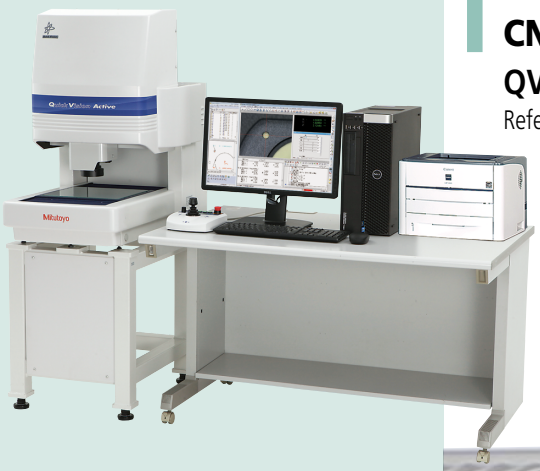
New Products



CNC Vision Measuring System
QV Active
Refer to page K-3 for details.

Vision Measuring Machine with Micro-Form Scanning Probe
MiSCAN Vision System
Refer to page K-10 for details.

Vision Measuring System
QUICK SCOPE QS-L
Refer to page K-13 for details.

Vision Measuring Systems

Quick Vision

MiSCAN Vision System

QUICK SCOPE

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Vision Measuring Systems

Vision measuring systems for multipurpose use

QV Active
CNC Vision Measuring System

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- Cost effective, multifunction, CNC Vision Measuring System.
- Usability has been improved by adopting a color camera and 8-step zoom optics.
- A touch-probe model can seamlessly perform non-contact and contact measurement.
- The zoom ratio of 7X (14X at maximum by changing the fixed-magnification objective lens) enables a wide range of inspection from wide view measurement at low magnification to micro-measurement at high magnification.
- The 74 mm maximum working distance (1X optional objective) promotes safe working by reducing the risk of collision, and allows greater freedom in fixture design.

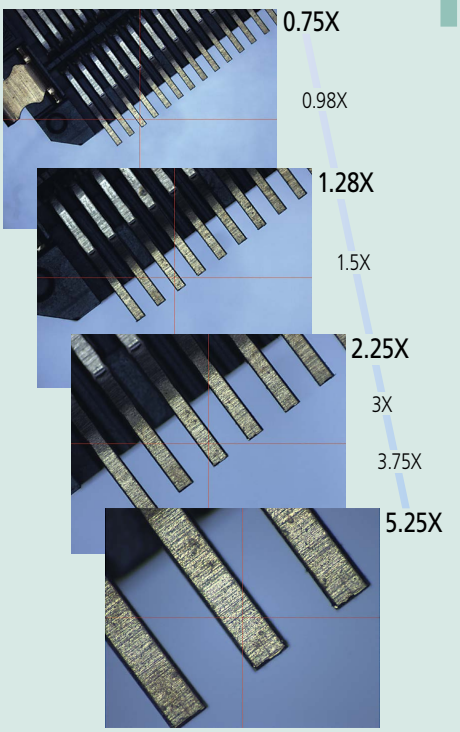
QV Active 202

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.



From wide view measurement to micro-measurement

Optical magnification	0.5X	0.65X	0.75X	0.85X	0.98X	1X	1.28X	1.3X	1.5X	1.7X	2X	2.25X	2.5X	3X	3.5X	3.75X	4X	5X	5.25X	7X
View field (mm) Horizontal (H)	13.60	10.46	9.07	8.00	6.94	6.80	5.31	5.23	4.53	4.00	3.40	3.02	2.72	2.27	1.94	1.81	1.70	1.36	1.30	0.97
Vertical (V)	10.80	8.31	7.20	6.35	5.51	5.40	4.22	4.15	3.60	3.18	2.70	2.40	2.16	1.80	1.54	1.44	1.35	1.08	1.03	0.77
Total magnification (on the monitor)	13.20	17.10	19.80	22.40	25.80	26.40	33.70	34.30	39.50	44.80	52.70	59.30	65.90	79.10	92.30	98.90	105.50	131.80	138.40	184.50

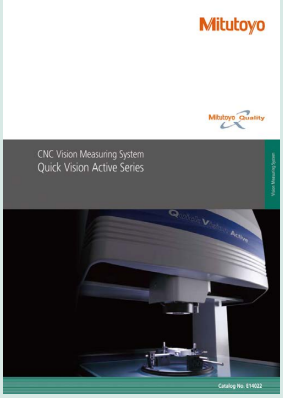
Objective lens		
	1X objective (optional) Working distance	74 mm
	1.5X objective (standard accessory) Working distance	42 mm
	2X objective (optional) Working distance	42 mm

Note: The total magnification indicates the magnification on the monitor when the size of the **QVPAK** video window is 178.8×143.0 mm (default).

SPECIFICATIONS

Model		QV Active 202	QV Active 404
Type		Standard model	Standard model
Measuring range (X×Y×Z)		250×200×150 mm (250×200×118 mm: when 1X objective is used)	400×400×200 mm (400×400×168 mm: when 1X objective is used)
Observation unit		Zoom unit (8 positions)	
Imaging device		Color CMOS camera	
Measuring accuracy*	E_{1X}, E_{1Y}	(2 + 3L/1000) µm	
	E_{1Z}	(3 + 5L/1000) µm	
	E_2	(2.5 + 4L/1000) µm	
	Accuracy guaranteed with optics specified	Objective: 1.5X, Optical magnification: 5.25X	
Touch-trigger probe measuring accuracy*	E_{1X}, E_{1Y}, E_{1Z}	—	—
Accuracy guaranteed temperature		20±1 °C	20±1 °C

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)



Refer to the **QUICK VISION Active** Series Brochure (**E14022**) for more details.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.

QV Apex/Hyper QV
CNC Vision Measuring System

MeasurLink® ENABLED
Data Management Software by Mitutoyo

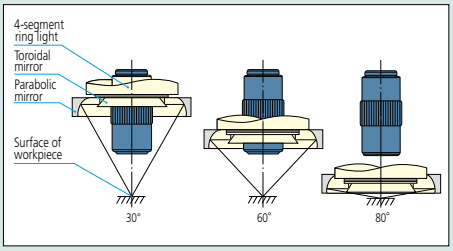
- QV Series standard models range in size from compact to large.
- There are a general-purpose model with white LED light and an enhanced edge detection model with RGB color LEDs.
- A custom model with higher optical performance 3CCD camera is also available to order.

QV Apex 302

Hyper QV 404

Programmable ring light

Fine control of obliquity and direction provides illumination optimal for measurement. Obliquity can be arbitrarily set in the range from 30° to 80°. Illumination can be controlled independently in every direction, back and forth, right and left.



Measurement example of IC package terminal bottom width

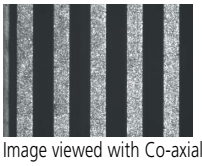


Image viewed with Co-axial light

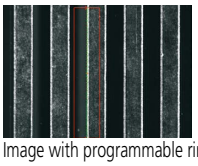
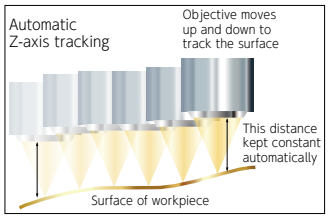


Image with programmable ring light

Tracking Auto Focus (TAF)

Laser radiation from the objective lens enables automatic focusing. The system automatically keeps the object in focus according to its shape, eliminating the task of focus adjustment and increasing measurement throughput.

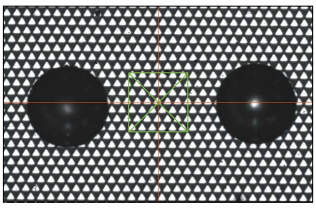


Laser source	Semiconductor laser (peak wavelength: 690 nm)
Laser safety	Class 2 (JIS C6802: 2014, EN/IEC 60825-1: 2014)
Auto focus system	Objective coaxial autofocusing (knife-edge method)

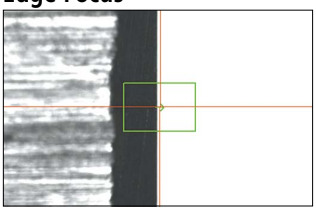
High-Performance Multi-Auto Focus

The **QV** Series is equipped with a high-performance image auto focus function as standard. Image auto focus is used to guarantee accuracy.
Thanks to the availability of various auto focus tools, the optimal focus for each surface texture and measured feature can be selected, which makes it possible to perform highly reliable height measurements.

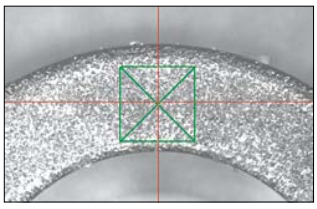
Pattern Focus



Edge Focus



Surface Focus



SPECIFICATIONS

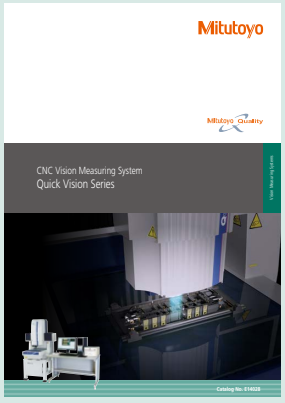
QV Apex

Model		QV Apex 302	QV Apex 404	QV Apex 606
Measuring range (X×Y×Z)		300×200×200 mm	400×400×250 mm	600×650×250 mm
Observation Unit		PT 1X-2X-6X		
Imaging Device		B&W CCD (1/2 in)		
Measuring accuracy*	E_{1X}, E_{1Y}	(1.5 + 3L/1000) µm		
	E_{1Z}	(1.5 + 4L/1000) µm		
	E_{2XY}	(2 + 4L/1000) µm		

Hyper QV (Specifications other than as quoted in the table are the same as the **QV Apex** specifications.)

Model		Hyper QV 302	Hyper QV 404	Hyper QV 606
Imaging Device		B&W CCD (1/2 in)		
Measuring accuracy*	E_{1X}, E_{1Y}	(0.8 + 2L/1000) µm		
	E_{1Z}	(1.5 + 2L/1000) µm		
	E_{2XY}	(1.4 + 3L/1000) µm		

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)



Refer to the **QUICK VISION** Series Brochure (**E14028**) for more details.

Mitutoyo

Vision Measuring Systems

Vision measuring systems for multipurpose use

QV STREAM PLUS
Non-stop CNC Vision Measuring System

MeasurLink® ENABLED
Data Management Software by Mitutoyo

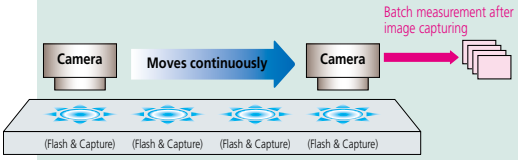
Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

An inspection certificate is supplied as standard. Refer to page U-11 for details.

- The main unit operation and the strobe light are synchronized to enable vision measurement without stopping the stage. As it is unnecessary to increase or decrease the stage speed, measurement becomes 5X faster than conventional models depending on the object type. (Compared with our conventional models.)
- The model with tracking auto focus performs continuous measurement by adapting to height differences, thus reducing the measurement time significantly.

QV STREAM PLUS 606

Flow of non-stop measurement



SPECIFICATIONS

Model No.		QV STREAM PLUS 302	QV STREAM PLUS 404	QV STREAM PLUS 606
Measuring range (X×Y×Z)		300×200×200 mm	400×400×250 mm	600×650×250 mm
Observation unit		PT 1X-2X-6X		
Imaging device		B&W CCD (1/2 in)		
Measuring accuracy*	E_{1X}, E_{1Y}	(1.5 + 3L/1000) µm		
	E_{1Z}	(1.5 + 4L/1000) µm		
	E_{2XY}	(2.0 + 4L/1000) µm		
Tracking auto focus device		Optional		

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

Note: Only one of the illumination functions (reflected, transmitted, and PRL illumination) can be set in STREAM mode. The 4-way PRL illumination can be set to 4-direction lighting or single-direction lighting.

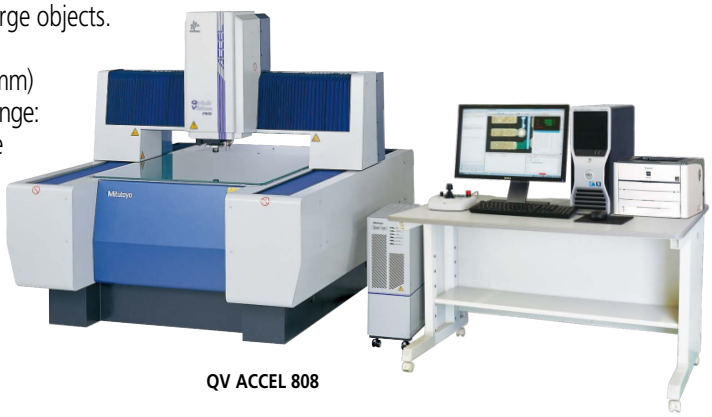
QV ACCEL
Large CNC Vision Measuring System

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

An inspection certificate is supplied as standard. Refer to page U-11 for details.

- This is a vision measuring machine with moving-bridge type main unit structure suitable for measuring large objects.
- **QV ACCEL 1212** (range: 1250×1250×100mm) and **QV ACCEL 1517** (range: 1500×1750×100 mm) are available to special order.
- As the stage is immobile on the moving-bridge structure, you can use a simple method to fix a workpiece,which is suitable for measuring small, thin objects.

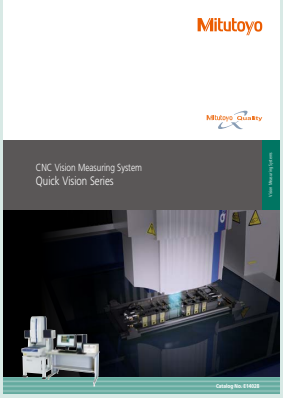


QV ACCEL 808

SPECIFICATIONS

Model No.			QV ACCEL 808	QV ACCEL 1010
Measuring range (X×Y×Z)			800×800×150 mm	1000×1000×150 mm
Observation unit			PT 1X-2X-6X	
Imaging device			B&W CCD (1/2 in)	
Measuring accuracy*	E_{1X}, E_{1Y}		(1.5 + 3L/1000) µm	
	E_{1Z}		(1.5 + 4L/1000) µm	
	E_{2XY}		(2.5 + 4L/1000) µm	
Repeatability*	Short dimensions	X axis, Y axis	3σ=0.2 µm	
	Long dimensions		3σ=0.7 µm	
Tracking auto focus device			Optional	

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)



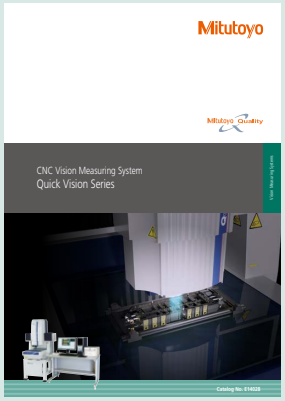
Refer to the **QUICK VISION** Series Brochure (**E14028**) for more details.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the **QUICK VISION** Series Brochure (**E14028**) for more details.

ULTRA QV 404
Ultra-High Accuracy CNC Vision Measuring System

MeasurLink ENABLED
Data Management Software by Mitutoyo

ULTRA QV 404

- Ultra-high accuracy CNC vision measuring machine with measuring accuracy of E_{1XY} (0.25 + L/1000) µm.
- Our proprietary high-resolution (Resolution: 0.01 µm) and high-accuracy low-expansion glass scales are used on the X, Y and Zaxes.
- The high-rigidity Y-axis table moving mechanism with fixed bridge has been adopted. The base is made of high stability granite.
- This model is standard-equipped with an automatic temperature compensation function that uses a temperature sensor on the main unit of the measuring machine and a temperature sensor for the workpiece.

SPECIFICATIONS

Model No.		ULTRA QV 404
Measuring range (X×Y×Z)		400×400×200 mm
Observation unit		PT 1X-2X-6X
Imaging device		B&W CCD (1/2 in)
Measuring accuracy (E_1)*1	E_{1X}, E_{1Y}	(0.25 + L/1000) µm
	E_{1Z} (Full stroke)	(1.5 + 2L/1000) µm (Range 200 mm)
	E_{1Z} (50 mm stroke)*2	(1.0 + 2L/1000) µm (Range 10 to 60 mm)
Measuring accuracy (E_2)*1	E_{2XY}	(0.5 + 2L/1000) µm
Tracking auto focus device		Optional

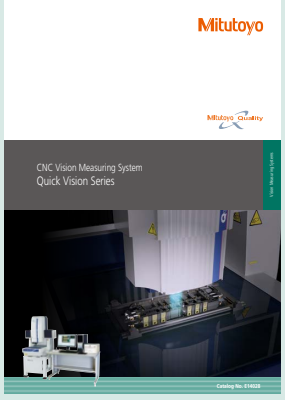
*1 Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)
*2 Verified at shipment from factory.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

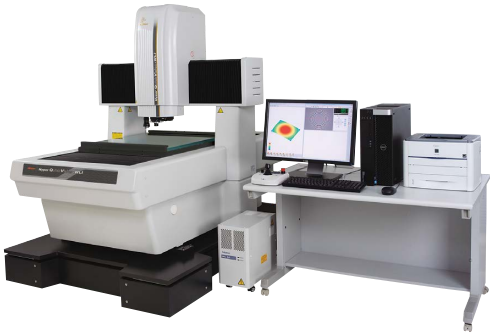
An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the **QUICK VISION** Series Brochure (**E14028**) for more details.

Hyper QVWLI
Non-contact 3D Measuring System

MeasurLink ENABLED
Data Management Software by Mitutoyo



Hyper QVWLI 606

- **Hyper QVWLI** is a high-accuracy complex 3D measurement system consisting of **QV** and a white light interferometer.
- Allows you to analyze 3D surface texture from 3D data captured by the WLI optical head. It is also suitable for measuring dimensions at a specific height and any cross-section from 3D data.

SPECIFICATIONS

Model No.		Hyper QVWLI 302	Hyper QVWLI 404	Hyper QVWLI 606
Measuring range (X×Y×Z)	Vision measuring area	300×200×190 mm	400×400×240 mm	600×650×220 mm
	WLI measuring area*1	215×200×190 mm	315×400×240 mm	515×650×220 mm
WLI optical head unit				
View field (H×V)		5X lens: approx. 0.64×0.48 mm/10X lens: approx. 0.32×0.24 mm/ 25X lens: approx. 0.13×0.10 mm/50X lens: approx. 0.064×0.048 mm		
Z repeatability		2σ≤ 0.08 µm		
Vision optical head unit				
Observation unit		PT 1X-2X-6X		
Imaging device		B&W CCD (1/2 in)		
Measuring accuracy*2	E_{1X}, E_{1Y}	(0.8 + 2L/1000) µm		
	E_{1Z}	(1.5 + 2L/1000) µm		
	E_{2XY}	(1.4 + 3L/1000) µm		

*1 Movable range of **WLI** optical head.
*2 Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

Refer to the **QUICK VISION** Series Brochure (**E14028**) for more details.

Mitutoyo

Vision Measuring Systems

Vision measuring systems for multipurpose use

QV TP
CNC Vision Measuring System equipped with a Touch Trigger Probe

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Non-contact and contact measurement on one machine

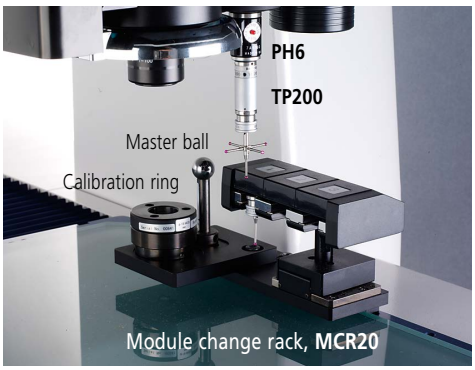
- **QV** touch-trigger probe unit enables both vision measurement and touch-trigger probe measurement.

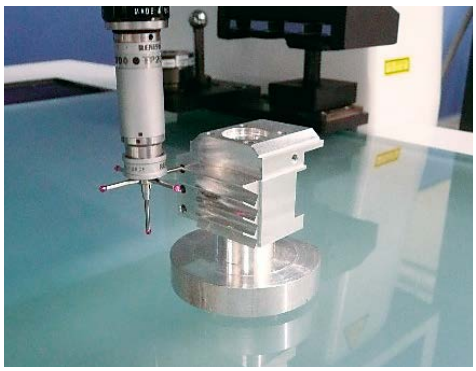
3D workpiece measurement

- Enables 3D measurement of workpieces, such as press-molded products, plastic-molded products, and machined products, that until now could not be measured with image processing alone.

Module change rack available

- Using the module change rack enables switching between vision measurement and touch probe measurement during an automatic measuring sequence.





MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.

K

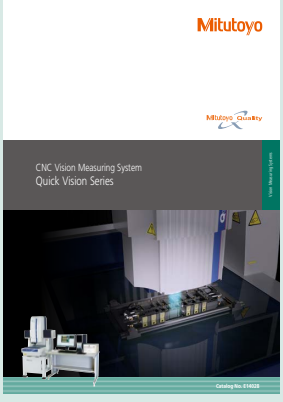
SPECIFICATIONS WITH TOUCH-TRIGGER PROBE OPTIONS MOUNTED

Items \ Model No.		QV TP Active 202	QV TP Active 404
Measuring range*1 (XxYxZ)	Vision	250×200×150 mm	400×400×200 mm
	Common to Touch-trigger Probe	184×200×150 mm	334×400×200 mm
Measuring accuracy*2 (Touch-trigger probe)	E1X, E1Y, E1Z	(2.4 + 3L/1000) µm	(2.4 + 3L/1000) µm

Items \ Model No.		QV TP Apex 302	QV TP Apex 404	QV TP Apex 606	Hyper QV TP 302	Hyper QV TP 404	Hyper QV TP 606
Measuring range*1 (XxYxZ)	Vision	300×200×200 mm	400×400×250 mm	600×650×250 mm	300×200×200 mm	400×400×250 mm	600×650×250 mm
	Common to Touch-trigger Probe	234×200×200 mm	334×400×250 mm	534×650×250 mm	234×200×200 mm	334×400×250 mm	534×650×250 mm
Measuring accuracy*2 (Touch-trigger probe)	E1X, E1Y, E1Z	(1.8 + 3L/1000) µm			(1.7 + 3L/1000) µm		

*1 When a module change rack, a master ball, and a calibration ring are mounted, the measurement ranges are smaller than those in the table. Other specifications are the same as those for **QV Active, QV Apex,** and **Hyper QV**. Please contact our sales office for more details.

*2 Inspected by Mitutoyo standard. L=length between two arbitrary points (mm)



Refer to the **QUICK VISION** Series Brochure (**E14028**) for more details.

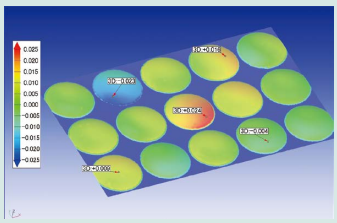
MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.

Example of 3D form comparison

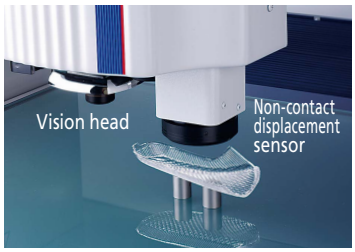


QVH Apex/Hyper QVH/ QVH STREAM PLUS

CNC Vision Measuring System equipped with Non-contact displacement sensor

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- A multi-sensor measuring machine equipped with an imaging optical head and non-contact displacement sensor. Both vision measurement and non-contact form measurement are possible.
- The laser probe equipped **HYBRID TYPE1** and CPS probe equipped **HYBRID TYPE4** are available.



QVH4 606

Features: HYBRID TYPE1

- The focusing point method minimizes the difference in the measuring face reflectance and achieves high measurement reproducibility.
- Capable of measuring detailed shapes in high resolution.

Features: HYBRID TYPE4

- Enables detection of high inclination angles for both mirror and diffused Surfaces.
- The automatic lighting adjustment function allows for high accuracy measurements.
- Surface roughness or thickness measurement of thin and transparent objects such as film.

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COMMON SPECIFICATIONS for TYPE1 / TYPE4

Apex / Hyper (Specifications other than as described below are the same as for models **QV Apex**, **Hyper QV**.)

Items \ Model No.			QVH Apex 302	QVH Apex 404	QVH Apex 606	Hyper QVH 302	Hyper QVH 404	Hyper QVH 606
Measuring range (X×Y×Z)	Vision		300×200×200 mm	400×400×250 mm	600×650×250 mm	300×200×200 mm	400×400×250 mm	600×650×250 mm
	Non-contact displacement sensor	**TYPE1**	180×200×200 mm	280×400×250 mm	480×650×250 mm	180×200×200 mm	280×400×250 mm	480×650×250 mm
		TYPE4	176×200×200 mm	276×400×250 mm	476×650×250 mm	176×200×200 mm	276×400×250 mm	476×650×250 mm
Measuring accuracy* (Vision)	E_{1X}, E_{1Y}		(1.5 + 3L/1000) µm			(0.8 + 2L/1000) µm		
	E_{1Z}		(1.5 + 4L/1000) µm			(1.5 + 2L/1000) µm		
	E_{2XY}		(2.0 + 4L/1000) µm			(1.4 + 3L/1000) µm		
Measuring accuracy (non-contact displacement sensor)*	E_{1Z}		(1.5 + 4L/1000) µm			(1.5 + 2L/1000) µm		

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

SPECIFICATIONS for TYPE4

STREAM PLUS (Specifications other than as described below are the same as for model **QV STREAM PLUS**.)

Items \ Model No.		QVH STREAM PLUS 302	QVH STREAM PLUS 404	QVH STREAM PLUS 606
Measuring range (X×Y×Z)	Vision	300×200×200 mm	400×400×250 mm	600×650×250 mm
	Non-contact displacement sensor	176×200×200 mm	276×400×250 mm	476×650×250 mm
Measuring accuracy* (Vision)	E_{1X}, E_{1Y}	(1.5 + 3L/1000) µm		
	E_{1Z}	(1.5 + 4L/1000) µm		
	E_{2XY}	(2.0 + 4L/1000) µm		
Measuring accuracy (non-contact displacement sensor)*	E_{1Z}	(1.5 + 4L/1000) µm		

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

CLASS 1 LASER PRODUCT

Safety precautions regarding QV HYBRID TYPE1

This product uses a low-power invisible laser (780 nm) for measurement. The laser is a CLASS 1 EN/IEC 60825-1 device. A warning and explanation label, as shown above, is attached to the product as appropriate.

Mitutoyo

Vision Measuring Systems

Vision measuring systems for multipurpose use

UMAP Vision System TYPE2
Micro Form Measuring System

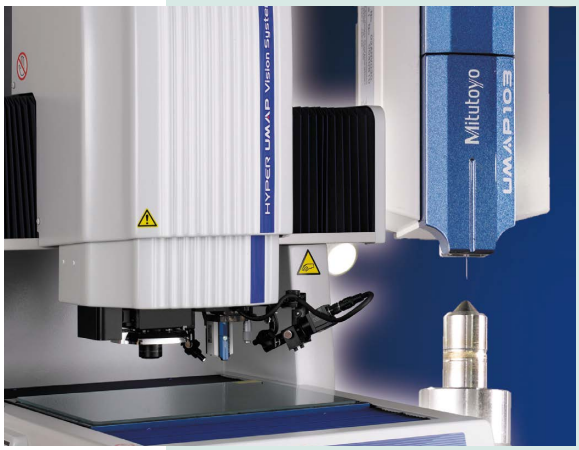
MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

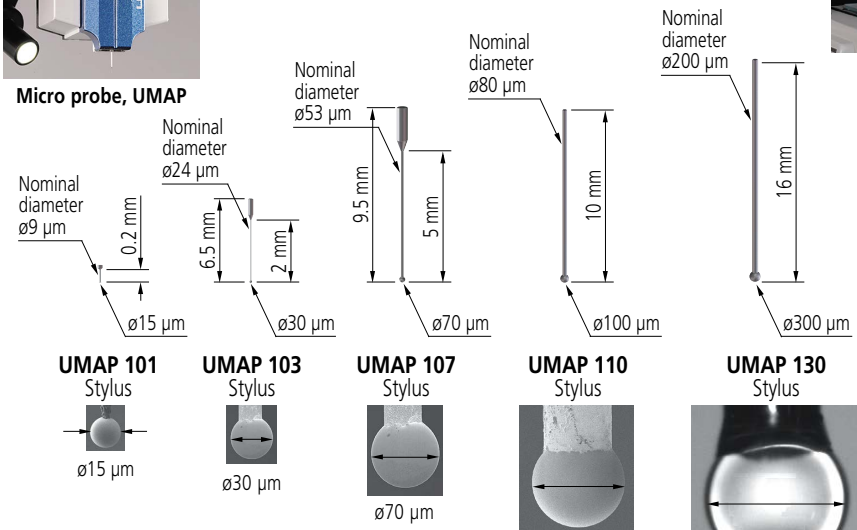
An inspection certificate is supplied as standard. Refer to page U-11 for details.

Ultrasonic Micro Probe UMAP

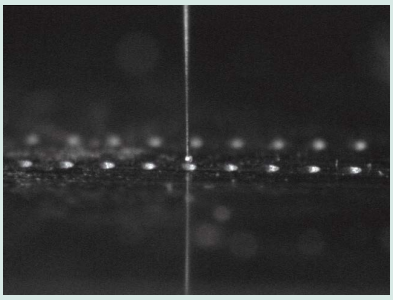
Contact measurement of a small hole's diameter and its section or contour is possible, which is difficult with a conventional Vision Measuring System or CMM. Capable of high accuracy, sophisticated, non-contact and contact measurement on one machine. With a minimum measuring force of 1 µN, it allows you to measure easy-to-deform and lightweight workpieces.



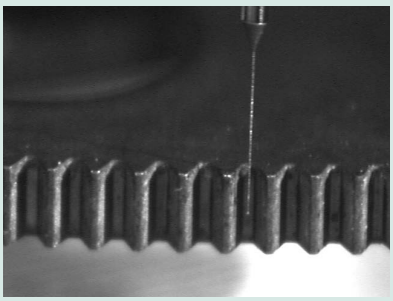
Micro probe, UMAP



Typical application

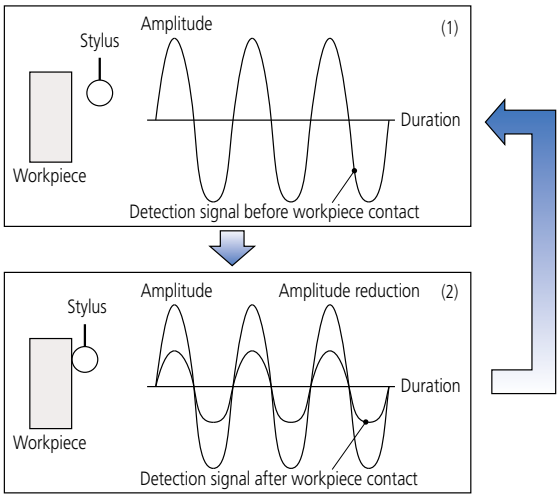


Contour measurement of a ø0.125 mm hole

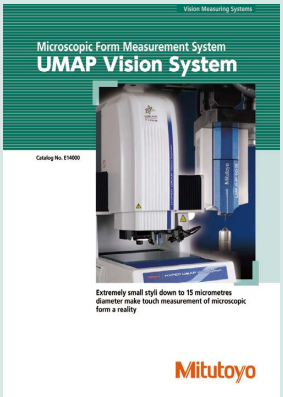


Measuring form of micro gear teeth

Detection of surface principle



(1) In this drawing, the stylus is vibrating with micro amplitude. If it does not come into contact with the workpiece the vibration state is maintained.
(2) As the stylus comes into contact with the workpiece surface the vibration amplitude decreases as the contact increases. When the decreasing amplitude falls below a certain level, a touch-trigger signal is generated.



Refer to **UMAP Vision System** Brochure (**E14000**) for more details.

SPECIFICATIONS

Model No.			TYPE2	
			Hyper UMAP 302	ULTRA UMAP 404
Measuring range (common to vision and **UMAP**)	X axis×Y axis		185×200 mm	285×400 mm
	Z axis	**UMAP 101/103**	175 mm	
		UMAP 107/110	180 mm	
		UMAP 130	185 mm	
Measuring accuracy (Vision)	E_{1X}, E_{1Y}		(0.8 + 2L/1000) µm	(0.25 + L/1000) µm
	E_{1Z}		(1.5 + 2L/1000) µm	
Repeatability	**UMAP 101/103/107**		σ=0.1 µm	σ=0.08 µm
	UMAP 110/130		σ=0.15 µm	σ=0.12 µm

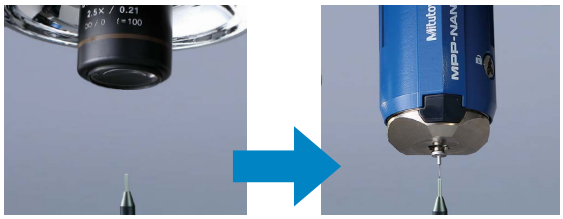
An online system to monitor the operational and mechanical statuses of measuring machines. This allows you to grasp the state of a process flow from the operational status of measuring machines within a production process.

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

An inspection certificate is supplied as standard. Refer to page U-11 for details.

Vision Measuring Machine with Micro-Form Scanning Probe MiSCAN Vision System

- Hybrid measuring machine with vision head and scanning probe (**MPP-NANO, SP25M**).
- Newly developed **MPP-NANO** probe on which styli as small as 125 µm diameter can be mounted achieves autonomous 3D scanning of fine detail. The highly proven **SP25M** scanning probe is also supported.
- Using the observation camera, the approach to the workpiece for **MPP-NANO** stylus where visual confirmation is difficult can be easily performed while also checking for dirt and scratches on the workpiece.
- Using the same vision head as the **Quick Vision** Series, the best-selling vision measuring system, high level performance can be provided in vision measurement.



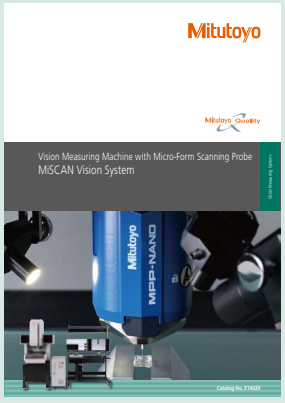
Precise positioning by monitoring the image

Measurement using **MPP-NANO** stylus

SPECIFICATIONS

Model No.			Hyper MVS 302	Hyper MVS 404	MVS Apex 404
Measuring range (X×Y×Z)	Vision measuring area		300×200×200 mm	400×400×250 mm	
	MPP-NANO / SP25M		175×200×200 mm	275×400×250 mm	
Imaging device			B&W CCD camera		
Observation unit			PT 1X-2X-6X		
Illumination unit			Co-axial light, Transmitted light, PRL (programmable ring light)		
Contact type probe			**MPP-NANO / SP25M**	**SP25M** only	
Measuring accuracy	Vision*	E_{1X}, E_{1Y}	(0.8 + 2L/1000) µm		(1.5 + 3L/1000) µm
		E_{1Z}	(1.5 + 2L/1000) µm		(1.5 + 4L/1000) µm
		E_{2XY}	(1.4 + 3L/1000) µm		(2.0 + 4L/1000) µm
	MPP-NANO	$E_{0, MPE}$	(1.9 + 4L/1000) µm	—	
	SP25M	$E_{0, MPE}$	(1.9 + 4L/1000) µm		(2.5 + 6L/1000) µm
Scanning accuracy	**MPP-NANO**		0.6 µm	—	
	SP25M	MPE_{THP}	2.5 µm		2.7 µm
Probing accuracy	**MPP-NANO**		0.6 µm	—	
	SP25M	$P_{FTU, MPE}$	1.9 µm		2.2 µm
Repeatabillity (σ)	**MPP-NANO**		0.05 µm	—	
Accuracy guaranteed temperature	Ambient temperature		18 to 23 °C		
	Temperature variation		0.5 °C / 1 H and 1 °C / 24 H		

* Image accuracy using a **QV-HR 2.5X** objective and 2X tube lens.



Refer to the **MiSCAN Vision System** Brochure (**E14024**) for more details.

Vision Measuring Systems

Vision measuring systems for multipurpose use

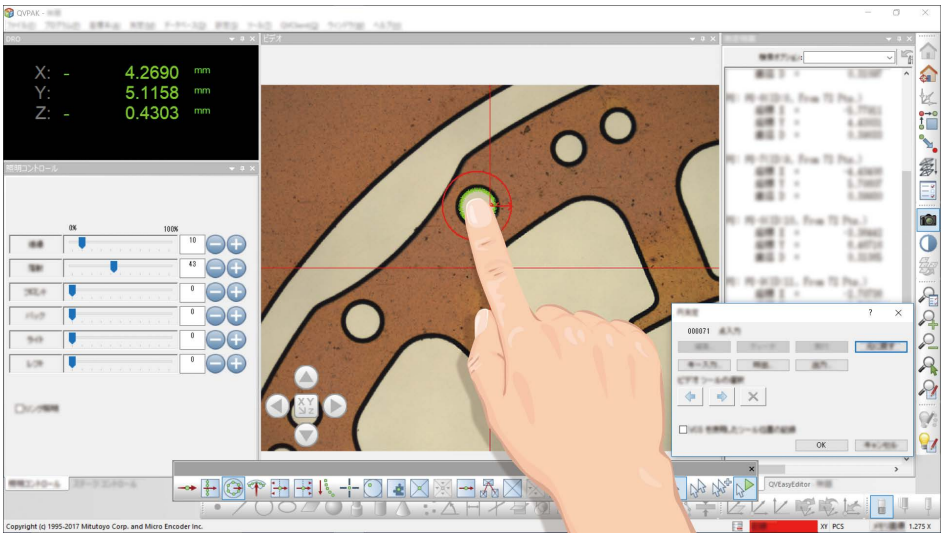
QVPAK
Data Processing Software for QUICK VISION

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

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

- The X, Y, and Z position data is detected from the measurement data gathered by the Quick Vision system and the arithmetic processing of coordinates and dimensions is performed immediately.



Gesture operation, like operating a smartphone, enables easy tool layout or stage shifting on systems with touch screens.

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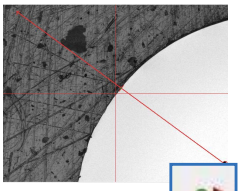
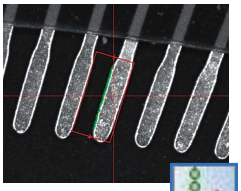
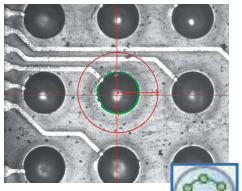
Edge Detection Tools



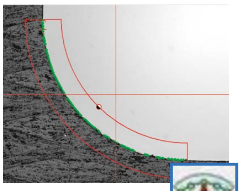
Point Tool
This is a basic tool for detecting one point.



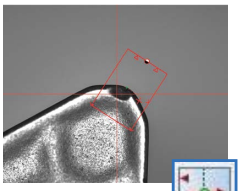
Box Tool
This tool detects linear edges with a minimum of one pixel interval. Compared to the point tool, the Box tool can perform averaging and remove abnormal points, which enables stable measurements.



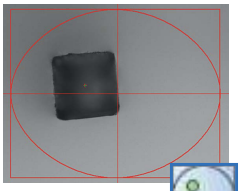
Circle Tool
This tool detects circular edges with a minimum of one pixel space. Edges can be specified easily with a single click.



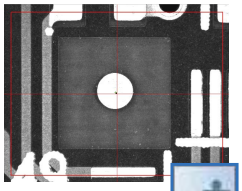
Arc Tool
This tool is suited to detection of arcs and corner radii.



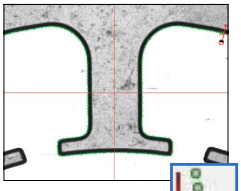
Maximum / Minimum Tool
This tool detects the maximum or minimum point within the range.



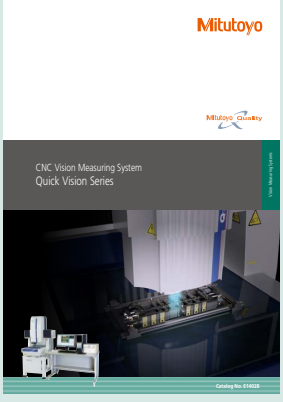
Area Centroid Tool
This tool detects the position of a form's centroid, and is suited to the positioning of different forms.



Pattern Search Tool
This tool performs pattern matching to detect a position, and is optimal for positioning alignment marks and similar tasks.



Auto Trace Tool
This is a shape-measuring tool that automatically tracks a contour with input consisting only of a start point and end point.

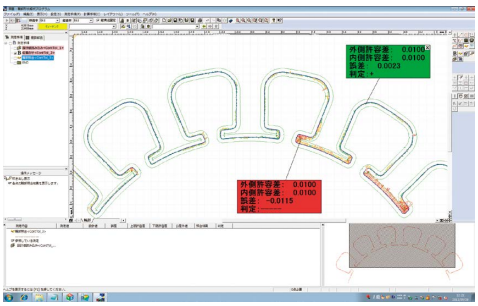


Refer to the **QUICK VISION** Series Brochure (**E14028**) for more details.

Application software (Optional)

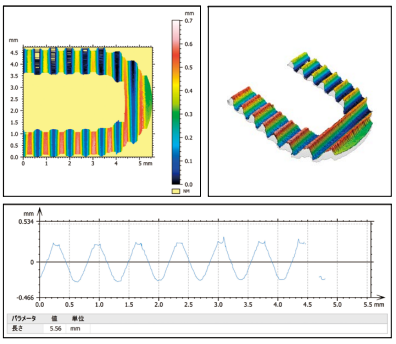
QV PartManager
The **QV PartManager** is execution program management software for multiple workpieces arranged on the measuring stage.

Form assessment / analysis software FORMTRACEPAK-AP
Verification of designed value and form analysis are performed on the basis of the contour data obtained via the **QV** auto trace tool, non-contact displacement sensor, PFF, and WLI.

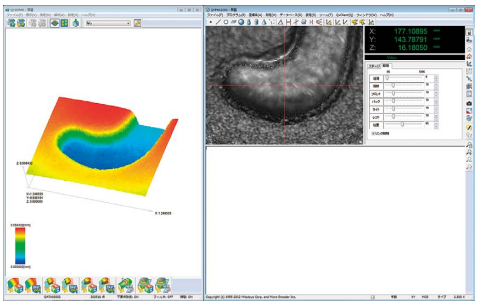


FORMTRACEPAK-PRO
This software performs 3D form analysis from the data obtained via the non-contact displacement sensor of the **QVHYBRID** Series.

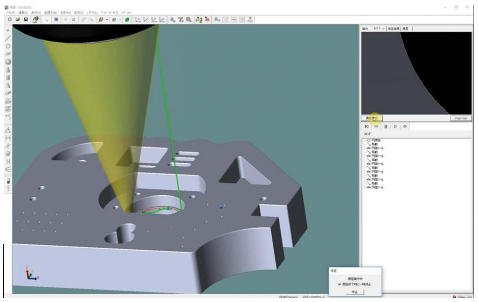
MCubeMap
Allows you to analyze parameters compliant with JIS B681-2: 2018 (ISO25178-6: 2010), such as Sa, Sq and other height parameters from the 3D data captured by **QVWLI**.



QV3DPAK
This software generates 3D forms from the PFF (Points From Focus) or WLI (White Light Interferometer) data.



Measurement support software QV3DCAD
QV3DCAD uses 3D CAD models to easily create **QVPAK** part program both online and offline.



Offline teaching software EASYPAG-PRO
This software creates **QVPAK** measurement procedure programs using 2D CAD data.

Statistical processing software MeasurLink
This software enables statistical arithmetic processing of measurement results.

External control software QVEio
Allows you to externally control or output the operating status of a **QV** connected to a PLC or PC.

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Vision Measuring Systems

Vision measuring systems for multipurpose use

QS-LZ/AFC
Manual Vision Measuring System

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- Manual vision measuring system with a high speed, high-definition auto focus 3-megapixel camera.
- A 4-quadrant high-intensity LED ring light provides excellent observation performance.
- The newly designed zoom unit and interchangeable objectives achieve a maximum magnification ratio of 14X. Viewing possibilities extend from low magnification wide view measurement to high magnification micro-measurement.

Auto focus image

QS-L3017Z/AFC

From wide view measurement to micro-measurement

Optical magnification		0.5X	0.65X	0.75X	0.85X	0.98X	1X	1.28X	1.3X	1.5X	1.7X	2X	2.25X	2.5X	3X	3.5X	3.75X	4X	5X	5.25X	7X
View field (mm)	Horizontal (H)	13.2	10.2	8.8	7.8	6.8	6.6	5.2	5.1	4.4	3.9	3.3	2.9	2.6	2.2	1.8	1.7	1.7	1.3	1.2	0.9
	Vertical (V)	9.9	7.7	6.6	5.9	5.1	5.0	3.9	3.8	3.3	2.9	2.4	2.2	2.0	1.6	1.4	1.3	1.2	1.0	1.0	0.7
Total magnification (on the monitor)		20	26	30	34	39	40	51	52	60	68	79.3	89	99.3	119	138.7	149	158.7	198.7	208	277.3
Objective lens	1X objective (optional) Working distance	74 mm																			
	1.5X objective (standard accessory) Working distance	42 mm																			
	2X objective (optional) Working distance	42 mm																			

Note: The total magnification indicates the magnification on the monitor when the size of the **QSPAK** video window is 252.7×214.9 mm (default).

SPECIFICATIONS

Model No.		QS-L2010Z/AFC	QS-L3017Z/AFC	QS-L4020Z/AFC
Drive method		Auto focus equipped, X, Y axis: manual; Z axis: motor-operated		
Measuring range (X×Y×Z)		200×100×150 mm	300×170×150 mm	400×200×150 mm
Resolution/Scale unit		0.1 µm/Linear encoder		
Measuring accuracy*1*2	X axis, Y axis	(2.2 + 0.02L/1000) µm		
	Z axis	(4.5 + 0.006L/1000) µm		
Accuracy guaranteed temperature		20±1 °C		
Observation unit*3		7X zoom (8 steps) interchangeable objective lenses (1X objective 0.5X - 3.5X; 1.5X objective 0.75X - 5.25X; 2X objective 1X - 7X)		
Image detection method		3 megapixel, CMOS color camera (1/2 in)		
Illumination	Transmitted light	White LED		
	Co-axial light	White LED		
	Ring light	4-quadrant white LED		

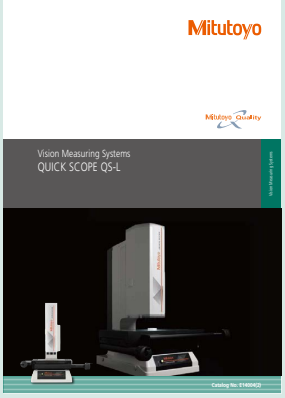
*1 Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)
*2 3X lens magnification or greater
*3 1X and 2X objective lenses are optional

MeasurLink® ENABLED Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the **QUICK SCOPE QS-L** Brochure (**E14004**) for more details.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.

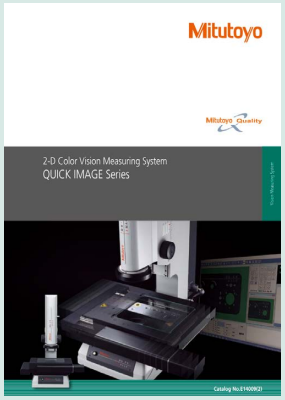
Quick Image
Non-contact 2D Vision Measuring System

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- This series of manual 2D vision measuring machines offers high-efficiency measurement by employing a telecentric optical system that has a deep focal depth and a wide view monitor.
- The stitching function enables the entire display of a large workpiece so that highly accurate and speedy measurement can be performed.
- A model equipped with a motorized stage has been added to the series to offer easy and comfortable stage operation.
- A single click enables multiple measurements in one display. A batch measurement can be applied to multiple workpieces in the display after executing a pattern search based on the workpiece position.
- This series is equipped with a 3-megapixel color camera. Even with low magnification, high repeatability can be obtained.
- The choice of five stage sizes makes it easy to choose a machine to suit the user's application.
- The video window automatically displays the measurement data, which enables quick verification.

QI-C2017D

A motorized stage



Refer to the **QUICK IMAGE** Series Brochure (**E14009**) for more details.

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SPECIFICATIONS

Model		Manual stage model					Motorized stage model		
	0.2X	QI-A1010D	QI-A2010D	QI-A2017D	QI-A3017D	QI-A4020D	QI-C2010D	QI-C2017D	QI-C3017D
	0.5X	QI-B1010D	QI-B2010D	QI-B2017D	QI-B3017D	QI-B4020D			
Measuring range (XxY)		100×100 mm	200×100 mm	200×170 mm	300×170 mm	400×200 mm	200×100 mm	200×170 mm	300×170 mm
Effective stage glass size		170×170 mm	242×140 mm	260×230 mm	360×230 mm	440×232 mm	242×140 mm	260×230 mm	360×230 mm
Maximum stage loading *		Approx. 10 kg		Approx. 20 kg		Approx. 15 kg	Approx. 10 kg	Approx. 20 kg	
Main unit mass		Approx. 65 kg	Approx. 69 kg	Approx. 150 kg	Approx. 158 kg	Approx. 164 kg	Approx. 72 kg	Approx. 153 kg	Approx. 161 kg

* Does not include extremely offset or concentrated loads

Model			QI-A / QI-C	QI-B
View field			32×24 mm	12.8×9.6 mm
Measurement mode			High resolution mode / Normal mode *4	
Travel range (Z axis)			100 mm	
Measuring accuracy	Measurement accuracy within the screen *1	High resolution mode	±2 µm	±1.5 µm
		Normal mode	±4 µm	±3 µm
	Repeatability within the screen (±2σ) *2	High resolution mode	±1 µm	±0.7 µm
		Normal mode	±2 µm	±1 µm
	Measurement accuracy (E1xy) *1		±(3.5 + 0.02L) µm L=arbitrary measuring length (mm)	
Monitor magnification *3			7.6X	18.9X
Optical system	Magnification (Telecentric Optical System)		0.2X	0.5X
	Depth of focus	High resolution mode	±0.6 mm	±0.6 mm
		Normal mode	±11 mm	±1.8 mm
	Working distance		90 mm	
Camera			3 megapixel, CMOS color camera (1/2 in)	
Illumination		Transmitted light	Green LED telecentric illumination	
		Co-axial light	White LED	
		Ring light	4-quadrant white LED	
Power supply			AC100 to 240 V 50/60 Hz	
Accuracy guaranteed temperature			20±1 °C	

*1 Inspected to Mitutoyo standards by focus point position.
*2 The measuring accuracy is guaranteed to be accurate within the depth of focus.
*3 For 1X digital zoom (when using a 22-inch-wide monitor)
*4 Patent registered (Japan)

Mitutoyo

Quick Guide to Precision Measuring Instruments

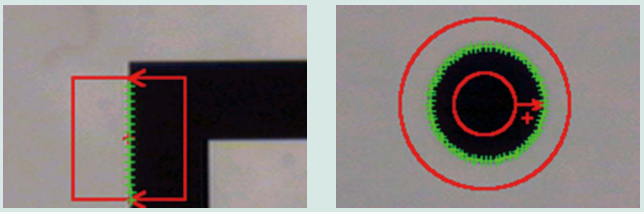
Vision Measuring Machines

Vision Measurement

Vision measuring machines mainly provide the following processing capabilities.

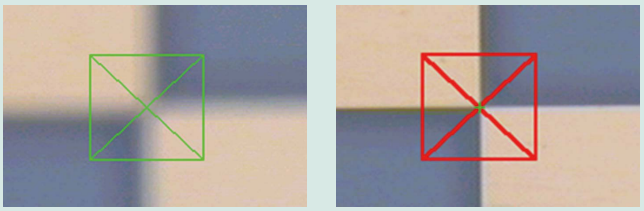
- **Edge detection**

  Detecting/measuring edges in the XY plane



- **Auto focusing**

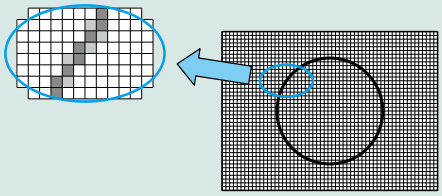
  Focusing and Z-axis measurement



- **Pattern recognition**

  Alignment, positioning, and inspecting a feature

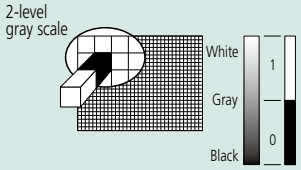
Image Storage



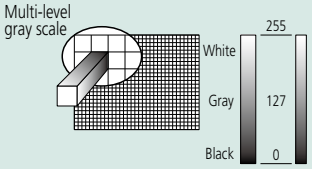
An image is comprised of a regular array of pixels. This is just like a picture on fine plotting paper with each square solid-filled differently.

Gray Scale

A PC stores an image after internally converting it to numeric values. A numeric value is assigned to each pixel of an image. Image quality varies depending on how many levels of gray scale are defined by the numeric values. The PC provides two types of gray scale: two-level and multi-level. The pixels in an image are usually displayed as 256-level gray scale.



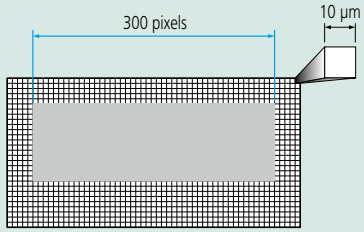
Pixels in an image brighter than a given level are displayed as white and all other pixels are displayed as black.



Each pixel is displayed as one of 256 levels between black and white. This allows high-fidelity images to be displayed.

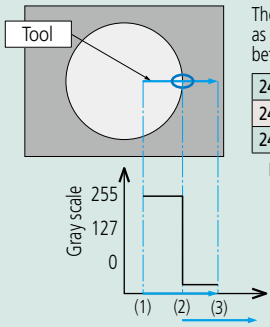
Dimensional Measurement

An image consists of pixels. If the number of pixels in a section to be measured is counted and is multiplied by the size of a pixel, then the section can be converted to a numeric value in length. For example, assume that the total number of pixels in the lateral size of a square workpiece is 300 pixels as shown in the figure below.
If a pixel size is 10 µm under imaging magnification, the total length of the workpiece is given by 10 µm ×300 pixels=3000 µm=3 mm.



Edge Detection

How to actually detect a workpiece edge in an image is described using the following monochrome picture as an example. Edge detection is performed within a given domain. A symbol which visually defines this domain is referred to as a tool. Multiple tools are provided to suit various workpiece geometries or measurement data.



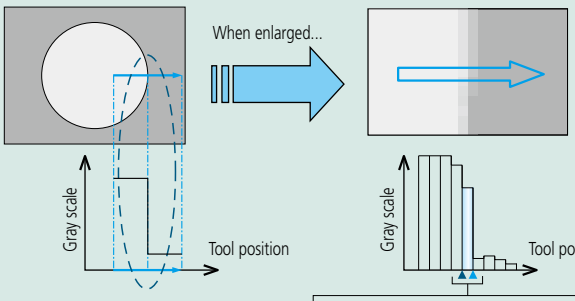
The edge detection system scans within the tool area as shown in the figure at left and detects the boundary between light and shade.

244	241	220	193	97	76	67	52	53	53
243	242	220	195	94	73	66	54	53	55
244	246	220	195	94	75	64	56	51	50

Example of numeric values assigned to pixels on the tool

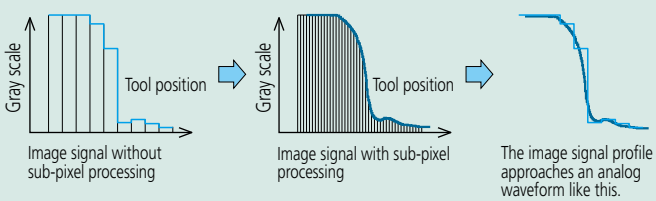
(1) Scan start position
(2) Edge detection position
(3) Scan end position

High-resolution Measurement



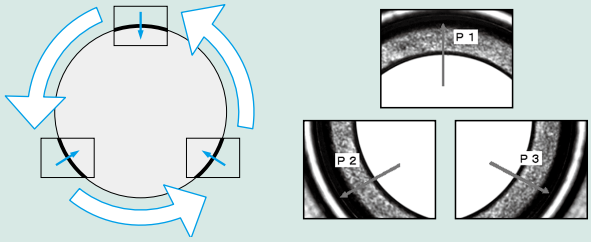
A position the system recognizes as an edge may be in error by up to one pixel width using normal image processing. This will prevent the execution of high-resolution measurement.

To increase the accuracy in edge detection, sub-pixel image processing is used. An edge is detected by determining an interpolation curve from adjacent pixel data as shown below.
As a result, it allows measurement with a resolution better than 1 pixel.



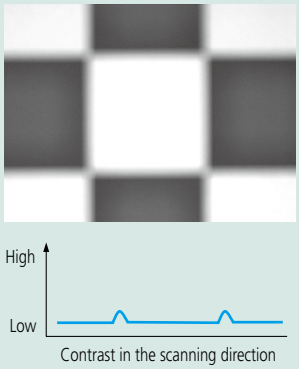
Measurement along Multiple Portions of an Image

Large features that cannot be contained on one screen have to be measured by precisely controlling the position of the sensor and stage so as to locate each reference point within individual images. By this means the system can measure even a large circle, as shown below, by detecting the edge while moving the stage across various parts of the periphery.

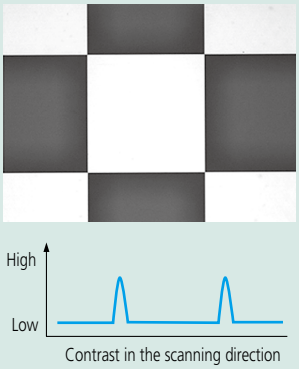


Variation in Contrast Depending on the Focus Condition

Edge contrast is low due to out-of-focus edges.

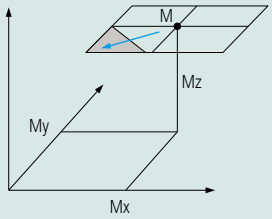


Edge contrast is high due to sharp, in-focus edges.



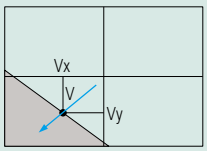
Composite Coordinates of a Point

Machine coordinate system



Measuring machine stage position
M = (Mx, My, Mz)

Vision coordinate system



Detected edge position (from the center of vision)
V = (Vx, Vy)

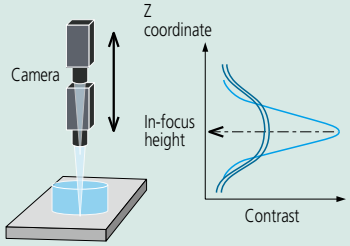
Actual coordinates are given by X=(Mx+Vx), Y=(My+Vy), and Z=Mz, respectively.

Since measurement is performed while individual measured positions are stored, the system can measure dimensions that cannot be included in one screen, without problems.

Principle of Auto Focusing

The system can perform XY-plane measurement, but cannot perform height measurement using only the camera image. The system is commonly provided with the Auto Focus (AF) mechanism for height measurement. The following explains the AF mechanism that uses a common image, although some systems may use a laser AF.

The AF system analyzes an image while moving the camera up and down in the Z axis. In the analysis of image contrast, an image in sharp focus will show a peak contrast and one out of focus will show a low contrast. Therefore, the height at which the image contrast peaks is the just-in-focus height.



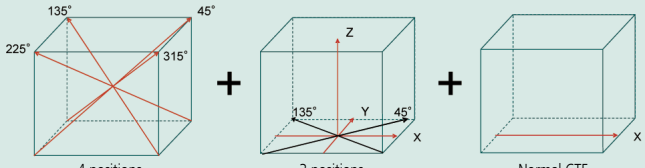
Overview of ISO 10360-7

ISO 10360-7 (Geometrical product specifications (GPS) -- Acceptance and reverification tests for coordinate measuring machines (CMM) -- Part 7: CMMs equipped with imaging probing systems) was published on June 1, 2011.
Some inspection items are listed in ISO 10360-7. The following summarizes the test method for determining length measurement error (E) and probing error (P_{F2D}).

Length measurement error, *E*

Five test lengths in seven different directions within the measuring volume, each length measured three times, for a total of 105 measurements. Four directions are the space diagonal. Remaining three directions are user specified; default locations are parallel to the VMM axes.

When CTE (coefficient of thermal expansion) of the test-length artifact is $< 2\times10^{-6}$/K, additional measurement using an artifact with a normal CTE (8 to 13×10^{-6}/K) is performed.

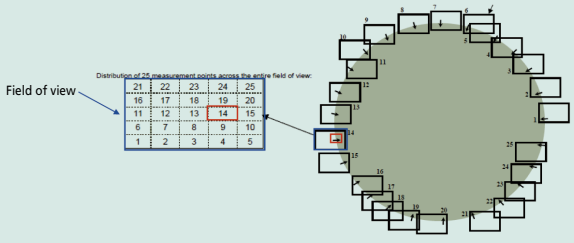


Probing error, P_{F2D}

Measure 25 points distributed evenly around the test circle (14.4° pitch).

Each of the 25 points shall be measured using the specified 25 areas of the field of view.

Calculate probing error as the range of the 25 radial distances (Rmax - Rmin) from the center of the least-square circle.



K