iGPS
Large volume metrology, tracking and positioning

Turn your shopfloor into a metrology enabled workspace

NIKON METROLOGY | VISION BEYOND PRECISION
iGPS drives Metrology Assisted Production

Scalable systems for large volume metrology
iGPS systems can be scaled from small work cells to facility-wide installations by just adding more transmitters. The measurement volume is configured to the size of the application, resulting in 360° part coverage.

Uniform accuracy for industrial large scale application
The typical accuracy of an iGPS system is 200µm. Where traditional metrology equipment accuracy decreases with distance and as a result of leapfrogging-related measurement errors, iGPS accuracy is uniform across the entire measurement volume, regardless of the size of the metrology enabled area.

Inherent robustness
Unlike traditional laser-based metrology tools, iGPS offers 360° part coverage without line-of-sight issues thanks to transmitter redundancy. Continuous health monitoring including on-line compensation in case of transmitter displacement and drift, guarantees optimum system performance without user intervention.

Easy to deploy and straightforward to use
Installing iGPS on the shop floor is easy and straightforward: just set up the transmitters on their portable tripods and calibrate the system by walking around in the measurement volume while holding a calibrated scale bar. As such, shopfloor measurement eliminates the need to transport large heavy parts to/from the measurement room.

Multi-user for concurrent applications
iGPS has the unique ability to serve multiple users simultaneously without performance loss. Once a work cell is iGPS-enabled, additional users and new applications can be added with minimum additional investment. Next to supporting a range of handheld metrology devices, iGPS positions tools or tracks multiple objects simultaneously, such as automated guided vehicles (AGVs) in a manufacturing environment.

Open solution that grows along with your measurement needs
As a modular and scalable solution, iGPS offers a broad application reach. Using off-the-shelf iGPS components, tailor-made tooling and the software development kit (SDK), all elements are present to build a custom solution that perfectly meets your needs.

Inspection applications
Ideally, large parts or components are verified on the shop floor where they are produced. Measuring large heavy parts using traditional metrology tools may require transportation overhead to bring the parts to the measurement equipment. iGPS overcomes these challenges by converting your workspace into a metrology enabled facility where users can easily measure multiple parts.

Aircraft fuselage inspection
- Measure individual points on a fuselage using the i7 Articulated Arm
- iMCA allows for easy measurement of hidden points in the workspace

Full car body inspection
- Operators use the i6 Long Reach Probe to measure multiple car bodies without leap-frogging
- Ideal for concurrent measurement of jigs/tooling

Measurement of features on large turbine casting
- The i6 Probe is used to measure surface features across the entire casting
- Full freedom measurement through wireless connection between PDA and portable client
Tailored configurations for each application

The iGPS portfolio can be delivered with endless set-up configurations starting with minimum 2 transmitters. More transmitters create a larger measurement volume and further improve line of sight. A few examples: a 4-transmitter iGPS set-up is easy to deploy, providing a smaller and unobstructed measurement volume; a 6-transmitter set-up is typically used where left/right measurements are taken on a vehicle body; an 8-transmitter set-up preserves the best line of sight in a measurement volume with a footprint up to 1.200m².

Each iGPS set-up is available in different configurations: as a portable lightweight system that is easy to set up or delivered with base stations that provide reference detectors for continuous health monitoring. To provide highest accuracy and system robustness, fixed iGPS monuments are used to capture position and scale reference points throughout the workspace. After having determined the positions of the reference points during system set-up using an external measurement device, iGPS continuously monitors these monuments to be able to maintain transmitter positions at highest accuracy.

Workstation options for every application

In a single application, data processing and system monitoring is handled by a portable, combined client/server workstation that runs the Surveyor control software and a (3rd party) application. In case of concurrent applications, the data streams and system monitoring are controlled by a metrology server that manages the connectivity between the measurement systems and multiple portable client applications.

Dynamic Tracking Kit

The Dynamic Tracking Kit (DTK) is an add-on to any iGPS system to support dynamic referencing and 6DOF part tracking. The DTK can be semi-permanently fixed to a part or jig and used for 6DOF tracking or dynamic referencing within an iGPS volume. The DTK can be configured to track a part’s local coordinate system by following a straightforward alignment procedure.

Tracking applications

iGPS offers dynamic tracking in support of precision assembly of large parts and continuous monitoring of tools and objects. As such, closed-loop iGPS measurements are directly integrated into the production and assembly stages, realizing a first-time-right Metrology Assisted Production process.

Dynamic tracking of ship models in towing tank applications

- Ship models are equipped with a Dynamic Tracking Kit (DTK)
- Ship model behavior is monitored using synchronized dynamic measurement data

Tracking and monitoring of industrial robots

- DTKs are embedded into robot and fixtures
- A single iGPS system monitors multiple robots on a factory-wide scale

Aligning and joining large subassemblies

- Fuselage sections, wings and control surfaces are equipped with iGPS DTKs to track their position
- iGPS systems enable monitoring of drilling and riveting robotic machining systems
Localizing applications

Localizing third party tools and instruments is essential in a wide range of large volume applications. iGPS technology enables 6DOF localization of any tool to enhance process capability or improve quality assurance for applications such as coating thickness measurement, drill marking, robot-guided painting, etc.

Targetless Laser Projection For Aircraft Final Finishes
- Laser projectors are equipped with iGPS enabled frames & the target aircraft is equipped with DTKs
- The aircraft & projectors are automatically aligned by the iGPS system enabling complete part coverage for final finishes layouts

Gap & Flush Measurements for Fasteners & Weld Seams
- A 2D laser gap and flush gauge is iGPS enabled via a custom i6 Probe adapter
- Positional information is linked with gap/flush measurements enhancing quality records and simplifying rework processes

Coating thickness measurement in aerospace applications
- i6 Probe is equipped with a coating thickness tool
- Exact position recording of coating measurement

... with countless applications
Full freedom operation in large volumes

iGPS technology provides the building blocks for the iGPS systems

iGPS is a scalable measurement concept that converts a workspace into a metrology enabled work volume. The operation of an iGPS system is comparable to a global positioning system (GPS) in a car, but it is designed for industrial applications on a facility-wide scale. GPS satellites are replaced by infrared iGPS laser transmitters that activate a measurement field as large as an entire room or facility.

iGPS features accuracies that are roughly a hundred thousand times higher than consumer GPS systems. Tools, parts, probes and equipment, such as AGVs, can be equipped with iGPS receivers that are tracked by the transmitters. As such, positions can be measured or dynamically tracked with a high degree of confidence in order to provide accurate metrology data or to facilitate tracking and positioning applications.

To obtain accurate positioning, receivers need line of sight from minimum 2 transmitter fields. Adding more transmitters enlarges the measurement area, improves robustness by guaranteeing line of sight, and further increases measurement accuracy. iGPS is a flexible metrology solution that offers full freedom operation for indoor and outdoor use. The iGPS systems are standardized configurations built with iGPS components focusing on ease of installation and use.

iGPS delivers significant value to the customer, right from the start!
Full freedom operation in large volumes

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Con configurations and specifications

Example iGPS set-ups, configurations, tools and options

<table>
<thead>
<tr>
<th>Transmitter count</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical measurement volume footprint</td>
<td>from 10x10m up to 40x40m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical use case</td>
<td>Smaller volume / Unobstructed line of sight / Lower accuracy</td>
<td>General purpose / Standard system size / Moderate line of sight obstructions</td>
<td>Larger volumes / Obstructed line of sight / Maximum accuracy</td>
</tr>
</tbody>
</table>

1. Configurations can be customized to suite the application and desired measurement volume.

<table>
<thead>
<tr>
<th>Hardware configuration</th>
<th>Basic set-up</th>
<th>Advanced set-up</th>
<th>Optimum set-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Workstation</td>
<td>Free network of transmitters</td>
<td>Transmitters plus base stations</td>
<td>Transmitters plus monuments</td>
</tr>
<tr>
<td>Dynamic Tracking Kit</td>
<td>Traceable length of scale</td>
<td>Traceable length of scale</td>
<td>Traceable monument network</td>
</tr>
<tr>
<td>3D point uncertainty</td>
<td>&lt; 200µm + 10ppm</td>
<td>&lt; 200µm + 10ppm</td>
<td>&lt; 200µm over monument volume</td>
</tr>
<tr>
<td>Point to Point uncertainty</td>
<td>&lt; 200µm over 3x scale-bar length</td>
<td>&lt; 200µm over 3x length of scale</td>
<td>&lt; 200µm over monument volume</td>
</tr>
<tr>
<td>Typical use case</td>
<td>Portable/Deployable set-up Short term measurement and tracking Engineering or R&amp;D focused Less health monitoring</td>
<td>Semi-portable or semi-fixed installations Longer term measurement and tracking Production focused High level of health monitoring</td>
<td>Fixed installation Always-on production system Maximum system robustness accuracy and reliability</td>
</tr>
</tbody>
</table>

Tools and options

- Fixed Workstation: Allows multiple independent clients to be used in the same iGPS network leveraging scalability
- Dynamic Tracking Kit: Kit of 4 vector bar sensors allowing 6DOF tracking of an object in the iGPS volume
- i5is Probe (5DOF): 2 sensor vector tool providing handheld inspection capability
- i6 Probe (6DOF): 4 sensor 6DOF tool providing handheld inspection capability with customizable probe tips
- i6 Long Reach Probe: 4 sensor 6DOF dual purpose inspection and bundle tool

Related products

- Supported software: Nikon Metrology Surveyor / NRK Spatial Analyzer / Tango3D / Verisurf / Mobigage
- Software development kit (SDK) for 3rd party integrations

Environmental requirements

- Operating temperature (standard performance): 10°C to 30°C (50°F to 86°F)
- Storage temperature: -20°C to 50°C (-4°F to 122°F)
- Relative humidity: 10% to 75% (non-condensing)