Laser Scanners for CMMs

Accuracy, Speed and Versatility

Make it smarter with laser scanning

In today's competitive industry, manufacturers need more than quality assurance from their metrology solutions.

Quality departments are increasingly tasked with finding opportunities to not only cut costs and save time, but to meet the growing demand for greater output and product customisation. In turn, this often involves working with parts characterised by complex geometries and sensitive material surfaces.

Traditionally, quality professionals have relied on tactile inspection methods and solutions to ensure the utmost accuracy. While contact measurement is the perfect solution for numerous applications, advances in non-contact technology has unleashed opportunities to maximise efficiency in a wide range of inspection tasks.

Laser scanning is one of the fastest measurement methods, able to collect hundreds of thousands of a data points per second. A coordinate measuring machine (CMM) laser scanner enables users to quickly capture a whole part, the surface around the part and to digitise complete freeform surfaces.

This opens up a range of options for product improvement, from using the measurement points to recreate a CAD model, through to identifying surface areas of difficult-to-manufacture parts.

As well as offering inspection speed and flexibility, the evolution of laser scanning technology is continuing to reduce the accuracy gap with tactile measurement solutions. Today, laser scanners offer the speed, precision and reliability needed to make manufacturing smarter.

HP-L-10.10 – The ONE laser scanner: fast, accurate, flexible and user-friendly

HP-L-10.10 sets new standards for laser scanners on CMMs.

With this laser scanner, users don't have to choose between accuracy and speed. HP-L-10.10 delivers both with unprecedented ease of use.

Cutting-edge laser scanning technology combined with unique software and features make the HP-L-10.10 the ONE laser scanner that can tackle the most complex CMM challenges with unequalled precision and efficiency.

Whether users are creating measurement programs, executing laser scans on complex parts or need detailed reports and data for further processing, HP-L-10.10 in combination with PC-DMIS metrology software supports users with unique functions and features in each phase of the quality control and evaluation process.

The ACCURATE laser scanner

With a probing form error of 8 μm, HP-L-10.10 is closing the precision gap between tactile probing methods and non-contact laser scanners. Measurements are compliant with relevant ISO accuracy standards.

The VERSATILE laser scanner

HP-L-10.10 captures reliable measurement data on many surfaces, even reflective and shiny ones. It also offers unique options to meet a range of application and quality process needs.

The FAST laser scanner

HP-L-10.10 boosts the throughput of manufactures. It captures 2000 points at a speed of 300Hz, which equals up to 600 000 individual points per second.

The USER-FRIENDLY laser scanner

With features such as variable scanning speed, extended field-of-view or a build-in overview camera, HP-L-10.10 is a technology-lover's dream. This laser scanner doesn't just get the job done - it makes it fun to do so.

Unique cutting-edge technologies, features and software possibilities

HP-L-10.10 uses innovative laser scanning technology for the fast and highly accurate creation of point cloud data on CMMs. Additionally, it is equipped with several unique hardware and software features that makes it easier for users in all stages of the measurement process to create measurement programs, execute routines on the CMM and further process the data.

- **Overview Camera**
  Integrated camera for remote operation, operator guidance and enhanced reporting.

- **Standoff features**
  Flexible standoff for optimised scanning paths and 30 mm additional field-of-view for optimised path programming.

- **Variable Scanning Speed**
  Vary the speed of the CMM, generate surface data and extract exact features quickly during the same measurement path.

- **UniScan**
  Automated creation of measurement programs; simply select surfaces on the CAD model to populate scanning commands.

- **Visual Guide and Work Distance Indicator**
  Immediate visual feedback informs operator about the status of the laser scanner and correct positioning for best measurement performance.

- **Acquisition modes**
  HP-L-10.10 offers two options for point cloud acquisition. In SHINE mode, the system automatically adjusts the settings to the measured surface. In UD (user-defined) mode, users can adjust the settings to individual needs and challenges.

- **Cutting-edge mechanical design**
  Unique features like the overview camera, the mechanical TKJ interface with warm-up connector, thermal compensation, the radial fan and the laser management make HP-L-10.10 the most advanced laser scanning sensor on the market.

Overview Camera – Remote programming, guided measurement and enhanced reporting

The built-in Overview Camera of the HP-L-10.10 offers many enhancements for before and during the measurement process, plus unprecedented possibilities for the creation of measurement reports.

Easy and fast remote programming

Thanks to the Overview Camera, machine operators can teach and execute measurement routines remotely. If a part is large or a position is difficult to reach, the overview camera helps to find the right position. On the livestream, the visual guide and the laser line are visible, which makes it easy to control if the right working distance is maintained.
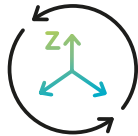
Guided measurement and part alignment

When measuring changing parts, it can be time-consuming to find all features that should be measured and adjust the part program to the changed part position. With HP-L-10.10 and PC-DMIS, measurement guidance can be included for each part program, which shows the machine operator the features that should be measured in sequence via livestream. This helps the operator to easily position the sensor analogue according to the guidance, even when the part is not positioned exactly the way it has been before.

Customised, automated and conditional snapshots

PC-DMIS lets users add snapshots to the measurement program, making it easier to recognise measured features. Snapshots can either be taken manually to simply recognise the part type or can be taken automatically during each measurement, which can help to identify certain individual differences between the parts, such as surface properties or a marked serial number. Snapshots can also be taken when predefined events occur, for example when the measurement result of a bore is out of tolerance or when a pre-defined number of measurements has been taken. This helps ensure the integrity of results and streamline the inspection process.

Handling features for flexible and fast measurement programming and execution

One of the most important factors for accurate laser scanning data is selecting the right distance between the sensor and the measured surface. The so-called standoff defines the spacing of the individual measurement points on the laser line, which ultimately determines the measurement speed. PC-DMIS offers operators unique possibilities to adjust the standoff to meet all needs.
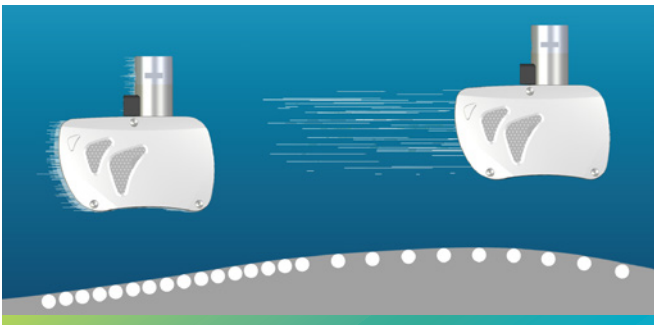
Variable Scanning Speed

The faster a laser scanner runs over a part, the space between individual lines gets wider. This can be especially helpful when operators need to capture a large surface quickly. But for certain features, the density must be higher to get better results. Thanks to the Variable Scanning Speed feature in PC-DMIS, users can vary the speed of the measurement during a measurement path to create both fast scans and detailed measurements in the same program.
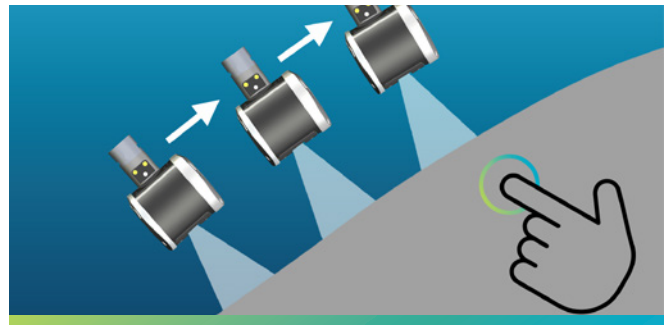

Uniscan

Depending on the requirements and shapes of the part, programming laser scanning paths can be time-consuming. PC-DMIS accelerates and simplifies the creation of measurement programs by automatically generating the path and laser settings after the user selects the surfaces on the CAD model. PC-DMIS automatically generates the needed probe head orientations, scans and motions required to measure the part.

Extended field-of-view

HP-L-10.10 has a measurement range of 60 mm, ensuring highest accuracy according to relevant ISO specifications. Sometimes users might need to extend this range, for example when measuring deep cavities and the sensor can't capture the surface on top and the feature at the bottom within the same path. PC-DMIS and HP-L-10.10 offer the possibility to add additional 30 mm of field-of-view in which measurements with slightly less accuracy can be taken. This increases measurement flexibility when creating part programs of hard to measure parts and saves time because there is no need for mechanical extensions.
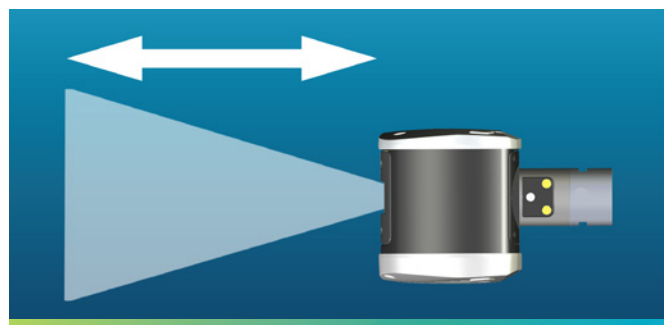
Flexible standoff

When scanning a part, the main objective is to reduce the cycle time without compromising accuracy. When choosing a larger standoff, the scanner can capture a larger area, but maybe the density is not high enough for crucial features. Thanks to the flexible standoff feature in PC-DMIS, users can vary the standoff according to their part or wider business requirements.
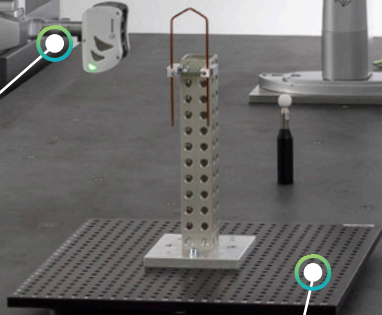
GLOBAL S
Coordinate measuring machine

PC-DMIS
Measuring software

HR-R
Sensor changing rack

HP-L-10.10
Laser scanner on
indexable probe head

Swift-Fix
Part fixturing

Complete inspection solution

Seamless system integration

HP-L laser scanning sensors deliver maximum performance for complex surfaces and workpieces made of materials that are difficult to measure, operating precisely at the highest speeds. But the task of creating fast and accurate laser scanning data with minimum effort can only be achieved with perfectly aligned system components, each doing their job in perfect coordination.

Hexagon has developed a complete system which completes the job according to customer requirements. Whether highest possible throughput is needed or flexibility is key, the GLOBAL S platform in combination with HP-L laser scanners and PC-DMIS software can be adjusted to all measurement challenges.

Equipped with HP-L laser scanning and in combination with Hexagon's PC-DMIS Software, the CMM is turned into a multisensor machine that combines traditional tactile probing with optical measurements, such as surface capture or optical feature measurement in a single part program. HP-L sensors are optimally designed to get the job done in the most effective way possible.
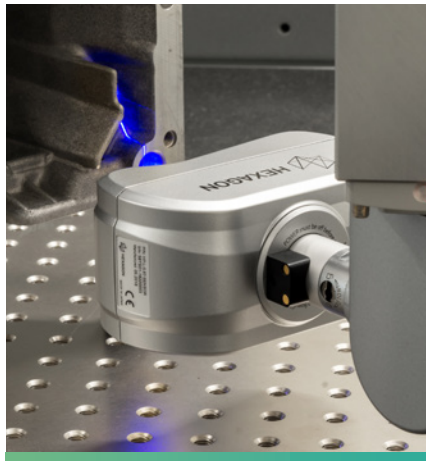
HP-L-5.8

Entering the world of laser scanning

The HP-L-5.8 laser scanning sensor makes it easy and affordable to begin creating point clouds.

As an alternative to the HP-L-10.10, this laser scanner is perfect for manufacturers working with less throughput and accuracy requirements, but that are looking for a reliable and cost-effective entry-point into laser scanning.

The fixed-line blue laser can measure a wide range of surfaces, from very dark through to very shiny. The rugged and compact design makes it ideal for laser scanning on smaller CMMs and where accessibility is restricted. The HP-L-5.8 is equipped with Hexagon's Kinematic Joint, making it compatible with existing Hexagon probe heads and accessories, including automatic sensor changing racks or extensions.

Blue line laser scanning

The fixed-line blue laser makes it possible to capture 900 points per line, with a measurement frequency of up to 40Hz, resulting in 36 000 points per second.

Rugged and compact design

HP-L-5.8's rugged design protects its components from collisions and vibrations. Its compact size and its short nominal working distance from the surface of 140 mm ± 40 mm means it is well-adapted for use with small CMMs and where accessibility is restricted.

Reliable accuracy

HP-L-5.8 offers a cost-effective entry-point into laser scanning that conforms to the latest ISO 10360-8:2013 and ISO 10360-9:2013 standards.

Laser scanning applications

Save time with fast, accurate and contactless measurement

Thanks to its high flexibility, laser scanning can be used for a variety of applications,
whether high accuracy is needed or surface data must be recorded quickly.
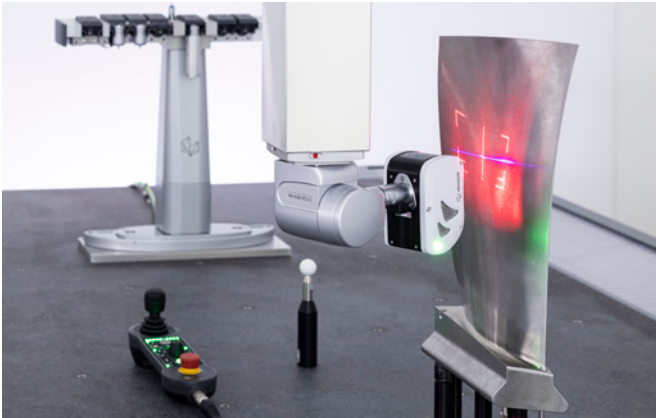
Blade measurement with tight tolerances

Due to the extremely tight tolerances, measurements of blades for compressors and turbines are crucial. The golden rule is that measurement devices should consume as less as possible from the drawing tolerance. Multiple sections of an airfoil can be captured at once as the laser sweeps along the blade path with no need to capture the individual sections. Users get all the data they need within a significantly reduced timeframe.

Measurement of sheet metal parts for feature inspection, profile and surface analysis

The surface or features of sheet-metal parts often differ from tolerances in the drawing for various reasons, for example due to the spring off effect. Because of the part's large surface, laser scanning is the ideal way of quickly controlling the accuracy in every step of the production, from a single component to the final assembly.

The long laser stripe enables fast data capture. Flexible stand-off helps achieve higher point density scans for better feature evaluation and point resolution. Users can enlarge the stand-off to drive faster surface scans.

Irregular shapes

Inspecting large numbers of objects with irregular shapes and surfaces is quick work for laser scanners. For example, one of Hexagon's customers reduced the time it took to measure studs on a car body from three hours using a tactile probe to just 20 minutes with a laser scanner.

Contactless, highly accurate hairpin measurements

The global warming emergency is accelerating the transition to new eMobility concepts, such as hairpin technology, which has the largest potential for an automated production of drivetrains in large quantities and at moderate costs.

Due to the bending process in manufacturing, the hairpin shows spring back effects and a thinning of the primary insulation layer. Because of the sensitive insulation layer and the flexibility of hairpins, a contactless inspection of a master part is needed. Thanks to the ultra-high measurement rate and the large working range, the HP-L-10.10 is ideal for inspecting hairpins at high throughput.

Due to the blue laser, shiny surfaces like the non-insulated area, copper wire or surfaces such as the primary insulation layer can be measured without gaps. Additionally, the intensity values can help to distinguish between insulated and non-insulated areas. Finally, the operator retrieves a high quality representation of the hairpin.
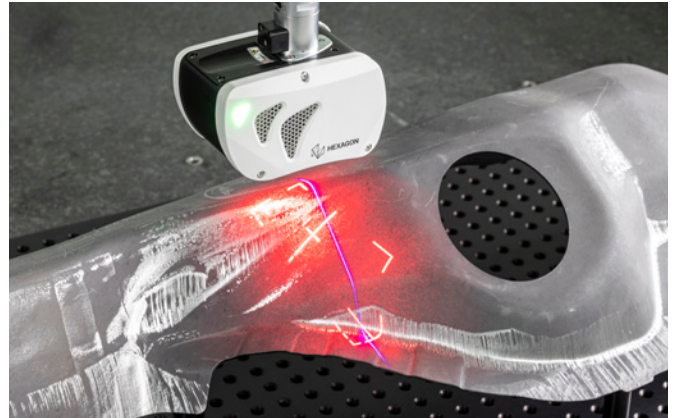
Technical data and specifications
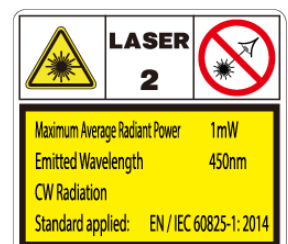
General technical data

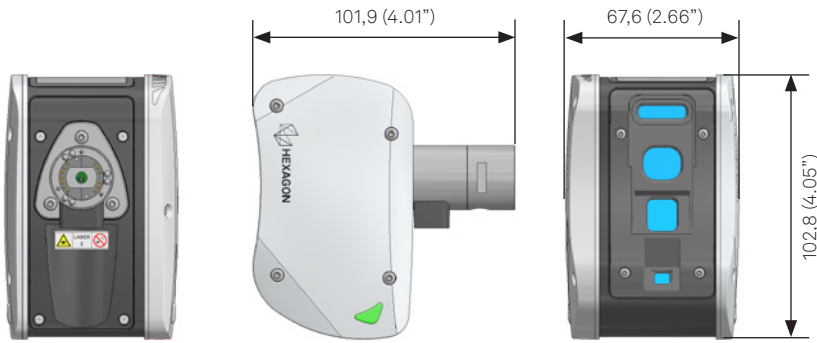|	HP-L-10.10	HP-L-5.8
Laser class	2 (EN / IEC 60825-1:2014)	2 (EN / IEC 60825-1: 2014)
Emitted wavelength	450 nm (visible blue)	450 nm (visible blue)
Maximum average radiant power	≤1 mW	≤1 mW
Declared accuracy temperature range	16 to 26 °C (61 to 79°F)	15 to 32° C (59° to 90°F)
Protection against dust and water	IP51 (IEC/EN 60529) (except for warm-up terminal)	IP64 (IEC/EN 60529) (except for warm-up terminal)
Ambient humidity	95% non-condensing	90% non-condensing
Operating temperature	16 to 32 °C (32 to 89.6°F)	5 to 45° C (41° to 113°F)
Storage temperature	-30 to +70 °C (-22 to +158°F)	-25° to +70° C (-13° to +158° F)
Weight	427 g	380 g (TKJ) / 360 g (AJ)

Performance data

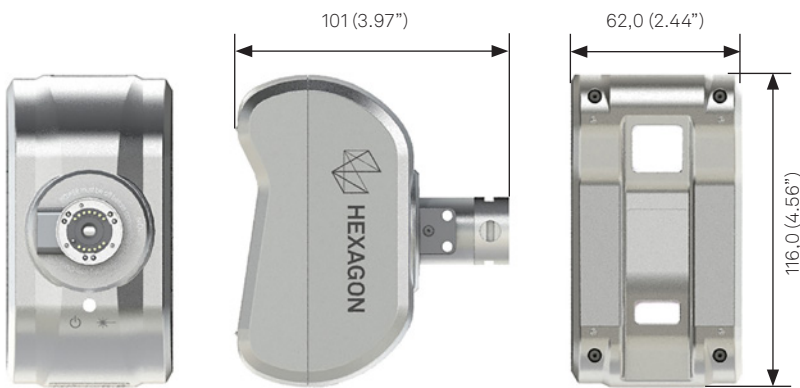|	HP-L-10.10	HP-L-5.8
Scanning frequency (Lines per second)	300 Hz	40 Hz
Data rate	600 000 pts/sec	36 000 pts/sec
Ambient light immunity of the sensor	10 000 lx	5 000 lx
Standoff and depth (Z)	90 ± 30 mm (additional 30 mm with eFOV)	140 ± 40 mm
Laser line width	80 mm (At mid-field)	47 mm (At mid-field)

Accuracy

Standard	Artefact	Specification (MPE/MPL)	HP-L-10.10	HP-L-5.8
ISO 10360-8:2013	Sphere	P[Form.Sph.D95%:Tr:ODS]	12 µm	34 µm
		P[Form.Sph.1x25:Tr:ODS]	8 µm	22 µm
		P[Size.Sph.All:Tr:ODS]	14 µm	25 µm
		L[Dia.5x25:Art:ODS	24 µm	45 µm
	Plane	P[Form.Sph.D95%:Tr:ODS]	12 µm	34 µm
ISO 10360-9:2013 (HP-L-10.10 + HP-THDe or HP-S-X1)	Sphere	L[Dia.2x25::MPS]	18 µm	42 µm

LASER 2

Maximum Average Radiant Power	1mW
Emitted Wavelength	450nm
CW Radiation	
Standard applied:	EN / IEC 60825-1: 2014

Dimensions HP-L-10.10

101,9 (4.01")

67,6 (2.66")

102,8 (4.05")

Dimensions HP-L-5.8A

101 (3.97")

62,0 (2.44")

116,0 (4.56")

Dimensions HP-L-5.8T

106,5 (4.19")

62,0 (2.44")

116,0 (4.56")
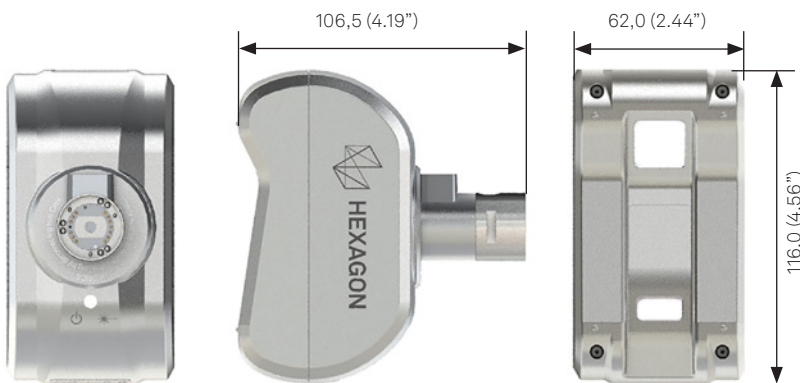
Side notes (HP-L-10.10):

All specifications are applicable for bridge type CMMs with indexable wrist. Specifications include measurement uncertainty according ISO/TS 17865:2016 and are valid for:

- Constant CMM scanning speed of 25 mm/sec
- Tests performed with standard configuration without (e.g. angular) adapters or/and extensions
- Exposure setting of 22% (UD)
- Standard field of view (sFOV)
- Automatic probe exchange when applicable for the test
- Combination of HP-L-10.10 with tactile probing sensor using the same styli specified for the single probing error test according ISO13060-5 when applicable for the test
- Probing error test on spherical artifact performed on white matt sphere: (Properties according PN: HP-L-10.10-I-SPH-KIT)
  - Calibrated for form with 3 great circles and maximum form deviation of 0,5 µm and maximum calibration uncertainty U of 0,04 µm
  - Calibrated for size with 3 great circles and maximum calibration uncertainty U of 0,02 µm
- Probing error test on plane artifact performed on white plane: (Properties according PN: HP-L-10.10-I-PLN-KIT)
  - Calibrated for form with union jack strategy with approximately 3000 individual points with maximum form deviation of 1,5 µm and maximum calibration uncertainty U of 0,28 µm

Measurements performed within extended field of view (eFOV) will result in approximately doubled dispersion error in comparison to the standard field of view (sFOV). Extended field of view (eFOV) enablement does not affect accuracy of measurements generated within standard field of view (sFOV).

All stated values are subject to change without further notice.

HEXAGON

Hexagon is a global leader in sensor, software and autonomous solutions.
We are putting data to work to boost efficiency, productivity,
and quality across industrial, manufacturing, infrastructure, safety,
and mobility applications.

Our technologies are shaping urban and production ecosystems
to become increasingly connected and autonomous – ensuring a scalable,
sustainable future.

Hexagon's Manufacturing Intelligence division provides solutions that utilise
data from design and engineering, production and metrology to make
manufacturing smarter. For more information, visit hexagonmi.com.

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