Mitutoyo

Mitutoyo Quality

Varifocal Lens
TAGLENS™

Optical Measuring

Catalog No.E14025-US

Mitutoyo

TAGLENS

Ultra-deep focus eliminates the limitations of the conventional lens

Optical imaging can be complicated: observation target distance may vary due to a tilt or complex geometry, target may be in motion, and more than one target may be captured in the frame. In such situations, TAGLENS keeps the entire imaging volume in focus resolving the inevitable problem of the conventional optical systems. Omnifocal shooting provides improved productivity through enhanced imaging efficiency and reduced costs.

TAGLENS-T1

Ultra-high-speed varifocal lens.
A dedicated controller and a control software TAGPAK-C are offered as a standard product.

TAGLENS main unit

Resonance frequency	70 kHz
Effective aperture	ø11 mm
Transmittance	90% or more (λ 400 nm to 700 nm)
Max. amplitude of optical power	1 D (total range 2D)
Min. amplitude of optical power	0.7 D (total range 1.4D)
Mounting angle	Any
Guaranteed operational temperature range	15 ℃ to 30 ℃
Operating Environment / Humidity	10 ℃ to 40 ℃ / 40% to 70% RH (non-condensing)
Storage Environment / Humidity	-10 ℃ to 50 ℃ / 80% RH or less (non-condensing)
Mass	Approx. 0.6 kg

Controller

Dimensions（W × D × H）	144.2 mm × 107 mm × 51.2 mm
Mass	Approx. 0.4 kg
Input	+12V (Attached AC adapter)
Power supply voltage	AC 100 V to 240 V 50 Hz / 60 Hz
Power consumption	Max. 20 W

Video Microscope Unit　VMU-T1

Microscope unit for configuring a varifocal optical system by incorporating the TAGLENS-T1, the objective lens and the camera.

Tube lens magnification	1X
Imaging FOV (diagonal)	ø11 mm
Applicable objective lenses	M Plan Apo Series
Options	Manual turret, Power turret, Polarizer and Analyzer, Focusing unit, X-Y stage, Simple stand

■ Variable focal length range

		M Plan Apo Series						
Objective lens		1X	2X	5X	7.5X	10X	20X	50X
Depth of focus × 2 (mm)*		0.88	0.18	0.028	0.012	0.007	0.003	0.0018
Z scan range (mm)		16	4	0.64	0.28	0.16	0.04	0.007
Real FOV (mm)	1/2" camera (V × H)**	4.8 × 6.4	2.4 × 3.2	0.96 × 1.28	0.64 × 0.85	0.48 × 0.64	0.24 × 0.32	0.096 × 0.128
	2/3" camera (V × H)**	6.6 × 8.8	3.3 × 4.4	1.32 × 1.76	0.88 × 1.17	0.66 × 0.88	0.33 × 0.44	0.132 × 0.176

Note: Not available for M Plan Apo HR 5X and 10X.
* Total in focus range without TAGLENS.
** V: Vertical field of view, H: Horizontal field of view

Illumination light source: Pulsed Light Source (PLS)

In combination with TAGLENS-T1, this ultra-high-speed LED pulsed light source device captures focused images at the desired height as well as focus stacking, etc.
Using this product and TAGLENS software (TAGPAK-C), you can adjust the brightness and focus position.

*1 Lighting frequency: 70 kHz, Input pulse width: 80 ns Light guide: 2 m long, multicomponent glass fiber
*2 Width of emission pulse (Varies with input pulse width)
*3 SMB connector, 5V TTL

Lighting system		Pulsed lighting
Luminous color		White
Maximum light output*1		30 lm
Dimming range		0 to 100 %
Dimming system (Controlled by TAGPAK-C)		1) Variable input pulse width 2) Pulse decimation
Light guiding system		Optical fiber light guide system
Number of optical fiber output channels		1 ch
Pulse input Trigger IN jack	Frequency (resonant frequency of the TAGLENS-T1)	75 kHz or less
	Input pulse width	10 ns to 85 ns
Pulse output	Optical pulse width (full width at half maximum) *2	50 ns to 100 ns
Extenal trigger input *3		• Trigger IN: Periodic signal from the TAG controller Input synchronized pulse signal • Camera IN: Camera trigger signal (as needed)
Interface		USB 2.0
Power consumption		Max. 25W
Operating temperature range		5 to 40 ℃,80 % RH max.
Dimensions		169.2 mm (W) × 133.2 mm (D) × 115.6 mm (H)
Mass		2.7 kg

Custom example: IR compatible
Production of a microscope unit capable of infrared observation, and a pulse lighting unit compatible with highly-transparent infrared wavelengths is also possible.
Wavelength: 1,300 nm
*Please contact Mitutoyo sales office or trading company for details.

Mitutoyo

APPLICATIONS

TAGLENS gives prompt solutions to problems in inspection and observation.
Some application examples using TAGLENS are introduced hereafter.

Inspection of electronic / precision components

Problem

- Inspection time for electronic and precision parts, etc., needs to be reduced.
- Equipment costs need to be reduced.

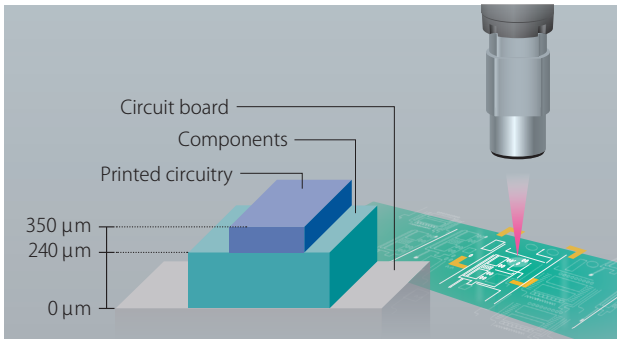
Solution

- A large depth of focus even in a high-magnification observation eliminates the need for focus adjustment, improving the inspection efficiency.
- Eliminates the use of a mechanical auto focus drive unit, achieving cost saving of inspection devices.

Proposed Functions

- EDOF • Auto Focus
- Multi Focus • Focus Stacking • TAGLENS-3D

Example: Semiconductor flaw inspection



Eliminates the need for focus adjustment, thus achieving effective inspection.

High-speed imaging

Problem

- Instantaneous shooting of a crash test results in defocusing of scattered chips.
- Completion with a single trial is needed because of destructive test.

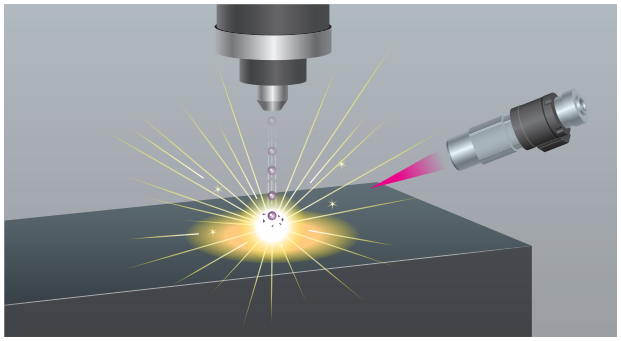
Solution

- Allows shooting of deep images at a time, thus capturing all scattered chips.

Proposed Functions

- EDOF • Focus Stacking

Example: Crash test



The high-speed shooting of a costly crash test is successfully completed at the first attempt thanks to a large depth of focus.

Machine vision

Problem

- Observation target heights and distances require the use of robots, leading to a complex and expensive system.

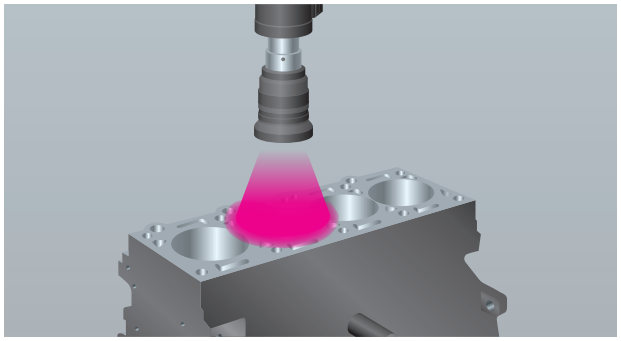
Solution

- Excellent focus expansion effects and long scan range.
- Wide field of view
- Realizes reduced system costs.

Proposed Functions

- Auto Focus • Multi Focus • Mixed Image
- TAGLENS-3D • EDOF

Example: Inspection of large parts for defects



Distant observation is possible with a machine vision lens

Measurement of minute particles and floating matter

Problem

- The 3D positions of particles cannot be captured.
- The deeply-located particles cannot be focused sharply.
- Focus on floating matter in liquids is not possible.

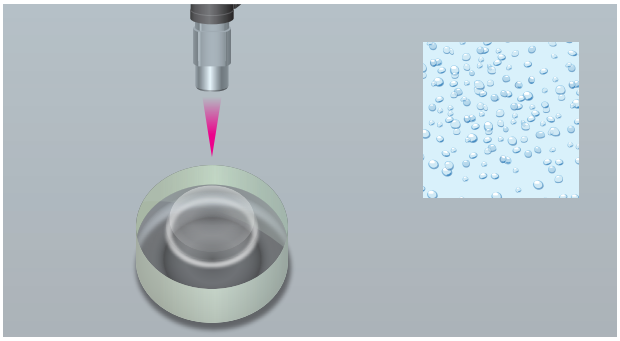
Solution

- Allows all the particles spread in a wide range to come into focus.
- Enables the 3D positions of spatially-moving particles to be determined from each focusing position.
- TAGLENS can be used in microfluidic channels.

Proposed Functions

- Auto Focus • Multi Focus • Mixed Image
- TAGLENS-3D

Example: Observation of minute bubbles in glass / liquid



Absolutely allows observation of target objects with a large depth of focus.

On a robot

Problem

- It takes time to observe a workpiece from various angles with the camera mounted on a robot arm.

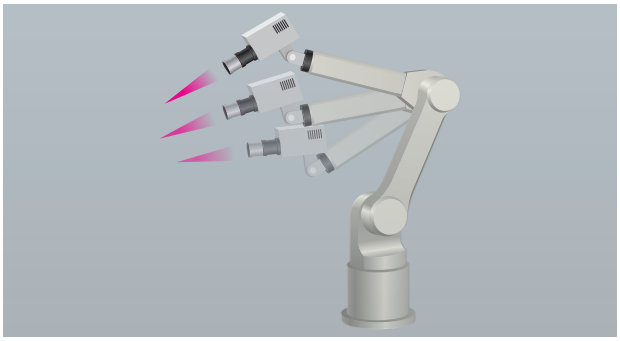
Solution

- The large depth of focus eliminates the need for focus adjustment and allows observation from various angles, thus contributing to time-saving of observation.

Proposed Functions

- EDOF • Multi Focus • Mixed Image

Example: Inspection using a robot.



Allows inspection of a workpiece with the camera mounted on a robot arm.

Measurement of semiconductor alignment *Custom-made product (IR compatible)

Problem

- Large-scale equipment and setup have become necessary for observation and inspection due to the adoption of chiplet systems and multiple layers.

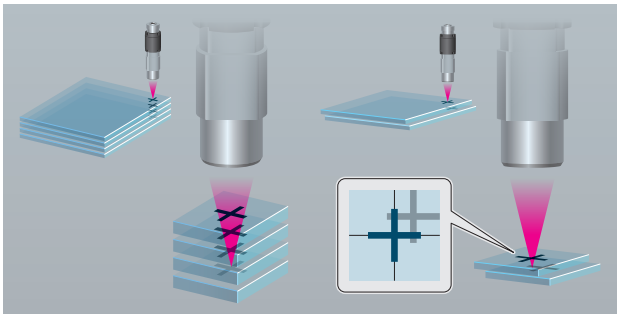
Solution

- Depth of focus can be extended using TAGLENS IR. Large Z observation range images can be obtained easily and at high speed.

Proposed Functions

- Auto Focus • Multi Focus
- Focus Stacking • TAGLENS-3D

Example: Simultaneous observation of alignment marks on different layers (left)
Simultaneous observation of alignment marks when bonding (right)



*This is a custom-made product. Please contact Mitutoyo sales office or trading company for details.

Mitutoyo

ABILITY

TAGLENS, the breakthrough ultra-fast varifocal lens, will always keep your sample in focus, enabling the highest observation and measurement efficiency.

Function List

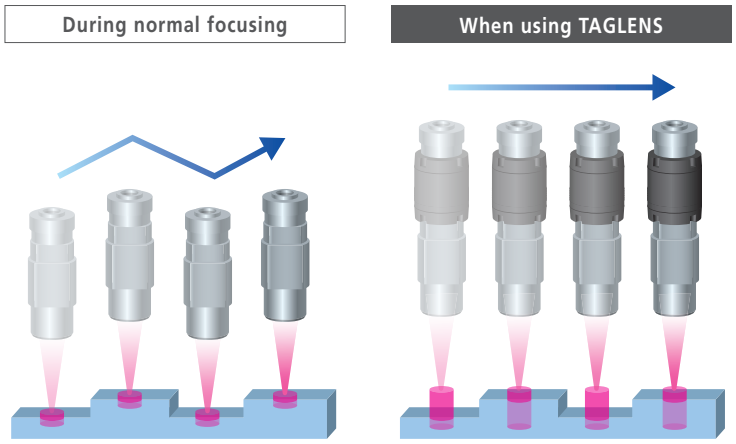
	EDOF	3ch	Mixed Image	Multi Focus	Focus Stacking	TAGLENS-3D
Function	All-focused image generation	Arbitrary cross-section observation	Simultaneous observation of multiple focal planes within one frame	Simultaneous observation of multiple focal planes in individual windows	All-focused image generation	3D display height map generation
Lighting equipment	Continuous light source	Pulsed light source	Pulsed light source	Pulsed light source	Pulsed light source	Pulsed light source
Image quality	Good	Excellent	Very good	Excellent	Excellent	—
Throughput	Fast: Postprocessing is also possible	Very fast	Very fast	Fast: Depends on number of divisions	Fast: Depends on number of stacked images	Good
Height output	—	—	—	—	—	Available

Improve inspection efficiency using TAGLENS with its ultra-wide focus range

EDOF (Extended Depth of Focus)

The focus range is variable without changing the camera position

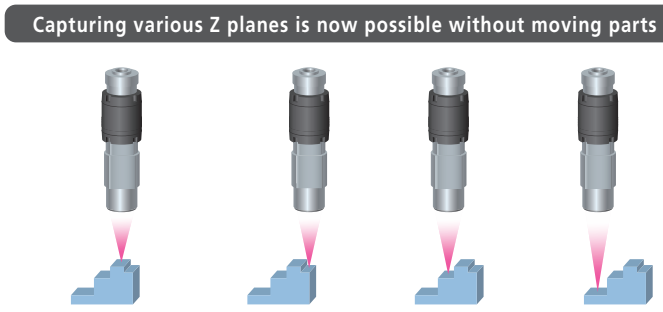
Until now, imaging of objects with differing heights and depths was performed by taking multiple photographs while moving the camera vertically (Z-axis motion). In contrast, TAGLENS allows simultaneous probing of multiple heights or depths. Moreover, a captured image is displayed in real time.



Multi Focus

Up to 20 cross-sectional images at arbitrary heights can be captured simultaneously

- A focused image in any specified Z-position can be captured without mechanical drive system within the observation range at an extended depth of focus.
- Multiple images focused in given Z-positions can be captured.

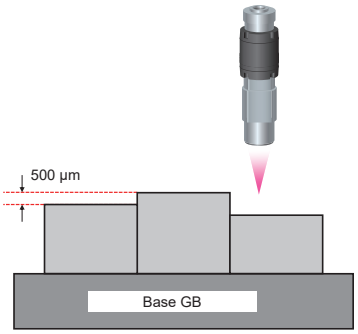


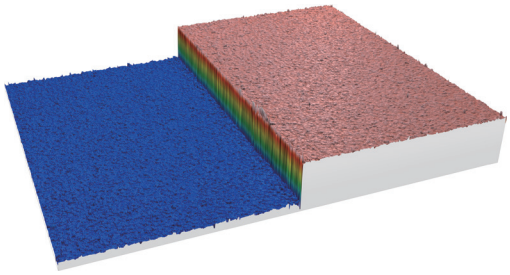
TAGLENS-3D/Z-Adjust

3D shapes can be captured without mechanical action in the height direction

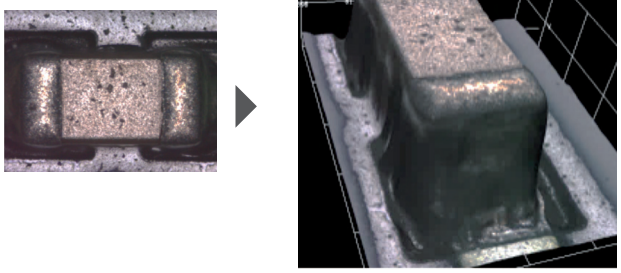
- Select Z-Adjust with dedicated chart or Nominal Z-Adjust with theoretical values.
- Using the height information obtained from Z-Adjust/Nominal Z-Adjust for TAGLENS-3D, point cloud data can be generated.

*Z-Adjust can be used only in combination with VMU-T1.
*3D shape data display/analysis software is to be prepared by the customer.



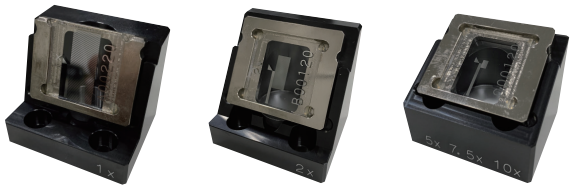


2D image composite from Z-stack and 3D image



Furthermore, 3D imaging with the aid of commercial 3D Viewer software

Dedicated Chart for Z-Adjust



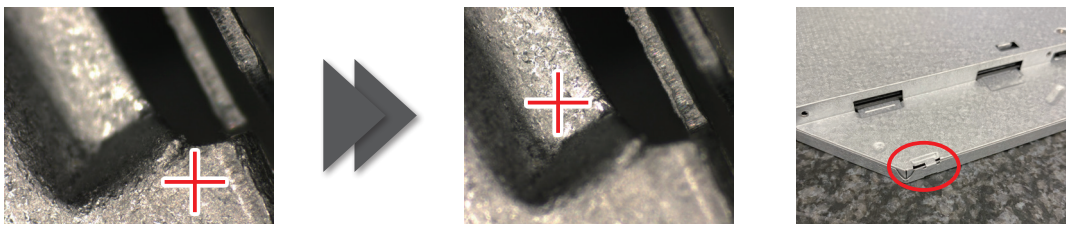
For 1X　For 2X　For 5X / 7.5X / 10X

Auto Focus

High-speed focusing without mechanical action

- Contrast peak position is determined from the images captured during the focal sweep.
- After image acquisition, it takes only 10 ms to determine the focus position, under conditions of 30 image acquisitions and a exposure time of 5 ms.

*With Mitutoyo demonstration system



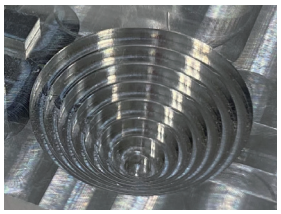
Objective Lens M Plan Apo	1X	2X	5X	7.5X	10X	20X
Depth of focus (DOF) [mm] without TAGLENS-3D	0.88 (± 0.44)	0.18 (± 0.09)	0.028 (± 0.014)	0.012 (± 0.006)	0.007 (± 0.0035)	0.003 (± 0.0015)
TAGLENS Scan Range [mm]	16	4.0	0.640	0.280	0.160	0.040
AF Range [mm] with TAGLENS-3D ( ) shows extension ratio with normal objective lens	12 (13.6 times)	3.0 (16.6 times)	0.500 (17.8 times)	0.225 (18.8 times)	0.120 (17.1 times)	0.025 (8.3 times)

Focus Stacking

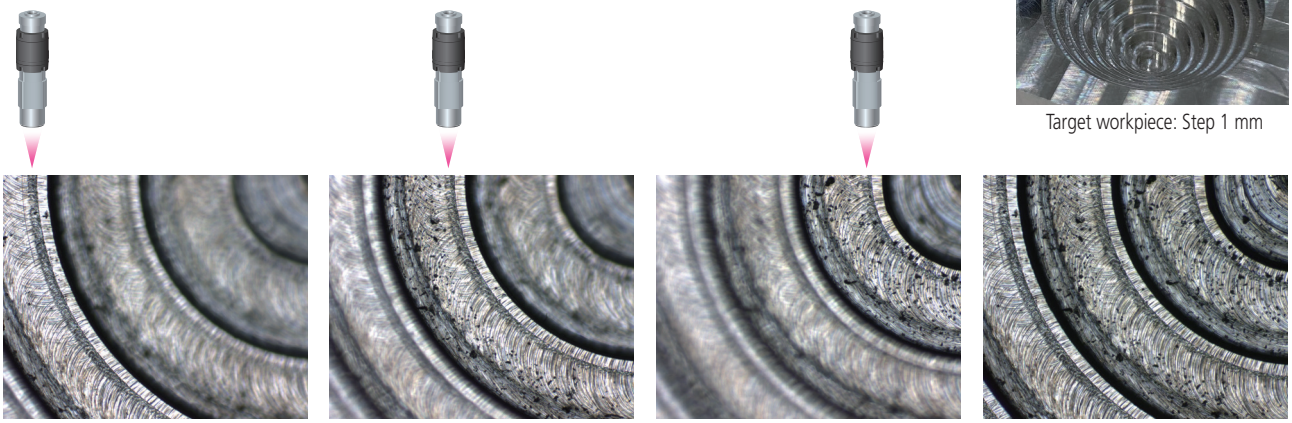
All-focused images generated from multiple cross-sectional images

- Contrast peak position is extracted and synthesized from images captured while changing focal position (image stack).
- After obtaining the image stack, output to other companies' focus stacking software is also possible.

*Image upload file type varies by company specifications



Target workpiece: Step 1 mm



All-focused image

Image Stacking Range (Z range)

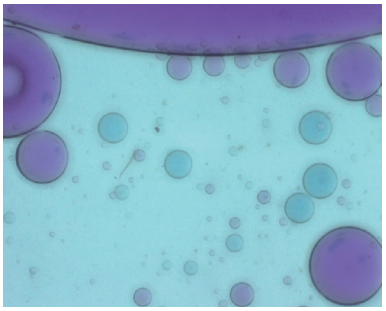
As well as 1X to 20X objective lenses, 50X, HR50X, SL20X, and SL50X can also be used.

Objective Lens M Plan Apo	1X	2X	5X	7.5X	10X	20X
Depth of focus (DOF) [mm] without TAGLENS	0.88 (± 0.44)	0.18 (± 0.09)	0.028 (± 0.014)	0.012 (± 0.006)	0.007 (± 0.0035)	0.003 (± 0.0015)
Stacking range [mm] with TAGLENS ( ) shows extension ratio with normal objective lens	16 (18.2 times)	4.0 (22.2 times)	0.640 (22.8 times)	0.280 (23.3 times)	0.160 (22.8 times)	0.040 (13.3 times)

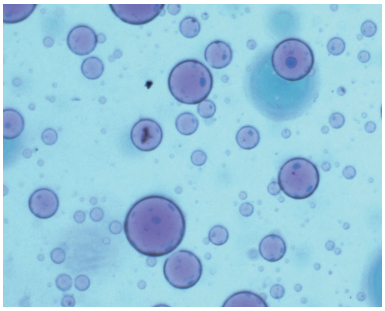
Mixed Image

Up to 3 cross-sectional images can be mixed for display within one frame

- Multiple height observation with TAGLENS at camera maximum frame rates.
- Ideal for observation targets requiring different brightness, as multiple pulsed light sources can be exposed within one frame.



TAGLENS ON



TAGLENS OFF

TAGPAK-C Supplied as standard

TAGPAK-C is software for setting the parameters to control "TAGLENS" and "Pulsed Light Source for TAGLENS".

Pulse output functions is available for the following modes:

Multi Focus, Mixed Image, and 3ch.

As well, a software development kit (SDK) is included to enable use of functions such as Auto Focus, Focus Stacking, TAGLENS-3D, and Z-Adjust, thus making it easy to equip on the system in use.

*The software required to use this function is to be prepared by the customer.

*To view camera images, use the optional TAGPAK-E Viewer function or prepare a viewer compatible with the camera in use.

TAGPAK-E Optional Software (Required for checking the inspection images.)

With a function converting images captured with a TAGLENS-enabled optical system into extended depth of focus images (EDOF images), various EDOF image-related parameters can be set and images can be saved and uploaded. (I/O-enabled still image file types are .bmp, .tiff, .png, and .jpeg)

*EDOF: Extended Depth of Focus

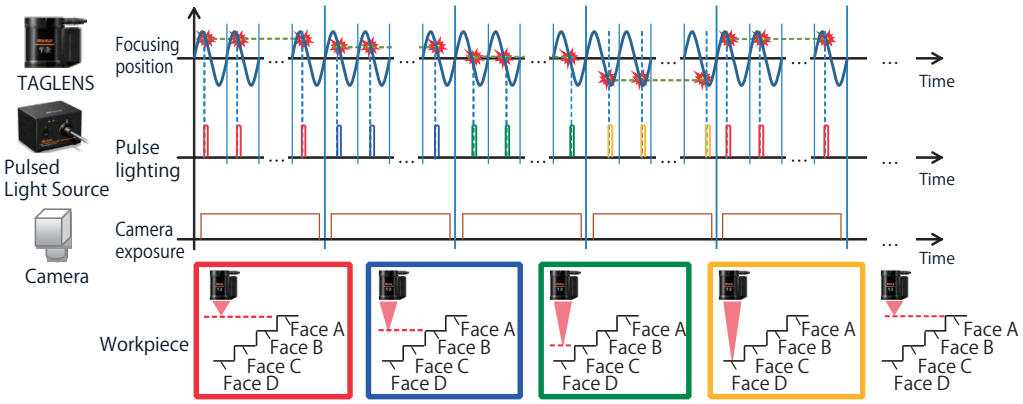
Viewer functions are available for the following modes:

EDOF, Multi Focus (up to 4 cross-sections), Mixed Image.

This software is included as standard in the TAGLENS-T1 E Set.

*Compatible camera interfaces: USB3 Vision, GigEVision

*To use the Multi Focus function, a separate camera trigger cable is required.



Items			System specifications
OS			Windows10 Pro 64bit
PC	CPU	Clock frequency	2.0 GHz or more
	Memory		8 GB or more
	Hard disk		25 GB or more
	Optical drive		DVD-ROM Drive for installation software
	Communication port	For TAGLENS control	USB 2.0 × 1 port or RS-232C × 1 port
		For Pulsed Light Source control	USB 2.0 × 1 port
		For camera control	LAN (1000BASE-T) × 1 port (for GigE VISION camera)
			USB 3.0 × 1 port (for USB3 VISION camera)
		Dongle	USB 2.0 × 1 port
Monitor			SXGA(1024×768 Pixel) or more Note: TAGPAK does not support High DPI monitor.

Note 1: PC is not included.

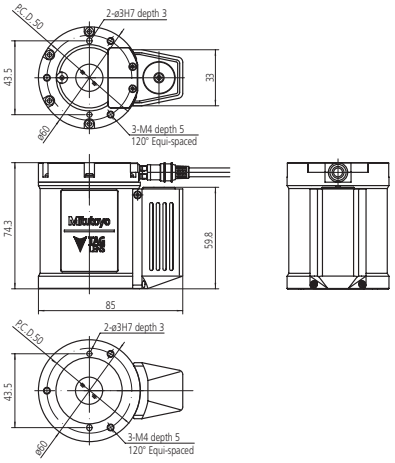
Note 2: For TAGPAK-E, some functions are available as SDK (Software Development Kit), enabling their integration into your software.

*When using only TAGPAK-C, use a camera driver provided by the manufacturer to control the camera.

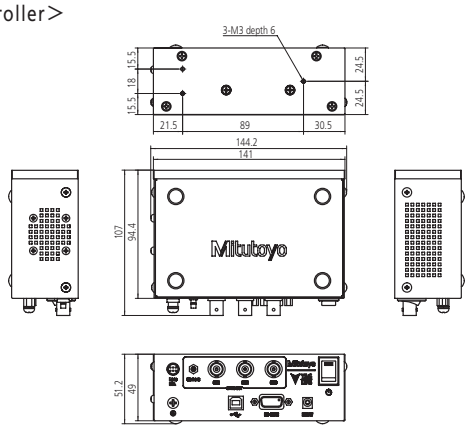
Unit: mm

TAGLENS-T1

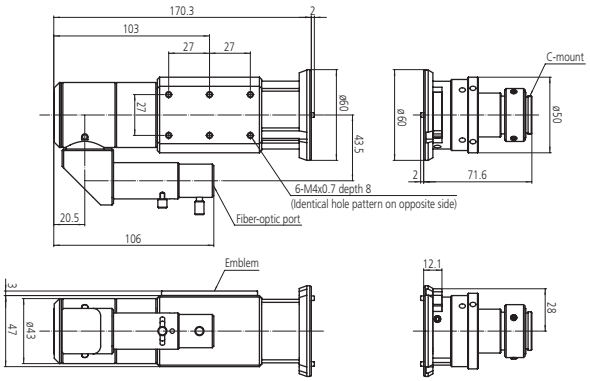
＜Main unit＞



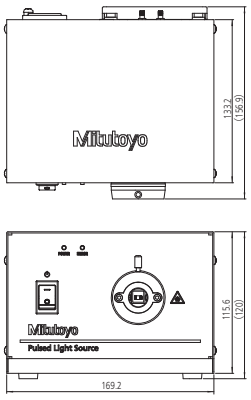
＜Controller＞



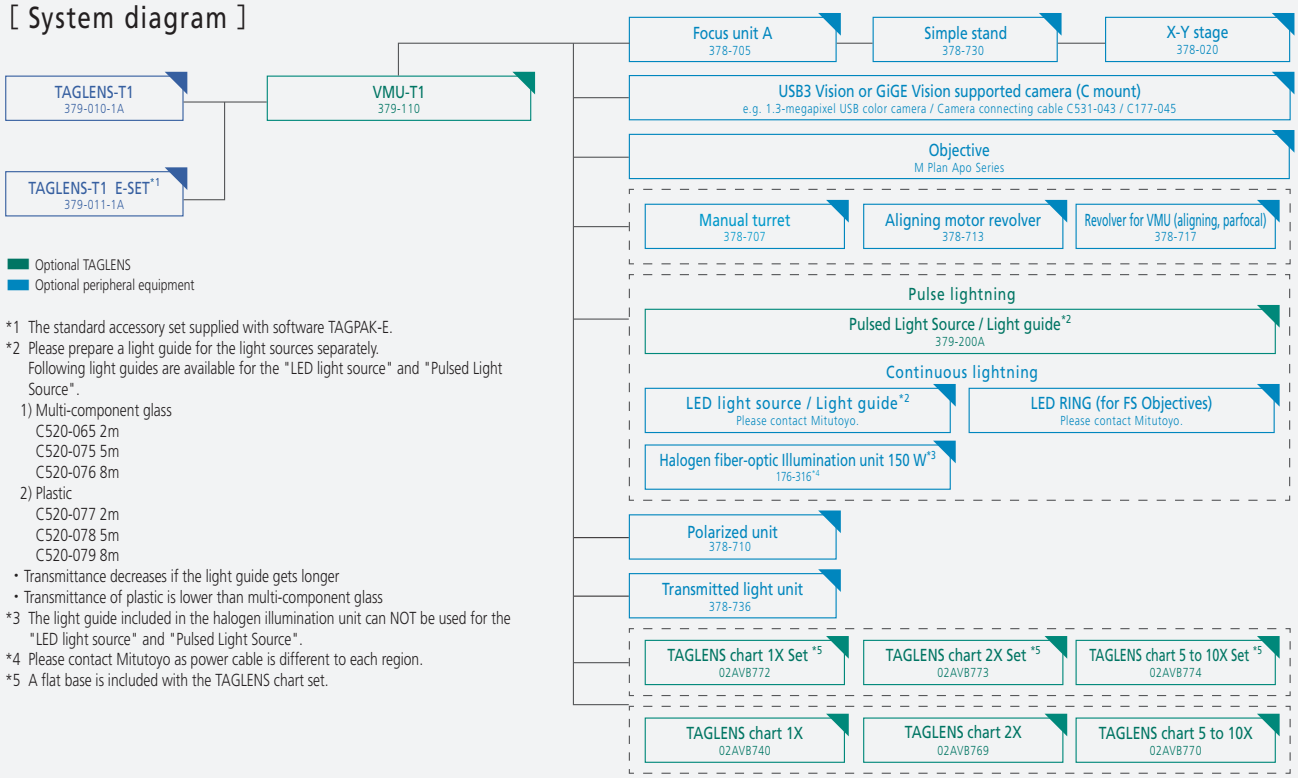
VMU-T1



Pulsed Light Source　PLS

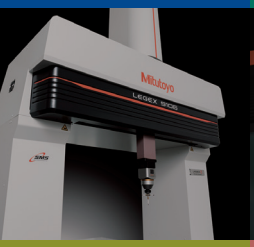


[System diagram]

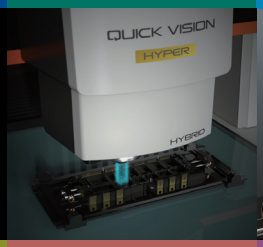


*1 The standard accessory set supplied with software TAGPAK-E.
*2 Please prepare a light guide for the light sources separately.
Following light guides are available for the "LED light source" and "Pulsed Light Source".
1) Multi-component glass
C520-065 2m
C520-075 5m
C520-076 8m
2) Plastic
C520-077 2m
C520-078 5m
C520-079 8m
・Transmittance decreases if the light guide gets longer
・Transmittance of plastic is lower than multi-component glass
*3 The light guide included in the halogen illumination unit can NOT be used for the "LED light source" and "Pulsed Light Source".
*4 Please contact Mitutoyo as power cable is different to each region.
*5 A flat base is included with the TAGLENS chart set.

Coordinate Measuring Machines

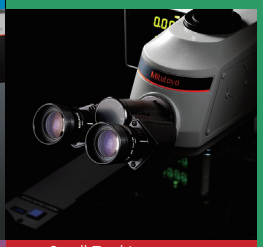


Vision Measuring Systems



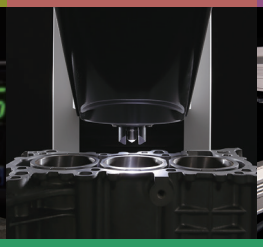
Form Measurement

Optical Measuring



Sensor Systems

Test Equipment



Digital Scale and DRO Systems

Small Tool Instruments and Data Management

Whatever your challenges are, Mitutoyo supports you from start to finish.

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.

My.Mitutoyo

Mitutoyo End User Portal
Search for products, request a product quote, take online metrology courses, and much more. **My.Mitutoyo.com** puts everything Mitutoyo directly in front of you.

Find additional product literature and our product catalog

www.mitutoyo.com

Mitutoyo

Mitutoyo America Corporation
www.mitutoyo.com
One Number to Serve You Better
1-888-MITUTOYO (1-888-648-8869)

M³ Solution Centers:
Aurora, Illinois (Headquarters)
Boston, Massachusetts
Charlotte, North Carolina
Cincinnati, Ohio
Detroit, Michigan
Los Angeles, California
Seattle, Washington
Houston, Texas

0425 • Printed in USA • April 2025