

**Mitutoyo**



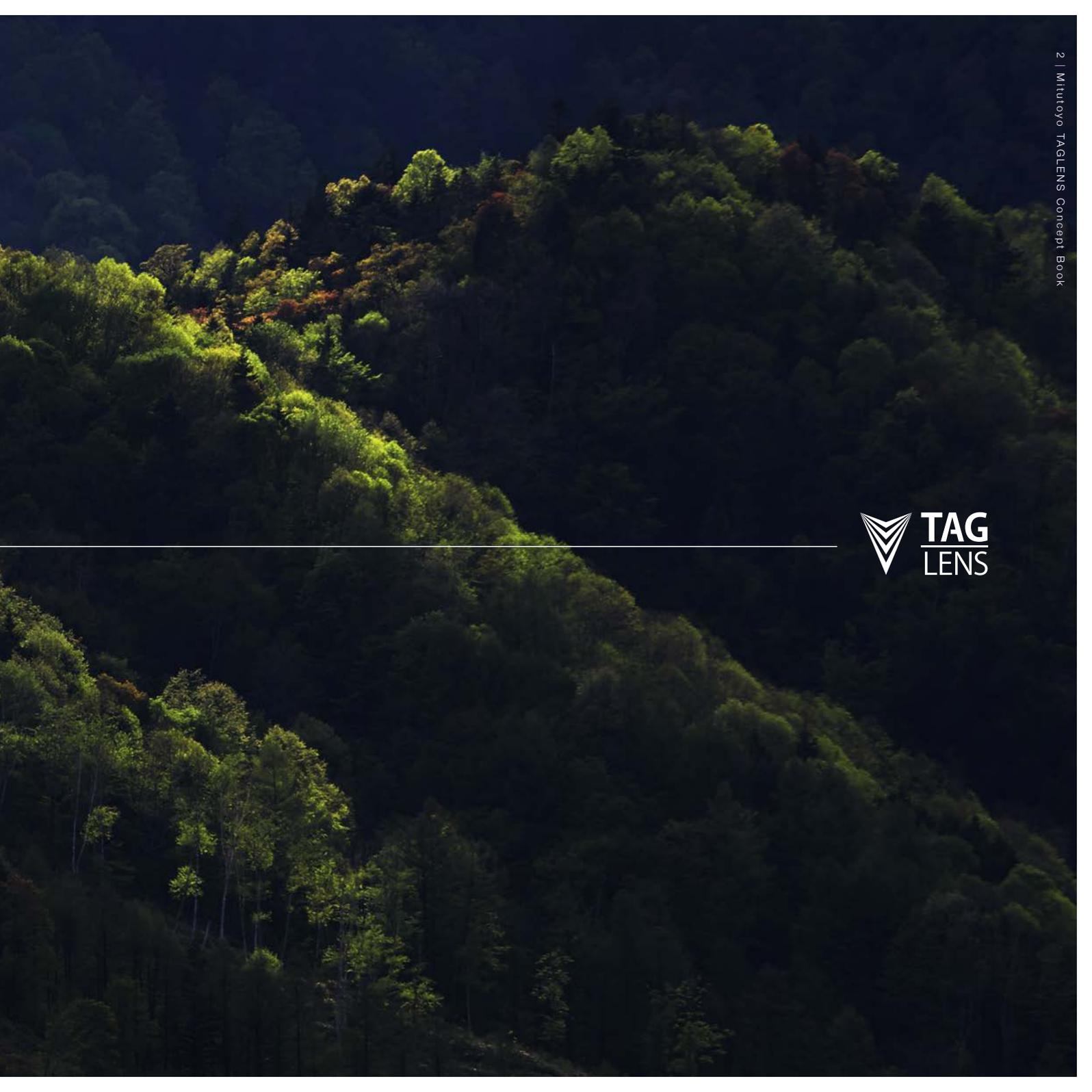
Revolutionizing the concept of focal points, a groundbreaking varifocal lens





# Look at the Trees and See the Forest

Ultra-high-speed, focusing not just at a single focal length, but at a wide range of focal lengths. Everything—even multiple subjects at different distances—in crystal clear focus. An astonishing world waits beyond the TAGLENS, full of wonders that no-one has seen before. In addition to immediately available applications such as circuit board inspection on production lines, TAGLENS offers innovative visual sensing in a range of fields, including factory automation, logistics, development of new materials, biosciences and medicine, environmental initiatives, and security. This innovative lens improves productivity and reduces cost, opening up new business possibilities for our customers.



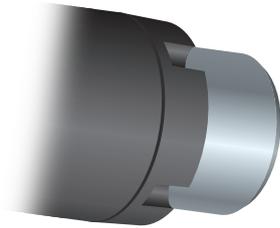
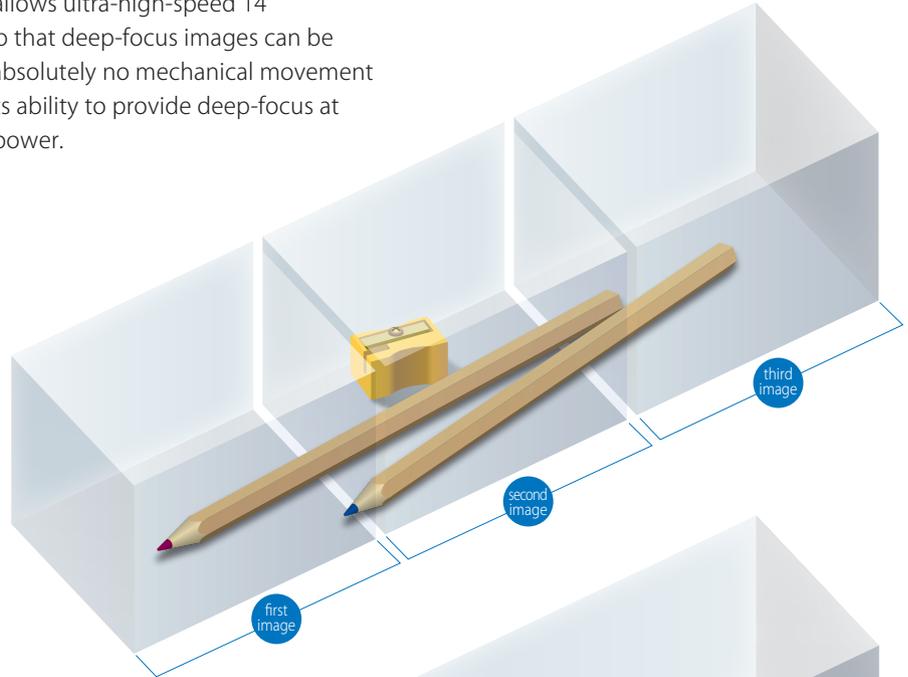
# Acquire an Image at All Focal Lengths Instantaneously

Adding TAGLENS to a conventional lens allows ultra-high-speed 14 microseconds changing of focal length so that deep-focus images can be obtained in real time. TAGLENS requires absolutely no mechanical movement when scanning, and is characterized by its ability to provide deep-focus at the desired magnification and resolving power.



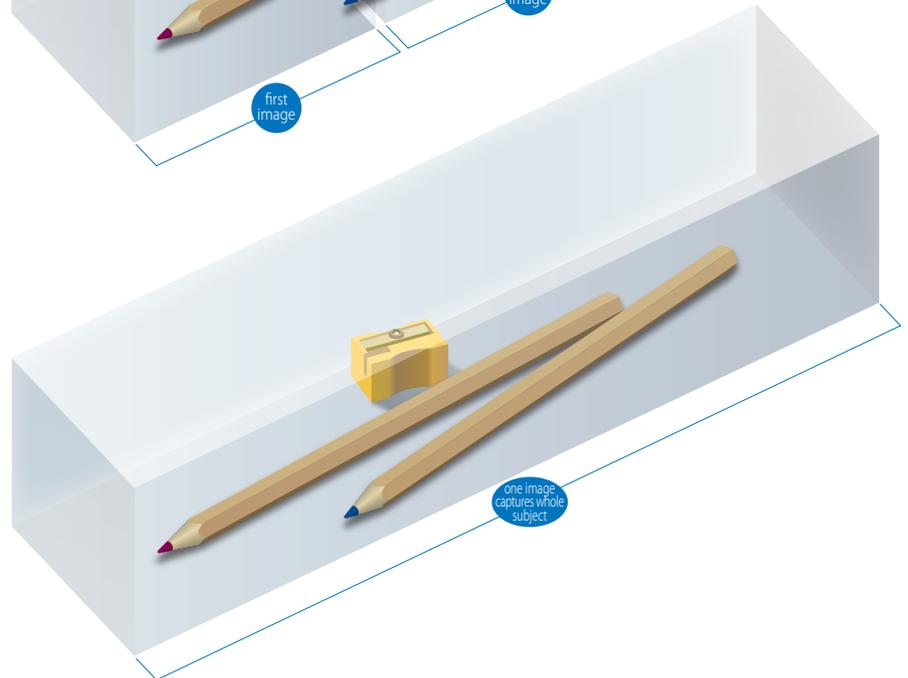
## Conventional lens

The focal depth is limited, thus several images must be captured to cover the subject.



## TAGLENS

Acquires an image at all focal depths covering the subject instantaneously.



**TAGLENS OFF**

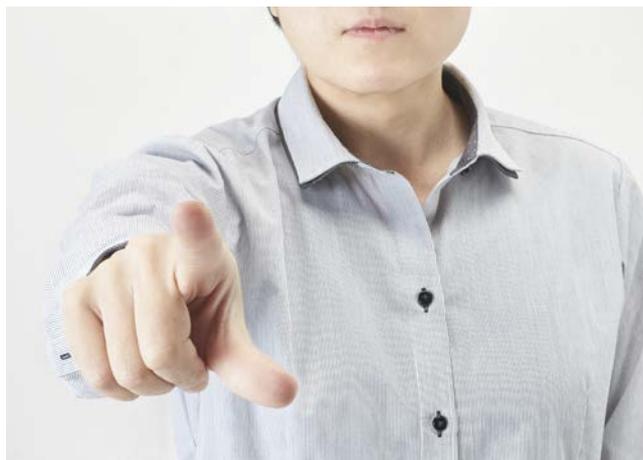
Shallow depth of field means that the parts other than the tip of the nearest pencil is out of focus.

**TAGLENS ON**

All areas of the image, such as the lead in the pencil at the front and the pencil sharpener in the rear, are in focus despite being at widely different distances from the objective lens.

**TAGLENS OFF**

For images with deep depth of field such as photographs of people, it is impossible to focus on both the fingers and face at the same time.

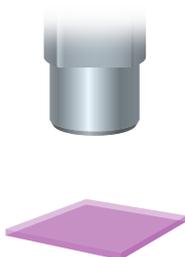
**TAGLENS ON**

Information on finger and faces can be obtained simultaneously.

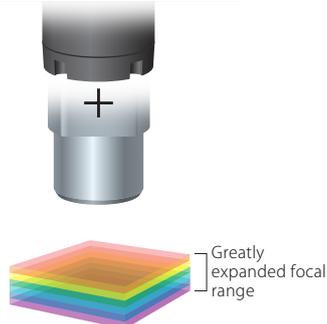
# No Autofocus or Z-axis Power Unit Required

## Reduced focusing time

During normal focusing



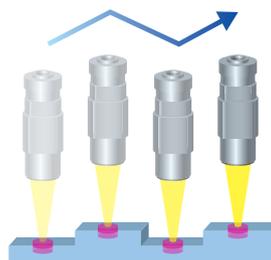
When using TAGLENS



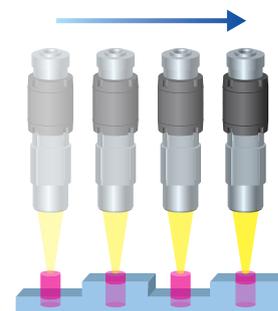
Using TAGLENS allows the focal range of conventional optical systems to be greatly expanded, eliminating the need to use multiple cameras or an autofocus unit. TAGLENS reduces autofocus time and helps to improve throughput for inspection equipment.

## Focal point range is changeable without Z-axis power

During normal focusing



When using TAGLENS



Until now, imaging for subjects with differing heights and depths was performed by taking multiple photographs while moving the camera vertically (Z-axis motion). In contrast, TAGLENS is able to focus on subjects with different heights and depths simultaneously, and can be used on production lines where products are in motion.



# A Design That Can Be Integrated with Existing Equipment Easily

The TAGLENS controller has a compact design that makes it easy to integrate with existing equipment. In addition to the standard software, TAGLENS also comes with SDK (Software Development Kit) files, Integration with customers' own software.

## TAGLENS-T1



TAGLENS main unit + Controller + Software

Operating principle	Variable refraction index
Resonance frequency	70 kHz
Effective opening diameter	ø11 mm
Transmittance	90%(for $\lambda = 400\sim 700$ nm)

## Video Microscope VMU-T1



Video microscope for TAGLENS-T1

Compatible TAGLENS	TAGLENS-T1
Imaging lens magnification	1X
Imaging area	ø11 mm
Applicable objective lenses	M Plan Apo series
Options	Manual turret, motorized turret, polarization unit, focusing unit, XY stage, simplified stand

	M Plan Apo Series						
Objective lens	1X	2X	5X	7.5X	10X	20X	50X
Depth of focus $\times 2$ (mm)	0.88	0.18	0.028	0.012	0.007	0.003	0.0018
Total scanning width (mm)	16	4.0	0.64	0.28	0.16	0.040	0.007
Real FOV (mm)	1/2 inch camera 2/3 inch camera	4.8 $\times$ 6.4 2.4 $\times$ 3.2	0.96 $\times$ 1.28 1.32 $\times$ 1.76	0.64 $\times$ 0.85 0.88 $\times$ 1.17	0.48 $\times$ 0.64 0.66 $\times$ 0.88	0.24 $\times$ 0.32 0.33 $\times$ 0.44	0.096 $\times$ 0.128 0.132 $\times$ 0.176



# ∞ × TAGLENS

Different distances to the subject, tilted subjects, moving subjects, multiple ghost images of the subject... delivering clear focus across the entire image in an instant, even in situations which would always have caused blurring before, TAGLENS is a capable means of improving efficiency and reducing cost. The following is a sample of the potential hiding within this powerful tool.

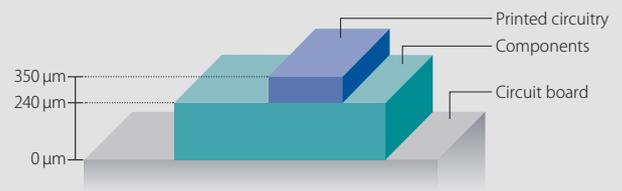
## Performs high-speed inspections



TAGLENS allows instantaneous, accurate checking of multiple subjects with different heights to be focused correctly, which have conventionally been checked by moving the camera vertically, since focal lengths differ.

### Flaw inspection

Incorporating TAGLENS into a microscope allows it to be used for PCB flaw inspection, for example. There are three aspects to PCB inspection: the circuit board, the printed circuitry and the electronic components, which normally require multiple image captures while adjusting the lens' z position. In comparison, using TAGLENS for inspection allows multiple subjects with different heights to be focused correctly, thus requiring only a single image capture, and reducing inspection time significantly.



## Acquires a large amount of information in a single image



In locations such as airports where large numbers of people gather, TAGLENS is able to focus clearly on the faces of all people shown by the lens, allowing clear identification of people who merit special attention.

## Deep depth of field, even in the microscopic world



Mounting TAGLENS on a microscope allows in-depth, accurate comprehension of moving organisms at different positions and focal lengths.

## Always in focus, even when in motion



Attaching TAGLENS to a robot and filming at high speed allows sites to be checked with images that are constantly in focus, even when moving over uneven locations.

## Even moving subjects stay in focus



Use TAGLENS for automatic driving, so that all moving objects in front of the vehicle, such as cars and people, stay in focus, allowing reliable monitoring of the vehicle's intended path.

# SERVICE ENGINEERING

Mitutoyo offers total support for its products and peripherals at every step, from proposals to delivery and maintenance. We also strive to improve our engineering prowess to allow us to address a broad range of issues encountered by our customers, from technical difficulties to managerial themes.

STEP  
1

## Orientation

Mitutoyo provides an overview of TAGLENS and obtains a basic understanding of customer applications.



STEP  
2

## Demonstration

Mitutoyo performs a demonstration of TAGLENS systems in front of the customer, providing a realistic experience that allows customers to check the images using an actual application sample.



STEP  
3

## Integration feasibility test

Assessment of the effect of TAGLENS through integration with the customer's equipment.



STEP  
4

## Shipping/Delivery

Mitutoyo logistics channels are used to ship and deliver TAGLENS to the customer.



STEP  
5

## Maintenance

Mitutoyo provides consultations on operations and methods for dealing with trouble, replacing parts, etc.



STEP  
6

## Feedback

Evaluation of issues with actual machinery operations and checking of customer needs and satisfaction, etc.



Providing an overview of TAGLENS



Visiting customers for demonstrations



Consulting with customers and checking their needs

# Q & A

We have compiled a collection of frequently asked questions and useful information regarding the use of TAGLENS.



**Q1** Can TAGLENS be fixed at a single intended focal length?

**A1** The TAGLENS focal length changes continuously, and this action cannot be stopped. However, the functions of the sensors inside the TAGLENS body can be used to acquire data at the desired focal length only.

**Q2** What are the approximate optical wavelengths that can be used with TAGLENS?

**A2** TAGLENS is compatible with visible wavelength light. Please contact Mitutoyo if you are considering using TAGLENS for non-visible wavelengths.

**Q3** Is the software used with TAGLENS proprietary to Mitutoyo?

**A3** The TAGLENS software is developed by Mitutoyo. Mitutoyo provides SDK (Software Development Kit) files to customers who purchase our software and are considering integrating it into their equipment. This enables customers to develop and produce their own software.

**Q4** Does the TAGLENS controller also have to be integrated into the customer's equipment?

**A4** In order to run TAGLENS, the controller must be integrated into the customer's equipment. The controller features a compact design that makes it easy to integrate.

**Q5** When using TAGLENS, is it necessary to combine it with a Mitutoyo microscope unit?

**A5** Combination with a Mitutoyo microscope unit is not a requirement, but Mitutoyo does offer the "VMU-T1 Microscope Unit" that can be combined with TAGLENS for immediate use. Please consider it as an option. Additionally, TAGLENS can be used in combination with a variety of optical systems for possible deployment in a diverse range of applications. Mitutoyo will offer assistance with applications under consideration by those interested in TAGLENS. Please ask your local Mitutoyo sales office for further information.



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## Mitutoyo America Corporation

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