Microscopic Form Measurement System

UMAP Vision System

Catalog No. E14000

Extremely small styli down to 15 micrometres diameter make touch measurement of microscopic form a reality

Mitutoyo

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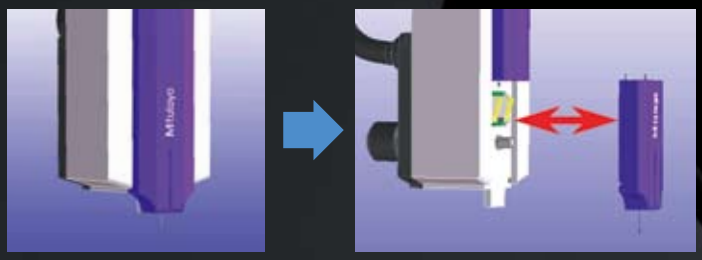
The UMAP Vision System is an ultra-low-measuring-force probe that uses Mitutoyo's proprietary sensing technology.
With a lineup of styli ranging from a minimum diameter of 15µm, this product responds to the needs of our customers for microscopic dimension and form measurement.

UMAP Vision System Features

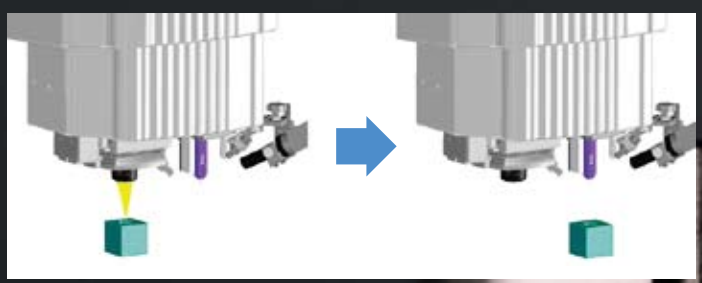
- Stylus with a minimum diameter of 15µm makes contact measurements of microscopic areas possible.


- Ultra low measuring force of a minimum 1µN (UMAP103) makes it possible to measure even workpieces that are easily deformed.

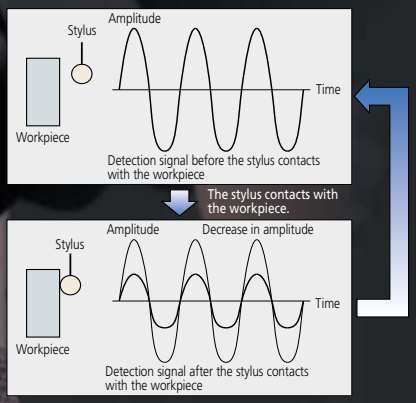
- Up to three types of UMAP styli, each of a different diameter can be used in combination. The user can install, remove, and replace styli.



- This one unit can be used to perform contact measurements using UMAP mode and non-contact measurements using vision mode.
  Even for parts that are difficult to see, vision mode can be used to perform workpiece positioning, and then the UMAP mode can be used to perform aimed measurements.



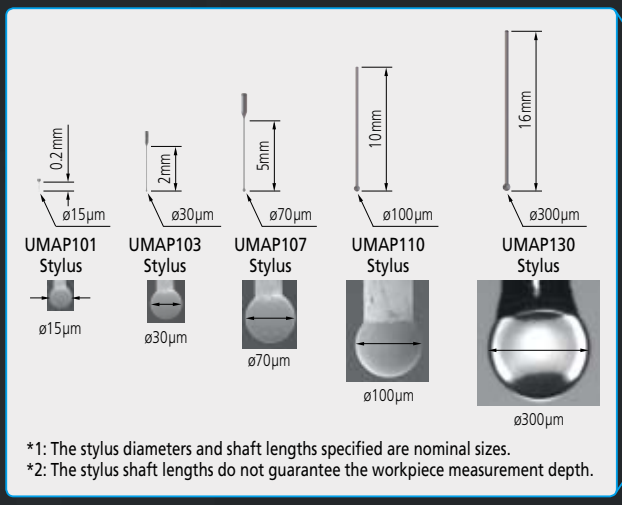
Detection Principle



1. As shown in the figure to the left, the stylus maintains a micro-vibrating state when not in contact with the workpiece.
2. When the stylus comes into contact with the workpiece, the stylus vibration is restricted by the workpiece, which causes the vibration amplitude to decrease. A touch-trigger signal will be detected when the amplitude decreases past a certain level.
3. When the stylus moves away from the workpiece, the stylus vibration amplitude returns to the state that was present when the stylus was not in contact with the workpiece, which makes the stylus ready for use in performing the next measurement.

UMAP Stylus Lineup

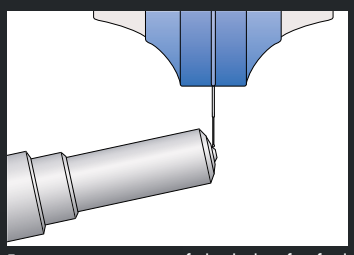
Five types of stylus modules that differ in stylus tip radius and shaft length are available.
Up to three types of styli can be used in combination, which makes it possible to select the optimum stylus to match the workpiece to be measured.



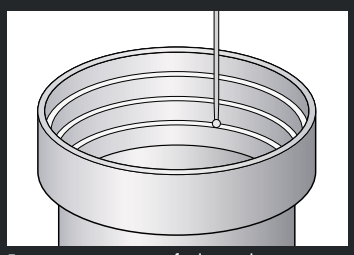
*1: The stylus diameters and shaft lengths specified are nominal sizes.
*2: The stylus shaft lengths do not guarantee the workpiece measurement depth.

UMAP Measurement Workpiece Examples

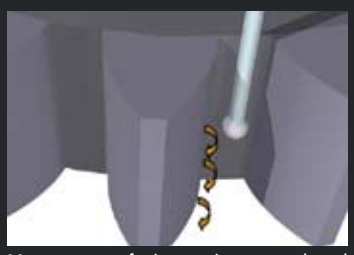
The following are examples of workpieces that can be measured with UMAP. UMAP provides a solution for microscopic dimension measurement and form evaluation in a wide variety of fields such as precise microscopic molds, micromachining pressed products, microscopic resin molded products, and EDM electrodes.



Form measurement of the hole of a fuel injection nozzle



Form measurement of a lens tube



Measurement of microscopic gear tooth and tooth-form profile / tooth-alignment profile

UMAP Vision System Specifications

Hyper UMAP Vision System 302 TYPE2

- The application of high-performance objectives with high NA and low distortion and a new optical system provide the UMAP Vision System with excellent edge-detection capability.
- The standard length measuring system uses a low-expansion glass scale with a linear expansion coefficient of $(0\pm0.02)\times10^{-6}$K, which keeps glass scale expansion/contraction due to temperature changes to the absolute minimum.

Model			Hyper UMAP Vision System 302 TYPE2	ULTRA UMAP Vision System 404 TYPE2
Order No.			364-713	364-717
Measuring range (X×Y×Z)			300×200×200mm	400×400×200mm Effective measuring range on glass stage: 360×400×200mm*1
Effective measuring range (common between images and UMAP103)			185×200×175mm	285×400×175mm
Observation unit*2			PPT 1X, 2X, 6X	PPT 1X, 2X, 6X
Resolution			0.02µm	0.01µm
Imaging Device			B&W CCD	B&W CCD
Illumination unit	Co-axial Light		White LED	Halogen
	Transmitted Light		White LED	Halogen
	PRL		White LED	Halogen
Measuring accuracy*3	Vision	E_{1X}, E_{1Y}	(0.8+2L/1000)µm	(0.25+L/1000)µm
		E_{1Z} (50mm stroke)*4	—	(1.0+2L/1000)µm
		E_{1Z} (full stroke)	(1.5+2L/1000)µm	(1.5+2L/1000)µm
		E_{2XY}	(1.4+3L/1000)µm	(0.5+2L/1000)µm
		Optical condition for accuracy assurance	QV-HR2.5X or QV-SL2.5X + Middle magnification tube lens	QV-5X + Middle magnification tube lens
	UMAP	E_{1X}, E_{1Y} (UMAP110)*5	(1.7+3L/1000)µm	(1.5+3L/1000)µm
UMAP repeatability*3, 6	**UMAP101, 103, 107**		σ = 0.1µm	σ = 0.08µm
	UMAP110, 130		σ = 0.15µm	σ = 0.12µm
Repeatability within screen*3			—	3σ = 0.2µm
Operating temperature range		Ambient temperature	18 ~ 23°C	19 ~ 23°C
		Temperature variation	0.5˚C / 1H and 1˚C / 24H	0.5˚C / 1H and 1˚C / 24H
Stage glass size			399×271mm	493×551mm
Maximum stage loading*7			15kg	40kg
Main unit external dimensions			859×951×1609mm	1200×1735×1910mm
Main unit mass (including the sub-base)			370kg	2160kg
Operating air pressure			0.4MPa (requires a supply pressure of 0.5 to 0.9MPa)	0.4MPa (requires a supply pressure of 0.5 to 0.9MPa)
Required air flow rate*8			—	300L/min (ANR)
Temperature compensation function			Automatic	Automatic

*1: Effective measuring range when contour light is used.
*2: The specific combination of 1X, 2X and 4X or 1X, 2X, 4X and 6X is available by custom order.
*3: Determined by Mitutoyo's inspection method. L is measured length (mm).
*4: Verified at shipment from factory.
*5: The assured accuracy of UMAP is specific to that of UMAP110 in the case of a measuring speed of 10µm/s.
*6: The accuracies are guaranteed for a measuring speed of 5µm/s for the UMAP101 and a measuring speed of 10µm/s for the UMAP103, 107, 110, and 130.
*7: An excessively biased or concentrated load is excluded.
*8: Hyper UMAP Vision System 302 TYPE2 only uses air to move UMAP up and down.
* The Laser Auto Focus (LAF) specification is available by custom order.
* Append "S" to the end of code number to order a QV machine compatible with ISO10360-7:2011 Accuracy Assurance.

NOTE: Machines in this series are equipped with the main unit deactivating system (relocation detection system) that prevents the machine from operating if it is subjected to an unexpected vibration or if it is relocated. Be sure to contact your nearest Mitutoyo sales office prior to relocating this machine after initial installation.

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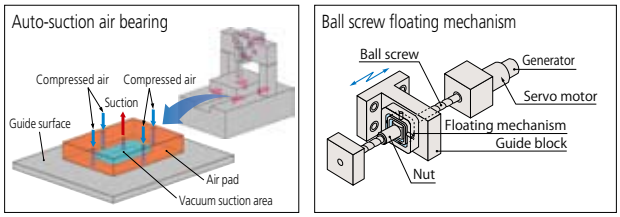
ULTRA UMAP Vision System 404 TYPE2

*ULTRA QV404 PRO

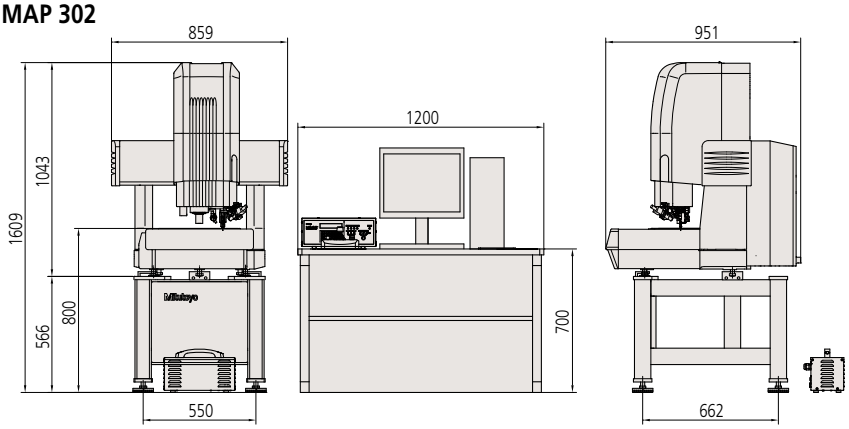
- This is a high-end microscopic-form measuring system that is based on the ULTRA QV404 PRO ultra-accurate vision measuring machine.
- By applying an auto-suction air bearing to the Y axis and a floating mechanism to the ball screw parts of each axis, we have made possible measurements with even higher accuracy and stability.



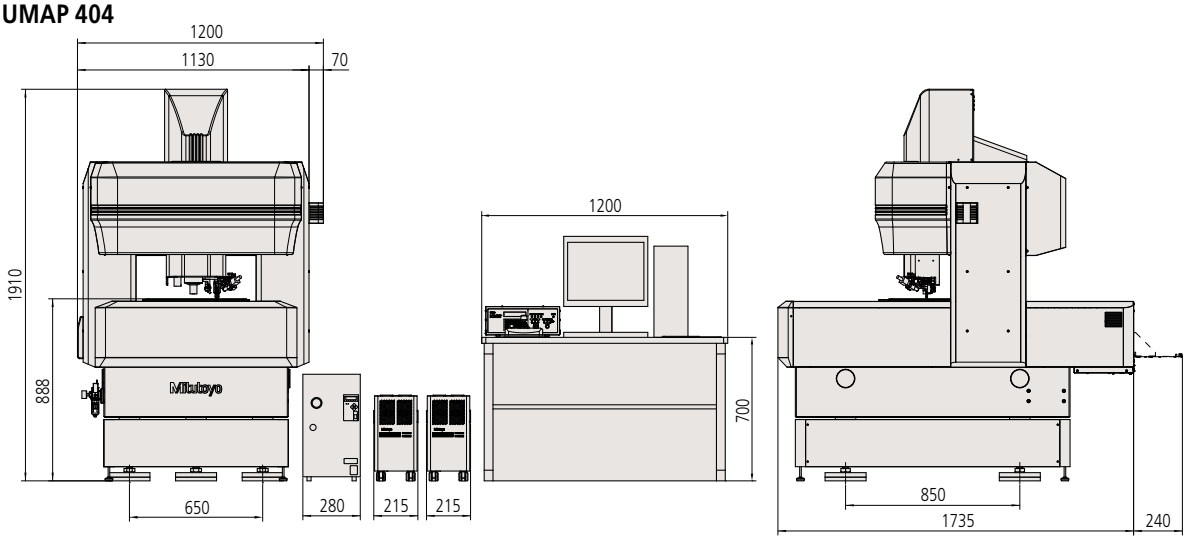
- The standard length measuring system uses a low-expansion glass scale with a linear expansion coefficient of $(0\pm0.02)\times10^{-6}$K, which keeps glass scale expansion/contraction due to temperature changes to the absolute minimum.

Dimensions

Hyper UMAP 302



ULTRA UMAP 404

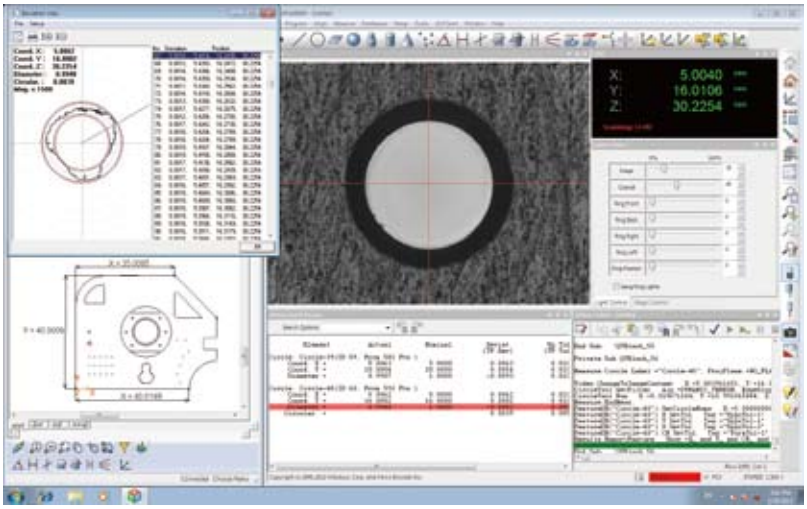


Software

QVPAK

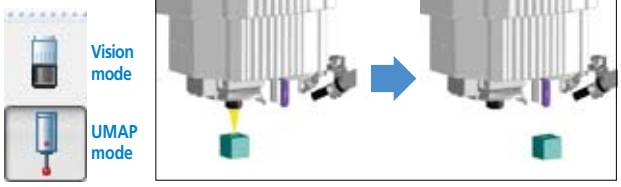
QVPAK, the main software, supports both non-contact measurements using vision mode and contact measurements using UMAP mode.

Calculation function example



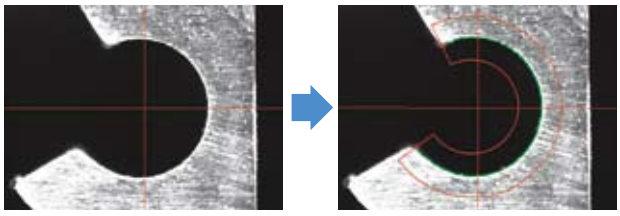
Switching between vision and UMAP modes

The user can click icons to switch between vision and UMAP modes. This makes it possible to use vision mode to perform workpiece positioning and then use UMAP mode to perform targeted measurements.



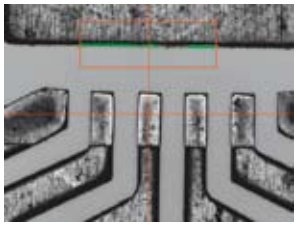
Measuring tool arrangement with a single click

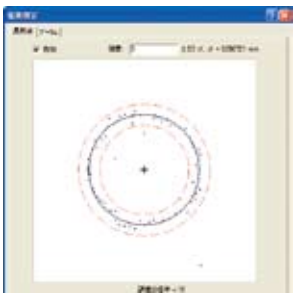
The tool size, orientation, and threshold of vision measuring tools are automatically set with one click of the mouse in the vicinity of the measurement location.



Abnormal point removal

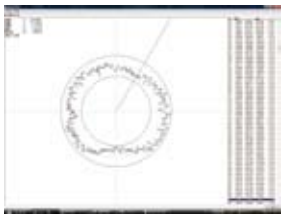
Abnormal points caused by dirt, burrs, and chips are removed automatically. Also, it is possible to determine the optimum removal level for abnormal points while viewing the measured data.





QVGraphics

The elements measured with QVPAK and the measurement results can be displayed graphically. It is also possible to calculate distances and angles for configuring the coordinate system settings of displayed elements that the user specifies.



Drawing the geometrical deviation of a circle

Graphical display of a measured element

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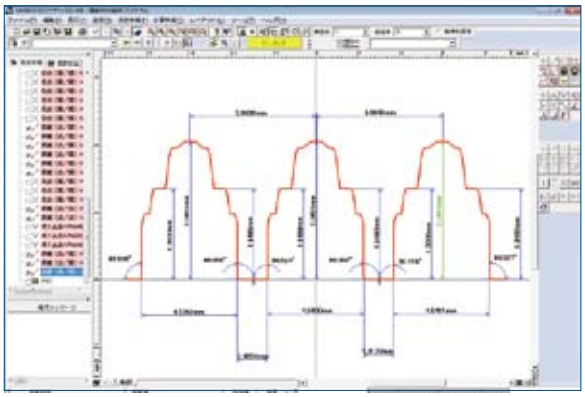
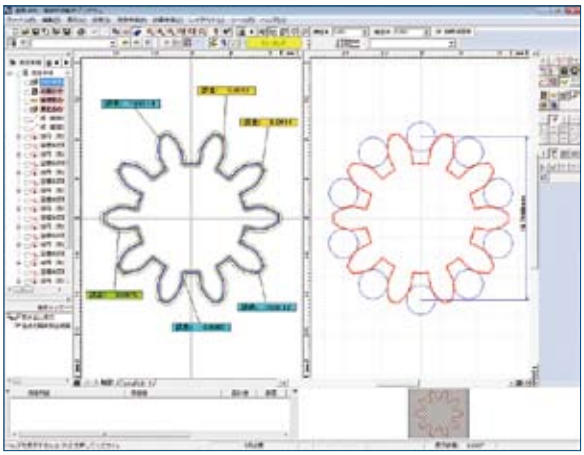
Options

FORMPAK-QV

This software makes it possible to use the point buffer data obtained in UMAP or vision mode as the base data for performing dimension analysis on microscopic forms and contour matching with the design data.



Microscopic dimension analysis example



Gear contour matching and over-pin diameter analysis example

Objectives

The objectives can be changed to give the observation magnification required or to suit the workpiece depth.

Objectives	Turret magnification	Monitor magnification	View field	Working distance*1
QV-SL0.5× *2	1X	15X	12.54×9.4	30.5
	2X	30X	6.27×4.7	
	6X	90X	2.09×1.56	
QV-SL1× **QV-HR1×**	1X	30X	6.27×4.7	52.5 40.6
	2X	60X	3.13×2.35	
	6X	180X	1.04×0.78	
QV-HR2.5× **QV-SL2.5×**	1X	75X	2.5×1.88	40.6 60
	2X	150X	1.25×0.94	
	6X	450X	0.41×0.31	
QV5×	1X	150X	1.25×0.94	33.5
	2X	300X	0.62×0.47	
	6X	900X	0.2×0.15	
QV-HR10× *2 **QV-10×**	1X	300X	0.62×0.47	20 30.5
	2X	600X	0.31×0.23	
	6X	1800X	0.1×0.07	
QV25× *2*3	1X	750X	0.25×0.18	13
	2X	1500X	0.12×0.09	
	6X	4500X	0.04×0.03	

*1: Depending on the PRL position, the PRL illumination unit may be shorter than the working distance.
*2: Depending on the workpiece, some limitations, such as the illumination being insufficient, may occur.
*3: The usable position for PRL is restricted.

Two-Axis Index Table (Made-to-Order Product)

The combining of two index tables makes the UMAP Vision System extremely well suited to measurements of complicated forms on the sides of workpieces as well as slanted holes.

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