



Leica Absolute Tracker  
Product Brochure  
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*Leica*  
Geosystems



 **HEXAGON**  
METROLOGY

# Leica Absolute Tracker with PowerLock. Simply the Best.

The Leica Absolute Tracker from Leica Geosystems is a portable measurement system that relies on a laser beam to accurately measure and inspect in a spherical volume of up to 160 m [525 ft]. The Leica Absolute Tracker can gather 3D coordinates in 3 ways: by following a small mirrored sphere, also known as a reflector; by tracking a Leica T-Probe, a hand-held "walk-around" wireless contact probe; or by tracking a Leica T-Scan, a contactless high-speed laser scanner. Which measurement method you should use will depend on your application.

From prototyping and reverse engineering to tooling inspection and part mating, from automotive to aerospace and everything in-between, our customer list reads like a "who's who" of the world's most successful enterprises – yet our equipment is just at home in small and medium-size companies. With the introduction of the world's first laser tracker in 1990, we revolutionized high-accuracy inspection as the world knew it. With the Leica Absolute Tracker, we have done it again.

## Our best laser tracker to date.

At Leica Geosystems, we have built up a rock-solid reputation for designing and manufacturing absolutely reliable, robust laser trackers that find application in the most demanding environments, from factory shop floors to metrology labs. It all started with the legendary SMART laser tracker series, then came the LTD500 generation, followed by the LTD700/800 lineup, and in 2005 we gave you the LTD640/706/709/840 family. With the Absolute Tracker, our fifth-generation laser tracker and running, we took everything we know about laser tracking and moved it to the next level in dependability, stability of operation, volumetric accuracy and ease of use.

The best tribute to our quality is the undisputed fact that most contract inspection companies rely on Leica Geosystems for their most crucial jobs. Most of our laser trackers, regardless of their age, are still up and running, including most of the venerable SMART series laser trackers.

## Leica Absolute Interferometer and PowerLock – changing laser trackers forever

With the combination of the Absolute Interferometer (AIFM) and PowerLock, you can forget about the laser beam forever. In the past, operators had to worry about loosing or "breaking" the beam because they had to lock back onto it somehow. This process has been constantly evolving ever since our first laser tracker was introduced in 1990. First was the Absolute Distance Meter (ADM) that allowed absolute distances to be reset to the laser interferometer (IFM) automatically, then the "fast" ADM's that sped this process up, then the Absolute Interferometer, that removed any accuracy loss due to the dynamic lock-on process, and now PowerLock with the ability to lock the laser back onto the Reflector or Probe automatically.

**"Breaking the beam" is something you'll quickly forget – because good things are easy to get used to.**

## We lead. Others follow.

When we gave you the first Leica Smart 310 in 1990, many had thought laser tracking would be a passing fashion. Almost 20 years later, most of our original laser trackers are still up and running – we couldn't ask for a better seal of approval. In the meantime, we have delivered thousands of laser trackers to customers the world over, turning large-scale metrology into an integral part of industrial processes in the automotive and aerospace segments but also in nearly every other industry in which assuring a perfect fit is part of the equation.

No other brand of laser tracker has been doing this longer, you can find Leica laser trackers that are almost 20 years old still in the work place today. We are the industry leader in laser tracker technology, inventor of the 6DoF laser tracker, creator of the most accurate dynamic distancing technology in the AIFM and the minds behind PowerLock, the vision technology that permanently removed the arduous task of loosing and re-locking onto the laser beam. Since 1990, this much has become apparent:

## We lead. Others follow.



### PowerLock

PowerLock vision technology completely changes the way that laser trackers have been used. No longer does the operator have to worry about the laser beam, they can simply measure what is needed and let the tracker lock on to them!



### Leica Absolute Interferometer (AIFM)

The AIFM is a single distancing unit with the dynamic performance of an interferometer, and the ability to re-acquire a moving target with the typical uncertainty of lock-on process being less than 5µm.



### Six Degrees of Freedom

By adding photogrammetric capabilities to the laser tracker, Leica Geosystems created the world's only technologically mature PCMM system that can probe like a fixed CMM, scan like a laser scanner and track automated applications – all in one system.



### Thermal stability & robustness

Intermediate adjustments required by most laser trackers are simply not needed. Rather than performing frequent, questionable compensations, the Leica Absolute Tracker allows you to perform reliable measurements instead.



# Why Absolute Tracker?

## Absolute Interferometer



In the ideal world, a laser tracker would combine the ability to instantly re-establish a broken laser beam and immediately start measuring a moving target. At the same time, it would measure absolute distances with the highest precision and would be arbitrarily fast with near zero integration times (the time required to determine the target's position). Until now no single distancing unit was capable of this, so laser tracker manufacturers were forced to use both laser interferometers (IFM) and Absolute Distance Meters (ADM) separately.

An IFM is unable to determine an absolute position in 3D space without having a known starting point first. An ADM on the other hand, measures absolute distances (i.e. distances to a known point in a 3D coordinate system) with extreme precision, but even the fastest ADM will never be able to achieve the speed of an IFM for dynamic measurements.

The AIFM combines the best of both worlds: it can measure absolute distances to a moving target without a loss in accuracy due to target instability during integration – a leading edge solution to an age old problem using mature technology.

The IFM and ADM core technologies have been used for more than a decade in our laser trackers around the world. These core technologies have been improved and combined to create what we have dubbed the "Absolute Interferometer", or AIFM, and represent the most accurate and stable dynamic distancing unit that we have ever created.



## 6 Degrees of Freedom

The Leica T-Cam, part of every Leica Geosystems Portable Coordinate Measurement System (PCMM) or as an add-on option for existing Leica Geosystems Laser Trackers migrating from reflector measurements to other target devices, is a CMOS digital camera system operating with visible light and near infrared (IR) radiation, with an optical vario zoom and a motor for vertical, angular movement. Mounted onto the Leica Absolute Tracker, the Leica T-Cam continuously follows the target device and captures the images of the IR LEDs located on them. The T-Cam's incremental angle encoder is used to provide the vertical, angular movement of the T-Cam based on tracker guidance angles.

A reflector integrated in a target device, together with a set of LEDs embedded on the surface of the target device, represent the measurement targets of the system. Six measurement parameters describe the target device in relation to the laser tracking system completely. These are 3 position parameters (x, y and z) and 3 orientation parameters (pitch, yaw and roll). Together, they comprise the Six Degrees of Freedom (6DOF) principle. These parameters are determined by the Leica Absolute Tracker (position) and the Leica T-Cam (orientation).

The vario zoom in the Leica T-Cam keeps the size of the target device as seen by the CMOS sensor constant, thus resolving the biggest issue previously faced by photogrammetry systems: their inaccuracy due to the camera-perceived changing size of the tracked object (i.e. the farther away the target device, the smaller it appears on the camera sensor).

## Impervious to environmental light

Regardless of whether you are conducting your measurements in direct sunlight, with welding sparks flying around or with sharply changing environmental light, the Leica T-Cam functions flawlessly. The target devices emit pulsating infrared light of a known wavelength, and the CMOS camera utilizes a shutter that engages at the same frequency at which the target device pulsates. That way, it can effectively "tune out" all other light sources except for the target device itself. Simply put, the Leica T-Cam "only has eyes" for Leica Geosystems target devices.



## Thermal stability and robustness second to none

Despite being an extremely sophisticated piece of equipment, a laser tracker is not intended just for controlled laboratory settings in which the temperature, humidity and the like are kept in check. In the real world, a laser tracker is subjected to punishing atmospheric conditions. Accounting for how they affect the refraction index of the emitting laser light is easy. The much bigger challenge lies in making sure that all the components inside the laser tracker also stay within check. There is plenty of room for things to go wrong, with electronic components inside all emitting heat.

The Leica Geosystems engineers have designed each and every component with the eye on the big picture, never losing sight of how different parts will mechanically and thermally interact with one another. The result: an extremely homogenous internal design and a laser tracker that refuses to drift out of spec. The Absolute Tracker's stunning looks are merely an extension of its inner beauty: a judicious, clean-cut design that leaves nothing to chance.

With the Absolute Tracker's, intermediate adjustments typically required to "reset" the entire apparatus to avoid going out of spec are simply not required. Rather than performing frequent, time-robbing mathematical compensations to keep in spec, you'll be performing measurements instead.



## PowerLock

By utilizing an active vision system built into the sensor the Leica Absolute Tracker can determine where a target is without the need for the laser beam to be locked on and without operator intervention. This revolutionary vision system works with all standard reflectors and all Leica T-products and can lock on to the target as soon as it is within view of the sensor. The Absolute Interferometer technology makes starting from the birdbath in an "interferometer only" mode (as is done with other laser trackers) versus utilizing PowerLock's revolutionary Lock on the fly capabilities irrelevant, as there is no difference on the absolute uncertainty of the measurements between the two methods. In fact, the PowerLock technology of the Leica Absolute Tracker is even more accurate than using previous generation laser trackers in "interferometer only mode" tracker and returning to the "bird bath" between measurements.



# Leica Absolute Tracker – that's right for you

## Leica Absolute Tracker product family

Leica Geosystems Laser Trackers have been at the forefront of laser tracking technology since 1990 – the year we gave you the world's first laser tracker. Bringing a machine, a fixture or tools into their correct position – from the trailing edge of an airplane wing to the Body-In-White inspection on a passenger car to the rollers on a paper mill – are some of the most critical production stages that will determine the overall quality of the finished product. Chances are, the car you are driving or the plane you recently flew on or even the press used to print this brochure were all built using our laser trackers. Their other uses may be less spectacular, but the relentless focus on manufacturing perfection is the same.

In today's technology-dominated world, the engineering prowess seems to be the only limit. Rather than play catch up with the needs of our customers, we have actively involved them in the design process, responding with cutting-edge engineering that has tremendously improved their innovation processes. Our new line of Absolute Trackers is just the latest installment in our never-ending quest for perfection.

## Leica Absolute Tracker 901-Basic

If your application requires positioning machines, fixtures or jigs, or if you are in the business of installing and aligning machine tools, roll mills, presses or gantry based machines, the Leica AT901-Basic is your tracker. Operating solely with a reflector, it is optimized for inspections within a typical measurement volume of up to 160 m (525 ft), and comes standard with our Leica Absolute Interferometer and PowerLock technologies.



## Leica Absolute Tracker 901-Mid Range

Since the introduction of the Leica T-Products in 2004, practically all leading automobile manufacturers have joined the ranks of our customers. When a reflector simply won't cut it because there is no clear line of sight to the part you are trying to inspect, the part is hidden or sunken deep beneath surrounding sheetmetal, or because you need to reverse-engineer a part right there on the spot, the Leica AT901-MR is all you will need. When coupled to the Leica T-Scan, T-Probe, or T-Mac the Leica AT901-MR gives you a measurement volume of up to 18 m (59 ft). Of course, it can also be used with a standard corner cube, in which case its measurement volume goes up to a full 50 m (164 ft). The sensor is designed for large vehicle size objects and of course comes standard with our Leica Absolute Interferometer and PowerLock technologies.

## Leica Absolute Tracker 901-Long Range

This is the laser tracker that set the new benchmark for aerospace and other large scale precision measurements such as windmill blade inspection or industrial machinery alignment. It gives you hand-held wireless probing (Leica T-Probe), hand-held contactless scanning (Leica T-Scan), and full machine control abilities (Leica T-Mac) in a volume of up to 30 m (98 ft). Of course, it can also be used with a standard corner cube, in which case its typical measurement volume goes past 160 m (525 ft). This is the laser tracker that set new standards for usability with the Leica Absolute Interferometer and PowerLock, and continues to be the best selling 6DoF laser tracker in the world.



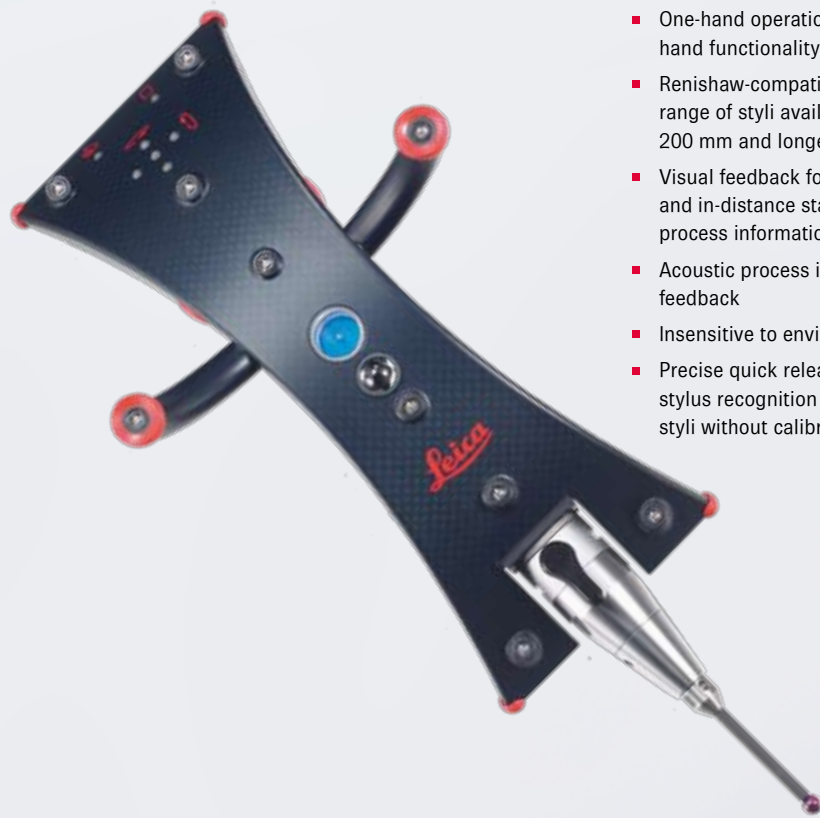
Leica AT901-MR gives you a measurement volume of up to 18 m (59 ft), Leica AT901-LR up to 30 m (98 ft)

### Leica T-Probe

Leica T-Probe, the "Walk-Around" armless, wireless solution for probing of hidden, hard-to-reach points in one go with minimal setup times, sets new standards by increasing accuracy, with a high point-acquisition rate and user-assignable multi-function buttons.

Small, light, user-friendly and more accurate than any other hand-held probe in the world, the Leica T-Probe gives you more than 6 Degrees of Freedom: It gives you the right way to measure. Now featuring longer styli, Leica T-Probe reaches up to 30 m [98 ft] in any dimension.

- Smaller, lighter and more convenient than comparable solutions
- Largest armless operation measurement volume of up to 30 m [98 ft], reducing inspections by min. 50%
- Wider acceptance angle than any comparable system: pitch  $\pm 45^\circ$ , yaw  $\pm 45^\circ$ , roll  $360^\circ$
- Battery-powered for wireless operation and increased productivity
- Extended battery life with flexible "sleep" mode
- Automated styli identification reduces operator errors
- User-assignable multi-function buttons for individual application functionality for all buttons
- One-hand operation with left/right-hand functionality
- Renishaw-compatible with a wide range of styli available, incl. 100 mm, 200 mm and longer
- Visual feedback for battery, in-view and in-distance status and for process information
- Acoustic process information feedback
- Insensitive to environmental light
- Precise quick release and automated stylus recognition for exchanging styli without calibration



### Leica T-Scan

Leica T-Scan TS50 is a high-speed hand scanner for large-volume portable applications. This third-generation Leica T-Scan is more accurate, provides a better performance on challenging material types and offers double the point acquisition rate compared to the previous generation.

The Leica T-Scan is more than just a line scanner. Its Flying Dot technology is the only truly automated scanning solution. The adjustment of the laser power to obtain the best measurement result of a specific surface type is completely autonomous. This ensures the best possible results – independent from the operator.

The Leica T-Scan adapts the laser intensity to shiny metallic or dark surfaces. They can even be captured in one scan pass! Powdering is not required and the technology is impervious to changing environmental light – which reduces preparation time to the absolute minimum. And if the measurement object is extremely large, no photogrammetric targets are required after the tracker relocation. Save time and do not compromise on accuracy.

Leica T-Scan scans large objects more accurately and 50 percent faster than comparable products.



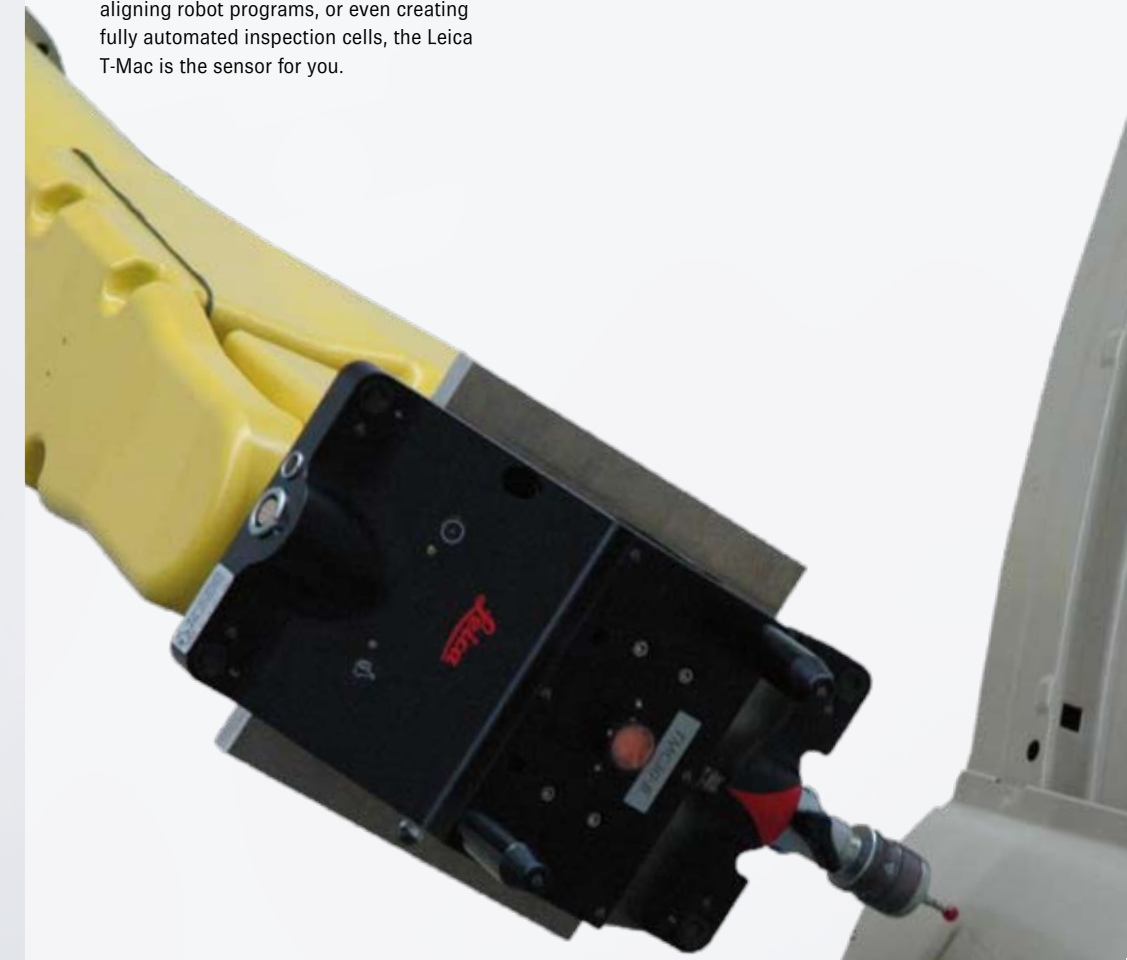
## Portable CMM. Because a laser tracker is just the beginning.

**User-friendly, fast and accurate, Portable CMM from Leica Geosystems allows you to assemble aircraft faster and inspect automotive parts more efficiently while minimizing digitization times and costs. If you want the whole picture, go portable CMM. A laser tracker is just the beginning.**

### Leica T-Mac

Leica T-Mac (Tracker-Machine control sensor), the next-generation 6DOF tracking device for automated applications, answers the needs of a growing number of Leica Geosystems customers who have either modified the existing Leica T-Probe for automated measurement applications or have expressed interest in doing so.

Leica T-Mac is an off-the-shelf solution that can be custom-tailored to the needs of a specific application. Whether you have a need for automated part positioning as in the Leica 6DoF MAP solution, correcting and aligning robot programs, or even creating fully automated inspection cells, the Leica T-Mac is the sensor for you.



# Your trust. We've been earning it for almost 200 years.

Both international and Swiss at the same time, Leica Geosystems is a global enterprise serving customers in some 120 countries. Those customers continue to work with us because of our exceptional support and service that accompanies every laser tracker we manufacture. We offer you a partnership, a commitment to fulfilling the trust you placed in Leica Geosystems by purchasing our equipment.

Due to the complexity of modern Portable CMM instruments, we put high value on making sure that our customers are armed with all the technical knowledge they need to not only meet but exceed their expectations over the entire product lifetime.

## The purchase is just the beginning.

Our "worry-free" concept of Service & Support has established a benchmark standard in the industry. At Leica Geosystems, we not only manufacture the world's most advanced Portable CMM products, we also provide world-class Service & Support that are second to none.

## Confidence in Quality

All Absolute Trackers are backed by our 5-Year-Warranty Program. It covers preventative inspection, re-certification and an extension of the factory warranty. After the factory warranty has expired, the warranty can be extended by one year, simply by having your system serviced and re-certified by Leica Geosystems Metrology Service at a very affordable price. This procedure can be repeated up to 4 times, resulting in a total of 5 years of prolonged warranty time, covering repairs, parts and labor.

In addition to our 5-Year Warranty Program, Leica offers top-of-the-bill service contracts, comprising a variety of services, such as stand-by systems, full onsite coverage, application software maintenance, telephone support, on-site application support, etc. If you want to get the most out of your system, the Silver and Gold Contracts are the way to go.

Leica Geosystems Service & Support program begins with our global Leica Absolute Tracker warranty and initial support program, which accompanies all new instrument sales for up to one year following the delivery of a new system and completion of at least Basic Level Training.



## What our customers say

"After dealing with Leica Geosystems service department for over the past ten years, I have been impressed with the professionalism and the rapid response time I have experienced with them. Their group of professionals combined their expertise to resolve my situation. I have found that it never seemed to matter when it happened. I always receive a quick response, but much more importantly, I get the correct resolution to the problem. I have always relied on Leica Geosystems to provide me with the equipment, accessories and technical expertise to satisfy my customers' requirements."

*Jeffrey D. Brehm  
Computer Aided Measurement Services  
St. Louis, Missouri  
USA*

"The Leica Geosystems Laser Trackers have been supported by yearly service contracts and emergency call-outs as and when required. My Maintenance and Production colleagues have always been impressed with the Leica Geosystems support organization in maintaining our laser trackers."

*Joe Fare, Senior Facilities Engineer  
JSF Operations, BAE Systems  
Sambesbury Aerodrome  
Lancashire  
United Kingdom*

"The consistently high level of service we receive from the UK Leica Geosystems Service Center ensures the Airbus UK at the Broughton tooling department meets the demanding re-certification schedules that we are continually aiming to achieve."

*Geoff Griffiths  
Aerotoooling Teamleader  
Airbus UK Ltd.  
Broughton  
United Kingdom*

"We at Schott Glass Manufacturing have been using a Leica Geosystems Laser Tracker for over six-and-a-half years. Over time, we have grown to depend on Leica Geosystems equipment because of its high dependability, great flexibility, precise measurement results and, last but not least, the outstanding service and support we receive from them – all factors that have made our Leica Geosystems equipment indispensable."

*Kirsten Wetzstein  
Quality Control Astro Space  
Schott AG  
Mainz  
Germany*

## When second-best is not an option.

We are interested in working with you to find a custom solution that best suits your particular situation. This commitment to excellence is not part of some premium customer care package, it is something we guarantee to every single customer as a matter of fact. Leica Geosystems maintains a dedicated support force that only focuses on customer support issues and is available in most countries in which our equipment is available. Our service centers are fully equipped, are authorized by Leica Geosystems, offer ISO9001 certification and employ superbly and regularly trained engineering staff.

Laser trackers from Leica Geosystems have been around since 1990. Nearly all of our now-legendary SMART Series laser trackers introduced that year are still up and running, not to mention the subsequent generations that followed.

The Absolute Tracker from Leica Geosystems starts our fifth generation of laser trackers. Owing one is a benchmark experience to which everyone else is compared.



- Leica Geosystems, Heerbrugg, Switzerland
- Each wave modulator is painstakingly put together by hand; most mechanical components are so miniaturized, they have to be made under a microscope. This part alone takes 1.5 days to make.
- A long series of exhaustive benchmark tests is made throughout the manufacturing process of each unit in order to assure that it will work on spec for years to come.
- Fine motor skills are required when calibrating instruments prior to final customer delivery.
- A highly skilled workforce is required to produce state-of-the-art components like the Leica T-Cam. In addition to requiring an education in fine mechanics, each team member undergoes 6 months of rigorous on-the-job training before he or she is able to work autonomously.
- Space-age alloys and high-precision optics combined in a zero-dust housing assure that the laser beam remains stable and can be predictably manipulated.
- All critical components are housed in high-strength, low-thermal-expansion alloy casings to guarantee predictable operation over the entire product lifetime.
- Sophisticated inspection methods objectively verify the integrity of finished components throughout the production process.
- Highly sensitive cameras are used to visually inspect the otherwise invisible laser light, thus inspecting the correctness of the optical path.



## Two centuries of quality Swiss manufacturing and innovation.

From its origins in a small Swiss town almost two centuries ago, Leica Geosystems has established a tradition of quality, innovation and dedication to customer satisfaction. In 1819 we started manufacturing geodetic instruments. In 1921 we gave you the world's first portable opto-mechanical theodolite, in 1925 the first-ever aerial photography camera, in 1969 the world's first infrared-based distancer, in 1990 the world's first laser tracker designed for shop floor use, in 1995 the world's first Absolute Distance Meter, in 2004 the world's first 6DoF laser tracker, in 2008 the world's first Absolute Interferometer. And in 2009 we completely changed the laser tracker market yet again with the PowerLock active vision technology.

Good reputation is extremely hard to achieve. It is not created with a clever marketing campaign. It is earned. At our plant in Heerbrugg, Switzerland you will see no mass manufacturing, no robots and no pre-assembled components from questionable suppliers. Every finished component is painstakingly tested and retested for every eventuality before it is delivered to the customer. We at Leica Geosystems have earned our reputation for quality and innovation by adhering to a simple principle of honest hard work, stubborn unwillingness to make engineering compromises that jeopardize the impeccable quality of the products we make, and by delivering what our customers want. They can go to anyone for a laser tracker, but they come to us. For a good reason.

We've helped thousands of customers optimally measure their world. We can do the same for you.



Whether building the fastest car, the biggest plane, or the most precise tooling, you need exact measurements to improve quality and productivity. So when it has to be right, professionals trust Leica Geosystems Metrology to help collect, analyze, and present 3-dimensional (3D) data for industrial measurement.

Leica Geosystems Metrology is best known for its broad array of control and industrial measurement products including laser trackers, Local Positioning Technology (LPT) based systems, hand-held scanners, 3D software and high-precision total stations. Those who use Leica Metrology products every day trust them for their dependability, the value they deliver, and the world-class service & support that's second to none.

Precision, reliability and service from Leica Geosystems Metrology.

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