

Absolute Tracker solutions

Explore our full range of laser tracker systems,
from portable and large volume to automated and high volume







The world's best laser trackers

Based on patented technology, Hexagon's range of laser tracker systems are the definition of portable high-grade metrology. The Absolute Interferometer, the absolute distance meter, direct scanning, PowerLock, SHINE scanning, MeteoStation monitoring, high-definition overview cameras: the range of technical features that form the basis of our laser tracker platforms is unmatched across the industry.

For every medium-to-large-scale manufacturing application, there's a suitable Absolute Tracker solution that can deliver greater productivity and a better final product. Quality room or shop floor, research centre or shipyard, there's an Absolute Tracker purpose-built to make your life easier.

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Our laser trackers

A tracker for every application

Laser trackers come in a range of shapes and sizes and are based on various technological foundations. These are ours, and together they represent a wider range of application solutions than is offered by any other manufacturer.

Leica Absolute Tracker AT960

The flagship of the Absolute Tracker range, offering full 6DoF measuring functionality capable of powering both manual and automated inspection and production systems.

Leica Absolute Tracker AT930

Our premium 3D tracker, for high-accuracy reflector measurements that can support a range of applications.

Leica Absolute Tracker ATS600

The ground-breaking direct scanning laser tracker, delivering metrology-grade measurement from a distance of up to 60 metres.

Leica Absolute Tracker AT500

An ultra-long-range tracker designed for measurement anywhere and best-in-class usability.



Our sensors

The keys to augmenting tracker functionality

Hexagon's sensors for laser tracker systems have an answer to every question in manufacturing, from inspection to production, from fine detail to high speed and everything in between.



Absolute Scanner AS1

Modular high-performance 3D laser scanner built on innovative SHINE technology for extremely fast measurement on any surface type or finish, both manual and automated.

Absolute Scanner AS1-XL

Extra-wide scan line modular 3D laser scanner powered by SHINE technology to enable extreme productivity scanning of large surfaces and deep cavities.

Leica T-Mac

The key component of laser tracker automated solutions, designed to allow unmatched high-accuracy control of robot systems for both inspection and production.

Leica T-Probe

High-accuracy 6DoF probing brings unbeatable inspection of hidden points to AT960 systems.

Leica B-Probe^{plus}

Entry-level 6DoF probing that allows simple hidden-area measurement with AT500 systems.

Reflectors

A range of retroreflector types and sizes facilitate the central functionality of all tracker systems – high-accuracy point measurement at a distance of up to 160 metres.

The Absolute Tracker

The foundation of absolute performance

The unmatched productivity and portability of the Absolute Tracker range is founded on innovative technologies that make it the pinnacle of high-performance metrology on the move.

Absolute accuracy

- The Absolute Interferometer (AIFM) combines the accuracy of an absolute distance meter (ADM) with the speed of an interferometer.
- Scanning accuracy to within as little as 50 microns.
- Reflector single-point accuracy to within 20 microns.
- Patented Absolute Encoders ensure angular accuracy performance with no referencing before use.
- Systems calibrated in ISO 170250-certified laboratories for accuracy specified in line with ISO 10360-10 standard.

Absolute productivity

- Non-contact measurement data collected at up to 1.2 million points and 300 lines per second.
- 3D laser scanning with a scan line width of 600 millimetres at standoff
- Orient-to-Gravity for levelling and alignment tasks.
- Ultra-large measurement volumes of up to 320 meters in diameter.
- Real-time architecture with dynamic performance delivers 1000 Hz data rate.
- Hidden-point measurement with a wireless probe can reduce measurement process time by up to 80 percent.

Absolute reliability

- Integrated MeteoStation environmental monitoring unit.
- IEC-certified IP54 sealed unit for challenging environments.
- Wide operating temperature range of -15 to 50 degrees C.
- Integrated mini variozoom delivers a constant field of view in any light conditions.
- Full 24-month factory warranty and guaranteed ten years of serviceability.

Absolute portability

- All-in-one integrated design.
- Built-in WiFi with true access point functionality.
- Batteries compliant to IATA regulations.
- Independent hot-swappable battery power supply.
- Convenient flight cases for simple transportation.



Absolute innovation

Groundbreaking technology

The Absolute Tracker range is the pinnacle of over 200 years of technical innovation, and our research and development teams continue to break new ground with every passing year.

Absolute distance meter

The foundation of laser tracker distance measurement delivers highly accurate 3D measurements over distances of up to 160 meters and was first introduced with the LTD500 in 1995.

Enhanced Wave Form Digitiser

An extension of the wave form digitizer technology pioneered by Hexagon in surveying applications, the enhanced WFD was introduced in 2019 with the ATS600 to deliver the world's first metrology-grade direct scanning laser tracker.

SHINE technology

The Systematic High-Intelligence Noise Elimination introduced with the Absolute Scanner AS1 allows for measurement with no hidden settings that limit speed and scan-line width in order to deliver peak accuracy – all the performance, all of the time.

Handheld sensors

Handheld sensors operated at the point of measurement in conjunction with a laser tracker have delivered enhanced measurement possibilities such as hidden point inspection and point cloud data acquisition since 2004.

7DoF control

Allowing for direct control of any robot or numerical control system in real-time, Absolute Tracker 7DoF metrology based on the state-of-the-art EtherCAT protocol has pioneered the development of automated production built on metrology-grade accuracy.

Absolute Interferometer

Combining interferometer and distance meter technology, the Absolute Interferometer (AIFM) is the foundation of 6DoF measurement, first introduced with the groundbreaking AT901 in 2008.

PowerLock

Automatic beam-targeting was introduced with the AT901 in 2009. This active vision technology made laser tracker operations simple and intuitive, reducing training needs and cutting measurement process times by up to 30 percent.

Automation

Automated inspection based on both 6DoF and 3D laser tracker technology is ground that was broken with Hexagon's LTD systems in the 1990s and has continued through to the development of the AT960 and ATS600 systems.

Modular concept

The unique modular construction of the Absolute Scanner AS1 and Absolute Scanner AS1-XL is the basis for the first ever cross-platform scanners, delivering high performance within both laser tracker and portable measuring arm-based systems.

Wide-angle reflector

The Super CatEye retroreflector is a unique solution for 3D point measurement, using special materials and a high-accuracy tracker to allow for an increased range of retroreflector measurement without tracker repositioning.

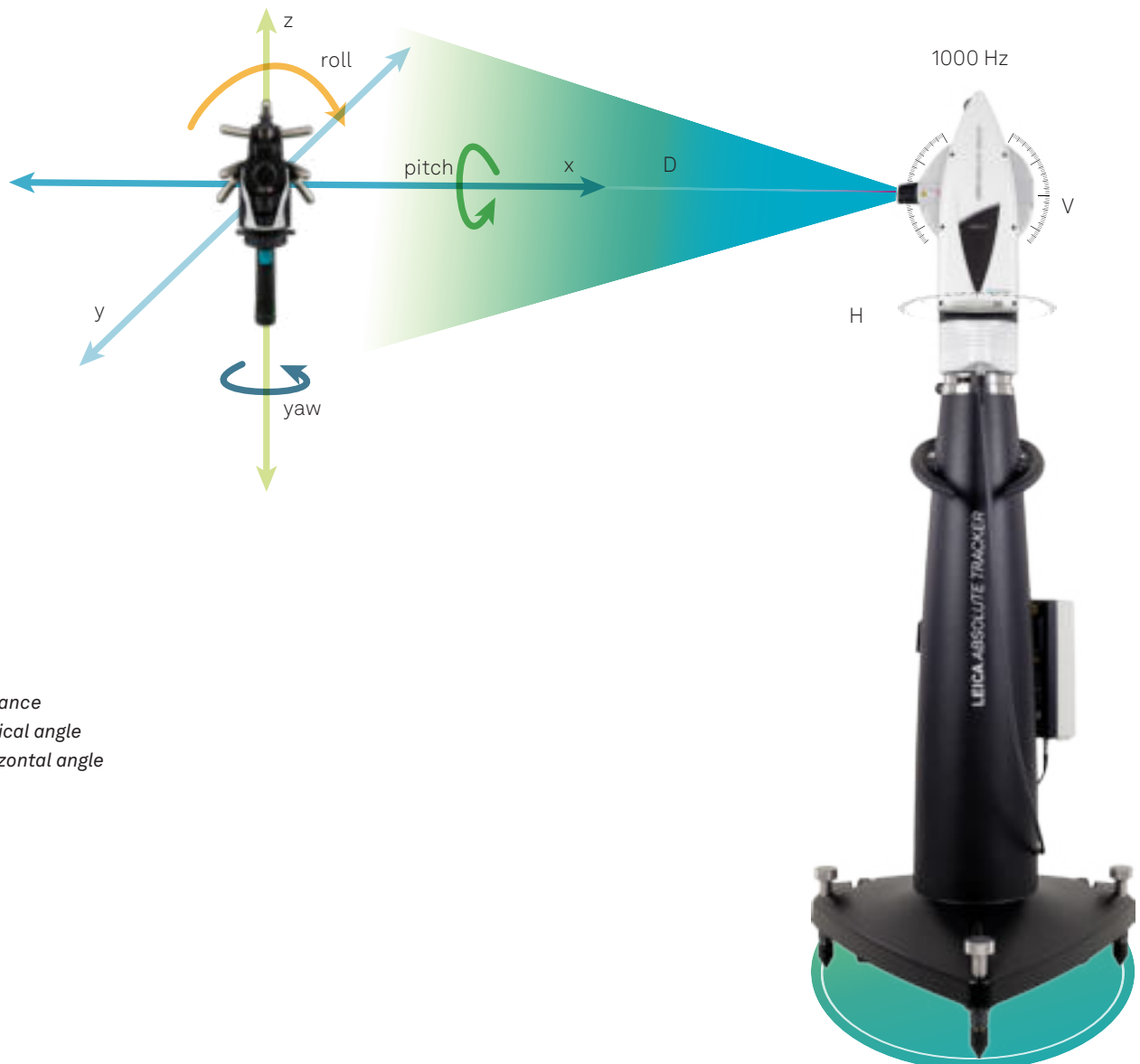


Introduction to 6DoF

Six degrees of measurement freedom

Extending the measurement capability of a laser tracker is possible with advanced 6DoF (six degrees of freedom) technology. By introducing an independent sensor with a constellation of LED targets, the tracker can calculate not just position but orientation. This allows for the accurate calculation of the 3D location of points offset from the main point of measurement.

From this functionality comes the capability to measure hidden areas by essentially allowing the line of sight of the tracker to see around a corner with an extended probe accessory. At a more advanced level, it allows the introduction of a scanner that the tracker can lock onto, allowing it to act as a global positioning reference that can then be translated into accurate measurement of every one of the millions of points collected by the scanner.



D: distance
V: vertical angle
H: horizontal angle



Laser tracker 6DoF

Key facts

- Horizontal and vertical angle measurements plus distance measurement make up the 3D location data, while a constellation of targets around the sensor deliver orientation information.
- A high-end probe tracked with an advanced 6DoF system can deliver accuracy almost identical to that possible with a retroreflector.
- The non-contact scanning sensors powered by 6DoF tracking allow for significant productivity improvements, through full-surface point cloud digitisation at high speed.
- Full 6DoF measurement is possible over a large measurement volume up to 60 metres in diameter with an extended range tracker model.
- A 6DoF tracker is the foundation of automated inspection and production systems that allow for accuracy performance independent of robot accuracy.
- Precisely calibrated mini variozoom camera technology allows for the measurement of rotation angles to within just 0.01 degrees at a distance of up to 30 meters.

Key applications

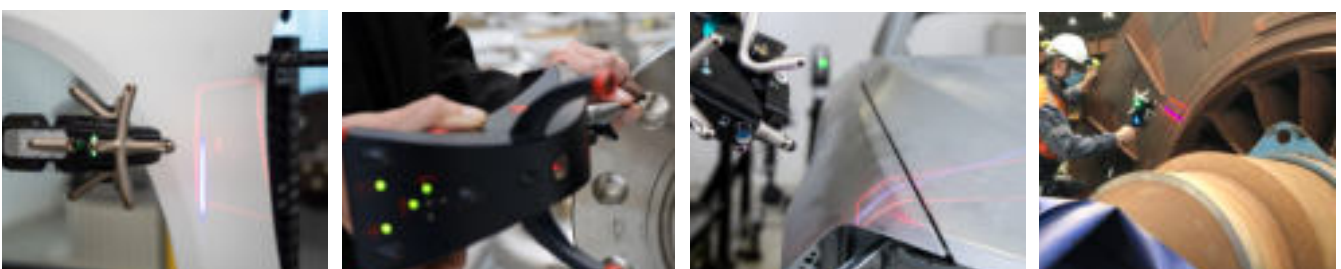
The application of 6DoF systems requires the use of a high-end laser tracker like the Leica Absolute Tracker AT960, and can be used in two key application contexts.

Probing and scanning

A 6DoF system can be used to provide global positional referencing for an extended sensor system that uses a handheld probe or scanner at the point of measurement. This allows for measurement of hidden points without tracker repositioning as well as the fast collection of point cloud data for complete surface mapping.

Automation

With a sensor like the Leica T-Mac or a laser scanner such as the Absolute Scanner AS1 or AS1-XL, a 6DoF system can be used to drive a fully automated inspection or even production system that is completely independent of the accuracy of the robot system being used.





TRACKER

LEICA T-Hite

The flagship 6DoF tracker

Leica Absolute Tracker AT960

The Leica Absolute Tracker AT960 is the first fully portable dynamic 6DoF laser measurement system. A robust solution to even the most challenging large-scale metrology applications, the AT960 is the definition of absolute speed, accuracy and portability.

Offering simple but sophisticated high-speed dynamic measurement as standard and compatible with Hexagon's best-in-class metrology sensors, the system represents a single-unit solution for reflector, probe and non-contact scanner inspection, as well as real-time machine-controlled production.

Combining high-end performance with unmatched usability, this is the ideal solution for applications spanning aerospace, automotive, shipbuilding, manufacturing and many more sectors. The AT960 sets a new standard in the world of portable industrial metrology.

Portable versatility

Designed to slip seamlessly into the production process, whether in the quality room or inline, manually operated or robot-mounted and fully automatic.

Unbeatable accuracy

The AIFM enables the AT960 to measure to any sensor with a maximum distance uncertainty of just ± 10 microns.

Multi-range measurement

Choose the right model for your application, whether you need no more than 5 meters between your tracker and automation setup or full-range high-accuracy reflector measurement at up to 80 meters from the tracker.

Intelligent zoom

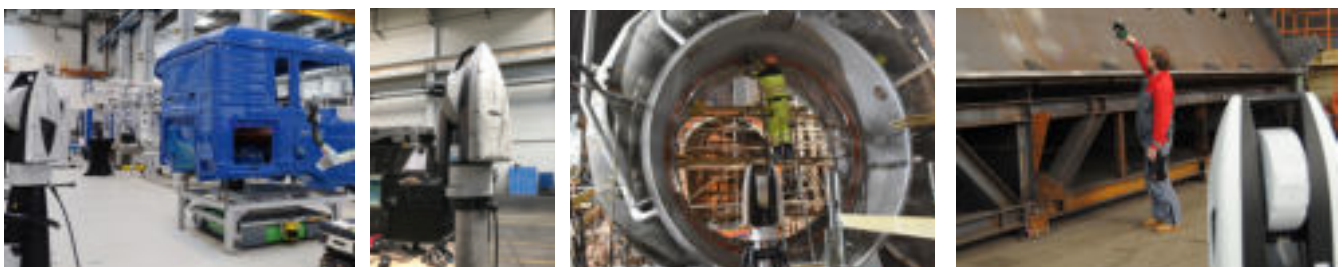
The multiple zooming lenses of the built-in mini variozoom camera account for distance to the 6DoF sensor. This delivers a constant clear image of the LED target configuration that allows for improved system orientation accuracy over larger distances.

Accelerated data

Location data can be collected by the tracker at a rate of up to 1000 Hertz, while our non-contact scanners can register up to 1.2 million points per second.

Automation ready

The AT960 is fully ready for automated inspection, assembly and production within a robotic setup when paired with sensors such as the Absolute Scanner AS1, Absolute Scanner AS1-XL and Leica T-Mac.





High-accuracy 6DoF probing

Leica T-Probe

The Leica T-Probe is a completely wireless solution for the probing of hidden and hard-to-reach points. With minimal setup times and station changes combined with a high point-acquisition rate, automatic stylus recognition and individually assignable multi-function buttons, the T-Probe is the key to high-productivity single-point data acquisition.

Together with the Leica Absolute Tracker AT960, the Leica T-Probe creates a flexible top-performance probing solution with a range of up to 30 meters from the tracker. Small, light, user-friendly, cable-free, battery powered and more accurate than any other handheld probe in the world, the T-Probe gives you more than six degrees of freedom: it gives you the right way to measure.

Improved productivity

Hidden-point capability allows the measurement of hidden areas without relocation of the laser tracker, with the potential to reduce measurement time by up to 80 percent compared to reflector measurement.

Intuitive operation

A simple automated pairing process combined with assignable multi-function buttons and automatic stylus recognition make the T-Probe incredibly easy to use with very little training.

Punch tool

With a dedicated punch tool accessory you can not only locate the exact position of where to drill a hole but also mark the object ready for punching.

Lightweight portability

Innovative carbon fiber construction that means the T-Probe weighs in at only 0.64 kilograms along with a long-life battery and complete wireless operation allow for a full day of measurement with no sign of operator fatigue.

Unlimited styli

A wide range of styli and tip options make probing easy for a variety of applications, offering the measurement flexibility that is particularly important for geometric dimensioning and tolerancing.

Error-free measurement

When measuring parts using reflectors mounted on holders, it's necessary to manually compensate the offset, a step that is too often overlooked and a common cause of inaccurate results. The T-Probe eliminates this problem with its faultless automatic stylus recognition.



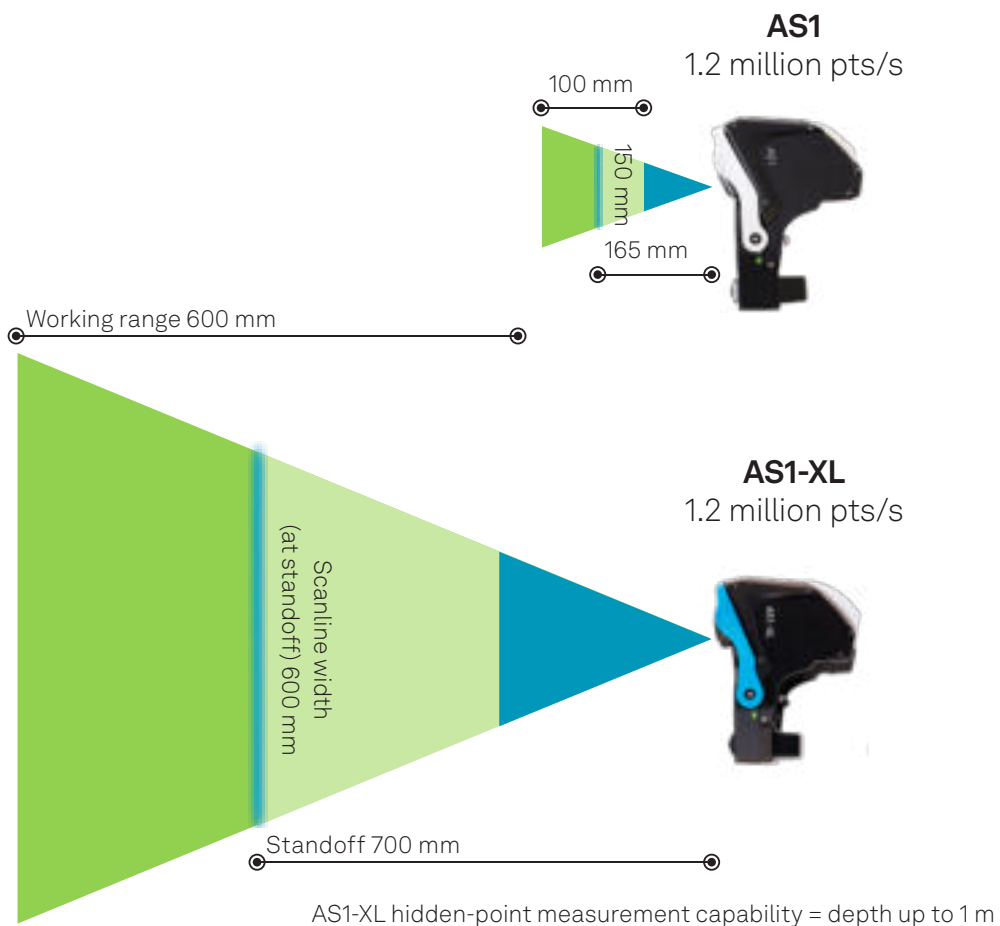
Introduction to laser scanning

Collecting and using 3D point cloud data

Laser scanners work in conjunction with a global referencing system such as a laser tracker or portable measuring arm to create a three-dimensional model of a surface or entire part. Due to their high data-density – millions of individual data points – these models are typically called "point clouds".

The scanner digitizes a part by projecting a laser onto it, and then detecting and analyzing the properties of the light reflected back. This information is interpreted as millions of individual data points that together represent the geometry of the scanned surface and features.

Laser scanners come in different forms, with different strengths, designed for specific purposes. This can translate to a wider laser scanning stripe for faster part coverage, increased standoff for easier hidden-point coverage, a faster rate of data capture for high-speed scanning or a laser concept designed for consistency across various surface types.



Laser scanning technology



Key facts

- Overall speed of data acquisition is defined by its data-points-per-second capability, scanning path width and the density of points per scan line.
- Complex parts with lots of curvature, varying textures or a range of features such as holes, slots and struts will benefit from scanning with a higher data-point density that can record finer-grained details but may take longer.
- For larger, more uniform surfaces with fewer fine details, a scanner with a wider scan line and therefore faster measurement process speed may be a better fit.
- Optical filters can allow scanners to overcome the effects of ambient light by ignoring wavelengths of light except those in the range of the laser being used.
- Automatic exposure control allows laser intensity to be automatically adjusted in real time to account for changes in material color and reflectivity that would otherwise make a part difficult to digitize.

Key applications

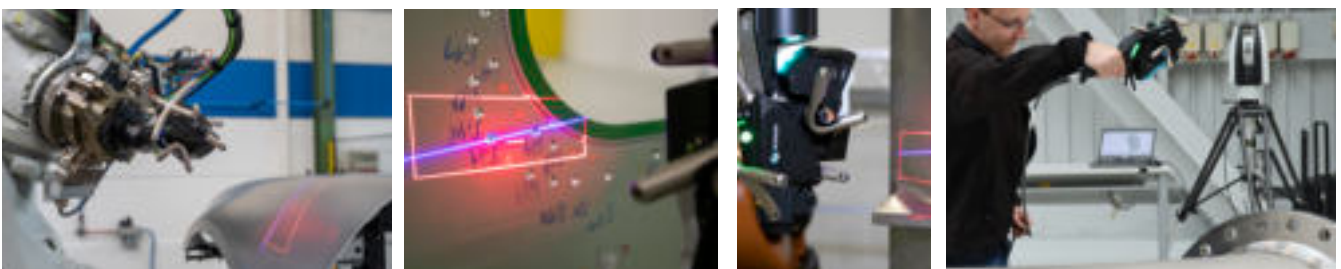
Laser scanning in an industrial metrology context can be used for several distinct purposes, which fall within two broad categories.

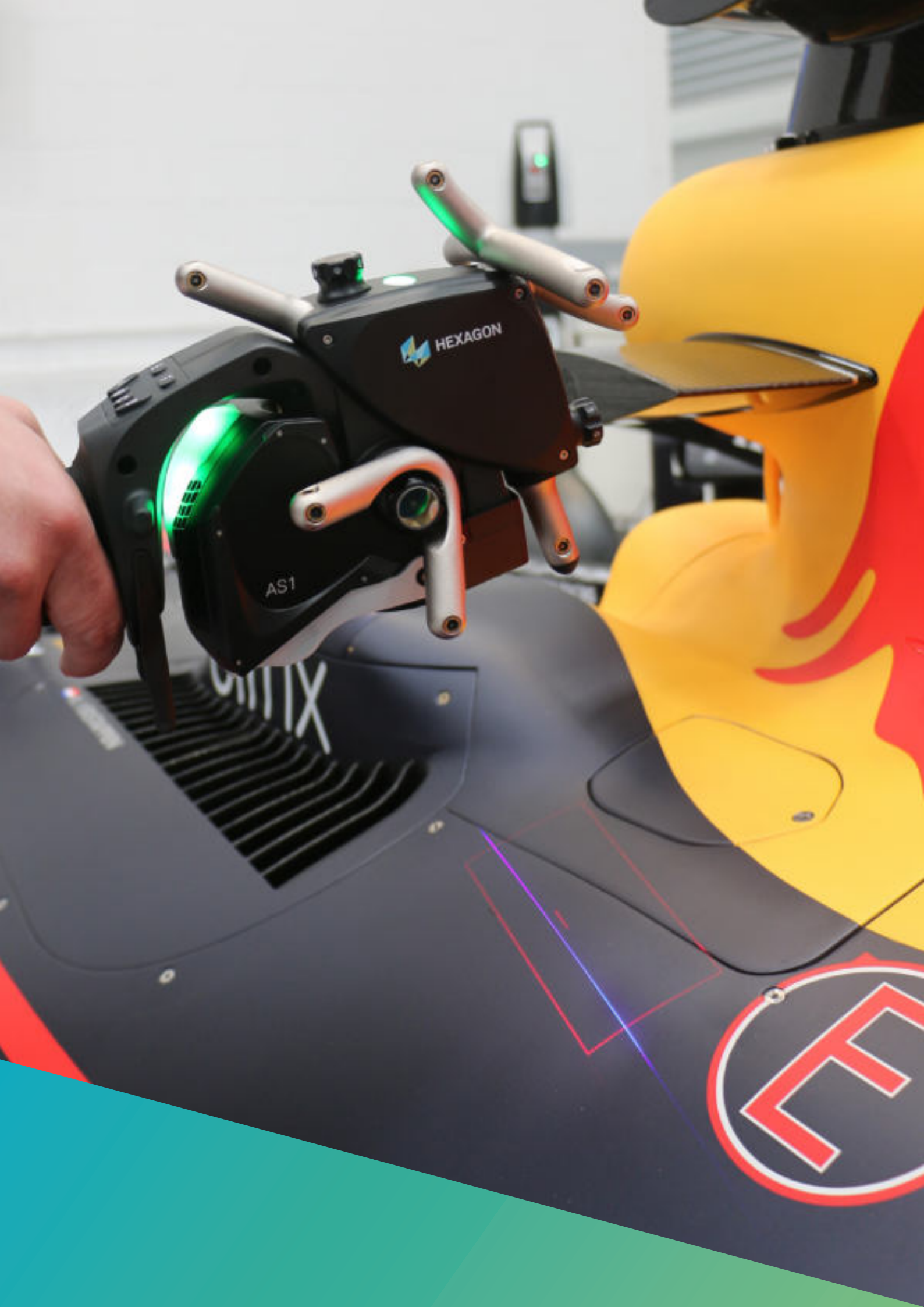
Inspection and validation

The 3D point cloud created by a laser scanning system can be used for dimensional inspection or geometric dimensioning and tolerancing, with the results being compared against nominal CAD values. With cloud-to-CAD comparison, large point clouds can be overlaid on a CAD model for fast visual inspection of deviations. Laser scanning can also be used for traditional (non-CAD) inspection using feature construction and dimensioning.

Reverse engineering

It can be useful to take an existing physical part, measure it to determine its characteristics and then process the data to create a CAD model. This method is often used in cases where the product design process involves significant manual operation, such as in automotive design. Some applications in this field can even be performed directly from the point cloud scan data or the mesh model without the need to create a full CAD model.





Absolute performance

Absolute Scanner AS1

Built on unique SHINE technology, the Absolute Scanner AS1 always delivers full scanning performance, even on the most challenging parts. Whether faced with glossy black plastic automotive body parts or moulded carbon-fiber components, this innovative exposure mode allows the AS1 to scan with no reduction in quality or productivity. Full frame rate and full laser line width, without spray and without the forced performance reductions that are a hallmark of other scanners.

And all that from a scanner built on a uniquely modular hardware architecture that allows it to be mounted on different high-accuracy metrology positioning devices depending on the application. Use the AS1 with the Absolute Positioner AP21 and the Absolute Tracker AT960 for larger-scale or automated applications, or mount the same scanner on an Absolute Arm for scanning small-to-medium sized components without the requirement of maintaining line-of-sight to a tracker.

SHINE innovation

Our Systematic High-Intelligence Noise Elimination – SHINE – technology is the key to the high scanning performance of the AS1. Cleaner, higher-quality data, collected faster, even on challenging surface types and finishes.

Uniquely usable

A robust design that's easy to maneuver with a single hand; a projected laser range finder that makes correct scanner positioning simple; compatibility with all major metrology software platforms; high-performance on 99 percent of surfaces when using default settings; customizable measurement profiles selectable directly from the scanner. The AS1 is in the running for the most user-friendly laser scanner ever designed.

Enhanced portability

Just a single Ethernet data cable is needed to connect the scanner to the tracker. This connection runs through the compact and lightweight Connect Box and AT Controller, both designed to clip to any standard tracker stand. The entire system can be powered from a single source, whether that's a single AC power cable or a hot-swappable battery that individually allows up to 9 hours of continuous scanning time.

Full speed, always on

The AS1 boasts a wide scan line – 150 millimeters at mid-range – and there's no need to narrow that range or slow down the scanner's market-leading 300-line-per-second data collection speed. With the AS1 it's simple – all the performance, all of the time.

Positional accuracy

The performance of the Absolute Scanner AS1 is powered by the Absolute Positioner AP21 unit on which it is mounted. The AP21 boasts a high-accuracy reflector that can be precisely tracked by the AT960 at a distance of up to 30 meters, along with a constellation of LEDs that the AT960's mini variozoom camera can use to calculate highly accurate orientation information.

Automation ready

The AS1 was built to be the next generation sensor of metrology-powered automation. Impressive performance on default exposure settings, as well as high-speed data collection of up to 1.2 million points per second makes it ideal for a variety of automated manufacturing applications, from systematic inline inspection to statistical checks in the quality room.





Absolute magnitude

Absolute Scanner AS1-XL

The SHINE technology that is the foundation of the Absolute Scanner AS1 is now operating on a bigger scale with the Absolute Scanner AS1-XL. An ultra-wide scan line, extended stand-off and a measurement speed ten times faster than the previous generation of XL 3D laser scanner from Hexagon – the AS1-XL is a quantum leap forward in large-scale handheld non-contact measurement.

Thanks to SHINE, the AS1-XL still delivers rich, clean data from every measurement surface, from glossy black plastic to moulded carbon-fiber. All this comes together with the same modular platform as the AS1, which means no-warm-up hot-swapping between laser tracker and portable measuring arm referencing depending on the needs of the application. And with a single-case AS1 | AS1-XL set, instant scanner exchange allows for fine feature measurement with the AS1, then large surface inspection with the AS1-XL, then back again in the same measuring session.

SHINE innovation

Our Systematic High-Intelligence Noise Elimination – SHINE – technology is the key to the high scanning performance of the AS1-XL. Cleaner, higher-quality data, collected faster, even on challenging surface types and finishes, and now available in a device dedicated to large surface area scanning.

Stand-off and scan

Thanks to an immense stand-off distance of up to an entire metre (700 millimeters at mid-range), the AS1-XL is easier to sweep over large surfaces, can be used to measure higher points without scaffolding and is ideal for hidden area measurement thanks to its capacity to see inside cavities.

Enhanced portability

Just a single Ethernet data cable is needed to connect the scanner to the tracker. This connection runs through the compact and lightweight Connect Box and AT Controller, both designed to clip to any standard tracker stand. The entire system can be powered from a single source, whether that's a single AC power cable or a hot-swappable battery that individually allows up to 9 hours of continuous scanning time.

Wider data

The AS1-XL boasts an ultra-wide scan line – 600 millimeters at mid-range – that allows it to make light work of large surfaces. For the larger-scale inspection applications that are becoming increasingly common across manufacturing sectors, the AS1-XL is an essential data collection tool.

Positional accuracy

The performance of the AS1-XL is powered by the Absolute Positioner AP21 unit on which it is mounted. The AP21 boasts a high-accuracy reflector that can be precisely tracked by the AT960 at a distance of up to 30 meters, along with a constellation of LEDs that the AT960's mini variozoom camera can use to calculate highly accurate orientation information.

Big automation

The AS1-XL was built as a next generation sensor capable of supporting metrology-powered automation. Its large stand-off distance make perfect for larger-scale integrations in the aerospace industry, and is of particular benefit when it comes to programming robot inspection paths that ensure the avoidance of costly collisions.





Absolute versatility

Absolute Tracker meets Absolute Arm

The Absolute Scanner AS1 and Absolute Scanner AS1-XL are uniquely capable of working with an portable measuring arm as well as a laser tracker system.

Absolute Tracker use

The scanner is simply mounted on the Absolute Positioner AP21, which allows it to be tracked by an AT960 laser tracker throughout a measurement volume up to 30 meters in diameter, whether being used as a handheld scanner or integrated within an automated inspection system.

Absolute Arm use

The scanner is simply mounted directly onto a current generation 7-axis model Absolute Arm, available with measurement volume diameters between 2.0* and 4.5 meters.

* AS1-XL only compatible with arms of diameter 2.5 meters and above

There aren't two different flavors of Absolute Scanner. The exact same scanner unit can be used with an Absolute Arm and an Absolute Tracker. Demounting and remounting takes only seconds and is performed entirely by the user with no special tools. This ground-breaking level of interoperability comes thanks to Hexagon's patented kinematic joint, which allows for the quick mounting of probes and sensors on a range of products with no need for a time-consuming realignment.



Applications

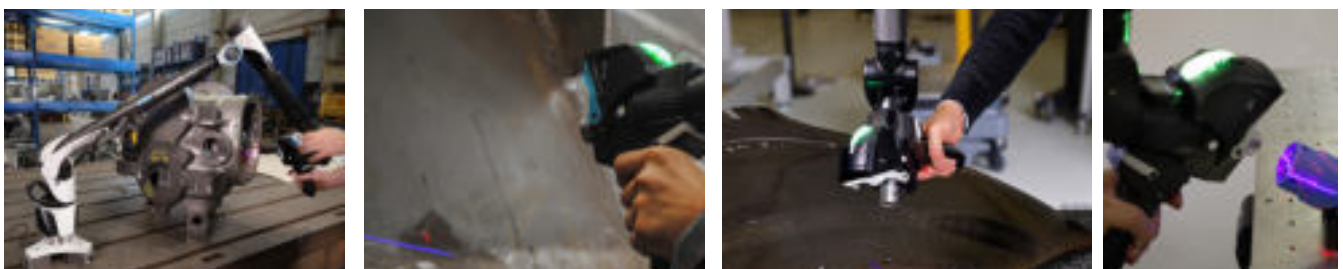
There are many ways in which the unique modular concept of the AS1 can be applied to benefit users, primarily by reducing the level of investment required to implement quality control processes across multiple parts of the manufacturing process.

Automotive

On the automotive shop floor, the same AS1 scanner module can be moved as needed between an Absolute Arm used for interior quality control and an AP21 and Absolute Tracker in the pilot plant performing flush and gap inspection.

Aerospace

In an aerospace context, the same AS1 module can be switched back and forth as required between scanning ribs inside the wing structure with an Absolute Arm and the outside surface of the wing with an AP21 and Absolute Tracker.

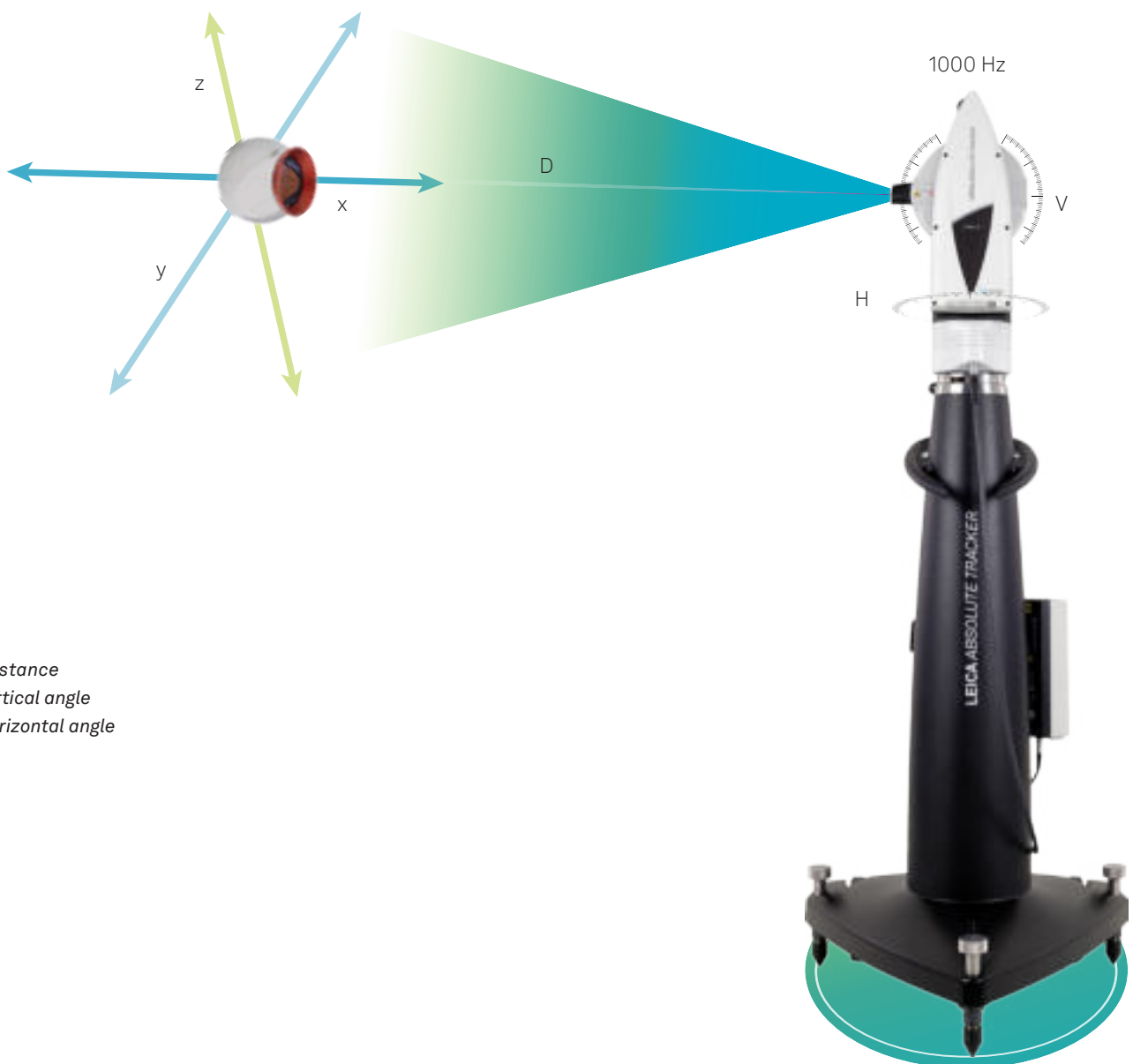


Introduction to 3D

Measuring direct from the tracker

The original laser tracker capability, 3D measurement is still a vital component of the tracker toolkit. By identifying your point of measurement with a specialized retroreflector, its precise geometry can be recorded in seconds. With a 3D laser tracker, high-accuracy inspection and alignment tasks can be performed over ultra-large measurement volumes of up to 320 meters in diameter.

A 3D laser tracker equipped with an automatic target-lock function like PowerLock can reduce measurement process times by as much as 30 percent by detecting reflector targets within the tracker's field of view with no need for operator intervention – particularly useful after line-of-sight is broken, as can happen often within a busy work environment. And with new Enhanced Wave Form Digitizer technology, accurate measurement of single 3D points can even be made without a target – the calculation is made directly to the point of measurement, with metrology-grade accuracy.



D : distance
 V : vertical angle
 H : horizontal angle

Laser tracker 3D



Key facts

- Horizontal and vertical angle measurements combined with a distance measurement allow the computation of the location of a point within three-dimensional space with distance accuracy to within as little as 10 microns.
- Measuring with reflectors allows the user to explore the full measurement volume of a laser tracker – measurement can start immediately in front of the tracker (no minimum distance) and extend to up to 160 meters away.
- 3D reflector measurement is the most accurate way to relocate the tracker in the relevant coordinate system when moving to a new station to cover a larger measurement volume.
- Using the same measurement principle as measurement to a reflector, innovative direct scanning uses a network of individually taken 3D data points collected directly by the tracker to create a 3D point cloud of a large surface.
- By placing the reflector on a tool, or measuring directly with direct scanning, it's possible to follow the coordinate of a point in real-time, allowing for fast adjustments.

Key applications

Large-volume 3D measurement with a laser tracker is a fast and accurate solution across a variety of major industrial applications.

Quality inspection

The measurement of discrete points to check geometry is the foundation of quality inspection and can be quickly carried out to a high degree of accuracy over great distances with a laser tracker and reflector combination. The introduction of direct scanning adds the possibility to inspect large surfaces with ease and metrology-grade accuracy without an operator at the point of measurement.

Build and adjust

Alignment and adjustment processes based on installed constellations of multiple reflectors are a key tool for a variety of large-scale assembly applications. The introduction of direct scanning makes the process even easier and faster when used in combination with a reflector measurement for initial alignment.





The first direct scanning tracker

Leica Absolute Tracker ATS600

The first ever direct scanning laser tracker bridges the gap between point-by-point measurement and advanced laser scanning, on a scale previously only matched by terrestrial laser scanners. The Leica Absolute Tracker ATS600 delivers large-scale direct measurement capabilities at three times the accuracy of leading terrestrial scanners while folding the entire measurement process within an established metrology workflow – results are provided immediately on-site with no need for post-processing.

Based on established technology used by high-definition surveying tools, the Enhanced Wave Form Digitiser of the ATS600 combines time-of-flight and phase-shift measurement technology to deliver fast measurement over long distances with no need for a target at the point of measurement. For the first time, the accuracy of this technology has been refined to metrological levels, allowing for non-contact measurement with a range noise of within 80 microns (1σ) – significantly more accurate than previous WFD-based measurement systems.

Large-scale power

The range of the ATS600 is fundamentally different to any comparable metrology system. Direct scanning with metrology-grade accuracy to within 300 microns is guaranteed at distances of up to 60 meters from the tracker.

Simple operation

Measurement is an easy one-user process where targets are easily identified and results are delivered and processed efficiently. Enhanced functionalities further improve accuracy and productivity, from uniform grid scanning and high-resolution zoom to panorama imaging and Line and Ring Scan profiles.

Automatic control

The ATS600 was designed with automation in mind. With minimal user intervention required, it can be set up to perform many repetitive measurements independently and without station relocations.

Metrology workflows

Direct scanning is completely integrated within a metrology-oriented workflow, with all measurement data collected at a rate of up to 1000 Hz and quickly delivered to the metrology software.

Fast measurement

Fully configurable data point density allows users to tailor the measurement process rate and accuracy level to their application – from a quick check at 10 seconds-per-square-meter to a high-accuracy scan at 135 seconds-per-square-meter.

Selective grid

The ATS600 works on a principle of selective scanning, where the user defines the area to be measured (through the overview camera or nominal data such as CAD) along with the measurement point density required. Combined with 3D orientation data, the result is a uniform grid of points accurately representing the entire measurement surface.





High-end 3D measurement

Leica Absolute Tracker AT930

The Leica Absolute Tracker AT930 is the next generation 3D laser tracker to feature the Absolute Interferometer, delivering high-speed dynamic measurement capabilities that set it apart from the competition. With automatic target location, real-time architecture and the ability to instantly re-establish an interrupted beam, it is the fast, accurate and user-friendly way to measure to reflectors.

Measurement volume

With no minimum measurement distance, the AT930 is uniquely applicable to measurement in confined spaces, while also able to measure from up to 80 meters away.

Smart connectivity

Wireless battery-powered operation allows for use on autonomous vehicles, with the PowerLock function allowing the system to locate itself in the coordinate system and perform inspection tasks automatically.

Unbeatable accuracy

The AIFM enables the AT930 to measure to any sensor with a maximum distance uncertainty of just +/-10 microns.

Robust construction

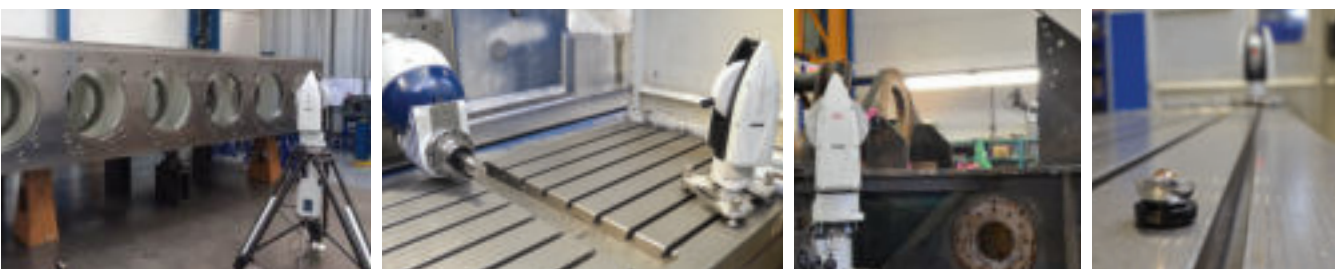
The IEC-certified IP54 sealed system of the AT930 makes it a perfect shopfloor tool.

Real-time data output

By using the optional Real-Time Feature Pack it's possible to export up to 1000 points per second with minimal latency and highly accurate timestamps – essential for specialized high-speed measurement applications.

Machine calibration

Compatibility with our specialized wide-angle Super CatEye Reflector allows the AT930 to be applied in the fast and highly accurate calibration of machine tools.





Ready to measure anywhere

Leica Absolute Tracker AT500

The first true all-in-one Hexagon laser tracker measurement solution, the Leica Absolute Tracker AT500 benefits from a fully battery-powered, integrated-controller design that makes it the most portable and easy to setup member of the Absolute Tracker range. Operational simplicity plays a key role in driving the enhanced productivity proposition of the AT500, from its easy ultra-long-range reflector measurement capabilities to the entry-level 6DoF probing functionality delivered by B-Probe^{plus}. With the usability and robust design that are the defining features of the AT500, absolutely anyone can measure absolutely anything, absolutely anywhere.

Measurement anywhere

The AT500 boasts IP54-rated protection from the elements, as well as an extended working temperature range of -15 to +50°C, allowing for measurement from the mountaintop to the foundry.

Integrated features

The batteries that power the AT500 have been built into the tracker head, making this a system that's ideal for setup and operation beyond the bounds of traditional inspection locations.

Extended range

The full reflector measurement range of the AT500 extends across a volume 320 meters in diameter, making it the ideal solution for inspection of large structures such as antennas or ships.

Next-generation probing

The battery-powered B-Probe^{plus} brings entry-level 6DoF handheld probing to the 3D tracker segment. The probe is easier to handle than the previous generation and boasts a widened acceptance angle and increased range.

Live 6DoF information

The digital read-out of the B-Probe^{plus} puts direct measurement feedback in the users hands. This simplifies and speeds up probing operations, and is particularly useful in supporting drilling applications when combined with a punch tool accessory.

Productivity made easy

One-button operation combined with WiFi access point connectivity and integrated batteries makes the AT500 the easiest tracker to use. And it's not limited to upright configuration — it can be used in any orientation, including upside down.





The power of automation

Industrial automation is long-established as the future of manufacturing. Metrology-enhanced automation is the key to that future. By making automated inspection and production independent of unreliable robot accuracy, metrology tools like laser trackers combine the fine attention-to-detail of manual production with the unbeatable productivity benefits of automated setups.

6DoF with the AT960

The dynamic position and orientation measurement of a moving sensor delivered by 6DoF tracking allows for a range of high-productivity automated inspection systems based on the Leica Absolute Tracker AT960. With the right sensors, single-point, point cloud and camera-based inspection can be automated with any feasible combination of robot arms, turntables, sliders, isolation walls, built-in control stations and tool changers for automatic sensor switching. The result is an automated system that delivers accuracy completely independent of the precision of the system's moving components.

7DoF with the AT960

Automated production control systems are made possible by the introduction of Hexagon's Real-Time Feature Pack, which upgrades the AT960 to meet the deterministic measurement data-delivery requirements of real-time robotic control. Built on the groundbreaking EtherCAT (Ethernet for Control Automation Technology) protocol, such a 7DoF system can provide precise and accurate control in applications involving processes such as machining or part assembly, putting never-before-seen levels of accuracy at the centre of the manufacturing process – controlling for and improving quality as the part is being produced rather than after.

Direct scanning with the ATS600

The unique direct scanning functionality of the Leica Absolute Tracker ATS600 presents a simple form of measurement automation that is easy to apply to a range of inspection applications. There's no need for a sensor or operator at the point of measurement, so components can just be brought into the tracker's field of view and automatically inspected with just a few software clicks.

Autonomous mobile inspection

Another innovative form of inspection automation is based on the distinctive portable form-factor of laser tracker systems, which allows for mounting on an Automated Guided Vehicle (AGV) or Autonomous Mobile Robot (AMR). Thanks to battery-powered operation and wireless data transmission accessories like the WRTL, Absolute Tracker systems can be programmed to perform automated inspection tasks with complete autonomy. Systems can involve just a single mobile 3D tracker or multiple mobile 6DoF trackers paired with mobile robot arms mounted with measurement sensors.





The tools of automation

Automation accessories and sensors

While powered by the market-leading tracking capabilities of the Leica Absolute Tracker AT960, Hexagon's Laser Tracker Automation solutions rely on a range of high-quality sensor technology and a selection of auxiliary accessories that broaden the capabilities of measurement automation.

Leica T-Mac

A 6DoF tracking device specifically designed for automated applications, the Leica T-Mac is a fully robot-mountable positioner that can be augmented with various probe and sensors to power automated inspection systems. Trackable with a high degree of accuracy at up to 30 meters from the tracker, it is also the basis of automated production solutions through combination with specially designed machine tools.

Wide-angle alignment

Wide-angle reflectors and targets are a vital tool for systems that use multiple trackers or place parts on rotary tables for measurement. With a 150-degree laser acceptance angle, a Super CatEye reflector can be used to quickly and easily align each aspect of the system within the same measurement reference frame, making results more reliable and accurate.

Robots and machine tools

Our Laser Tracker Automation solutions are compatible with products from every major robot arm manufacturer, whether simple single axis arms or full 7-axis systems that allow the sensor at the point of measurement complete freedom of movement. Systems can even be integrated within large-scale machine tools to deliver metrology-assisted production solutions.

Scanner automation

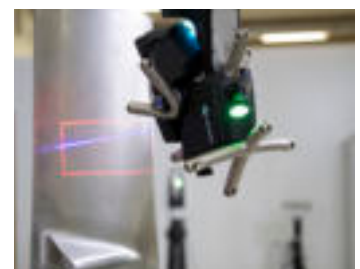
Laser Tracker Automation systems that require surface and feature scanning capabilities can be fitted with either the cutting-edge Absolute Scanner AS1 or Absolute Scanner AS1-XL. Both provide highly capable dynamic measurement performance that can keep up with today's improving robot speeds.

Tool changer

For highly versatile automated inspection setups that encompass probing, scanning and camera-based inspection functionalities, a dedicated tool changer allows a specifically programmed system to switch between sensors on the fly within a single measurement program, delivering unmatched automation efficiency.

Cells, turntables and sliders

Whether turnkey from Hexagon or custom-developed by an experienced integrator, a full tracker-based inspection cell is a complete measurement solution. They often include a bespoke software control system, and can be setup singularly for simple systems or applied in large multi-unit configurations for more complex automated measurement processes. Functionality is typically augmented by singular or multiple turntables and/or sliders, allowing additional freedom of movement to the robot driving the position of the sensor or moving the part under inspection for better access.



Reflectors

A retroreflector for every application

Thanks to automatic target location, real-time architecture and the ability to instantly re-establish an interrupted beam, measurements to retroreflectors are performed quickly, accurately and easily. We offer a range of reflectors to meet the needs of any application – take a look at our product catalog for details on the full range.

Red Ring Reflector



Ultimate 3D accuracy

The absolute standard for accurate 3D measurement, Red Ring Reflectors are precision corner-cube reflectors with a hardened steel surface, available in three sizes (1.5", 7/8" and 0.5").

Super CatEye Reflector



Ultra-wide acceptance angle

The Super CatEye Reflector offers a unique ultra-wide laser acceptance angle, designed to deliver productivity improvement without the need for high-cost investment in additional complex technical devices.

Break Resistant Reflector



Shop-floor resilience

Designed for challenging industrial environments, Break Resistant Reflectors offer a greater degree of robust construction.

Super CatEye Reference Target



Mountable ultra-wide-angle measurement

A variant of the Super CatEye Reflector, the Super CatEye Reference Target offers the same ultra-wide acceptance angle while being directly surface mountable, either magnetically or through its 6-mm M4 center bore hole, making it ideal for machine calibration tasks.

Tooling Ball Reflector



Basic reflector measurement

For those situations where the ability to make many measurements is more important than having the highest degree of accuracy, the Tooling Ball Reflector is a basic entry-level retroreflector suitable for a wide range of industrial applications.

Fixed Installation Reflector



Mountable and reliable measurement

For applications demanding the same measurements be made repeatedly, a fully mountable retroreflector that can be fixed in place provides a robust and cost-effective solution.

Accessories

Making the most of laser tracker technology

Driven by a truly end-to-end approach to innovation, Hexagon's wide range of accessories for laser trackers reaches from added functionality to improved productivity while covering every need in between.

Probing styli



Wall mounts



Tripods and stands



Measurement cart



Levelling unit



Certifying absolute accuracy

The standards behind Absolute Tracker accuracy

To ensure our trackers deliver not just a high degree of accuracy but also proven and traceable results, we align with a selection of defined and trusted international standards.

ISO 10360-10

The accuracy specifications for measurement with our laser trackers are stated in accordance with the international ISO 10360-10 standard for laser tracker measurements.

ASTM E3125-17

The direct scanning performance of ATS600 systems is specified in line with the ASMT E3125-17 standard that is used to test the performance of large-volume 3D scanners.

ISO 17025

To ensure delivery in line with our published accuracies, every one of our Absolute Tracker systems and sensors is calibrated at an ISO 17025 accredited laboratory staffed by skilled engineers and outfitted with a wide range of high-end technical equipment and diagnostic tools.



Defining absolute accuracy

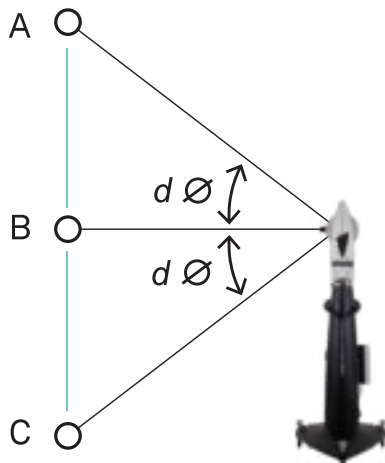
The tests that guarantee absolute accuracy

We use three main tests to check the accuracy of our various tracker systems, in line with the ISO 10360-10 standard for laser trackers and the ASMT E3125-17 standard for large-volume 3D scanners.

Location test

Also known as a two-face test. Comparison of measurements to a stationary target by rotating the horizontal encoder 180 degrees and elevating the vertical encoder to lock onto the target. This test is designed to quickly reveal geometry imperfections.

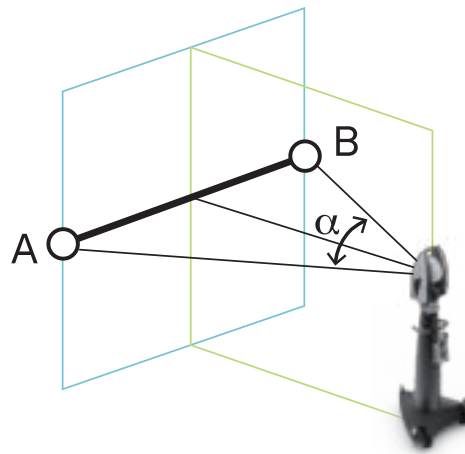
This test is performed using reflectors in line with ISO 10360-10, and also using direct scanning in line with ASMT E3125-17.



Length test

Measurement of a standardised and calibrated scale bar at predefined distances. This test is designed to show how accurately the tracker measures in a specified volume.

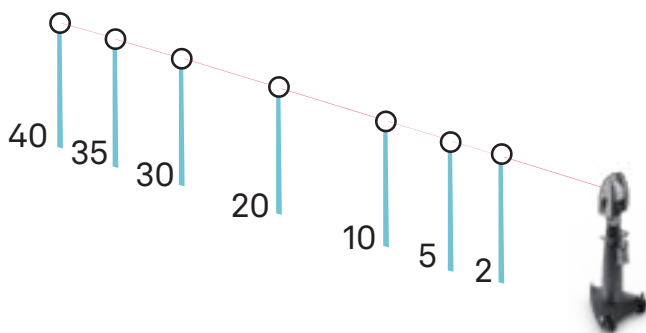
This test is performed using reflectors according to ISO 10360-10. For direct scanning, it's in accordance to ASTM E3125-17.



Ranging test

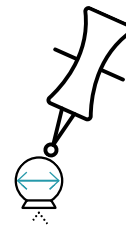
Comparison of measurements to a series of calibrated stationary targets at increasing distance from the tracker. This test is designed to verify the performance of the distance meter.

This test is performed using reflectors in line with ISO 10360-10.



P_{SIZE}

The P_{SIZE} value is the maximum permissible error for measuring the diameter of a sphere. It therefore signifies the accuracy of feature measurements.



Specifications

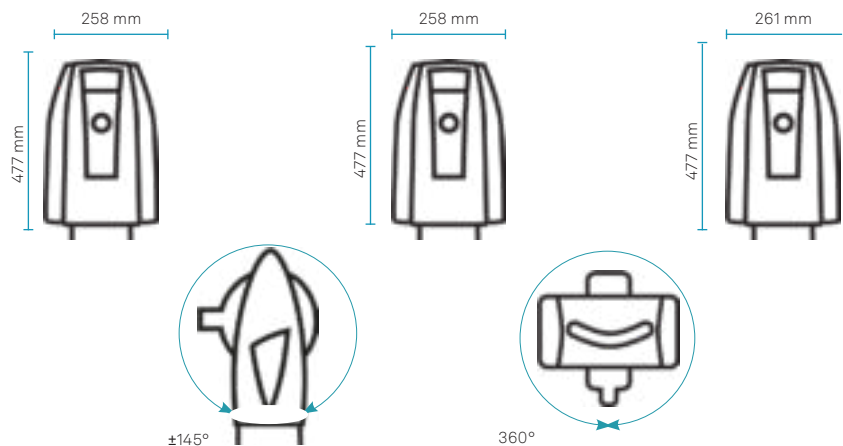
Measurement ranges

Tracker model	3D	6D
AT960-XR	0 to 80 m	1.2 to 30 m
AT960-LR	0 to 80 m	1.2 to 20 m
AT960-MR	0 to 20 m	1.2 to 10 m
AT960-SR	0 to 6 m	1.2 to 5 m
AT930	0 to 80 m	-
ATS600	0.8 to 80 m 1.5 to 60 m (direct scanning)	-
AT500	0.8 to 160 m	1.6 to 12 m

* Typical values

Trackers compared

	AT960 AT930	ATS600	AT500	
General information	Tracker size weight	477 x 258 x 258 mm 14.2 kg	477 x 258 x 258 mm 14.2 kg	477 x 261 x 238 mm 13.6 kg
	Controller size weight	249 x 148 x 59 mm 1.65 kg	249 x 148 x 59 mm 1.65 kg	built-in controller, 0 kg
	Laser class	Class 2 Laser Product in accordance with IEC 60825-1 Second Edition (2014-05)	Class 2 Laser Product in accordance with IEC 60825-1 Second Edition (2014-05)	Class 2 Laser Product in accordance with IEC 60825-1 Second Edition (2014-05)
	Overview Camera	5MP 10-degree FOV	5MP 10-degree FOV	5MP 10-degree FOV
	PowerLock range	60 m	60 m	80 m
	ISO 17025 certified	✓	✓	✓
	Warranty	2 years extension possible with Customer Care Packages	2 years extension possible with Customer Care Packages	2 years extension possible with Customer Care Packages
Environmental	Operating temperature	0°C to +40°C	0°C to +40°C	-15°C to +50°C
	Relative humidity	max. 95% non-condensing	max. 95% non-condensing	max. 95% non-condensing
	Operating elevation	-700 m to +5500 m	-700 m to +5500 m	-700 m to +5500 m
	Dust water	IP54	IP54	IP54
Interface	Cable	Cat6	Cat6	Cat6
	Wireless	WLAN (IEEE 802.11n)	WLAN (IEEE 802.11n)	WLAN (IEEE 802.11n)
Power management	Battery type	Lithium-ion battery swappable	Lithium-ion battery swappable	Lithium-ion battery integrated and swappable
	Typical battery runtime (single charge)	6 hours	6 hours	6 hours
	Data output	1000 Hz	1000 Hz	100 Hz
	Mains	AC power supply	AC power supply	AC power supply



Angular performance (location test)

Measurement distance	AT960 AT930 AT500 ATS600	
	Typical	MPE
5 m	±23 µm	±45 µm
10 m	±38 µm	±75 µm
20 m	±68 µm	±135 µm

Length measurement (length test)

Measurement distance	AT960 930 500		ATS600	
	Typical	MPE	Typical	MPE
5 m	±32 µm	±64 µm	±40 µm	±81 µm
10 m	±53 µm	±106 µm	±53 µm	±106 µm
20 m	±96 µm	±191 µm	±96 µm	±191 µm

Distance measurement (ranging test)

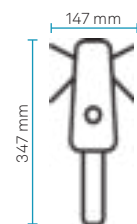
Measurement distance	AT960 AT930 (IFM)		AT930 AT960 AT500 (ADM)		ATS600	
	Typical	MPE	Typical	MPE	Typical	MPE
1.5 to 5 m	±1 µm	±1 µm	±7 µm	±14 µm	±71 µm	±142 µm
1.5 to 10 m	±1 µm	±3 µm			±72 µm	±143 µm
1.5 to 20 m	±3 µm	±5 µm			±76 µm	±152 µm
1.5 to 30 m	±4 µm	±8 µm			±83 µm	±165 µm
1.5 to 40 m	±5 µm	±11 µm			±92 µm	±183 µm
1.5 to 50 m	±8 µm	±15 µm	±102 µm	±203 µm		

Scanning accuracies

Sensor	P _{SIZE} ¹	Length measurement ²
Absolute Scanner AS1	±60 µm	±50 µm
Absolute Scanner AS1-XL	±240 µm	±150 µm

3D scanner specifications

	AS1	AS1-XL
Scanner type	Blue laser line scanner	Blue laser line scanner
Accuracy	0.013 mm ³	0.134 mm ³
Point acquisition rate	1.2 million points/s	1.2 million points/s
Points per frame	max. 4000	max. 4000
Frame rate	max. 300 Hz	max. 300 Hz
Line width (mid)	150 mm	600 mm
Standoff	165 ± 50 mm	700 ± 300 mm
Minimum point spacing	0.027 mm ⁴	0.08 mm ⁴
System scanning certification	yes	yes
Laser class	2	2
Protection rating	IP54	IP54
Operating temperature	0-40°C	0-40°C
Weight	0.43 kg	0.46 kg

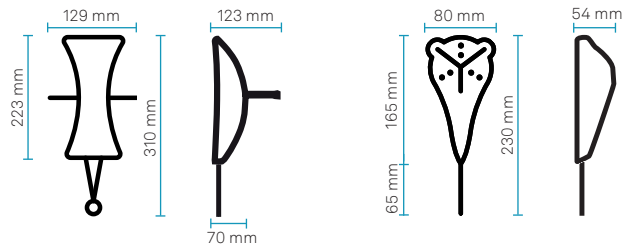


Probing accuracy

Sensor	P _{SIZE} ¹	Length measurement ⁵
Leica T-Probe	± 50 µm	± 57 µm
Leica B-Probe ^{plus}	± 100 µm	± 150 µm
1.5" Red Ring reflector	± 20 µm	± 38 µm

Probes compared

	T-Probe	B-Probe ^{plus}
Size weight	310 x 129 x 70 mm 0.65 kg	230 x 80 x 54 mm 0.14 kg
Cable-free operation	✓	✓
Multiple programmable buttons	✓	-
Instant visibility feedback	✓	-
Automatic stylus recognition	✓	-
Multiple stylus mounting positions	✓	-
Acoustic feedback	✓	-
Battery type	1 x Lithium-ion swappable	2 x AAA (NiMH) swappable
Typical battery runtime (single charge)	> 5 hours	> 6 hours

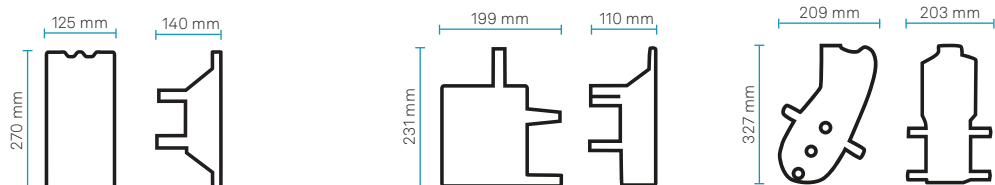


Other accuracies

Absolute angular performance e_t ⁶	±15 µm + 6 µm/m
AIFM absolute distance performance	±0.5 µm/m
Dynamic lock-on	±10 µm
Inclination sensor	±1.0 arcsec
Orient to gravity U_z	±15 µm + 8 µm/m
Timestamp accuracy	< 5 µsec

T-Mac models compared

	T-Mac Basic TMC30	T-Mac Frame TMC30-F	T-Mac Multiface TMC30-M
Size	270 x 125 x 140 mm	231 x 199 x 110 mm	327 x 209 x 203 mm
Weight	1.48 kg	1.11 kg	2.9 kg



ATS600 scanning specifications

Accuracy	
Range noise ⁷	< 80 µm
Absolute accuracy ⁸	< ±300 µm
Angular performance $E_{\text{two-face,MPE}}^9$	±50 µm + 10 µm/m
Length measurement $E_{\text{distance,MPE}}^9$	±150 µm

Speed	
Scan rate	1000 Hz
Scan speed ¹⁰	< 10 sec/m ² in fast mode

All accuracies stated as Maximum Permissible Error (MPE). Typical values half of MPE.

¹ $P_{\text{Size,Sphere,t25:ODR:LT,MPE}}$ measured at 2 m according to ISO 10360-10: 2021 Annex G

² Up to 30 m

³ $P_{\text{Form,Sph,t25:ODS,MPE}}$

⁴ Near range

⁵ Accuracy at 2 m measurement distance; for other measurement distances:

Length measurement T-Probe $E_{\text{vol:ODR:LT,MPE}} : \pm 42 \mu\text{m} + 7.7 \mu\text{m/m}$

Length measurement B-Probe^{plus} $E_{\text{vol:ODR:LT,MPE}} : \pm 137 \mu\text{m} + 6.3 \mu\text{m/m}$

Length measurement 1.5" RRR $E_{\text{vol:ODR:LT,MPE}} : \pm 21 + 8.5 \mu\text{m/m}$

⁶ Angular Performance Transverse e_r according to ISO 10360-10

⁷ Standard deviation (1σ) of a best-fit plane (78% albedo), distance 1.5 to 30 m, standard measurement mode, target aligned

⁸ Maximum deviation (MPE) of the absolute position of a plane (78% Albedo), 1.5 to 30 m, 0 to ±45° incidence angle

⁹ In accordance with ASTM E3125-17 Tables 2, 3 and 4

¹⁰ At default point-to-point and line-to-line distance, measurement distance 10 m

Patent notice

Products described in this brochure are covered by the following US patents.

AT930

US 9,377,296 B2 | US 10,054,422 B2 | US 9,638,519 B2 | US 9,612,331 B2 | US 10,036,811 B2 | US 8,279,430 B2 | US 9,366,531 B2 | US 7,609,387 B2 | US 8,305,563 B2

AT960

US 9,377,296 B2 | US 10,054,422 B2 | US 9,401,024 B2 | US 9,638,519 B2 | US 9,612,331 B2 | US 9,720,087 B2 | US 10,036,811 B2 | US 8,031,331 B2 | US 8,279,430 B2 | US 9,366,531 B2 | US 7,609,387 B2 | US 8,305,563 B2

AT960-XR

US 9,377,296 B2 | US 10,054,422 B2 | US 9,401,024 B2 | US 9,638,519 B2 | US 9,612,331 B2 | US 9,720,087 B2 | US 10,036,811 B2 | US 8,031,331 B2 | US 9,864,062 B2 | US 8,279,430 B2 | US 9,366,531 B2 | US 7,609,387 B2 | US 8,305,563 B2

AT500

US 9,377,296 B2 | US 9,322,654 B2 | US 10,036,811 B2 | US 8,279,430 B2 | US 8,772,719 B2 | US 9,366,531 B2 | US 8,305,563 B2 | US RE47,430 E | US 9,341,500 B2 | US 9,810,964 B2 | US 9,405,007 B2

AS1 and AS1-XL

US 10,302,745 B2 | US 10,330,466 B2 | US 10,323,927 B2

B-Probe^{plus}

US 9,816,813 B2