IN-LINE 2D MEASUREMENT SYSTEM

MEASURES 2 DIMENSIONS WITH MICRON PRECISION
**Commitment to In-line Measurement**

Performs in line 2D dimensional measurements with high speed and precision. The new TM-3000 Series, the industry’s first inline 2D measurement system.

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**Because the TM-3000 is 2D it can...**

**Measure single point and edge dimensions**

No need to position an object, outer diameter and angles can be measured instantaneously. In addition, since the object position is recognised, accurate measurement is performed with position correction. Furthermore, variations due to surface roughness of an object are suppressed with edge averaging, improving the reliability of measurement.

**High speed production support**

**Newly developed HT processor**

Newly developed high speed 2D dedicated includes a high-speed computing CPU and two dedicated image processing DSPs. Using a total of four processors for parallel processing, TM-3000 Series allows for fast processing of 1800(images)/minute.

*HT Processor...High Speed Two Dimensional Processor
*1800 images/min... calculated with approx. 33 ms trigger interval (default setting)

**High precision inspection**

A high brightness LED and a double telecentric optical system ensure high precision performance

A advantage of the thrubeam type which is not affected by external lighting, ±0.15 μm repeatability.
**High speed and high precision** are achieved by performing pinpoint extraction and sub-pixel processing on just the contour within the specified measurement area, from the silhouette imaged on the CMOS.

**Collimated light** is produced without any unevenness by spreading LED light uniformly across the complete range.  
*HUD unit = High Uniform Diffusion unit*

**Even with slight deviations of the object within the measurement area, the size of the image does not change.**

**Pinpoint sub-pixel processing**

**Measurement principle**
Uniform collimated lighting with a green LED. Two-dimensional CMOS array detects the light-dark edges in the received light, and measures the dimensions.

**Dual telecentric optical system**
Dual telecentric lenses ensure only collimated light is used for imaging. Even though the distance from the object to the lenses change, the size of the image on the CMOS does not change. High precision measurement is possible.

**High brightness InGaN green LED**
A high brightness LED is used, combining three features,  
- Even Brightness Distribution  
- Resistant to EMF  
- Eye Safe

**Traceable two dimensional inspections in line**
A variety of measurement modes greatly expand the inspection possibilities

Because the system works in two dimensions it can...

Simultaneously measure a maximum of 16 measurement points within the measurement area. The time for measurement has been greatly reduced.

Diverse measurement modes

A flexible combination of 15 types of basic measurement modes, and 8 types of auxiliary measurement modes, can support a variety of inspections.

- **Outer diameter/Step/Width**
  Measures a maximum diameter/minimum diameter within the specified area, and a step/width between the detected edges.

- **Distance/Intersection Point Distance**
  Measures a centre of the circles and intersection point, distance between 2 specified points, distance from a point to a straight line.

- **Radius/Roundness**
  Measures radius and roundness of specified arc.

- **Height / Position/Coordinates**
  Measures height/ position of detected edges and coordinates of specified points.

- **Angle**
  Measures an angle between two detected straight lines, and a tilt angle from a virtual line.

- **Pitch**
  Measures a maximum/minimum/average pitch within the specified area.

**Example of measurement**
- Hole diameter
- Centre pitch
- Intersection point coordinates
- R radius
- Width
- Angle
- Perpendicular distance
- Area
APPLICAT I O N S

Measures outer diameter /pitch angle of springs

Measures outer diameter /tip angle of needle valves

Measures pulley groove pitches / V groove angles

Measures multi-point outer diameter / point angle of injection needles

Measures diameter / height of lenses

Measures maximum diameter / minimum diameter of ampules

Measures outer diameter and threading a PET bottle

Measures roundness / thickness of O-rings
Correction function with on-the-spot power

Position correction function [edge correction/pattern correction]
Automatically corrects misalignments and tilt of the target which is directly linked to measurement errors. Can measure accurately even when positioning is difficult or objects are conveyed in random orientations.

Tilt correction function
When installing the sensor head, a tilt of the master workpiece is horizontally/vertically corrected, which significantly reduces adjustment times.
Simple setting and analysis with a PC

**SETTING SUPPORT SOFTWARE**

**TM-Navigator (TM-H1)**

With the included software, settings can be easily configured and data can be saved and analysed with a PC.

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**Large capacity memory for saving data**

The controller has built in high capacity memory. A memory card slot is included for recording histories of multiproduct/mass production.

**Profile saving**

For analysing NG records or production history.

**Maximum 100 images**

For daily production control and traceability

**65,536 data can be stored**

**Handling many product types**

The memory in the controller stores up to 16 programmes. By using a function to search from the memory card, up to 256 programmes can be switched to handle various product types.

<table>
<thead>
<tr>
<th></th>
<th>Programme setting</th>
<th>Image saving</th>
<th>Data storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal memory</td>
<td>16</td>
<td>100</td>
<td>65,536 × 16</td>
</tr>
<tr>
<td>SD card (4GB)</td>
<td>256</td>
<td>Approx. 3,800</td>
<td>65,536 × Approx. 8,000</td>
</tr>
</tbody>
</table>
**SPECIFICATIONS (SENSOR HEAD)**

<table>
<thead>
<tr>
<th>Model</th>
<th>TM-006</th>
<th>TM-040</th>
<th>TM-065</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>±6 mm</td>
<td>±40 mm</td>
<td>±60 mm</td>
</tr>
<tr>
<td>Smallest detectable object</td>
<td>0.04 mm</td>
<td>0.3 mm</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>Transmitter/receiver distance</td>
<td>60 mm</td>
<td>180 mm</td>
<td>270 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>GaN Green LED</td>
<td>InGaN Green LED</td>
<td></td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 µm*</td>
<td>±2 µm**</td>
<td>±3 µm***</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.06 µm**</td>
<td>±0.15 µm***</td>
<td>±0.2 µm****</td>
</tr>
<tr>
<td>Sampling cycle (trigger interval)**</td>
<td>5.5ms (33ms at the initial setting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>IP64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enclosure rating</td>
<td>35 to 95% (No condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0 to 50°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Transmitter</td>
<td>Approx. 140g</td>
<td>Approx. 560g</td>
</tr>
<tr>
<td></td>
<td>Receiver</td>
<td>Approx. 340g</td>
<td>Approx. 720g</td>
</tr>
<tr>
<td></td>
<td>Base</td>
<td>Approx. 220g</td>
<td>Approx. 650g</td>
</tr>
</tbody>
</table>

*1 In measurement around 3 mm, an imprecision when measuring width of KEYENCE standard object (glass calibration scale).
*2 Measurement of ±2 µm measuring the width of the KEYENCE standard object (glass calibration scale) in the centre of the measurement area.
*3 In measurement around 10 mm, ±0.05 mm error when measuring width of KEYENCE standard object (glass calibration scale).
*4 Measurement of ±3 µm measuring the width of the KEYENCE standard object (glass calibration scale) in the centre of the measurement area.
*5 Error when measuring width of KEYENCE standard object (glass calibration scale) in a measurement area of 0.05 mm to 0.4 mm.
*6 Value of ±3 µm measuring the width of the KEYENCE standard object (glass calibration scale) in the centre of the measurement area.
*7 When measurement area is minimum, others are initial settings.

**SPECIFICATIONS (CONTROLLER)**

<table>
<thead>
<tr>
<th>Model</th>
<th>TM-3001</th>
<th>TM-3001P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor head compatibility</td>
<td>Compatible</td>
<td></td>
</tr>
<tr>
<td>Number of connectable sensors**</td>
<td>2 units max.</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>Maximum display unit</td>
<td>0.01 µm, 0.001 mm, 0.01&quot;</td>
</tr>
<tr>
<td></td>
<td>Non-voltage input</td>
<td>Voltage input</td>
</tr>
<tr>
<td>Input terminal block</td>
<td>Analogue voltage output</td>
<td>±10 V x 2 outputs, output impedance: 100 Ω</td>
</tr>
<tr>
<td></td>
<td>Total judgment output</td>
<td>NPN open-collector output, PNP open-collector output</td>
</tr>
<tr>
<td></td>
<td>Error output</td>
<td>NPN open-collector output (N.C.), PNP open-collector output (N.C.)</td>
</tr>
<tr>
<td></td>
<td>Process output</td>
<td>NPN open-collector output</td>
</tr>
<tr>
<td></td>
<td>Trigger input enable output</td>
<td>NPN open-collector output</td>
</tr>
<tr>
<td></td>
<td>Adjusted error output</td>
<td>NPN open-collector output</td>
</tr>
<tr>
<td></td>
<td>Timing 2 input</td>
<td>Non-voltage input</td>
</tr>
<tr>
<td></td>
<td>Auto-zero 2 input</td>
<td>Voltage input</td>
</tr>
<tr>
<td></td>
<td>Trigger input (for Head A)</td>
<td>NPN open-collector output</td>
</tr>
<tr>
<td></td>
<td>Auto-zero 2 input</td>
<td>Voltage input</td>
</tr>
<tr>
<td></td>
<td>Programme switching input</td>
<td>Non-voltage input, 4 inputs</td>
</tr>
<tr>
<td></td>
<td>Memory card save input</td>
<td>Voltage input, 4 inputs</td>
</tr>
<tr>
<td></td>
<td>Judgment/Binary output**</td>
<td>3-level judgment output: OUT1 to OUT16, total judgment output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Binary output: OUT1 to OUT16 measured data output (21 bits)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NPN open-collector output</td>
</tr>
<tr>
<td></td>
<td>Stroke output</td>
<td>NPN open-collector output</td>
</tr>
<tr>
<td></td>
<td>Trigger input enable output</td>
<td>NPN open-collector output</td>
</tr>
<tr>
<td>Analogue RGB monitor output</td>
<td>SVGA (800 x 600 pixels)</td>
<td></td>
</tr>
<tr>
<td>RS-232C interface</td>
<td>Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)</td>
<td></td>
</tr>
<tr>
<td>USB interface</td>
<td>In conformity with USB Revision 2.0 Hi-Speed (USB 1.1 Full-Speed compatible)</td>
<td></td>
</tr>
<tr>
<td>Ethernet interface</td>
<td>1000BASE-T/100BASE-TX/10BASE-T</td>
<td></td>
</tr>
<tr>
<td>Memory card</td>
<td>SD card CA-SD4G (4GB), CA-SD1G (1GB) support</td>
<td></td>
</tr>
</tbody>
</table>

**Major functions**

- Position correction function, OUT name change function, select measurement mode (outer diameter, height, step height, position, width, distance, intersection distance, angle, radius, roundness, coordinates, area, search, ring test, pitch) functions.
- OUT function between operators, auxiliary measurements (straight edge, circular edge, the edge bounding line, centre line, intersection, straight line between two points, any line, any point), functions, scaling function, average function, measurement function, measurement value alarm setting function, tolerance setting function, auto-zero function, storage (data/image) function, memory card storage function, programme memory function, trigger mode change function, mutual interference prevention function, adjustable measuring range function, detection threshold.
- Value change function, mask function, altitude correction function, display language switching function, support software setting function, trigger interval-measurement time display function, others.

**Ratings**

- Power supply voltage: 24 VDC ±10%, Ripple: 10% (P to P) or less
- Current consumption: 1 head connected 480mA max./ 2 heads connected 550mA max.
- Environmental resistance: 0 to 50°C
- Relative humidity: 35 to 85% (No condensation)
- Material: Polycarbonate
- Weight: Approx. 1120g

**Notes:**

- *2 OUT1 to OUT 8 & OUT 8 & OUT 10 16 and OUT 16 determine, pulse width and variable input of binary measurement data.
- *3 OUT 1 to OUT 8 & OUT 8 & OUT 10 16 and OUT 16 determine, time share output of binary measurement data.
- *4 The rating is for NPN/PNP open-collector output (output terminal block): 50 mA (30 V or less) max., residual voltage 1.4 V or less (50 mA) 1.0 V or less (20 mA).
- *5 Measurement area of 0.05 mm to 0.4 mm, residual voltage 1.0 V or less.
- *6 Measurement area of 0.05 mm to 0.2 mm, residual voltage 1.3 V or less.
- *7 If the value is ±2, others are initial settings.

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*σ* 1 or 2 units can be connected only with the same head model.

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**8**
OPERATING SYSTEM ENVIRONMENT

CPU
Pentium III 1GHz min. (recommended 1.7GHz min.)

Support OS
Windows 7 *1 Windows Vista *2
Windows XP Professional Edition/Home Edition
Windows 2000 Professional

Memory capacity
512MB min. (1GB min. recommended)

Resolution of display
XGA (1024 x 768 pixels) min. 256 colours min.

Free disk space
1GB min.

Interface *3
As described above, all those mounted. USB2.0/1.1 *4, Ethernet *5

*For your OS, use environments above that recommended.
*1 Supports all editions Home Premium, Professional, Ultimate.
*2 Supports all editions Ultimate, Business, Home Premium, Home Basic. 64 bit versions are not supported.
*3 Communicate selecting any of them. Simultaneous communication is not possible.
*4 Connection through a USB hub is not included in the guarantee.
*5 Connection to LAN and connection via a router is not included in the guarantee.

•Pentium is a registered trademark of Intel Corporation.

SENSOR HEADS
Sensor head ø6 mm type
TM-006
Sensor head ø40mm type
TM-040
Sensor head ø65mm type
TM-065

CONTROLLER LINEUP
NPN Output type
TM-3001
PNP Output type
TM-3001P

CABLE - CONNECTOR
Cable between head and controller
CB-AXx (0.7, 2, 5, 10, 20, 30m)
Transmitter to receiver expansion cable
OP-87033 (1m) OP-87034 (3m)
Cable between controller - monitor
OP-66842 (3m)
I/O connector cable
OP-51657 (3m)

Ethernet cable
OP-66843 (3 m)
RS-232C communication cable
OP-96368 (2.5m)
D-sub9 pin conversion connector
OP-26401
D-sub25 pin conversion connector
OP-96369

OPTION
Protective cover
OP-87035 (2 per pack) (for TM-040) OP-87036 (2 per pack) (for TM-065)
Memory card
CA-SD4G (4GB) CA-SD1G (1GB)
**LASER DISPLACEMENT (2D)**

- High-accuracy of ±0.1% of F.S.
- High-speed sampling
- Simultaneous measurement/judgment at 8 points
- Stable measurement of all targets

**OPTICAL MICROMETER**

- High repeatability ±0.06 µm
- High speed 2,400 samples/second
- Maintenance-free design
- Easy set-up, target viewer

**LASER DISPLACEMENT**

- Sampling rate of 392 kHz
- Linearity of ± 0.02% of F.S.
- Repeatability down to 0.01 µm

**CONFOCAL DISPLACEMENT**

- Surface scanning method for a variety of high accuracy measurements
- Multiple measurement modes
- 0.3 µm resolution

**SAFETY INFORMATION**

Please read the instruction manual carefully in order to safely operate any KEYENCE product.

**KEYENCE CORPORATION**

Please visit:  www.keyence.com