KEYENCE

Telecentric Measurement System

NEW TM-X5000 Series

Silhouette-based analysis for guaranteed accuracy

TM-X5040

Fast and accurate inline measurement

Measure parts in motion

Shortest exposure time: 25 µs

High-speed measurement of targets
as they pass

❙ System configuration
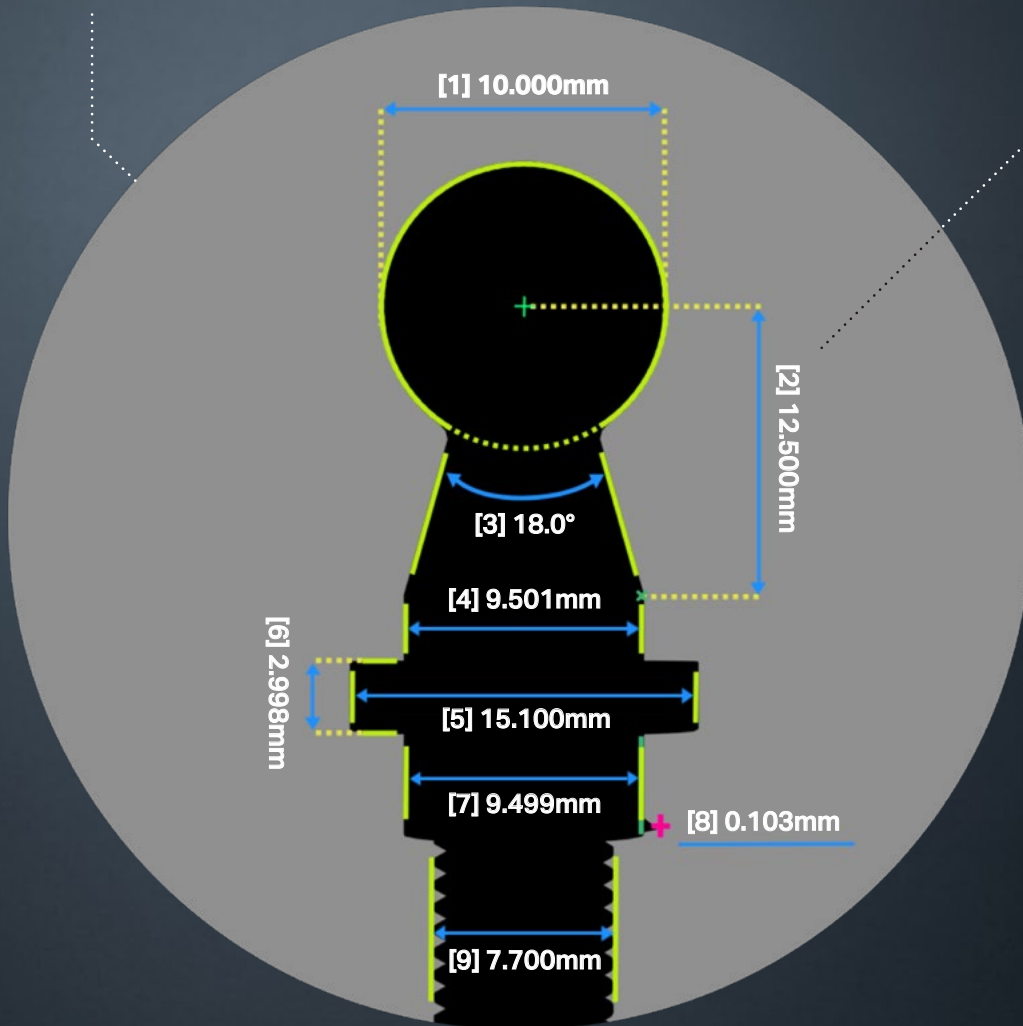
Sensor head Controller Display

Calibrated high-speed measurement

Dual telecentric optical system
No need to worry about focusing or misalignment

Silhouette-based analysis
Stable measurement of any material

[1] 10.000mm
[2] 12.500mm
[3] 18.0°
[4] 9.501mm
[5] 15.100mm
[6] 2.998mm
[7] 9.499mm
[8] 0.103mm
[9] 7.700mm

▌Selection of sensors available to suit a variety of applications

| Field of view		ø6 mm ø0.24"	ø40 mm ø1.57"	ø65 mm ø2.56"
Repeatability		±0.03 µm ±0.000001"	±0.08 µm ±0.000003"	±0.1 µm ±0.000004"
Measurement position accuracy		±0.2 µm ±0.000008"	±1 µm ±0.000039"	±1.2 µm ±0.000047"
Sampling cycle		As fast as 3 ms (approx.)		

Versatile solution for any industry

GD&T

Instant measurement of all
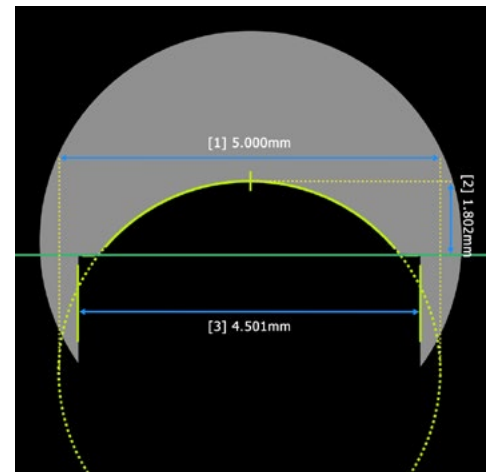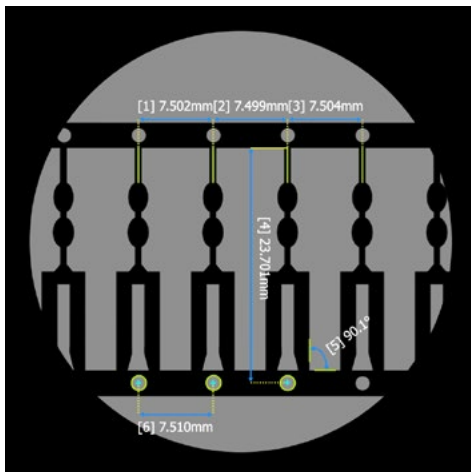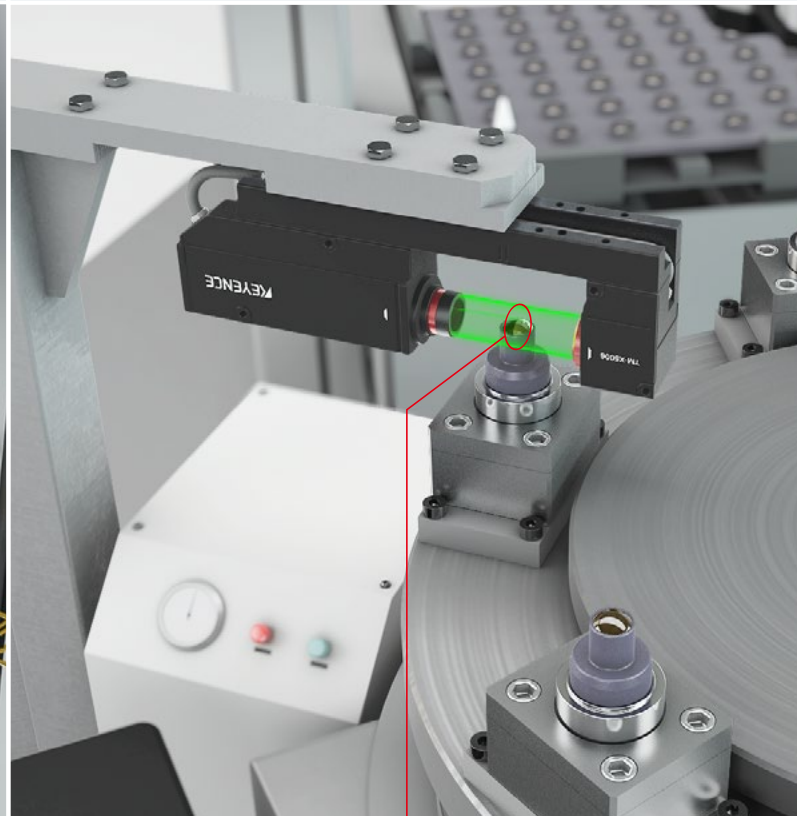drawing instructions

Lead frame dimensions

Outer diameter/profile

Batch measurement of up to 100 dimensions
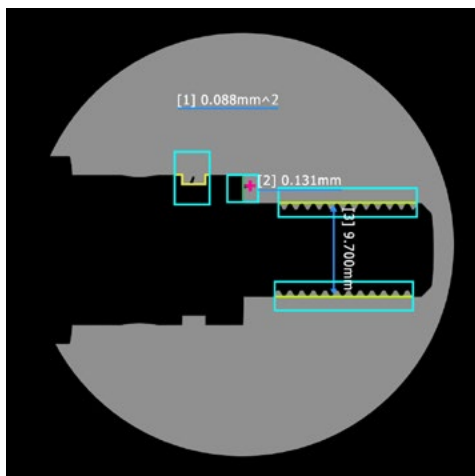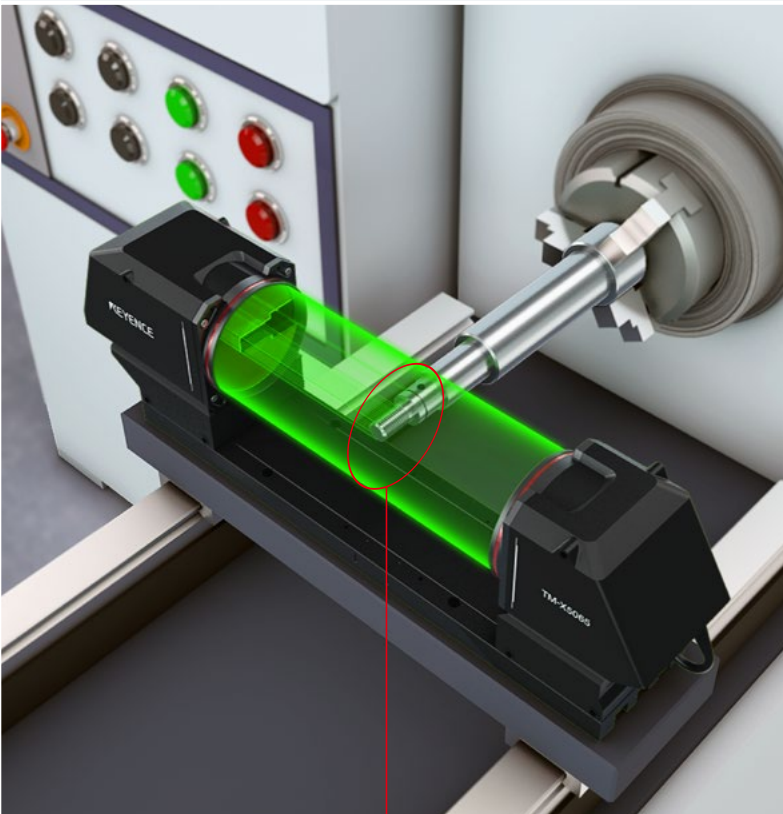(diameter, width, height, radius, etc.)
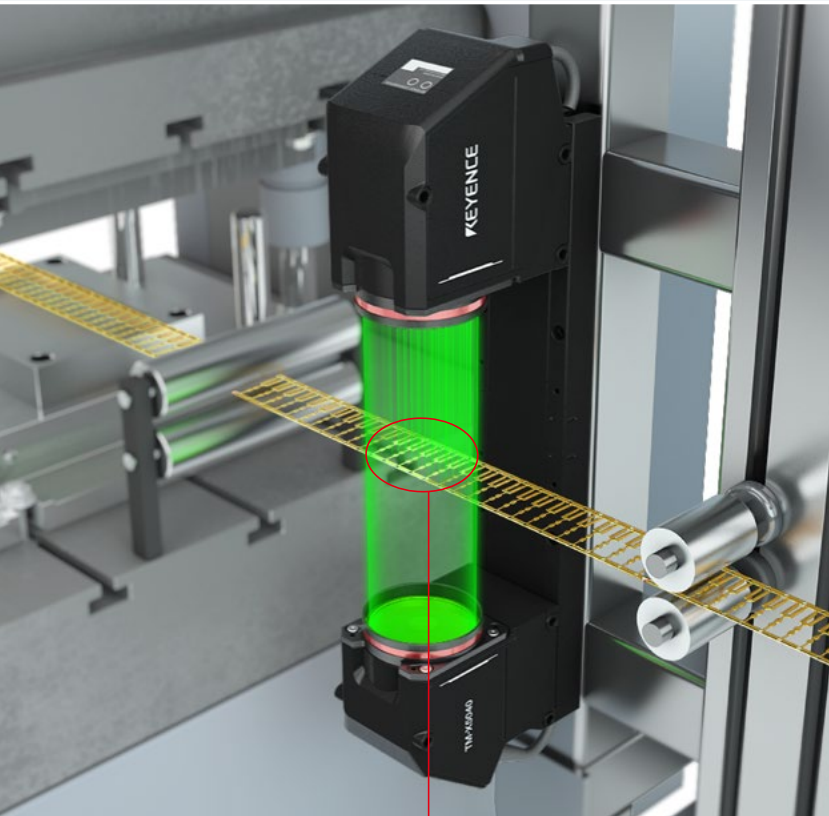
Lens diameter/height

Abnormality detection

Detect foreign particles, flaws, burrs, or chips, while performing dimensional measurement.

Shaft diameter and foreign particle detection
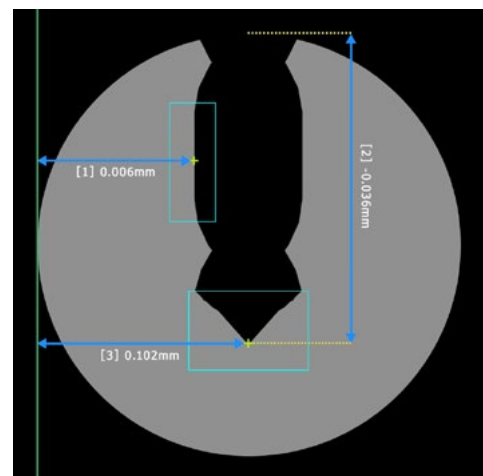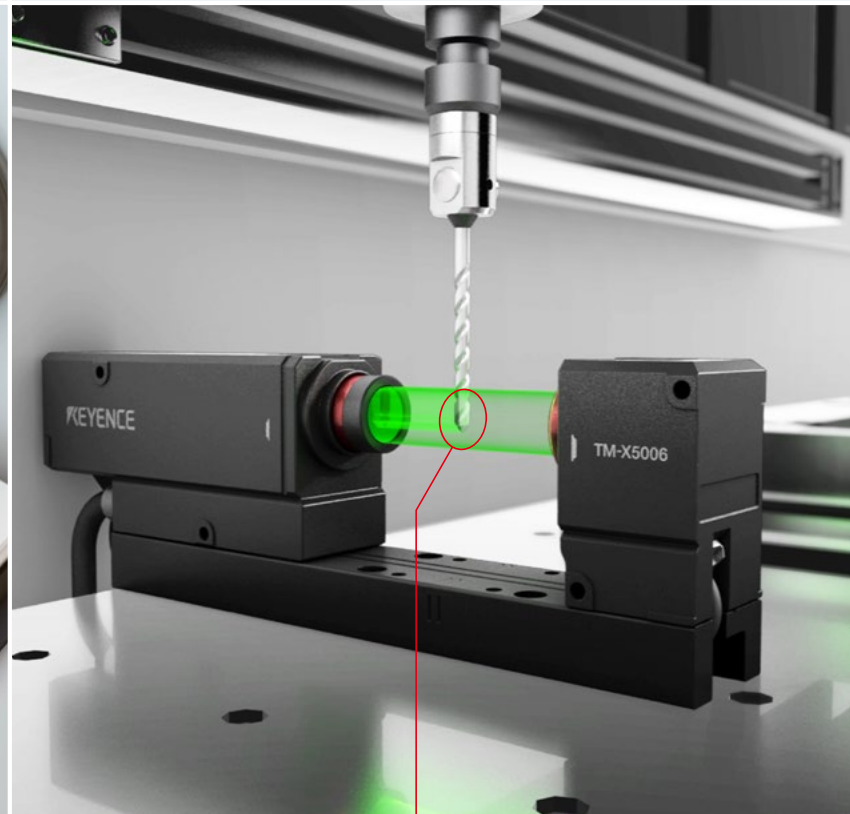

[1] 0.088mm^2

[2] 0.131mm

[3] 9.700mm

Runout and positioning

Measure runout for rotating targets and get position feedback.

Tool run-out/positioning

KEYENCE
TM-X5006

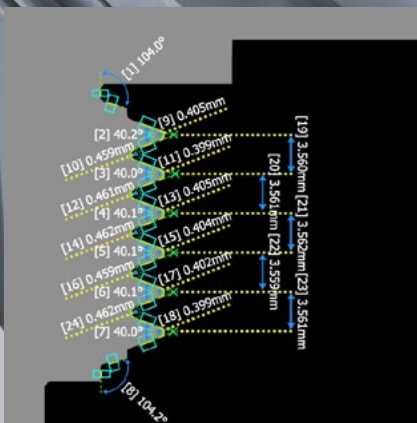[1] 0.006mm

[2] -0.036mm

[3] 0.102mm

Simplified measurement with easy installation

Optical-axis alignment
function for easy installation

Wide range of tools for up to
100 simultaneous measurements

KEYENCE

TM-X5065

All-in-one setup for robust inline measurement

The system provides a pre-calibrated solution for backlit inspection.
The dual telecentric optical system has a large depth of field,
eliminating errors caused by poor focus.

Guaranteed accuracy throughout the field of view

Distortion-free lenses and sub-pixel processing ensure a measurement
position accuracy of ±0.2 µm ±0.000008" with no calibration necessary.

Simple configuration, advanced capability

The modern interface features a wide variety of measurement tools
that let you intuitively configure the settings.

Telecentric Measurement System
NEW **TM-X5000 Series**

All-in-one setup for robust inline measurement

Dual telecentric silhouette-based system provides exceptional stability

The transmitter emits collimated lighting with a green LED to project a shadow on the CMOS sensor in the receiver. Measurement is then performed using this captured image. The TM-X5000 Series includes telecentric lenses in both the transmitter and the receiver, ensuring stable, high-accuracy measurement.
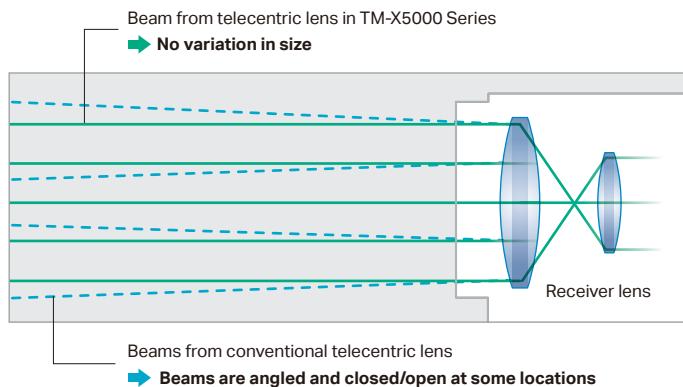
Telecentric lens in transmitter

High-brightness InGaN green LED
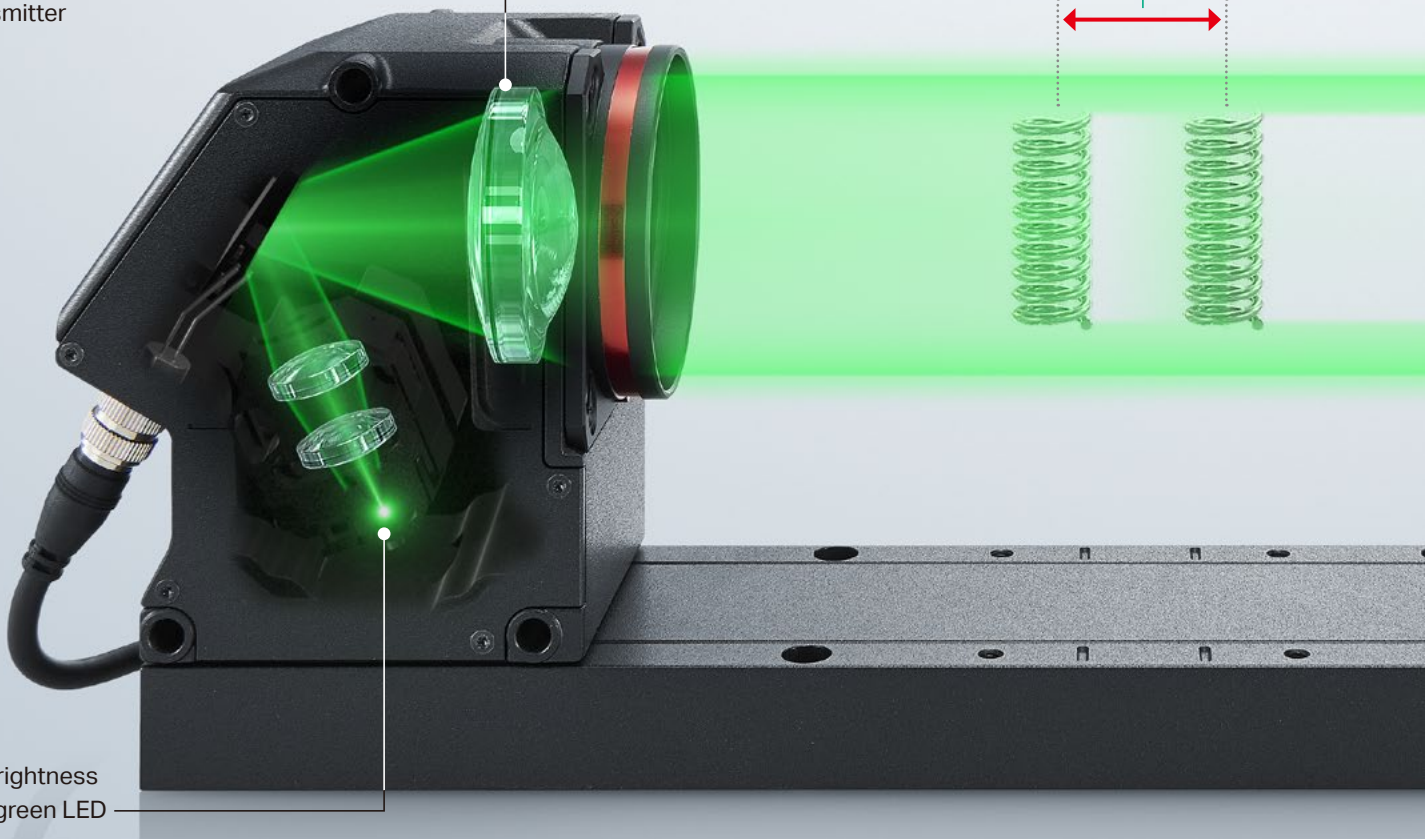
Reliable measurement through advanced telecentricity

The specially designed telecentric optics greatly improve measurement repeatability by increasing uniformity throughout the field of view. Compared with conventional telecentric optical systems, the TM-X5000 Series offers about 100 times greater telecentricity.

Beam from telecentric lens in TM-X5000 Series
➡ **No variation in size**

Receiver lens

Beams from conventional telecentric lens
➡ **Beams are angled and closed/open at some locations**

Telecentricity: Measure of deviation from perfectly collimated light

The TM-X5000 Series has a telecentricity of just 0.0001° (typical value for TM-X5065). With KEYENCE's exceptional optical system, you can have confidence in the results even for misaligned targets.

Large depth of field: ±15 mm ±0.59"

By utilizing telecentric lenses in both the transmitter and receiver, the system can capture focused images of the target over a large depth of field. This provides clear, sharp edges and stable measurement results, even in cases where the target's position can vary.
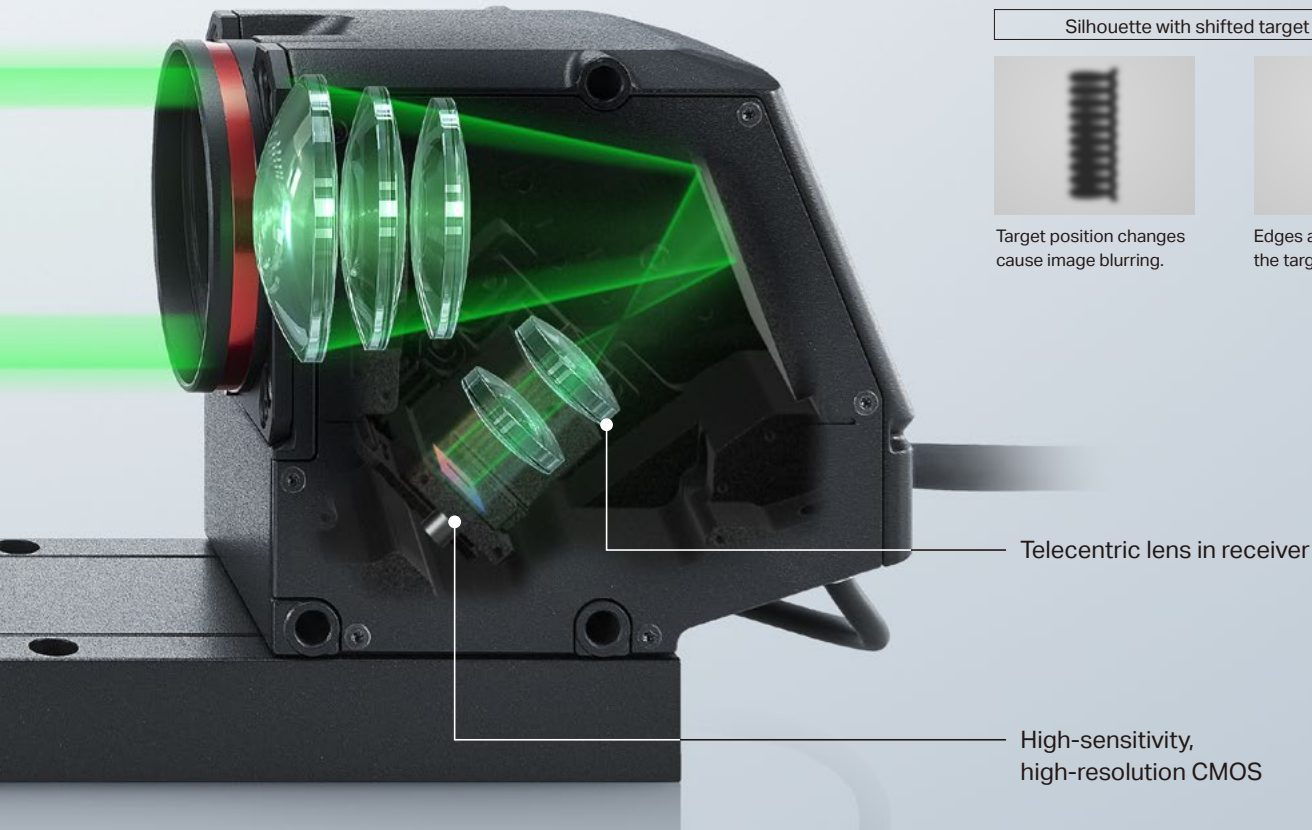
❙ Conventional optical systems   **❙ TM-X5000**

Silhouette with optimal target location


Silhouette with shifted target location


Target position changes cause image blurring.

Edges are sharp even if the target is shifted.

Telecentric lens in receiver

High-sensitivity, high-resolution CMOS

Blur-free measurement of moving targets

The optical system uses a high-intensity LED that significantly increases the received light intensity, allowing for exposure times of just 25 μs—40 times faster than conventional models. This enables accurate measurement of high-speed targets by eliminating any blur from the image.
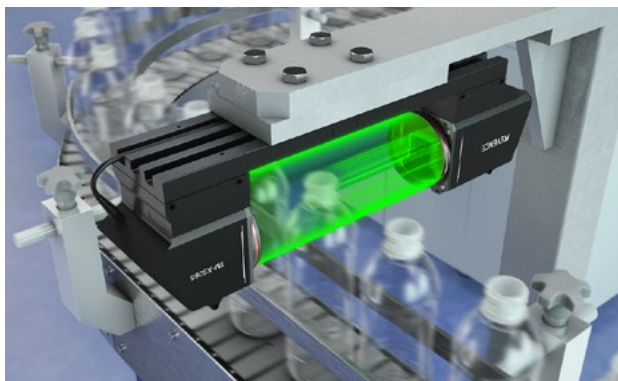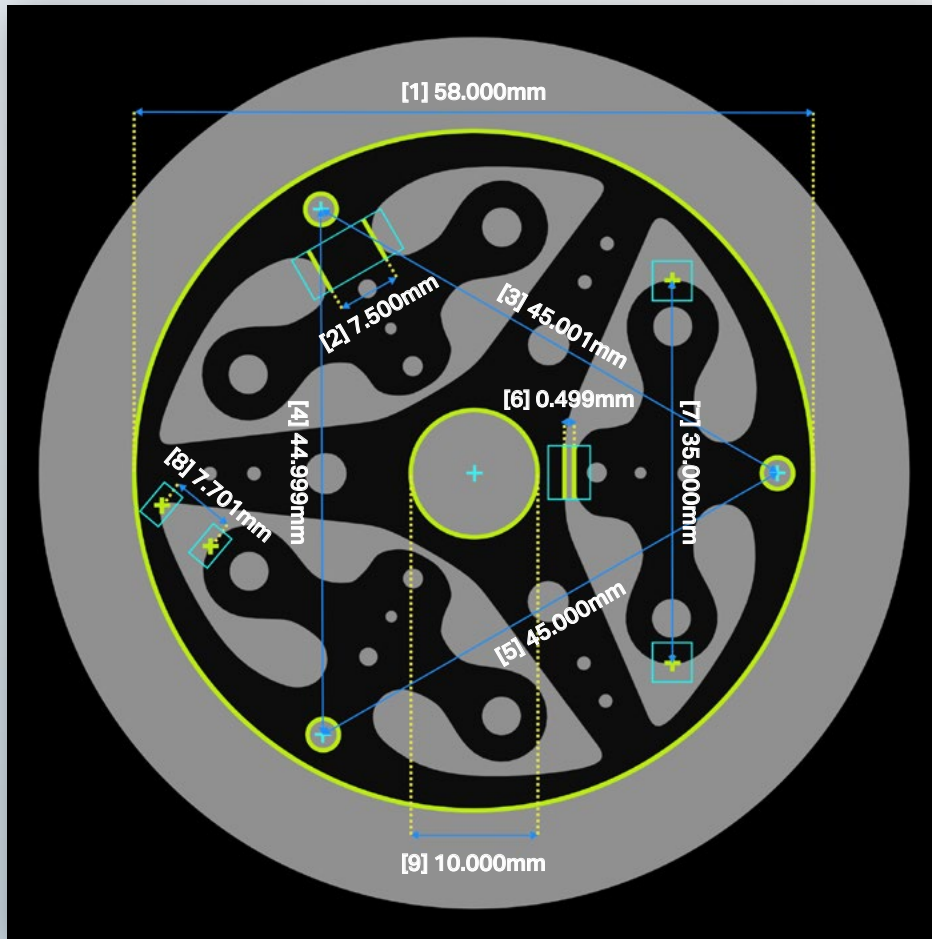

Example: Plastic bottle opening inspection
Measurement is possible even if targets are rotating or passing at high speeds.
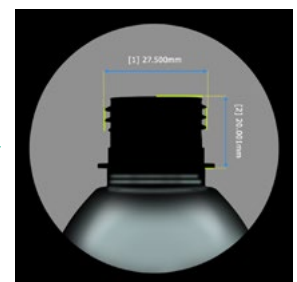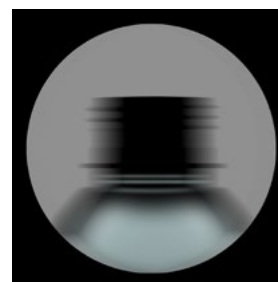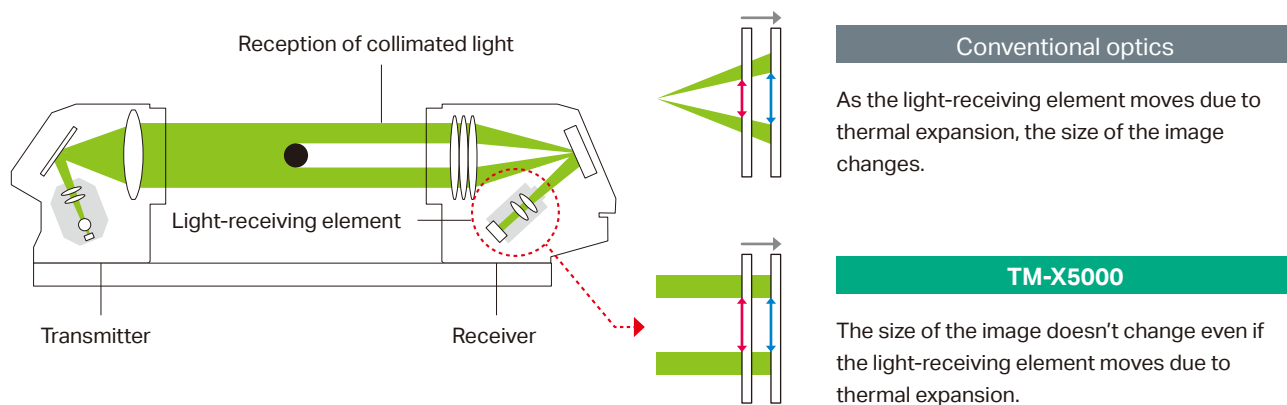

Conventional systems   **TM-X5000**

Guaranteed accuracy throughout the field of view

## Minimal effects from ambient light and temperature changes

Designed to receive only collimated light, the dual telecentric optical system is resistant to ambient light. This design also minimizes error due to temperature changes because thermal expansion is unlikely to impact the size of the formed image.

Reception of collimated light

Light-receiving element

Transmitter

Receiver

Conventional optics

As the light-receiving element moves due to thermal expansion, the size of the image changes.

TM-X5000

The size of the image doesn't change even if the light-receiving element moves due to thermal expansion.

# Accurate results with no calibration or adjustment required

Low-distortion lenses help minimize distortion of the captured image even near the edges.
KEYENCE also uses a proprietary algorithm that can perform measurement with no need to worry about the position of targets.
This eliminates the need for conventional lighting, fixed target positioning, and calibration.

❙ Conventional lens
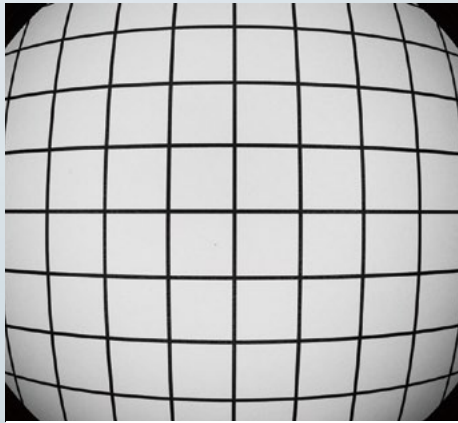
Distortion occurs near the edges

❙ TM-X5000 lens
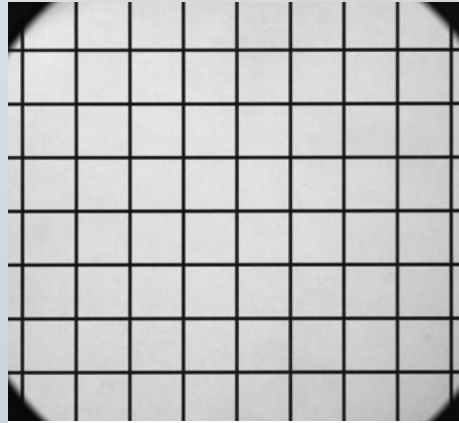
Minimal distortion throughout the entire field of view

Backlit inspection that's backed by a calibration certificate

To ensure reliable measurements, KEYENCE maintains traceability according to international standards for optical measuring instruments.
Measurement position and repeatability accuracy (correctness) are guaranteed before the product is shipped.
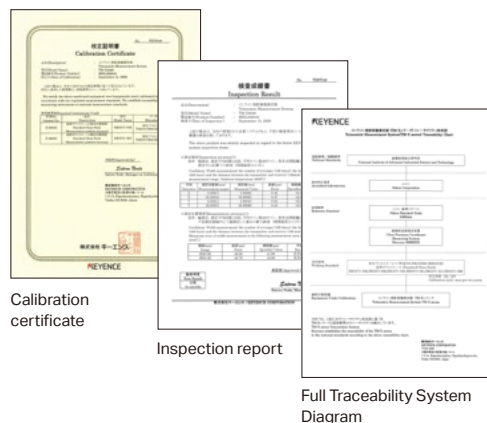
Calibration certificate

Inspection report

Full Traceability System Diagram

| International Standard	National Institute of Advanced Industrial Science and Technology (AIST)
JCSS accredited calibration laboratory	Reference scale
Reference standard	Precision coordinate measuring instrument
Common standard	Reference scale
Measuring instrument to be calibrated	TM-X5000 Series Telecentric Measurement System

Simple configuration, advanced capability
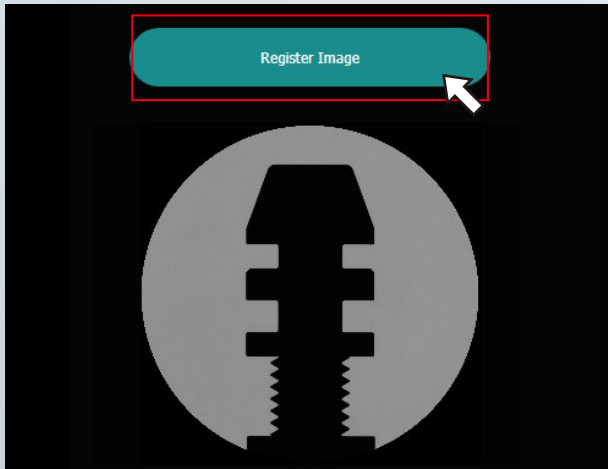
Register Target

Register the target being measured.

Select Measurement
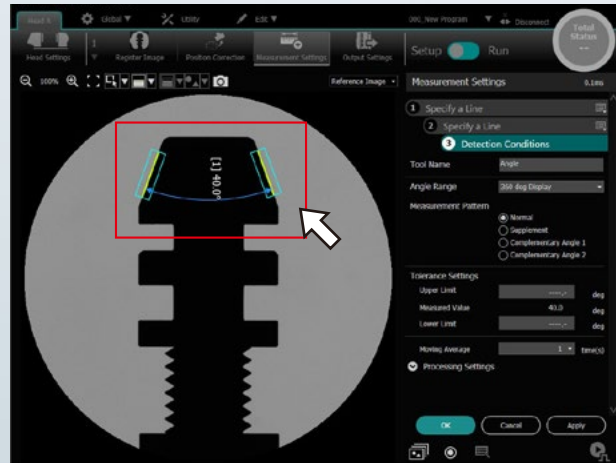
Select the tool to use for measurement and click the area to be measured.

Easy-to-use measurement tools make setup simple

Take advantage of more than 100 measurement tools that can be mixed and matched. Utilize a wide range of inline inspections beyond simple dimensional measurements, including GD&T, master comparisons for identifying products, and defect distance measurements for visual inspections.
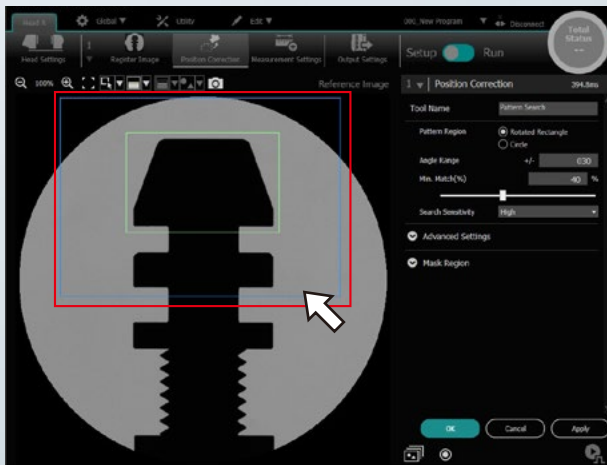

Basic tools

Element tools

Auxiliary tools

Application tools

GD&T tools
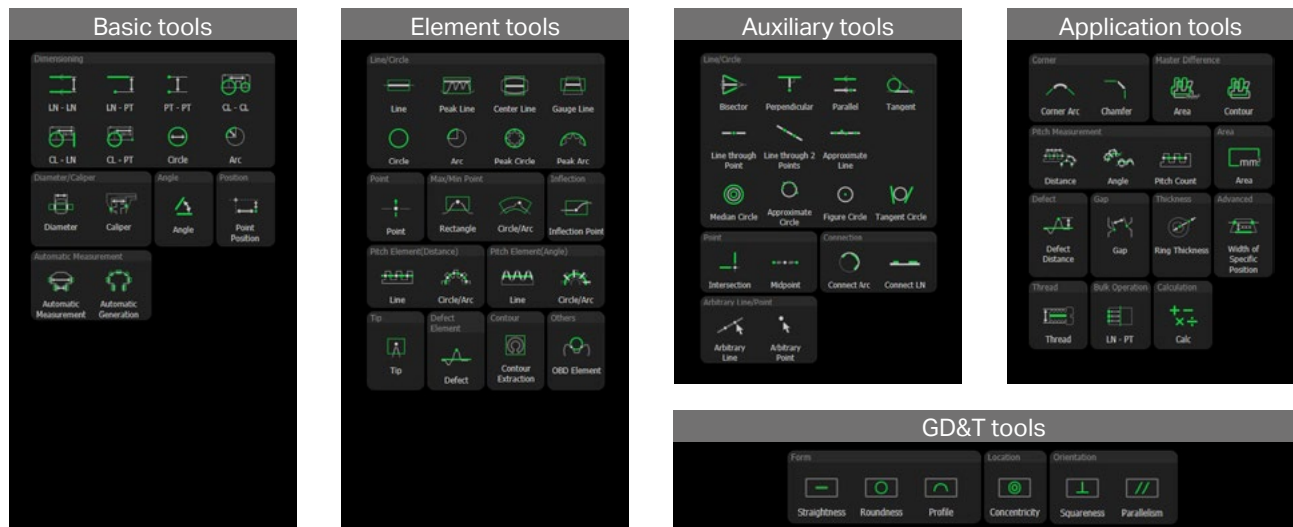
# Apply Position Correction ▶ Ready to measure moving targets!

Draw a square around the shape of the target, and set the area for position correction.

Measurements will be performed properly, even if the target shifts or tilts relative to the registered image.

Set up to four position adjustment areas

The position adjustment function allows users to set various position adjustments in multiple locations. This is effective when measuring items such as height differences, gaps, and angles between two targets that can move independently.
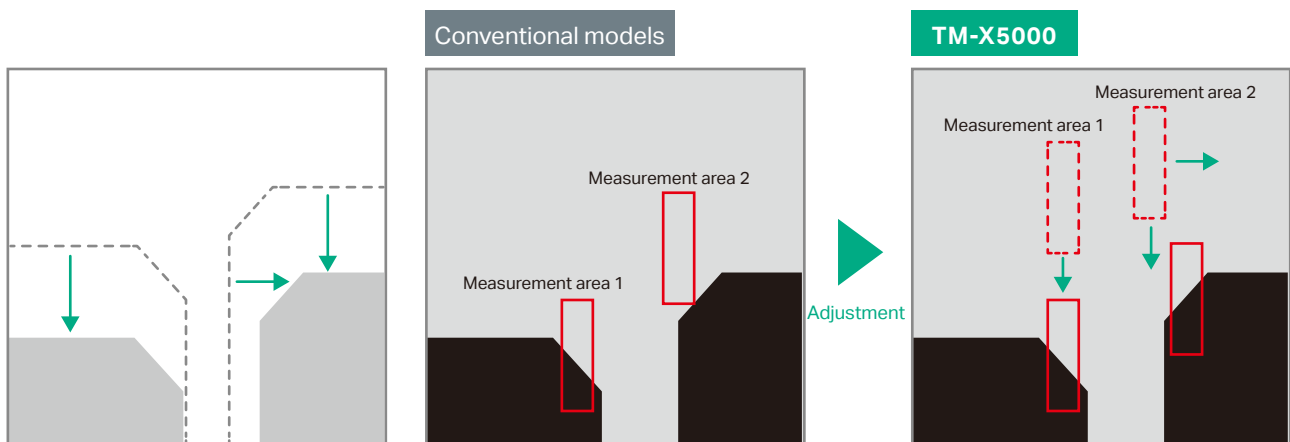
In this example, two measurement targets have shifted from their original positions.

Conventional models

Measurement cannot be performed properly because position adjustment references only one target's location.

TM-X5000

Measurement area 2

Measurement area 1

Measurement can be performed properly because adjustment is applied to measurement areas 1 and 2.

Easy and flexible installation

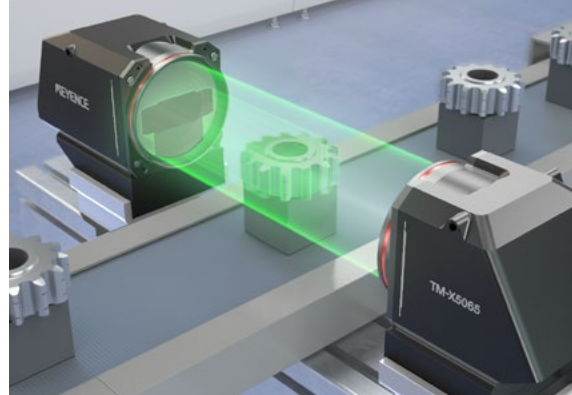## Two installation methods to choose from

With included base

The included base can be used to hold the transmitter and receiver in place. This method is convenient for benchtop use.

Multi-point shaft diameter/pitch measurement

Without base

The sensor can be installed without the base to avoid interfering with existing fixtures or conveyors.


Diameter and slot detection for gears on a conveyor

Designed to make installation without the base simple

Optical-axis alignment function

The optical-axis alignment function makes it possible to quickly confirm proper transmitter-receiver alignment without using the base. This eliminates the need for post-setup calibration, making it easy to perform high-accuracy measurement.

Misalignment of the optical axes can be visualized for easy and reliable alignment.
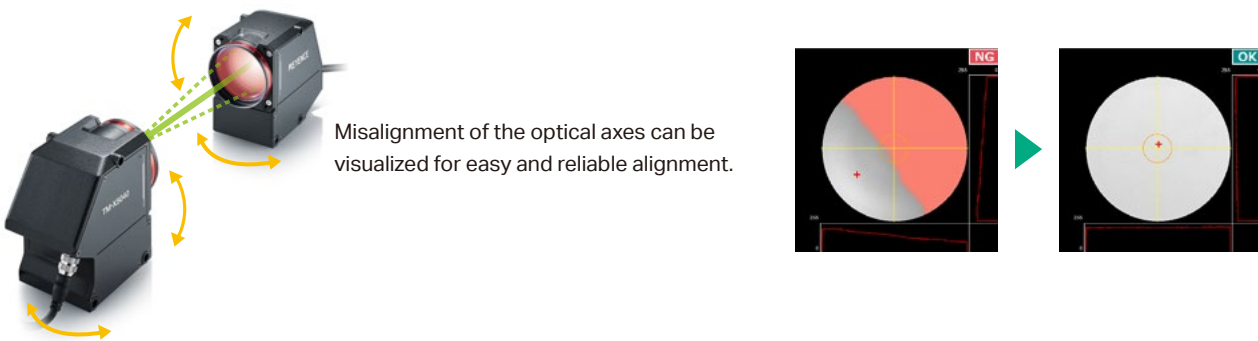

Adjustable installation distance

The installation distance of the transmitter head can be adjusted as necessary. The telecentric design allows the sensor to maintain a focused image as the installation distance changes, minimizing the effects on accuracy.
(Contact KEYENCE for accuracy information when changing the installation distance of the receiver head.)

Measure in space-constrained areas using mirrors

In situations where installation space is limited, angled mirrors can be used to bend the optical axis.
For best results, mirrors should have a flatness of λ/4 and be placed between the transmitter and measurement target.

90° angle

45° angle

Mirror

Mirror
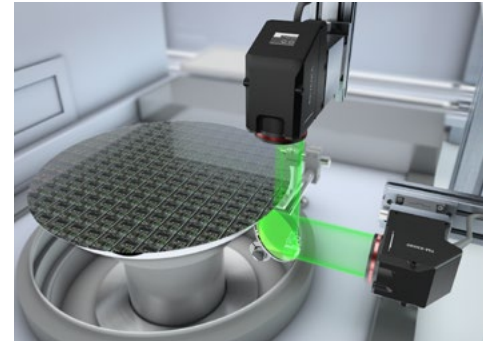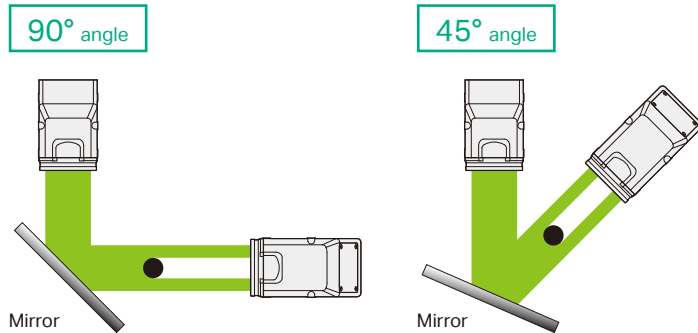
Wafer notch profile measurement

Ultra-compact head

Compared to imaging systems that use conventional telecentric lenses in both the transmitter and receiver, the ultra-compact structure of the TM-X5000 Series requires less installation space.

❚ Conventional imaging system with telecentric lenses

❚ TM-X5000 Series

Significantly reduced size
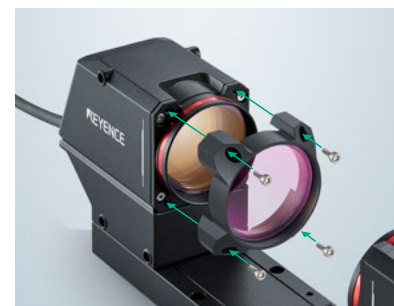
Highly durable

The TM-X5000 Series is a highly durable system with high-flex cables for easier head movement during measurement.
An easy-to-install special protective cover is also available for added security.

High-flex cable

Dust- and water-resistant
IP64 enclosure

Special protective cover

Advanced functions for stable inspection and operation

## Eliminating variations in edge detection

Sub-pixel processing

By splitting each pixel into 100 or more sub-pixels, this function enables a wide field of view while ensuring high-accuracy measurement.

One pixel of light-receiving element

Without sub-pixel processing   With sub-pixel processing
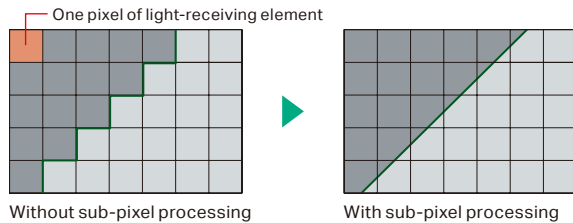
Abnormality exclusion function

To ensure stable measurement, this function excludes abnormalities such as foreign particles and chips in the measurement area.
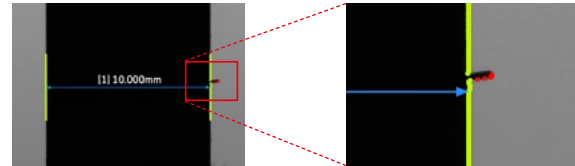
Significant reduction in startup adjustment time

Setting changes and batch testing using archived images

Archived images can be used for immediate identification of problem areas, which is especially useful during startup.
Changes can be set and tested against the batch of images, significantly reducing the time spent on adjustments and checking targets.
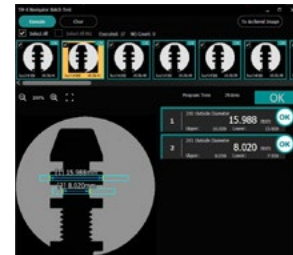
Identify problems using archived images

Display archived images for correction
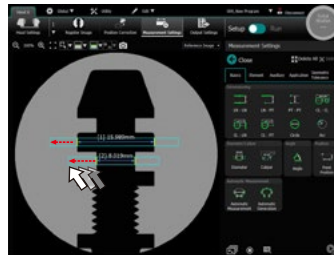
Perform batch testing to complete correction

## On-site traceability and trend management

Statistical analysis (Histogram)

The histogram allows users to check for product variations. The graph includes OK and NG counts, NG rates, and maximum, minimum, average, and deviation values.

Excel-based analysis

Measurements can be exported directly to Excel for further analysis or to support user preferences for managing trends.
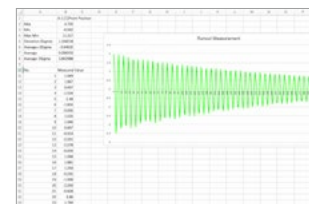
* Excel is a trademark or registered trademark of Microsoft Corporation in the United States and other countries.

# CAD import function for creating measurement settings files

Inspection programs can be quickly created by importing DXF format CAD data. Programs can be easily created even when no measurement target is available.

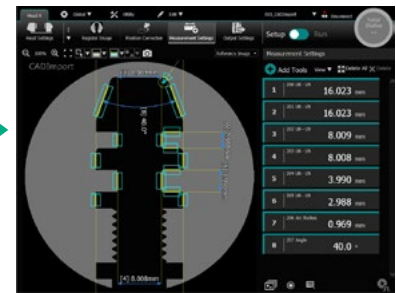* The CAD import module (TM-H1C) sold separately, is required to use the CAD import function.

Open the CAD file and specify the import area.
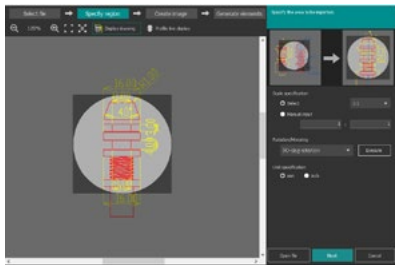
Fill in the area to be imported with black and select the tool to import.
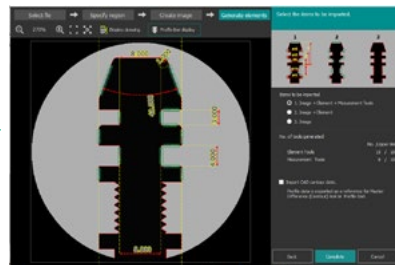
The creation of the measurement settings file is complete.

Operation support with TM-X Navigator

TM-X Navigator makes it possible to reconfigure and operate controllers remotely.
This enables simulations based on previously acquired measurement images and settings, even if the equipment is not connected.

Controller

Switching hub

PC

PLC

Network-compliant HDD with FTP server functionality
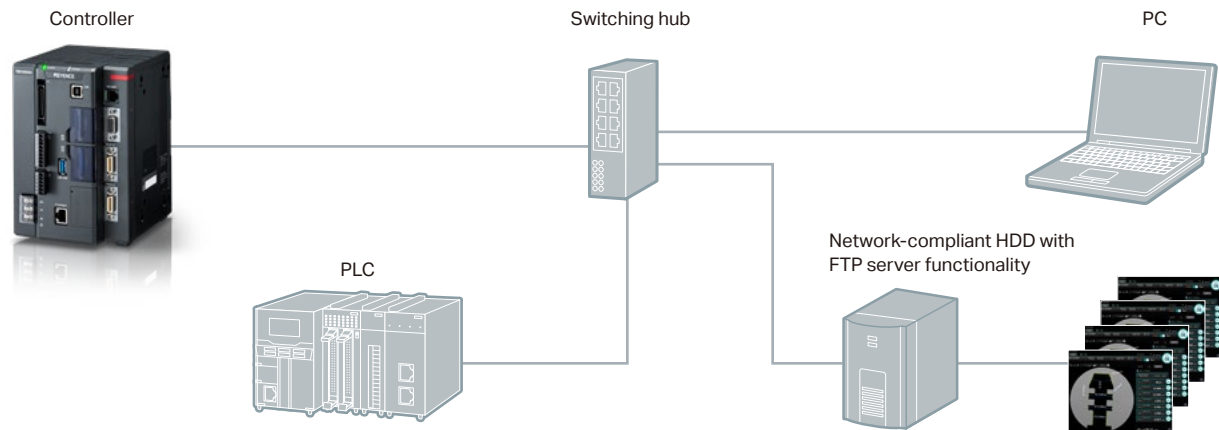
Images and measurements can be output to FTP servers, enabling long-term image storage when using a large-capacity HDD with an FTP server function.

EtherNet/IP   **RS-232C/Ethernet**   **PLC link**

PROFINET   **EtherCAT**

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Communication libraries for original program creation

KEYENCE offers sample programs showing how to use communication libraries. This makes creating programs to control and monitor TM-X5000 Series devices easy. The programs can also be used for outputting captured images and point-sequence data from specified locations to create unique and complex detection and measurement processes.

# Measurement and foreign particle inspection of stepped shafts

In addition to measurement of various dimensions of the entire circumference, rotating targets can also be inspected for burrs and foreign particles.
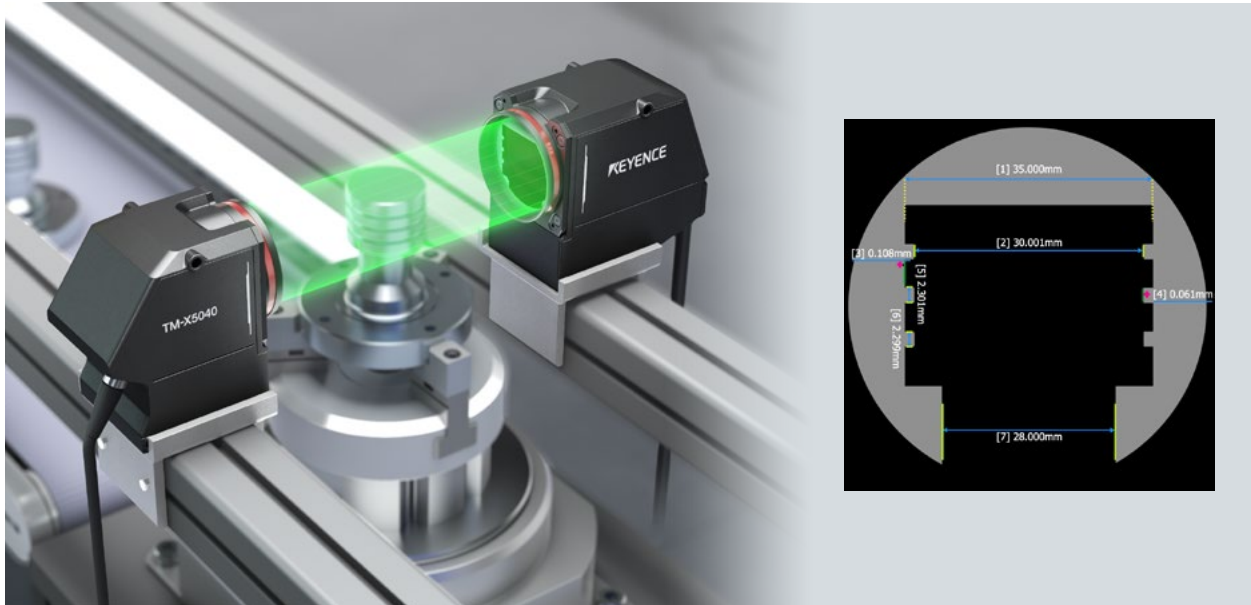
Detect abnormalities and complete dimensional inspection simultaneously
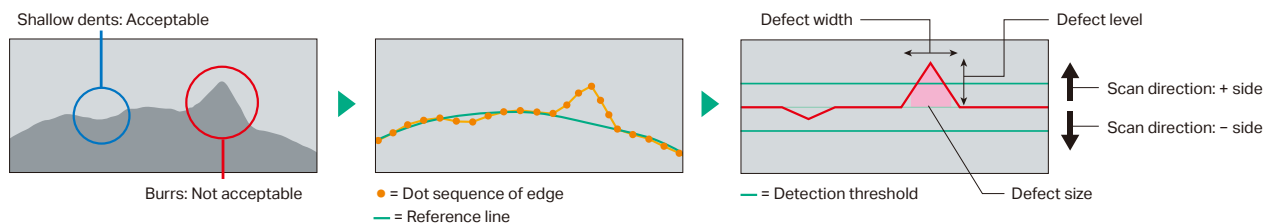
Defect distance measurement

Extracting the contours of a target's edge enables detection of abnormalities such as burrs, chips, and foreign particles by identifying areas that deviate from the contour line. This function measures the distance between the extracted contour and the tip of the abnormality. Extracted contours can include straight lines, circles, wavy surfaces, and other complex shapes consisting of curved lines.

Foreign particle analysis

Chipping inspection
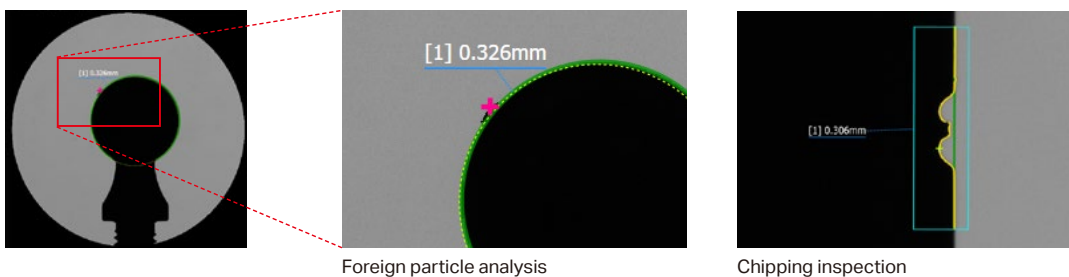
Algorithm for identifying defects while ignoring normal variation

A variety of parameters are available for identifying certain defects.
Settings can be optimized according to the inspection category, such as +/– from the reference line (for burrs and flaws) and amount exceeding the specified threshold.

Shallow dents: Acceptable

Burrs: Not acceptable

● = Dot sequence of edge
— = Reference line

Defect width

Defect level

— = Detection threshold

Scan direction: + side

Scan direction: − side

Defect size

Measurement and inspection of lead frames

Multiple dimensions and inspections can be completed simultaneously, enabling reliable defect detection of lead frames with complex shapes.
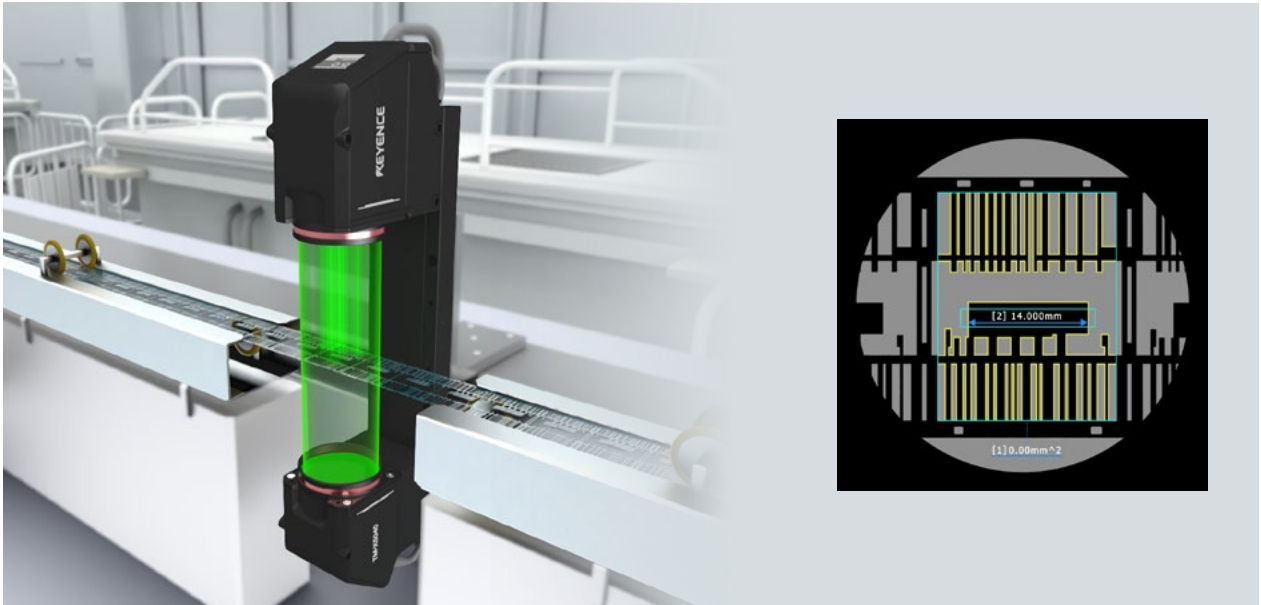
Master comparison tool for intuitive inspection of complex shapes

Master comparison tool (Area)

In addition to traditional dimensional measurements such as pitch and hole area, the master comparison tool compares the area of the target at different locations with a master image to identify defects.
This tool allows consistent inspection of complex shapes that are otherwise difficult to analyze, such as lead frames.

Registered master image

Captured image
(with position adjustment)

Normal product

1 | 200 Master Difference 0.00 mm² **OK**

Unacceptable bending

1 | 200 Master Difference 2.90 mm² **NG**

Unacceptable cut marks

1 | 200 Master Difference 0.51 mm² **NG**

Motor core outer diameter measurement

Targets larger than the field of view can be measured by using two heads. Cross-head tool sharing makes this type of measurement accurate and simple to perform.


Head A   Head B

1	200 Outside Diameter
	250.002 mm
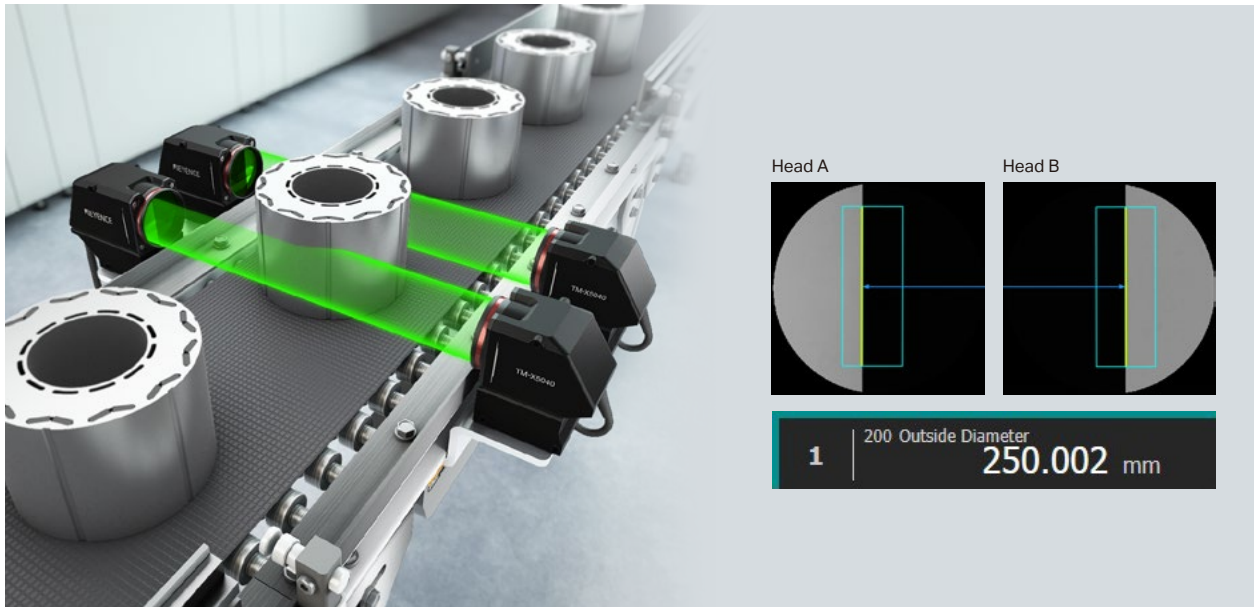
Wide range of tools can be applied across two heads

Cross-head sharing of tool settings

Tools configured in one head can be shared between both heads.
This allows for a variety of measurements, including line-to-line distance measurement and diameter measurement of circles created by combining the two head images. The large pulley below shows an example of performing dimensional measurement across two heads using this functionality.
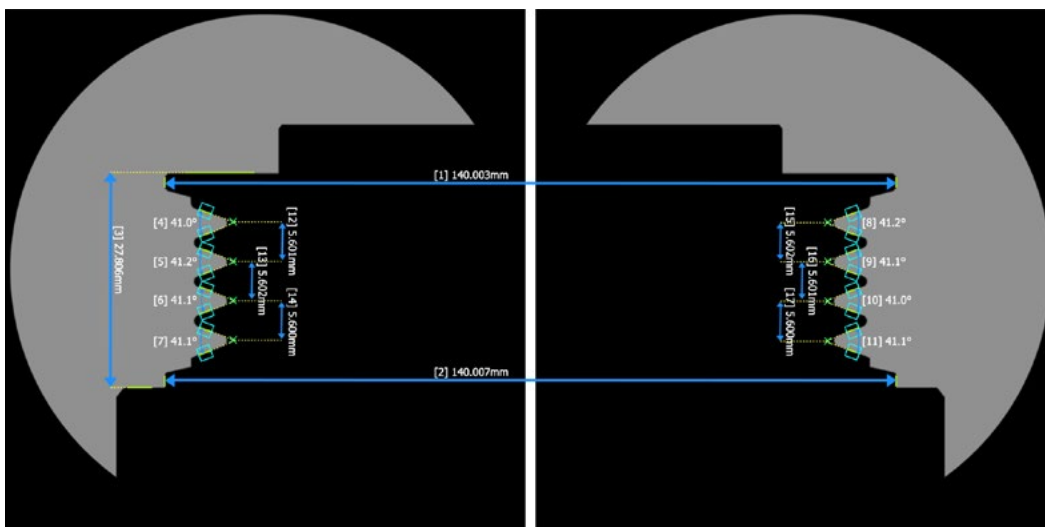
## Outer diameter measurement of catheter balloon

The large depth of field ensures stable measurement of the balloon shape.
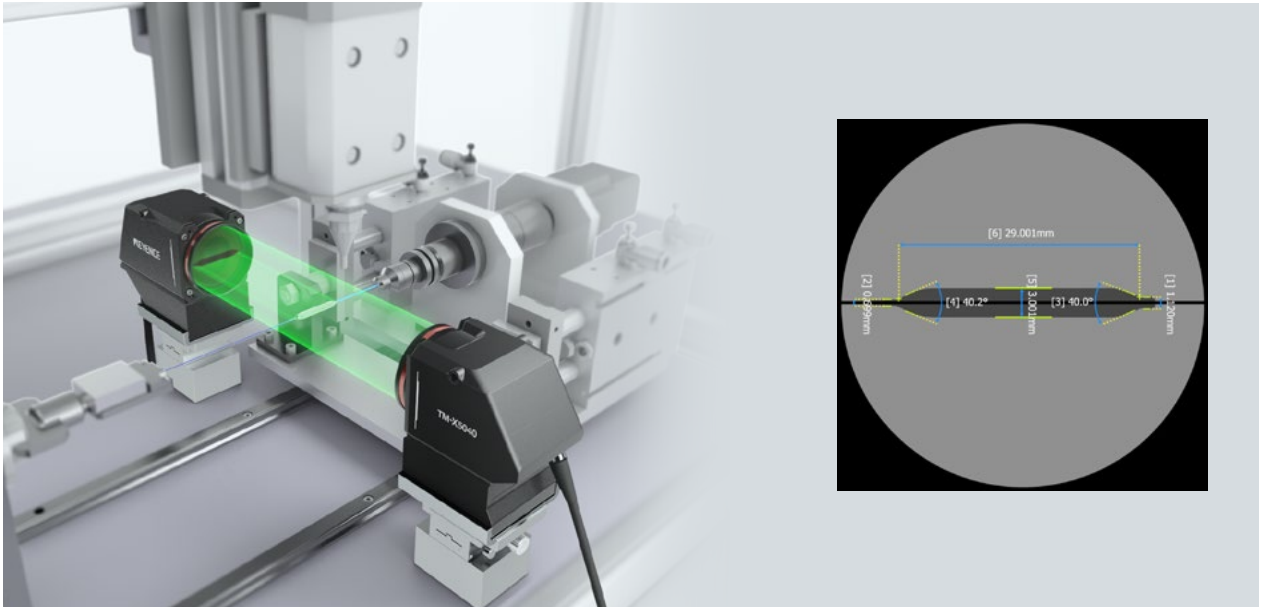
Dual telecentric optical system for high-accuracy measurement with no adjustment necessary

High-speed imaging with a large depth of field and minimal noise

The dual telecentric optical system creates a large depth of field for capturing images with low noise, even at high shutter speeds. This makes the system ideal for virtually any application, with no need for adjustments or calibration after installation.

Reception of collimated light

Light-receiving element

Transmitter

Receiver
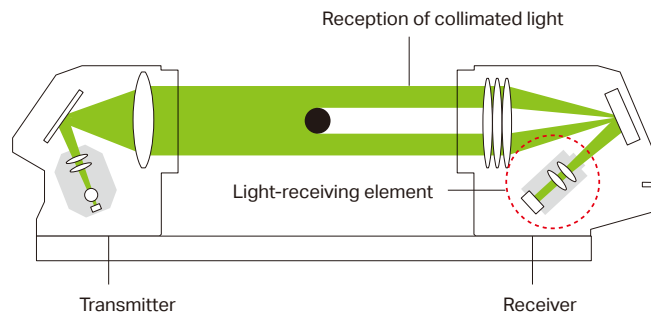
Stable measurement of thin wires

With four times the number of pixels of conventional models and an upgraded optical system, the TM-X5000 Series can stably measure fine wires.
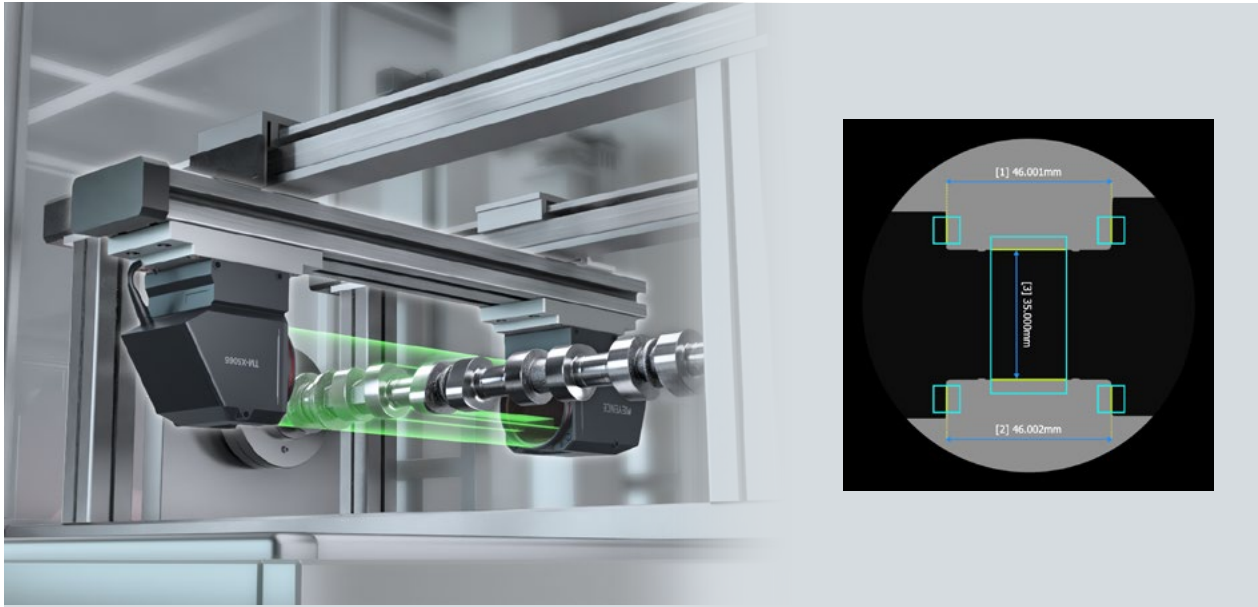
❙ **Minimum measurable outer diameter**

TM-X5006	TM-X5040	TM-X5065
20 µm 0.000787"	150 µm 0.005906"	250 µm 0.009843"

* Contact KEYENCE for measurement of wires with even smaller diameters.

Multiple wires can be measured simultaneously.

Camshaft diameter between journals

Measuring a long target is possible by moving the device along the entire target.

Automatic pattern recognition and recipe switching for fast, simple operation

For long targets

Total evaluation for longer targets is possible by dividing them into several sections. Each program can include up to eight recipes with unique master images, so analysis can be performed even if captured images and measurement items differ from one location to the next. The recipe is switched automatically between measurements to ensure fast operation.

OK
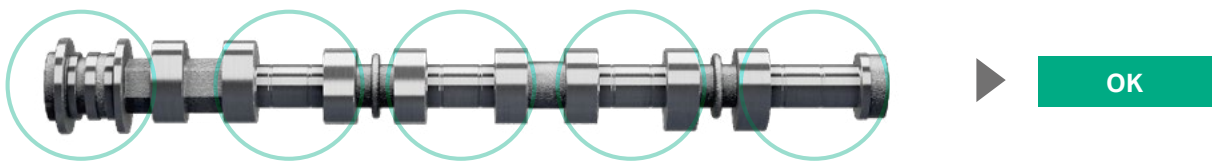
For various targets

Automatic switching between recipes can also be used for measurement with mixed production lines or when analyzing various targets at random.
After identifying the shape of the target, the controller automatically switches to the appropriate recipe according to the target shape. This eliminates the need for a signal or command input between different product types.

1st	2nd	3rd

 OK   OK   NG
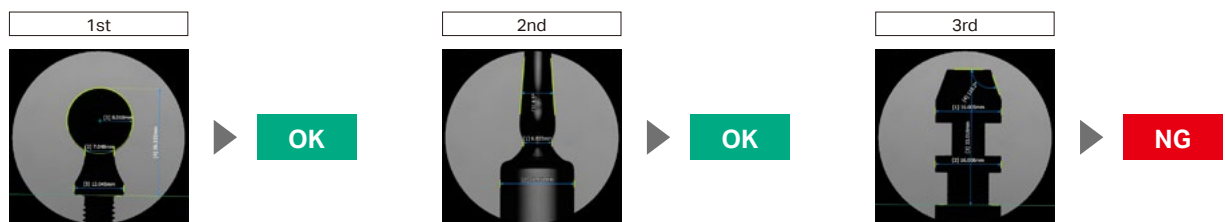
Robot stop accuracy and dynamic evaluation

The TM-X5000 can be used to quantify the stopping and movement accuracy of a robot that moves to the same position repeatedly.

X-Position	0.022 mm
Y-Position	0.063 mm
Angle	10.1°
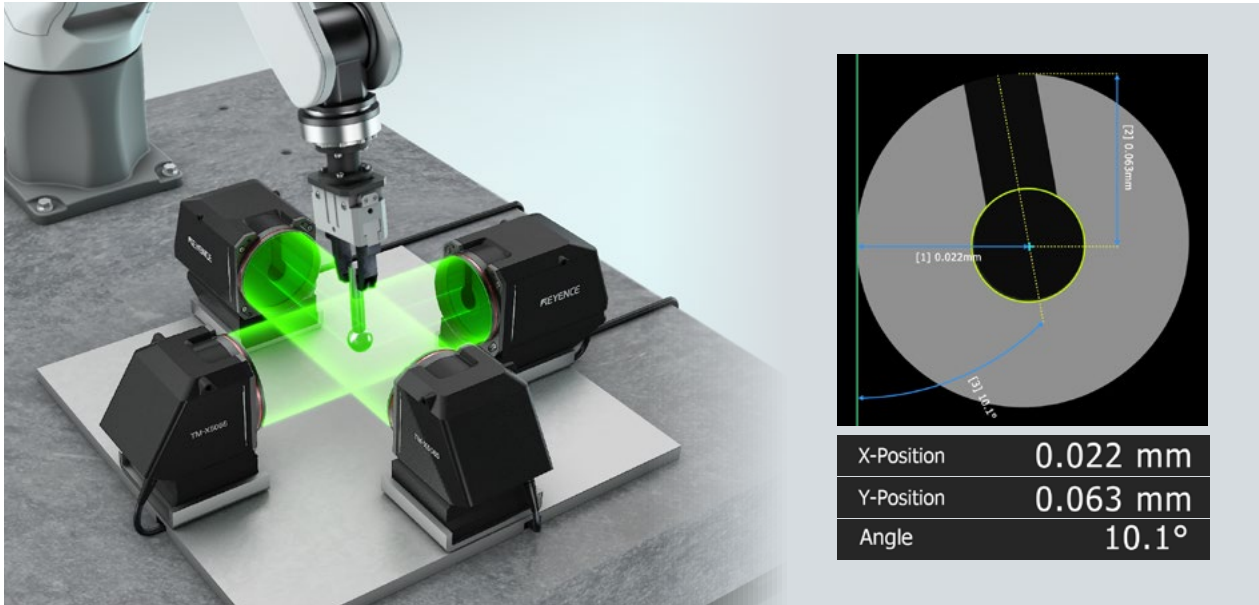
R&D and prototyping phase functions

Statistical analysis and historical image function for easy data analysis

For each sampling cycle, both the measured values and the captured images are logged. This information can then be used for measuring dynamic changes in shapes and sizes as well as runout and stroke.

Statistical analysis (trend graph)

The trend graph displays the changes in values over time to visualize dynamic changes such as target runout and misalignment.

Historical image function

When measuring the area of a water droplet, previously captured images can be re-measured using a PC program, as shown in the image to the right. Additional measurements such as width and length can also be performed when re-measuring an image.


Log data directly to Excel

The Excel output function writes measurement data to specified cells in Excel on command (using a mouse click or external signal). This function is useful for quickly recording prototype measurements or avoiding errors during manual logging.

Multi-point diameter and terminal height of batteries

With an exposure time of just 25 µs, the TM-X5000 Series is capable of inline multi-point diameter and terminal height measurement of cylindrical batteries, improving quality while maintaining line speed.
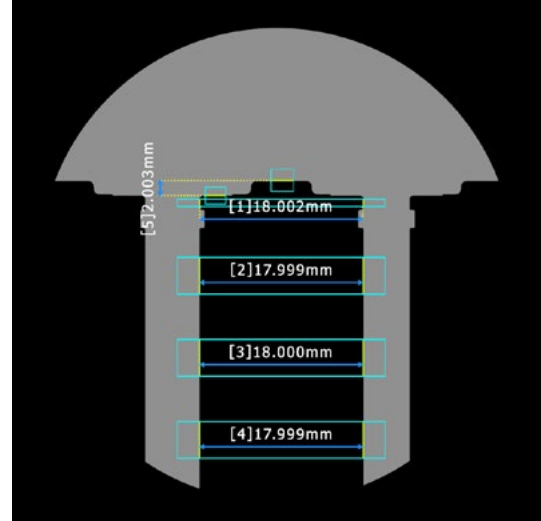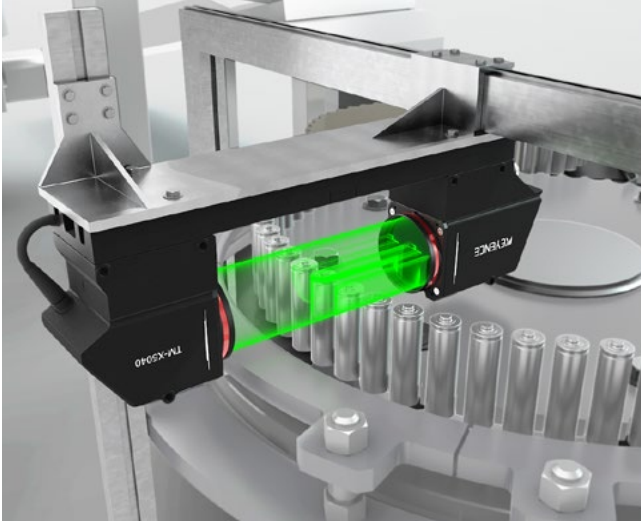
Reduced setup time for targets with multiple measurements

Multi-setting copy function

The multi-setting copy function can be used for batch copying and arranging various tools in any number, direction, and interval to simplify configuration of multiple measurement tools.
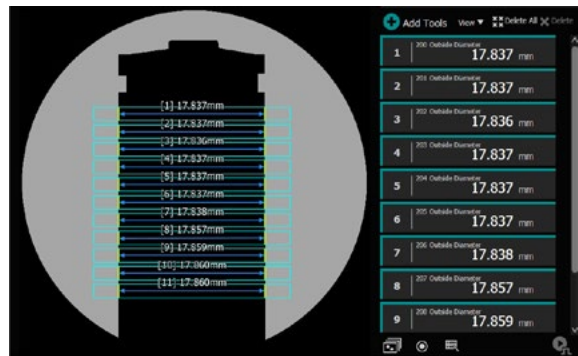
High-accuracy telecentric lens in the transmitter improves reliability

Utilizing a telecentric lens in the transmitter improves the consistency of the light source throughout the field of view. This enables repeatable, high-accuracy measurement, even if the target can move throughout the field of view.
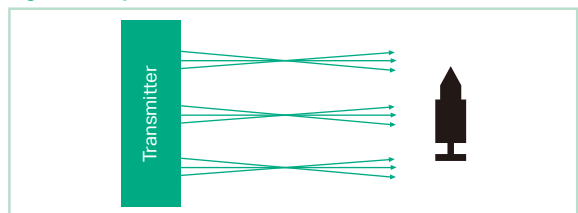
Conventional telecentric illumination
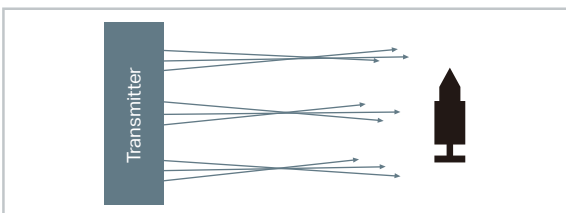
The angle and intensity distribution of the light source is not uniform, leading to poor reproducibility in some situations.
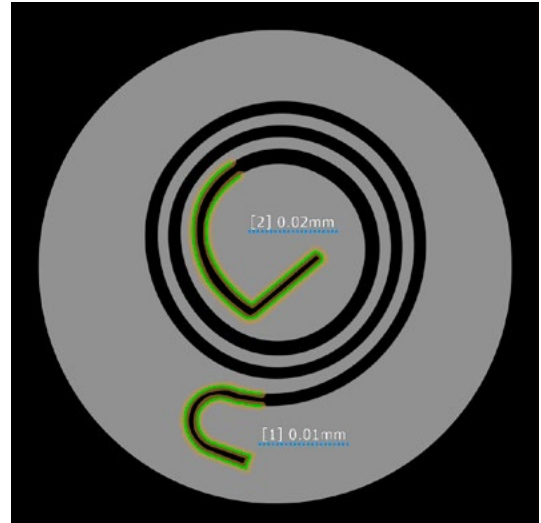
High-accuracy telecentric illumination

Variation in the angle and intensity distribution of the light is minimal, ensuring high reproducibility, even if the target is misaligned.

Spiral spring profile measurement

The Master Comparison Tool (Contour) makes it possible to check whether the profile shape of curved parts have been machined correctly.

Differential dimension measurement from the master image's profile

Master comparison tool (Contour)

Differential dimension measurement is possible by comparing the profile line of a reference master image and the actual measurement target. The shape of the reference profile can also be imported from CAD data.

* The CAD import module (TM-H1C) sold separately, is required to use the CAD import function.

Plate spring profile measurement - Good part
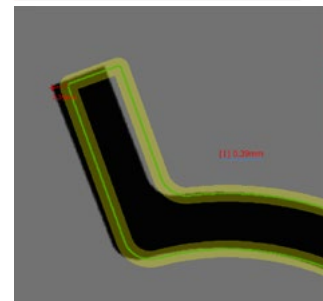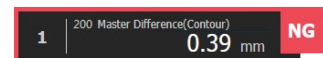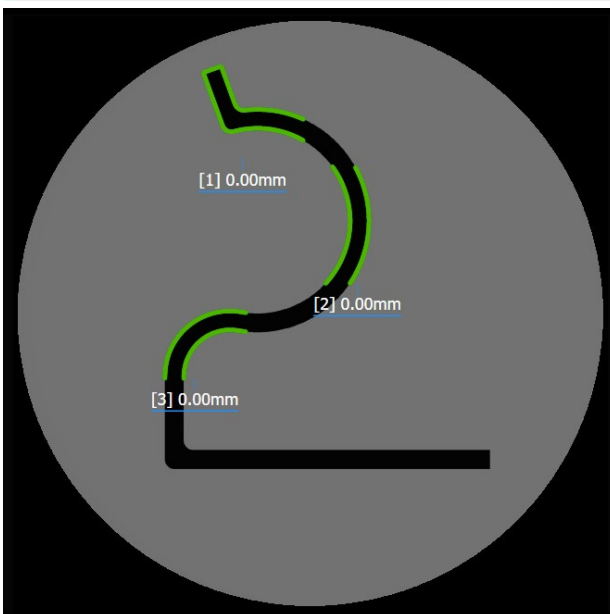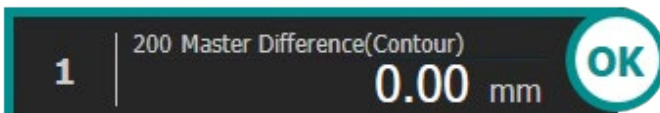
Unacceptable protrusions
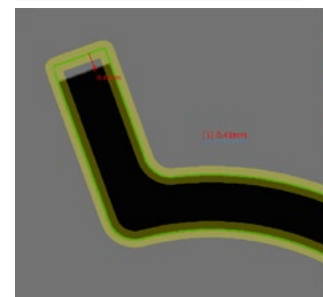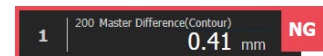
Unacceptable indentation

Film substrate and coating material thickness

By capturing the silhouette at the edge of the web, the roll, the base material, and the coating can all be referenced in a single image. This enables simultaneous thickness measurement of both the base material and coating layer. These measurements can be performed both for transparent and non-transparent materials.
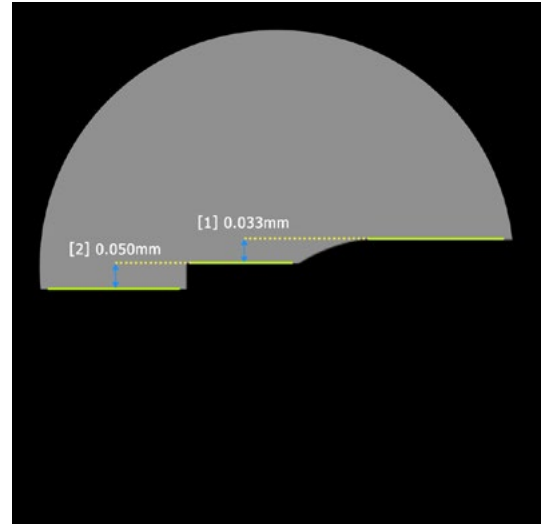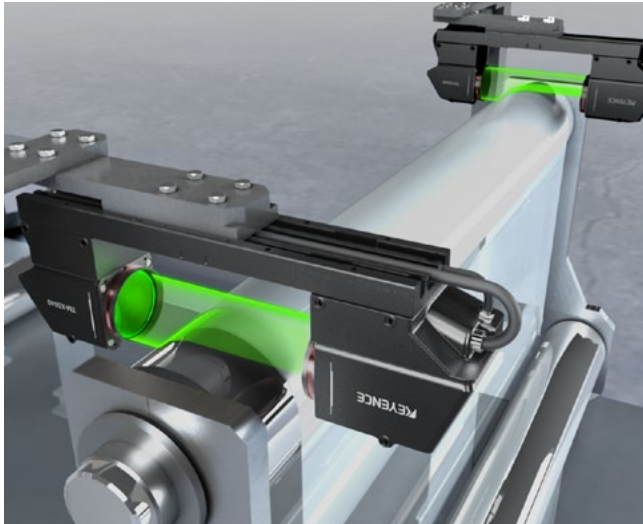
Cylinder liner outer diameter and groove distance measurement

When using two heads for large targets, the cross-head adjustment function ensures accurate measurement of various factors, including outer diameter and groove distance.
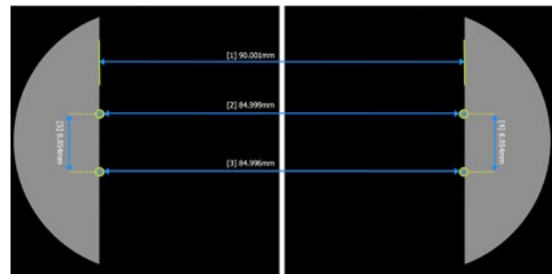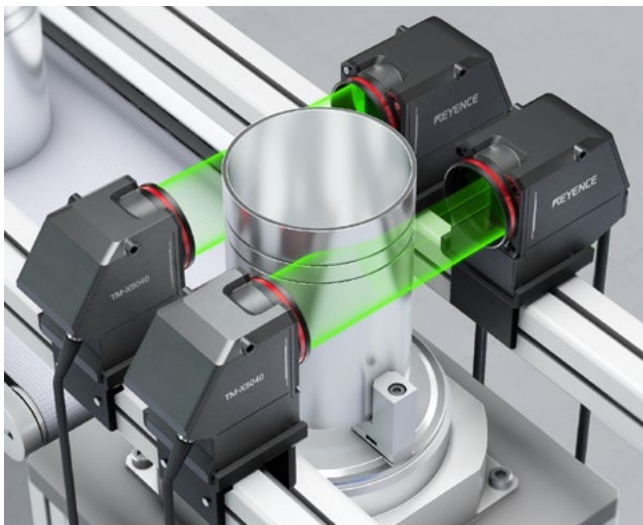
Outer and tip diameter measurement of ball end mills

The image composition function combines multiple projected images into a single image. The resulting image can be inspected for outer diameter, tip diameter, tool length or chip inspection.
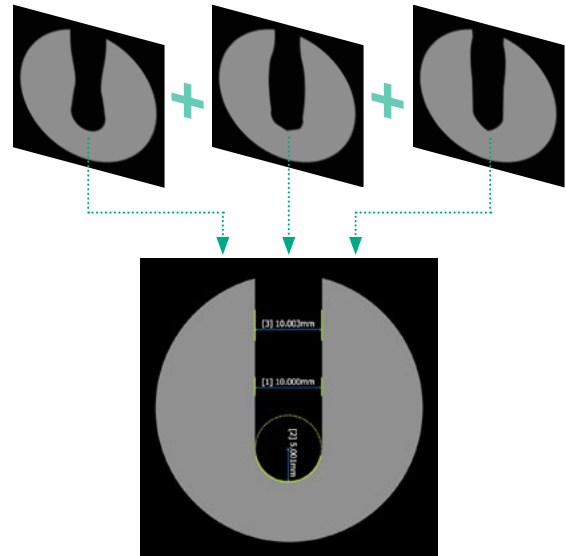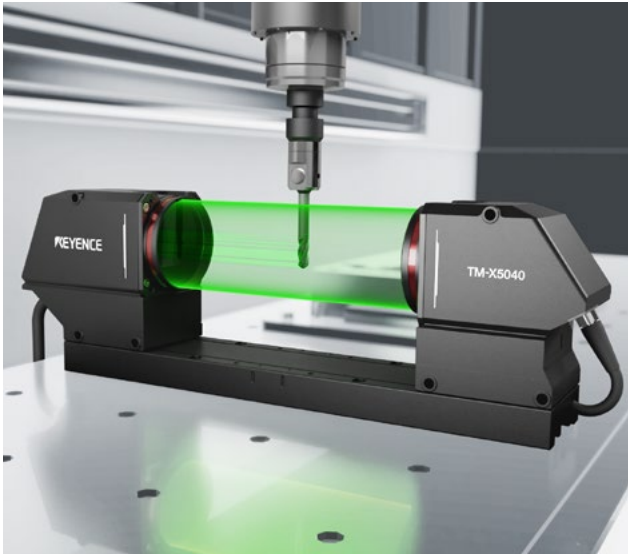
Measurement of H-cut shaft dimensions

Measurement can be performed to determine whether the H-cut is in alignment with the shaft axis.
The distance to the surface of the shaft is measured when the H-cut is at its smallest on the top and bottom, and the difference between these two measurements is used to calculate alignment with the shaft.
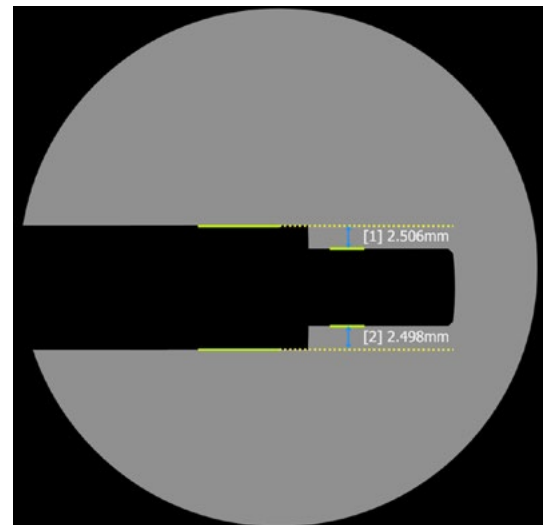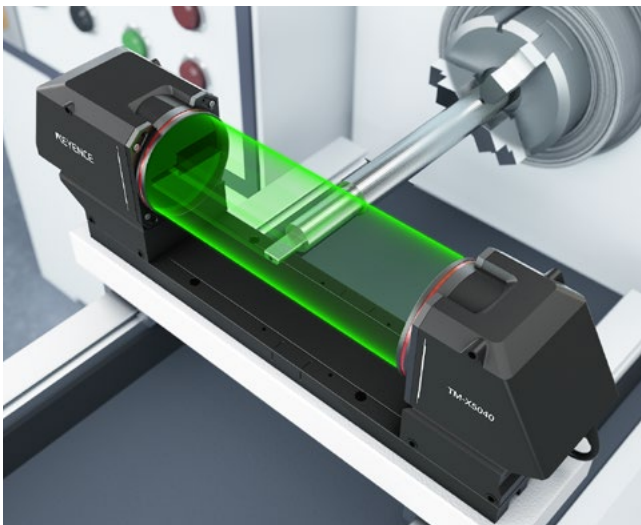
Outer diameter, angle, and tip length of needles

High-accuracy dimensional measurements—including diameter, angle, and tip length—with a repeatability of ±0.03 μm ±0.000001" can help to improve the quality of injection needles.
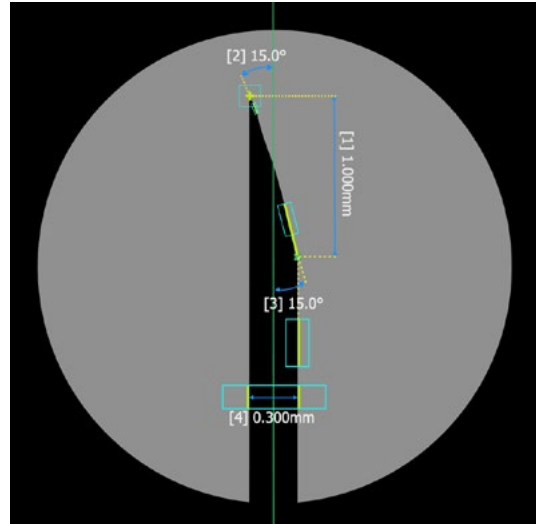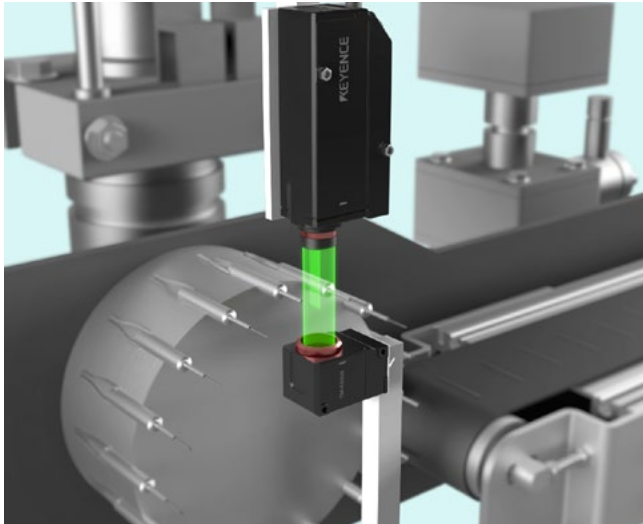
Maximum, minimum, and average outer diameter of ampules

When measuring the outer diameter of an ampule, measurement must be performed at multiple points. Silhouette-based analysis ensures high-accuracy measurement of diameter and other dimensions, even for transparent targets, such as ampules and vials.
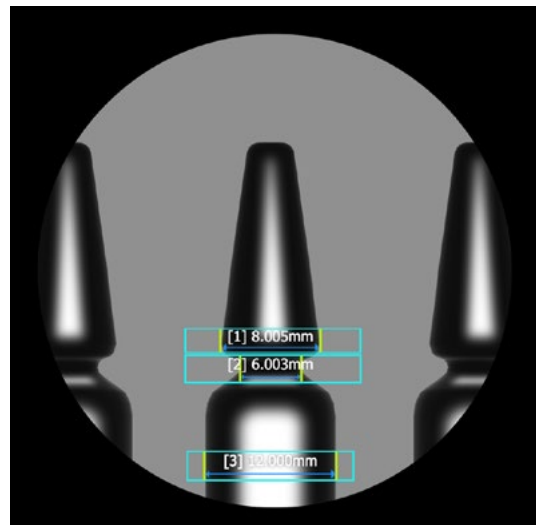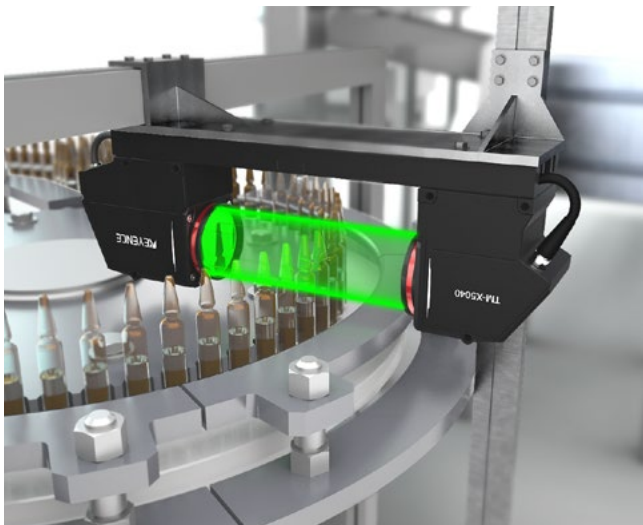
Multi-point diameter and height measurement of injectors

Simultaneous multi-point measurement is possible for a wide variety of injectors. Because there is minimal distortion throughout the entire field of view, targets of any size can be measured accurately, even if they take up the full window.
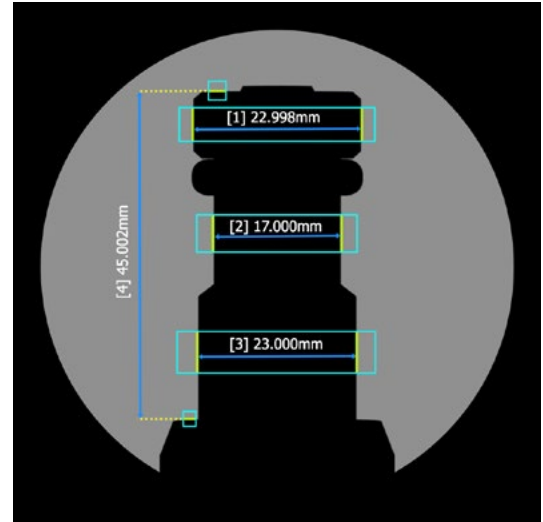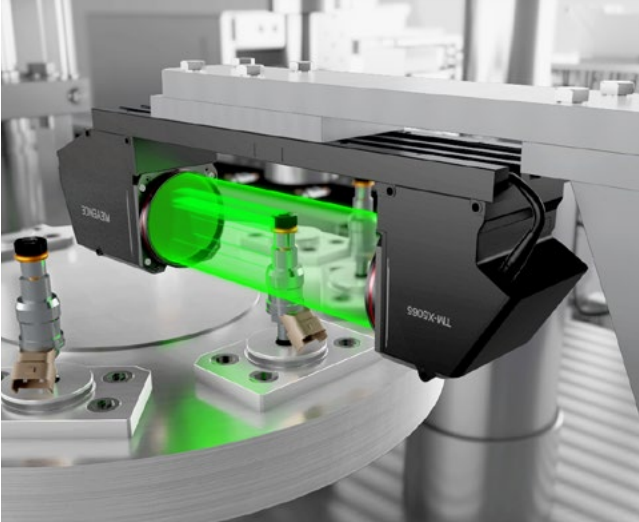
TIG welding electrode wear measurement

This function measures the tip size of electrodes used for TIG welding. Periodic measurement of the electrode tip helps track wear and improves the quality of welds.
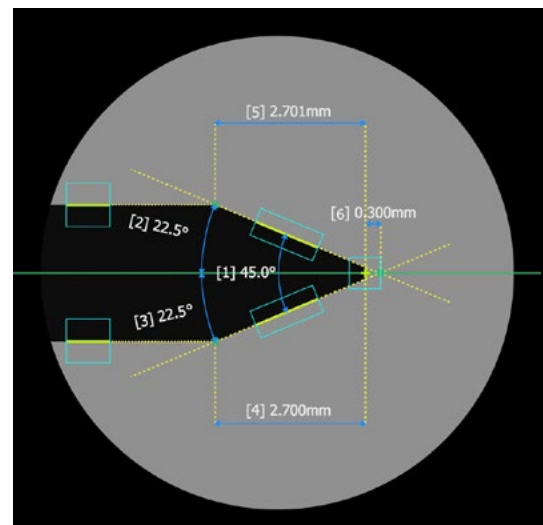
Coil winding unevenness detection

A combination of tools, including point and straight line tools, can be used to measure protrusions on the coil.
Setting the tolerance for these measurements makes it possible to determine whether the target is defective.
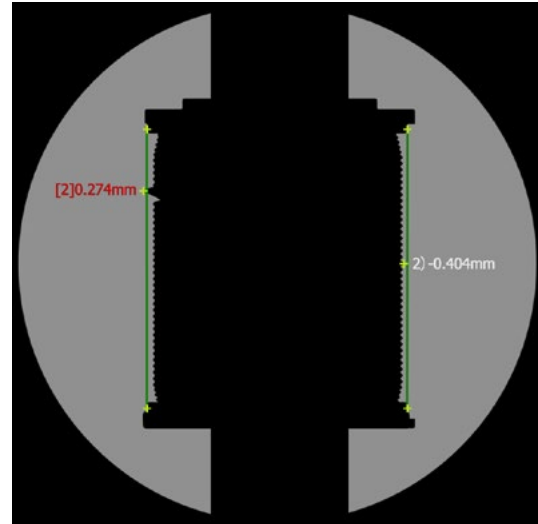
Wafer notch position detection and dimensional measurement

Angled mirrors can be used to perform measurement where installation space is limited.
In addition to detecting the coordinates of tangent circles at specified diameters and intersection point coordinates, angled mirrors can also be used to measure notch dimensions and identify shape problems.
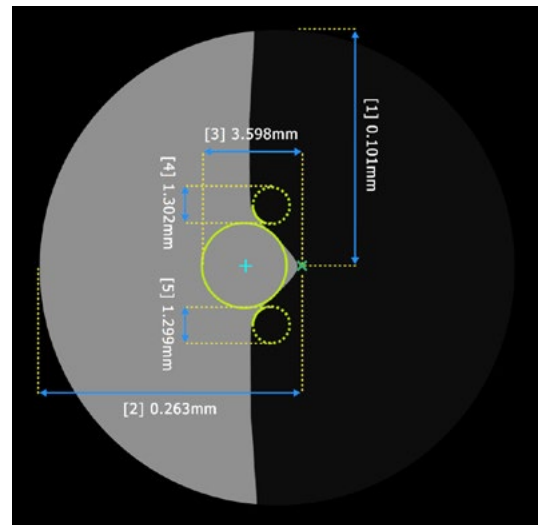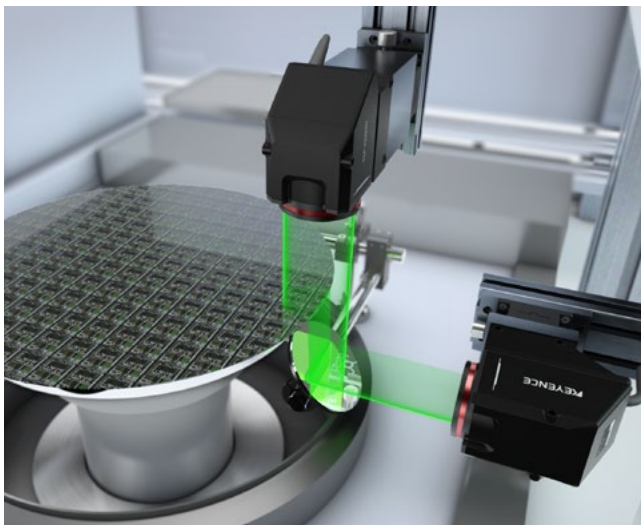
Test piece measurement during tension testing

The width of test pieces can be measured in real time during tension testing, allowing users to capture the minimum width at the time of failure. Measured data can be output directly to Excel.

[1] 10.523mm
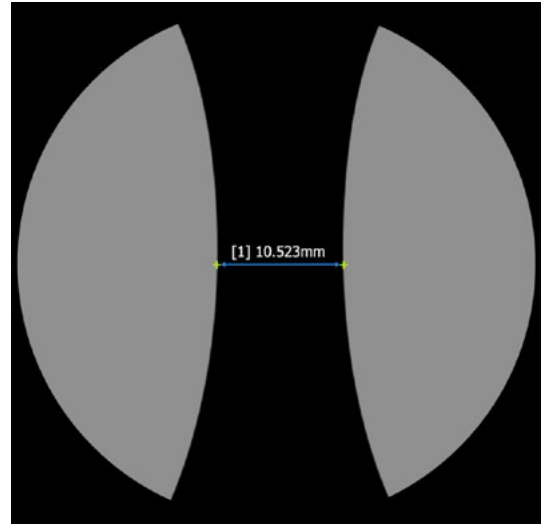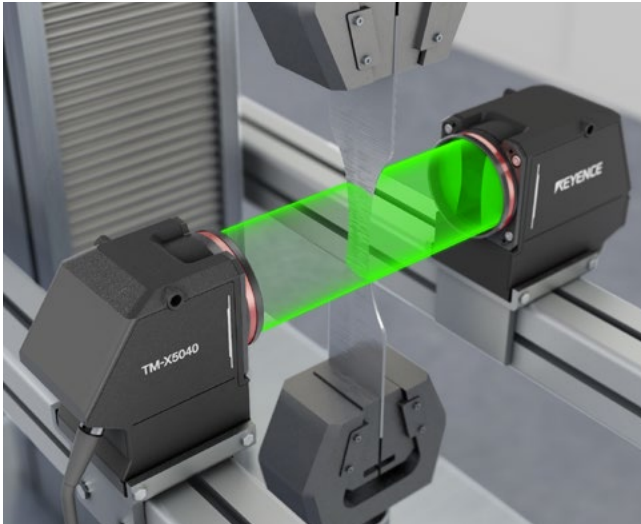
Outer diameter measurement of bearings

Accurate measurement is possible throughout the ø65 mm ø2.56" field of view, ensuring high-accuracy measurement even with large-sized targets. The dual telecentric optical system also minimizes the effects of ambient light and temperature changes.

[1] 44.999mm
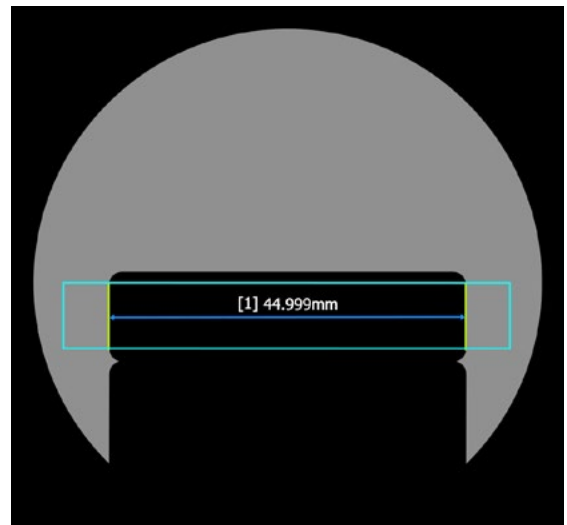
Thread dimension measurement of solenoid valves

Perform inline thread inspections without the need for a conventional thread gauge.
The included thread tool makes it easy to measure the effective diameter, major diameter, minor diameter, pitch, and thread angle.
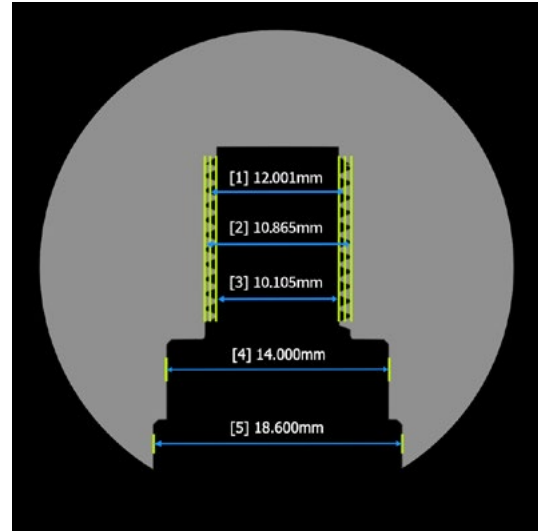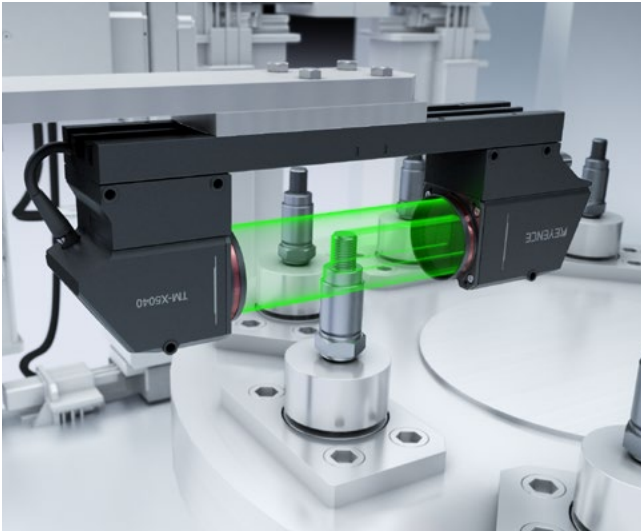
Band saw pitch, angle, and blade height

While conventional systems use a projector to perform offline inspection, the TM-X5000 Series can perform inline inspection of the pitch, angle, and blade height of band saws.
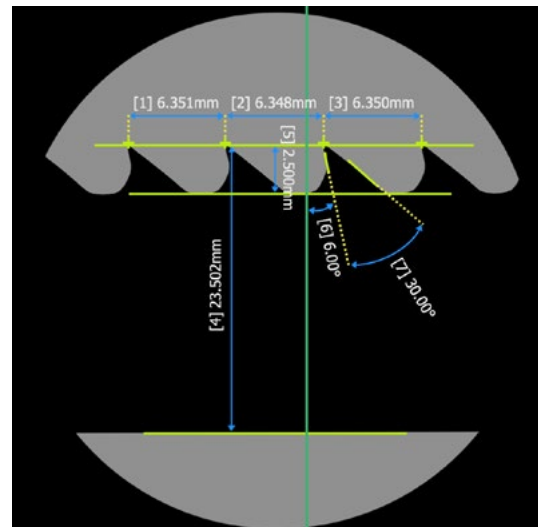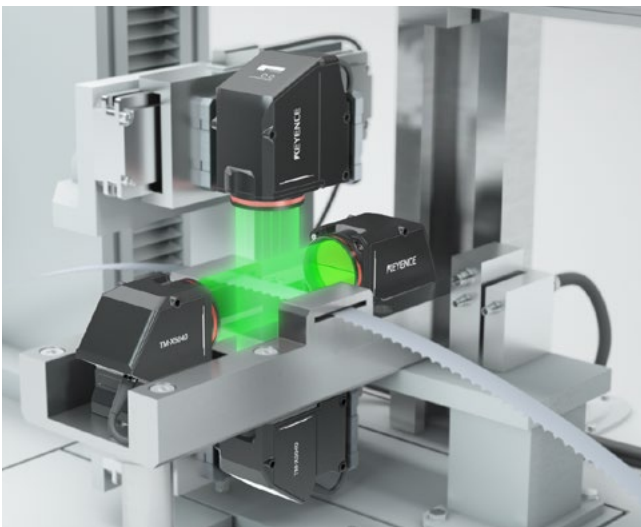
Measurement and type identification of gears

The TM-X5000 Series detects the peaks and valleys of the teeth when measuring the dimensions of a gear. The gear type can also be identified by combining the measurement results with the pitch count and other items.
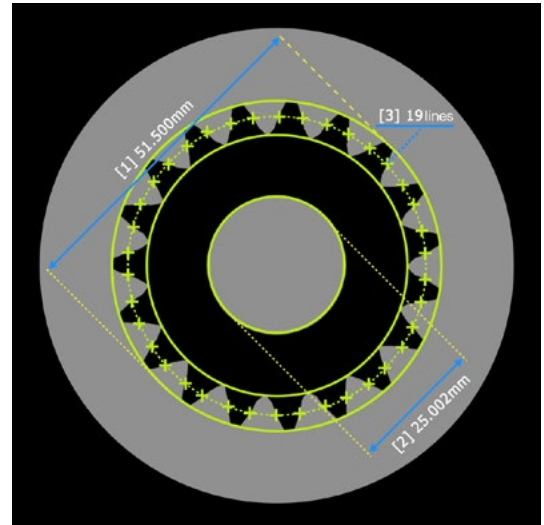
Motor winding defect inspection

The dual telecentric optical system's large depth of field means inspection can be performed for an entire winding, including the winding width, even for targets that take up the entire field of view.
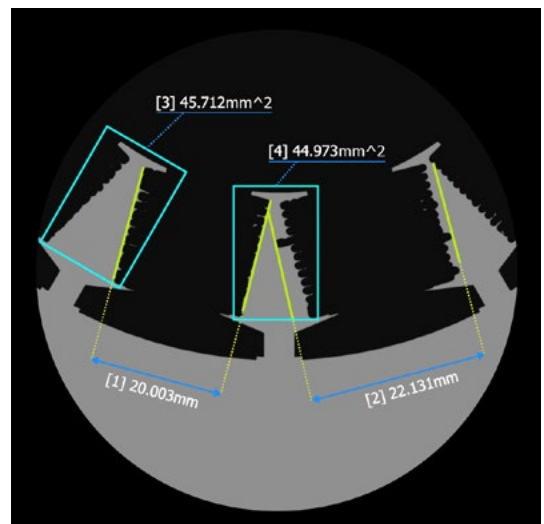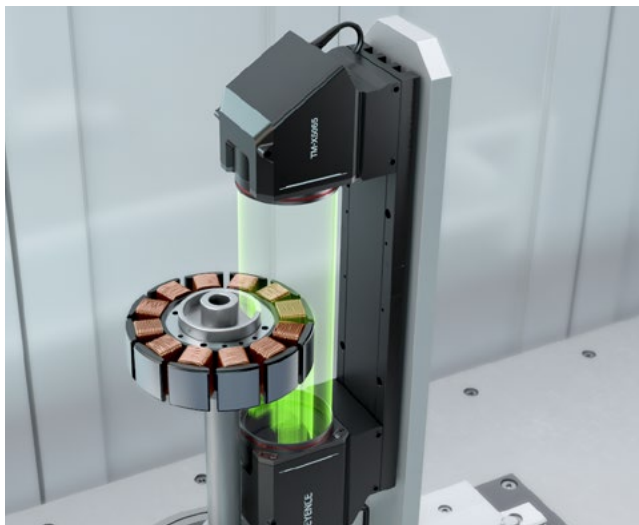
Three models to suit a variety of applications

Compact, ultra-high-accuracy model
TM-X5006

Measuring range	ø6 mm ø0.24"
Repeatability	±0.03 µm ±0.000001"
Measurement position accuracy	±0.2 µm ±0.000008"

Standard model
TM-X5040

Measuring range	ø40 mm ø1.57"
Repeatability	±0.08 µm ±0.000003"
Measurement position accuracy	±1.0 µm ±0.000039"

Wide-field model
TM-X5065

Measuring range	ø65 mm ø2.56"
Repeatability	±0.1 µm ±0.000004"
Measurement position accuracy	±1.2 µm ±0.000047"

Sensor head

Two heads can be connected to a single controller.
(Connecting different heads is possible.)

Required

Head connection cable
High-flex 3 m 9.8' cable: **CB-C3R**
High-flex 5 m 16.4' cable: **CB-C5R**
High-flex 10 m 32.8' cable: **CB-C10R**

<Extension>
High-flex 10 m 32.8' extension cable:
CB-C10RX
Extension cable repeater:
TM-CX10U

Required

Controller
TM-X5000

❙ Dedicated display

USB cable
OP-35331 (3 m 9.8')

12-inch dedicated monitor
TM-MP120

Ethernet cable
OP-66843 (3 m 9.8')

Monitor stand
OP-87262

❙ PC or Windows device with touch panel

USB cable
OP-35331 (3 m 9.8')

PC / Windows device with touch panel

Ethernet cable
OP-66843 (3 m 9.8')

❙ RGB monitor

Controller-monitor cable
OP-66842 (3 m 9.8')

RGB monitor

Expansion units

EtherCAT® unit
CB-NEC20E

PROFINET unit
CB-NPN20E

EtherNet/IP™ unit
CB-NEP20E

Optional accessories

CAD import module
TM-H1C

Protective cover
OP-88575
(2-piece set for TM-X5040)
OP-88576
(2-piece set for TM-X5065)

Transmitter-receiver cable

Transmitter-receiver extension cable
OP-87033 (1 m 3.3')
Transmitter-receiver extension cable
OP-87034 (3 m 9.8')

Communication cables and connectors

I/O expansion connector cable
OP-51657 (3 m 9.8')

RS-232C cable conversion connector
OP-26486

RS-232C cable
OP-26487 (2.5 m 8.2')

Ethernet cable
OP-66843 (3 m 9.8')

USB cable
OP-35331 (3 m 9.8')

Other

SD card (industrial-grade)
16 GB **CA-SD16G**
4 GB **CA-SD4G**
1 GB **CA-SD1G**
512 MB **OP-87133**

Dedicated mouse
OP-87506
Mouse stand
OP-87601
24 VDC power supply
CA-U4

Specifications

Sensor head

Model			TM-X5006	TM-X5040	TM-X5065
Transmitter/receiver distance			60 mm 2.36"	180 mm 7.09"	270 mm 10.63"
Measuring range	Field of view	High-accuracy measurement area	ø4 mm ø0.16"	ø26 mm ø1.02"	ø40 mm ø1.57"
		Measurement area	ø6 mm ø0.24"	ø40 mm ø1.57"	ø65 mm ø2.56"
	Depth of field	High-accuracy measurement area	2 mm 0.08"	10 mm 0.39"	20 mm 0.79"
		Measurement area	4 mm 0.16"	20 mm 0.79"	30 mm 1.18"
Exposure time			25/50/100 μs (Adjustable 3-stage)		
Imaging time (Trigger interval)			Approx. 24 ms (at "Full" vertical/horizontal measurement range sizes) Approx. 3 ms (at "4/16" vertical/horizontal measurement range sizes)		
Light source			InGaN green LED		
Measurement position accuracy*1		High-accuracy measurement area	±0.2 μm ±0.000008"	±1 μm ±0.000039"	±1.2 μm ±0.000047"
		Measurement area	±0.3 μm ±0.000012"	±2 μm ±0.000079"	±2.2 μm ±0.000087"
Repeatability*2			±0.03 μm ±0.000001"	±0.08 μm ±0.000003"	±0.1 μm ±0.000004"
Pixel resolution			Approx. 3.5 μm 0.000138"	Approx. 21 μm 0.000827"	Approx. 37 μm 0.001457"
Environmental resistance	Enclosure rating*3		IP64		
	Operating ambient temperature		0 to +45°C 32 to 113°F		
	Operating ambient humidity		20 to 85% RH (No condensation)		
Material			Aluminum		
Weight	Transmitter		Approx. 160 g 5.65 oz	Approx. 620 g 21.89 oz	Approx. 1300 g 2.87 lb
	Receiver		Approx. 480 g 16.94 oz	Approx. 890 g 31.42 oz	Approx. 1900 g 4.19 lb
	Base		Approx. 210 g 7.41 oz	Approx. 670 g 23.65 oz	Approx. 1500 g 3.31 lb

*1 Error when measuring width of KEYENCE standard object (glass calibration scale).
*2 Average value of ±2σ measuring the width of a KEYENCE standard object (glass calibration scale) 16 times in the center of the measurement area.
*3 Excluding connectors and cable boxes.

Dedicated monitor for TM-X

Model		TM-MP120
LCD panel	Display element	TFT LCD
	Display colors	16 million colors
	Number of dots	1024 × 768 (W × H)
	Effective display area	245.7 × 184.3 9.67" × 7.26" (W × H mm inch)
	Backlight	White LED (non-replaceable); Life expectancy (normal temperature/humidity): Approx. 50000 hours
Interface	Ethernet	1 port on rear (1000BASE-T/100BASE-TX)
	USB*1	1 port on front, 2 ports on rear
Ratings	Power voltage	24 VDC ±10%
	Max. current consumption	2.5 A
Environmental resistance	Operating ambient temperature	0 to +50°C 32 to 122°F
	Operating ambient humidity	35 to 85% RH (No condensation)
	Structure	Panel-embedded, IP65f (dust-/drip-proof) on front operating section only
Weight		Approx. 2400 g 5.29 lb

*1 Use USB cable OP-35331 (3 m 9.8') to connect to the controller.

Cable

Type	Model	Cable length	Weight
Head connection cable	CB-C3R	3 m 9.8'	Approx. 250 g 8.83 oz
	CB-C5R	5 m 16.4'	Approx. 410 g 14.47 oz
	CB-C10R	10 m 32.8'	Approx. 740 g 26.12 oz
Head connection extension cable	CB-C10RX	10 m 32.8'	Approx. 740 g 26.12 oz
Transmitter-receiver cable	OP-87033	1 m 3.3'	Approx. 60 g 2.12 oz
	OP-87034	3 m 9.8'	Approx. 130 g 4.59 oz

Extension cable repeater

Model		TM-CX10U
Max. connections	Number of steps	2
	Cable length	30 m 98.4' total (10 m 32.8' between devices)
Environmental resistance	Operating ambient temperature	0 to +45°C 32 to 113°F
	Operating ambient humidity	35 to 85% (No condensation)
Weight		Approx. 60 g 2.12 oz

Controller

Model	TM-X5000		
Number of connectable sensor heads	2		
Number of setting registrations	Up to 1000 settings (depending on SD card capacity and setting contents) for SD card 1 and SD card 2 individually. External switching is possible.		
Memory cards	• SD card slot × 2 • Supports OP-87133 (512 MB), CA-SD1G (1 GB: Equipped as standard for SD1 slot), CA-SD4G (4 GB), CA-SD16G (16 GB)		
Number of configurable tools	Up to 100 measurement tools and 100 element tools per head[1]		
Interface	Control inputs	20 (Terminal block: 5, Parallel I/O: 15)	
	Control outputs	• 28 (Terminal block: 6, Parallel I/O: 22) • Photo MOSFET[2]	
	RS-232C	Numerical value output and control input/output	
	PLC link	Numerical value output and control input/output using Ethernet port (Cannot be used in conjunction with EtherNet/IP™, PROFINET, and EtherCAT®) Compatible models: Mitsubishi Electric PLCs (MELSEC Q Series, L Series, iQ-R Series, iQ-F Series)	
	Ethernet	• Numerical value output and control input/output • Connection to KEYENCE dedicated monitor (TM-MP120) • Connection to KEYENCE PC application software • Support for FTP client/server functions, BOOTP functions • 1000BASE-T/100BASE-TX/10BASE-T • Support for jumbo frames (Ethernet port on main unit only)	
	USB	• Connection to KEYENCE dedicated monitor (TM-MP120) • Connection to KEYENCE PC application software • USB 2.0 only	
	EtherNet/IP™	• Numerical value output and control input/output using Ethernet port or optional EtherNet/IP™ unit CB-NEP20E (Cannot be used in conjunction with PLC link, PROFINET, and EtherCAT®) • Supports cyclic communication (max. 1436 bytes) and message communication • Maximum connections: 32 (Ethernet port) / 1: Exclusive Owner, 4: Input only (CB-NEP20E) • Conforms to conformance test Version CT17 (Ethernet port) / CT17 (CB-NEP20E)	
	PROFINET	• Numerical value output and control input/output using Ethernet port or optional PROFINET unit CB-NPN20E (Cannot be used in conjunction with PLC link, EtherNet/IP™, and EtherCAT®) • Supports cyclic communication (max. 1408 bytes (Ethernet port) / 1212 bytes (CB-NPN20E)) • Supports non-cyclic communication (recorded data) • Conforms to Conformance Class A (Ethernet port) / C (CB-NPN20E)	
	EtherCAT®	• Numerical value output and control input/output using optional EtherCAT® unit CB-NEC20E (Cannot be used in conjunction with PLC link, EtherNet/IP™, and PROFINET) • Supports cyclic communication (process data object communication) (Input: max. 530 bytes / Output: max. 534 bytes) • Supports non-cyclic communication (mailbox communication) • Supports CoE • Conforms to conformance test V2.2.1.0	
	SNTP	Automatic date and time correction when connected to SNTP server	
	USB HDD	Various data output, including image data, when connecting an HDD (2 TB max.) to dedicated USB port (USB 3.0 support, bus-powered, rated output: 900 mA)	
	Simple monitor output	Analog RGB output, XGA (1024 × 768 (24-bit color, 60 Hz))	
Minimum display unit	0.01 μm, 0.0001°, 0.0001 mm^2		
Display language (Simple monitor output)	Switchable between English, Japanese, Simplified Chinese, Traditional Chinese, Korean, Thai, German, French, Italian, Spanish (Mexico), Czech, Hungarian, and Polish		
Ratings	Power voltage	24 VDC ±10%	
	Current consumption	3.5 A	
Environmental resistance	Operating ambient temperature	0 to +45°C 32 to 113°F (when installed on a DIN rail) / 0 to +40°C 32 to 104°F (when installed on a surface)	
	Operating ambient humidity	35 to 85% RH (No condensation)	
Weight	Approx. 1600 g 3.53 lb		

[1] Up to 7 master comparison tools (area/contour), 19 pitch measurement tools (distance/angle), 13 foreign particle distance tools (rotating rectangle), 8 foreign particle distance tools (circle/arc), and 7 profile extraction tools (depending on SD card capacity and settings).
[2] Positive common connection for NPN input devices and negative common connection for PNP input devices supported.
• EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

TM-X Navigator operating environment

Model	TM-H1X
Supported OS	Microsoft Windows10 Home/Pro/Enterprise • Supported OS languages: English, Japanese, Simplified Chinese, Traditional Chinese, Korean, Thai, German, French, Italian, Spanish (Mexico), Czech, Hungarian, and Polish
Required free space on hard disk	2 GB or more (with additional space for storing images required)
Display resolution	1366 × 768 pixels or higher (1920 × 1080 pixels or higher recommended)

• Windows® is a trademark or registered trademark of Microsoft Corporation in the United States and other countries.
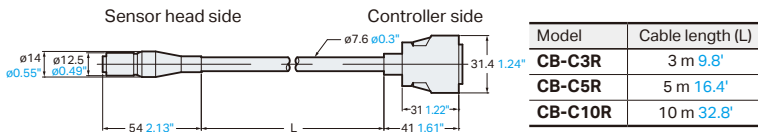
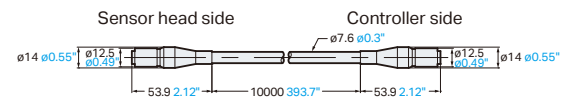## Sensor head (Compact, ultra-high-accuracy model): **TM-X5006**
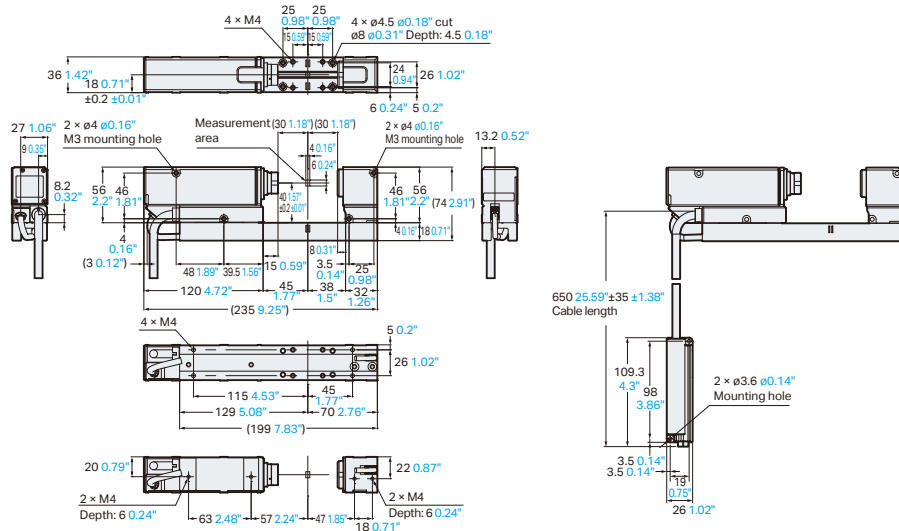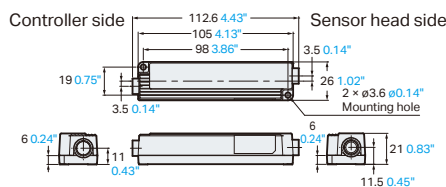

Sensor head (Standard model): **TM-X5040**
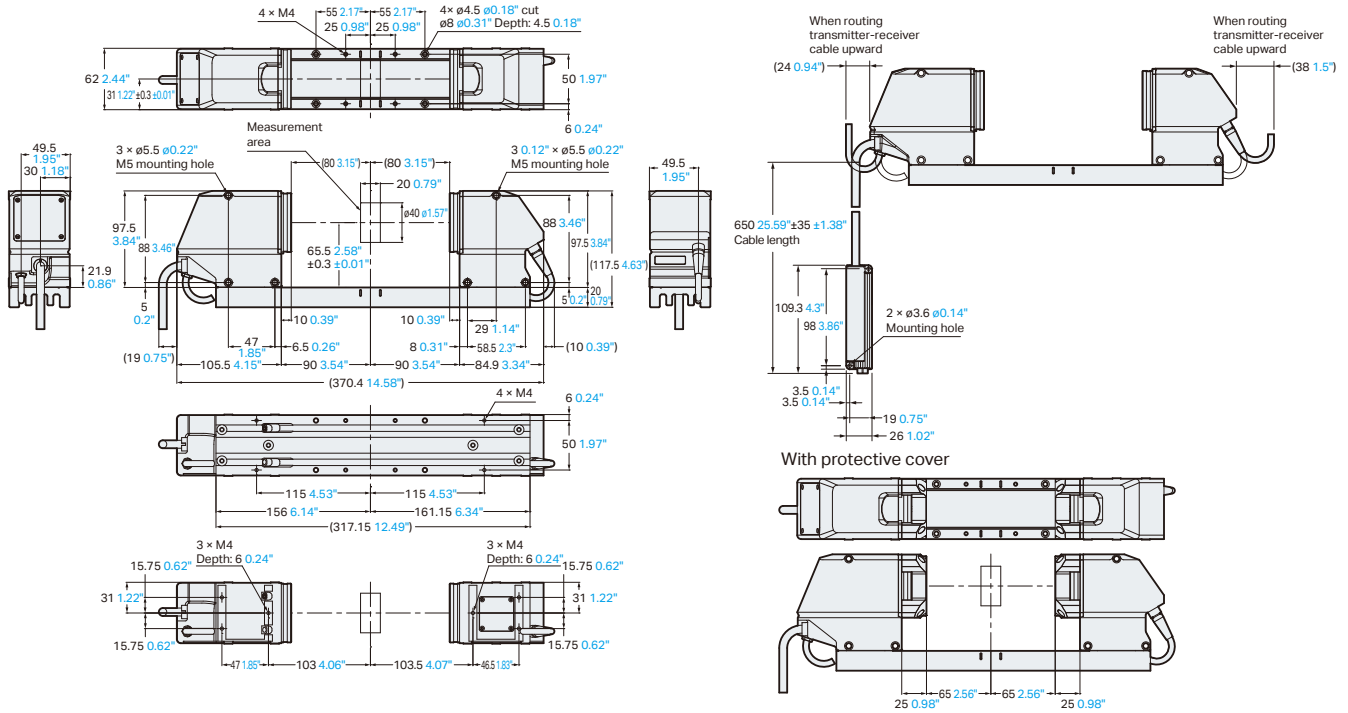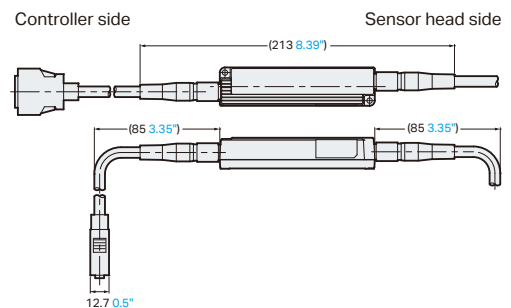

Head connection cable: **CB-C3R/CB-C5R/CB-C10R**

Model	Cable length (L)
CB-C3R	3 m 9.8'
CB-C5R	5 m 16.4'
CB-C10R	10 m 32.8'

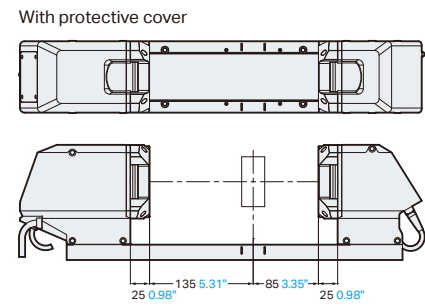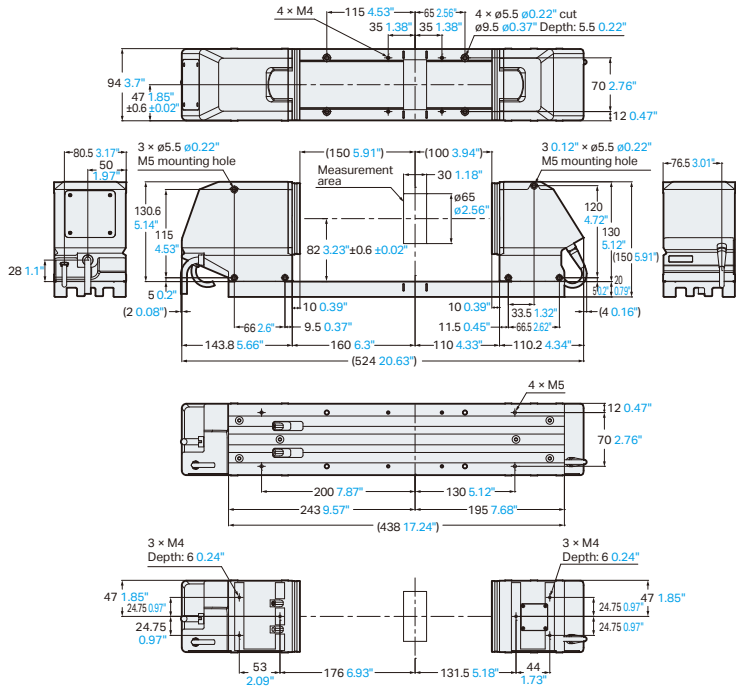## Head connection extension cable: **CB-C10RX**

With cables connected

Head connection extension repeater: **TM-CX10U**

Sensor head (Wide-field model): **TM-X5065**

When routing transmitter-receiver cable upward

When routing transmitter-receiver cable upward

With protective cover
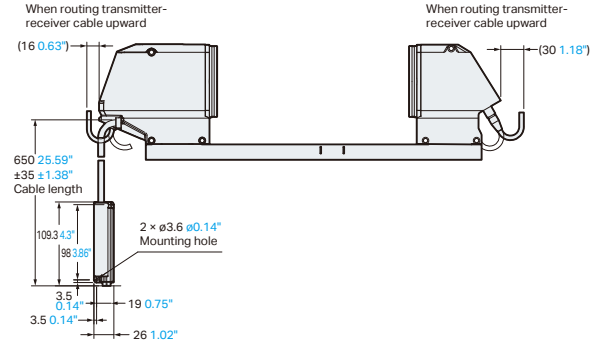
Controller:
TM-X5000
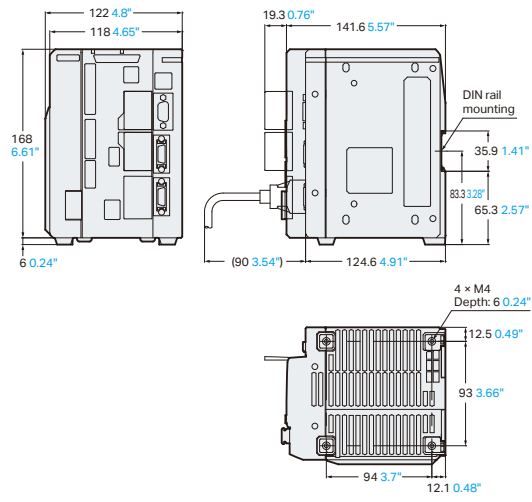
Dedicated monitor for TM-X:
TM-MP120

With mounting bracket (accessory) attached

Panel cutting dimensions

Panel installation (front)
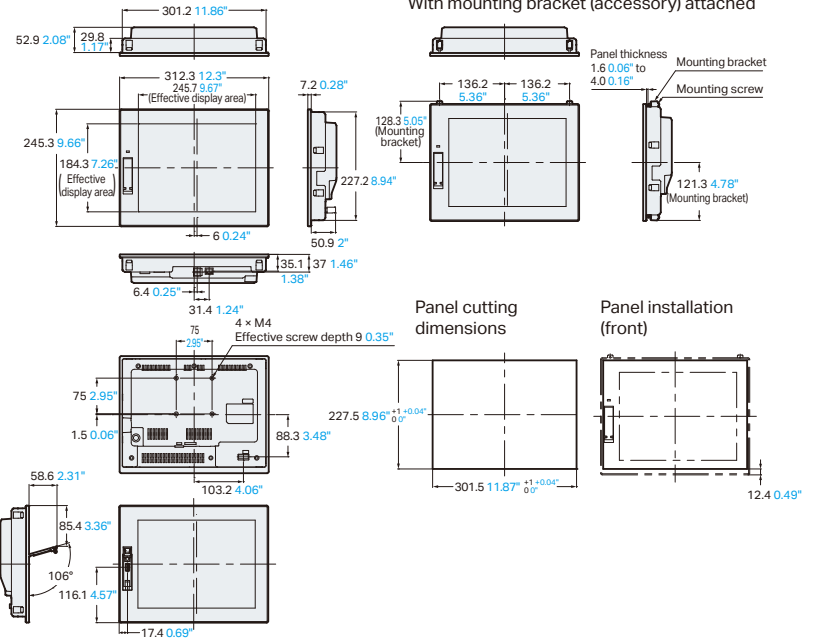
Expansion unit:
CB-NEC20E/CB-NPN20E/CB-NEP20E
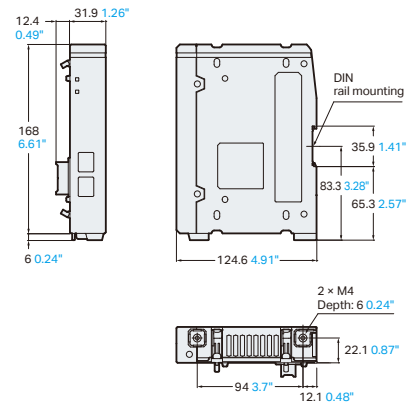
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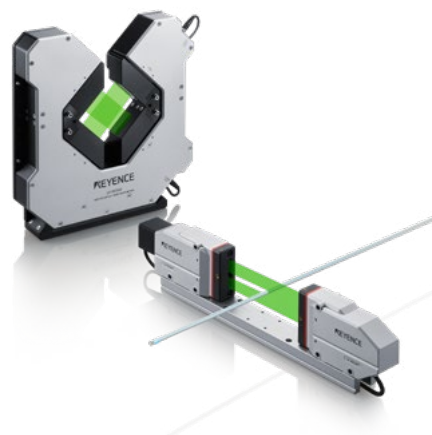
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⚠ **SAFETY INFORMATION**
Please read the instruction manual carefully in order to safely operate any KEYENCE product.

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KEYENCE CORPORATION OF AMERICA
Head Office   500 Park Boulevard, Suite 200, Itasca, IL 60143, U.S.A.   **PHONE:** +1-201-930-0100   **FAX:** +1-855-539-0123   **E-mail:** keyence@keyence.com

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KEYENCE CANADA INC.
Head Office   **PHONE:** +1-905-366-7655   **FAX:** +1-905-366-1122   **E-mail:** keyencecanada@keyence.com
Montreal   **PHONE:** +1-514-694-4740   **FAX:** +1-514-694-3206   **Windsor PHONE:** +1-905-366-7655   **FAX:** +1-905-366-1122

KEYENCE MEXICO S.A. DE C.V.
PHONE: +52-55-8850-0100   **FAX:** +52-81-8220-9097
E-mail: keyencemexico@keyence.com

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