

# DEA BRAVO

## HORIZONTAL-ARM COORDINATE MEASURING MACHINES



# EVOLVING SHEET METAL INSPECTION

Integrating industrial metrology in fast, modern production lines for car bodies and complex contoured shapes requires dynamic, accurate and robust systems. With hundreds of installations at the world's major carmakers, the DEA BRAVO family of coordinate measuring machines (CMMs) integrate innovative measurement technologies into single, double and multiple arm horizontal structures, offering efficient inspection of automotive body-in-white, subassemblies, and other large workpieces.



## **What makes DEA BRAVO the state-of-the-art solution for flexible, automated sheet metal inspection applications?**

### **Performance**

Dynamic and operating at high speeds, DEA BRAVO systems contribute to reducing measuring cycle times, helping to keep the production process under control in real time.

### **Integrability**

The open architecture of the system enables effective integration of the measurement cell in manufacturing environments.

### **Flexibility**

DEA BRAVO can inspect several components in a single measurement cell and use a broad range of indexable or continuous motorised heads, probe extensions, contact and non-contact sensors.

### **Accuracy**

Generating accurate, significant data, DEA BRAVO ensures unrivalled throughput alongside optimum preventive measurements, in the control room and on the assembly line.

### **Dependability**

Proven technologies ensure DEA BRAVO operates with maximum accuracy even in environments with sudden temperature changes.

### **Modularity**

By configuring the measurement system to specific manufacturing process requirements, DEA BRAVO offers the widest range of measuring volume.

# DEA BRAVO HA

## FLEXIBLE AND RELIABLE

DEA BRAVO HA is the highest performance horizontal-arm CMM from Hexagon Manufacturing Intelligence. Optimised for high-speed flexible in-process gauging of car bodies and subassemblies on the shop floor, it can be easily integrated into the production line and configured in multi-arm cells that combine the flexibility and ease of programming of CMMs with the speed and user-friendliness of conventional measuring gauges.

### Main Features

- Advanced statistical process control (SPC) and process monitoring
- Management of FIVE U-nique flexible fixturing system options
- HH-ACW-43MW continuous wrist available as standard
- Silicon carbide Y ram, combining maximum rigidity with small cross section for excellent accessibility inside car bodies
- Aluminium-plate walkable covers on the X axis
- Isostatic three-point support system
- Axis sliding: air bearing and linear recirculating ball
- Provision for installation flush to the floor
- Optional anti-crash protection system on the Y axis

### Applications

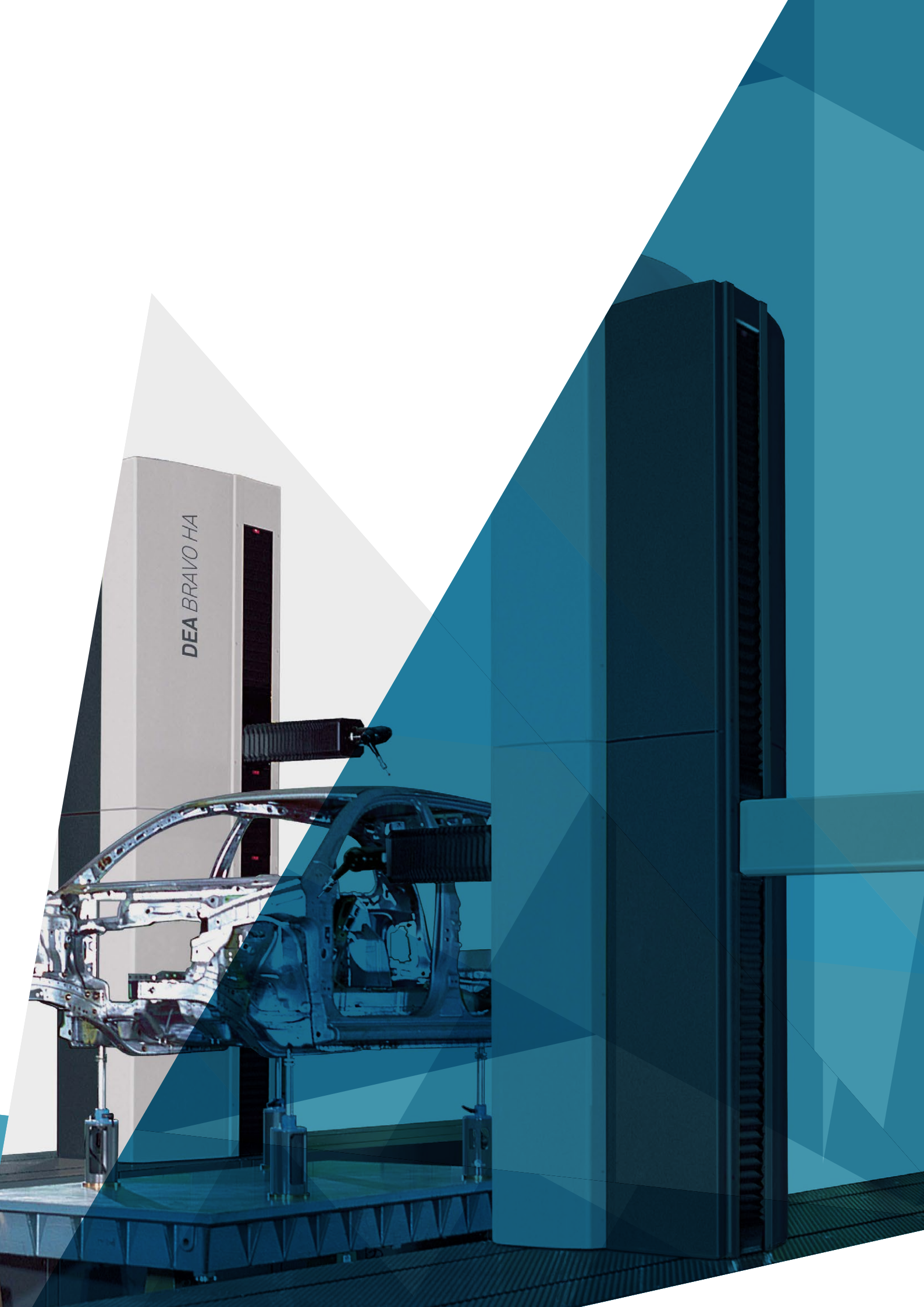
- Dimensional inspection of car body components, body-in-white, thin-walled components and subassemblies
- Process monitoring and control across assembly lines
- High-speed reverse engineering of complex surfaces creating CAD models

### Operating Environment

- Shop floor, integrated into the assembly lines
- Measurement temperature range: 16-24 °C; 16-32 °C
- Dynamics optimised for maximum speed and throughput



DEA BRAVO HA



# DEA BRAVO HD, DEA BRAVO HP

## SAFE AND SECURE

DEA BRAVO HP and DEA BRAVO HD ensure protection for the operator and parts being measured. Walkable covers along the longitudinal axes maximise access to the measurement area, simplifying the part loading/unloading operations, programming and automatic dimensional inspection.

### Main Features

- Rigid steel structure maximises stability in a range of operating conditions
- Axis sliding through high-accuracy recirculating ball pads (compressed air is not required)
- Rigid ram, prewired to accept the anti-crash protection option
- Forced air circulation inside the main beam for levelling structure temperature
- Axis motion with sturdy reliable motors coupled with rack and pinion systems for the X axis and timing belts on the Y and Z axes
- Adjustable slack-free arm counterbalance
- X sliding can be installed flush to the floor
- Compatibility with HH-ACW-43MW continuous rotary wrist (up to 3 axes), efficient control of non-contact sensors and probe extensions up to 800 mm
- Management of FIVE U-nique flexible fixturing system options
- BRAVO HD bellow kit is a light and flexible textile solution that is able to guarantee the maximum protection



DEA BRAVO HP



# DEA BRAVO HD

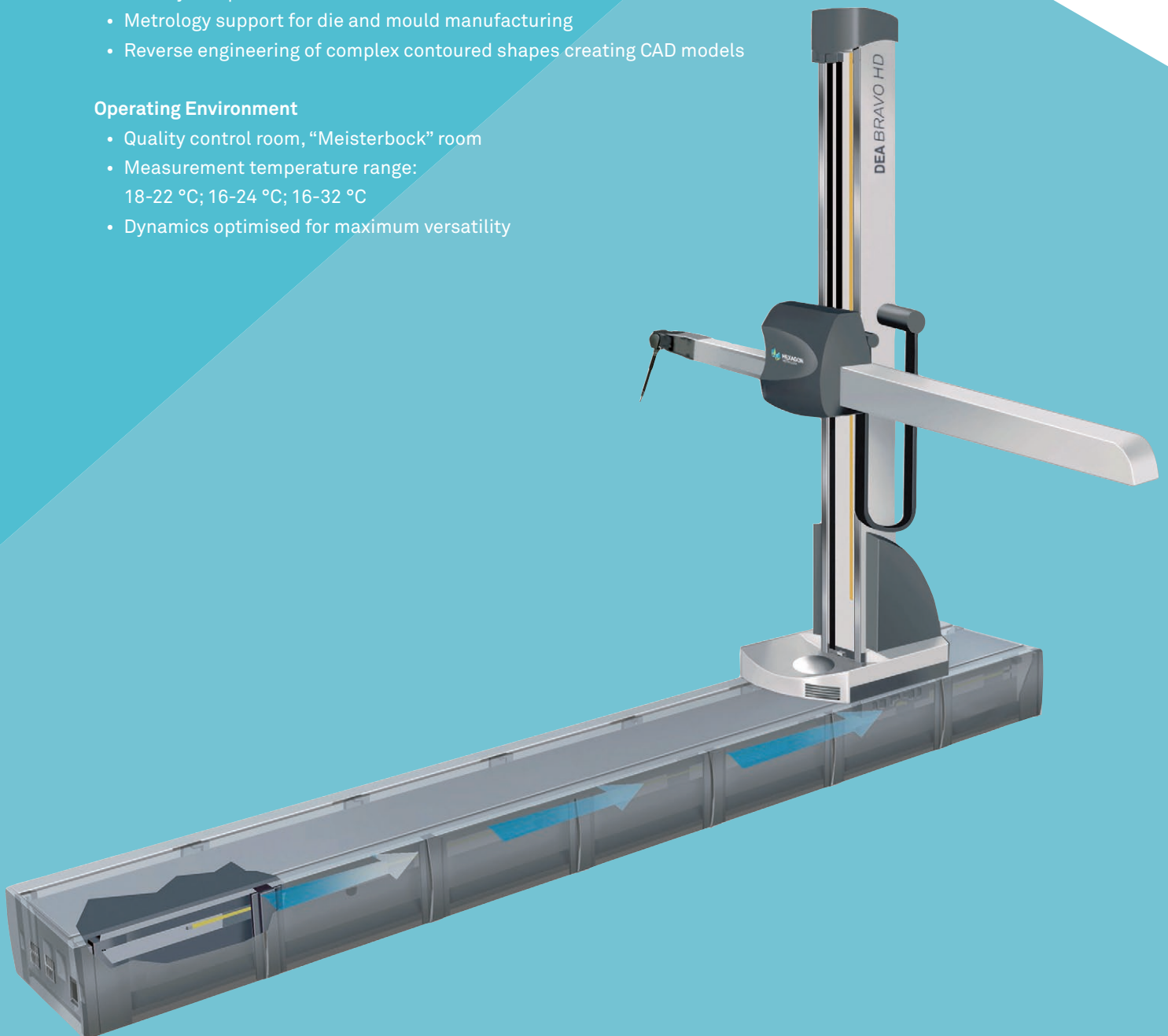
## VERSATILE AND ROBUST

### Applications

- Dimensional inspection of thin-walled components, bodysells, chassis, subassemblies, panels, car doors, glasses and dashboards
- Dimensional inspection of castings and structural aircraft, ship and railway components
- Metrology support for die and mould manufacturing
- Reverse engineering of complex contoured shapes creating CAD models

### Operating Environment

- Quality control room, “Meisterbock” room
- Measurement temperature range:  
18-22 °C; 16-24 °C; 16-32 °C
- Dynamics optimised for maximum versatility







# DEA BRAVO HP

## FAST AND ACCURATE

### Applications

- Dimensional inspection of car body components, body-in-white, chassis, subassemblies and panels
- Process control along assembly lines
- High-speed reverse engineering of complex surfaces creating CAD models

### Operating Environment

- Shop floor, adjacent to or integrated into assembly lines or car body welding (fully covered mechanical structure)
- Measurement temperature range:  
18-22 °C, 16-26 °C, 16-32 °C
- Dynamics optimised for maximum speed and throughput



# DEA BRAVO C, DEA BRAVO C HS

## COMPACT AND FLEXIBLE

DEA BRAVO Console is a technically advanced and cost-effective solution for flexible and accurate inspection of thin-walled components. Guideways on the side of the machine base allow the arm to be moved fully outside of the working area, maximising work area access for simple part loading/unloading operations. The cast iron machine table features the exclusive three-point support system, eliminating the need for costly dedicated foundations and simplifying the installation of vibration dampers. DEA BRAVO Console is fully made of steel, ensuring high structural stability in all environments.

### Main Features

- Axes slide on high-accuracy recirculating ball pads
- Adjustable slack-free arm counterbalance system
- Compatibility with HH-ACW-43MW continuous wrist (compressed air is required); efficient control of non-contact sensors and probe extensions up to 800 mm
- Isostatic three-point support system only for X stroke = 3 000 mm
- Optional protection bellows on the X, Y and Z axes
- Axis motion with reliable motors coupled with rack and pinion systems for the X axis and timing belts on the Y and Z axes
- Work plate made in cast iron, available as options with tapered M8 x 1.25 holes pattern, T-slot, high load-bearing capacity and FIVE U-nique plane

### Applications

- Dimensional inspection of thin-walled components, ideal for mid-size parts in industrial environments
- Reverse engineering of complex contoured shapes creating CAD models with non-contact probes

### Operating Environment

- Quality control rooms, clean workshop
- Measurement temperature range:  
18-22 °C, 16-24 °C
- Dynamics optimised for maximum versatility

# FACTORS AFFECTING ACCURACY AND METROLOGICAL PERFORMANCE

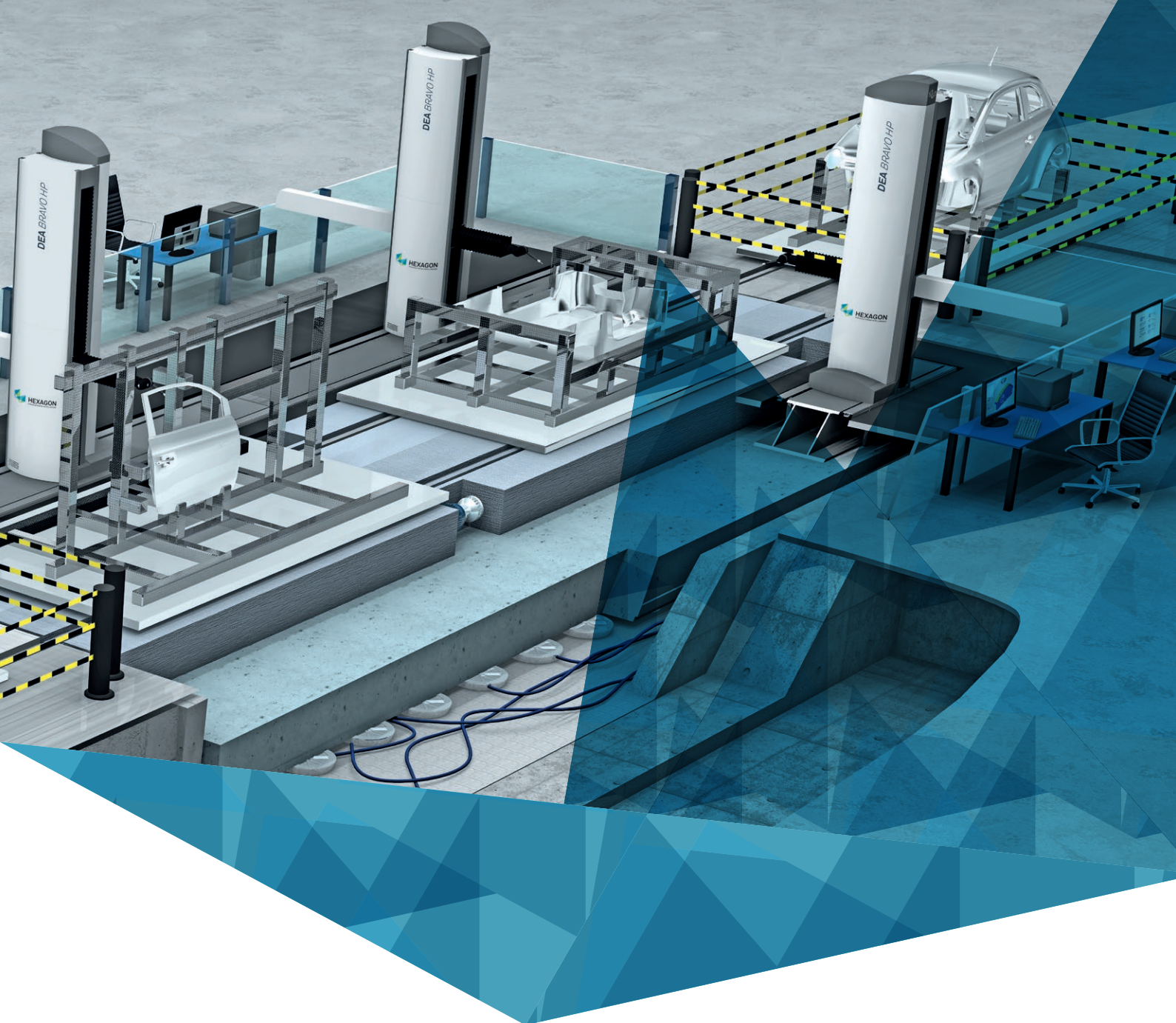
## **Temperature Variation**

Simulating ideal temperature conditions in enclosures or rooms is a common solution to limit the effects of temperature change. But this can be expensive, particularly for large measuring machines. DEA BRAVO HA and HP systems are designed to work efficiently in a shop-floor environment and don't usually require air-conditioned machine enclosures.

## **Vibrations**

The foundation on which the measuring machine is installed stabilises the geometric rigidity of dual-arm systems and insulates vibrations. Depending on the frequency and intensity of vibrations, further insulation may be added to the foundation – both passive and, in critical cases, active elements. The rigidity of the X beam of the DEA BRAVO HA, HP and HD systems helps ensure that initial performance is retained over time.

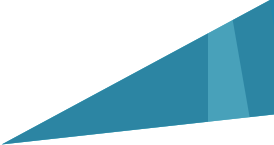




# TURNKEY SOLUTIONS FOR IN-PROCESS SHEET METAL GAUGING

For efficient production line integration, DE A BRAVO can be automated with the same part loading or transfer devices as other equipment in the manufacturing process and remotely managed by a computer system. The possibility of installing the robot flush to the floor and its robust walk-on covers that protect the longitudinal ways simplify part loading and unloading operations.

Additional hardware, such as pallet transfer systems, handling robots, operator safety and part recognition devices can be supplied with DE A BRAVO to help maximise manufacturing productivity.



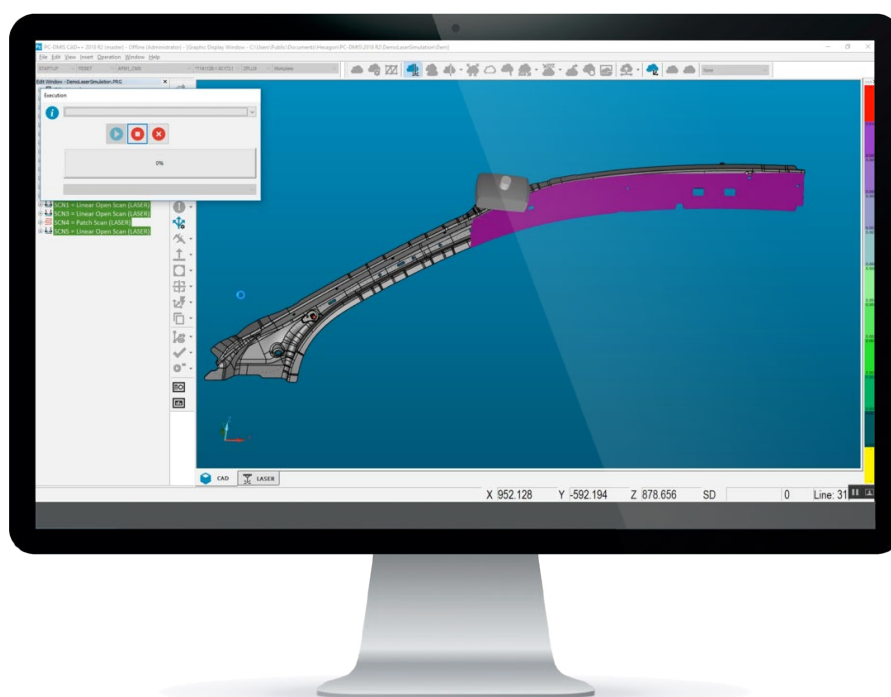
# PC-DMIS

## THE WORLD'S LEADING MEASUREMENT SOFTWARE

PC-DMIS® is designed for analysis and inspection of simple prismatic parts, complex geometric features and 3D surfaces. Available in three versions (Pro, CAD, CAD++), PC-DMIS performs most application tasks required by modern industry.

### Automatic Procedures for Measuring Sheet Metal Components

To measure the characteristic features of sheet metal components, the CAD++ module of PC-DMIS includes automatic procedures that improve measurement system efficiency and streamline programming tasks. The operator only needs to enter key data. The system automatically generates the measurement program, complete with positional moves and measurement instructions. As the cycle is being executed, automatic feature search functions prevent part positional errors or a lack of the characteristics required from causing system collisions or accidental program blocks.





# SENSORS

## **Easy access to the feature**

Body-in-white inspection requires long probe extensions and special angles of approach, which is particularly important when non-contact probes are used. The angle of approach may considerably affect probing accuracy. The DEA BRAVO series is therefore available with both the HH-ACW-43MW continuous wrist and HA-A motorised indexable probe head.

**HH-ACW-43MW** – allows full access to the part being measured and automatically changes extensions and adapters. This continuous wrist is available in 3rd continuous axis configuration for the correct application of non-contact sensors, such as the laser sensor HP-L.

**HH-A-H2.5** – capable of indexing in 2.5° increments and achieving 20 736 unique positions. The Heavy Duty Kinematic Joint allows extensions up to 750 mm.

**HH-A-T2.5** – capable of indexing in 2.5° increments and achieving 12 440 unique positions. The head is fitted with a Kinematic Joint (TKJ), allowing extensions up to 450 mm.

**HA-A** – capable of rotating about two axes in 5° increments, which translates to a total of 2 952 possible positions. The robust aluminium construction permits extension rods with lengths over 300 mm.

**HP-L Laser Scanners** – HP-L-5.8, HP-L-10.6 and HP-L-20.8 deliver maximum performance for complex surfaces at highest speeds and turn the DEA BRAVO into a multisensor machine.

The sensor offers rapid non-contact metrology for three key application areas: free form surface inspection, sheet metal feature inspection and reverse engineering.

Hexagon Manufacturing Intelligence helps industrial manufacturers develop the disruptive technologies of today and the life-changing products of tomorrow. As a leading metrology and manufacturing solution specialist, our expertise in sensing, thinking and acting – the collection, analysis and active use of measurement data – gives our customers the confidence to increase production speed and accelerate productivity while enhancing product quality.

Through a network of local service centres, production facilities and commercial operations across five continents, we are shaping smart change in manufacturing to build a world where quality drives productivity. For more information, visit [HexagonMI.com](https://www.hexagonmi.com).

Hexagon Manufacturing Intelligence is part of Hexagon (Nasdaq Stockholm: HEXA B; [hexagon.com](https://www.hexagon.com)), a leading global provider of information technologies that drive quality and productivity across geospatial and industrial enterprise applications.

-  COORDINATE MEASURING MACHINES
-  3D LASER SCANNING
-  SENSORS
-  PORTABLE MEASURING ARMS
-  SERVICES
-  LASER TRACKERS & STATIONS
-  MULTISENSOR & OPTICAL SYSTEMS
-  WHITE LIGHT SCANNERS
-  METROLOGY SOFTWARE SOLUTIONS
-  CAD / CAM
-  STATISTICAL PROCESS CONTROL
-  AUTOMATED APPLICATIONS
-  MICROMETERS, CALIPERS AND GAUGES
-  DESIGN AND COSTING SOFTWARE