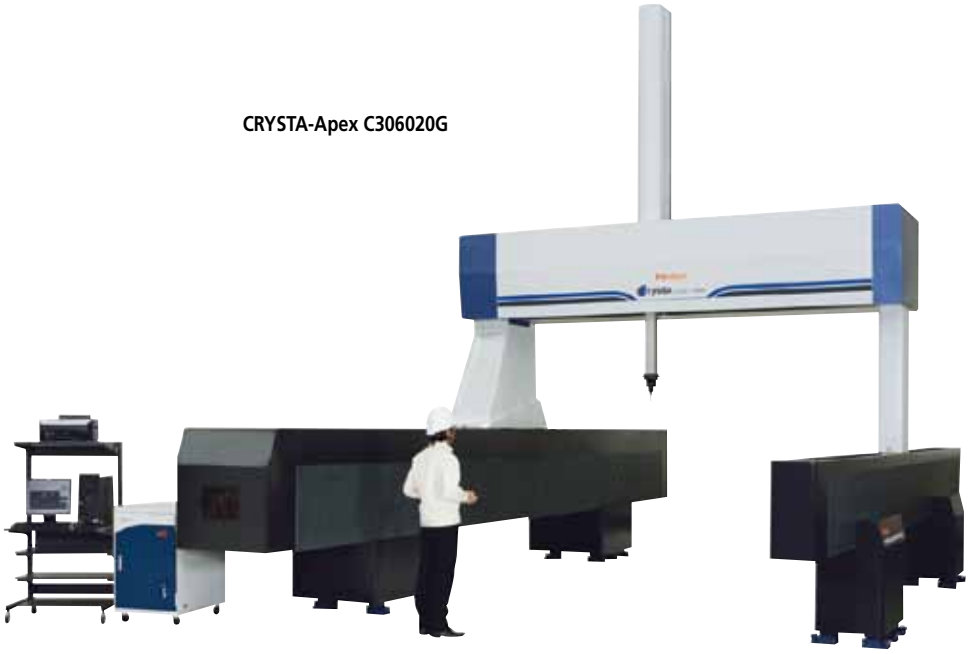
CRYSTA-Apex

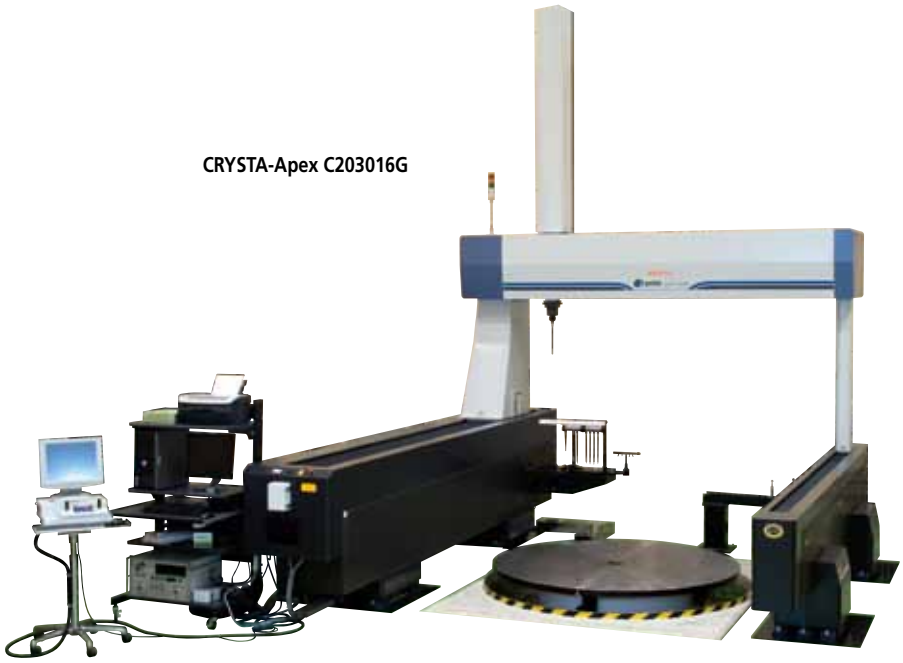
SERIES 191 – Large Gantry CNC CMM

- This gantry type CNC CMM provides a large measuring range of 2000 x 3000 x 1600 mm to 3000 x 6000 x 2000 mm with large-size CMM accuracy.
- Lightweight materials and an innovative moving-bridge type machine structure provide high motion stability, high accuracy, and affordability.

CRYSTA-Apex C306020G



CRYSTA-Apex C203016G



Technical Data

Length standard:	High-accuracy linear encoder
Guide system:	Air bearing
Max. drive speed:	500 mm/s

Guaranteed accuracy temperature environment*

Temperature range		18°C - 22°C
Temperature change	Per hour	1.0 K
	Per 24 hours	2.0 K
Temperature gradient	Vertical	1.0 K/m
	Horizontal	1.0 K/m

* When using thermal compensation system.

Main Unit Startup System

A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

SPECIFICATIONS

Model		CRYSTA-Apex	
		C203016G	C306020G
Measuring range	X	2005 mm	3005 mm
	Y	3005 mm	6005 mm
	Z	1605 mm	2005 mm
Resolution		0.1 µm	
Accuracy*	MPEE	±(9+6L/1000) µm	±(11+7L/1000) µm
Mass (main unit)		6000 kg	14000 kg

* The machine is equipped with a thermal compensation system.
When using the TP200 probe system. L: measuring length (mm)

STRATO-Apex

SERIES 355 – High Accuracy CNC CMM

- A long-awaited, state-of-the-art CNC coordinate measuring machine that achieves high accuracy combined with high-speed operation.
- The high drive speed and acceleration guarantee top scanning performance in a machine that also offers high-accuracy measuring in the 1 µm class.
- High speed and accuracy in measurement is ensured by a redesign of the machine body that has improved rigidity of the structure, and by a remodelled guide mechanism.
- High-performance scanning measurement has been achieved through the improved structural rigidity and incorporation of a newly developed compensation technology.
- Ultra-high precision scales are used on each axis to provide a higher resolution and accuracy that complements the improved overall performance.

Technical Data

Length standard:	Ultra-high-accuracy linear encoder (glass scale with virtually zero thermal expansion coefficient)
Guide system:	Air bearing
Max. drive speed:	200 mm/s
Max. acceleration:	1000 mm/s^2
Air pressure:	0.4 MPa (0.5 MPa: LEGEX 9106)
Air consumption:	120 L/min

Guaranteed accuracy temperature environment*

Temperature range		20±2°C
Temperature change	Per hour	0.5 K
	Per 24 hours	1.0 K
Temperature gradient	Vertical	1.0 K/m
	Horizontal	1.0 K/m

* When using thermal compensation system.

Main Unit Startup System

A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

STRATO-Apex 9106

SPECIFICATIONS

Model		STRATO-Apex				
		574	776	7106	9106	9166
Measuring range	X	500 mm	700 mm		900 mm	
	Y	700 mm		1000 mm		1600 mm
	Z	400 mm	600 mm			
Resolution		0.05 µm	0.02 µm			
Accuracy*	$E_{0,MPE}$	±(0.7+0.25L/100) µm	±(0.9+0.25L/100) µm			
	$P_{FTU,MPE}$	±0.7 µm	±0.9 µm			
	MPE_{THP}	±1.3 µm (40 s)	±1.8 µm (45 s)			
Work table	Material	Granite				
	Size	700 x 1420 mm	880 x 1420 mm	880 x 1720 mm	1080 x 1720 mm	1080 x 2320 mm
	Tapped insert	M8 x 1.25 mm				
	Max. loading	180 kg	500 kg	800 kg		1200 kg
Max. workpiece height		560 mm	770 mm			
Mass (main unit)		1530 kg	1895 kg	2180 kg	2410 kg	3085 kg

* The machine is equipped with a thermal compensation system.
According to ISO 10360-2/4/5 methods when using the SP25M probe system with a ø4 x 50 mm stylus.
L: measuring length (mm)

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FALCIO-Apex

SERIES 355 – High Accuracy CNC CMM

- A large, moving-bridge type CNC CMM offering extra-heavy workpiece handling (up to 3.5/4.5 tonne).
- Designed for scanning applications when high accuracy is needed.

FALCIO Apex 163012

Technical Data

Length standard:	High-accuracy linear encoder
Guide system:	Air bearing
Max. drive speed:	519 mm/s
Max. acceleration:	1299 mm/s^2
Air pressure:	0.4 MPa
Air consumption:	150 L/min

Guaranteed accuracy temperature environment*

Temperature range		18°C - 22°C
Temperature change	Per hour	1.0 K
	Per 24 hours	2.0 K
Temperature gradient	Vertical	1.0 K/m
	Horizontal	1.0 K/m

* When using thermal compensation system.

Main Unit Startup System

A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

SPECIFICATIONS

Model		FALCIO-Apex		
		162012 [**162015**]	**163012** [**163015**]	**164012** [**164015**]
Measuring range	X	1600 mm		
	Y	2000 mm	3000 mm	4000 mm
	Z	1200 mm [1500 mm]		
Resolution		0.1 µm		
Accuracy*	$E_{0,MPE}$	±(2.8+0.4L/100) µm [±(3.3+0.45L/100) µm]		
	$P_{FTU,MPE}$	±2.8 µm [±3.3 µm]		
	MPE_{THP}	±2.8 µm (110 s) [±3.5 µm (90s)]		
Work table	Material	Granite		
	Size	1850 x 3280 mm	1850 x 4280 mm	1850 x 5280 mm
	Tapped insert	M8 x 1.25 mm		
	Max. loading	3500 kg	4000 kg	4500 kg
Max. workpiece height		1350 mm [1650 mm]		
Mass (main unit)		9550 kg [9600 kg]	14000 kg [14050 kg]	25000 kg [25050 kg]

* The machine is equipped with a thermal compensation system.
According to ISO 10360-2/4/5 methods when using the SP25M probe system with a ø4 x 50 mm stylus.
L: measuring length (mm)

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FALCIO-Apex

SERIES 355 – High Accuracy Large Gantry CNC CMM

- Specially sized for highly accurate measurement of large workpieces.
- Measurement of press tooling for road vehicles.
- Measurement of aircraft and ship parts.
- Measurement of truck, heavy machinery, and construction equipment parts.

Technical Data

Length standard: High-accuracy linear encoder
Guide system: Air bearing
Max. drive speed: 520 mm/s

Guaranteed accuracy temperature environment*

Temperature range		18°C - 22°C
Temperature change	Per hour	1.0 K
	Per 24 hours	2.0 K
Temperature gradient	Vertical	1.0 K/m
	Horizontal	1.0 K/m

* When using thermal compensation system.

Main Unit Startup System

A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

FALCIO-Apex 305020G measuring a gear for a wind turbine engine.

FALCIO Apex 406020G

SPECIFICATIONS

Model		FALCIO-Apex			
		203015G	203020G	204015G	303012G
Measuring range	X	2005 mm			3005 mm
	Y	3005 mm		4005 mm	3005 mm
	Z	1505 mm	2005 mm	1505 mm	1205 mm
Resolution		0.1 µm			
Accuracy*	MPEE	±(4.8+5L/1000) µm	±(7+7L/1000) µm	±(4.8+5L/1000) µm	±(4.9+5L/1000) µm

Model		FALCIO-Apex		
		305015G	305020G	406020G
Measuring range	X	3005 mm		4005 mm
	Y	5005 mm		6005 mm
	Z	1505 mm	2005 mm	
Resolution		0.1 µm		
Accuracy*	MPEE	±(5.5+5L/1000) µm	±(6+8L/1000) µm	±(8+8L/1000) µm

* The machine is equipped with a thermal compensation system.
When using the SP25M probe system. L: measuring length (mm).

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LEGEX

SERIES 356 – Ultra-High Accuracy CNC CMM

- Achieving premium performance, the fixed bridge structure and precision air bearings running on rigid guideways ensure superior stability of motion and ultra-high measuring accuracy.
- Machines in this series are suitable for complex, small- to medium-sized workpieces such as gears, bearings, lenses, dies and scroll rotors which must be inspected to exceptionally high dimensional accuracy.
- The MPP-310Q probe adds a scanning function to the standard point-to-point measurement.
- The most accurate CNC CMM family is launched, made possible by rigorous analysis of all possible error-producing factors and elimination or minimization of their effects.
- A newly developed, ultra-high accuracy crystallized-glass scale with the ultra-low expansion coefficient of 0.01×10^{-6}/K is used on each axis.
- The fixed bridge structure and precision air bearings running on highly rigid guideways ensure superior motion stability and ultra-high geometrical accuracy.
- Many types of optional probe systems are available, including touch-trigger probes, laser scanning probes, and vision measuring probes.

LEGEX 574

LEGEX 774

Technical Data

Length standard:	High-accuracy linear encoder
Guide system:	Air bearing
Max. drive speed:	519 mm/s
Max. acceleration:	1299 mm/s^2
Air pressure:	0.4 MPa
Air consumption:	150 L/min

Guaranteed accuracy temperature environment*

Temperature range		18°C - 22°C
Temperature change	Per hour	1.0 K
	Per 24 hours	2.0 K
Temperature gradient	Vertical	1.0 K/m
	Horizontal	1.0 K/m

* When using thermal compensation system.

Main Unit Startup System

A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

CMM calibration using a virtually zero thermal expansion glass gauge.

SPECIFICATIONS

Model		LEGEX				
		574	774	776	9106	12128
Measuring range	X	500 mm	700 mm	700 mm	900 mm	1200 mm
	Y	700 mm			1000 mm	1200 mm
	Z	450 mm		600 mm		800 mm
Resolution		0.01 µm				
Accuracy*	$E_{0,MPE}$	±(0.35+0.1L/100) µm				±(0.6+0.15L/100) µm
	$P_{FTU,MPE}$	±0.45 µm				±0.6 µm
	MPE_{THP}	±1.4 µm (150 s)				±1.8 µm (150 s)
Work table	Material	Cast iron				
	Size	550 x 750 mm	750 x 750 mm		950 x 1050 mm	1250 x 1250 mm
	Tapped insert	M8 x 1.25 mm				
	Max. loading	250 kg	500 kg		800 kg	1000 kg
Max. workpiece height		706 mm	696 mm	867 mm	861 mm	1056 mm
Mass (main unit)		3900 kg	5000 kg	5100 kg	6500 kg	10500 kg

* The machine is equipped with a thermal compensation system.
According to ISO 10360-2/4/5 methods when using the MPP-310Q probe system.
L: measuring length (mm)

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Probes

Probe Systems for Manual/CNC Coordinate Measuring Machines

Contact-scanning probe systems

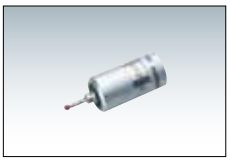
MPP-310Q
Ultra-high accuracy and low measuring force type.

SP80
High accuracy type and available with 500 mm long extension.

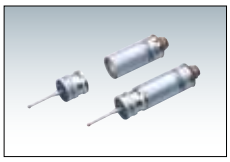
SP25M
Compact and high-accuracy type.

REVO
High speed 5-axis scanning-head type.

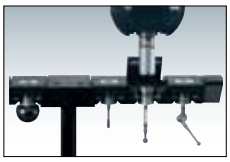
Touch-trigger probe systems

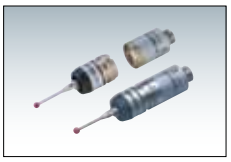


TP7M
High-accuracy type.



TP200
Compact and high-accuracy (stylus change) type.





TP20
Compact type.

Micro Touch Probe
UMAP-CMM.

TP8
Manual indexable probe.

MH20
High-accuracy type.

MH20i
High-accuracy type.

PH20
5-axis control touch-trigger type.

Probe heads

PH10M / PH10MQ
Motor-drive indexing type.

MIH
Manual indexing type.

PH1
Simple manual type.

Note: Probes shown mounted on these probe heads are optional.

Optical (non-contact) probe systems

Surface Measure 606
Laser scanning probe.

QVP (Quick Vision Probe)
Video probe.

CF20
Video camera system.

CF20
Centering microscope system.

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Mitutoyo

Software

Software for Manual/CNC Coordinate Measuring Machines

Three levels of module configuration

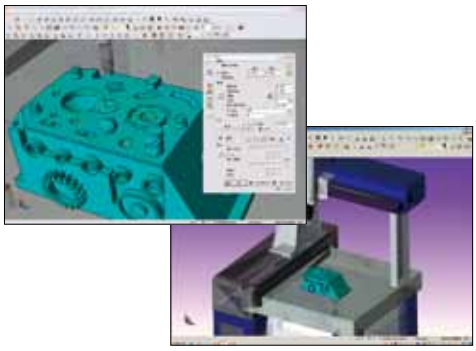
MCOSMOS has three module configurations, from the basic MCOSMOS1 to the advanced MCOSMOS3. This enables you to choose the appropriate functionality for your current measurement applications now and expand, if needed, in the future.

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

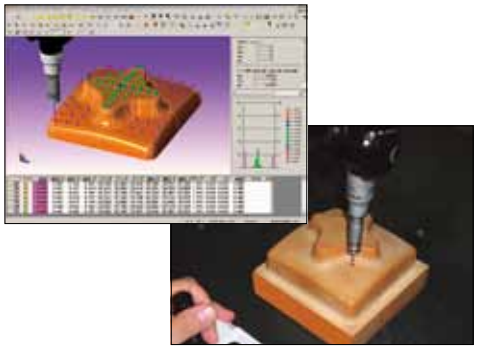
Module included	GEOPAK	CAT1000P	CAT1000S	SCANPAK
MCOSMOS1	✓	—	—	—
MCOSMOS2	✓	✓	✓	—
MCOSMOS3	✓	✓	✓	✓

GEOPAK (Geometry Module)
This is our universal geometric measurement program, which allows you to control the measurement of your workpiece from drawing to completion, or simply to run existing measurement programs on a repeat basis.

CAT1000P (Offline Part Program Module)
For online/offline part program creation, using the measurement of geometric elements directly from the CAD model, with automatic collision avoidance.

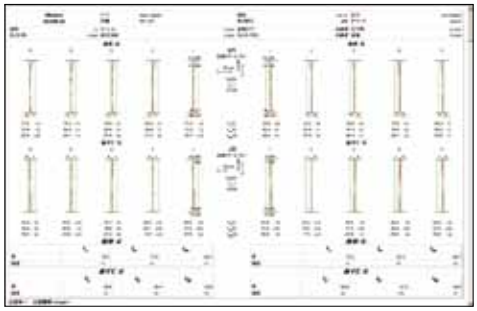


CAT1000S (Free Form Surface Evaluation Module)
In addition to online/offline part program creation, CAD model based generation of surface measurement points, and comparison of actual/nominal data, with graphical output.



SCANPAK (2D Profile Evaluation Module)
For the scanning and evaluation of workpiece contours (2D), and data transfer to CAD system.

GEARPAK (Gear Measurement and Analysis Module)
Advances in CMM controller techniques make the measurement of gears feasible, and the GEARPAK module takes advantage of this to bring sophisticated measurement capabilities within easy reach.



MAFIS (Mitutoyo Airfoil Inspection System)
Evaluation and analysis of airfoil shape such as Turbine Blades requires special calculations according to the particular design specifications. The MAFIS system uses cross-sectional data of the shape obtained by SCANPAK to perform these calculations, and output the result via the standard geometry program.

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Quick Guide to Precision Measuring Instruments

Coordinate Measuring Machines

The procedure for assessing the performance of CMMs is defined in the multi-part international standard ISO 10360. This page gives you an overview of the CMM-specific parameters defined in this standard that may be referenced in Mitutoyo catalogues and product brochures.

Maximum Permissible Measuring Error (MPE) of Length Measurement $E_{0,MPE}$ (ISO 10360-2:2009)

This part of ISO 10360 defines acceptance and reverification tests for coordinate measuring machines. The test procedure is that a coordinate measuring machine (CMM) is made to perform a series of measurements on five different test lengths in each of seven directions, as shown in Figure 1, to produce a set of 35 measurements. This sequence is then repeated twice to produce 105 measurements in all. If these results, including allowances for the uncertainty of measurement, are equal to or less than the values specified by the manufacturer then the performance of the CMM has been proved to meet its specification.

The standard allows up to five measurements to exceed the specified value (two NG results among 3-time measurements in the same position are not allowed). If this is the case, additional 10-times measurements for the relevant position are performed. If all the 10 results, including the uncertainty allowance, are within the specified value, the CMM is assumed to pass the test. The uncertainties to be considered in determining the maximum permissible measuring error are those concerning calibration and alignment methods used with the particular material standards of length involved with the test. (The values obtained by adding an extended uncertainty combining the above two uncertainties to all test results must be less than the specified value.) The result of the test may be expressed in any of the following three forms (unit: µm).

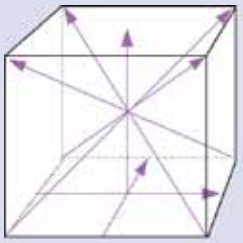

Figure 1 Typical test measurement directions within the CMM measuring volume.

$E_{0,MPE} = A + L/K \leq B$

$E_{0,MPE} = A + L/K$

$E_{0,MPE} = B$

A: Constant (µm) specified by the manufacturer
K: Dimensionless constant specified by the manufacturer
L: Measured length (mm)
B: Upper limit value (µm) specified by the manufacturer

Maximum Permissible Single Stylus Form Error $P_{FTU,MPE}$ (ISO 10360-5:2010)

This part of ISO 10360 defines the accuracy of a CMM using stylus contacting probing systems. The test procedure is that a probe is used to measure defined target points on a standard sphere (25 points, as in Figure 2) and the result used to calculate the position of the sphere centre by a least squares method. Then the distance R from the sphere centre for each of the 25 measurement points is calculated, and the radius difference Rmax - Rmin is computed. An extended uncertainty that combines the uncertainty of the stylus tip shape and that of the standard test sphere is added to the radius difference. If this final calculated value is equal to or less than the specified value, the probe has passed the test.

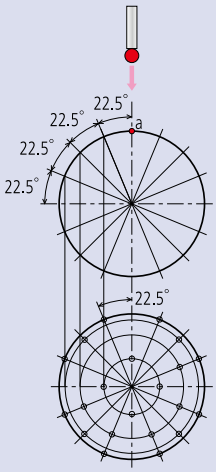

Figure 2 Target points on standard sphere for determining the maximum permissible probing error.

Maximum Permissible Scanning Probing Error MPE_{THP} (ISO 10360-4:2000)

This part of ISO 10360 defines the accuracy of a CMM equipped with a scanning probe. The test procedure is to perform a scanning measurement of 4 planes on the standard sphere and then, for the least squares sphere centre calculated using all the measurement points, calculate the range (dimension A in Figure 3) in which all measurement points exist. Based on the least squares sphere centre calculated above, calculate the distance between the calibrated standard sphere radius and the maximum measurement point or minimum measurement point, and take the larger distance (dimension B in Figure 3). Add an extended uncertainty that combines the uncertainty of the stylus tip shape and the uncertainty of the standard test sphere shape to each A and B dimension. If both calculated values are less than the specified values, this scanning probe test is passed.

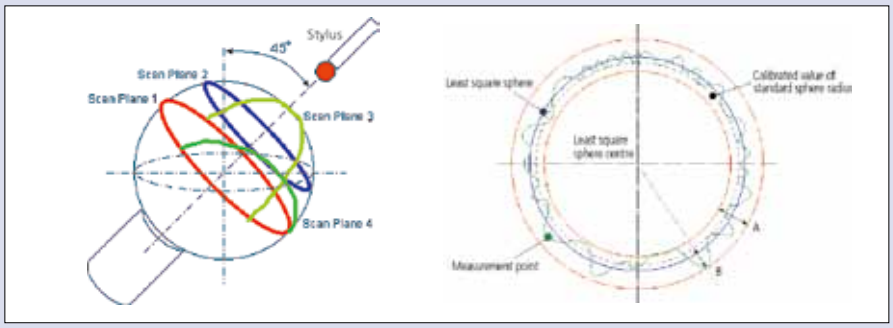

Figure 3 Target measurement planes for the maximum permissible scanning probing error and its evaluation concept.

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