ROTATIONALLY SYMMETRICAL WORKPIECES
HP-0 Measurement Solution on Leitz CMMs
THE HP-O MEASUREMENT SOLUTION
– CONTACTLESS, FLEXIBLE, FAST AND ALWAYS ACCURATE

Non-contact measurement reaches a new dimension with the HP-O, the high-speed optical sensor. The HP-O technology solution is a new scanning technology on stationary CMMs based on frequency-modulated interferometric optical distance measurement.

The HP-O features an accuracy and reliability comparable to tactile scanning probes, a higher scanning speed, increased measurement range and the generic optic advantage of non-contact measurements. It is an alternative for high-precision tactile measurements when speed is important, parts are difficult to access for tactile probes or when parts are deformed or get damaged by tactile probing.

The HP-O solution is multi-sensor compatible - multiple optical sensors or tactile probes are interchangeable in a single program using the standard tool changer. Optical measurements can be made in single point or scanning mode with 3- or 4-axis scanning. The solution is launched as a complete system including Hexagon Metrology software QUINDOS and selected highly accurate Leitz CMMs.

The HP-O solution system outperforms other systems when it comes to highly accurate optical scanning in hard to reach areas with high speed.
ROTATIONALLY SYMMETRICAL WORKPIECES
– MEASURE WITH HIGH SPEED

Like most aspects of the manufacturing process, metrology relies on you having the right tools for the job. There are many ways that you can measure a single object, each with their pros and cons. But sometimes, even having the best equipment doesn’t guarantee success – a problem that Hexagon Metrology tackled when designing the HP-O optical probe. An example is measuring rotationally symmetrical workpieces. This is a recurring task, which appears in all kinds of industries and production-areas.

Especially for the fourth axis, this task has high requirements for the control of the machine. The use of an additional, highly precise rotary table can eliminate this problem and enable a much higher scanning-speed. For this type of measurement, the form and diameter results stay comparable to tactile measurements, even at much higher speeds.

When comparing the quality of form measurements with high speed, it becomes obvious that the HP-O has clear benefits compared to tactile scanning.

Shape control of rotational symetric workpieces with high-speed and without loss of quality

Comparison optical / Tactile measurement
Illustration of the quality loss when controlling the shape with High Speed

Scanning Speed on workpiece
10 mm/s  20 mm/s  30 mm/s  40 mm/s

Result HP-O measurement:
No loss of quality with high speed measurements

Result tactile measurement:
Obvious loss of quality with high speed measurements
TIP-MEASUREMENT
– SCANNING INSTEAD OF
SINGLE POINT PROBING

The HP-O is an interferometric system and is thus one of the most precise technologies for distance measurements on the market. With help of the interferometric laser system, a thousand points per second can be captured. The high accuracy together with the high speed allows more applications than other systems. The HP-O measuring solution in combination with a rotary table enables measurements with never before seen speeds.

Especially for measurements of interrupted geometries the cycle time can be significantly reduced. Rather than probing every segment with at least 2 tactile measuring points, only the table simply rotates while the HP-O measures continuously. For the first time ever, the HP-O makes it possible for this kind of workpiece to be measured with scanning technology. And the higher the amount of interrupted geometries, the higher the time saving.

“Scanning instead of single point probing – up to 80% time saving!”
**TECNICAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Probe Type</th>
<th>frequency modulated interferometric optical distance measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser Wavelength</td>
<td>1550 nm</td>
</tr>
<tr>
<td>Laser Class</td>
<td>2</td>
</tr>
<tr>
<td>Probe Measurement Directions</td>
<td>0°, 90°</td>
</tr>
<tr>
<td>Probe Shaft Dimensions</td>
<td>~100 mm φ 3 / 5 mm</td>
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<tr>
<td>Probe Types</td>
<td>Fixed / Adjustable (3-joint)</td>
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<tr>
<td>Probe Weight</td>
<td>~190 g</td>
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<tr>
<td>Measurement range</td>
<td>± 10 mm long-range, ± 1 mm mid-range, ± 0.2 mm short-range</td>
</tr>
<tr>
<td>Working Distance</td>
<td>16/15 mm (0/90°) long-range 10.5/9.3 mm (0/90°) mid-range 6.5/4.3 mm (0/90°) short-range</td>
</tr>
<tr>
<td>Spot Size (in focus)</td>
<td>180 µm long-range, 40 µm mid-range, 11 µm short-range</td>
</tr>
<tr>
<td>Acceptance Angle (rough metal surface)</td>
<td>±10° long-range, ±30° mid-range, ±30° short-range</td>
</tr>
<tr>
<td>Acceptance Angle (mirror surface)</td>
<td>±0.3° long-range, ±1° mid-range, ±4° short-range</td>
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<tr>
<td>Resolution</td>
<td>0.9 nm</td>
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<tr>
<td>Repeatability on an optical surface</td>
<td>0.2 µm (3σ)</td>
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<tr>
<td>Crash Protection</td>
<td>x,y,z via spring force of stylus module</td>
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<tr>
<td>Output signal</td>
<td>digital 24-bit via USB</td>
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<tr>
<td>Styli lengths</td>
<td>100 mm</td>
</tr>
</tbody>
</table>

**Measurement range**

![Measurement range diagram](image)

**Measurement angle**

![Measurement angle diagram](image)

**VISIBLE AND INVISIBLE LASER RADIATION**

**DO NOT STARE INTO BEAM**

**CLASS 2 LASER PRODUCT**

620-690 nm / 1 mW cw
1500-1600 nm / 10 mW max.
Standard applied IEC 60825-1 (2007-03)
HIGHER MEASUREMENT THROUGHPUT COMPARED TO MECHANICAL PROBING SYSTEMS

Frequency modulated interferometric optical distance measurement offers the following benefits:

- Touch-free process - no mechanical influence on the part, eliminating wear on the stylus tip and marks on the part
- Higher data collection rate - 1kHz measurement frequency
- High spatial resolution measures smallest details - spot size down to 11µm
- Lightweight probe head - as low as 190g
- Acceptance angle up to ±30 degrees (rough surface) ±4 degrees (mirror surface)
- Probe diameter as small as 3mm and measurement range up to 20mm provide access to points inaccessible by tactile probes
- Higher measurement speeds based on high data acquisition rate and probing speed
- Acquires feature information easily with higher density

You never have measured faster at this level of precision
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