KEYENCE

NEW **High-speed Microscope**
VW-9000 Series

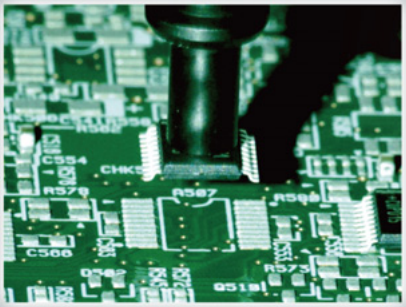
High Speed Imaging for Slow Motion Analysis

Introducing the VW-9000 Series High-speed Microscope

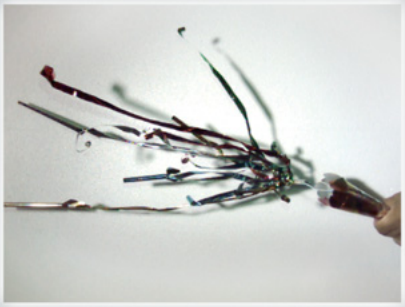
Falling light bulb

Falling mobile phone

Soap bubble



Chip mounting machine



Party cracker

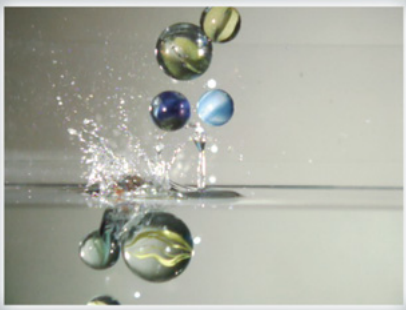
Spray atomization

Fully-Integrated High Speed Imaging Solution

Splash crown of milk

Handy terminal drop test

Laser marker inscription



Marbles falling into water

Wine droplets in a glass

Drinking glass impact test

Easy setup + a ready to use all-in-one system

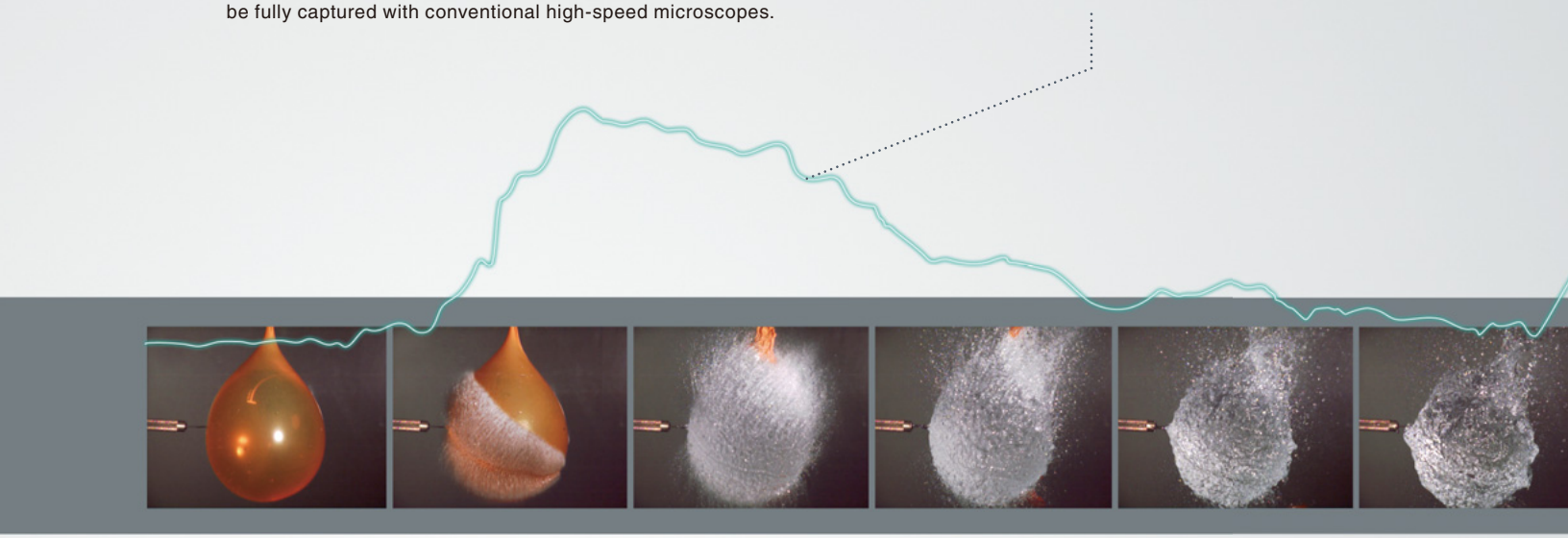
16 times the recording performance of conventional high-speed microscopes

It's now possible to record high-speed video at 4,000 fps at VGA resolution and up to 230,000 fps. The VW-9000 Series can accurately record objects moving at high-speeds, which could not be fully captured with conventional high-speed microscopes.

NEW

Automatically recognizes motion

The VW-9000 Series is able to recognize the amount of change in motion for each frame. By graphing the amount of change in motion automatically, the time used to set and edit cumbersome high-speed recordings is greatly reduced.



NEW

High-speed Microscope
VW-9000E

Microscope Functionality

Dual-use system for high-speed and microscope applications

Incorporates many of the capabilities of the VHX-1000 Digital Microscope

Deep depth of field ▶ P16

Advanced functions ▶ P17

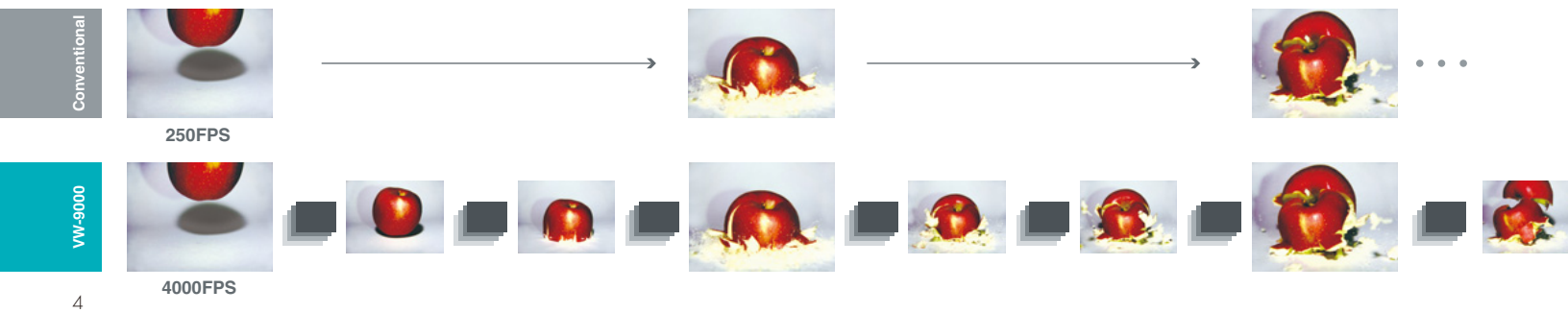
Records motion that previously could not be seen

Achieves 16 times the recording performance of conventional high-speed microscopes

We re-examined the camera element from scratch and developed a CMOS sensor that is best suited for magnified observation and recording high-speed video. Capable of providing 16 times the recording performance and more than 4 times the camera sensitivity compared to conventional models, the VW-9000 can record at up to 4,000 fps without dropping resolution (640 x 480).

Performance comparison **Using VGA (640 x 480) recording**

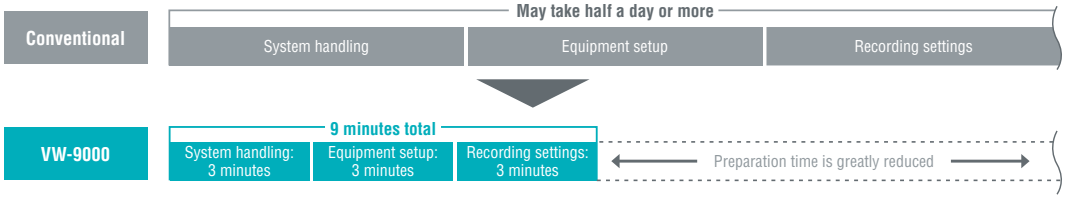
Previous high-speed microscopes could only record at a maximum of 250 fps at a resolution of 640 x 480. The VW-9000 Series can record video using the same resolution, but at 16 times the speed (4,000 fps).



Set up and record in minutes

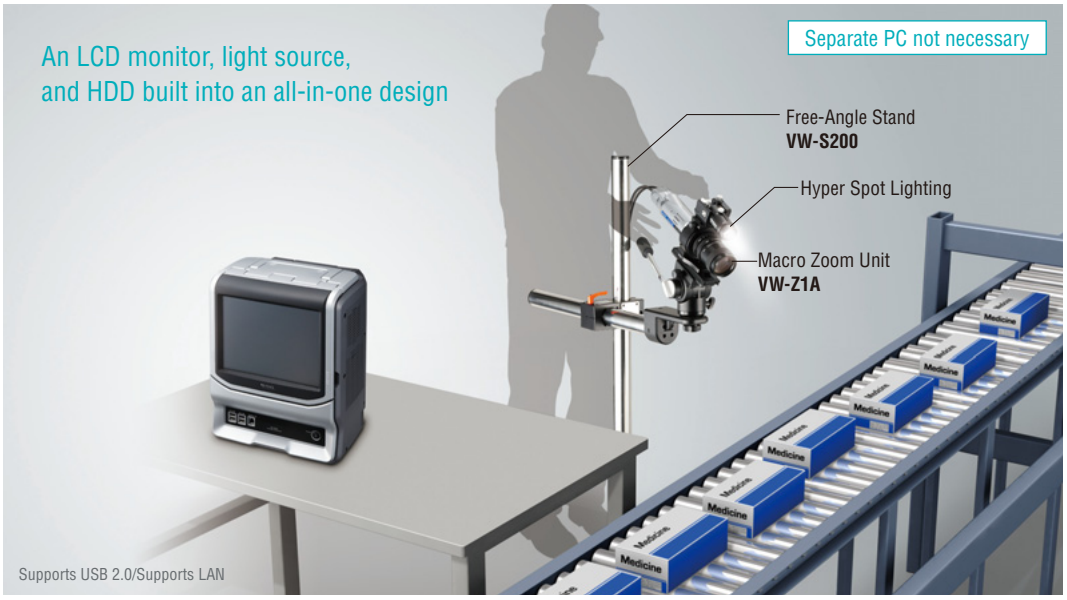
Minimize installation space and required equipment

TRADITIONALLY...



Dramatically reduce the amount of time it takes to setup equipment

THE VW-9000 SERIES OFFERS...



The VW-9000 Series features built-in lighting and an LCD monitor - both items that are separate in conventional products. The system has been reduced to the bare essentials, eliminating the need to make large investments in equipment. With the VW-9000's space-saving design, you'll be surprised at just how easy it is to achieve high-speed recording even in on-site applications and laboratories where space is limited.

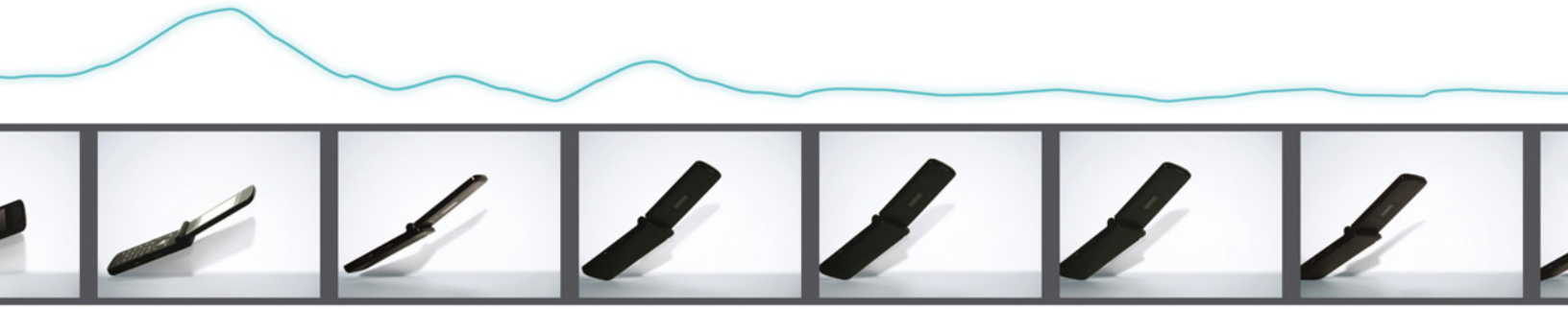
Automatically Determine Changes in Motion

The VW-9000 greatly shortens the amount of time spent on setting and saving recordings by being able to recognize changes in motion automatically.

Motion Graph function NEW

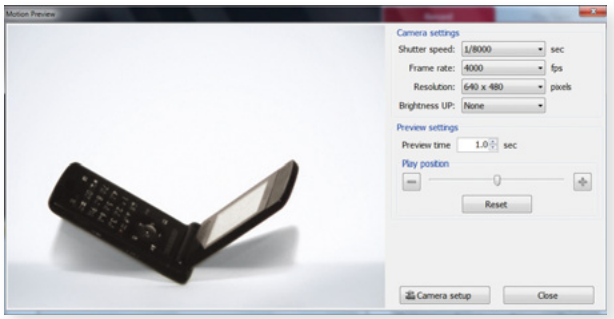
A detailed graph allows users to visually track and quantify the amount of movement (amount of change) of a target.

Automatically adjusts shutter speed. Users can also easily perform field of view and focus adjustments.

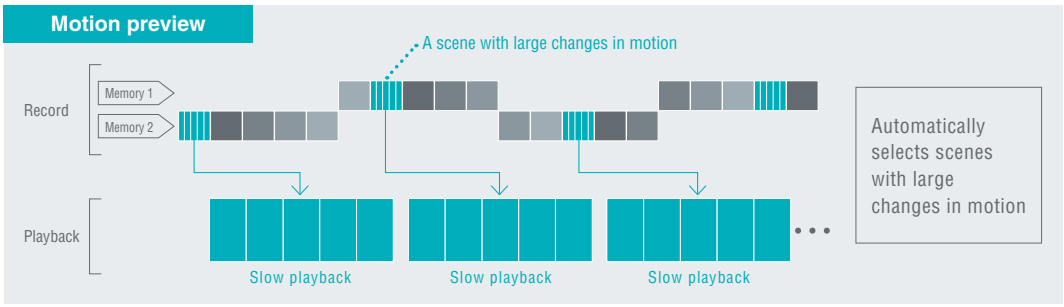


Motion Preview function

Capture and preview a video using the double memory feature, while only displaying scenes that show large changes in motion.



Shutter speed and frame rate can be adjusted while previewing the video.



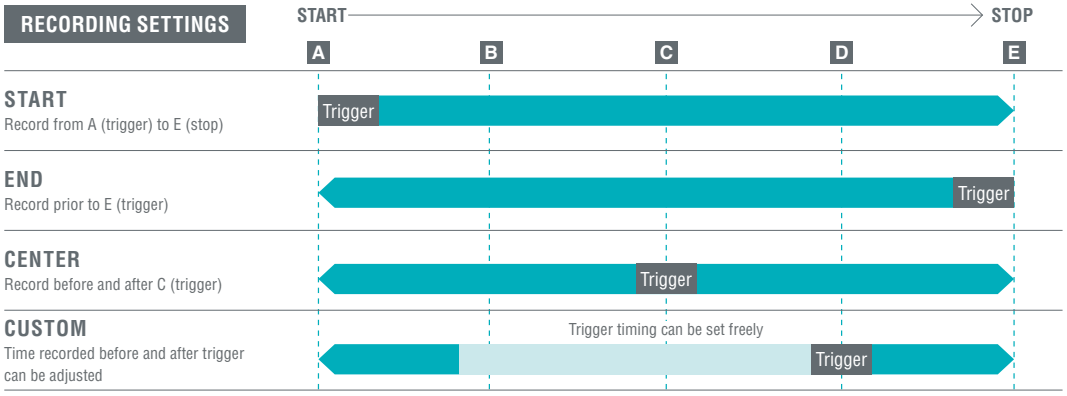
Scene Marking function

By analyzing the motion graph, this function recognizes changes in behavior and automatically leaves a marker associated with each time interval. Scene markers can also be added manually as needed. These markers allow users to display only the scenes that they want to view and skip other parts of the video.

Functions to Simplify the Recording Process

Diverse lineup of trigger settings

Triggers dictate how information will be recorded once an event of interest has been observed. The VW-9000 supports both internal and external triggers to provide the most user-friendly methods of recording video.



*The duration of the recording will differ depending on the frame rate. (Approx. 22 seconds when at 1,000 fps)

TRIGGER INPUT METHODS

Sensor/Mic trigger NEW

Trigger video capture using an analog voltage from devices such as displacement gauges or microphones (commercially available)

Image trigger

Triggers based on a change in brightness in a specified area of the screen

External trigger

Capable of setting off a trigger with a detection signal from devices such as photoelectric or image sensors

High-Speed Long-Term Recording function

Record video for up to 13 hours at a maximum speed of 1,800 fps. Because it's also possible to set end triggers, you can stop recording after an error has occurred and check behavior retroactively.

Saved directly to the internal hard drive

Internal data logger

Syncs video with data

The controller has a built-in single channel data logger. Videos and analog waveforms from vibration gauges, displacement gauges, and other devices can be displayed in sync.

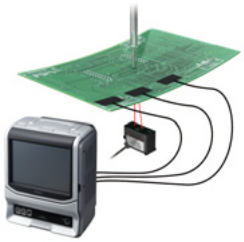
Use an input terminal for external device signals

Voltage | Current | Temperature | Vibration | Impact | Strain | Voice | Pressure

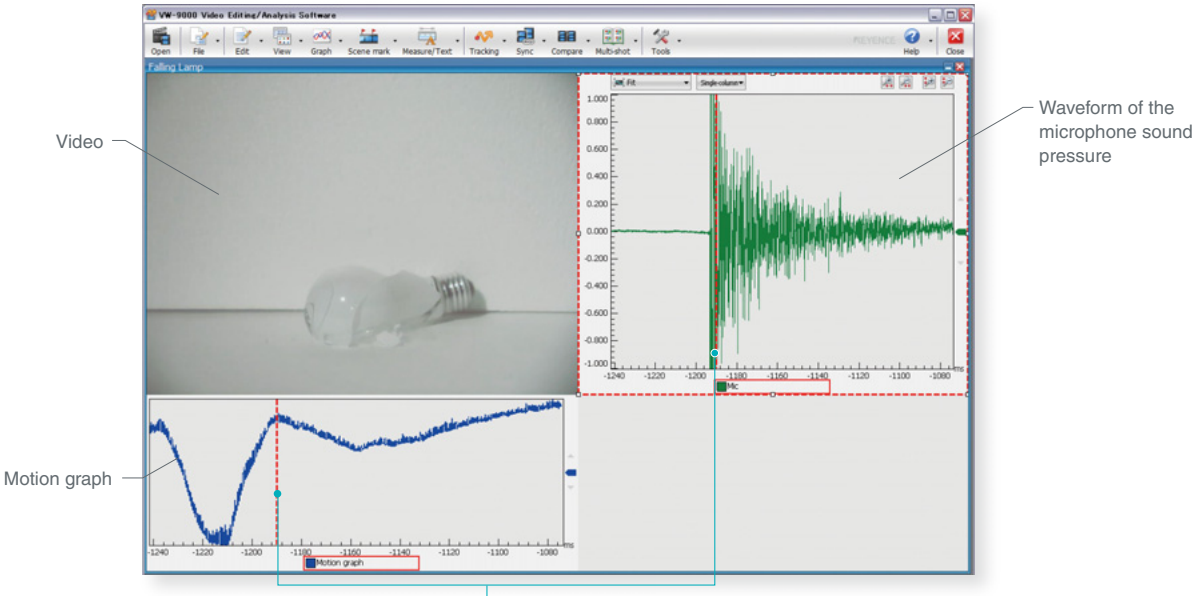
HDD drop test

Measuring wire bonding strain

Measuring printed circuit board strength



Example of data collection on shattering light bulb (movement and microphone sound pressure data)



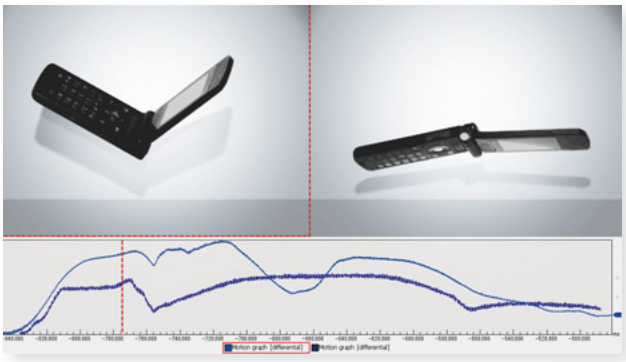
The VW-9000 can record high-speed video and any associated data.

- Correlate data from multiple devices to better understand the cause of a particular event
- Quantify motion (velocity, acceleration, etc)
- Accepts trigger inputs from external sensors

Other Advanced Functions

Video comparison (Automatic Synchronized Playback function)

Analyze and compare motion-graph waveforms in real-time. This function automatically adjusts the start position of a video, even when videos are of different recording lengths, and eliminates the need to adjust playback or recording time manually.



Evaluate and save comparison data

Error Monitoring function NEW

Automatically analyzes a repetitive process and captures video only when an error has occurred. Since the system discards information that is not relevant to the defect, only a limited amount of memory is needed when capturing video.

Normal behavior | Normal behavior | Abnormal behavior

Monitors a process and automatically records a video once a change or defect has been detected.

Conventional

A sensor is used to indicate when an error has occurred, but no video has been recorded

A user must monitor a process for long periods of time to try to detect a defect

Impossible to continuously record a process due to memory limitations

Solution

Record and analyze video of only the defective process:

- Detect the error AND why it happened
- Eliminate wasted operator time
- Requires only a limited amount of memory

Easy System Operation

Console

Easily perform on-site operations without having to use a mouse.

Easy-to-use Video Software

[Video editing]

Edit recorded videos directly on the controller or on a PC. The data management software also allows users to easily modify on-screen measurements and images captured using the Multi-Frame Overlay function.

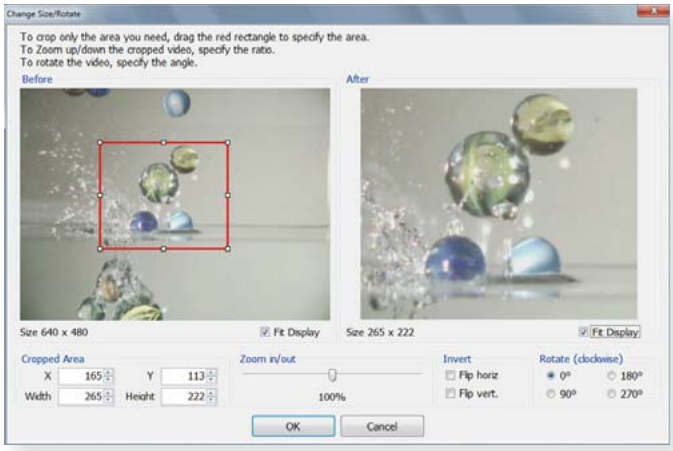


Image Resizing
Reduce the size of recorded footage.

Image Trimming and Rotation
Resize videos to a specific display resolution and rotate as needed.

Still Image Extraction/ Sequential Saving
Save a desired event as a sequence of still images.

Image Touch Up
Adjust the white balance, edge enhancement, and other settings.

Comment Input
Insert comments into recorded videos.

Dimension Measurement
Provides the same dimension measurement functions as the controller.

Multi-Frame Overlay
Combine several frames of a video into a single image.

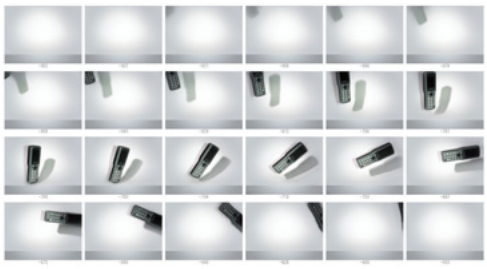
Frame-by-Frame Capture
Capable of saving continuous frame by frame images as a list

Multi-Frame Overlay function NEW

Handy terminal drop test

Multi-Frame Overlay

Combine multiple frames from a recorded video into a single image.

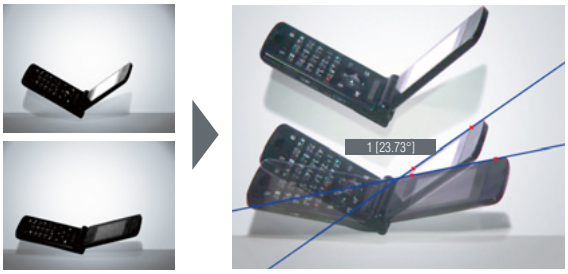


Frame-by-Frame Capture function

Create and save recorded video as a list of frame by frame images.

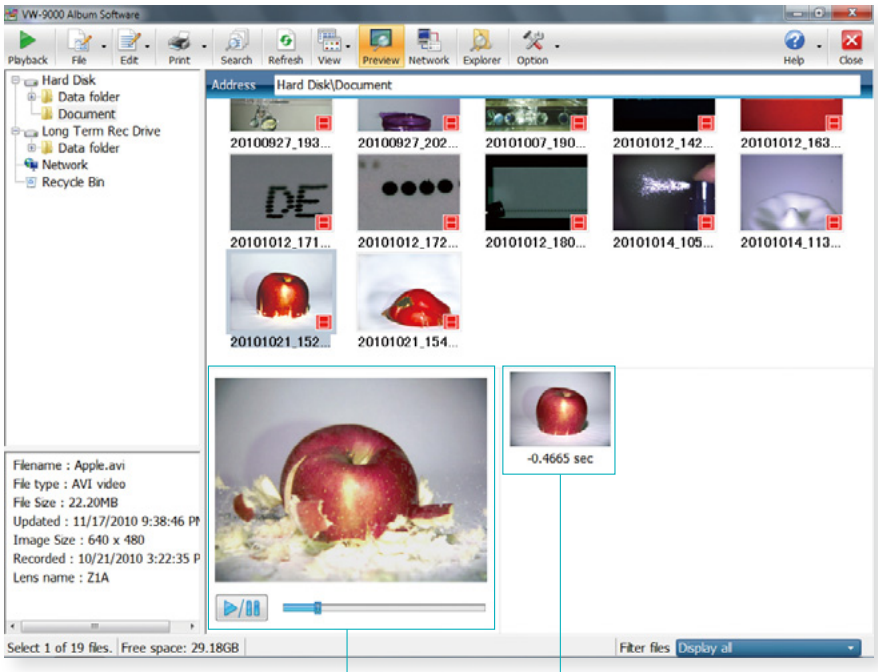
Multi-Frame Overlay Measurement function NEW

Measure the distance and angle of moving targets that have been captured using the Multi-Frame Overlay function.



[Data management]

Using a built-in 500 GB hard drive, the VW-9000 is capable of saving both image and video files. While conventional systems have difficulty searching through video files due to their large size, our unique file management software lets you quickly record and view video footage.



Easy preview

Preview saved videos on the thumbnail screen without having to take the time to open them.

Scene preview

Displays scenes within the video that contain large changes in motion or that were tagged with Scene Markers, allowing you to check areas of interest without playing back an entire video.

Communication software

Connect the VW-9000 to a separate PC via LAN. Limited operation and control of the system is available through the Album screen.

VW-9000 Series

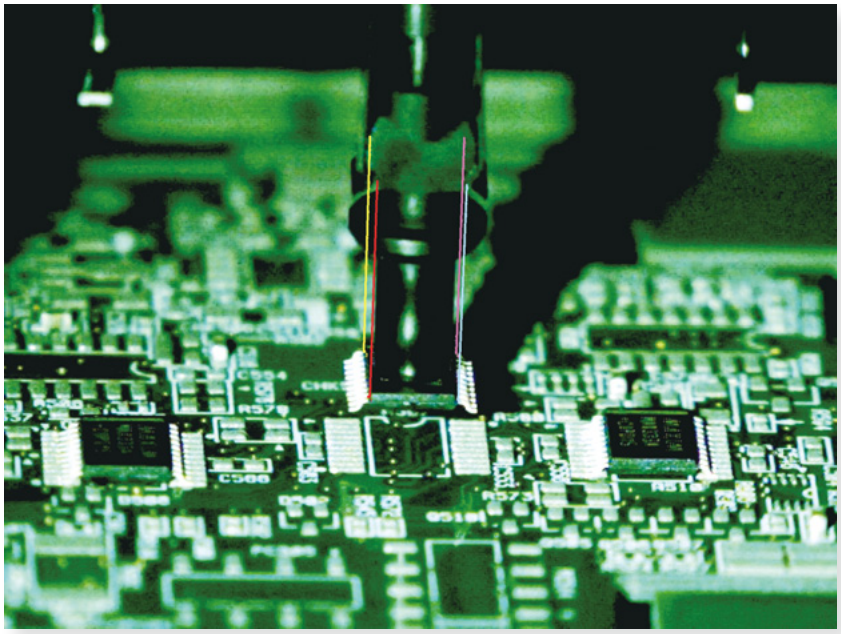
PC

Advanced Analysis Capabilities

An enhanced quantitative analysis tool

In addition to high-speed recording, the VW-9000 Series also has software available to perform analysis on the videos. It can remember specified points (areas) in the video and track them to see how much change has occurred between each frame. Other functions include velocity, acceleration, distance (displacement), angle and blur width calculations.

Trail Display Tool



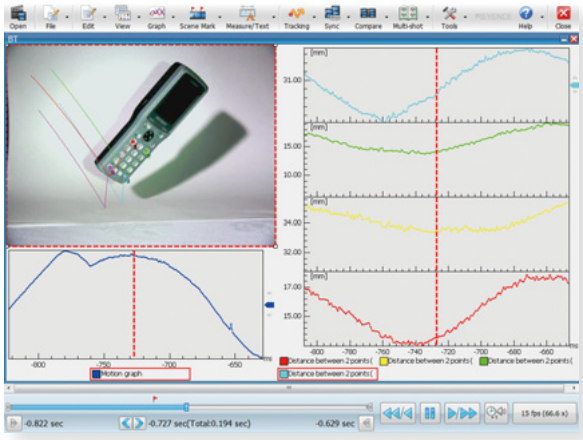
Chip mounting machine

Improved tracking accuracy

The VW-9000 is capable of tracking objects in a recorded video based on the principle of pattern matching. After analyzing user-specified areas on the screen before and after each frame, coordinate points for the targeted areas are saved to memory. From these coordinates and their time information, velocity and distance (displacement) can be analyzed.
By improving the accuracy of the software, analysis of the changes can be tracked in real-time. Even previously difficult-to-track movements, such as those of a revolving object, can be easily tracked.

Graphing and Quantifying Images

After tracking an object, the results are displayed as a graph. The VW-9000 allows you to perform quantitative evaluation of the amount of movement, frequency, and changes in movement.



Falling behavior of a handy terminal

In addition to viewing images that have been recorded at high-speeds, analyzing the behavior in the images leads to the identification of causal relationships.
By quantifying changes in an image, verifiable steps can be taken to create and evaluate solutions.

Analysis items

X coordinate | Y coordinate | Speed | Acceleration | Distance | Displacement | Angle acceleration | Angle speed

Position measurement

	Graphable data
Individual Point Measures specified target coordinates	Horizontal positions on the screen
	Vertical positions on the screen
	Distance from the start frame position
	Moving speed
	Moving acceleration

Distance measurement

	Graphable data
Two Points Specifies two target points and measures the distance between the two points	Horizontal distance of two points
	Vertical distance of two points
	Straight-line distance of two points
	Speed of change in distance
	Acceleration of change in distance
Vertical Line Sets a reference line that connects two points and measures the vertical distance between the reference line and measurement point	Vertical distance between the reference line and measurement point
	Speed of change in distance
	Acceleration of change in distance

Angle measurement

	Graphable data
Between Two Lines Specifies two straight lines that connect two points, and measures the angle at the intersection of the two straight lines	Angle
	Speed of change in angle
	Acceleration of change in angle
Angle Between Three Points Measures an angle constructed from three points	Angle
	Speed of change in angle
	Acceleration of change in angle

Advanced magnified observation

Hybrid microscope system combines high-speed camera with digital microscope capabilities

Large depth of field for vivid and sharp 3D observation

Quick and natural observation

The VW-9000 Series provides a depth of field at least 20 times larger than optical microscopes. Because of this, the VW-9000 Series can accurately observe the surface topography of a target with large peaks and valleys; imaging that is typically impossible for conventional optical microscopes to achieve. Furthermore, the number of steps required for observation and focus adjustment can be reduced considerably.

Probe tip (100x)

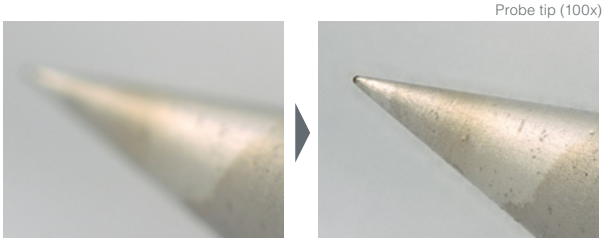


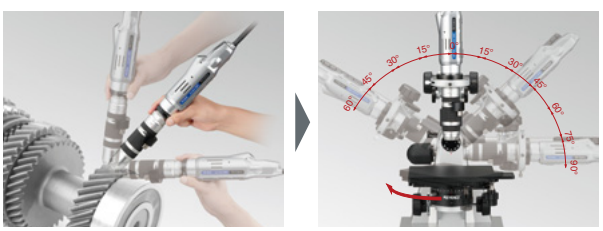
Image captured with an optical microscope

Image captured with a digital microscope

Observation at all angles

The Free-angle observation system eliminates blind spots on the target by simplifying multi-angle viewing

The VW-9000 system provides both easy handheld operation and simplified stand-mounted observation. Considerably reduce the time it takes to capture images of a target at a wide variety of angles and positions by using the Free-angle observation system. Using these two methods of observation, you will never again miss a detail in your observation.



Handheld observation

Free-angle observation system

HDR High Dynamic Range

High Dynamic Range function

Visualize low-contrast and reflective targets with ease

CONVENTIONAL 8-bit...

HDR 16-bit...

Capable of HDR at 2.7 megapixels

High performance graphics engine with 16-bit color resolution

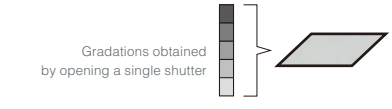
The advanced high performance graphics engine allows you to capture images in 16-bit gradation through RGB data from each pixel, instead of conventional 8-bit data. This enables target profiles to be accurate in a way that is not possible with conventional systems. Furthermore, the obtained images are stored as 16-bit data, allowing you to more acutely observe images as needed.

HIGH DYNAMIC RANGE

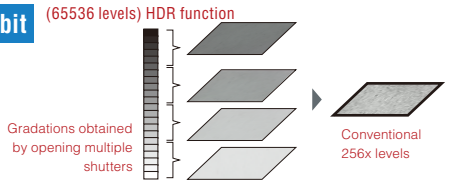
HDR function

The camera captures multiple color images of varying brightness by automatically adjusting the shutter speed, and then produces an image with a high level of gradation data. Since the range of obtainable brightness levels has been widened, accurate representations of targets with glare, as well as detailed images of areas with low color gradation can be rendered.

8 bit (256 levels of gray) Conventional method



16 bit (65536 levels) HDR function



PROBLEMS

- The range of obtainable brightness is narrow, resulting in the glaring of areas beyond the range.
- Subtle contrast cannot be rendered because of coarse resolutions.

SOLUTIONS

- The range of obtainable brightness is wide, diminishing the perceived glare.
- Subtle contrast can be rendered because of detailed gradation.

Can Easily be Used by Anyone

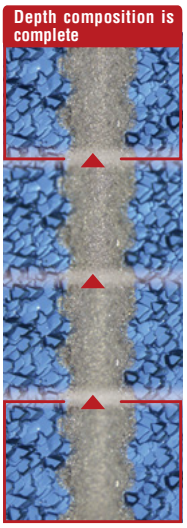
Auto Focus & Jog Focus

Capable of automatic focus adjustment (auto focus) when using the motorized Free-Angle Stand (VHX-S50).
A separate dial (Jog Focus) also provides the ability to perform fine focus adjustments.

Quick 3D Display function

Combined with the Z-axis motorized stage, automatic depth composition and 3D display are possible with just the push of a button on the console. In addition to shortening observation time, this also eliminates human error in 3D image construction.

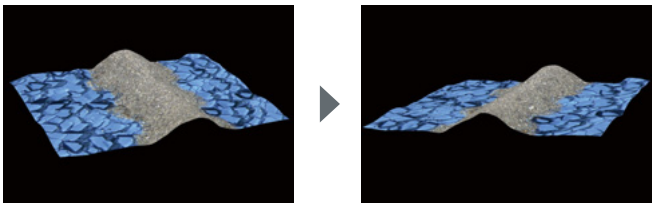
Step1 Adjust the lens to the lowest focal position and press console DEPTH UP/3D



Solder paste (300x)

Step2 Wait until the target is fully-focused and press console DEPTH UP/3D

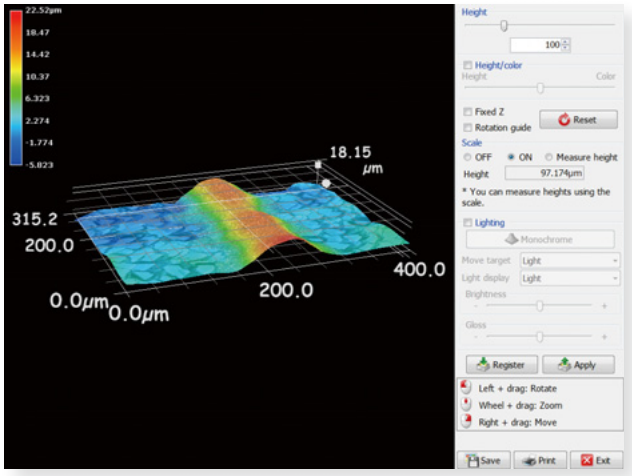
Depth composition will be completed for the specified range and then instantly displayed in 3D.


Converted directly into a 3D image

Manipulate the 3D image with the mouse

3D Height Measurement function

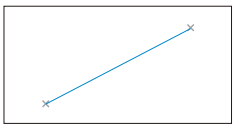
Provides a scale and height/color map on 3D images. The color scale allows users to easily visualize different heights on a surface with varying topography.



Real-time Measurement

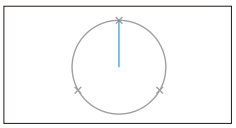
Several measurement tools are available to provide quantitative data on any two-dimensional image taken with the VW High-speed Microscope. Measurements can be easily performed by just clicking on the desired points on an image or by having the system automatically extract the areas of interest.

DISTANCE



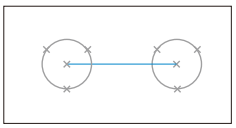
The distance between two points on the screen can be measured by specifying the points with the cursor.

RADIUS



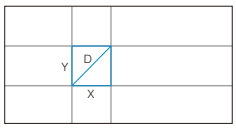
The radius of the circle can be measured by specifying three points on the circle.

CENTER DISTANCE



Specify three points on the circumference of two separate circles to find the coordinate of the center of the circle. The distance between the centers of two cirlces can be measured by specifying two circles sequentially.

X-Y DISTANCE



The longitudinal (X-direction), transversal (Y-direction), and diagonal (D-direction) distances of a rectangle formed by four coordinate axes (two in the X-direction and two in the Y-direction) can be measured at one time.

AREA/COUNT/AUTO MEASUREMENT

The target of the measurement can be extracted automatically by differentiating the brightness and colors in the image. The area and the perimeter length are measured. The number of extracted areas can be counted automatically as well.

LENGTH OF PERPENDICULAR LINE

The shortest distance (perpendicular line) between a line specified by two points and another arbitrary point can be measured.

DISTANCE BETWEEN PARALLEL LINES

The shortest distance between two parallel lines can be measured by specifying two points that draw a line and another line parallel to the first line.

ANGLE

The angle determined by three selected points on the screen can be measured.

OVERLAY SCALES

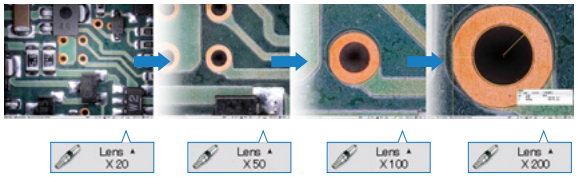
A bar, mesh, cross and other various shapes can be displayed as a scale. These can be conveniently used as the reference scale for simplified measurement or for printing the images.

Automatic Lens/Zoom Recognition function

Recognizes the current lens and magnification being used. This eliminates the need for calibration when changing magnification.

New system having both lens and zoom recognition [Double Recognize]

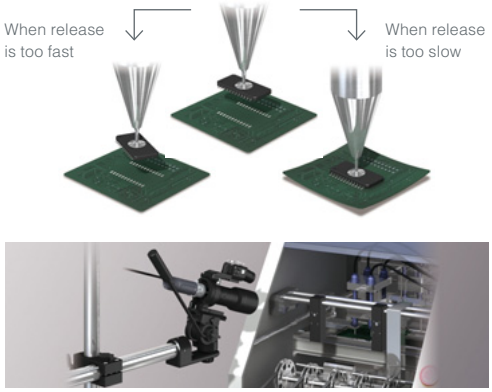
DOUBLE'R



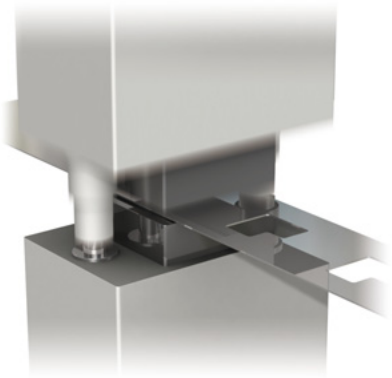
AN INTRODUCTION TO APPLICATIONS

HIGH-SPEED RECORDING

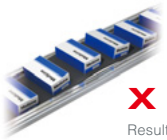
ANALYZING MOUNTING DEFECTS FOR CHIP MOUNTING MACHINES



OBSERVATION OF PRESS MACHINE MOVEMENT

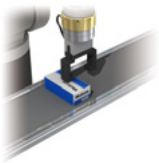


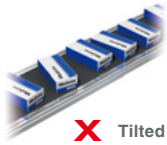
ANALYZING ERRORS IN CONVEYOR BELT OPERATIONS



X Conveyor belt buckling

Results in the improper transportation of parts





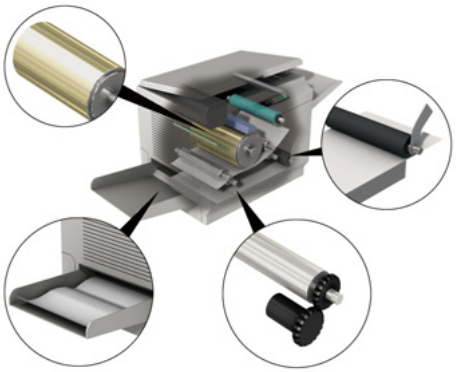
X Chucking cannot be performed well

The relationship of timing and position for the head and parts are incorrect.

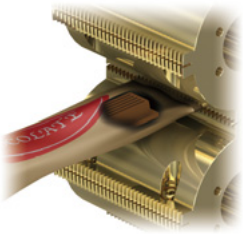
X Tilted and misaligned parts

If parts cannot be transported in the correct direction or position, it will lead to defects in subsequent operations.

EVALUATING PARTS WHEN DEVELOPING MULTI-FUNCTION PRINTERS



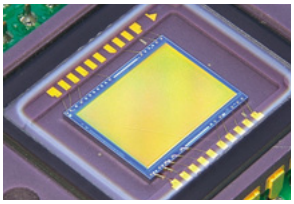
ANALYZING DEFECTS FOR WRAPPING AND FILLING OPERATIONS

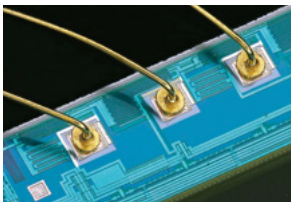


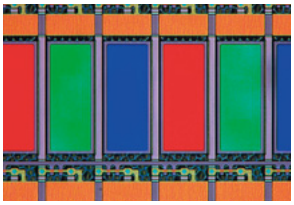
DROP TESTS (VARIOUS EVALUATIONS)

MAGNIFIED OBSERVATION

SEMICONDUCTOR


CMOS (15x)


Wire bonding (300x)


Color filter (800x)

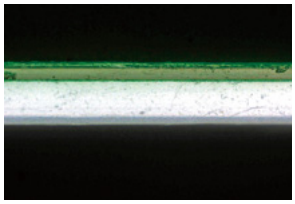
AUTOMOTIVE/METAL

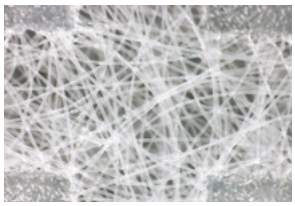

Miniature bearing (10x)

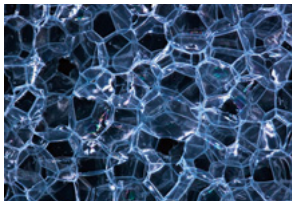

CVT gear (50x)


Metal structure (400x)

MATERIAL/CHEMICAL

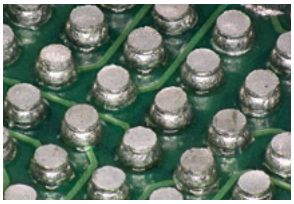

Cross section of multilayer film (1000x)

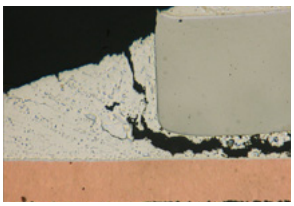

Nonwoven fabric (200x)


Heat insulator (50x)

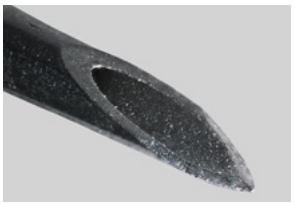
ELECTRONICS

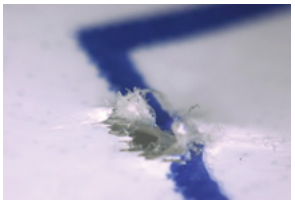

Connector terminal (70x)

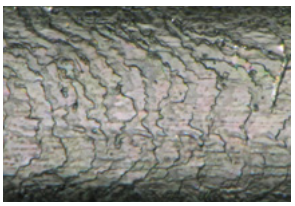

BGA (50x)


Cross section of solder (1000x)

PHARMACEUTICAL/ PACKAGING

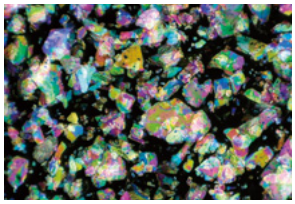

Injection needle (100x)


Tear in package (100x)


Hair (3000x)

OTHER INDUSTRIES


Bath agent (20x)


Mica (500x)


Scarab beetle (30x)

External Devices that Support Observation

Macro Zoom Unit

6x optical zoom

VW-Z1A NEW

One of the most difficult aspects of high-speed recording has been adjusting the lighting appropriately.
We took a completely fresh look at this issue and designed a macro zoom unit with built-in lighting.
Lighting coverage and angle can be adjusted freely to suit the target.

		Observation distance (working distance) (mm)	Horizontal field of view size (H) (mm)	
			Magnification (zoom) Wide side (1x)	Magnification (zoom) Telecentric side (6x)
Close-up lenses	None	3840 151.18"	2840 111.81"	480 18.90"
	No.1	600 23.62"	480 18.90"	80 3.15"
	No.2	380 14.96"	270 10.63"	50 1.97"
	No.3	270 10.63"	200 7.87"	35 1.38"
	No.4	220 8.66"	160 6.30"	25 0.98"

• Close-up lenses No. 1 and No. 4 are optional.

Long-Range Macro Zoom Unit

200 to 2000 mm (7.87" to 78.74") WD, 4x optical zoom

VW-Z2 NEW

Conventionally, it was difficult to perform high-speed imaging due to magnification and working distance issues, especially when trying to monitor objects that were blocked by obstructions.
The ability to record at a maximum of 60x while keeping a LONG working distance of 200 to 2000 mm (7.87" to 78.74"), makes observation from a remote distance possible.

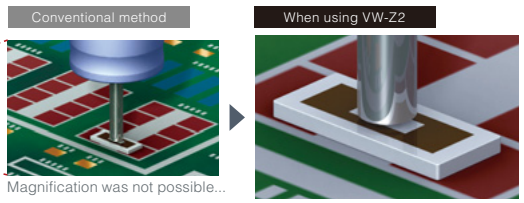
Observation distance (working distance) (mm)	Horizontal field of view size (H) (mm)	
	Magnification (zoom) Wide side (1x)	Magnification (zoom) Telecentric side (4x)
2000 78.74"	284.4 11.20"	71.0 2.80"
1000 39.37"	136.2 5.36"	34.4 1.35"
500 19.69"	64.0 2.52"	16.0 0.63"
200 7.87"	19.9 0.78"	5.0 0.20"

LONG-RANGE 200mm to 2000mm (7.87" to 78.74")

Crisp and bright observation is possible even from a distance

HIGH MAGNIFICATION 1x to 60x

High magnification in hard-to-see areas is made simple



AN OPTIMALLY DESIGNED STRUCTURE

Quickly and Easily Adjust the Camera Angle to Capture the Desired Motion

Free-Angle Stand VW-S200 NEW

The camera/lens can be manipulated for viewing at any angle. With its simple operation, stable high speed video capture is supported for a variety of locations and applications.

Movable range of 500 mm (19.69")

The camera arm has a movable range of 500 mm (19.69"), giving the camera the ability to be positioned inside of a machine in order to get closer to a target.

Flexible mirror/ Mouse platform

Used for viewing in tight spaces, the flexible mirror (OP-87139) can also function as a platform for a mouse. [OPTIONAL]

Angle Adjustment

[Smooth operation with the camera adjustment arm]

The camera/lens can move freely: left - right, up - down. The lens, combined with the integrated hyper-spot light, simplifies previously impossible observations.

Control Unit Mounting

[Wide base allows control unit mounting]

For applications where space is limited for filming, save space by mounting the VW control unit onto the base of the stand.

Easily performs low-angle recording

Capable of recording at extremely low heights or directly beneath a target. Can meet the demands of any situation that the recording site requires.

Outstanding Stability

With its low center of gravity design, the VW-S200 is unaffected by environmental vibrations allowing for smooth, on-site video capture.

High-Performance Low-Range Zoom Lens

VH-Z00R/Z00W

0 50

From the whole target to a magnified image

With a range from 0.1x - 50x magnification, a target can be viewed from its entirety down to more in-depth observation. This macro lens excels in workability and high performance with click-style magnification adjustment, an aperture mechanism, and a viewing distance of 95mm (3.74") or more.

Model		VH-Z00R/Z00W						
Magnification [1]		0.1×	0.5×	1×	5×	10×	30×	50×
Monitoring range (mm inch)	Horizontal	3200 126"	640 25.2"	320 12.6"	61 2.40"	30.5 1.20"	10.2 0.40"	6.1 0.24"
	Vertical	2400 94.49"	480 18.9"	240 9.45"	45.5 1.79"	22.8 0.80"	7.6 0.30"	4.6 0.18"
	Diagonal	4000 157.5"	800 31.5"	400 15.75"	76.2 3"	38.1 1.5"	12.7 0.5"	7.6 0.30"
Monitoring distance (mm inch)		Approx. 7700 303.1"	Approx. 1500 59.08"	Approx. 720 28.35"	95 3.74"			

1. Magnification on a 15-inch monitor

Ultra-Small, High-Performance Zoom Lens

VH-Z20R/Z20W

20 200

Versatile lens provides high-resolution imaging with large depth-of-field

The VH-Z20R/Z20W offers high-resolution observation at general purpose magnifications of 20x - 200x. This lens has been designed to optimize both depth-of-field and resolution and can be used in handheld mode.

Model		VH-Z20R/Z20W					
Magnification [1]		20×	30×	50×	100×	150×	200×
Monitoring range (mm inch)	Horizontal	15.24 0.60"	10.16 0.40"	6.10 0.24"	3.05 0.12"	2.03 0.08"	1.52 0.06"
	Vertical	11.40 0.45"	7.60 0.30"	4.56 0.18"	2.28 0.09"	1.52 0.06"	1.14 0.04"
	Diagonal	19.05 0.75"	12.70 0.50"	7.62 0.30"	3.81 0.15"	2.54 0.10"	1.91 0.08"
Depth of field [2] (mm inch)		34 1.34"	15.5 0.61"	6.0 0.24"	1.6 0.06"	0.74 0.03"	0.44 0.02"
Monitoring distance (mm inch)		25.5 1"					

1. Magnification on a 15-inch monitor
2. The value when the lens is set with priority to depth of field. The depth of field changes depending on the setting of the aperture ring.

Long-Focal-Distance, High-Performance Zoom Lens

VH-Z50L/Z50W NEW

50 500

Long range lens with an 85 mm 3.35" working distance

Enables high-magnification observation while maintaining a long working distance. This lens is ideal for viewing objects that have highly-irregular surfaces or recesses that cannot be observed up close.

Model		VH-Z50L/Z50W					
Magnification [1]		50x	100x	200x	300x	400x	500x
Monitoring range (mm inch)	Horizontal	6.09 0.24"	3.05 0.12"	1.53 0.06"	1.02 0.04"	0.76 0.03"	0.61 0.02"
	Vertical	4.57 0.18"	2.28 0.09"	1.14 0.04"	0.76 0.03"	0.57 0.02"	0.46 0.02"
	Diagonal	7.62 0.30"	3.81 0.15"	1.90 0.07"	1.27 0.05	0.95 0.04"	0.76 0.03"
Monitoring distance (mm inch)		85.0 3.35"					

1. Magnification on a 15-inch monitor

Wide-Range Zoom Lens

VH-Z100R/Z100W

100 1000

Wide-range zoom lens offers high resolution and large depth of field

This innovative lens was developed to satisfy the need for high-resolution, long working distance and large depth-of-field. Provides both ring light and bright field illumination.

Model		VH-Z100R/Z100W					
Magnification [1]		100×	200×	300×	500×	700×	1000×
Monitoring range (mm inch)	Horizontal	3.05 0.12"	1.53 0.06"	1.02 0.04"	0.61 0.02"	0.44 0.02"	0.30 0.01"
	Vertical	2.28 0.09"	1.14 0.04"	0.76 0.03"	0.46 0.02"	0.33 0.01"	0.23 0.01"
	Diagonal	3.81 0.15"	1.90 0.07"	1.27 0.05"	0.76 0.03"	0.54 0.02"	0.38 0.01"
Monitoring distance (mm inch)		25 (20 [2]) 0.98" (0.79 [2])					

1. Magnification on a 15-inch monitor
2. The Dual Light Base Unit (OP-84430) and the Adjustable Illumination (OP-72402) are attached.

Dual Light High-Magnification Zoom Lens

VH-Z250R/Z250W NEW

250 2500

Observe with both bright field and dark field at high-magnification

Easily switch between ring light and coaxial illumination with just the touch of a button. View objects at up to 2500x magnification while still maintaining a 6.5mm working distance

Model		VH-Z250R/Z250W						
Magnification [1]		250×	300×	500×	1000×	1500×	2000×	2500×
Monitoring range (mm inch)	Horizontal	1.22 0.05"	1.02 0.04"	0.61 0.02"	0.31 0.01"	0.2 0.01"	0.15 0.005"	0.12 0.004"
	Vertical	0.92 0.04"	0.76 0.03"	0.46 0.02"	0.23 0.01"	0.15 0.005"	0.11 0.004"	0.09 0.003"
	Diagonal	1.52 0.06"	1.27 0.05"	0.76 0.03"	0.38 0.01"	0.25 0.009"	0.19 0.007"	0.15 0.005"
Monitoring distance (mm inch)		6.5 0.26"						

1. When displayed on a standard 15-inch monitor.

High-Resolution Zoom Lens

VH-Z500R/Z500W

500 5000

Our highest magnification and resolution zoom lens

This zoom lens incorporates high-quality fluorite optics to provide the highest resolution in its class. With an N.A. of 0.82, achieve up to 5000x magnification with a 4.4mm working distance

Model		VH-Z500R/Z500W				
Magnification [1]		500×	1000×	2000×	3000×	5000×
Monitoring range (μm Mil)	Horizontal	610 24.02	305 12.01	152 5.98	102 4.02	61 2.4
	Vertical	457 17.99	229 9.02	114 4.49	76 2.99	46 1.81
	Diagonal	762 30	381 15	191 7.52	127 5	76 2.99
Monitoring distance (mm inch)		4.4 0.17"				

1. Magnification on a 15-inch monitor

The DOUBLE'R compliant VH-Z250W/Z500W lenses are fitted with Automatic Lens/Zoom Recognition units.

BORESCOPE LENS

VH-B18/B27/B40/B55/B100 NEW

Capable of observation in 2 directions (direct-view and lateral view) with a single lens

Switch from a direct view to a lateral view by installing the 90° lateral view tube on the borescope lens. The extensive lineup of five diameter types, ø1.8, ø2.7, ø4, ø5.5, ø10 (ø0.07", ø0.11", ø0.16", ø0.22", ø0.39"), allows for the most suitable selection of borescope according to the application. In addition, the Borescope Lens Zoom Attachment has a 3x optical zoom mechanism which produces observation with higher resolution and magnification.

Model	Borescope	VH-B18		VH-B27		VH-B40		VH-B55		VH-B100	
	Lens attachment	VH-BA									
Outer diameter [1] (mm inch)		ø1.8 (ø2.0) ø0.07" (ø0.08")	ø2.0 [5] ø0.08"	ø2.7 (ø3.0) ø0.11" (ø0.12")	ø3.0 [5] ø0.12"	ø4.0 ø0.16"	ø4.4 [5] ø0.17"	ø5.5 ø0.22"	ø5.9 [5] ø0.23"	ø10.0 ø0.39"	ø10.5 [5] ø0.41"
Effective length (mm inch)		95 3.74"		185.3 7.30"		141.5 5.57"		276 10.87"		276 10.87"	
View direction [2]	Direct view	0°		0°		0°		0°		0°	
	Lateral view	90°		90°		90°		90°		90°	
View angle		30°		32°		30°		35°		35°	
Observation distance (mm inch)		3 or more 0.12" or more		3 or more 0.12" or more		5 or more 0.20" or more		5 or more 0.20" or more		3 or more 0.12" or more	
Maximum observation magnification [3]		360x		150x		140x		125x		135x	
Minimum view range (mm inch) [4]		0.8 0.03"		2 0.08"		2 0.08"		2.4 0.09"		2.2 0.09"	
Ambient temperature		0 to 40°C 32 to 104°F									

1. The value in parenthesis is when the Guard tube is installed.
2. 0°: With or without the Guard tube installed, 90°: When the Lateral view tube is installed
3. The magnification at around the center of a 15-inch monitor.
4. Horizontal view angle
5. The value when the Lateral tube is installed.

VH Lighting Unit VW-L1

A lighting unit that allows attachment of VH Series lenses

Designed to provide the appropriate lighting when using VH Series lenses.

* Lenses sold separately.

MACRO LENS

Macro Zoom Unit
VW-Z1A

Long-range
Macro Zoom Unit
VW-Z2

Standard close-up lenses
No.2/No.3[*6]

RZ LENS[*4]

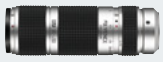
High-resolution zoom lens
VH-Z500R[*1] **/Z500W**
500x to 5000x

Dual-light
high-magnification lens
VH-Z250R[*2] **/Z250W**
250x to 2500x

Wide-range zoom lens
VH-Z100R[*1] **/Z100W**
100x to 1000x

Ultra-small,
high-performance zoom lens
VH-Z20R/Z20W
20x to 200x

High-performance low-range
zoom lens
VH-Z00R/Z00W
0.1x to 50x



LW LENS[*4]

Long-focal-distance,
high-performance zoom lens
VH-Z50L/Z50W
50x to 500x

VH Lighting Unit
VW-L1

Bayonet-type
standard attachment[*3]
OP-51478

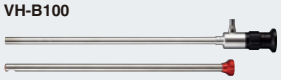
Bayonet-type C-mount
attachment
OP-51479

VH-F

Compatible with all VH Series lenses:
Zoom lenses, fixed focal length lenses, borescope lenses, etc.

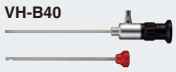
BORESCOPE LENS

VH-B100



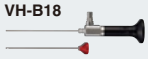
VH-B55

VH-B40



VH-B27

VH-B18

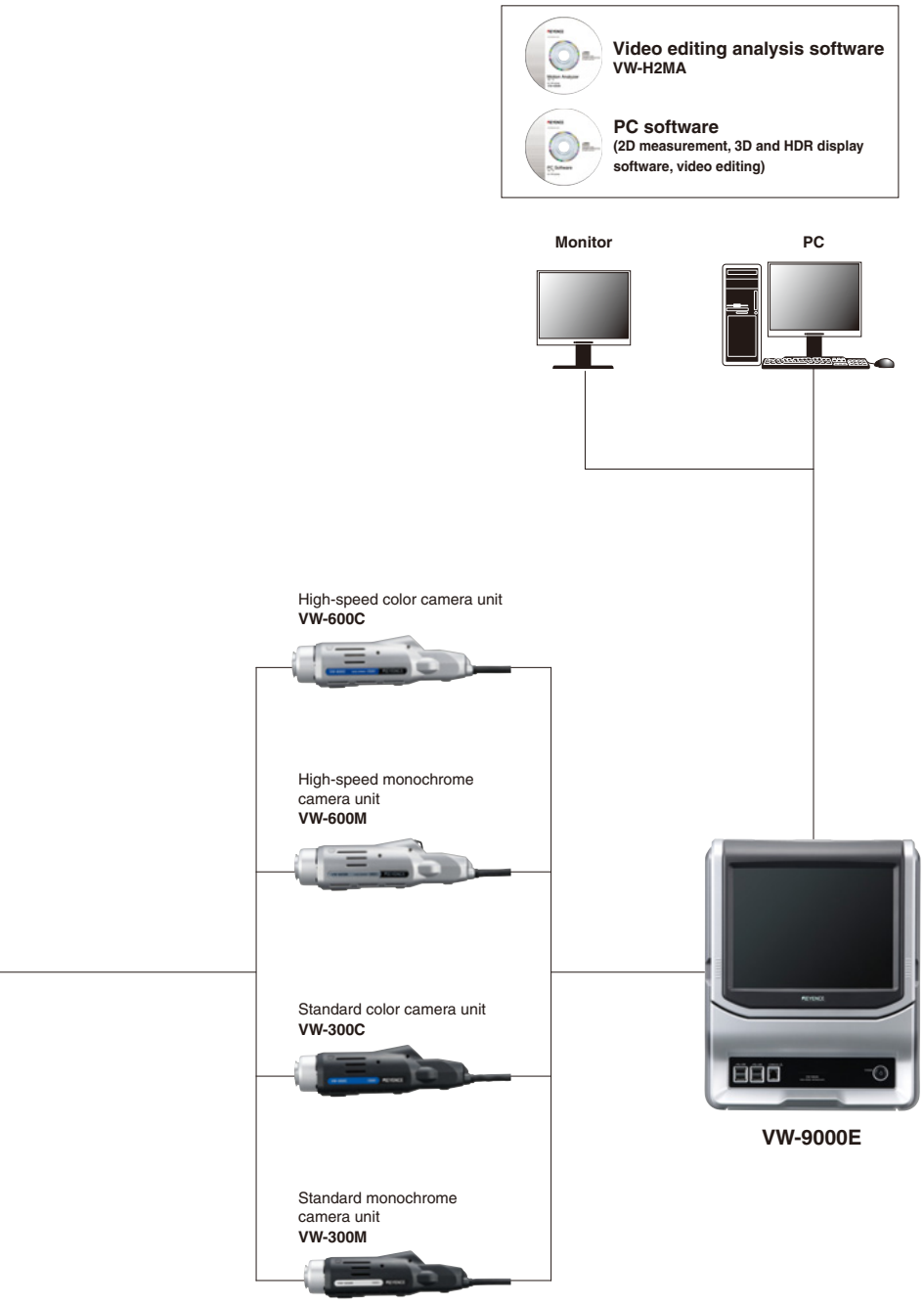


VH-BA

FIBERSCOPE[*5]

VH-F61

VH-F111



*1 Requires VW Vertical Illumination Cap (OP-84306) or VHX Fiber Cable (OP-51480) and VW-VHX Cap (OP-87054).
*2: Requires VW-VH Cap (OP-87054).
*3 Attachment for VH-Z50L/VH-Z100R/VH-Z500R/VH-Z450 is OP-51647.
*4 Magnification on 15" monitor.
*5 Requires attachment of VHX Fiber Cable Adapter (OP-51482) and VW-VHX Cap (OP-87054).
*6: For the VW-Z1A only.
*7: VW-Z2 cannot be attached.

Stands

For high-speed recording

Free-angle stand
VW-S200

Tripod*7
971931

For magnified observation

Free-angle observation system
VH-S30

Free-angle observation system (motorized Z-axis)
VHX-S50

High-precision VH mounting stand (with X-Y stage and transmitted illumination)
VH-S5

VH lens mounting stand (with XY stage)
OP-25539 + OP-22124

OPTIONS

VH Lighting Unit VW-L1

A lighting unit that allows attachment of VH Series lenses.
A variety of lenses can be attached.
*Lenses sold separately.

Close-Up Lenses No.1/No.4*1

Flexible mirror (mouse platform) OP-87139

A flexible mirror that offers support for observation of targets that cannot be directly viewed.
It can also be attached to the free-angle stand and used as a platform for a mouse.

VW Vertical Illumination Cap OP-84306

An adapter that is used to connect the VW Series fiber cable to the lighting unit of a coaxial vertical illumination zoom lens.

VW-VHX Cap OP-87054

An adaptor that is used to connect the VHX/VH Series fiber cable to the VW Series controller.

VW Camera Bracket OP-87253

Used when installing a C-mount.

VW Carrying Case OP-87251

Camera Platform Balancer OP-87140*2

An attachment that connects the lens to the free-angle stand with a sliding mechanism.

Compact Pressure-resistant Probe (1:1) OP-84266

A probe for sensor waveform input.

Console OP-87145

A console that dramatically improves operability when performing magnified observation.

Hyper spot light conversion adapter OP-87271

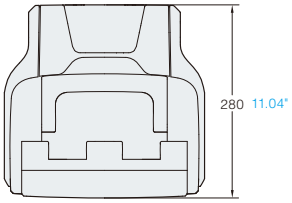
An adapter that is used when connecting a VH Series digital microscope with a VW Series lens.

*1: For the VW-Z1A only. *2: 1 unit is attached to the VW-S200.

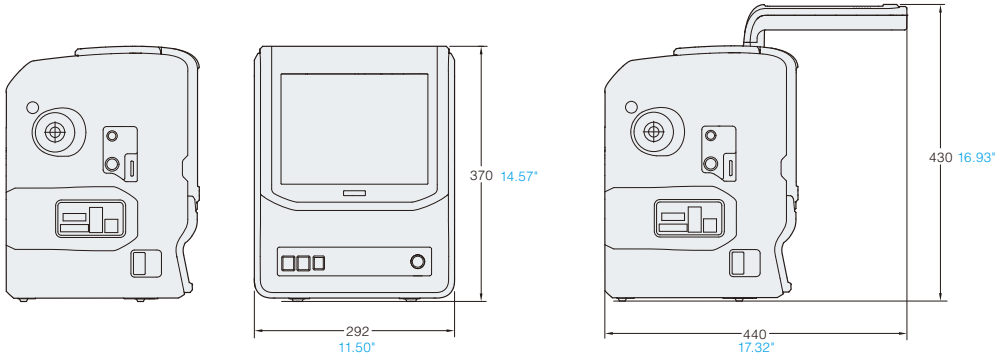
DIMENSIONS

(Unit:mm inch)

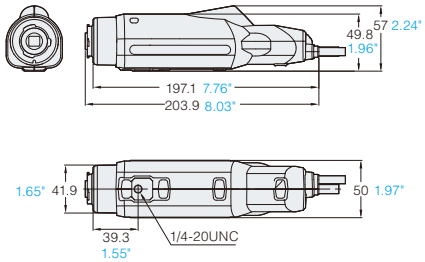
Controller
VW-9000E



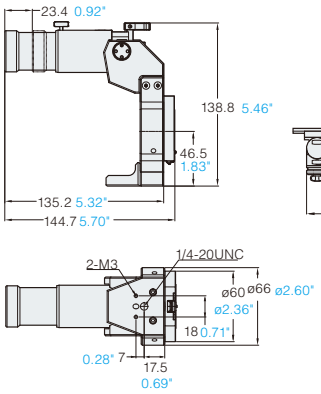
When the monitor is open/closed



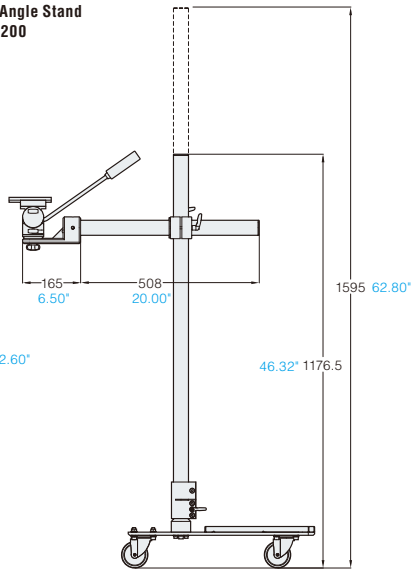
Camera Unit
VW-600C/M, VW-300C/M



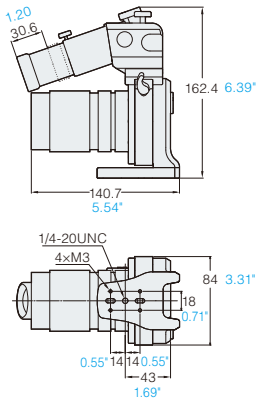
VH Lighting Unit
VW-L1



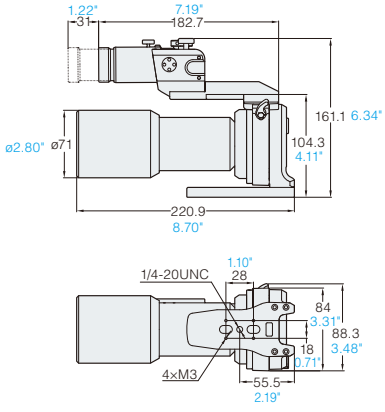
Free-Angle Stand
VW-S200

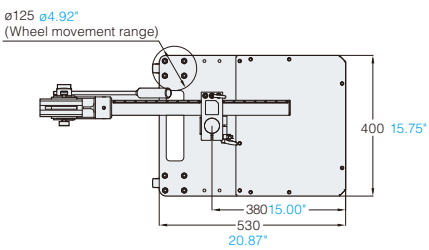


Macro Zoom Unit
VW-Z1A



Long-Range Macro Zoom Unit
VW-Z2





SPECIFICATIONS

Main unit

Model		VW-9000E
LCD monitor*1	Size	Color LCD (TFT) 10.4"
	Dimensions	210.4 mm (H) × 157.8 mm (V) 8.28"(H) x 6.21"(V)
	Pixel pitch	0.2055 mm (H) × 0.2055 mm (V) 0.008"(H) x 0.008"(V)
	Number of pixels	1024 (H) × 768 (V) XGA
	Display color	Approx. 16 million*2
	Brightness	400 cd/m^2 (typical)
Recording media	Semiconductor memory	8GB
	Hard drive	500GB (Includes reserved system space of 100 GB)
Image format	Video	AVI: uncompressed, JPEG: compressed, WMV: compressed
	Still images	JPEG: compressed, TIFF: uncompressed
Light source	Lamp	Specialized metal halide lamp
	Type	Color camera: 60 W high color rendering type Monochrome camera: 80 W high-brightness type
	Lifetime	2000 hr (average)
	Color temperature	Color camera: 8000K Monochrome camera: 6400K
Input	Mouse input	Supports USB mouse
	Keyboard input	Supports USB keyboards
Terminal block I/O	Recording start input (TRG IN)	Non-voltage input, TTL
	Sync input (SYNC IN)	TTL
	Photo start input (CAPTURE)	Non-voltage input
	Still image input (PAUSE)	Non-voltage input
	Video trigger output (TRG OUT)	NPN open collector output, TTL
	Sync output (SYNC OUT)	TTL
	Recording ready output (READY OUT)	NPN open collector output
	Recording complete output (REC OUT)	NPN open collector output
	Service power supply (+12V)	12 VDC, 125mA
Sensor input Mic input	Input channel number	1CH
	Measurement range	±10 V, ±5 V, Mic
	Input ports	BNC, Mic jack
	Resolution	14bit
Video output	Analog RGB	1024 (H) × 768 (V) XGA
	DVI	
USB 2.0 ports	Type A	8x
LAN ports	For external PC communication	RJ-45 (100BASE-TX/1000BASW-T)
Power supply	Power-supply voltage	100 to 240 VAC ±10% 50/60 Hz
	Power consumption	290 VA max.
Environmental resistance	Ambient temperature	5 to 40°C 41 to 104°F
	Relative humidity	35 to 80% RH (No condensation)
Weight	Controller (main unit)	Approx. 11 kg
	Optical fiber cable	Approx. 800 g
	VW console	Approx. 180 g
Dimensions		292 (W) x 370 (H) x 280 (D) mm 11.5"(W) x 14.57"(H) x 11.0"(D)

*1 The LCD monitor provided with the VW Series is based on extremely advanced technology. Rarely, an unlit part (black spot) or lit part (bright spot) may exist on the monitor screen. However, this is not an indication of the LCD monitor being defective.
*2 Approximately 16,770,000 colors are rendered with the dithering processing of the display controller.

Camera

Model		VW-600C	VW-600M	VW-300C	VW-300M
Type		Color	Monochrome	Color	Monochrome
Image receiving element		1/2" CMOS image sensor			
Camera resolution		640 × 480			
Scanning system		Progressive			
Maximum resolution (When saving video)	30fps	640 × 480		640 × 480	
	60fps				
	125fps				
	250fps				
	500fps				
	1,000fps				
	2,000fps			640 × 240	
	4,000fps			320 × 240	
	6,000fps	640 × 320		320 × 160	
	8,000fps	640 × 240		256 × 128	
	10,000fps	640 × 192		160 × 112	
	12,000fps	320 × 240			
	15,000fps				
	23,000fps	320 × 160		160 × 80	
	35,000fps	256 × 128		160 × 42	
	57,000fps	160 × 112		160 × 32	
	80,000fps	160 × 80		—	
	120,000fps	160 × 42		—	
	150,000fps			—	
	230,000fps	160 × 32		—	
Maximum recording pixels (When saving still images)		1920 × 1440 (When using pixel shift)	640 × 480	1920 × 1440 (When using pixel shift)	640 × 480
Gradation		24bit	8 bits	24bit	8bit
Electronic shutter		AUTO, MANUAL (1/30 to 1/900000 s)			
White balance		MANUAL, PUSH-SET	—	MANUAL, PUSH-SET	—
Weight		Approx. 930g	Approx. 840g	Approx. 930g	Approx. 840 g
Dimensions		50 (W) x 57 (H) x 197.1 (D) mm 1.97" (W) x 2.24" (H) x 7.76"(W)			

Detailed Modules

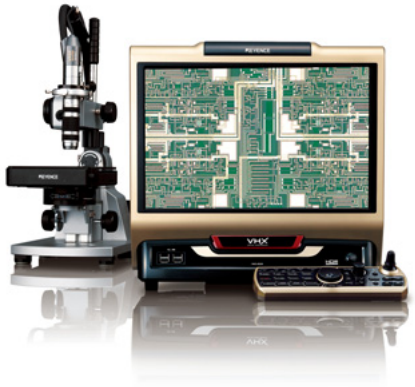
Controller		Records and plays video and still images
Software	Easy recording software	Uses a simple flow chart to set and record video
	Double memory software	Splits the recording memory into two parts to conduct recording and saving simultaneously
	Long-term recording software	Saves data directly to the hard drive and performs long-term recording
	Advanced recording software	Performs special recording such as error monitoring, repeat recording, and synchronized recording
	Still image/3D recording software	Records still and 3D images (magnified observation mode)
	Area measurement software	Measures areas of 2D images
	Split screen software	Function for splitting an image vertically, horizontally, or into four parts, and displaying the image
	Depth-composition software	Loads multiple, in-focus images of the target at various heights to create a single composite image

New principle that has realized overwhelming observation

Digital Microscope

NEW **VHX-2000**

- Exceeding the resolution capabilities of an optical microscope
- Realizes vivid 3D observation with large depth-of-field
- Simple operation using 3-axis (XYZ) motorized control
- High-speed image stitching function
- Advanced automatic measurement functions
- Quick Depth Composition function & 3D composition



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