HIROX
http://www.hirox.com

NEW DIGITAL MICROSCOPE KH-7700

3D Imaging Solutions

The New Generation Digital Microscope

HIROX
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PHP-0911-C001A_

KH-7700 Digital Microscope

The KH-7700 system serves as the interface for operators with numerous applications.

All-In-One Unit

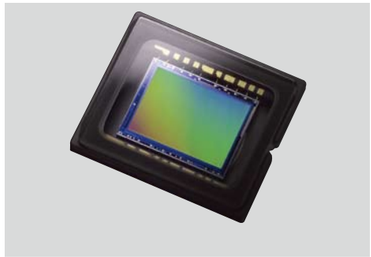
All-in-one portable design provides high quality live observation, recording and measurement.

The KH-7700 comes integrated with a 15" UXGA (1200 x 1600) LCD monitor, a 160GB hard drive and CD/DVD-R/RW drive. The 2D and 3D measurement software is also pre-installed. It can be used for observation, recording and measurement. Since the KH-7700 has USB 2.0 and LAN output, it can be connected to external storage devices and a network.

USB LAN PICTBRIDGE

Compact High Resolution CCD Camera

A newly developed company body 2.11 mega pixel CCD camera provides a UXGA (1200 x 1600) high quality observable image.



Auto Calibration Select (ACS)

Stress Free Operation

"ACS" stands for "Auto Calibration Select," a Hirox original function. The ACS function automatically selects the lens and calibration values as the lens and magnification are changed.

Lens
Optical Zoom

By connecting the ACS cable to the lens, the main control unit identifies the signal of the lens and changes the calibration set up.

KH-7700
Main Control Unit

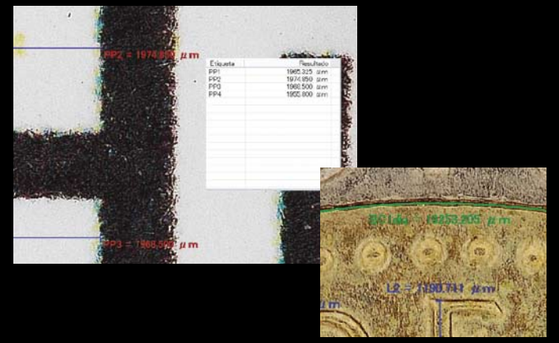
The main control unit communicates with the lens through ACS for stress free function control.

Z-Axis Stage
High Precision Stand

This function recognizes the lens and selected magnification providing the system with the depth-of-field data. As a result, the travel speed of the motorized Z-axis is automatically adjusted.

2D Image
Measurement

The ACS function prevents selecting incorrect calibration data while zooming in/out.
After adjusting focus, the system is ready to make accurate and precise measurements smoothly.



3D Image
3D Profile

Defining the bottom and top in-focus portion of a target area, with surface height variation, allows the ACS sensor to assign the ideal number of images to be captured on the Z-axis, while gathering the height information to create a 3D model.

Captured
2D and 3D Images

All of the parameters, including the calibration data are saved into the 2D and 3D image files.
This allows future analysis of the saved images without having to re-adjust the calibration data or any other parameters.

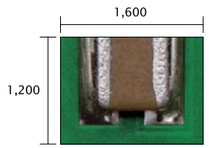
2D and 3D Tiling

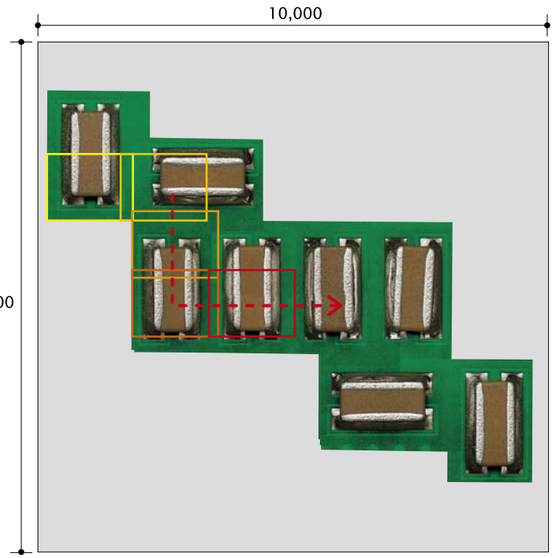
Increase the field of view up to 50 times at high magnification.

Real-Time 2D Tiling Feature

A Hirox original algorithm achieves quick tiling in real time.
It is a constant challenge for optical microscopes to capture with a high optical resolution and a wide field of view simultaneously. This new process does not require a specified position to match tile to tile. The image will automatically begin tiling seamlessly in real-time just by moving the XY stage. This Hirox original method increase the field of view from 1200 x 1600 pixels up to 10,000 x 10,000 pixels while retaining a high optical resolution.

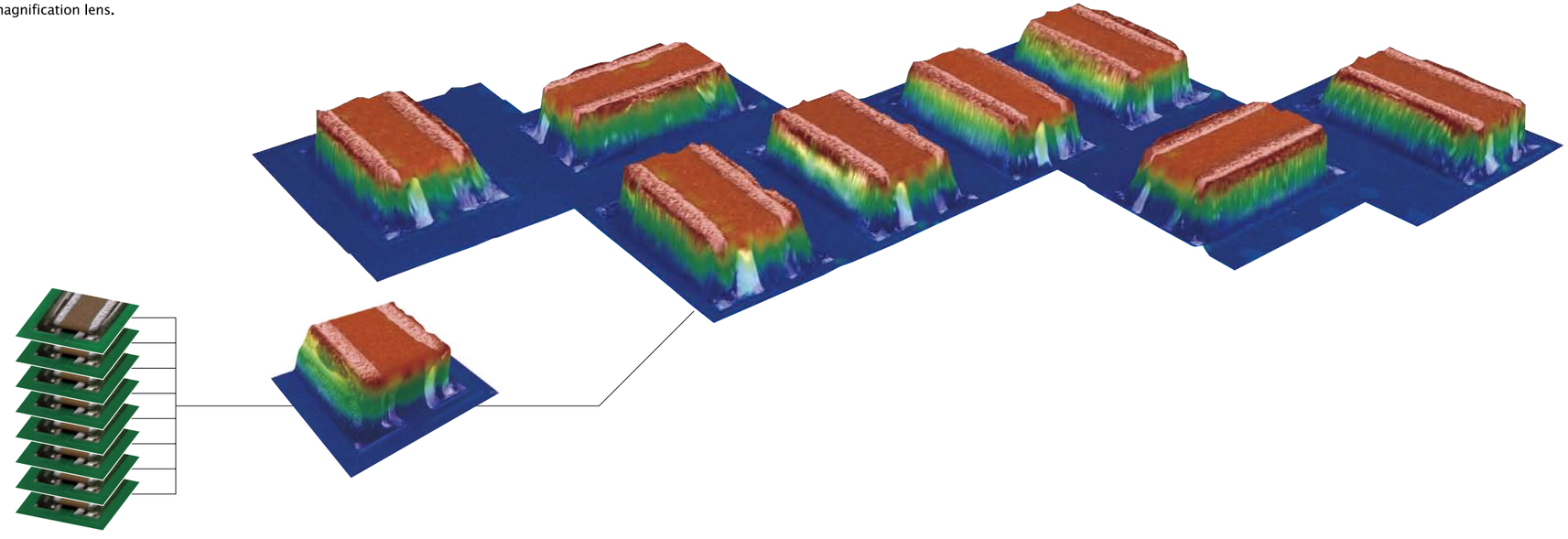
All you have to do is move the XY stage





Real-Time 3D Tiling Feature

Creating Wide Field of View 3D Images
In an optical system, 3D images are produced by vertically stacking the depth of field, focus point to focus point. However, at low magnification this method is not possible, because the depth of field is too high. Until now, height information could only be gathered in the vertical axis. The solution is 3D Tiling, a combination of high magnification Z-axis image stacking and a wide field of view. By allowing the user to continuously stack the depth of field, focus point to focus point with the freedom to move horizontally, the user can create a 3D model with a field of view as if it were captured with a low magnification lens.

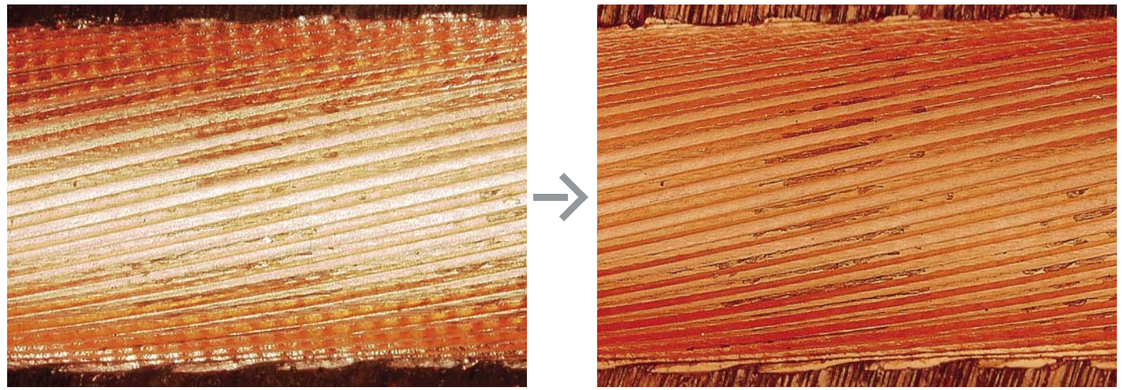


Super High Dynamic Range (S-HDR)

Expanding the CCD's Dynamic Range to "naked eye" resolution.

The S-HDR function is a ground-breaking observation technology based on a Hirox original algorithm. It reproduces a dynamic range as a visual image in ways unheard-of until now. This function provides for easy, ultra-precise observation and analysis by extracting and producing accurate image data from parts of images that could not be detected previously because of halation or darkness.

High reflection sample (Metal Tube) - 40x



Before S-HDR

After S-HDR

Poor contrast sample (Toner) - 20x

Before S-HDR

After S-HDR

Poor sharpness sample (Apple) - 20x

Before S-HDR

After S-HDR

S-HDR (Super High Dynamic Range)

S-HDR has a greater dynamic range compared to normal imaging techniques. S-HDR aims to accurately represent the wide range of intensity levels found in real scenes by blending the information from multiple exposures each taken at different shutter speeds.

Problem:Single shutter speed images limit the amount of lighting control, resulting in over/under exposed areas.

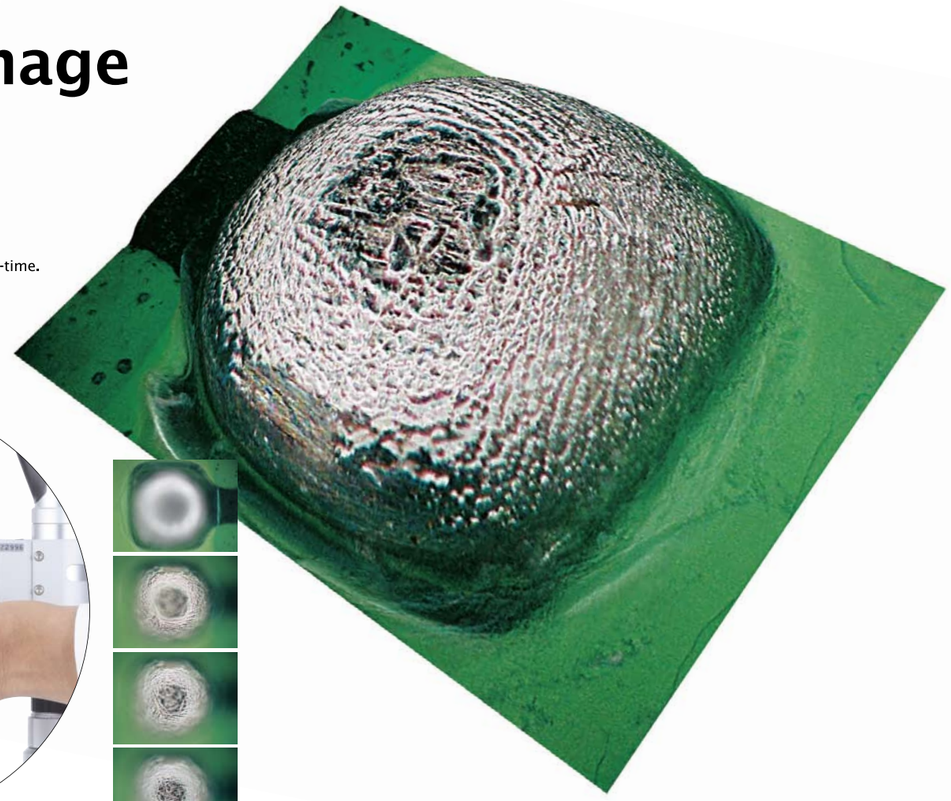
Solution:
Multiple exposures blended together create a single image in which all areas of the image have the perfect exposure.

Perfect Image

Digital Enhancement

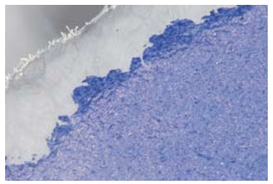
Handy Synthesis

Extended depth image composition in real-time. This function merges images together as the focus dial is turned.

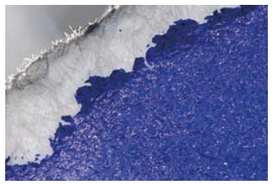


High-Contrast Feature

Increase the contrast of the CCD camera setup to emphasize colors on low detail applications. This function provides easy observation on poor contrast surfaces.



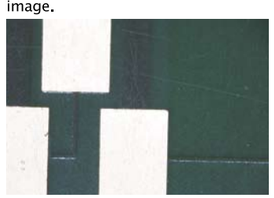
Regular Image (Printed paper)



Hi-Contrast Image (Printed paper)

Anti-Halation Function

Just “one click.” An original anti-halation algorithm eliminates strong flare from highly reflective objects. This function reduces the significant amount of time required for lighting adjustments and creates an easily observable image.

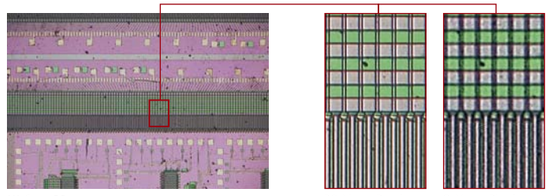


Before anti-halation (PCB) - 40x

After anti-halation (PCB) - 40x

30 Mega Pixel Image

Even though the CCD camera is compact in size, Hirox’s original algorithm creates an actual 30 mega pixel image (4800 x 6400 pixels). This method provides detailed texture and color reproduction.



Wafer - 60x

30 Mega Pixel

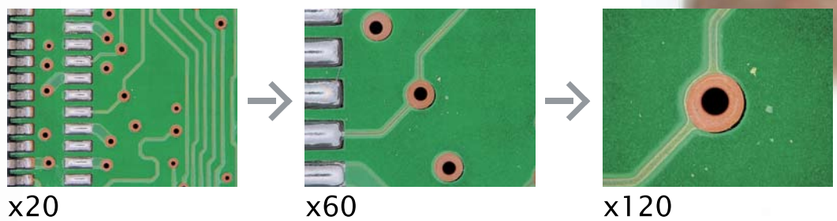
2 Mega Pixel

Real-Time Measurement on the Monitor

2D Measurement with Various Tools

Measurement coordinates with the ACS Function.

ACS (Auto Calibration Select) identifies the lens and zoom magnification automatically, relaying it to the main control unit when the lens is zoomed in/out. This function eliminates any possibility of measurement errors.



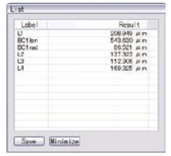
x20 x60 x120

Measurement Tools

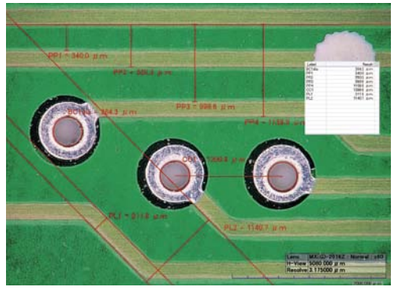
Measurements including length, surface area, and angles can be takes in various styles. With just mouse operation, the object on the monitor can be measured in real-time. In addition, the actual dimensions and measurement results can be saved on the captured image or saved as a CSV file.

One Click Unit Conversion

With just a click of the mouse, the measurement unit can be changed from Metric to English. All this can be done without having to re-measure or realign.

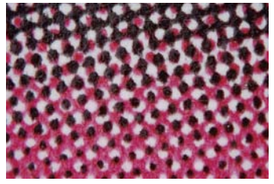


Measurement list display
(L2 is the reference for L3 and L4 relative measurements)

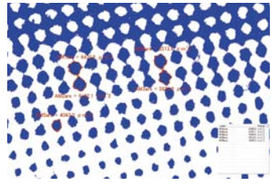


Binarization

Image Brightness and RGB values are displayed as a binarized image. Adjust the threshold according to desired value (RGB) to verify a specific region on the image. The black color on the image was binarized, providing easy area measurement.



Regular Image (Ink) – 160x



Binarized Image (Ink) – 160x

3D Profile Measurement

XYZ Measurement in 3D

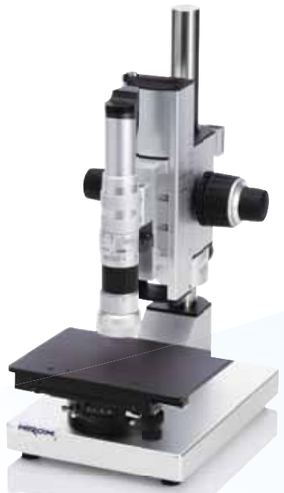
A newly developed 3D modeling algorithm and high precision motorized Z-axis stage creates accurate 3D construction of detailed height information and extended depth composition. The 3D analysis software is pre-installed into the KH-7700 for further advanced analysis and is ready from the start to complete these advanced measurement functions.

3D Profile Measurement

Move the cross section on the 3D model to display height, width, and surface irregularities as a graph. Interlocking the profile graph with the image display area allows you to intuitively grasp the 3D model.

3D Viewer Software

Free 3D viewer software is available to install into any PCs to share 3D image files .



High Precision Motorized Z-Axis Stand

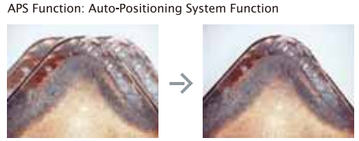
Free Angle Motorized Z-Axis Stand

Motorized Z-Axis Controller

Auto Function Method

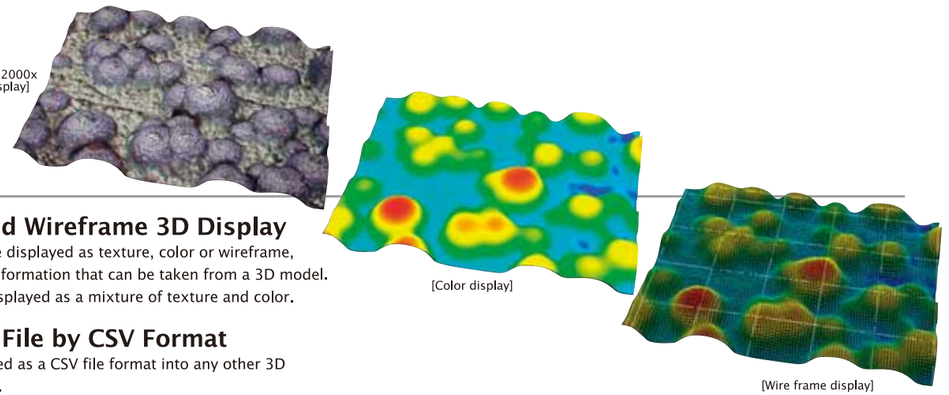
AMF3D Merge Function: Auto Multi-focus 3D Merge Function

APS Function: Auto-Positioning System Function



Bite cut-60x
[Before auto alignment]

Bite cut-60x
[After auto alignment]



IC bump at 2000x
[Texture display]

[Color display]

[Wire frame display]

Texture, Color and Wireframe 3D Display

3D model information can be displayed as texture, color or wireframe, maximizing the amount of information that can be taken from a 3D model. The 3D model can also be displayed as a mixture of texture and color.

Export 3D Image File by CSV Format

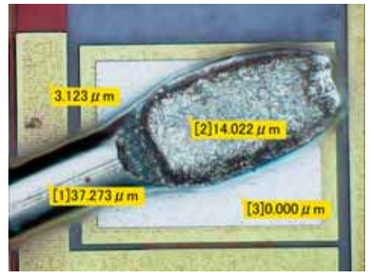
The 3D image can be exported as a CSV file format into any other 3D analysis application software.

Point Height Measurement

Display point height by simply clicking on the 2D image. Each click displays height value labels that can be easily used for reports.

Volume and Area Measurement

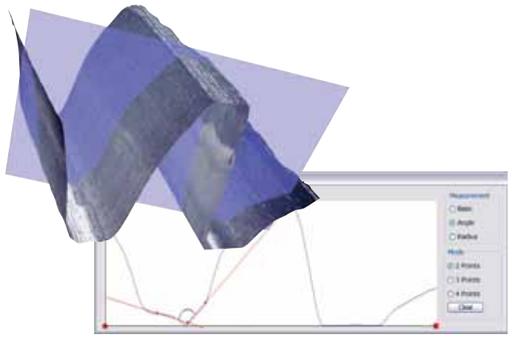
The operator can highlight a volume measurement range, then click on an area to color and view measurements of that area.The volume of the 3D model can be measured at any height above or below the highlighted area.



IC pad bonding-2500x

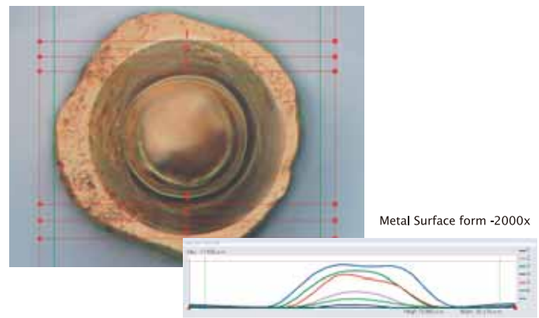
Angle and Radius Measurement on the 3D Profile

In addition to 3D height information, angle and radius measurements on the 3D profile can also be obtained for further analysis.



2D Profile Measurement

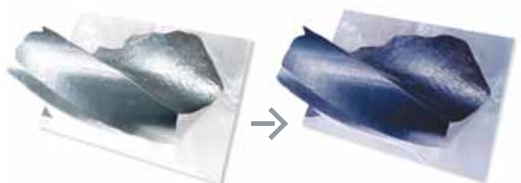
Measure profiles of an object in 2D. Switching to 3D profiling is easy, as a line selected in 2D profiling can be moved into 3D profiling. Set multiple measurement lines simultaneously and compare cross section profiles.



Metal Surface form -2000x

Anti-Halation 3D Model

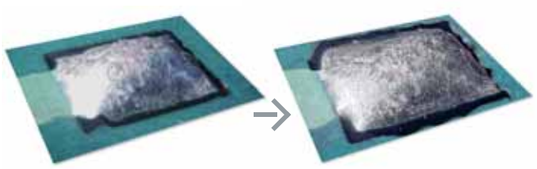
Halation on reflective surfaces is an issue when creating an ideal 3D model. This function eliminates this issue of halation.



Anti-Halation 3D Model

S-HDR 3D Model

This emphasis of subtle changes in color produced by S-HDR can be expanded into multiple layers of focus and results in a 3D model with details, gradation, reduction in flare and a wide range of brightness.



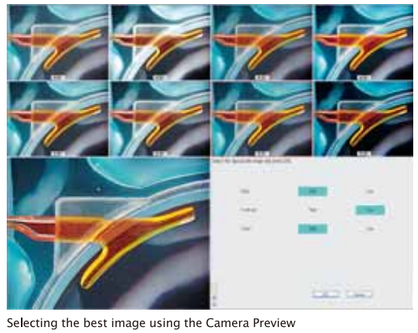
S-HDR 3D Model

Quick Operation

Easy-to-Use

Camera Preview Function

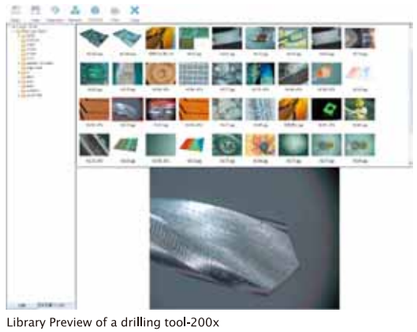
Automatically displays eight image combinations of gamma, edge and color without the need for troublesome adjustments. The operator can chose the most suitable image combination.



Selecting the best image using the Camera Preview

Library Preview Function

Manage captured images and recorded videos displayed in the library window. View and play movies, browse through thousands of images, and access folders on the network. All files can be transferred to external storage devices.

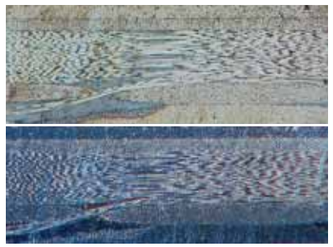


Library Preview of a drilling tool-200x

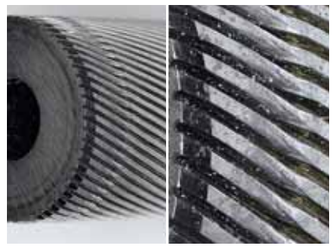
Split Window Function

The monitor can be split horizontally and vertically or divided up into 4, 9 or 16 windows. Images can be simultaneously displayed for comparing pass/fail, various angles and magnifications.

4 Screen Split



Horizontal Split



Vertical Split

Calibration Data Security

Setup a password to protect calibration data for multiple users in the workplace.

Diversified Language Selection

Language preference selection includes English, Spanish, German, French, Italian and Japanese.

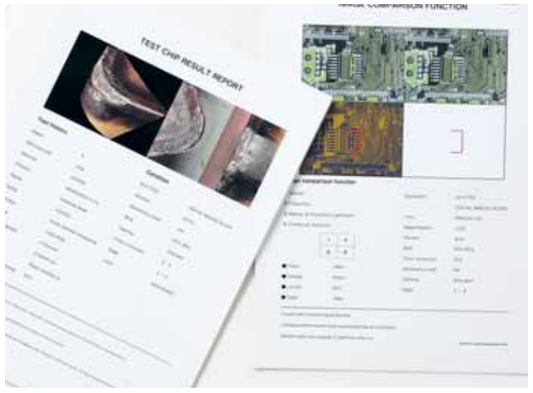
Real-Time-Zoom

An original digital processing algorithm allows images to be freely zoomed with the depth-of-field intact, merely by operating the mouse wheel.

Lily (Macro Lens)

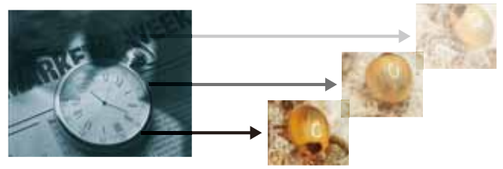
Easy Report Writer

The easy report function creates documents with images, data, measurements, comments and diagrams.



Auto Interval Capture Timer

Capture images of objects over a preferred duration. The light source will automatically turn off after the image has been captured to preserve the life of the light bulb.



Custom Menu and Quick F-Keys

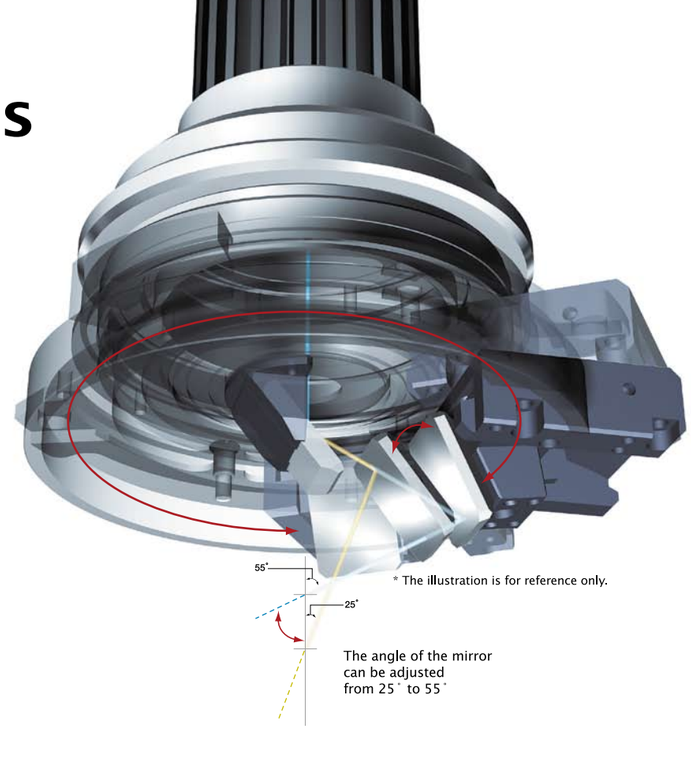
Place the most frequently used icons, chosen from among the multitude of functions, on the custom menu bar. This custom menu can be accessed from the keyboard F-keys or just by clicking.

Quick Capturing and Recording

Just touch the button on the front panel to capture the still image or record a movie.

Superior Optics

Optical 3D Live Image

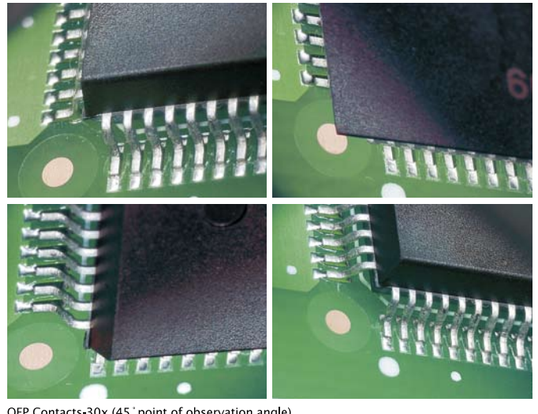


360 Degree View Rotary Head

360 degree rotation of the mirror enables the side of the object to be thoroughly observed. The object shape can be freely ascertained in a limited space and in 3D without the need to tilt the lens, object or make complex focus adjustments.

Easy Control of the Angle, Rotational Direction and Speed

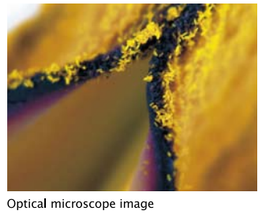
With the variable angle rotary-head, subjects can be captured as desired by operating a 360 degree rotating mirror vertically within 25 to 55 degrees. Rotation direction and speed can are controlled from a simple external interface.



QFP Contacts-30x (45 ˚point of observation angle)
[Conditions of solder application]

High Depth of Field and Long Working Distance

By pursuing subtle balances, Hirox has been able to accomplish high-resolution images with lenses that have high-depth of field and long working distances. Excellent color reproduction allows objects to be captured faithfully compared to the original state.



Optical microscope image

Hirox digital microscope image

Working Distance (WD)

The 2016 series has a maximum zoom of 160x at 44 mm (WD).
The 5040 series has a maximum zoom of 400x at 54 mm (WD).
The 10C series has a maximum zoom of 7000x at 3.4 mm (WD).

Superior Hardware

Observing True-To-Life with High Repeatability

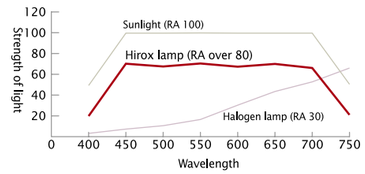
Light Source

The new metal-halide lamp features high color reproduction and long service life. With a high performance color temperature of 5460K, this lamp is indeed the optimum light source for state-of-the-art digital microscopes.

High Frame Rate - 30 f/s DFM

Image output of 15f/s, considered the limit in video observation, is now exceeded. Both high-definition images and ambience can be achieved thanks to the double-flip mode (DFM), which uses a newly developed custom IC to enable image output equivalent to 30f/s.

Spectral Distribution Graph



Hirox Lamp
(60 W metal halide lamp SH-SL7)

User Mode

All of the camera setup information can be recorded and repeatedly selected by registering parameters as a user mode. To repeat those parameters select the user mode on the front panel.

Applications

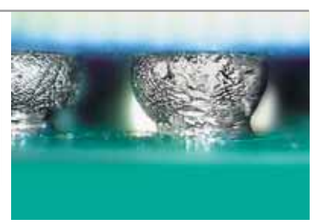
Sample Images

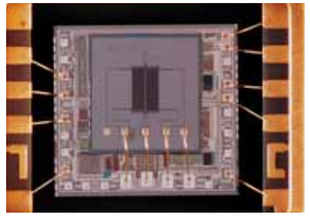
Covering a wide range of applications for the demands of numerous industries.

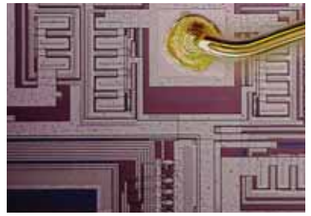
Electric/Electronics

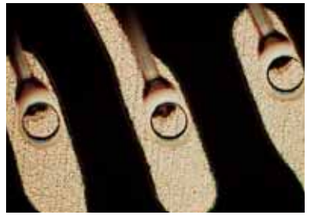

GFP (150x)


Electronic Component (100x)


BGA Ball (150x)

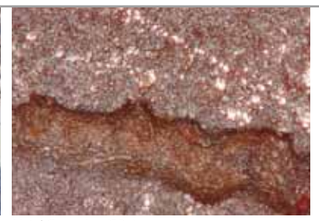

IC Package (100x)


IC Package (1000x)

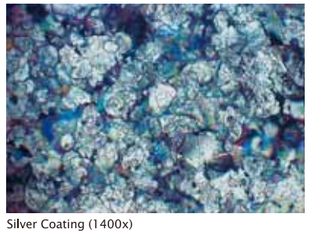

Wire Bonding (2000x)

Material/ Metallurgical


Metallographic Structure (700x)


Metal Corrosion (50x)


Fatigue Fracture (20x)


Silver Coating (1400x)

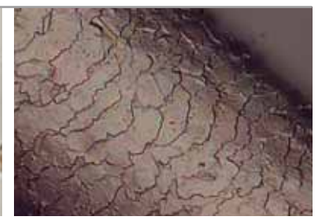

Section Fatigue Crack (50x)


Metallic Organization (2000x)

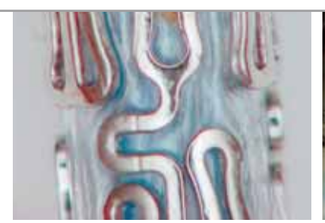
Organism/ Healthcare

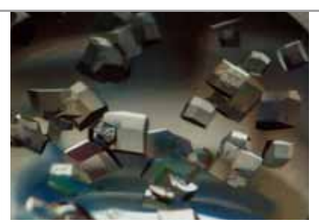

Mouse Fetus 10.5 Days after Conception (150x)

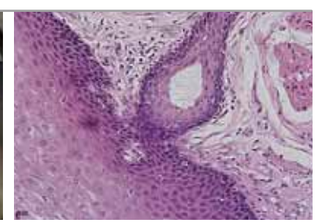

A Fruit Fly (100x) – Split Image


Hair Cuticle (3500x)

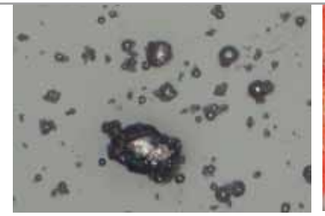
Medical/ Pharmaceutical


Stent (150x)


Protein Crystals (100x)


Smear Cell (2100x)

Forensic

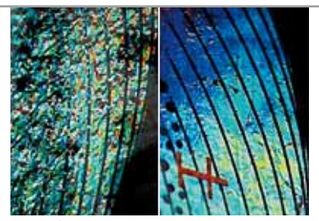

Bullet Powder Residues (1750x)

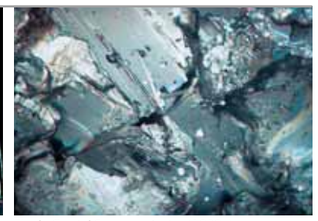

Textile Color Comparison (1000x) – Split Image

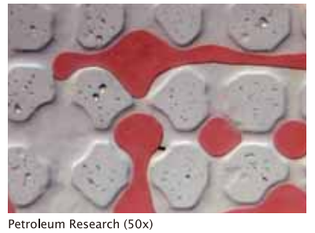

Bullet Shell Comparison (100x) – Split Image

Other Application


Carbon-Based Film (1000x)


Counterfeit Money (350x) – Sprit Image


Single Crystal Superconductor (1000x)


Petroleum Research (50x)


Borne Piece - Archaeology (40x)


Mechanical Watch (100x)

MX Lens Series

Genuine Optical Lenses

High-resolution, high-precision, and high depth of field optical lenses made for everyday measurements. The MX lenses can be used for highly complex 2D and 3D measurements down to the micron level.

High Resolution Macro Zoom Lens

MXG-MACROZ VI /MX-MACROZ VI

0-50x

Multi-functional Macro Zoom lens

This zoom lens can achieve a view of the entire object and a magnification of up to 50x. A light source is integrated into the lens for diverse environments. This lens can be switched from an infinity-5x magnification lens to a 5-50x par-focal magnification lens.

Model		MX - MACROZ VI / MXG - MACROZ VI	
Magnification		∞ - 5x	5 - 50x
mm / inch	View (mm / inch)	∞ - 61 / ∞ - 2.4"	61 - 6.1 / 2.4 - 0.24"
	Working Distance	∞ - 90 / ∞ - 3.54"	90 / 3.55"
ACS Option		N/A	Yes

Low Range High Resolution Zoom Lens

MXG-2016Z /MX-2016Z

20-160x (6-320x)

Compact High-Performance Zoom Lens

This zoom lens has a compact body, provides a high resolution image, and offers a large optical depth of field, and an even larger digital depth of field. It can be handheld and accommodates numerous applications through the attachment of 13 various adapters. The adapters allow an entire magnification range of 6x to 320x.

Model		MX - 2016Z / MXG-2016Z		
Adapter		Normal	Low	High
Magnification		20 - 160x	6 - 48x	40 - 320x
mm / inch	Working Distance	44 / 1.73"	132 / 5.2"	20 / 0.79"
	Horizontal View	15.4 - 2.0 / 0.61 - 0.08"	50.8 - 6.35 / 2 - 0.25"	7.62 - 0.95 / 0.3 - 0.04"
Depth of Field*		13.3 - 0.25 / 0.52 - 0.01"	170.45 - 4.20 / 6.71 - 0.17"	3.02 - 0.10 / 0.12 - 0.04"
ACS Option		Yes		

*This is optical depth of field, digital depth of field is more than 34 mm

Middle Range High Resolution Zoom Lens with Optical 3D Rotation

MXG-5040RZ (SZ) /MX-5040RZ (SZ)

50-400x (20-800x)

Universal Type Zoom Lens Equipped with a Wide Range of Adapters

This high-performance lens can be equipped with a wide selection of optical adapters. Attaching the rotary head adapter achieves 360° - 3D image detection. The various exclusive adapters snap-on, allowing one-touch replacement and a magnification range that expands observation from 20 to 800x.

Model		MX - 5040RZ (SZ) / MXG-5040RZ (SZ)		
Adapter		Normal	Low	High
Magnification		50 - 400x	20 - 160x	100 - 800x
mm / inch	Working Distance	54 / 2.13" (63 / 2.48")	80 / 3.15" (80 / 3.15")	20 / 0.79" (29 / 1.14")
	Horizontal View	6.1 - 0.78 / 0.24 - 0.03"	15.4 - 2.0 / 0.61 - 0.08"	3.05 - 0.39 / 0.12" - 0.02"
Depth of Field*		2.7 - 0.08 / 0.11" - 3.15 mil	16.81 - 0.58 / 0.66 - 0.02"	0.68 - 0.02 / 0.03" - 0.79 mil
ACS Option		Yes		

*This is optical depth of field, digital depth of field is more than 34 mm

High Range High Resolution 10x Co-axial Zoom Lens

MXG-10C /MX-10C

35-7000x

High-level Optical Observation Achieved by Co-axial Vertical Lighting

This zoom lens incorporates high expandability and the highest resolution in the MX series. There are six interchangeable objective lenses. These lenses cover a magnification range of 35 to 7000x. A directional lighting adapter is provided for co-axial vertical lighting to achieve intricate optical observation.

Model		MX - 10C / MXG-10C					
Objective Lens		OL - 35	OL - 70 II	OL - 140	OL - 140 II	OL - 350 II	OL - 700II
Magnification		35 - 350x	70 - 700x	140 - 1400x	140 - 1400x	350 - 3500x	700 - 7000x
mm / inch	Working Distance	34 / 1.34"	21 / 0.83"	30.5 / 1.20"	12 / 0.47"	10.6 / 0.42"	3.4 / 0.13"
	Horizontal View	9.83 - 1.05	4.42 - 0.47	2.46 - 0.26	2.21 - 0.23	880 - 90 um	440 - 40 um
		0.39 - 0.04"	0.17 - 0.02"	0.10 - 0.01"	0.09 - 0.01"	30 - 3.54 mil	20 - 1.57 mil
ACS Option		Yes					

Wide Range Optical Zoom Lens

Hirox MX lenses cover a large optical zoom range and even more than 10x by switching adapters. The par-focal MX lenses retain working distance across the entire zoom range, target and accurate measurement to adjust the best focus point in the low magnification range. This provides efficient operation in finding the target and making accurate measurements, by adjusting the best focus point in the low magnification range.

LCD 140x | LCD 1400x | Metal Cross Section 20x | Metal Cross Section 200x

Highly Compact, Extensive Field of View Macro Lens

MX-MACROZ VI / MT-C16

0-50x 0-20x

Designed simply to support an Incredible field-of-view

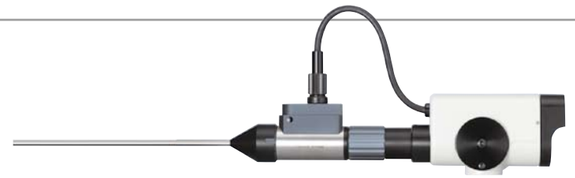
The aperture function varies lighting, and the magnification is correlative with working distance, expanding on available options for macro inspection and image capture.

Model		MX - MACROZ IV
Magnification		0 - 50x
mm / inch	Horizontal View	∞ - 6.1 / 0.24"
	Working Distance	∞ - 21.44 / 0.84"
ACS Option		N/A

Model		MT - C16
Magnification		0 - 20x
mm / inch	Horizontal View	∞ - 15.4 / 0.61"
	Working Distance	∞ - 26 / 1.02"
ACS Option		N/A

Straw-scope Lens

MX-STZ Lens



For areas that only straw-scopes can reach

The straw-scope lens allows observation in congested areas. The sleeve is designed with independent optical and lighting systems to achieve an outstanding resolution impossible for existing optical straw-scopes. Additional optical magnification allows the image to be rectangular instead of circular.

Model	MX - STZ / AD-STL	25-128	40-120	40-245	58-135	58-275
mm / inch	Outer Diameter	2.8 / 0.11"	4.0 / 0.16"	4.0 / 0.16"	4.0 / 0.16"	5.8 / 0.23"
	Effective Length	125 / 4.92"	120 / 4.27"	245 / 9.65"	135 / 5.31"	275 / 10.83"
	Direct View	0°				
	View Angle	40°				
	Adapter View Angle	90°				
	Adapter Diameter	3.05 / 0.12"	4.5 / 0.18"	4.5 / 0.18"	6.3 / 0.25"	6.3 / 0.25"

Differential Interference Contrast (DIC) Zoom Lens

MX-180DIL

180-330x (180-1300x)

Designed exclusively to facilitate lighting control

This zoom lens aids in both illumination control and observation with both a polarizing and a differential interference slider. The slider is angle adjustable and facilitates observing images of differential interference. The polarizing adapter suppresses reflection.

Model		MX - 180DIL	
Objective Lens		OLD-1833	OLD-7013
Magnification		180 - 330x	700 - 1300x
mm / inch	Horizontal View	1.74 - 0.87 / 1.74 - 0.07"	0.44 - 0.21 / 0.02 - 0.01"
	Working Distance	21.5 / 0.85"	11 / 0.43"
ACS		No	

Various Optical Lighting Adapters

Advanced Lighting Techniques

Acquire various views of the object using our original optical adapters.

Variable Angle Lighting Adapter

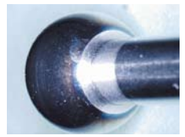
This adapter varies the lighting angle from vertical to lateral. There are many examples where invisible objects became visible by changing the lighting angle. It is possible to easily create an optimum lighting angle to match the same desired point on the object. This is effective for detecting scratches, burrs and blotches.

25 cent coin-20x
[Vertical lighting]

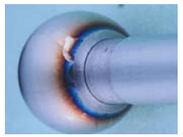
25 cent coin-20x
[Lateral lighting]

Diffuse Lighting Adapter

Produces diffused and soft illumination in every direction by reducing the directionality of the light. This adapter reduces strong reflections, so that the light is even, allowing clear observations of metallic surfaces without halation.



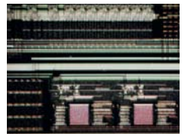
Ball joint-40x
[Vertical lighting]



Ball joint-40x
[Diffuse lighting]

Co-axial Lighting Adapter

Intensely reflective or highly polished surfaces, when observed through lighting that is parallel with the lens axis, can be difficult to ascertain and inspect. With this adapter the light is reflected perpendicular to the lens axis, a great deal of information can be gathered contrary to the previous lighting method.



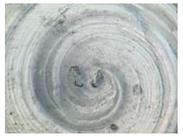
IC pattern-1400x
[Dark field lighting]

IC pattern-1400x
[Bright field lighting using coaxial lighting]

Co-Axial Directional Lighting Adapter

Understanding the standard method of Co-axial lighting, Hirox designed this adapter in order to improve the user's control of the light even further. In comparison with standard high-resolution bright field images this adapter can help clearly identify shapes on extremely microscopic surfaces.

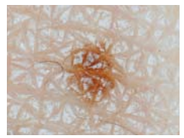
Bottom of a can-250x
[Vertical lighting]



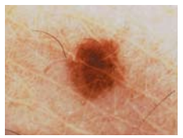
Bottom of a can-250x
[Co-axial directional lighting]

Polarizing Adapter

Natural light waves oscillate in all directions whereas polarized light has only one direction. This adapter's polarizing filter is specialized to change the multi-directionality of natural light wave patterns and hones them to eliminate surface reflection and aid in the analysis of surface colors sensitive to this type of lighting.



Freckle-50x
[Lateral lighting]



Freckle-50x
[Polarized lighting]

Differential Interface Contrast

The prism adapter can be used to separate linear polarized light into two rays of polarized light that can more easily penetrate on object requiring this type of observation. The differing optical paths of the polarized light rays, in response to the phase contrast, can detect shading interference. Depending on the difference in wavelengths of the optical paths, a single shading streak on the brightest and darkest parts of the object's height difference can be observed over one hundred nanometers.

Indentations of LCD conduction poles -200x
[Bright field lighting]

Indentations of LCD conduction poles -200x
[Differential interference]

BGA Inspection

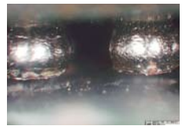
Easy and Accurate BGA Exterior Observation

Inspect the shape of all the components

The mode-switch ring changes from normal to wide mode enabling not only detailed observation of the BGA, but also confirmation of surrounding component integrity.

Exterior analysis clearly identifies defects

Over extended preheating has caused ball oxidization from non-melted and deteriorated flux.



Outer pressure has caused detachment. Unfavorable junctions as well have caused detachment from the land itself.

The result of an over abundance of heat from the upper heater is the cause of warped parts and balls that are extended with non-uniform halation from the bottom.

Over extended preheating can once again be attributed this time to flux deterioration resulting in non-joined solder and balls.

Prism chip structure	Soft spring structure for protecting substrates
Prism adaptation width	0.9mm
Observation angle	90 degrees or higher
Illumination methods	Optical multi illumination
magnification	100 - 180x power *1
Operational distance	0.9 - 8.0mm *2
Weight	695g
ACS	No

*1: Mode Switch Ring set to 'Normal' magnification.
*2: Distance from the Prism tip to the BGA ball.

Easy Operation

3 rings provide image focus, top and bottom inspection, and wide or normal view.

Optical rotary Ring

Rotating the ring changes observation angles. Without moving the lens and substrates, it enables detailed analysis of upper and lower joint parts of the BGA ball.

Points of contact
for BGA upper parts.

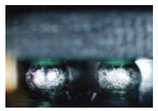
Points of contact
for BGA lower parts.

Focus Ring

Rotating the ring facilitates focusing on the BGA.

Mode Switch Ring

Rotating the ring switches the observation range without changing the distance from the lens to BGA and allows confirmation of parts warpage and uplift on mounting substrates.



Illumination-attached prism chip

A 45° prism mirror helps view the BGA ball from the side. This prism chip serves the role of a light guide, and enables bright, high-resolution observation even on a concentrated substrate.

ST-G Stand Series

Stress Free Observation System

High Precision Straight Stand

A high performance lens only shows its power when it is operated. It is the stand that connects the lens to the operator's hand, meaning that the stand must have a high level of precision and be easy to use.

Lock Lever

Even when a big height change is required, the moving of the focus block can be done with only a touch, thanks to the newly adopted handle-based operation.

[Cable Holder]

Cable Holder

Tightly secures cables to eliminate fine vibrations.

[Coarse micromotion dial]

Dynamic Focus

85mm (3.35") travel range focus block with 2um precision

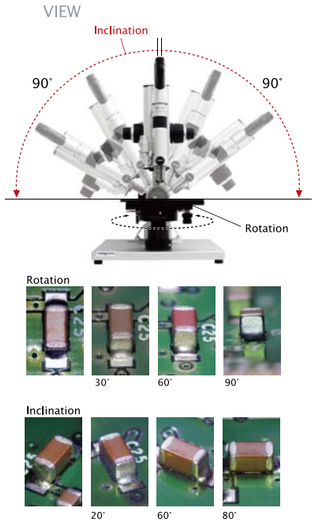
[Stage]

Vibration Absorber

Specialized material reduces a wide range of vibrations.

High Precision Free Angle Stand

Now the operator is free to choose 180 degrees of inclination and 360 degrees of stage rotation for target observation up to 3500x. Combined with the option of the Electronic Focus Block for 3D observation and height measurements; the ST-GA is undoubtedly Hirox's most versatile stand to date.



[Base]

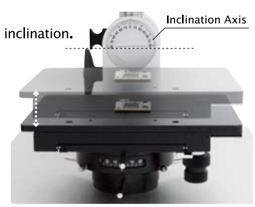
Structured Stability

Weight distribution designed to eliminate vibration and specialized material reduces a wide range of vibrations.

[Angle stage]

Stage Z-Movement

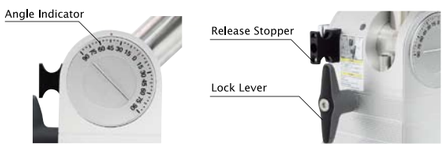
Easy Z-axis movement allows stress free inclination.



[Control Part]

Angle Adjustment

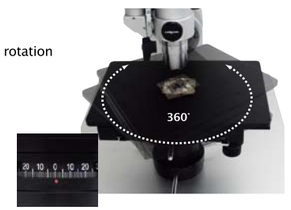
Inclination Safely Stop at 45˚, 60˚, 90˚ and any angle within 180 degree can be secured with the lock lever.



[Stage]

Flexible Operation

Reach unattainable angles with 360˚ rotation



KH-7700 System Line Up

System Configuration

An extensive lens adapter line up and the connectivity of peripheral devices make it easy to build customized configuration.

MX-MACROZ VI/MXG-MA
0-50x macro lens

MX-2016Z/MXG-2016Z
20-160x zoom lens

MX-5040RZ/MXG-5040RZ※
50-400x zoom lens

MX-5040SZ/MXG-5040SZ
50-400x zoom lens

MX-10C/MXG-10C
Co-axial 10x zoom lens

MX-MACROZ IV
0-50x macro lens

MT-C16
0-20x macro lens

MX-BGAZⅡ
BGA lens

MX-STZ28-125
Straw-scope lens
ϕ2.8~5.8mm L125~275mm

MX-180DIL
180-330x Differential interference lens

■ included accessories.

■ **AD-2016H**
Non-contact adapter

■ **AD-2016S**
Variable Angle Lighting Adapter

■ **AD-2016SV**
Contact adapter

AD-2016LOW
Low magnification adapter

AD-2016HI
High magnification adapter

AD-2016SL
Laser slit light adapter

AD-2016LOWR※
Low magnification rotary head

AD-2016L(S/L)
Side view adapter

AD-2016D
Diffuse lighting adapter

AD-2016HIS
High magnification variable angle adapter

AD-2016P
Polarizing adapter

AD-2016C
Co-axial lighting adapter

AD-2016RLD
Diffuse lighting adapter for rotary head

AD-2016RLM※
Rotary head

■ **AD-5040HS**
Non-contact adapter

AD-5040DS
Diffuse lighting adapter

AD-5040SVS
Contact adapter

AD-5040LOWRS
Low magnification rotary head

AD-5040HIRS
High magnification rotary head

AD-5040RVS
Variable angle rotary head

AD-5040RVD
Diffuse lighting adapter for rotary head

AD-5040LOWS
Low magnification adapter

AD-5040HIS
High magnification adapter

AD-5040SS
Variable angle lighting adapter

AD-5040SHIS
High magnification variable angle adapter

AD-5040CS
Co-axial lighting adapter

AD-5040PS
Polarizing adapter

AD-5040SLS
Laser slit light adapter

AD-5040SD
Snap-on adapter

■ **AD-5040H**
Non-contact adapter

AD-5040LOW
Low magnification adapter

AD-5040HI
High magnification adapter

AD-5040SHI
High magnification variable angle adapter

AD-5040VLS
Lift off adapter

■ **AD-10S**
Directional lighting adapter

AD-10P
Polarizing adapter

AD-10R
Optical rotary adapter

HS-CHv7
Lens Holder

CT-1
Moter controller

*Controller for the MXG-5040RZ, MX-5040RZ, AD-2016LOWR, AD-2016RLM

OL-35
35-350x object lens

OL-70Ⅱ
70-700x object lens

OL-140/OL-140Ⅱ
140-400x object lens

OL-350Ⅱ
350-3500x object lens

OL-700/OL-700Ⅱ
700-7000x object lens

NR-405-OL
Fiber ring lighting for MX and MXG-10C

R-OL-D
Ling light Diffuser

NR-405-M4
Fiber ring light for MX/MACROZ IV

AD-BGA BL
Backlight

AD-STL28-125
Side view adapter

Other
ϕ3.0~6.0mm L125~275mm

OLD-7013
700-1300x Objective lens

ST-G SERIES
STAND

High Precision Straight Stand
·High precision vibration free stand
·High Precision Focus Block

Motorized Z-Axis Straight Stand
·High precision vibration free stand
·Motorize Z-Axis with High Precision Focus Block

STAGE·UNIT

XY Stage Unit
·XY Stage
·Rotary XY Stage Base

Transmit Lighting XY Stage Unit
·XY Stage with Glass Plate
·Transmit Lighting XY Stage Base
·Light Source Guide for XY-CB

Hight Precision Free Angle Stand
·Base board ·pole part high precision block
·XY stage block

Motorized Z-Axis Free Angle Stand
·Base board·pole part Electrically operated block
·XY stage block

STAND·STAGE
STAND

Standard light-weight stand
ST-HE

Large Size Stand
ST-HL

Stand for BGA
ST-HK

STAGE·UNIT

XY Stage
AS-XY

Large XY Stage
AS-XYL

BGA Substrate holder
AS-BH

KH-7700 Ver.2.0

Specifications

Specifications (Basic Functions)

Camera	Imaging Device	1/1.8-inch, 2.11 Mega-pixel CCD Sensor
	Scanning Mode	Progressive Scan
	Total Pixels	2.11 Mega-pixels 1688 (H) x 1248 (V)
	Effective Pixels	2.01 Mega-pixels 1688 (H) x 1236 (V)
	Visual Pixels	1600 (H) x 1200 (V)
	Frame Rate	30 Frame (15 fps, double buffer method)
	Maximum Pixel Resolution	30 Mega-pixels 6400 (H) x 4800 (V),
	Electronic Shutter	AUTO, MANUAL (1/15000, 1/8300, 1/5800, 1/4400, 1/3600, 1/2500, 1/1000, 1/500, 1/250, 1/125, 1/60, 1/30, 1/15)
	Supercharge Shutter	1/7.5, 1/4, 1/2, 1, 2, 4, 8, 16
	Gain	Auto, Manual, OFF
	White Balance	Auto, Manual (R, B)
	Image Adjustment	Gamma Correction, Color Correction, Edge Enhancement
	Camera Cable Length	2 Meter (option: up to 10 meter extension)
	Back-Focus Adjustment	Not Required
LCD Monitor	Display Size	15" LCD Monitor
	Panel Size	11.99" (H) x 8.99" (V) - 304.5 (H) x 228.4 (V) mm
	Pixel Pitch	0.008" (H) x 0.008" (V) - 0.1905 (H) x 0.1905 (V) mm
	Number of Pixels	1600 (H) x 1200 (V) (UXGA)
	Display Color	Approx. 16,770,000 colors
	Brightness	200cd/m2 (typical)
	Contrast Ratio	500:1 (typ)
	Viewing Angle	170˚ [H], 170˚ [V] (type)
Light Source	Lamp	60 W Metal Halide Lamp
	Lamp Life	4000 hours (average)
	Color Temperature	5500±100K (at maximum light intensity)
Output	Analog RGB output	UXGA, SXGA, XGA
	Printer Output	USB 2.0 (B type), PictBridge
	Remote Control	RS-232C Connector
Input	ACS Terminal Input	ACS Sensor (10 pin connecter)
	Mouse and Keyboard Input	USB 2.0 (Type A)
	External Remote Input	Freeze / Capture Image (6 pin connecter)
	Microphone Input	MIC jack
Interface	LAN	10BASE-T/100BASE-TX/1000BASE-T
	USB Ports	USB 2.0 (Type A) x 6
Hard Disk Drive	Storage Capacity	160 GB Hard Drive (including 40GB reservation area) Approx 575,000 Images (compressed images) to Approx 19,000 Images (not compressed images)
Recording Devices	Speed	24x Write, 10x Re-write, 24x Read
	Used Disk	CD-R/RW, DVD±R/+R DL/±RW/-RAM
Image Format		Exif-JPEG (compressed), Exif-TIFF (non-compressed), BMP (non-compressed)
Maximum Image Pixel Size		10000 Pixels (H) x 10000 Pixels (V) (Tiling image)
Power Supply	Rated Voltage	AC100~240V, 50/60Hz
	Power Consumption	250W
Environmental Resistance	Ambient Temperature	5˚ C to 40˚C (no freezing or condensation)
	Storage Temperature	-15˚ C to 50˚ C (no freezing or condensation)
	Relative Humidity	25 to 85% RH (no condensation)
	Atmosphere	Corrosive Gas Prohibited
Weight	Main Unit	Approx. 12 kg
	Camera	Approx. 1 kg
Size	LCD Close	16.43" (W) x 6.06" (H) x 13.51" (D) - 417.4(W) x 154(H) x 343.1(D)mm
	LCD Open	16.43" (W) x 6.06" (H) x 16.91" (D) - 417.4(W) x 429.6(H) x 343.1(D)mm

Optional Motorized Z-Axis Specifications

Z-Axis Step Motor	Model	FB-E and CT-7
	Stage Stroke Distance	30 mm (1.18")
	Resolution	0.05 um (0.002 Mil) / pulse
	Repeatability	0.5 um (0.23 Mil)
	Weight	Controller: 1.36 kg, Step Motor: 1 kg

[Compliance with the RoHS Environmental Protection Program]

Hirox is compliant with the [RoHS Directives] based on the fundamental principals and plan stated below. These directives regulate goods manufactured after October 2006 that use hazardous substances that have an adverse affect on the environment or human life.

■ Fundamental Principles: Recognizing that preservation of the environment is the greatest problem facing the human race, Hirox is working with all of its divisions to reduce its environmental impact.

■ Plan: In order to reduce the environmental impact of all manufacturing and consumption practices related to the production and sale of our digital microscopes as well as future products and services, Hirox is pursuing an environmental management program striving to achieve harmony with the environment.

RoHS Directive: Known as the "Directive for the reduction of the use of certain hazardous substances in electrical and electronic equipment." It is effective in all areas of the EU. The use of the following six hazardous substances in electrical and electronic equipment is regulated: Pb (lead), Cd (cadmium), Hg (mercury), hexavalent chrome, PBB (polybrominated biphenyl), and PBDE (polybrominated diphenyl).

Specifications (Numerous Functions)

Observation Settings	Camera Preview Function (displays eight automatically adjusted image previews)
	Individual Camera Preview
	Camera Image Settings
	Mode Function (save camera settings)
	Auto Calibration Select (ACS) (zoom mag is automatically relayed to the system)
	Edge Enhancement Function (OFF, 7 levels)
	Edge Filter Size Setting (4 levels), Edge Circuit ON/OFF
	Hue Correction (7 levels), Chroma Correction Setting [5 levels]
	Gamma Correction
	Contrast Settings
	Live Anti-Halation Mode
	Brightness Level (0-127 Levels)
	Chroma ON/OFF
	Lamp ON/OFF
	Auto White Balance
Observation Tool Observation Controller	Handy Synthesis (quick extended depth composition)
	Multi Focus (fully automatic, semi automatic, manual)
	Depth Composition: AMF3D merge function: Auto Multi-focus 3D Merge function
	Depth Composition: APS function: Auto-Positioning function
	Real-Time Digital Zoom
	Focus Control (auto Z-axis controller)
	Focus Indicator
	Library Management
	Lighting
	2D and 3D Display
	List Display
	Super High Dynamic Range (S-HDR) Function
	Anti-Halation Function
	Noise Reduction Function
	High Contrast Mode
	2D Image Tiling Function
	3D Image Tiling Function
	Movie Image Recording (640x480~1600x1200)
	High Resolution Image Capture (4 levels)
	Grid Settings (Various Functions are available)
	Timer Recording Function
	Image Adjustment (contrast, edge enhancement, noise reduction, binarizing)
	Custom Tool Bar and Quick Function Key
	Image Comparison
2D Measurement Function	Distance, Angle, Radius, Diameter, Area, etc.
	High Resolution Measurement
	Auto Calibration (Auto / Manual)
	Calibration Data Protection
	Automatic Measurement Function
	Automatic Edge Detection
	Scale Display (Various Functions are available)
	List Display
	CSV output
	Image Data Parameter
3D Measurement Function	Auto-Focus Control
	3D Profile (Cross-section) Measurement
	Anti-Halation 3D Model
	S-HDR 3D Model
	3D Image Map CSV Output
	3D Height Texture / Wireframe / Rainbow Display Function
	Height Difference Measurement Function
	Focus Point Memory Function
	2D Image Height Measurement
	Selection Profile (Height, Length, Angle, Radius etc.)
	3D Illumination Simulation Function
	Display Height Information in Real-Time
	3D Volume Measurement
Display	Split Monitor (Top/bottom, right/left, 4/9/16 window splitting)
	Turning Over, ±90 Rotation
	Grid, Scale Display
	Display Date
	Comments, Graphics Display
	Display Image Information
Utility	Soft Keyboard and External Keyboard
	Easy Report Writer
	Microphone Control
	System Settings
	Time Setting
	Volume and luminance Adjustment
	Network Settings
	Compatible with a Foot Switch
	Language Setting (English, Spanish, German, French, Italian, Japanese)
	Help (Pop-up User Guide)
	Version Information
	Pict Bridge Print
Additional Software for PC	Free 3D Image File Viewing Software