The HN-6060 non-contact, multi-sensor, 3D metrology system makes automatic shape measurement of complex components a reality. With a two-axis rotary table and a three-axis high-rigidity air bearing construction CMM, incorporating five-axis synchronous linear motor drive and control mechanism, the hardware has been optimized for stability. Additionally, with the adoption of Nikon’s proprietary low thermal expansion encoder scales and a design optimized for minimizing Abbé errors, the accuracy of this high-precision 3D measurement instrument is 1.5+4L/1000 μm.

The HN-6060 is equipped with newly developed high-speed and high-precision laser scanner and SFF (shape from focus) sensor, which uses active texture projection to perform high-precision measurement of shapes even with glossy surfaces or with no surface texture. Touch probes and optical heads with built-in TTL laser AF (with proven performance in Nikon’s NEXIV VMR series CNC Video Measuring System) complete the multi-sensor system. The system’s use of multi-sensors allows it to perform diverse shape measurements of parts such as complex automotive and machined components, molded parts, medical devices etc.
The main features of the HN-6060
High-precision and optimized shape capturing and measurement for 3D components
Nikon has combined leading-edge optical and hardware control technology and developed a laser scanner system that acquires point clouds with high precision at a rate of 120,000 points per second. The HN-6060 has proven its ability in comparison checking of surface shape inspection data with 3D CAD models (part-to-CAD comparison) and in reverse engineering.

Enhanced multi-sensor technology enables shape inspection without manual preparation of samples
Using newly developed high-precision laser scanner, SFF and tactile sensors, and five axis hardware control, the system can perform many types of high-precision inspection of components and match processing for automatic assembly of point clouds. The system also allows high-precision, non-contact 3D inspection without manual preparation (such as application of powder to the object under inspection) of black molded components and shapes with glossy surfaces, which have traditionally been difficult to measure.

Five-axis synchronized hardware control for high-precision metrology
In addition to a newly developed high-precision three-axis orthogonal drive system driven by linear motors, the system is also equipped with a two-axis rotary table. This technology allows for acquisition and inspection of point clouds at the optimum orientation necessary for gear inspection.

A high level of user operability is incorporated, including fixed viewpoint five-axis operation control (for easy acquisition of surface point clouds) plus simulation running mode.
With a design that takes full account of user safety and operability (such as fixed viewpoint joystick operation for easy acquisition of point clouds from 3D shapes and simulation for collision avoidance), the system makes non-contact shape inspection a reality.

HN Metrology 3D — feature-rich 3D metrology software
The new HN Metrology 3D software represents an evolution in multi-sensor metrology software based on the dimension inspection software for the proven Nikon NEXIV VMR series. The user can easily make use of a wide variety of advanced functions for set-up, teaching, shape measurement, comparative error estimation with reference to 3D CAD data, and result output.

Focus point cloud analysis software (optional)
The Focus Inspection option allows error comparison with reference to 3D CAD data and creation of detailed reports based on high-precision point cloud and mesh data. Point clouds can also be used for reverse engineering.

The HN-6060 metrology system assists, drives and streamlines the production process with high accuracy 3D digitizing and measuring capabilities. The unique system is designed in close cooperation with leading industrial manufacturers and offers many benefits to produce better products in a faster way.

Full 3D point cloud data of complex parts
Non-contact measurement
Manual preparation-free laser scanning
High precision and high quality
Fast, automated inspection
Easy operation
High rigidity 5 axis hardware
Multi-sensors cover a wide application range
The five-axis hardware control, which incorporates Nikon control technology, supports multi-sensor high-precision non-contact 3D metrology.

CMM design for top accuracy

A linear motor drive mechanism is the heart of the three-axis orthogonal section, guaranteeing stable and high-precision inspection over a long period of time. Concurrently, the system also achieves high-precision positioning control. With the system’s high-rigidity air bearing construction, the design has been optimized to compensate deformation caused by changes in temperature. Additionally, with the adoption of Nikon’s proprietary low-temperature expansion encoder scales and a layout optimized to minimize Abbé errors, the accuracy of the high-precision 3D measurement hardware is $1.5 + 4L/1000 \ \mu m$.

High-precision, two-axis rotary stage

The adoption of a high-rigidity design enables control with high-precision positioning repeatability and unlimited angular rotation with a free swivel angle of up to 95°. Ideal for gear inspection, the system carries out inspection with the optimum sensor orientation for the stereoscopic shape of the target object.

Ergonomic operator console

The console, which enables easy five-axis synchronized operation, features a simple configuration and includes switches for changing between sensors, and buttons for carrying out simple inspection. The fixed-viewpoint control function allows for easy control of the optimum sensor attitude for a particular shape.

Calibration system for multi-sensor metrology

The system comes with a calibration set that is designed to enable non-contact, 3D metrology at the highest accuracy. This enables measurement with a single datum using a variety of different sensors. A specially made ball bar, traceable to the National Institute of Advanced Industrial Science and Technology’s non-contact measurement standards is used for calibration of the main unit. This guarantees traceability to public and international agencies that require certified non-contact measurements of the highest precision.

The low thermal expansion linear encoder scales, which are key components in high-precision measurement, are manufactured in-house, using Nikon optical technology.
Multi-sensor measurement head featuring Nikon’s newly developed high-precision laser scanner that attains non-contact measurement uncertainty of 5 μm (Es, MPE).

**Newly developed high-precision laser scanner**

As a long-established manufacturer of high-quality optical instruments, Nikon took a completely fresh look at non-contact-sensor optical systems. In order to achieve measurement with such an unprecedentedly high degree of precision, Nikon developed special optics such as a newly designed cylindrical lens for the light emitter and an image-side telecentric system directing the object image to a detector with high precision. Nikon, also, designed the hardware mechanism suppressing variation in magnification due to changes in temperature. In addition, the implementation of a hinged optical system (in accordance with the Scheimpflug principle) enables surface data to be acquired with a constant focus above the detection device. A CCD with dramatically improved smear resistance has been employed for the light detecting section. In tandem with the bright optical system, this enables detection on low-reflectivity, or glossy surfaces without manual preparation such as spraying. The system has a built-in finder-camera for monitoring the surface measurement of an object. This enables the user to carry out measurement programming in the video window of the host PC and to monitor inspection in real time.

**Image-processing optical system with built-in SFF sensor and TTL laser AF, and 15x zoom**

The system features the proven high-NA zoom optical system from the NEXIV VMR series CNC Video Measuring Systems — now illuminated exclusively with LEDs — as well as image processing developed in-house by Nikon. In addition, the system is equipped with the very latest SFF (shape from focus) inspection sensor. Using active texture pattern projection mechanism, the system can perform high-precision shape acquisition for surfaces that are as devoid of texture as the surface of a mirror, while TTL laser AF enables level difference and profile measurement.

**High-speed high-density acquisition of shape point cloud data**

High-speed digital transform processing enables surface point clouds to be acquired at the rate of 120,000 points per second. Fine Mode enables high-density acquisition of in-line point clouds with a line pitch of 20 μm — not only for shapes with features but also for surface waviness.

**Ready to fit with Renishaw touch probes**

In cases where touch probes are required for datum shape acquisition (for example, with cylindrical shapes), measurement with the TP200 trigger sensors, as fitted to the PH1, is effective.
HN Metrology 3D software makes straightforward high-precision non-contact 3D metrology a reality

Multi-sensor 3D metrology software

Newly developed HN Metrology 3D metrology software integrates a whole range of tasks, including touch probe and image-processing measurement, acquisition of point clouds using light section and SFF sensors, and part to 3D CAD model for deviation comparison. The software measures the dimensions and shape of the object under inspection in diverse ways.

On-line/off-line operation function simulator

When sampling complex shapes, it is possible to read the model data and to verify device operation prior to actual measurements using either the On-Line or Off-Line Simulator Mode.

Focus Inspection point cloud software (option)

Focus Inspection is the standard point cloud inspection software application. This software boasts outstanding metrology functions, an intuitive user interface, and standard macro functionality, enabling the entire inspection process to be automated. Focus Inspection enables partial or total 3D part-to-CAD inspection based on mesh data or point cloud data from a CMM scanner or handheld scanner, or from CT (Computed Tomography) data. Focus Inspection can be used to create easy-to-interpret interactive inspection result tables and reports.

Ready for reverse engineering (option)

As the resulting scan data is a 3D point cloud, the data can also be used for various reverse engineering purposes. This technology is typically used to create CAD from handmade clay models, to regenerate CAD data from existing parts when the original CAD data is missing, to update designs from part surface data produced by high yield dies & molds, or to serve as input for rapid prototyping of freeform parts and products.
## Specifications

### HN-6060 Main unit and rotary table

**Orthogonal three-axis stroke (X×Y×Z)**: 600 mm × 600 mm × 600 mm (24" × 24" × 24")

**Orthogonal three axis hardware accuracy**

| Maximum Permissible Error E MPE | 1.5+4L/1000um - ISO10360-2, JIS7440-2: 2003 |

### Two-axis rotary table

| Maximum diameter (ϕ) of object under inspection | 300 mm |
| Maximum height (H) of object under inspection | 200 mm |
| Maximum weight of object under inspection | 20 kg |

### Dimensions of main unit

1850 mm (W) × 1540 mm (D) × 2650 mm (H)

Weight of main unit: 2600 kg

### Recommended dimensions of space for installation

3500 mm (W) × 3500 mm (D) × 2800 mm (H)

(including mounting surface for controller and for operation devices for host computer)

### Guidance system

Air bearings

### Maximum drive speed

300 mm/sec. in each axis (X, Y, and Z)

### Multi-sensor head

**High-precision laser scanner**

| Operating distance | 50 mm (from the center of the measurement range) |
| Measurement distance | 20 mm linear |
| Height detection range | ±10 mm |
| Total accuracy | 5 μm (ES, MPE) – Maximum Permissible Error of sphere-spacing measurement – JIS B 7441: 2009 |
| Linear resolution | 20 μm |
| Laser class | Class 2 |

**Image probe**

| Camera | 1/3-inch 3-CCD progressive scan camera |
| Operating distance | 50 mm |
| Magnification range | Optical magnification: 1x – 15x |
| | Screen magnification: 36x – 540x |
| FOV size | From 4.67 mm × 3.5 mm to 0.311 mm × 0.23 mm |
| Illumination device | Epi-illumination: white LEDs |
| | Ring illumination: illumination by 8 distributed white LEDs |
| | Transmitted-light illumination: supplied on special order basis |
| TTL laser AF | Height detection in single point focus and scan mode, Laser class 1M |
| SFF (shape from focus) | 5 μm (Pff, MPE) - Maximum Permissible Error of flat form measurement (at 4x) – JIS B 7441: 2009 |

**Touch probes**

| Probe heads | Renishaw PH1 (fixed), PH10T (index movement) can be fitted |
| Touch probes | Renishaw TP20 or TP200 |
| Stylus changer | MCR20 Module Change Rack |

### Installation requirements

| Power | 200 V ± 10%, 20 A |
| Barometric pressure | 0.6 Mpa |
| Temperature for guaranteed accuracy | 20°C ± 0.5K |
| Permissible floor vibration | −10 Hz, ≤ 3 μm P-P, 10 Hz– with speed of acceleration ≤ 0.012/s²m |

### Host computer

| OS | Windows 7, 64-bit editions |
| Interface | USB 2.0 x 1, IEEE1394b x 1 |
Specifications and equipment are subject to change without any notice or obligation on the part of the manufacturer. October 2010 ©2005-10 NIKON CORPORATION

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WARNING

TO ENSURE CORRECT USAGE, READ THE CORRESPONDING MANUALS CAREFULLY BEFORE USING YOUR EQUIPMENT.

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