

Ultra-high Accuracy CNC Coordinate Measuring Machine LEGEX Series



The Pinnacle of Mitutoyo technology –
Legex, a world-class series of precision measuring machines.



LEGEX574

World-class accuracy of E_0 , $MPE=0.28 + L/1000$



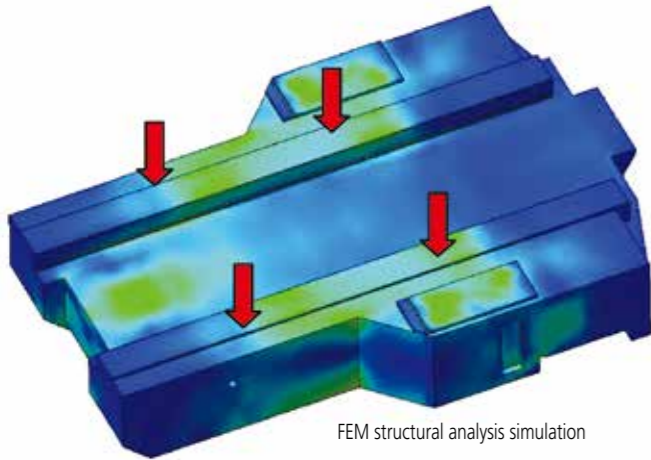
LEGEX776



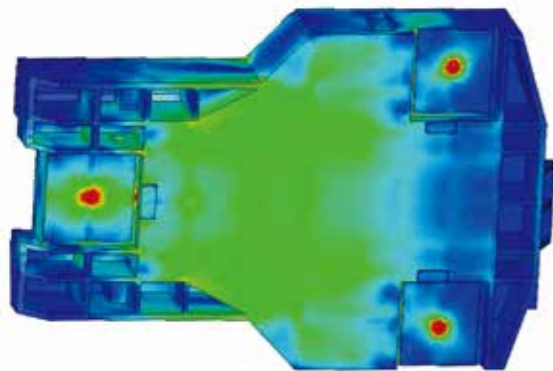
LEGEX9106

Evolving technology

Thorough analysis and elimination of error factors Part 1



FEM structural analysis simulation



Base design

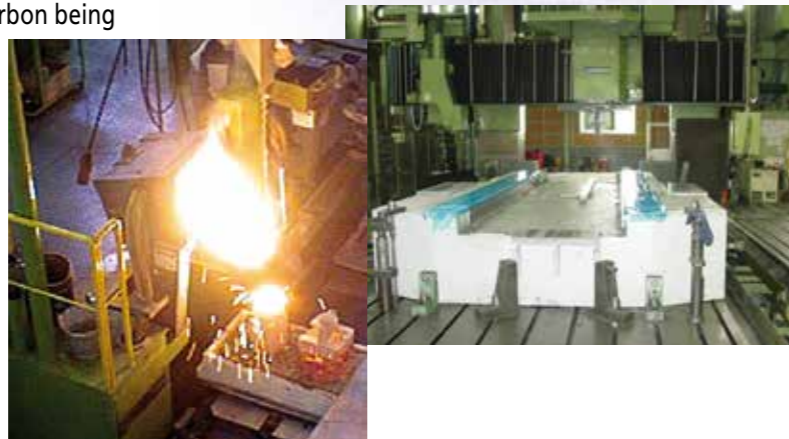
High rigidity

The LEGEX base is a sealed structure manufactured from spheroidal graphite ductile cast iron*, this provides high rigidity and excellent vibration attenuation. In addition, stress analysis through FEM structural simulation minimises deformation due to load variation, ensuring a high level of geometric accuracy.

*Spheroidal graphite ductile cast iron

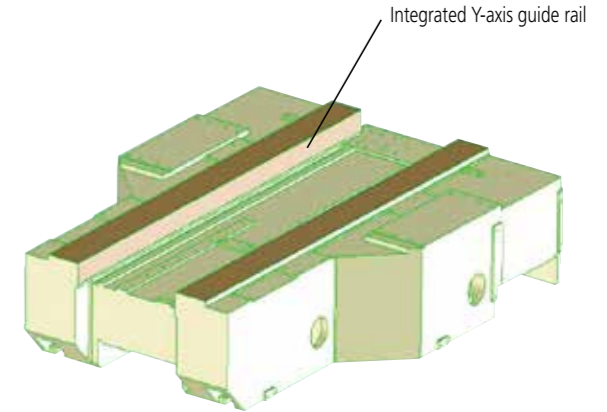
Cast iron is an alloy of iron, carbon, silicon, manganese, phosphorus, sulfur, and traces of other elements, and exhibits characteristic properties due to the carbon being distributed throughout the metal in the form of graphite.

Ductile cast iron is created by spheroidizing the graphite by adding magnesium alloy to the melt. Compared with normal cast iron, it has great tensile strength, is relatively tough, and has excellent machinability and wear resistance. Ductile cast iron is thus used for components such as automotive parts. LEGEX employs FCD600 ductile cast iron but made in such a way as to eliminate blow holes and pin holes (defects) of 0.1 mm or larger.



Integrated Y-axis guide rail

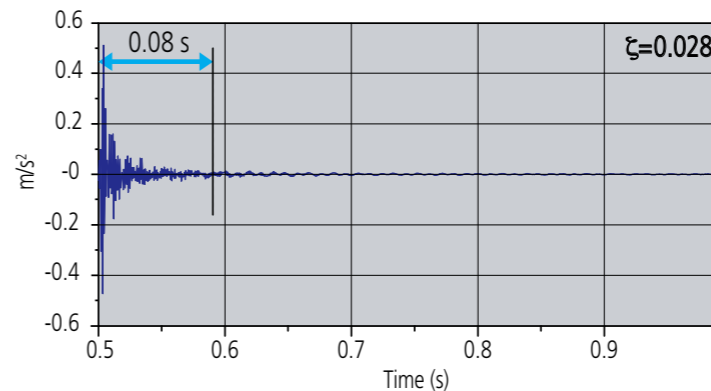
The Y-axis guide rail is integrated into the main unit base to increase rigidity and thermal stability.



Integrated Y-axis guide rail

Ceramic plasma spraying for each axis sliding section

Ceramic plasma spraying is applied to sliding sections for the Y-axis guide rail, X-axis beam, and Z-axis spindle, creating surfaces suitable for highly accurate air-bearing operation. It also produces excellent corrosion resistance.

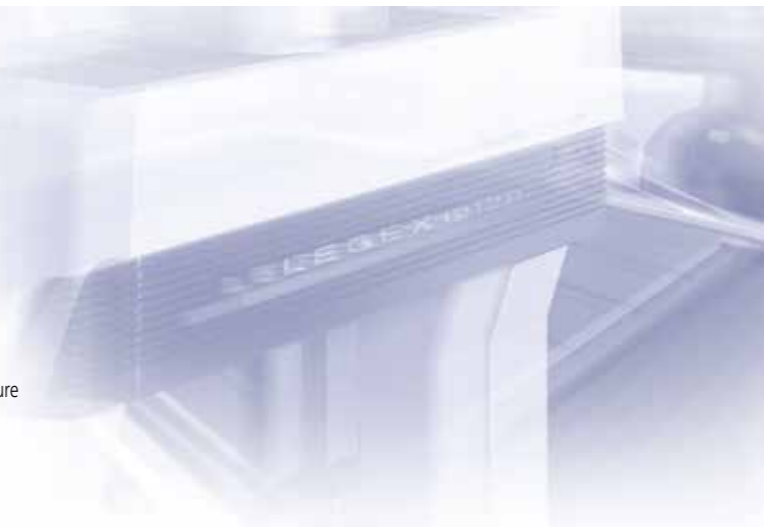
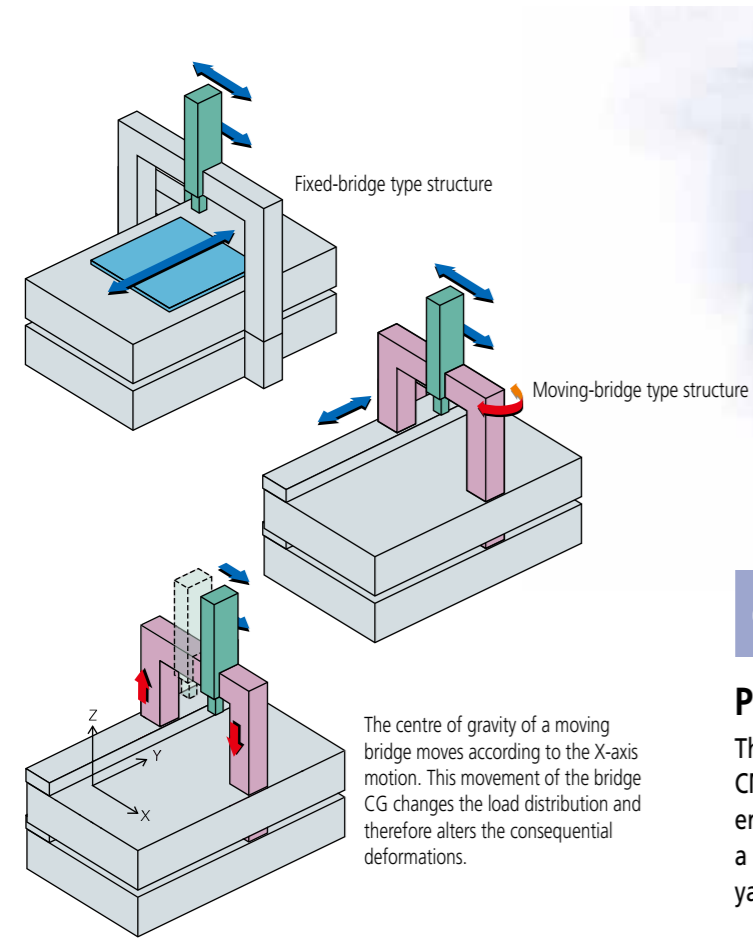


Vibration attenuation

The LEGEX structure quickly attenuates traverse-induced vibrations and so reduces any adverse effect on measurements. This characteristic also allows ultra-high scanning accuracy to be realized.

Evolving technology

Thorough analysis and elimination of error factors Part 2



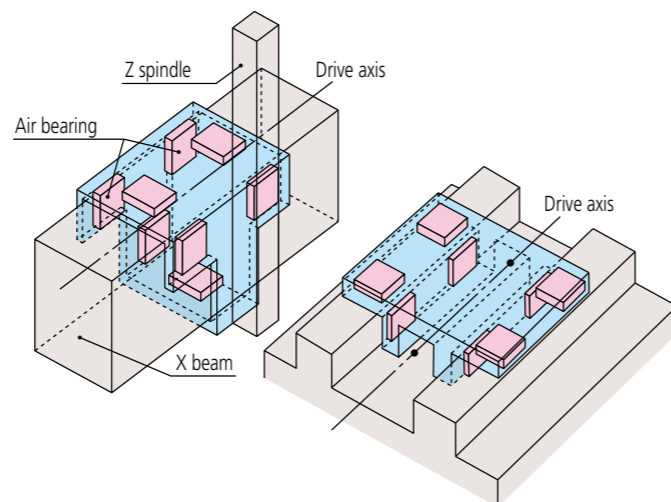
Construction

Pitch and yaw errors practically eliminated
 The LEGEX uses a fixed-bridge type structure. This is the ideal CMM architecture and virtually eliminates pitch and yaw errors. Most other CMMs use a moving-bridge design with a single drive unit under the column, which tends to cause yawing and pitching during slide movements.

Dynamic accuracy

X- and Y-axis independence and a 'center of gravity' type drive system

The fixed-bridge design of the LEGEX allows the axes to operate totally independently. Movement of the X-axis slide does not change the loading on the Y-axis slide, and so does not cause deformation. Also, the 'center of gravity' type drive system places the drive units near the center of gravity of each slide. This feature allows very high speed, highly accurate measurements by reducing inertia-induced deflections during acceleration and deceleration.



Vibration control

Isolating floor vibration

The LEGEX is hardened against floor induced vibration by use of 'air-damped spring isolators' with an auto-leveling function. This virtually eliminates factory floor vibrations from the entire machine structure.

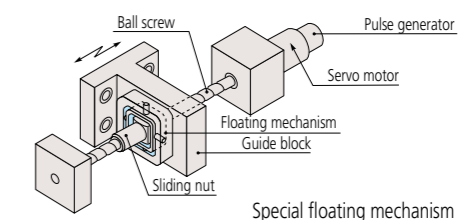


Floating mechanism reduces internal vibration

To reduce the effects of internally generated vibration, the LEGEX uses a special floating mechanism to couple each ballscrew to its guide block. This isolates the slide from the servo motor as it turns the ball screw and thus prevents transmission of motor vibrations, especially during acceleration and deceleration.



Air-damped spring isolators



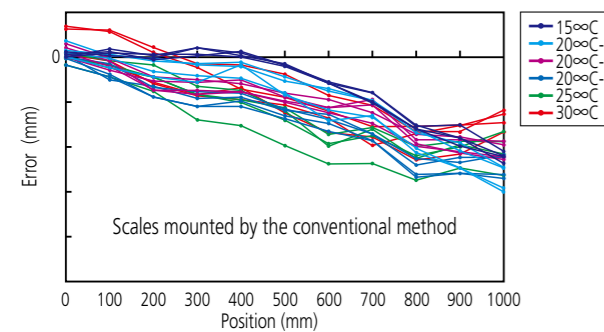
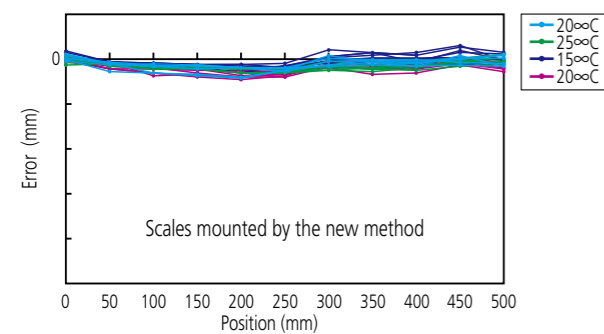
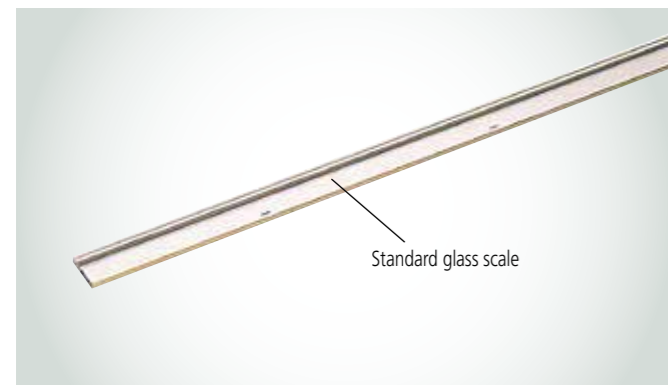
Evolving technology

Thorough analysis and elimination of error factors Part 3

Length standard

Linear glass scales with virtually zero thermal expansion coefficient

The LEGEX is equipped with crystallized-glass scales with a resolution of 0.01 μm and an ultra-low linear expansion coefficient of $0.01 \times 10^{-6}/^{\circ}\text{C}$. This virtually zero thermal expansion coefficient means the LEGEX can maintain its extreme accuracy in spite of thermal changes. The scales are also mounted in a unique new way that reduces the hysteresis error to 1/5 that of previous models. The graphs below show the reduction in hysteresis error that results from this new mounting method.



Hysteresis comparison between the conventional and the new scale mounting methods

Temperature compensation

Effective over the 18 °C to 22 °C (64.4 °F to 71.6 °F) temperature range

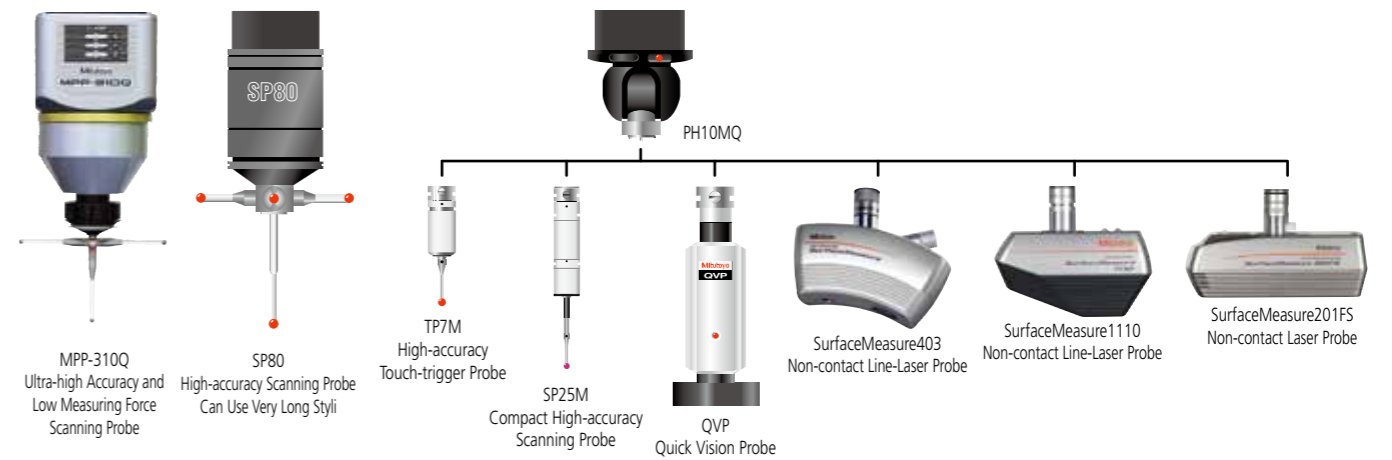
While conventional very high accuracy CMMs require fairly strict temperature controlled environments, the LEGEX has been designed to improve the thermal stability of each component to minimize deformation. In addition, temperature sensors on each axis and for the workpiece itself detect temperature changes in real time and are used to compensate back to size at 20 °C.

State-of-the-art control

Our proprietary control unit has been upgraded with sophisticated control technology that uses a new algorithm. A newly developed high-resolution linear encoder is also used to achieve higher accuracy.



Probes



MPP-310Q



SP80 Scanning Probe



QVP

MRT240 Rotary table

The LEGEX can be used with the MRT240 rotary table as the 4th axis. It can be used with a scanning probe for rotation-synchronized scanning measurement.



Specifications

Resolution		0.00005" (0.18")
Accuracy	Indexing accuracy	0.7"
	Radial deflection of rotation axis	0.4 μm
	Axial deflection of rotation axis	0.4 μm
Maximum table load		40 kg
Table	Diameter	$\phi 240$ mm
	Height	105 mm

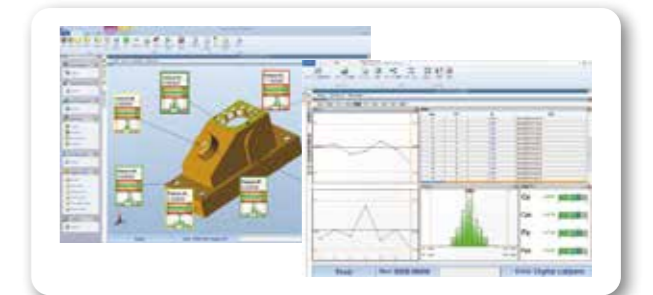
Status Monitor

Can remotely monitor measuring machines



MeasurLink®

Reduces defective products by visualizing quality



Note: MeasurLink® is a registered trademark of Mitutoyo Corporation in Japan and Mitutoyo America Corporation in the United States.

Specifications

Model		LEGEX574	LEGEX774	LEGEX776	LEGEX9106
Measuring range	X axis	500 mm	700 mm		900 mm
	Y axis	700 mm			1000 mm
	Z axis	450 mm		600 mm	
Measurement method		Linear encoder			
Maximum measuring speed		200 mm/s			
Maximum acceleration		980 mm/s ²			
Resolution		0.00001 mm			
Guide method		Air bearing			
Measuring table	Material	Cast iron			
	Size	550×750 mm	750×750 mm	950×1050 mm	
Workpiece	Maximum workpiece height	700 mm		850 mm	
	Maximum table loading	250 kg	500 kg		800 kg
Mass (includes the vibration-damping platform and controller, but not workpiece)		3500 kg	5000 kg	5100 kg	6500 kg
Air supply	Pressure	0.5 MPa			
	Consumption	120 L/min under normal conditions (air source: 160 L/min or more)			

Main unit accuracy

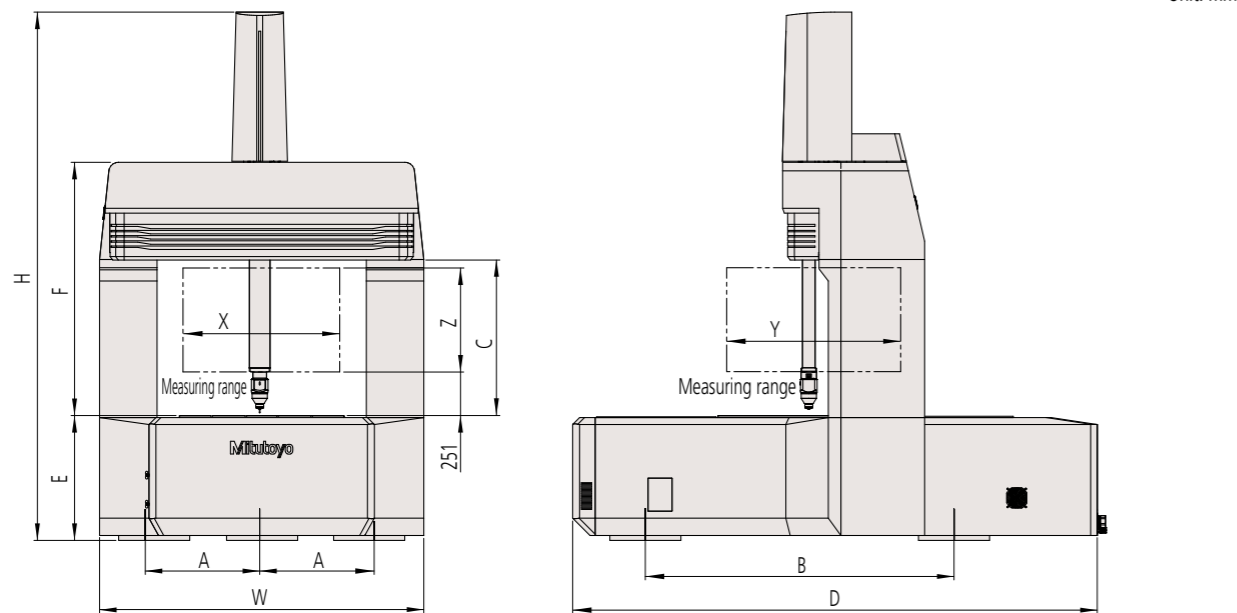
Probe	Length measurement error E _{0,MPE}
MPP-310Q (ø4×18)	(0.28 + L/1000) μm (Temperature environment 1)
	(0.30 + L/1000) μm (Temperature environment 2)
SP25M (ø4×50)	(0.38 + L/1000) μm (Temperature environment 1)
	(0.40 + L/1000) μm (Temperature environment 2)

Note 1: L = measured length (mm)
 Note 2: Table at right defines temperature environments 1 and 2

Installation temperature environment

	Temperature environment 1	Temperature environment 2
Temperature range	19 to 21 °C	18 to 22 °C
Rate of change	0.5 °C/h	
Gradient	1.0 °C/m	

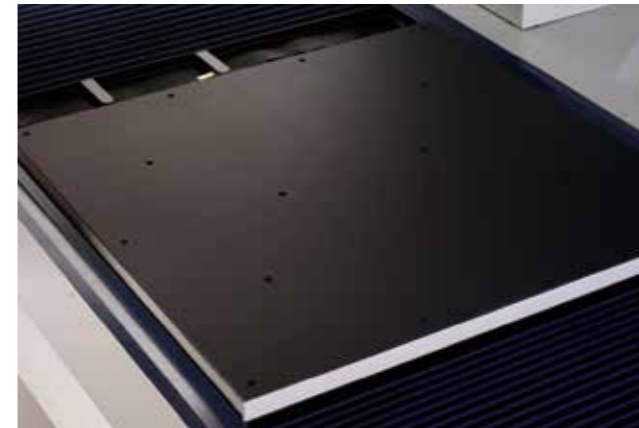
Dimensions



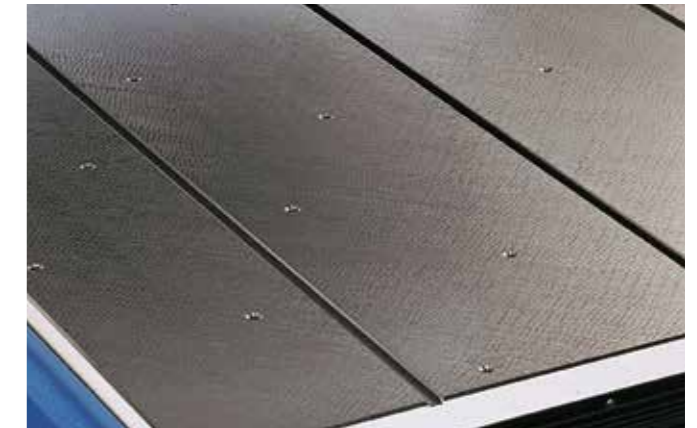
Unit: mm

Model	LEGEX574	LEGEX774	LEGEX776	LEGEX9106
W	1470	1670		1870
H	2630		2930	3050
D	2430			3030
A	445	550		660
B	1390	1410		1795
C	745		895	
E	600			720
F	1311	1461		

Worktable options



Standard worktable: Ceramic-coated worktable



Custom-ordered: Scraped

Introduction to LEGEX12128



Main Specifications

Model		LEGEX12128
Measuring range	X axis	1200 mm
	Y axis	1200 mm
	Z axis	800 mm
Resolution		0.00001 mm
Guide method		Air bearing
Length measurement error E _{0,MPE} (Temperature environment 2) Probe: MPP-310Q (ø4×18)		(0.6 + 1.5L/1000) μm

Note 1: L = measured length (mm)
 Note 2: This is a custom-order product.
 Note 3: For temperature environment 2, refer to the installation temperature environment of the LEGEX Series on page 10.

Note: This machine incorporates a main unit Startup system (relocation detection system), which disables 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.



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 up 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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