HEXAGON

Product brochure

Photogrammetry inspection solutions

Camera-based 3D optical metrology systems


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CRANES

Advanced camera-based 3D measurement

Measurement systems based on high-speed photography are intrinsically fast in terms of data collection, offering large fields of view that can be applied to quickly capture entire part profiles. Combined with the use of well-placed reference targets and scales, initial photography is efficiently transformed into a single 3D model using advanced processing algorithms that turn images into data in an instant.

There are few faster and more portable ways to inspect part features than with Hexagon's range of photogrammetry systems build on the intrinsic speed of phototography.

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Introduction to photogrammetry

How digital photogrammetric analysis works

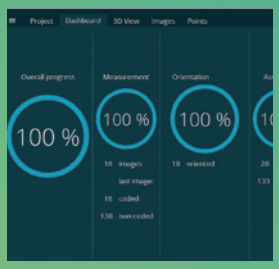
The DPA Series systems are portable 3D measuring tools that use a high-resolution digital camera for data collection. They are based on the principles of digital photogrammetric analysis. Measurement with a photogrammetric system involves the following four key steps.

1. Signalising

To measure a part, it is first signalised with a selection of targets. Coverage of hidden points or features such as holes and edges is ensured with the use of appropriate target adaptors.

2. Capturing

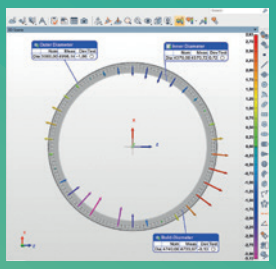
The part is then photographed from several directions, with the targets in view and overlapping between shots.



3. Calculating

The images produced are processed either simultaneously with data collection (online processing) or after data collection (offline processing) through a dedicated photogrammetry software tool like DPA Pilot. The software automatically calculates the 3D coordinates of all targeted points.

The calculation is based on the principle of spatial image triangulation and is fully automated. With software that employs an integrated simultaneous calibration procedure, the highest levels of accuracy can be achieved onsite during the measurement process.

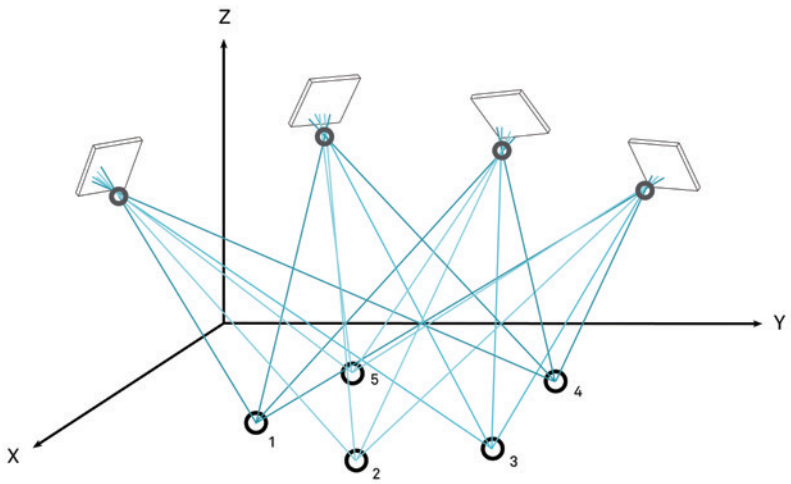


4. Reporting

In addition to 3D coordinates, quality photogrammetry software such as DPA Pilot can provide statistical analysis of the results with specific accuracy information about each coordinate. This allows for instant evaluation of the quality of the measurement. DPA Pilot is also very deeply integrated into the best inspection software packages and allows complete automations of calculation steps and advanced analyses.

The principle of photogrammetric triangulation

With multiple reference targets captured from multiple angles, we can both calculate relative geometries and connect them within a single unified coordinate system.



The DPA Series

Handheld photogrammetry

When it comes to shop-floor measurement processes, it's important to have a simple workflow that's as immune as possible to user error and the hazards of an industrial environment. That's why the DPA Series photogrammetry systems have been designed to deliver user-friendly measurement and processing in every situation.

Relying on just a single handheld camera unit backed by a dedicated software platform, DPA Series systems are among the most portable measurement systems in the world, without compromising on metrology-grade accuracy delivered at productivity-enhancing speed.

DPA Series systems are available in three configurations that allow the user to tailor their experience to the needs of their applications. Each system runs on the same advanced DPA Pilot software platform – the foundation of the leading measurement functionality of the DPA Series.

DPA Industrial

DPA Professional

DPA Entry

Key advantages

- High-end industrial sensor – 50.6 megapixels
- Accuracy to within 10 microns
- Ruggedised housing for strong protection
- Laser pattern projects field-of-view for easy targeting
- Built-in high-speed WiFi connectivity
- Long-life battery – more than 5000 shots
- Remote-control functionality
- Simplified control schema minimises operating errors during measuring tasks
- Full range of measurement targets, adapters and scale bars
- Modern, easy to use interface to major metrology software packages

DPA Industrial

High-end photogrammetry designed for the shop floor

DPA Industrial is our top-of-the-line photogrammetry system. It is built on the inclusion of a specially ruggedised digital camera unit – the C1 Camera. Whether on the shop floor or in the yard, DPA Industrial is the perfect measurement solution for fast and easy measurement.

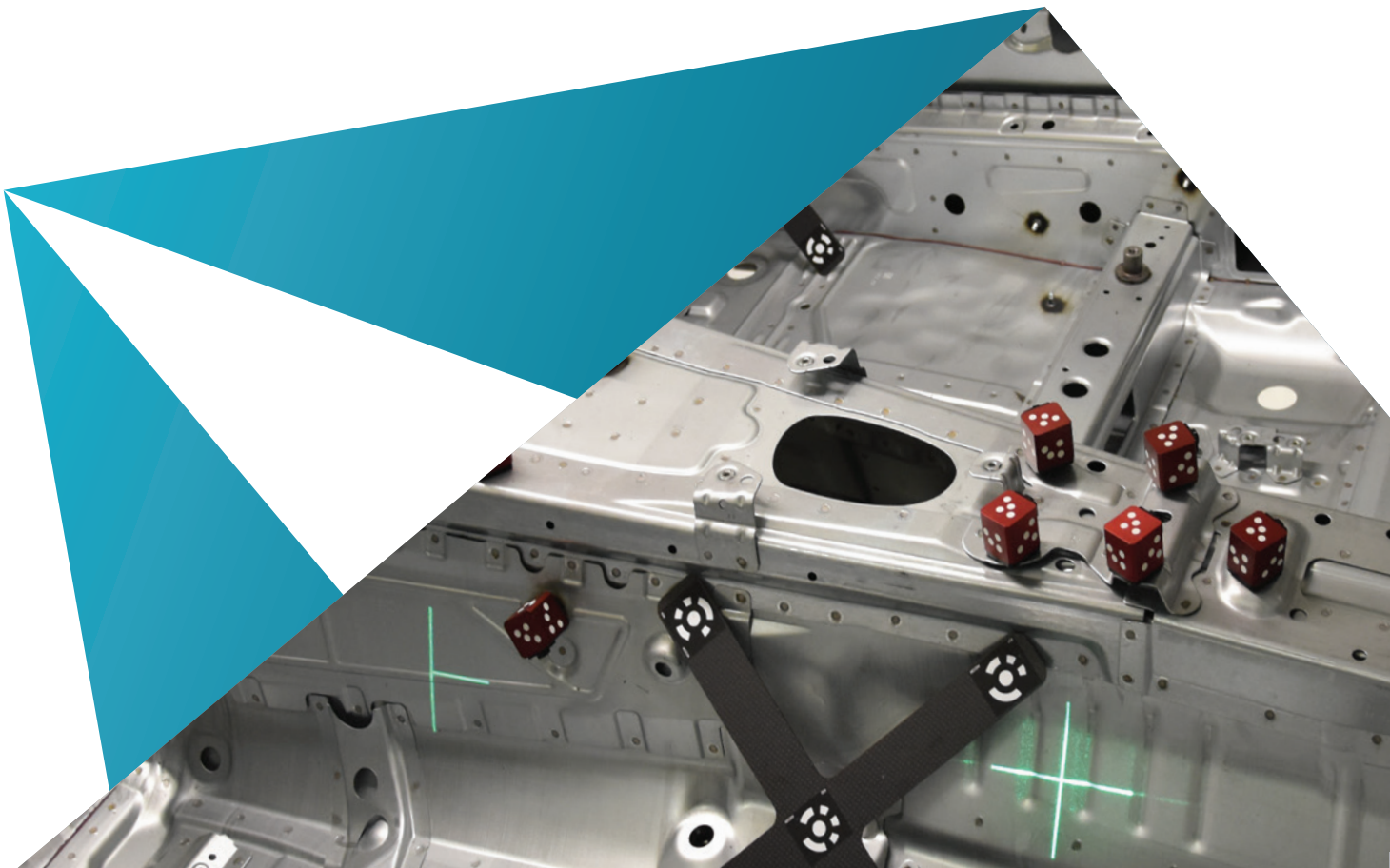
The entire process is simplified by reducing user interaction to defining field of view and image capture, with all settings and processing handled behind the scenes, powered by the DPA Pilot software platform. When measurement is brought out of the quality room, special tools that minimise the potential for compromised results are called for. DPA Industrial and the C1 Camera deliver exactly that – high-end industrial metrology with simple handling.

Rugged protection

The C1 Camera is contained within a protective IP51-rated casing that makes it ideal for use in the challenging environments within which metrology tools are increasingly being applied and where photogrammetry excels as a measurement solution.

Simple operation

The unique simplified control schema of the C1 Camera unit is designed to minimise operating errors during measuring tasks. With no need for complex settings adjustment in the field during the measurement process, photogrammetry becomes an easy point-and-shoot exercise requiring minimal training.



DPA Professional

The standard for high-end photogrammetry

DPA Professional is a high-end photogrammetry system designed for expert metrologists with a strong knowledge of photogrammetric techniques and the ability to take complete control of every aspect of measurement.

Designed to allow specialist users to work with DPA Pilot to achieve best-in-class measurement results, DPA Professional is the ideal solution for experienced high-level operators measuring within clean and safe environments.

- High-end sensor – 30.3 megapixels
- Accuracy to within 10 microns
- Full control of all camera settings directly in the hands of the end-user
- Optional remote-control functionality
- Optional high-speed WiFi connectivity
- Extended range of measurement targets, adapters and scale bars
- Modern, easy-to-use interface to major metrology software packages

DPA Entry

Entry-level photogrammetry

DPA Entry is available to users working in the sort of challenging industrial environments where a standard digital camera represents a more practical investment.

Built on the same DPA Pilot software platform, DPA Entry can deliver excellent measurement results to users well-trained in directing the functionalities of the camera unit.

- Mid-range sensor unit
- Accuracy to within 15 microns
- Full control of all camera settings directly in the hands of the end-user
- Basic range of measurement targets and scale bars
- Modern, easy-to-use interface to major metrology software packages

Key advantages

- High resolution 8-megapixel cameras for highest accuracy across the entire measurement volume
- Highly stable carbon frame with integrated vibration damper for mounting the cameras in vertical or horizontal setup
- Customisable measuring volume due to flexible number of cameras
- Supplies any number of measuring points and object information at the same time (3D and 6DoF)
- Multiple simultaneous point and adaptor measurements time allows monitoring of complex assembly processes
- Vertical or horizontal setup allows for unobstructed views and a flexible use of space
- Compatible with the wireless handheld MI.Probe for measuring of areas out of sight of the cameras
- Targets allow repeated inspections without interrupting processes for realignments
- Solution-based adaptors for custom-made applications help to speed up adjustment and inspection tasks
- Applicable for measurements under challenging and harsh environmental conditions directly within production areas

3D Arena

Automated installed photogrammetry systems

The 3D Arena is a flexible multi-camera photogrammetry measurement concept that allows an unprecedented level of freedom to users, both in terms of designing their measuring area and in terms of capturing location data.

A constellation of high-definition cameras supported by a high-stability carbon frame captures a constant live feed of a signalised measurement object. Every measurement is automatically transformed into the object coordinate system, and the 3D Arena always knows where the object as well as work tools and testing devices are located within the coordinate space.

Flexible scale

A 3D Arena installation is inherently customisable, with no theoretical limit to the number of cameras integrated within the system. A typical 16-camera system can be ceiling mounted, allowing inspection and alignment over a space of 6 by 8 metres, or a 4-camera system could be vertically mounted on a one-square-metre frame to dynamic alignment of a single component.

Application versatility

An installed 3D Arena system is massively versatile, offering probing measurement, tool tracking, both 3D and 6DoF positioning and alignment and deformation tracking. The system's live dynamic referencing capability allows users to forgo the rigid fixation of the measuring object by allowing for the measurement of objects in motion without any loss of accuracy.

Photogrammetry meets structured light

Combining leading structured light scanning and photogrammetry technology is an unrivalled way to achieve high-accuracy 3D digitisation results on large measurement objects.

The measurement volume captured in a single scan by a Hexagon structured light scanner ranges from a few millimetres to about one metre across. By combining this technology with a photogrammetry system from the DPA Series, considerably larger freeform areas can also be captured at the highest level of detail. This add-on technology combination provides more reliable and much more precise global coordinates in the measurement object's coordinate system, allowing for accurate measurement across a greater volume.

- Targets are used to signalise reference points on the object
- A digital camera takes photos from a variety of directions and angles
- From this data, a point cloud that can be used as a reference system is created
- Single surface scans are made by a structured light scanner
- The scan data is then matched into the reference system

Photogrammetry meets portable measuring arm

Combining photogrammetry technology with a portable measuring arm equipped with a 3D laser scanner makes it possible for the arm and scanner to cover larger measurement areas without losing measurement accuracy.

The measuring volume captured in a single scan by a Hexagon Absolute Arm has a maximum diameter of 4.5 metres. The addition of a photogrammetry system allows for a greater area to be covered by repositioning the arm through a series of station changes, with the photogrammetry system acting as a global referencing system that ties together the multiple coordinate systems delivered by the arm.

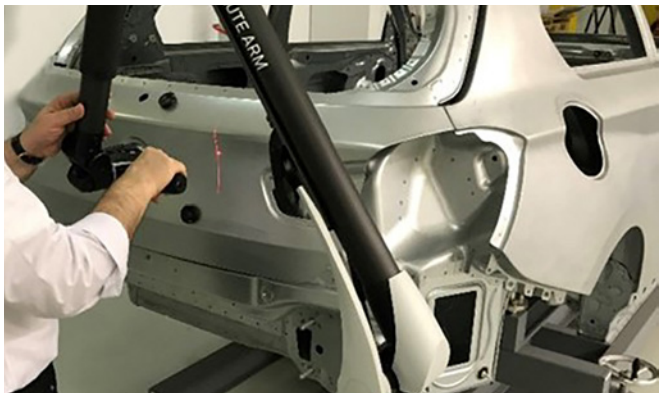
- Targets that can be measured by both an Absolute Arm and a DPA Series camera are used to signalise reference points on the object
- A digital camera from DPA Series takes photos from a variety of directions and angles
- From this data, a point cloud that can be used as a reference system is created
- Areas of the measurement object are scanned by an arm-mounted 3D laser scanner
- The scan data is then matched automatically into the reference

Photogrammetry meets laser tracker

The highly customisable nature of a 3D Arena allows it to be used in conjunction with laser trackers within large integrated measurement and alignment systems, such as might be used in wind energy construction and assembly.

This sort of metrology-assisted assembly system has the potential to deliver large productivity gains when used in combination with a specially designed automation and control system.

- Fixed wide-angle laser tracker targets can be used to introduce a coordinate system within which the photogrammetry results can be referenced
- Calibration is automatable using a custom robot and turntable based system
- Flexibility of the 3D Arena concept means there is no limit to part size
- Live results provided by the 3D Arena dynamic referencing capability is ideal for assembly alignment task



Applications

Hexagon photogrammetry is suited for a wide range of applications

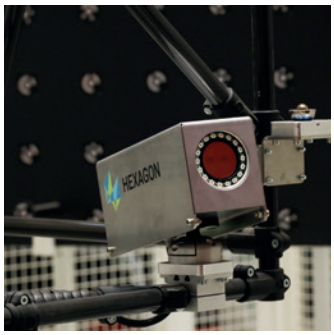
Roundness inspection

Deformation analysis

Quality control

Sheet-metal inspection

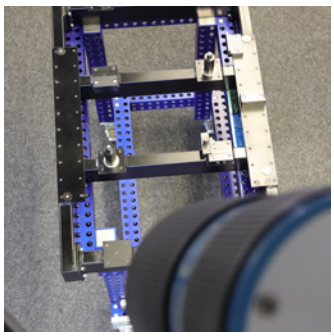
Fixture inspection



Part alignment

Tolerance analysis

Machine part measurement



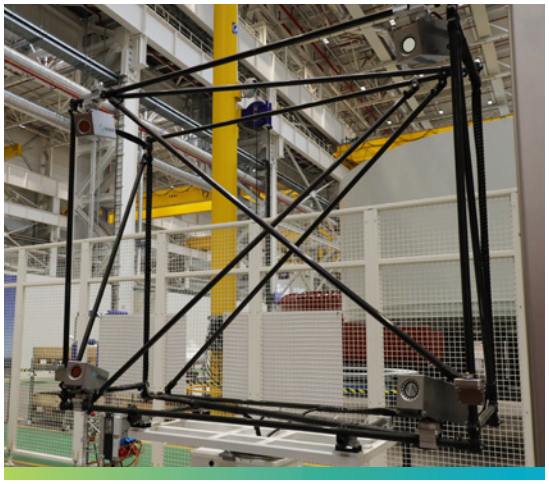
Referencing for other measurement systems

Testimonials

Hexagon photogrammetry throught the eyes of our customers

In the past, we had to change the position of the blade for the measurement and then restore it. This was a very time consuming process, which can now be omitted thanks to Hexagon's DPA. The short measurement times enable us to use the DPA for further measurement tasks in the future. "

Andy Arndt,
Head of quality assurance, ENERCON GmbH



Safely and reliably assembling bigger components requires more than traditional, manual methods. With the new 3D Arena-Tracker system from Hexagon and ARGON, dealing with larger components benefits all parties."

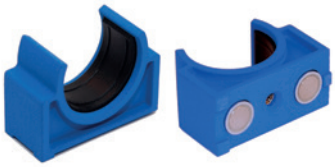
Marius Fuerst-Sylvester,
Calibration Engineer, Siemens Gamesa

I'll put it quite simply: we take a few pictures and can tell whether the fixture is OK or not OK. "

Marc Gündel,
Assembly master, analyses and metrology,
Volkswagen Sachsen GmbH

Accessories

Making the most of photogrammetry



Magnetic holder for scale bars

Telescopic camera holder for DPA Industrial

Targets

Scale crosses

Scale bars

Box for accessories

Igloos

Adaptor cubes

Visit our shop

AICON 3D Studio

Software for all DPA Series applications

AICON 3D Studio is the standard software used for the evaluation and visualisation of photogrammetric measuring processes with devices in the DPA Series, chiefly used in deformation analysis. The 3D graphic window displays point clouds and deformation vectors. The user can freely select views and table representations and individually scale the vectors.

The extended configuration allows for optimal adaption to the measuring task or user workflow. The software has a modular setup. Depending on the application, suitable add-on modules can be integrated into the basic software to meet all requirements.

- One software for all applications of the Hexagon photogrammetry systems of the DPA Series
- Automatic recording, evaluating and maintenance of measuring data
- Individual configuration according to the measuring task and requirements
- Effective data handling and comprehensive options for creating reports
- Numerous export options for further data processing

AICON 3D Studio modules

Standard modules	
DPA	Photogrammetry plug-in for AICON 3D Studio; Fully automatic processing of digital images
Transform	Coordinate transformation with three major transformation techniques; Best-fit-transformation
Adaptor	Automatic correction of adaptors; 3D measurement of points indirectly signalised by means of adaptors
Deform	Deformation analysis between different states; Selectable deformation points; Requires module Transform
Geometry	Comparison of measured 3D points with user-defined geometry elements
Feature	Additional measuring functionality; Measurement of natural targets like points, holes, etc.

DPA Pilot

Deeply embedded software inspection plug-in

DPA Pilot is a well-integrated plug-in that lets users work directly within their preferred Hexagon or third-party metrology software with a DPA Series system. The plug-in serves the following software.

- SpatialAnalyzer
- Polyworks Inspector
- Polyworks Inspector Probing
- MetrologyX4
- Further software packages on request

The above mentioned software packages are not included. Plug-in can only be used in combination with an already existing DPA Series system and/or software module DPA.

Service and support

World-class products to rely on

Drawing on decades of research and development experience, photogrammetry technology from Hexagon's Manufacturing Intelligence division is built on a long history of outperforming technological innovation. Deriving quality from experience to drive productivity is what keeps Hexagon in front and able to deliver first-class solutions for industries around the world.

Along with the assurance of five years of serviceability, owners of Hexagon photogrammetry technology systems benefit from a minimum 12-month factory warranty as standard – our guarantee that our technology will always meet the needs of our users.

World-class support delivered locally

The international presence of Hexagon guarantees comprehensive aftersales support and services across the globe. With the largest dedicated service team of any metrology equipment manufacturer and an emphasis on locally delivered solutions, Hexagon is unmatched from service, repair, certification and calibration through operator training and software maintenance and upgrades.

World-class service made simple

Hexagon offers a wide range of support services extending well beyond the point of purchase. Delivered by experienced and skilled engineers at ISO-certified laboratories, local Hexagon Precision Centres or even on-site to minimise downtime, our after-sales portfolio is the most complete on the market.

- Maintenance and warranty plans that ensure equipment availability
- Trouble-free usage and minimal downtime
- Preferred hotline access at no additional cost
- Access to professional advice whenever needed

Customer Care Packages

Owners of the Hexagon photogrammetry products featured in this brochure also have the opportunity to invest in a Customer Care Package designed to ensure equipment remains in top condition and can be relied on for accurate measurement results throughout a lifetime of use.

Customer Care Packages include a selection of the following benefits, depending on the tier chosen.

	Platinum	Gold	Silver	Bronze
Planned annual service	✓	✓	✓	✓
Customer hardware support	✓	✓	✓	
Software support and software updates	✓	✓	✓	
Annual maintenance and recertification	✓	✓		
Remote connected assistance	✓	✓		
Repair parts and labour	✓			
Customised local benefits	✓	✓	✓	✓

For complete details of the benefits of each level of Customer Care Package, please contact a local Hexagon representative.

Specifications DPA Series

Hardware configurations

Accuracy specifications

	DPA Industrial	DPA Professional	DPA Entry
Length measurement accuracy | MPE[1]	15 µm + 15 µm * $Length_{diagonal}$ [m]	15 µm + 15 µm * $Length_{diagonal}$ [m]	25 µm + 25 µm * $Length_{diagonal}$ [m]
Point-based measurement accuracy	2 µm + 5 µm/m (RMS) 3 µm + 7 µm/m (3 sigma)	2 µm + 5 µm/m (RMS) 3 µm + 7 µm/m (3 sigma)	4 µm + 6 µm/m (RMS) 5 µm + 9 µm/m (3 sigma)

[1] MPE (Maximum Permissible Error) of length measurement error, based on VDI/VDE 2634 part 1: defined as maximum permissible deviation of a measured length, which is located between two measuring points, signalised with photogrammetric targets, in the entire measuring volume of the measuring object, regardless of the position and orientation.

Software specifications

	DPA Industrial	DPA Professional	DPA Entry
Photogrammetric processing	DPA/DPA Pilot	DPA/DPA Pilot	DPA/DPA Pilot
Control software interfaces for post-processing and reporting	AICON 3D Studio, PolyWorks, SpatialAnalyzer, Metrolog X4		
Automatic on-the-job calibration	Yes	Yes	Yes
Online calculation	Yes	Yes	Not supported
Deformation analysis	Yes	Yes	Yes
Adaptor correction	Yes	Yes	Yes
Feature measurement	Yes	Yes	Yes

Technical specifications

Camera specifications

	DPA Industrial	DPA Professional	DPA Entry
Sensor unit	C1 Camera	Canon EOS R	Canon 6D Mk2
Lens	28 mm AICON metric wide-angle lens	28 mm AICON metric wide-angle lens	30 mm standard wide-angle lens
Camera resolution	50.6 MP (8688 x 5792)	30.3 MP (6720 x 4480)	26.2 MP (6240 x 4160)
Field of view (FoV)	65 x 46°	65 x 46°	62 x 44°
Illumination	White-light flash	White-light flash	White-light flash
Speed	Up to 5 images per second	Up to 8 images per second	Up to 4 images per second
Viewfinder	Laser pattern, laser safety class 1M Diopter	Diopter	Diopter
Wireless data transfer	Integrated WiFi 802.11n/ 2.4 GHz/WPA2/PSK	Optional	Not supported
Power supply	System internal Li-ion battery (more than 5000 shots)	Li-ion battery	Li-ion battery

Interface and connectivity

	DPA Industrial	DPA Professional	DPA Entry
Processing unit	High-end notebook	High-end notebook	Notebook
Operating system	Microsoft Windows 11 approved, Windows 10 and Windows 7	Microsoft Windows 11 approved, Windows 10 and Windows 7	Microsoft Windows 11 approved, Windows 10 and Windows 7
Connectivity	WiFi, ethernet via RJ45 connector, removable SD card	Removable storage device (SD or CF card), USB cable; WiFi optional	Removable storage device (SD or CF card), USB cable
Control modes	Manual trigger Remote-control trigger	Manual trigger Remote-control trigger	Manual trigger

Geometric specifications

	DPA Industrial	DPA Professional	DPA Entry
Dimensions	300 x 100 x 170 mm	215 x 120 x 140 mm	245 x 110 x 150 mm
External dimensions, transportation box	570 x 460 x 265 mm	520 x 430 x 250 mm	870 x 230 x 170 mm
Sensor weight	2.8 kg	1.7 kg	1.4 kg
Weight, transportation box (including system)	Approx. 14.5 kg	Approx. 12 kg	Approx. 7.7 kg
Storage	Robust case with trolley	Robust case with trolley	Robust case

Technical regulations

	DPA Industrial	DPA Professional	DPA Entry
Operating temperature	5 to 45°C recommended	5 to 45°C recommended	5 to 45°C recommended
IP protection class	IP51	Not specified	Not specified
Conformity	CE, RoHS	CE, RoHS	CE, RoHS
Calibration and certification	DAkkS certificate for the complete measuring system including scale bars and sensor DAkkS calibrated scale bars, 2 x 1430 mm VDI 2634 page 1 certified system	DAkkS certificate for the complete measuring system including scale bars and sensor DAkkS calibrated scale bars, 1 x 1430 mm, 1 x 830 mm VDI 2634 page 1 certified system	DAkkS certificate for the complete measuring system including scale bars and sensor Factory-calibrated scale cross 800 Opt. VDI 2634 page 1 certified system

Specifications 3D Arena

Hardware specifications

	3D Arena
Sensor resolution	8 MP XR cameras
Protection class	IP65
Illumination	Internal infrared illumination, independent from environmental lighting, operator is not disturbed by visible flashing
Operating temperature	5 to 45°C room temperature (without condensation)
Operating humidity	10-90%
Camera frame size	Depends on selected package
Camera array weight	Depends on selected package (<25 kg for 4-camera setup with supporting frame)
MI.Probe weight	850 g (without extension)
Control unit	Syncbox for up to 4 XR cameras, external synchronisation, power supply 90-240 V (quantity depending on selected package)
Processing unit	High-end notebook (industrial PC possible) with Microsoft® Windows® 10 (64 Bit)
Accessories	Camera transportation box, MI.Probe with equipment and transportation box, calibration tool, coded and noncoded targets

DAkkS accreditation

Hexagon DPA Series sytems are produced and accredited in a DAkkS-certified calibration laboratory according to DIN EN ISO/IEC 17025:2018. This allows the DPA Series products to be delivered with a DAkkS certificate upon request. DAkkS accreditation means that calibration methods, services and system accuracy are confirmed by an trusted independent institution.

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

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

Hexagon's Manufacturing Intelligence division provides solutions that use data from design and engineering, production and metrology to make manufacturing smarter.

Learn more about Hexagon (Nasdaq Stockholm: HEXA B) at hexagon.com and follow us @HexagonAB.