Vision Measuring Systems

INDEX

NEW-STYLE
Vision Measuring Systems

Quick Vision ELF

QV Apex606PRO

Quick Vision ELF

Bench-Top CNC Vision Measuring Systems

FEATURES

- **Controller-integrated compact size design**
  This series is appropriate for installation at a small site because of its light weight and space saving design.
- **Small body packed full of functions**
  This series offers various types of machines equipped with the PRL illuminator and power turret. Also, the laser auto-focus unit can be installed, as a factory option.
- The highest performance/cost ratio of the Quick Vision series

QV-ELF202PRO

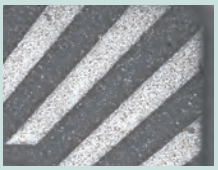
SPECIFICATIONS

Model No. and Type		QVELF202
		PRO machine
Range	X-axis	10" / 250mm
	Y-axis	8" / 200mm
	Z-axis	8" / 200mm
Resolution		0.1µm
High-sensitivity CCD camera		B&W
Accuracy* (20°C±1°C)	E_{1XY}	(2.0+3L/1000)µm
	E_{1Z}	(3.0+5L/1000)µm
Max. drive speed (X/Y/Z-axis)		200mm/s
Illumination (PRL: Programmable Ring Light)	Surface	LED, White
	Contour	LED, White
	Ring light	LED, White
Magnification change system		Programmable power turret (1X, 2X, 6X)
Stage glass size		12.24 x 10.59" / 311 x 269mm
Max workpiece load		33lbs / 15kg
Optional accessory *		laser auto-focus (factory installed option)

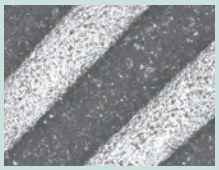
* The measuring accuracy is defined at the following conditions
Programmable power turret: 1X Objective lens: 2.5X (HR or SL) L = Dimension between two arbitrary points (mm)

Programmable Power Turret (PPT)

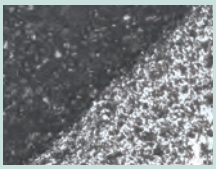
The three tube lens selection provides three magnification levels with the same objective lens. Replacement objective lenses allow a wide range of magnifications to support a variety of measurements.



1X tube lens x 2.5X objective
View field: 2.5 x 1.88 mm



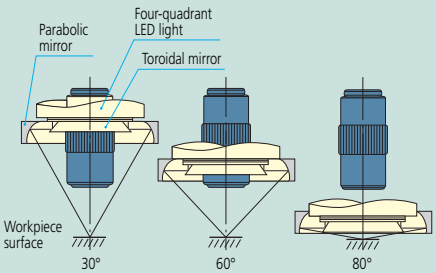
2X tube lens x 2.5X objective
View field: 1.25 x 0.94 mm



6X tube lens x 2.5X objective
View field: 0.41 x 0.31 mm

Programmable Ring Light (PRL)

Fine control of obliquity and direction provides illumination optimal for measurement. Obliquity can be arbitrarily set in the range from 30° to 80°. This type of illumination is effective for enhancing the edge of inclined surfaces or very small steps. Illumination can be controlled independently in every direction, front and back, right and left. Measurement with edge enhancement is possible by forming a shadow by lighting from only one direction.



Laser Auto Focus (LAF) Function*

Mitutoyo offers models featuring the LAF system which enables high-speed focusing. Refer to page N-7 for more details. *Available on the PRO model.(Factory installed option)

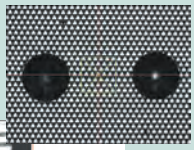
Touch System

The QV Touch system is available on all the QVE, QV Apex and QV Accel models as a factory option. All systems include probe, calibration articles and installed software.

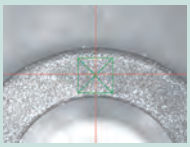
(Factory installed option)

Image Multi-AutoFocus

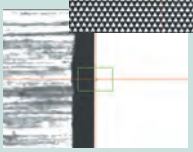
The optimal focus can be selected for each surface texture and measured feature, realizing high reproducibility and reliable edge detection.



Pattern focus



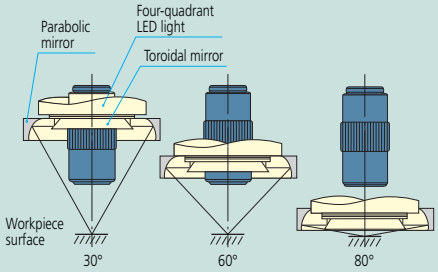
Surface focus



Edge focus

Programmable Ring Light (PRL)

Fine control of obliquity and direction provides illumination optimal for measurement. Obliquity can be arbitrarily set in the range from 30° to 80°. This type of illumination is effective for enhancing the edge of inclined surfaces or very small steps. Illumination can be controlled independently in every direction, front and back, right and left. Measurement with edge enhancement is possible by forming a shadow by lighting from only one direction.



RGB Color LED Illumination

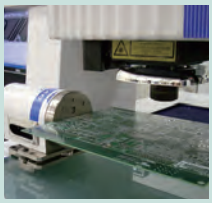
Changing the illumination color to red, green, blue, or white (synthesized) allows detection of edges which could not be measured with conventional white light.

Laser Auto Focus (LAF) Function*

Mitutoyo offers models featuring the LAF system which enables high-speed focusing.*Available on 3 models. Refer to page M-7 for more details.

Optional Index table*

Automatic multi-plane measurement is possible with the optional index table. Refer to page N-7 for more details.
*Not available with QV ACCEL models



Optional Accessories: Refer to page M-8.

QV Apex / Hyper QV

SERIES 363 — CNC Vision Measuring System

QV Apex302PRO

Hyper QV404PRO

QV Apex606PRO

SPECIFICATIONS

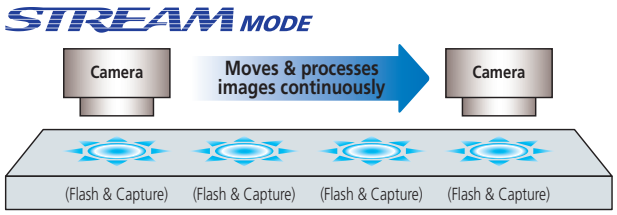
Model No.		QV Apex302PRO QV Apex302PRO3 Hyper QV302PRO	QV Apex404PRO QV Apex404PRO3 Hyper QV404PRO	QV Apex606PRO QV Apex606PRO3 Hyper QV606PRO
Range	X-axis	12" / 300mm	16" / 400mm	24" / 600mm
	Y-axis	8" / 200mm	16" / 400mm	26" / 650mm
	Z-axis	8" / 200mm	10" / 250mm	10" / 250mm
Resolution		0.1µm [0.02µm]		
High-sensitivity CCD camera		B&W (PRO3 model: color)		
Accuracy*	E_{1XY}	(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+4L/1000)µm [(1.4+3L/1000)µm]		
Illumination (PRL: Programmable Ring Light)	Surface	LED, RGB (PRO2 and PRO3 models: Halogen)		
	Contour	LED, white (PRO2 and PRO3 models: Halogen)		
	PRL	LED, RGB (PRO2 and PRO3 models: Halogen)		
Magnification change system		Programmable power turret (1X, 2X, 6X)		
Max. drive speed	X/Y-axis	300mm/s [200mm/s]	400mm/s [200mm/s]	400mm/s [200mm/s]
	Z-axis	300mm/s [200mm/s]	300mm/s [200mm/s]	300mm/s [200mm/s]
Stage glass size		15.7x10.7" / 399 x 271mm	19.4x21.7" / 493 x 551mm	27.4x29.8" / 697 x 758mm
Max workpiece height		7.8" / 200mm	9.8" / 250mm	9.8" / 250mm
Max. stage loading		44lbs [33lbs] / 20kg [15kg]	88lbs [66lbs] / 40kg [30kg]	110lbs [88lbs] / 50kg [40kg]
Dimensions (W x D x H)**		33.8 x 37.4 x 63.3" 859 x 951 x 1609mm	40.4 x 55.3 x 70" 1027 x 1407 x 1778mm	51.5 x 78.1 x 70.6" 1309 x 1985 x 1794mm
Mass**		794lbs / 360kg	1276lbs / 579kg	3196lbs / 1450kg

* The measuring accuracy is defined at the following conditions, Programmable power turret: 1X, Objective lens: 2.5X (HR or SL), L = Dimension between two arbitrary points (mm)
**Including machine stand

QV STREAM PLUS

SERIES 363 — CNC Vision Measuring System

QV STREAM PLUS 606



QV STREAM PLUS 404

SPECIFICATIONS

Model No.		QV STREAM PLUS 302	QV STREAM PLUS 404	QV STREAM PLUS 606
Range	X-axis	12″ / 300mm	16″ / 400mm	24″ / 600mm
	Y-axis	8″ / 200mm	16″ / 400mm	26″ / 650mm
	Z-axis	8″ / 200mm	10″ / 250mm	10″ / 250mm
Resolution		0.1µm		
High-sensitivity CCD camera		B&W, progressive scan CCD		
Accuracy*	E_{1XY}	(1.5+3L/1000)µm		
	E_{1Z}	(1.5+4L/1000)µm		
	E_{2XY}	(2.0+4L/1000)µm		
Max. drive speed (X/Y/Z-axis)		300mm/s	XY: 400mm/s, Z:300mm/s	XY: 400mm/s, Z:300mm/s
Max. measuring speed		40mm/s	40mm/s	40mm/s
Illumination (PRL: Programmable Ring Light)	Surface	Hi-intensity LED [stroboscopic (B) and continuous (RGB & W) illumination, switchable]		
	Contour	Hi-intensity LED [stroboscopic (B) and continuous (B) illumination, switchable]		
	PRL	Hi-intensity LED [stroboscopic (B) and continuous (RGB & W) illumination, switchable]		
Magnification change system		Programmable power turret (1X, 2X, 6X)		
Stage glass size		15.7 x 10.7″ / 399 x 271mm	19.4 x 21.7″ / 493 x 551mm	27.4 x 29.8″ / 697 x 758mm
Max. stage loading		44lbs / 20kg	88lbs / 40kg	110lbs / 50kg
Dimensions (W x D x H)**		33.8 x 37.4 x 63.3″ 859 x 951 x 1609mm	40.4 x 55.3 x 70″ 1027 x 1407 x 1778mm	51.5 x 78.15 x 70.62″ 1309 x 1985 x 1794mm
Mass**		794lbs / 360kg	1276lbs / 579kg	3196lbs / 1450kg

* The measuring accuracy is defined at the following conditions
Programmable power turret: 1X Objective lens: 2.5X (HR or SL)
L = Dimension between two arbitrary points (mm)

** Including machine stand

FEATURES

Non-stop Vision Measurement
Extreme Improvement in Throughput*

Conventional vision measuring systems endlessly repeat the cycle of stage displacement, stage stop, measurement, stage start and stage displacement again. This mode of operation is a fundamental limitation on improving measurement throughput.

In contrast, the Quick Vision Stream system uses an innovative image capture technique that avoids the need to repeatedly stop the stage so measurement can be continuous, but measuring accuracy is retained. Eliminating the time needed to accelerate, decelerate and then hold the stage motionless while a measurement is made achieves an extreme improvement in productivity.

Measurement Throughput Comparison between QV STREAM and the Conventional System

STREAM PLUS series: more than 5 times faster

* Comparison of measurement throughput using a Mitutoyo sample workpiece with that of Mitutoyo conventional systems

STREAM Mode

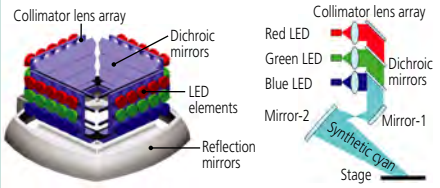
The measurement mode of a non-stop vision measuring system is referred to as the STREAM mode.

Newly Developed Stroboscopic Illumination System

The development of a high-intensity LED flash illuminator has made non-stop vision measurement possible. At the precise moment the stage reaches a measurement point the illuminator creates an extremely short, high-intensity flash that effectively freezes all motion. The illuminator turns on and off so fast that no image blur occurs and the image is captured in full and accurate detail.

This innovative design takes full advantage of high-density, high-intensity LED arrays aided by collimating lenses and dichroic mirrors to produce ultra bright, directional and efficient illumination.

High-density mounting of ultra-high intensity LED elements

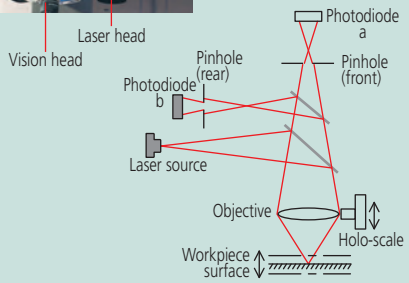


QV HYBRID TYPE1, TYPE3

SERIES 365 — CNC Vision Measuring System

FEATURES: Hybrid Type1

- The focusing point method minimizes the difference in the measuring face reflectance and realizing high measurement reporducibility.
- The double pinhole method (less directivity) is employed as the measurement principle.



Laser Beam Safety Precautions

This system uses a low-power invisible laser beam (780nm) which corresponds to a CLASS 1 (invisible radiation) of IEC60825-1 for measurement. The CLASS 1 laser warning label as shown below is attached to the main unit.

CLASS 1 LASER PRODUCT

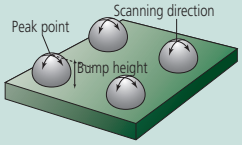
FEATURES: Hybrid Type3

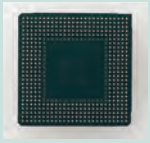
- Enables surface roughness or thickness measurement of thin and transparent objects such as film.
  Measurable thickness: 25 to 300µm
- Enables detection of high inclination angles both for mirrored surfaces and diffusing surfaces.
  Maximum tracking inclination angle ±87° (diffusing surface)
- Realizes high-resolution and high-accuracy height measurement by the wavelength confocal method using axial chromatic aberration.

*For Type3, due to the white halogen light, it is not applicable to JIS C 6802 "Radiation safety standard of laser products".

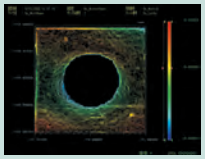
Applications

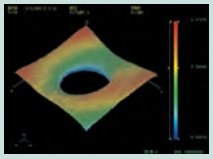
- Measurement of BGA/CSP bump height and coplanarity of IC packages



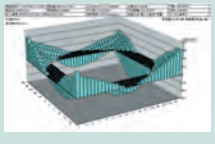


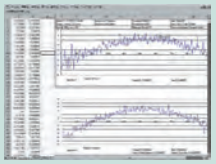
- Curved-form analysis (MSHAPE-QV)
  2D/3D contour lines display
  2D/3D unfiltered profile display
  Shadow graph display
  Curved plane analysis
  Unfiltered profile analysis, etc.





- Data processing (QV Graph)
  3D Bar chart display
  3D Surface chart display
  2D continuous cross-section graph display





Main Unit Startup System

This machine incorporates a 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 prior to relocating this machine after initial installation. Refer to page IX for details.

FEATURES

The Quick Vision Hybrid is an advanced machine which allows vision measurement with both a CCD camera and high-speed scanning by applying a vision measurement unit in parallel with a non-contact displacement sensor.

SPECIFICATION: QV Apex-based

Model No.			QVH Apex302	QVH Apex404	QVH Apex606
Range	Vision		12"x8"x8" 300 x 200 x 200mm	16"x16"x10" 400 x 400 x 250mm	24"x26"x10" 600 x 650 x 250mm
	Non-contact displacement sensor	Type1	7"x8"x8" 180 x 200 x 200mm	11"x16"x10" 280 x 400x 250mm	19"x26"x10" 480 x 650 x 250mm
		Type3	7"x8"x8" 176 x 200 x 200mm	11"x16"x10" 276 x 400 x 250mm	19"x26"x10" 476 x 650 x 250mm
Accuracy**	E_{1XY}		(1.5+3L/1000)µm		
	E_{1Z}		(1.5+4L/1000)µm / (1.5+4L/1000)µm*		
	E_{2XY}		(2.0+4L/1000)µm		

SPECIFICATION: QV STREAM PLUS-based

Model No.			QVH STREAM PLUS302	QVH STREAM PLUS404	QVH STREAM PLUS606
Range	Vision		12"x8"x8" 300 x 200 x 200mm	16"x16"x10" 400 x 400 x 250mm	24"x26"x10" 600 x 650 x 250mm
	Non-contact displacement sensor	Type1	7"x8"x8" 180 x 200 x 200mm	11"x16"x10" 280 x 400x 250mm	19"x26"x10" 480 x 650 x 250mm
		Type3	7"x8"x8" 176 x 200 x 200mm	11"x16"x10" 276 x 400 x 250mm	19"x26"x10" 476 x 650 x 250mm
Accuracy**	E_{1XY}		(1.5+3L/1000)µm		
	E_{1Z}		(1.5+4L/1000)µm / (1.5+4L/1000)µm*		
	E_{2XY}		(2.0+4L/1000)µm		

SPECIFICATION: Hyper QV-based

Model No.			Hyper QVH302	Hyper QVH404	Hyper QVH606
Range	Vision		12"x8"x8" 300 x 200 x 200mm	16"x16"x10" 400 x 400 x 250mm	24"x26"x10" 600 x 650 x 250mm
	Non contact displacement sensor	Type1	7"x8"x8" 180 x 200 x 200mm	11"x16"x10" 280 x 400x 250mm	19"x26"x10" 480 x 650 x 250mm
		Type3	7"x8"x8" 176 x 200 x 200mm	11"x16"x10" 276 x 400 x 250mm	19"x26"x10" 476 x 650 x 250mm
Accuracy**	E_{1XY}		(0.8+2L/1000)µm		
	E_{1Z}		(1.5+2L/1000)µm / (1.5+2L/1000)µm*		
	E_{2XY}		(1.4+3L/1000)µm		

SPECIFICATION: QV ACCEL-based

Model No.			QVH ACCEL808	QVH ACCEL1010	QVH ACCEL1212	QVH ACCEL1517
Range	Vision		32"x32"x6" 800 x 800 x 150mm	40"x40"x6" 1000 x 1000 x 150mm	50"x50"x4" 1250 x 1250 x 100mm	60"x70"x4" 1500 x 1750 x 100mm
	Non contact displacement sensor	Type1	27"x32"x6" 680 x 800 x 150mm	35"x40"x6" 880 x 1000 x150mm	45"x50"x4" 1130 x 1250 x 100mm	55"x70"x4" 1380 x 1750 x 100mm
Accuracy**		E_{1XY}	(1.5+3L/1000)µm		(2.2+3L/1000)µm	
		E_{1Z}	(1.5+4L/1000)µm / (1.5+4L/1000)µm*		(2.5+5L/1000)µm / (2.5+5L/1000)µm*	
		E_{2XY}	(2.5+4L/1000)µm		(3.5+4L/1000)µm	

* Using Non-contact displacement sensor
**The measuring accuracy is defined at the following conditions
Programmable power turret: 1X, Objective lens: 2.5X (HR or SL), L = Dimension between two arbitrary points (mm)

Quick Vision WLI

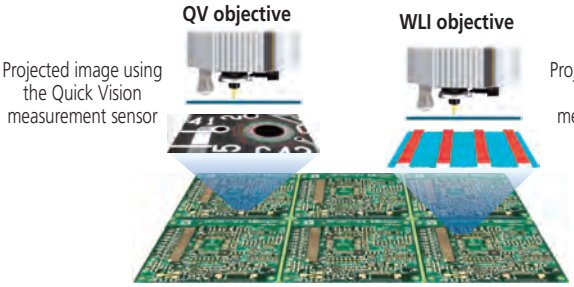
SERIES 363 — CNC Video Measuring System with White Light Inferometry

FEATURES

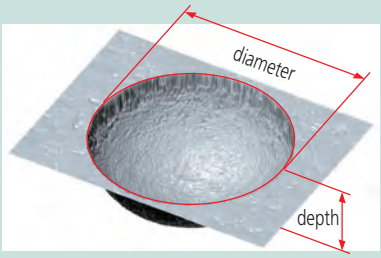
Both non-contact measurement & minute 3D evaluation in single machine. High precision hybrid measurement system with built in WLI (White Light Interferometer) head.
Large format style, evaluation series with built in vibration isolation stand.

NEW-STYLE
Vision Measuring Systems

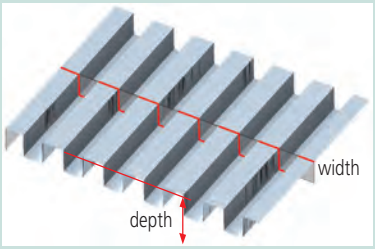
QV Hyper Apex404



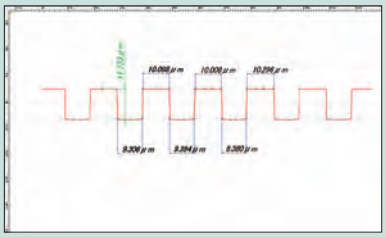
QV WLI 10x objective QV WLI 25x objective



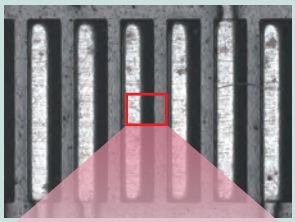
Application view of nano hole



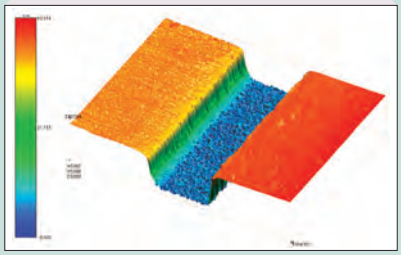
Application view of surface trace



QV - FORMPAK 2D analysis



Region of interest evaluation



3-dimensional topigraphical result, data of micro-circuit

SPECIFICATIONS

Model		Quick Vision WLI 404	Quick Vision WLI 606
Stroke	Vision Head	16 x 16 x 9.5" 400×400×240mm	24 x 26 x 9.5" 600×650×240mm
XxYxZ	WLI Head	12 x 16 x 9.5" 315×400×240mm	20 x 26 x 9.5" 515×650×240mm
WLI Head			
Tube Lens		2×	
Field of View (H×V)		10×Len: Approx .013 x .1" / 0.32×0.24mm 25×Len: Approx .005 x .004" / 0.128×0.096mm	
Repeatability		2≤0.2μm	
Z-axis measuring range		200um	
Vision Head			
Magnification change mechanism		PPT 1×-2×-6×	
CCD Camera		B&W	
Illumination Unit	Surface	Color LED	
	Contour	White LED	
	PRL	Color LED	
Measurement	E1 XY axis	(0.8+2L/1000)μm	
Accuracy	E1 Z axis	(1.5+2L/1000)μm	
	E2 XY plane	(1.4+3L/1000)μm	
Main Unit			
Minimum Reading		0.01um	
Maximum Stage Loading		55lbs / 25kg	77lbs / 35kg
Guiding method		Linear motion bearing	
Main Unit Dimension W×D×H		40 x 55 x 70" 1027×1407×1775mm	52 x 78 x 71" 1309×1985×1797mm

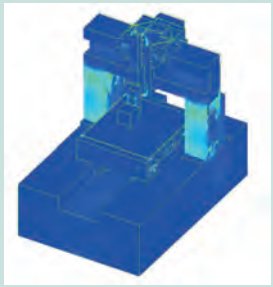
ULTRA QV

SERIES 363 — Ultra-high Accuracy CNC Vision Measuring System

Ultra-high accuracy crystallized glass scale with virtually zero thermal expansion

The Ultra Quick Vision is equipped with a crystallized glass scale having a resolution of 0.01µm and linear expansion coefficient of 0.08×10^{-6}/K. This virtually zero thermal expansion means the Ultra Quick Vision can minimize accuracy fluctuation resulting from thermal changes.

Ultra-precision manufacture eleven meters underground



By using FEM (Finite-Element Method) analysis of the base design, the placement of stiffening ribs and beams has been determined for the Ultra Quick Vision to provide optimal structural rigidity.

FEATURES

- Minimizes straightness errors through the use of a precision air-bearing linear guide system.
- Utilizes a 0.01µm resolution glass scale manufactured at an ultra-precision facility located eleven meters underground.
- Minimizes accuracy fluctuation against thermal change through the use of virtually zero thermal expansion glass scales.
- Optimizes the mechanical structure of the main unit in Finite Element Method analysis.
- Stabilizes the geometrical accuracy (i.e. straightness of each axis and perpendicularity) to lessen thermal effects.

ULTRA QV404 PRO

SPECIFICATIONS

Model No.		ULTRA QV404 PRO
Range	X-axis	16″ / 400mm
	Y-axis	16″ / 400mm
	Z-axis	8″ / 200mm
Resolution		0.01µm
High-sensitivity CCD camera		B&W
Accuracy* (20°C±0.2°C)	E_{1XY}	(0.25+L/1000)µm
	E_{1Z}	(1.5+2L/1000)µm [(1+2L/1000)µm: 10 - 60mm]
	E_{2XY}	(0.5+2L/1000)µm
Max. drive speed (X/Y/Z-axis)		150mm/sec
Illumination (PRL: Programmable Ring Light)	Surface	Halogen
	Contour	Halogen
	PRL	Halogen
Magnification change system		Programmable power turret (1X, 2X, 6X)
Stage glass size		19.4 x 21.7″ / 493 x 551mm
Max. stage loading		88lbs / 40kg
Dimensions (W x D x H)**		47.2 x 68.3 x 75.2″ /1200 x 1735 x 1910mm
Mass**		4464lbs / 2025kg

* The measuring accuracy is defined at the following conditions
Programmable power turret: 1X, Objective lens: 5X
L = Dimension between two arbitrary points (mm)
** Including machine stand

QV ACCEL

SERIES 363 — CNC Vision Measuring System

FEATURES

Moving-bridge type structure

Designed with primary focus on measurement efficiency, the machine adopts a more rigid construction and drives the X and Y axes at 400mm/s (QV ACCEL808, ACCEL1010), which is approximately 30% faster than that of standard QV Apex models. The moving-bridge type structure also eliminates the need for a moving stage. This facilitates a more simplified design of the workpiece fixture, resulting in a significant reduction in the man-hours required for fixture fabrication and inspection.

QV ACCEL808PRO

QV ACCEL1212PRO

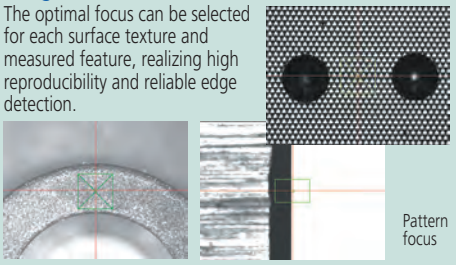
SPECIFICATIONS

Model No.		QV ACCEL808PRO QV ACCEL808PRO3	QV ACCEL1010PRO QV ACCEL1010PRO3	QV ACCEL1212PRO QV ACCEL1212PRO3	QV ACCEL1517PRO QV ACCEL1517PRO3
Range	X-axis	32″ / 800mm	40″ / 1000mm	50″ / 1250mm	60″ / 1500mm
	Y-axis	32″ / 800mm	40″ / 1000mm	50″ / 1250mm	70″ / 1750mm
	Z-axis	6″ / 150mm	6″ / 150mm	4″ / 100mm	4″ / 100mm
Resolution		0.1µm			
High-sensitivity CCD camera		B&W (PRO3 model: color)			
Accuracy*	E_{1XY}	(1.5+3L/1000)µm		(2.2+3L/1000)µm	
	E_{1Z}	(1.5+4L/1000)µm		(2.5+5L/1000)µm	
	E_{2XY}	(2.5+4L/1000)µm		(3.5+4L/1000)µm	
Max. drive speed	X/Y-axis	400mm/s		300mm/s	
	Z-axis	150mm/s		150mm/s	
Illumination (PRL: Programmable Ring Light)	Surface	LED, RGB (PRO3 models: Halogen)			
	Contour	LED, white (PRO3 models: Halogen)			
	PRL	LED, RGB (PRO3 models: Halogen)			
Magnification change system		Programmable power turret (1X, 2x, 6x)			
Stage glass size		34.8″ x 37.7″ 883 x 958mm	46.7″ x 46.7″ 1186 x 1186mm	56.7″ x 56.7″ 1440 x 1440mm	67.5″ x 77.5″ 1714 x 1968mm
Dimensions (W x D x H)		58 x 67.5 x 62″ 1475x1716x1578mm	75.3 x 82 x 63″ 1912x2086x1603mm	85.3 x 92 x 61″ 2166x2340 x1554mm	96 x 113 x 61″ 2440 x 2868 x 1554mm
Max stage loading		22lbs / 10kg	66.1lbs / 30kg	66.1lbs / 30kg	66.1lbs / 30kg
Mass		5666lbs / 2570kg	6504lbs / 2950kg	7937lbs / 3600kg	9921lbs / 4500kg

* The measuring accuracy is defined at the following conditions, Programmable power turret: 1X, Objective lens: 2.5X (HR or SL), L = Dimension between two arbitrary points (mm)

Image Multi-AutoFocus

The optimal focus can be selected for each surface texture and measured feature, realizing high reproducibility and reliable edge detection.



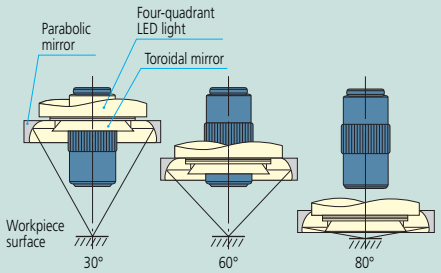
Surface focus

Edge focus

Pattern focus

Programmable Ring Light (PRL)

Fine control of obliquity and direction provides illumination optimal for measurement. Obliquity can be arbitrarily set in the range from 30° to 80°. This type of illumination is effective for enhancing the edge of inclined surfaces or very small steps. Illumination can be controlled independently in every direction, back and forth, right and left. Measurement with edge enhancement is possible by forming a shadow by lighting from only one direction.



RGB Color LED Illumination

Changing the illumination color to red, green, blue, or white (synthesized) allows detection of edges which could not be measured with conventional white light.

Laser Auto Focus (LAF) Function*

Mitutoyo offers models featuring the LAF system which enables high-speed focusing.

*Also available to PRO 3 model. (Factory option)

(Factory installed option)

Touch System

The QV Touch system is available on the QV Accel models as a factory option. All systems include probe, calibration articles and installed software.

Accessories for Quick Vision

Objective †

Objective	Order No.	Working distance
QV-SL0.5X	**02AKT199**	30.5mm
QV-HR1X	**02AKT250**	40.6mm
QV-SL1X	**02ALA150**	52.5mm
QV-HR2.5X	**02AKT300**	40.6mm
QV-SL2.5X	**02ALA170**	60mm
QV-5X	**02ALA420**	33.5mm
QV-10XHR	**02AKT650**	20mm
QV-25X	**02ALG020**	13mm

The monitor magnification and field of view values are for the PRO machine.
QV-10X, QV-25X: Depending on a workpiece of illumination may be insufficient at a turret lens magnification of 2X and 6X.
QV-25X: The PRL illumination is restricted in its usable position.

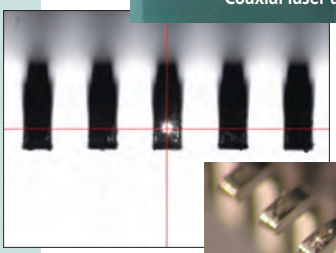
Objective mag.	Turret lens mag.	Monitor mag.	View Field
0.5X	1X	16X	12.54 x 9.40
	2X	32X	6.27 x 4.70
	6X	96X	2.09 x 1.56
1X	1X	32X	6.27 x 4.70
	2X	64X	3.13 x 2.35
	6X	192X	1.04 x 0.78
2.5X	1X	80X	2.50 x 1.88
	2X	160X	1.25 x 0.94
	6X	480X	0.41 x 0.31
5X	1X	160X	1.25 x 0.94
	2X	320X	0.62 x 0.47
	6X	960X	0.20 x 0.15
10X	1X	320X	0.62 x 0.47
	2X	640X	0.31 x 0.23
	6X	1920X	0.10 x 0.07
25X	1X	800X	0.25 x 0.18
	2X	1600X	0.12 x 0.09
	6X	4800X	0.04 x 0.03

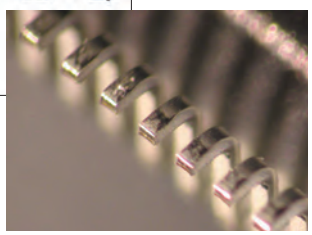
Calibration glass chart No. 02AKN020 †

A calibration chart is used to compensate for the pixel size of the CCD chip, autofocus accuracy and the optical axis offset at each magnification of the variable magnification unit (PPT).

Compensation chart No. 02AKU400*

A compensation chart is used to decrease optical distortion and errors caused by difference of the pattern & texture on the workpiece surface.



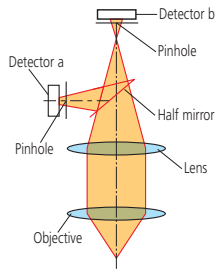


Example: Height of leads from a QFP package

Laser Auto Focus* (Factory-installed option)

The system can be equipped with a Laser Auto Focus unit that allows a stable, high-speed height measurement during high-speed travel. This unit provides stable measurement results with minimum dependence on surface inclination since the double pinhole method is adopted in the detection system.

Objective	QV2.5X HR
Measurement principle	Double pinhole method
Laser spot diameter	3μm
Repeatability	σ = 0.4μm



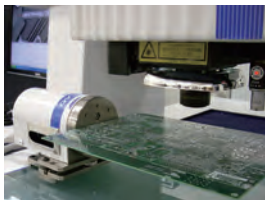
Safety Precautions against Laser Beam

This system uses a low-power visible laser beam which corresponds to a CLASS 1 (visible light) of IEC 60825 for measurement. The CLASS 1 laser warning label as shown right is attached to the main unit.

CLASS 1 LASER PRODUCT

QV-Index Head*

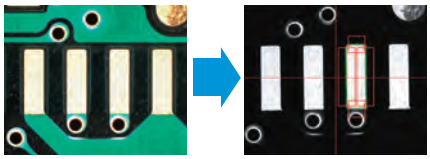
Automatic multi-plane measurement is possible with the optional index table.



Max. workpiece diameter	5.51" / 140mm
Max. workpiece mass	4.41 lbs / 2kg
Min. rotation angle	0.1°
Positioning accuracy	±0.5°
Max. rotation speed	10rpm

RGB color filtering unit* (PRO 3 only)

The color filtering function can be added to the vertical reflected illumination or programmable ring light in Quick Vision models that use a halogen light source. This function enhances the visibility of low-reflection surfaces on colored workpieces, facilitating edge detection. This function can also be retrofitted to a conventional Quick Vision. In addition, a yellow filter enables vision measurement in the yellow light region, which provides high sensitivity.



Red filter used

* Accessories for Quick Vision Series only

† Accessories for Quick Vision and Quick Scope Series

Quick Scope

SERIES 359 — CNC / Manual Vision Measuring System

QS250Z

SPECIFICATIONS

Model No.		QS250Z
Range	X-axis	8" / 200mm
	Y-axis	10" / 250mm
	Z-axis	4" / 100mm
Resolution		0.5µm
Scale type		Linear encoder
Measuring accuracy (at 20°C)*		XY: (2.5+6L/1000)µm, Z: (5+6L/1000)µm
Magnification	Objective	0.5X - 3.5X zoom
	On monitor	21X - 147X
Image detecting unit		Color CCD camera
Illumination		Surface: co-axial light, fiber-optic ring light Contour: stage light
Stage glass size		10.6 x 12.2" / 269 x 311mm
Max. workpiece height		4.3" / 110mm
Max. stage loading		22lbs / 10kg
Dimensions (W x D x H), Mass		18.3 x 32 x 26" / 465 x 815 x 663mm, 167lbs / 76kg

*When using 2.5X objective or the zoom lens in 2.5X magnification (Magnification on monitor: 105X), L = Measuring length (mm)

FEATURES: CNC model

- Surface, contour and fiber-optic ring light illumination options enables users to configure the QS lighting to meet a variety of measurement needs.
- Powerful, Windows® based QSPAK software is easy to use and offers a wide spectrum of measuring and analysis capabilities.
- Functions include zoom, auto-focus, measurement playback, one-click edge detection, graphic display, 48 different macros and a pattern matching function for several common part features.
- The stage can be controlled by mouse or through the optional multi-function control box.

FEATURES: Manual model

- Excellent surface observation model for a wide variety of workpieces.
- 0.1µm resolution and 150mm Z-axis range.
- Power zoom enables easy and fast magnification change.
- Fine illumination capability enables lighting changes to match workpiece requirements.
- The quick release system on the stage enables instant switching between coarse movement and fine movement.
- Quick Navigation function enables the user to repeat measurements quickly.

QS-L2010ZB

SPECIFICATIONS

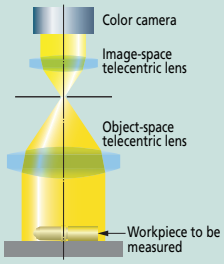
Model No.	QS-L2010ZB	QS-L3017ZB	QS-L4020ZB
Range (X-axis / Y-axis / Z-axis)	8" x 4" x 6" / 200 x 100 x 150mm	12" x 6.7" x 6" / 300 x 170 x 150mm	15.7" x 8" X 6" / 400 x 200 x 150mm
Resolution	0.1µm		
Scale type	Linear encoder		
Measuring accuracy (at 20°C and 3.0x magnification)*	"XY: (2.5+20L/1000)µm Z: (5+40L/1000)µm"		
Image detecting unit	1/2" 3 MP Color CMOS camera		
Illumination (Halogen)	Surface: co-axial light, fiber-optic ring light Contour, stage light		
Stage glass size	250 x 150 mm	370 x 240 mm	440 x 240 mm
Max. workpiece height	6" / 150mm		
Max. stage loading	22 lbs / 10 kg	44 lbs / 20 kg	33 lbs / 15 kg
Dimensions (W x D x H)	25" x 30" x 28" / 624 x 769 x 722 mm	27" x 33" x 36" / 682 x 837 x 916 mm	30" x 33" x 37" / 757 x 837 x 930 mm
Mass (Main Unit)	158.7 lbs / 72 kg	308.6 lbs /140 kg	321.9 lbs / 146 kg

Zoom Lens Magnifications

QSL Magnification	Zoom Mag.	0.75x	0.98x	1.28x	1.5x	2.25x	3x	3.75x	5.25x
	On monitor	30x	39x	51	60x	89	119	149	208x
	FOV (mm)	8.8 x 6.6	6.8 x 5.1	5.2x3.9	4.4x3.3	2.9x2.2	2.2x1.6	1.7x1.3	1.2x0.9
QS 250 Magnification	Zoom Mag.	.5x	.05x	.85x	1.0x	1.5x	2.0x	2.5x	3.5x
	On monitor	20x	25x	34x	39x	59x	78x	98x	137x
	FOV (mm)	8.8 x 6.6	6.8 x 5.1	5.2x3.9	4.4x3.3	2.9x2.2	2.2x1.6	1.7x1.3	1.2x0.9

Double-telecentric optics enable highly efficient measurement with a wide field of view

Batch measurement with a wide view field 1.259″ x 0.945″ (32 x 24mm) realized using a 0.2X magnification model can substantially improve measurement efficiency.
With a 0.5X magnification model, dimensions of very small workpieces and stepped workpieces can be easily measured.



Actual image acquired with a 0.2X magnification model

Actual image acquired with a 0.5X magnification model

Quick Image

SERIES 361 — Non-contact 2-D Vision Measuring System

Quick Image is a new concept in 2-D vision measuring instruments. It provides unique features for improving measurement efficiency.

FEATURES

- Long focal depth and wide field of view
- Telecentric optical system
- Mega-pixel color CCD camera
- Large quadrant LED ring light

QI-A2010B

QI-B4020B

SPECIFICATIONS

Model		QI-A1010B	QI-B1010B	QI-A2010B	QI-B2010B	QI-A2017B	QI-B2017B	QI-A3017B	QI-B3017B	QI-A4020B	QI-B4020B
Range	X, Y-axis	4 x 4″ / 100 x 100mm		8 x 4″ / 200 x 100mm		8 x 7″ / 200 x 170mm		12 x 7″ / 300 x 170mm		16 x 8″ / 400 x 200mm	
	Z-axis	4″ / 100mm		4″ / 100mm		4″ / 100mm		4″ / 100mm		4″ / 100mm	
Measuring mode		High-resolution mode and Normal mode									
Accuracy	Within the screen	QI-A models: ±5µm (high-resolution mode), ±8µm (normal mode) [QI-B models: ±2.7µm (high-resolution mode), ±4µm (normal mode)]									
	U_{1XY}	±(5+0.08L)µm L = measuring length (mm)									
Repeatability within the screen (±2σ)		QI-A models: ±1µm (high-resolution mode), ±2µm (normal mode) [QI-B models: ±0.7µm (high-resolution mode), ±1µm (normal mode)]									
CCD camera		Megapixels color CCD camera									
Optical system	Magnification*	0.2X	0.5X	0.2X	0.5X	0.2X	0.5X	0.2X	0.5X	0.2X	0.5X
	Working distance	90mm									
	Depth of focus	High-resolution mode: ±0.6mm, Normal mode: ±11mm (±1.8mm) ( ): QI-B models									
Illumination	Contour	✔		✔		✔		✔		✔	
	Surface	✔		✔		✔		✔		✔	
	4-quadrant LED	✔		✔		✔		✔		✔	
Stage glass size		170 x 170mm		242 x 140mm		260 x 230mm		360 x 230mm		440 x 232mm	
Max. stage loading		10kg		10kg		20kg		20kg		15kg	
Mass		70kg		74kg		140kg		148kg		154kg	

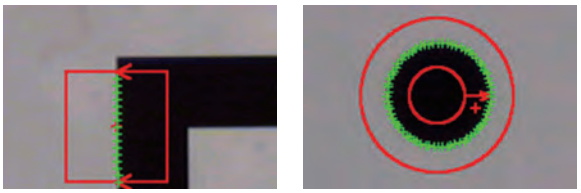
*Double telecentric system

Vision Measurement

Vision measuring machines mainly provide the following processing capabilities.

Edge detection

Detecting/measuring edges in the XY plane



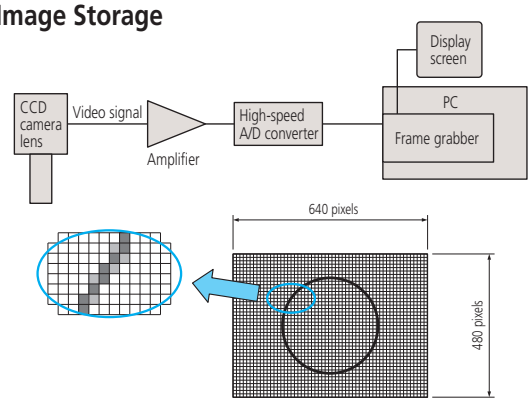
Auto focusing

Focusing and Z measurement

Pattern recognition

Alignment, positioning, and checking the presence of a feature

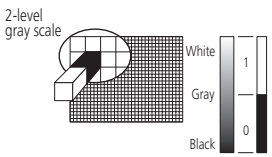
Image Storage



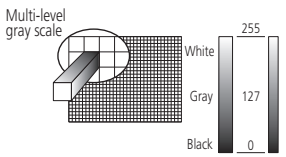
An image is comprised of a regular array of pixels, similar to the process that produces a printed image picture on fine plotting paper with each square solid-filled.

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 the 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.

Difference in Image Quality

Difference between 2-level and 256-level gray-scale images

Sample image displayed in 2-level gray scale

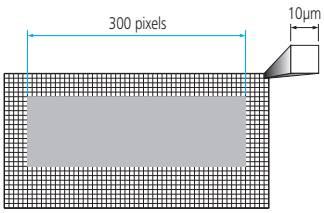
Sample image displayed in 256-level gray scale

Variation in Image Depending on Threshold Level

These three pictures are the same image displayed as 2-level gray scale at different slice levels (threshold levels). In a 2-level gray-scale image, different images are provided as shown above due to a difference in slice level. Therefore, the 2-level gray scale is not used for high-precision vision measurement since numeric values will change depending on the threshold level that is set.

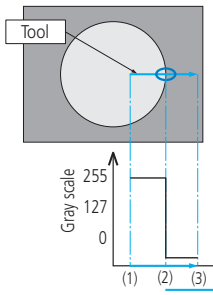
Dimensional Measurement

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 10µm under a specific imaging magnification, the total length of the workpiece is given by 10µm x 300 pixels = 3000µm = 3mm.



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.



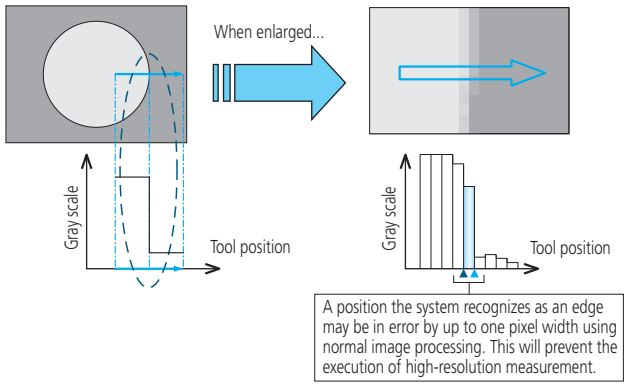
The edge detection system scans within the tool area as shown in the figure at left and detects the boundary between light and shade.

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

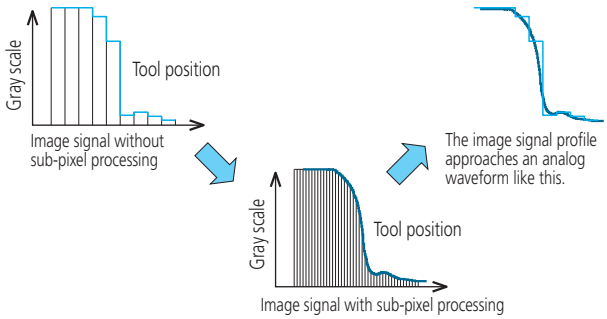
Example of numeric values assigned to pixels on the tool

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

High-resolution Measurement

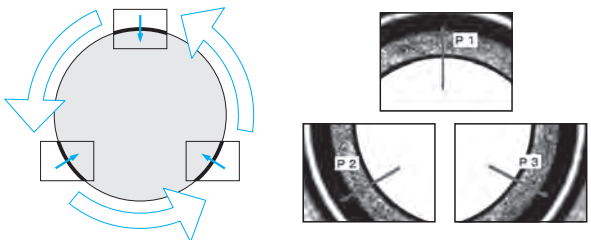


To increase the accuracy in edge detection, sub-pixel image processing is used.
An edge is detected by determining an interpolation curve from adjacent pixel data as shown below.
As a result, it allows measurement with a resolution higher than 1 pixel.

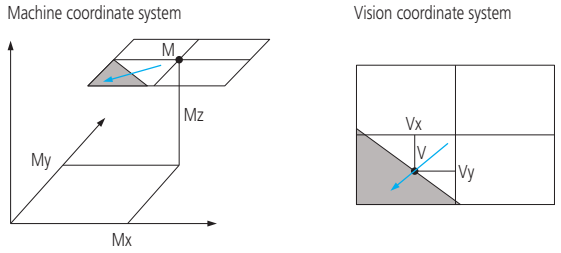


Measurement along Multiple Portions of an Image

Large features that cannot be contained on one screen have to be measured by precisely controlling the position of the CCD 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.



Composite Coordinates of a Point



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

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

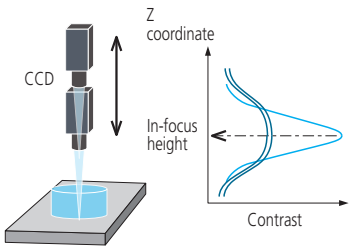
Actual coordinates are given by X = (Mx + Vx), Y = (My + Vy), and Z = Mz, respectively.

Since measurement is performed while individual measured positions are stored, the system can measure dimensions that cannot be included in one screen.

Principle of Auto Focusing

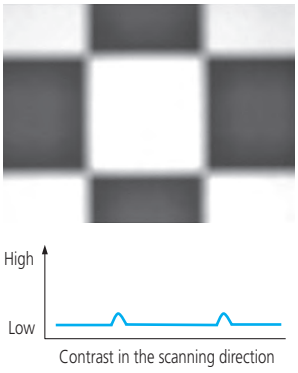
The system can perform XY-plane measurement, but cannot perform height measurement using only the CCD camera image. The system is commonly provided with the Auto Focus (AF) mechanism for height measurement. The following explains the AF mechanism that uses a common image, although some systems may use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

The AF system analyzes an image while moving the CCD 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.



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.