HEXAGON
MANUFACTURING INTELLIGENCE

APPLICATION BROCHURE

# HTA MEASUREMENT SOLUTIONS

## HIGH THROUGHPUT AND ACCURACY SOLUTIONS FOR CHALLENGING MEASUREMENT APPLICATIONS


Leitz

# HTA: HIGH THROUGHPUT AND ACCURACY SOLUTIONS

Manufacturers today face unprecedented challenges as consumer expectations drive increased competition and shorten the lifecycle of products. Time-to-market and production cycle times are key differentiators across the industry spectrum, so achieving high throughput with the precision to maintain product quality is critical to success. However, the intricate inspection required to ensure the quality of complex parts can cause production bottlenecks and affect profitability.

Hexagon Manufacturing Intelligence's HTA solutions offer manufacturers both high throughput and accuracy with the flexibility to address the most complex measurement tasks.

Utilising Hexagon's advanced HP-O optical interferometric sensor technology in combination with a high-accuracy coordinate measuring machine (CMM), tactile scanning sensors, rotary table and the powerful QUINDOS metrology software package, the HTA solutions provide accurate high-speed non-contact and contact scanning with the potential to reduce inspection times for any number of industry applications. An HTA solution gives manufacturers the ability to match measurement cycle times to their production cycle and remove the bottlenecks to positively impact productivity.

# HP-O: OPTICAL SCANNING WITH CONFIDENCE

The HP-O sensor range is based on frequency-modulated interferometric optical distance measurement and brings rapid scanning technology to CMMs. Of the many sensor technologies available today, there is no other solution on the market that combines the precision, measurement flexibility and throughput of the HP-O solutions.

The HP-O range utilises the same non-contact laser measurement technology in six different configurations, each developed to reduce scanning times for specific customer requirements. If a part can be measured optically then no matter how demanding the application, there's an HP-O sensor solution.

### HP-O

The HP-O is a fixed stylus solution for optical measurements in single point or scanning mode. It uses the LSP-S2O probe head and can be interchanged with tactile sensors using a standard tool rack. It is ideal for rotationally symmetrical parts with easy-to-access standard geometries.

### HP-O Hybrid

Combining optical and tactile styli within a single configuration, the HP-O Hybrid allows a setup of up to five styli, including a maximum of four optical. It enables instant switches between measurement technique without changing sensors, making it ideal for time- and accuracy-critical measurements.

### HP-O Flex

The HP-O Flex uses the HH-AS-OT2.5 indexing probe head to enable users to place the optical stylus in 12 240 unique sensor positions, making it perfect for geometrically complex components requiring a high degree of accessibility. It can also be exchanged with tactile styli using a standard tool changer.

### HP-O Adjustable

The HP-O Adjustable is a fixed sensor with a 3-axis joint, which allows unlimited styli alignment within the measurement volume to adjust to more intricate measurement tasks such as rotationally symmetrical parts with no axially parallel features.

### HP-O Multi

A multiple optical stylus configuration carrying up to six different styli, the HP-O Multi is a fixed sensor solution that enables individual stylus alignment to provide better access on parts with difficult-to-reach features.

### HP-O Flex 90

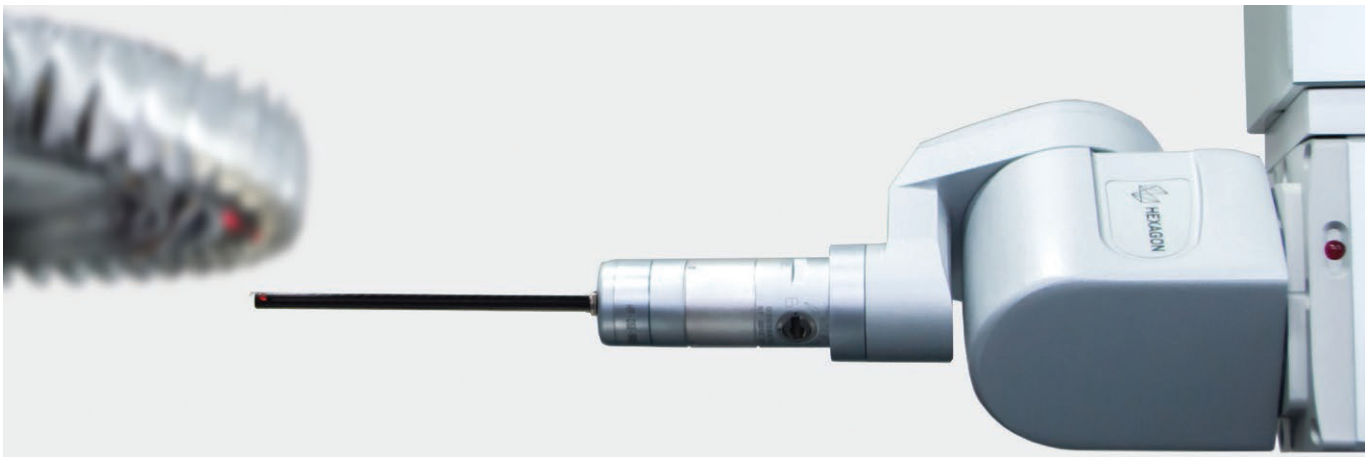
The HP-O Flex 90 mounts the indexing head with the optical sensor at a 90-degree angle, enabling the optical probe to rotate around the B-axis of the indexing head. It is ideal for measuring horizontally aligned parts such as blisks.

# BLISK MEASUREMENT

Offering lower weight and drag compared to conventional blade and disc assemblies, blisks are complex components with high added value. Their functional features, including the locators and fixing holes on the disc, and the surface profile and location of each blade, must be correctly aligned. With a lengthy machining cycle required to make each one, it is important to validate the process through efficient and accurate inspection. However, the complexity of the part can result in long measurement cycles that impact throughput.

The HTA solution for blisk measurement uses the indexing head of the HP-O Flex 90 to position the sensor perpendicular to the measured surface for accurate data capture. Gas path features such as the annulus, fillet radii and radial sections can be captured in continuous scanning mode. For aerofoils, the HTA solution's unique ladder-scan technique addresses the risk of overshoot by generating a single 4-axis motion path with a user-defined undershoot or overshoot at the start or end of each section.

With the HTA solution, blisk measurement cycle times can be reduced by up to 50%, while the non-contact inspection method also protects coated or polished surfaces from potential damage.



## Key Features of the HTA Solution for Blisk Measurement

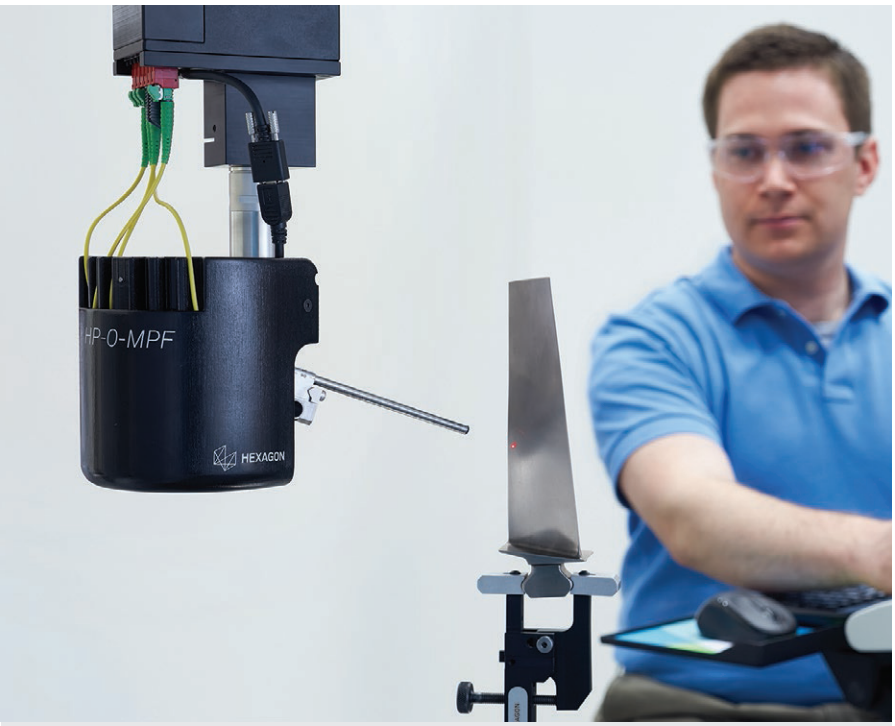
- Leitz Reference CMM with rotary table
- HP-O Flex 90 optical sensor
- HP-S-X1 tactile sensor
- Ladder-scan mode
- Variable high-speed scanning (VHSS)
- QUINDOS metrology software

# BLADE MEASUREMENT

Aeroengine manufacturers are under constant pressure to increase the number of high performance engines produced and develop technologies to offer significant fuel efficiency improvements. Validation of finished blades using contact scanning can be a time-consuming process that has the potential to slow production. In addition, challenging blade geometries, leading and trailing edge, polished finishes and 3D aerofoil surfaces critical to engine performance require ultra-high resolution non-contact measurement to meet design requirements.

The HTA solution for blade measurement provides a non-contact scanning solution capable of inspecting blade characteristics including the aerofoil, platform, root, shroud and more using the flexibility of the HP-O Multi sensor. It can measure the leading-edge blade profile with an 11 µm laser spot and eliminates the risk of probe ball compensation error. The solution also includes the BladeSmart parameterised blade measurement software for faster part programming, and the simplified BladeRunner interface, which enables tasks to be completed by shop-floor operators.

Designed to answer the needs of aeroengine manufacturers, the HTA solution for blade measurement can reduce cycle times by up to 60% compared to current tactile scanning methods, and provides a richer measurement data set.




### HTA Solution for Blade Measurement

- GLOBAL Advantage CMM with rotary table
- HP-O Multi optical sensor
- B5 High-function controller
- BladeSmart Measurement Application Software Suite

# SPLINE MEASUREMENT

As powertrain systems have developed, the move away from chain drives and axles to gearboxes and driveshafts has resulted in the development of the spline assembly for torque transmission. Whatever type of spline is used, these assemblies have a key characteristic in common – complexity that demands high-accuracy metrology to ensure quality. There are three main features to be captured – the tooth profile, the degree of straightness along the length of the tooth, and the pitch of the teeth – and all can be time-consuming to measure.

The HTA solution for spline measurement combines tactile and optical inspection using the HP-O Hybrid and spin-scan mode. Its tactile sensor can be used for part positioning, while the optical sensor can capture the complete spline profile by spinning the part through one revolution. Because the optical sensor captures the complete part and the software evaluates the individual features within it, both the tooth profiles and the pitch points can be extracted from a single scan.

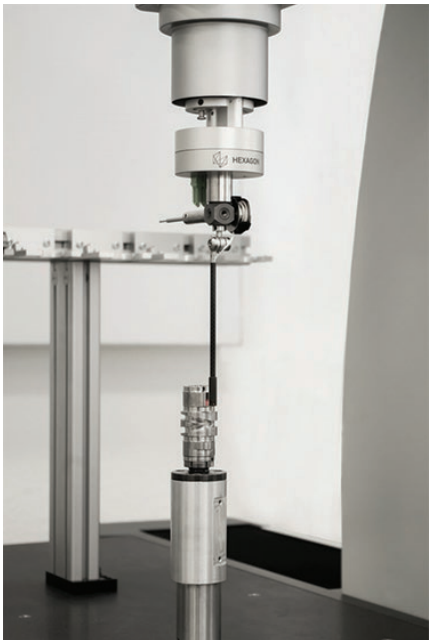
Using the HTA solution, the reporting of spline measurement is more comprehensive and cycle times can be cut by up to 80% compared to a tactile scanning method of measurement.

## Key Features of the HTA Solution for Spline Measurement

- Leitz Reference or Leitz PMM-C CMM with rotary table
- HP-O Hybrid optical sensor
- Spin-scan mode
- Variable high-speed scanning (VHSS)
- QUINDOS metrology software

# CAMSHAFT MEASUREMENT

In modern camshaft and cam segment assemblies the positioning of the cam segments relative to each other, as well as the relationship between the functional features on each segment, is critical for the efficiency of the engine. However, with up to six segments per shaft each requiring a separate tool to accurately measure their size and geometry, the cycle time is prolonged for tactile measurement.



The HTA solution for camshaft measurement reduces the number of tool changes using the HP-O Hybrid combined optical and tactile sensor for instant switches within the same measurement program. The internal spline, which locates the cam segment on the shaft, is the datum feature for the part. The complete spline profile can be captured optically in a few seconds using spin-scan mode. Cam profiles are captured optically using variable high-speed scanning, while the actuation slot is measured using a tactile sensor as the sides of the slot cannot be accessed by the optical sensor.

Measuring camshafts with the HTA solution can reduce measurement cycle times by up to 40%, which opens the door to inline metrology that uses fully-automated pallet storage and robotic loading systems to keep in-time with production.

### Key Features of the HTA Solution for Camshaft Measurement

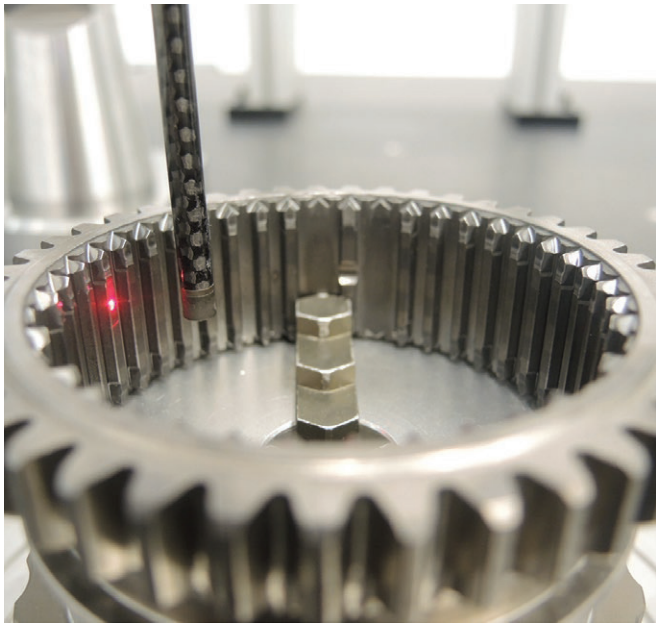
- Leitz Reference or Leitz PMM-C CMM with rotary table
- HP-O Hybrid optical sensor
- Spin-scan mode
- Variable high-speed scanning (VHSS)
- QUINDOS metrology software

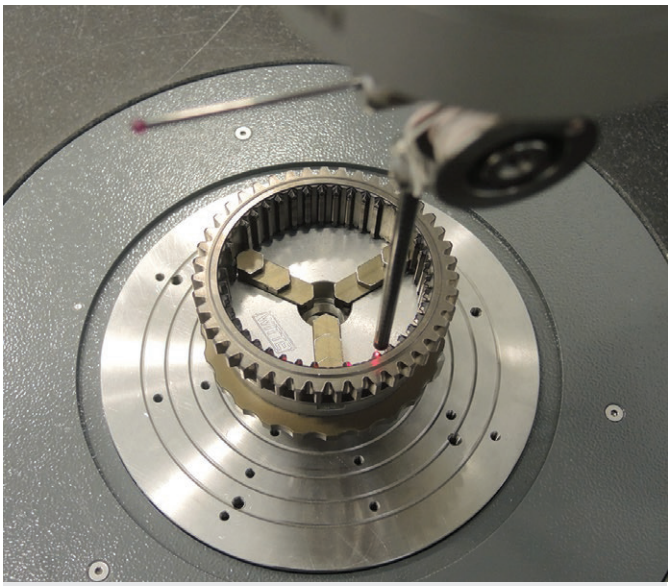
# SYNCHRO RING MEASUREMENT

Synchro rings are the key components of syncromesh gearboxes. They synchronise the speed of the gears and also prevent gear changes happening before the gears are synchronised. The functional features of a synchro ring are the teeth, which transmit the power when the gears are out of mesh, and the tooth ends, which prevent meshing when the gears are not synchronised. The tooth form appears to be very simple, however the flanks are involute and taper towards the middle and the tooth tips are pointed at both ends.

The HTA solution for synchro ring measurement improves throughput by combining tactile and optical measurement using the HP-O Hybrid sensor. The part is aligned with the tactile sensor. The tooth tips can be captured optically in a few seconds using spin-scan mode. The tooth profile and flank, as well as the other geometric features, can be measured either optically or through tactile measurement with variable high-speed scanning.

The HP-O Hybrid's high scanning speed and ability to reduce the number of tool changes means that the HTA solution can cut synchro ring measurement cycle times by up to 40%, and gives the potential to move inspection inline.





### Key Features of the HTA Solution for Synchro Ring Measurement

- Leitz Reference or Leitz PMM-C CMM with rotary table
- HP-O Hybrid optical sensor
- Spin-scan mode
- Variable high-speed scanning (VHSS)
- QUINDOS metrology software

# CLUTCH BASKET MEASUREMENT

With the high rotational speeds of a gearbox, any imbalance or eccentricity in the clutch basket can cause vibrations, increase wear and decrease the life of the transmission system. Any conicity or ovality of the basket reduces the amount of power transmitted and can cause clutch failure. The critical features of the clutch basket are the locators, diameters, wall thicknesses and runouts, all of which must be produced within fine margins to ensure reliability. Fast punching and forming processes mean clutch baskets can be produced very quickly, so their comparatively long inspection cycle almost certainly causes a bottleneck.

The HTA solution for clutch basket measurement uses the HP-O Hybrid optical and tactile sensor to address this issue. The optical sensor can record up to a thousand data points per second, giving a significant speed advantage over tactile inspection. Using the optical sensor and spin-scan mode, the system can capture the rotationally-symmetrical features of the clutch basket, while seamless in-program switches to the tactile sensor ensure the high-accuracy required to ensure its quality.

Altogether, the HTA solution can cut measurement cycle times for clutch baskets and similar high-performance engine components by as much as 80% – a step change that helps manufacturers match the inspection time to the production cycle.

## Key Features of the HTA Solution for Clutch Basket Measurement

- Leitz Reference or Leitz PMM-C CMM with rotary table
- HP-O Hybrid optical sensor
- Spin-scan mode
- Variable high-speed scanning (VHSS)
- QUINDOS metrology software

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Hexagon Manufacturing Intelligence helps industrial manufacturers develop the disruptive technologies of today and the life-changing products of tomorrow. As a leading metrology and manufacturing solution specialist, our expertise in sensing,thinking and acting - the collection, analysis and active use of measurement data – gives our customers the confidence to increase production speed and accelerate productivity while enhancing product quality.

Through a network of local service centres, production facilities and commercial operations across five continents, we are shaping smart change in manufacturing to build a world where quality drives productivity.

Hexagon Manufacturing Intelligence is part of Hexagon (Nasdaq Stockholm: HEXA B;hexagon.com ), a leading global provider of information technologies that drive quality and productivity across geospatial and industrial enterprise applications.

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Full Bright 福宮通商股份有限公司

總公司:新北市 235 中和區連城路 258 號 3F-3
（遠東世紀廣場 I 棟）
Tel: 02- 82271200 Fax: 02-82271266
Http:// www.fullbright.com.tw
E-mail : sales@fullbright.com.tw

台北 Tel: 02 - 82271227 Fax: 02 - 82271191
台中 Tel: 04 - 24736300 Fax: 04 - 24734733
高雄 Tel: 07 - 3430270 Fax: 07 - 3430296
昆山 Tel: 512 - 57751291 Fax: 512 - 57751293
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