

MICROCORD STRATO-APEX SERIES

High Accuracy CNC Coordinate Measuring Machine

A state-of-the-art CNC coordinate measuring machine that offers a rare blend of high-speed operation combined with highly accurate measurement



STRATO-Apex Series: A state-of-the-art CNC coordinate accuracy combined with high-speed operation

The high drive speed and acceleration guarantee top scanning performance

Improved machine rigidity

- 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 remodeled guide mechanism

Newly developed, built-in, high-performance controller

- Uses a digital servo system that processes all control loops for position, speed, and current as digital signals.
- The digital servo system offers the following benefits:
 - (1) Little drift or deterioration with time
 - (2) Wide dynamic range
 - (3) Easy implementation of various types of control algorithm

Scanning measurement technology

- High-performance scanning measurement has been achieved through the improved structural rigidity and incorporation of a newly developed compensation technology
Maximum permissible scanning probing error: $MPE_{THP} = 1.3 \mu\text{m}$ (STRATO-Apex 574)
Maximum permissible scanning test time $MPT_{\tau HP} = 40 \text{ sec}$ (STRATO-Apex 574)
(cf. Existing FALCIO Series: $MPE_{THP} = 2.2 \mu\text{m}$)
 $MPT_{\tau HP} = 110 \text{ sec.}$)

*Probe used: SP25M



Mitutoyo

measuring machine that achieves high

in a machine that also offers high-accuracy measuring in the 1 μm class

Internal heat generation minimized

- The controller is positioned outside the main unit, thereby eliminating the effect of the generated heat on the main unit.
- Compact layout has been achieved, resulting in a small footprint, even with the externally positioned controller.



STRATO-Apex 700/900 Series

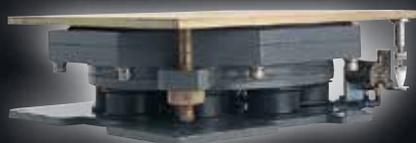
Ultra-high precision glass scales

- An ultra-high precision crystallized glass scale which has practically no thermal expansion (coefficient of linear expansion $0.01 \times 10^{-6}/^{\circ}\text{C}$) is combined with a high-performance reflective linear encoder with resolution of $2/100 \mu\text{m}$ to create the ultra-high accuracy measurement unit installed on each axis of STRATO-Apex. This is basically the same unit as used in the LEGEX Series of ultra-high accuracy CNC coordinate measuring machines. (Applies to STRATO-Apex 700/900 Series).
- A unique securing method used for the scales minimizes the hysteresis error that can result from the difference in the coefficients of linear expansion between the installation plane and scale.

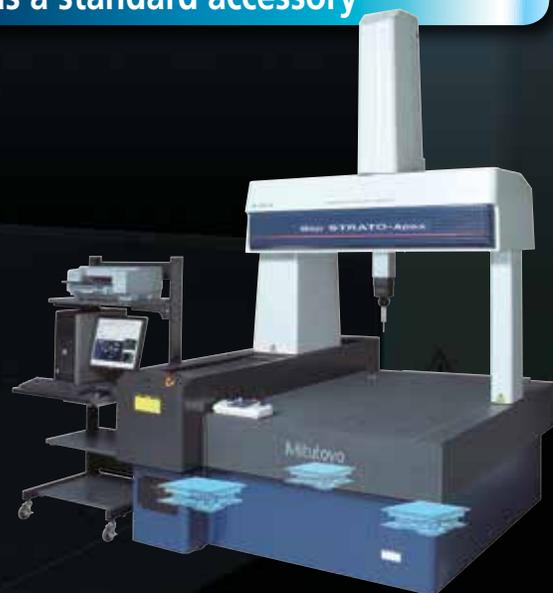


Vibration-damping unit included as a standard accessory

- Vibration of the floor where the unit is installed shows up as measurement value variations. The STRATO-Apex Series comes equipped with a vibration-damping unit that uses auto-leveling air springs. The vibration-damping unit not only prevents floor vibrations from reaching the main unit, but also has a function that uses a sensor to detect load changes caused by movements of the individual axes and placement of a workpiece and quickly restores the main unit to horizontal orientation.



▲Vibration-damping unit with auto-leveling air springs



▲Vibration-damping unit positioning

STRATO-Apex 574



STRATO-Apex 574

Specifications

Item		STRATO-Apex 574	
Measuring range	X	19.6" (500mm)	
	Y	27.5" (700mm)	
	Z	15.7" (400mm)	
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)	
	J/S mode	Measuring Speed 1 – 3mm/s	
		Drive Speed 0 – 80mm/s	
Drive acceleration (3D)		Measuring Speed 0 – 3mm/s	
Measuring method		Linear encoder	
Resolution		0.000019" (0.00005mm)	
Work table	Material	Granite	
	Size (table surface)	26.6" x 55.9" (676mm x 1420mm)	
	Tapped inserts	M8 1.25mm	
Workpiece	Maximum height	22.04" (560mm)	
	Maximum mass	396 lbs (180kg)	
Machine mass (includes the vibration-dampening platform and controller, but not workpiece)		3373 lbs (1530kg)	
Power supply specifications (including the probe option interface)		Power supply voltage: AC100-120/200-240 V ± 10%; power supply capacity: 700 VA (of which 170 VA is used for the probe option interface)	
Air supply	Pressure	0.4 MPa (4kgf/cm ²) or 58 PSI	
	Consumption	2.1/CFM (60 L/minute) air source minimum: 4.2 (120 L/minute)	
Guaranteed accuracy temperature environment	Temperature range	64.4 – 71.6 °F (18 - 22 °C)	
	Temperature change	Per hour	1.0 K
		Per 24 hours	2.0 K
Temperature gradient	vertical/horizontal	1.0 K/m	

* 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.

Length measurement error

unit: μm

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	$E_{0, MPE} = 0.7 + 2.5L/1000$
		$E_{150, MPE} = 0.7 + 2.5L/1000$

Repeatability

unit: μm

Standard	Probe used	Repeatability range of E_0
ISO 10360-2: 2009	SP25M	$R_{0, MPL} = 0.7$

Single stylus form error

unit: μm

Standard	Probe used	Max. permissible single stylus form error
ISO 10360-5: 2010	SP25M	$P_{FTU, MPE} = 0.7$

Scanning probing error

unit: μm

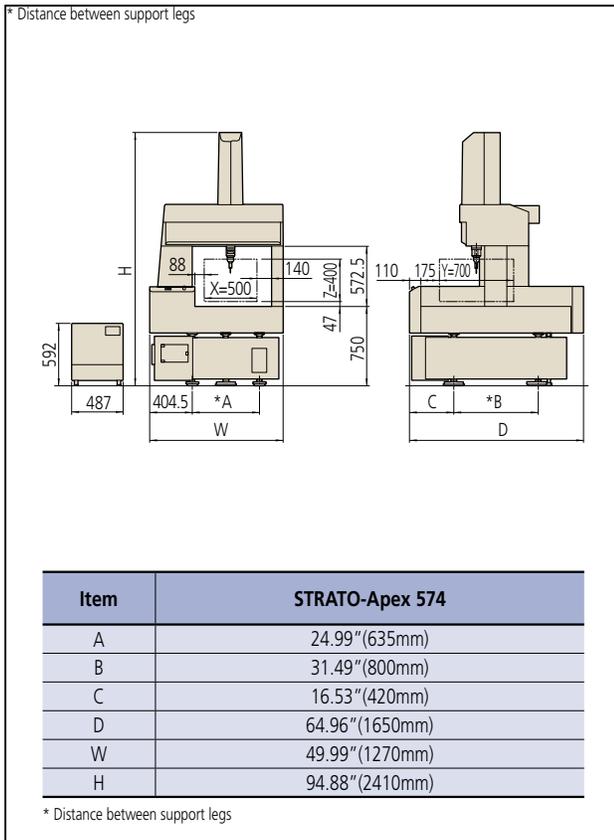
Standard	Probe used	Maximum permissible scanning probing error (Maximum permissible scanning test time) [sec]
ISO 10360-4: 2000	SP25M	$MPE_{THP} = 1.3$ ($MPT_{THP} = 40$)

Note: This machine incorporates a main unit Startup system (relocation detection system), which disable operation when an unexpected vibration is applied or the machine is relocated. Be sure to contact your nearest Mitutoyo Sales Office prior to relocating this machine after initial installation.

Length measurement error of $E_{0, MPE} = 0.7 + 2.5L/1000$ (μm)

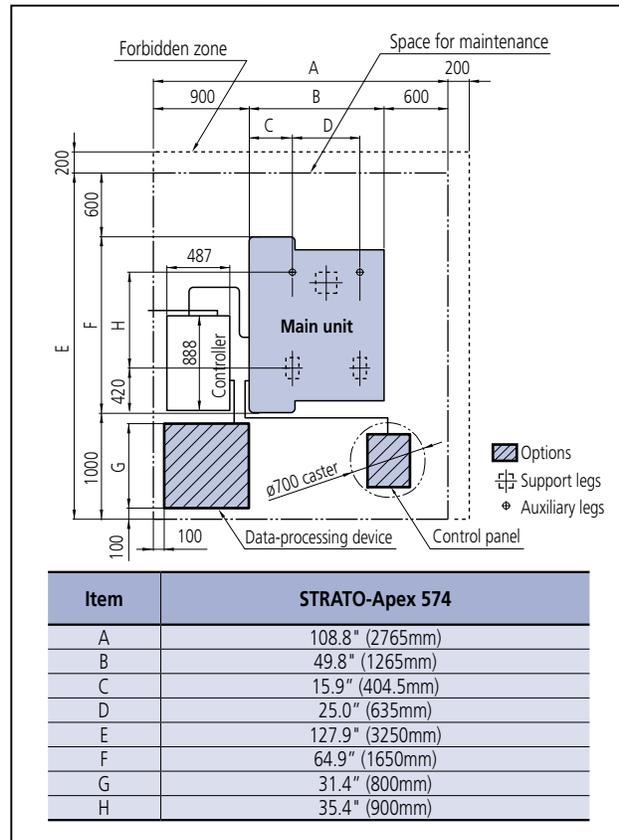
■ Dimensions

unit: mm



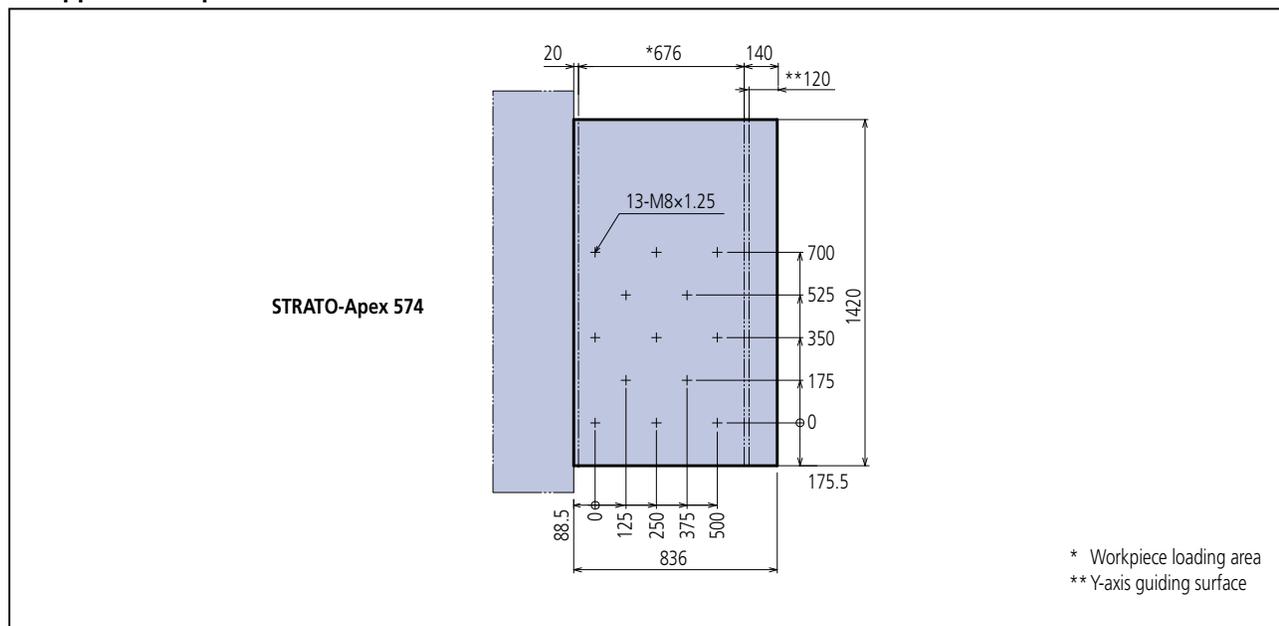
■ Installation floor space

unit: mm



■ Tapped insert positions in the table surface

unit: mm



STRATO-Apex 700/900 Series



STRATO-Apex 776



STRATO-Apex 9106

Specifications

Item		STRATO-Apex 776	STRATO-Apex 7106	STRATO-Apex 9106	STRATO-Apex 9166
Measuring range	X	27.5" (700mm)		35.4" (900mm)	
	Y	27.5" (700mm)	39.3" (1000mm)	62.9" (1600mm)	
	Z	23.6" (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 – 3mm/s			
	I/S mode	Drive Speed 0 – 80mm/s			
		Measuring Speed 0 – 3mm/s			
Drive acceleration (3D)		0.26G (2,598mm/s ²)			
Measuring method		Linear encoder			
Resolution		0.0000078" (0.00002mm)			
Work table	Material	Granite			
	Size (table surface)	33.9" x 55.9" (862mm x 1420mm)	33.9" x 67.7" (862mm x 1720mm)	41.8" x 67.7" (1062mm x 1720mm)	41.8" x 91.3" (1062mm x 2320mm)
	Tapped inserts	M8 1.25mm			
Workpiece	Maximum height	30.31" (770mm)			
	Maximum mass	1760 lbs (800kg)	2200 lbs (1000kg)	2640 lbs (1200kg)	3300 lbs (1500kg)
Machine mass (includes the vibration-dampening platform and controller, but not workpiece)		4177 lbs (1895kg)	4806 lbs (2180kg)	5313 lbs (2410kg)	6801 lbs (3085kg)
Power supply specifications (including the probe option interface)		Power supply voltage: AC100-120/200-240 V ± 10%; power supply capacity: 700 VA (of which 170 VA is used for the probe option interface)			
Air supply	Pressure	0.4 MPa (4kgf/cm ²) or 58 PSI			
	Consumption	2.1/CFM (60 L/minute) air source minimum: 4.2 (120 L/minute)			
Guaranteed accuracy temperature environment	Temperature range		66.2 - 69.8 °F (19 - 21 °C)		
	Temperature change	Per hour	1.0 K		
		Per 24 hours	2.0 K		
	Temperature gradient	vertical/horizontal	1.0 K/m		

* 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.

Length measurement error

unit: μm

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	$E_{0,MPE}=0.9+2.5L/1000$
		$E_{ISO,MPE}=0.9+2.5L/1000$

Repeatability

unit: μm

Standard	Probe used	Repeatability range of E_0
ISO 10360-2: 2009	SP25M	$R_{0,MPL}=0.8$

Single stylus form error

unit: μm

Standard	Probe used	Max. permissible single stylus form error
ISO 10360-5: 2010	SP25M	$P_{FTU,MPE}=0.9$

Scanning probing error

unit: μm

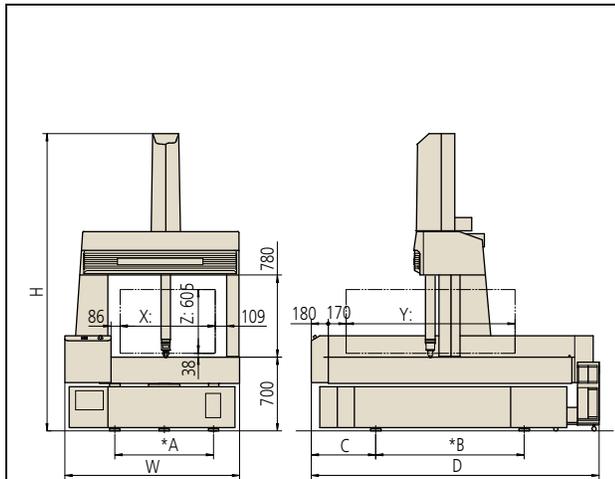
Standard	Probe used	Maximum permissible scanning probing error (Maximum permissible scanning test time) [sec]
ISO 10360-4: 2000	SP25M	$MPE_{THP}=1.8 (MPT_{THP}=45)$

Note: This machine incorporates a main unit Startup system (relocation detection system), which disable operation when an unexpected vibration is applied or the machine is relocated. Be sure to contact your nearest Mitutoyo Sales Office prior to relocating this machine after initial installation.

Providing the Highest Speed and Accuracy in Moving-Bridge Type Coordinate Measuring Machines Integration of Key Measurement Technologies

■ Dimensions

unit: mm

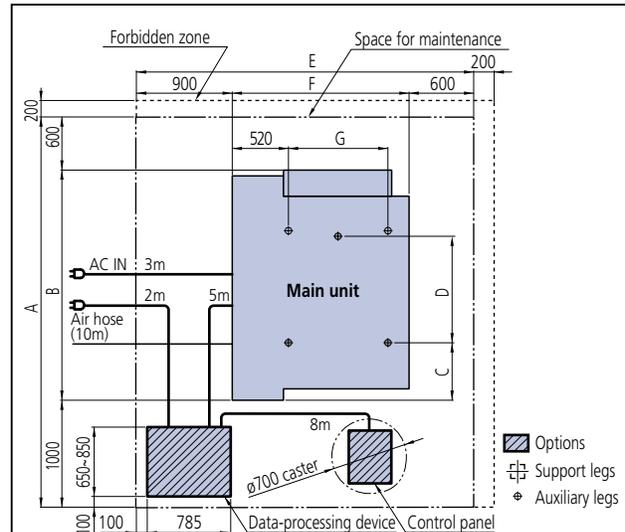


Item	STRATO-Apex 776	STRATO-Apex 7106	STRATO-Apex 9106	STRATO-Apex 9166
A	29.13"(740)		37.01"(940)	
B	27.56"(700)	39.37"(1000)		55.51"(1410)
C	21.25"(540)			24.9"(632.5)
D	73.3"(1860)	85.1"(2160)		108.7"(2760)
W	163.9"(4160)		65.4"(1660)	
H	93.70"(2380mm)			

* Distance between support legs

■ Installation floor space

unit: mm

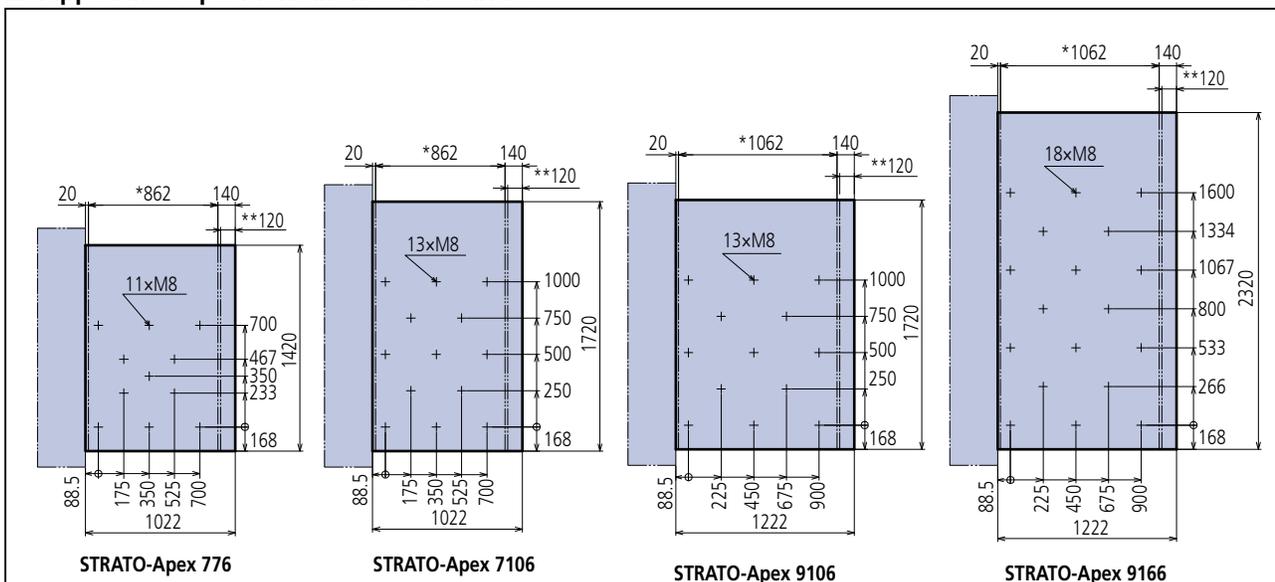


Item	STRATO-Apex 776	STRATO-Apex 7106	STRATO-Apex 9106	STRATO-Apex 9166
A	136.22"(3460)	148.0"(3760)		171.6"(4360)
B	73.3"(1860)	85.1"(2160)		108.7"(2760)
C	21.25"(540)			24.9"(632.5)
D	27.56"(700)	39.37"(1000)		55.51"(1410)
E	116.5"(2960)		124.4"(3160)	
F	163.9"(4160)		65.4"(1660)	
G	29.13"(740)		37.01"(940)	

- Options
- Support legs
- Auxiliary legs

■ Tapped insert positions in the table surface

unit: mm



* Workpiece loading area
**Y-axis guiding surface

STRATO-Apex 1600 Series



STRATO-Apex 162016

Specifications

Item		STRATO-Apex 162012	STRATO-Apex 162016	STRATO-Apex 163012	STRATO-Apex 163016
Measuring range	X	62.99" (1600mm)			
	Y	78.73" (2000mm)		118.10" (3000mm)	
	Z	47.24" (1200mm)	62.99" (1600mm)	47.24" (1200mm)	62.99" (1600mm)
Guide method		Air bearings on all axes (static pressure air bearings)			
Drive speed	CNC mode	Drive speed: From 8 to 350 mm/s for each axis (maximum combined speed: 606 mm/s)			
		Measuring Speed 1 – 3 mm/s Drive Speed 0 – 80 mm/s			
	I/S mode	Measuring Speed 0 – 3 mm/s Fine-positioning Speed 0.05 mm/s			
Drive acceleration (3D)		0.13G (1,350 mm/s ²)			
Measuring method		Linear encoder			
Resolution		0.0000019" (0.00005 mm)			
Work table	Material	Granite*			
	Size (table surface)	72.83" x 129.13" (1850mm x 3280mm)		72.83" x 168.50" (1850mm x 4280mm)	
	Tapped inserts	M8 x 1.25			
Workpiece	Maximum height	53.14" (1350mm)	68.89" (1750mm)	53.14" (1350mm)	68.89" (1750mm)
	Maximum mass	7,716 lbs. (3500kg)		8,818 lb. (4000kg)	
Machine mass (includes the vibration-damping platform and controller, but not workpiece)		24,581 lbs. (11,150kg)	24,691 lbs. (11,200kg)	33,730 lbs. (15,300kg)	33,840 lbs. (15,350kg)
Power supply specifications (including the probe option interface)		Power supply voltage: AC 100-120/200-240 V ± 10%; power supply capacity: 1500 W (of which 170 W is used for the probe option interface)			
Air supply	Pressure	0.4 MPa (4kgf/cm ²) or 58 PSI			
	Consumption	3.53CFM (100 L/min) source minimum: 8.82CFM (250 L/min)			
Guaranteed accuracy temperature environment	Temperature range		64.4°F – 71.6°F (18 – 22 °C)		
	Temperature change	Per hour	1.8°F (1.0 °C)		
		Per 24 hours	3.6°F (2.0 °C)		
Temperature gradient	vertical/horizontal	1.8°F (1.0 °C/m)			

* 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.

STRATO-Apex 162012/163012

Length measurement error

unit: μm

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	$E_0, MPE=2.5+4.0L/1000$
		$E_{150, MPE}=2.5+4.0L/1000$

Repeatability

unit: μm

Standard	Probe used	Repeatability range of E_0
ISO 10360-2: 2009	SP25M	$R_0, MPL=2.5$

Single stylus form error

unit: μm

Standard	Probe used	Max. permissible single stylus form error
ISO 10360-5: 2010	SP25M	$P_{FTU, MPE}=2.3$

Scanning probing error

unit: μm

Standard	Probe used	Maximum permissible scanning probing error (Maximum permissible scanning test time) [sec]
ISO 10360-4: 2000	SP25M	$MPE_{THP}=2.5$ ($MPT_{+HP}=60$)

Note: This machine incorporates a main unit Startup system (relocation detection system), which disable operation when an unexpected vibration is applied or the machine is relocated. Be sure to contact your nearest Mitutoyo Sales Office prior to relocating this machine after initial installation.

High accuracy combined with wide measuring range Best suited for highly accurate measurement of large workpieces

STRATO-Apex162016/163016

Length measurement error unit: μm

Standard	Probe used	Max. permissible length measurement error
ISO 10360-2: 2009	SP25M	$E_{D, MPE} = 3.0 + 4.0L/1000$
		$E_{ISO, MPE} = 3.0 + 4.0L/1000$

Repeatability unit: μm

Standard	Probe used	Repeatability range of E_D
ISO 10360-2: 2009	SP25M	$R_{D, MPL} = 2.5$

Single stylus form error unit: μm

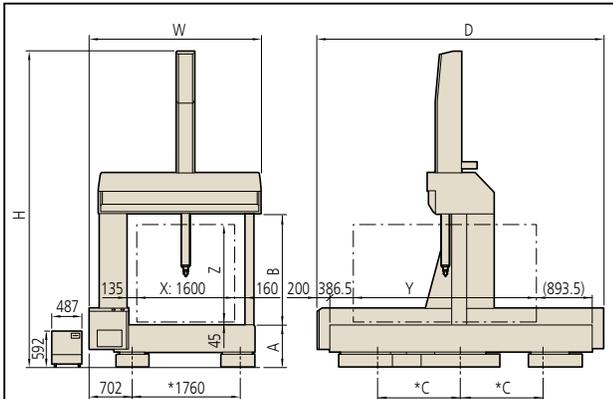
Standard	Probe used	Max. permissible single stylus form error
ISO 10360-5: 2010	SP25M	$P_{FTU, MPE} = 2.8$

Scanning probing error unit: μm

Standard	Probe used	Maximum permissible scanning probing error (Maximum permissible scanning test time) [sec]
ISO 10360-4: 2000	SP25M	$MPE_{THP} = 3.0$ ($MPT_{+HP} = 60$)

Dimensions

unit: mm

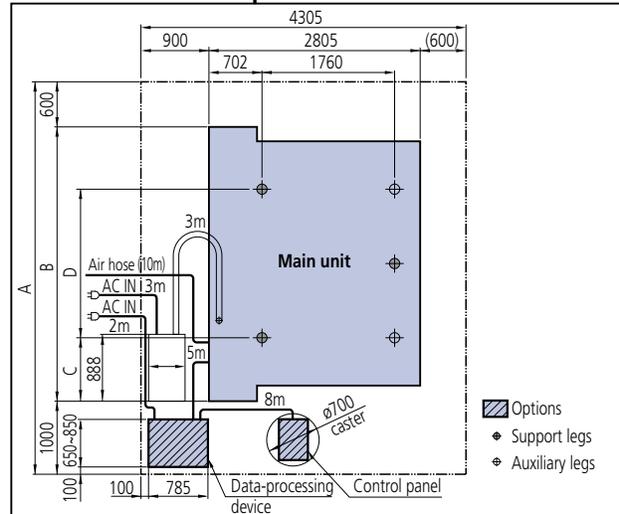


Item	STRATO-Apex 162012	STRATO-Apex 162016	STRATO-Apex 163012	STRATO-Apex 163016
A	25.59" (650)		27.56" (700)	
B	55.70" (1415)	71.45" (1815)	55.70" (1415)	71.45" (1815)
C	39.37" (1000)		53.14" (1350)	
D	145.07" (3685)		184.44" (4685)	
H	170.86" (4340)	202.36" (5140)	172.83" (4390)	204.33" (5190)
W	110.45" (2805mm)			

* Distance between support legs

Installation floor space

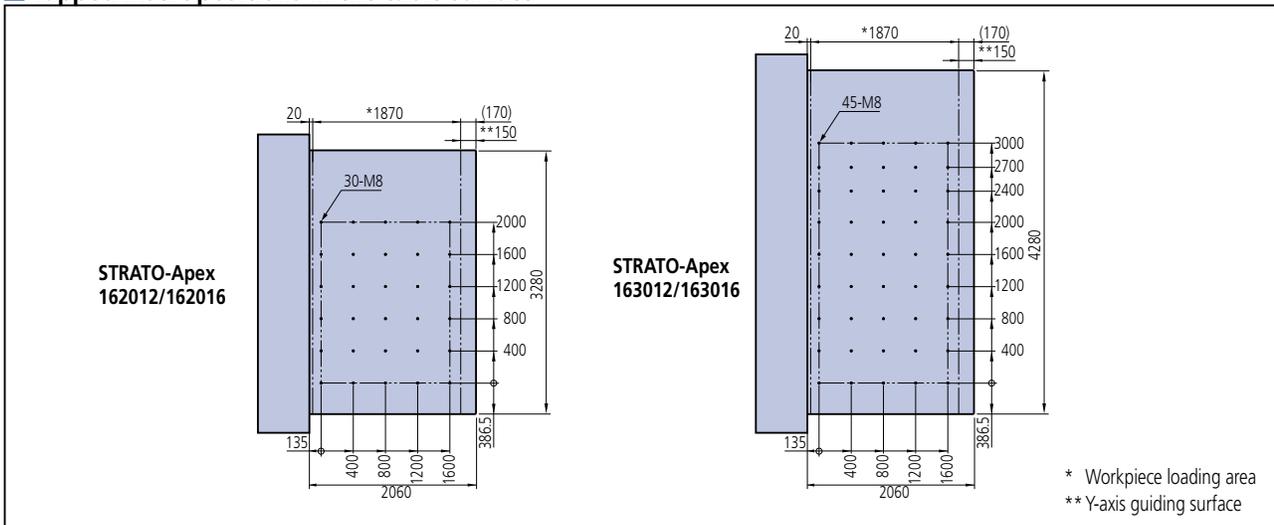
unit: mm



Item	STRATO-Apex162012/162016	STRATO-Apex163012/163016
A	208.07" (5285)	244.47" (6285)
B	145.07" (3685)	184.44" (4685)
C	38.07" (840)	38.97" (990)
D	78.73" (2000)	106.29" (2700)

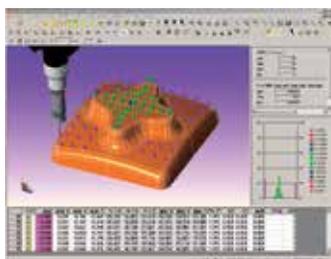
Tapped insert positions in the table surface

unit: mm



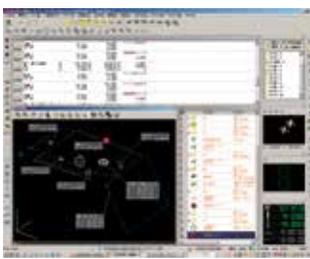
* Workpiece loading area
** Y-axis guiding surface

Software options handle all kinds of measurement



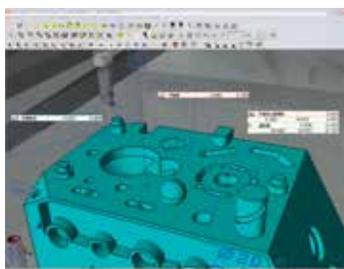
CAT1000S (freeform surface evaluation program)

Checks and compares the workpiece with the CAD data containing freeform surfaces and directly outputs the results in the form of CAD data in various formats. Software to directly convert from/to various types of CAD data is available as an option.



GEOPAK (high-functionality general-purpose measurement program)

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



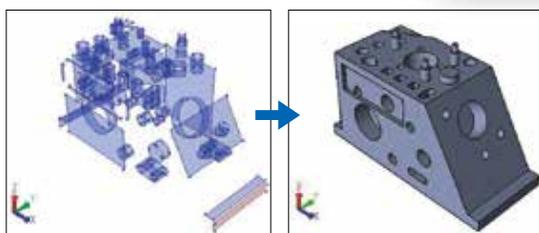
CAT1000P (off-line teaching program)

This module enables the user to use CAD data and on-screen simulation to create parts programs for making automated measurements (off-line teaching). This module allows the user to begin creating a parts program as soon as the design data has been finalized, shortening the entire process.



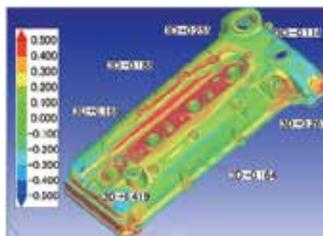
NC-Auto measure

This program generates CAD data from NC data.



Solid Model Developer

This program generates CAD data from data measured using MCOSMOS.



MSURF (non-contact laser measurement and evaluation program)

MSURF-S is used for obtaining measured point cloud data with the SurfaceMeasure (non-contact laser probe), while MSURF-I is used for comparing this data with the master model data, and for making dimensional measurements. Furthermore, MSURF-G for offline teaching allows the user to create a measurement macro even without the actual workpiece, improving the measuring machine's uptime.



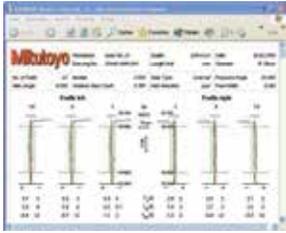
SCANPAK (contour measurement program)

Software for scanning and evaluating workpiece contours (2D). Evaluates contour tolerance between measurement data and design data, and performs various types of element and inter-element calculations based on a desired range of measurement data specified by the user.



MeasurLink STATMeasure Plus (statistical-processing and process-controlling program)

Performs various types of statistical computations using measurement results. In addition, by displaying a control diagram on a real-time basis, this program allows defects that may occur in the future (e.g., wear or damage to cutting tools) to be discovered early on. This program can also be linked to a higher-level network environment to build a central control system.



GEARPAK (gear evaluation program)

For evaluating the most types of involute gears.



MPP-310Q (scanning probe)

A probe that collects coordinate values (point cloud data) at high accuracy by moving at speeds of up to of 120 mm/s while in contact with the workpiece. Because MPP-310Q can also be used with the rotary table (MRT320) for synchronous scanning, it is effective for measuring gears, blades, ball screws, cylindrical cams, etc.



MRT320



MPP-10 (probe for effective screw depth measurement)

The probe that made it possible for a coordinate measuring machine to measure effective screw depth for the first time. The introduction of the auto probe changing system allows normal dimensional measurements as well as effective screw depth measurements to be made automatically.



(2)



Source of photographs

- (1) SHIN-NIHON TECH INC. URL <http://www.sn-tec.com>
- (2) TOYOTECH Co.,Ltd URL <http://www.toyotec.com>

SP25M (compact high-accuracy scanning probe)

This is a compact, high-accuracy, multi-function scanning probe with a 25-mm outside diameter that makes scanning measurements, high-accuracy point measurements, and centripetal point measurements (optional function). The SP25M is used with the PH10MQ/10M auto probe head to provide a high degree of measurement freedom.



UMAP-CMM

This head makes it possible to use an ultra-small stylus (0.1- or 0.3-mm diameter). It can be installed on the PH10MQ to measure the shape and dimensions of microfabricated products from multiple directions.



QVP (vision probe)

This probe automatically detects edges from image data of the workpiece magnified by a CCD camera. It is extremely useful for measuring microfabricated products that cannot be measured using a contact-type probe and soft objects that cannot be subjected to any measurement force. The QVP can also be used for measuring height based on autofocus.

SURFTEST PROBE

The SURFTEST PROBE is a highly sensitive detector for measuring surface roughness using a CNC coordinate measuring machine. It is compatible with automatic probe-changing systems and therefore can be handled just as easily as the usual touch trigger or scanning probes. This new probe provides the ability to perform combined, automatic measurement of dimension, form and surface roughness on one machine at one setup. Mitutoyo will endeavor to meet requests for assistance with custom measurement applications by providing dedicated software making best use of its wide range of optional detectors.

SurfaceMeasure606/610/1010/606T (non-contact laser probe)

A lightweight, high-performance, non-contact probe developed for CNC coordinate measuring machines. Powder spray-less measurement has been achieved through automatic setting of appropriate laser intensity and camera sensitivity according to environment or material, providing a simpler and more comfortable laser scanning environment.



SurfaceMeasure 606/610/1010



SurfaceMeasure 606T

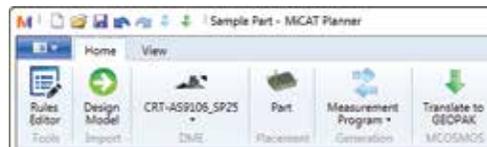


MiCAT Planner

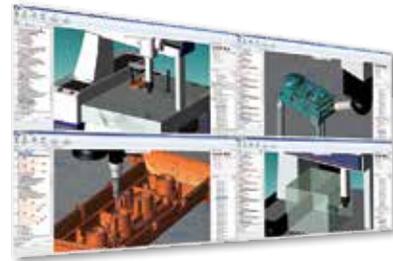
Automatic measurement program generation software

MiCAT Planner is Mitutoyo's latest software development for fast and efficient CMM part programming. Operation of MiCAT Planner is very easy and intuitive. Programs are made with just a few mouse clicks in just a few minutes instead of hours or days. **WORKFLOW:**

- 1) Load design model
- 2) Select target CMM
- 3) Part placement via virtual alignment
- 4) Measurement program creation
- 5) Translate to Geopak MCOSMOS



MiCAT



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Coordinate Measuring Machines	Vision Measuring Systems	Form Measurement	Optical Measuring
Sensor Systems	Test Equipment and Seismometers	Digital Scale and DRO Systems	Small Tool Instruments and Data Management

Whatever your challenges are, Mitutoyo supports you from start to finish.

Mitutoyo is not only a manufacturer of top-quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.



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