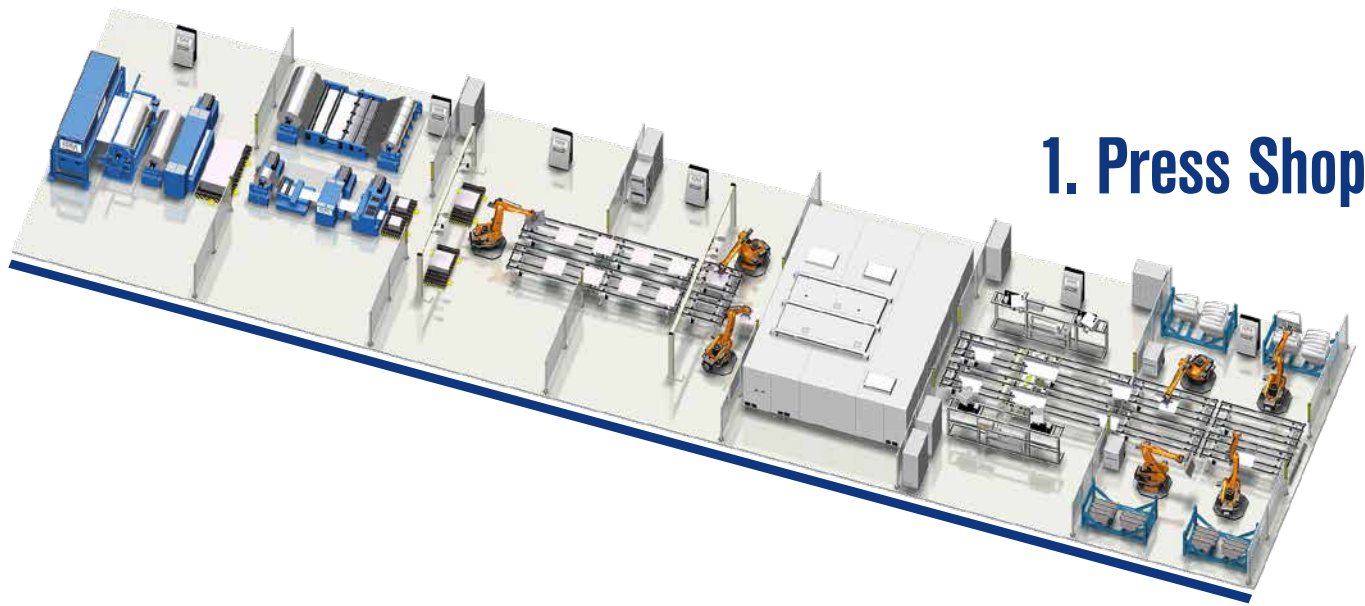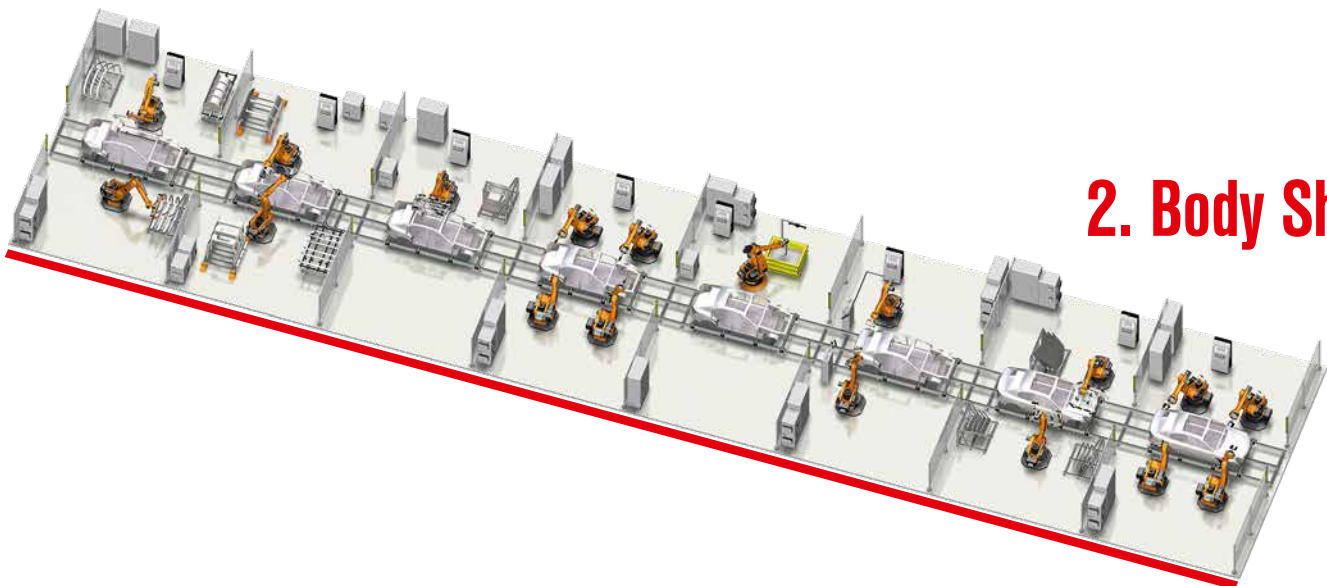# Flexible, efficient, economical ...

... the Future of Automotive Production

ISRA
VISION
perceptron

1. Press Shop

2. Body Shop

ISRA Machine Vision Systems

Quality assurance and high-precision position detection systems for component handling applications are essential items in the automation engineering toolkit. Intelligent vision systems provide the key to higher productivity, greater efficiency and total quality assurance. They ensure that the required precision and speed are achieved during robotic assembly and production, and they offer significant potential for enhancing the efficiency of automotive manufacturing. Vision systems must deliver 100% availability and reliability. They also have to be user friendly and suitable for industrial environments. It takes a great deal of basic know-how and applications expertise to develop these machine vision systems, which is what ISRA, the market leader, can offer you. The user-friendly ISRA systems are designed for the most demanding applications, and they are carefully tailored to the specific application. They offer a variety of solutions including 2D systems, innovative 2½D technology and multiple 3D stereo systems at an unbeatable price / performance ratio, reflecting an attention to detail that is based on 35 years of experience. The entire solution is supplied from a single source. More than 10,000 ISRA systems are currently being used leading car manufacturers, providing the most efficient solution possible to highly complex applications 24 hours a day, 7 days a week.

# The **Right Solution** for Every Step in the Process

ISRA VISION, the key to innovative automotive production

... intelligent, flexible, innovative, rugged ...

Car manufacturers, automotive suppliers and industry integrators are always looking for ways to improve productivity and quality, and they have been working with ISRA for many years to achieve this goal. ISRA VISION is a professional, highly qualified partner and supplier of system solutions. Because the company is very familiar with all of the steps in the car production, it is very capable of assessing where, when and how machine vision can best be used to optimize the process. When you work with ISRA, you are working together with a highly qualified team which joins forces with your engineering team to design and deploy solutions today which are ready to handle tomorrow's challenges.

When you work with ISRA, you will be engaging in a long-term collaboration with a partner who is able and willing to meet your challenges. As a global car manufacturer, you can be sure that you will get everything you need from ISRA including expert advice, service, confidentiality and total problem resolution. We are focused on cost-effective solutions for the automotive manufacturing industry, and we can help you become more competitive and cost-effective. We can deliver and support solutions worldwide which give our customers exactly what they need and want and need.

Challenge us.

3. Paint Shop

4. Final Assembly
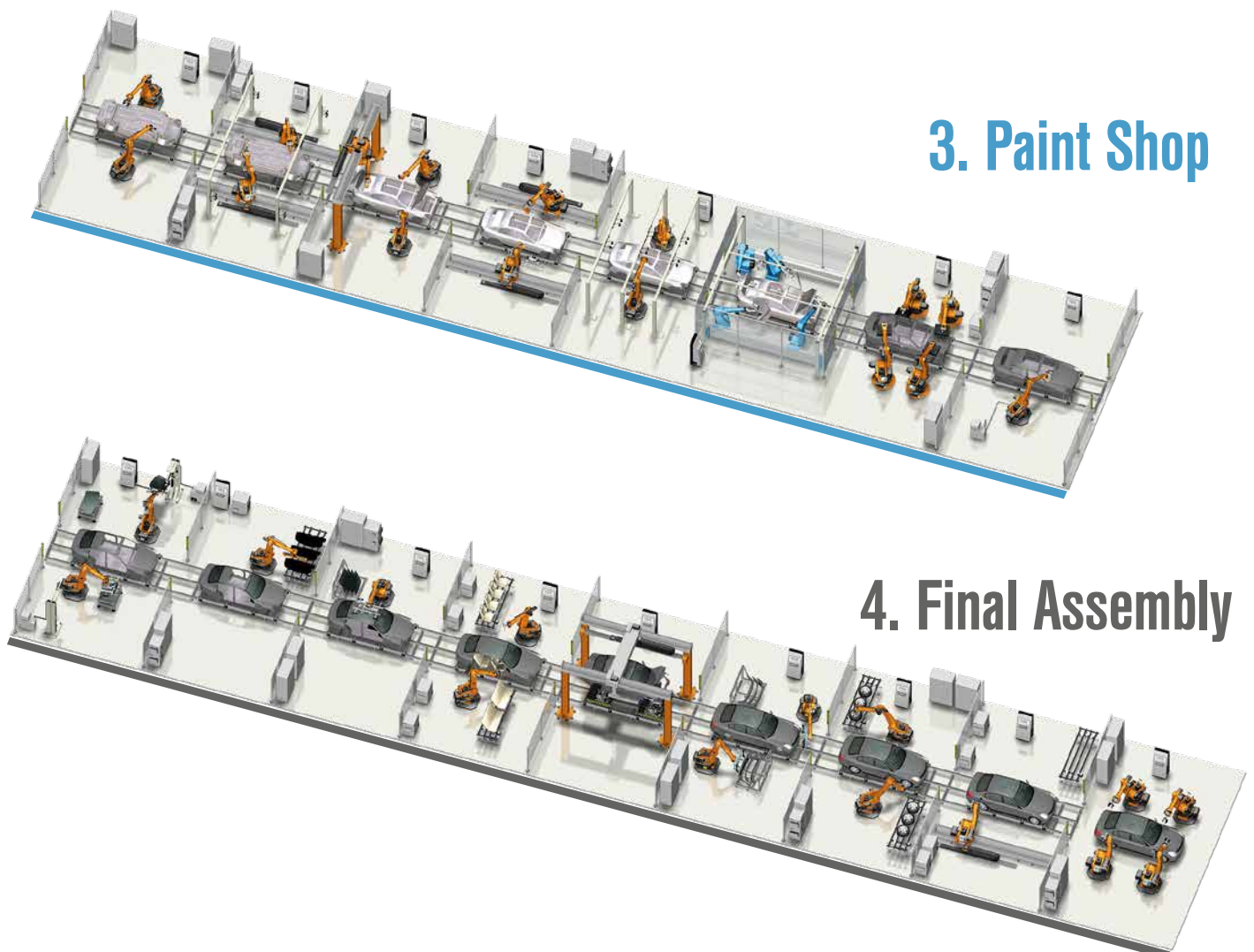
The coil cutting process can be monitored automatically using surface inspection systems. All defects such as holes and cut edge defects are detected with 100% accuracy. The precise cutting width is measured. Through cut optimization, the systems can also ensure maximum use of the material available.

Monitoring the Coil Cutting Process

Surface Inspection of Metal Strips

Individual surface inspection systems are available for monitoring metal strips and can be tailored exactly to production requirements. With an inspection performance of almost 100%, these optical systems ensure that only the most immaculate material is turned into components for body production in the pressing plant.

2½D Blank Stack Detection

Pressing plants process various plates, requiring production robots to pick the correct one from the stack every time. Highly-flexible, low-maintenance optical 2½D position detection for the stack and type verification of the plates can be done using an industrial machine vision system. The system is based on a scalable, stationary robot guidance system.

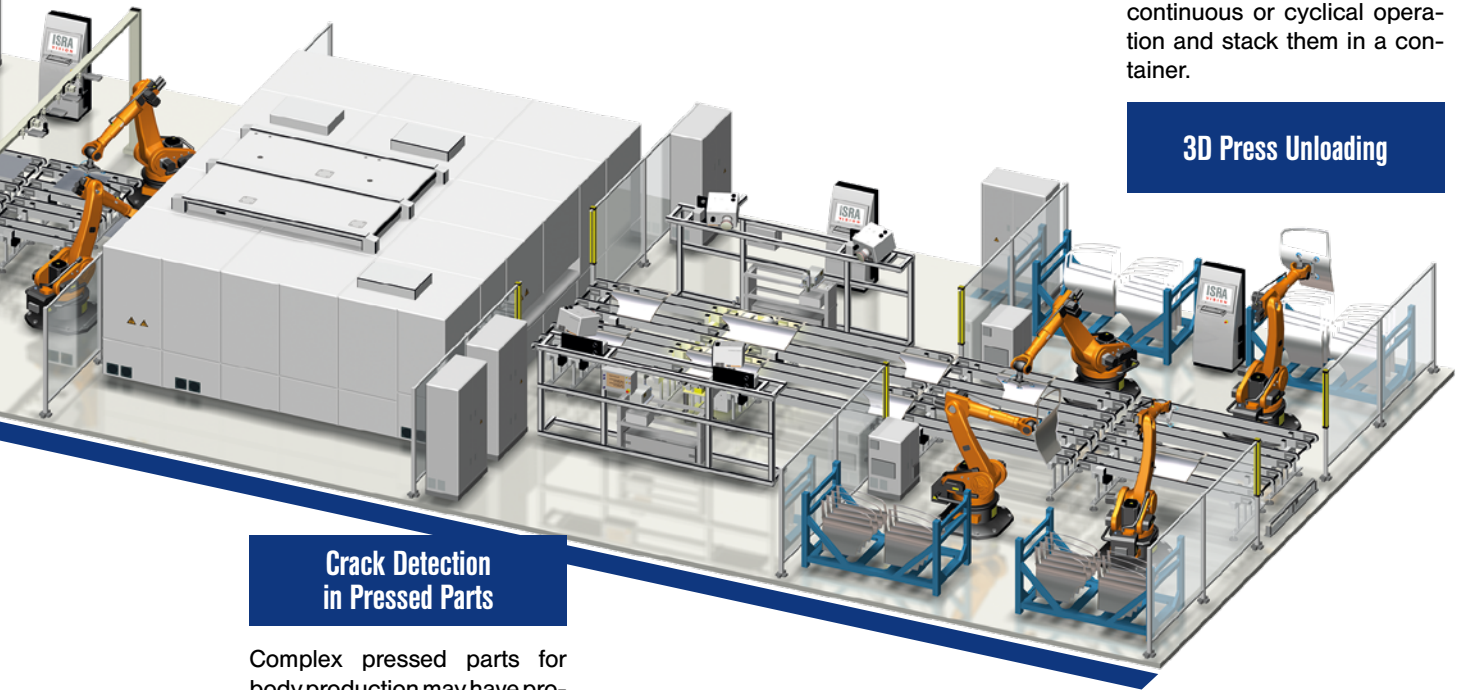# Surface Inspection and Robot Guidance in the Pressing Plant

In the pressing plant, blanks are molded into bodywork parts. Stamping plants consist of three areas: delivery, blank cutting and stamping. The material is delivered by the steel producer in the form of coils or as finished plates. The metal strip is then initially processed in the cutting area, where the continuous material is divided into small plates on cutting lines, such as strip cutting or plate cutting plants. The sheets produced in the cutting area are then molded into the required shape in presses. Because the pressed parts have a significant impact on the quality of the bodywork, it is recommended that surface inspection take place in multiple process steps. In addition, robots aided by robot guidance systems can achieve enhanced availability and significantly improved flexibility, while taking on monotonous and tiring tasks.

Press Shop

In pressing blanks, industry robots have to load the press with plates automatically and with the highest precision. This is often done mechanically and can be high-maintenance. Robots need to be able to independently pick the plates from the conveyor belt in the correct position. For highly-flexible, low-maintenance optical centering, using an industrial machine vision system is the answer. Here, too, the system is based on a scalable, stationary robot guidance system.

2D / 3D Optical Centering of Blanks

In existing modern pressing plants, the finished parts are removed from the outlet conveyor manually and are stored in containers. This extremely monotonous and physically demanding work can be done fully automatically by robots. Stationary or mobile robot guidance systems allow the components' precise position on the outlet conveyor to be easily determined, so that the robot can remove the components from the conveyor in continuous or cyclical operation and stack them in a container.

3D Press Unloading

Crack Detection in Pressed Parts

Complex pressed parts for body production may have process or material defects that can lead to production problems as body construction progresses. These defects need to be detected earlier so that the affected pressed parts can be discharged. This is done with a machine vision system, equipped with four line cameras, that inspect all pressed parts in production in motion.

3D Quality Inspection of the Component Container

The automotive industry uses component containers in almost all areas of production. Most are used to transport and store various components. They are increasingly loaded and unloaded by robots. Mobile measuring systems consisting of 3D sensors allow deformed or damaged containers to be accurately identified and the affected areas marked. Using the container number, this makes it possible to reliably rework the affected containers and ensures that only inspected containers are passed on to production.

Unloading finished parts from containers is a monotonous and very physically demanding task – and one that is increasingly being done by robots. But the effectiveness of automatic removal is limited, as the components in the container may have shifted in transit. Highly-flexible robot guidance systems detect the components in the container, so that the robots always pick up the components in the right position, regardless of movement.

3D Container Unloading

The wide range of roof shapes constantly present new challenges for handling and assembly technology. Stationary or mobile 3D robot guidance systems ensure that the robots pick up the vehicle roofs perfectly and insert them into the vehicle with an even space to the side walls on all sides. The process is then subjected to quality measurement to document and record the high installation quality.

3D Roof Loading

2D / 3D Glue Bead Inspection

More and more adhesives, sealants and structural adhesives are being used in the automotive industry. Glue beads can be inspected either after application in a separate station or directly in-process during application. The BeadMaster 2D system allows the bead position on the component and the width to be fully inspected automatically and detects interruptions in the glue bead.

2D / 3D Geometric Process Monitoring

Checking reference points inline is becoming increasingly important as part of geometric process controls. This is necessary as it is essential to ensuring that the vehicles are produced exactly as specified in body construction, in order to prevent time-consuming and costly reworking following final assembly. A contactless 3D machine vision system is used for 100 % inspection of all vehicles.

High-Quality Production and Reliable Monitoring in Body Construction

In body construction, the sheet metal parts from the pressing plant are assembled to form the body in white. This is done using various welding and joining technologies, as well as processes such as riveting and, increasingly, adhesion. These are tiring, monotonous and physically demanding tasks, which is why body construction is home to the highest number of industrial robots. Their role is to precisely position attachment parts using BestFit, to check the quality of glue beads, to monitor the gap width and flushness of the attachment parts in the body, and to control 100 % the vehicle production process. 3D robot guidance systems and 3D measurement sensors ensure that high quality is achieved and specific tolerances adhered to.
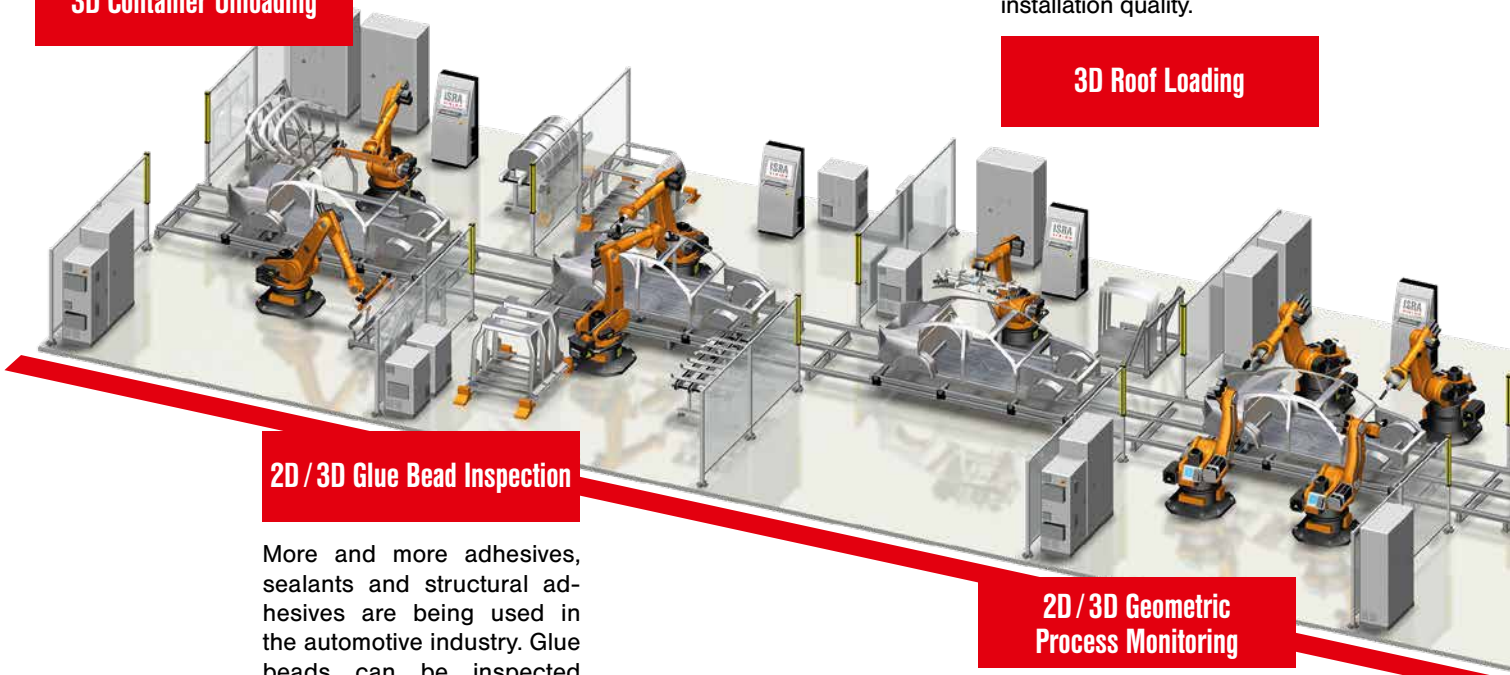
Body Shop

2D / 3D Absolute Precise GeometRic Quality Measurement

Given the enhanced quality requirements and the significant reduction in vehicle start-up curves, in-line, near-line and even off-line systems that provide absolute measurements are becoming increasingly more important. One of the key advantages of these systems is that there is no need for calibration with the inspection lab, so the measured values provide information on the process and the quality of the vehicle immediately.

Small and finished parts are delivered to the plant in un-sorted containers. Although the objects are provided in chaotic and unsorted form, high-performance machine vision systems allow them to be picked and removed by robots. This is done using 3D robot guidance systems mounted above the container on a stable, vibration-free frame.

3D Bin Picking

Assembling different materials, such as steel, aluminum, high-strength steels and, in the future, CFRP components, is often highly complex. As a result, it is not always possible to achieve areas or holes that are essential for the function of the overall body using joining technology. In these cases, production uses a perforation and embossing tool guided by a robot. Stationary, mobile or a combination of 3D robot guidance sensors are used to achieve the expected accuracy.
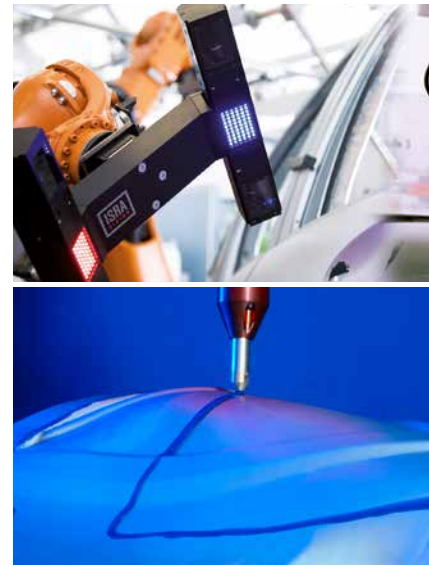
3D Form and Piece

3D Best-fit Joining of Attachment Parts

Assembling attachment parts (e.g. doors, hoods and flaps) demand high precision. The specifications for gap width and flushness must be met. Robots are increasingly being used for fully-automated assembly. 3D Best-fit robot guidance systems ensure that the gap and flushness specifications are adhered to, regardless of the vehicle and the quality of the attachment parts.

3D Gap and Flushness Measurement

Additional in-line gap and flushness measurement station are increasingly being installed as the final station in body construction. The idea is to detect and document the quality of the body construction before the body is passed on to the paint shop. Detecting the gap and flushness values also helps to establish control loops and improve production.

Customers are demanding lighter and more cost-effective vehicles, and the seam sealing process is no exception. In modern production, robots, which are commonly used for seam sealing, apply relatively wide seams in order to ensure that every seam is reliably sealed despite the production tolerances in body construction. Using a seam guidance system makes this unnecessary, as the seams can be applied with high precision and seam optimization.

Covering fine seams in the paint shop is a very time-consuming process that usually requires multiple workers per shift. In the near future, modern industrial robots will completely take over this process, which will also keep quality consistent throughout production. Mobile 3D robot guidance systems enable a fully-automated sealing process with high precision.

3D Seam Tracking in PVC Application

3D Position Measurement for Fine Sealing
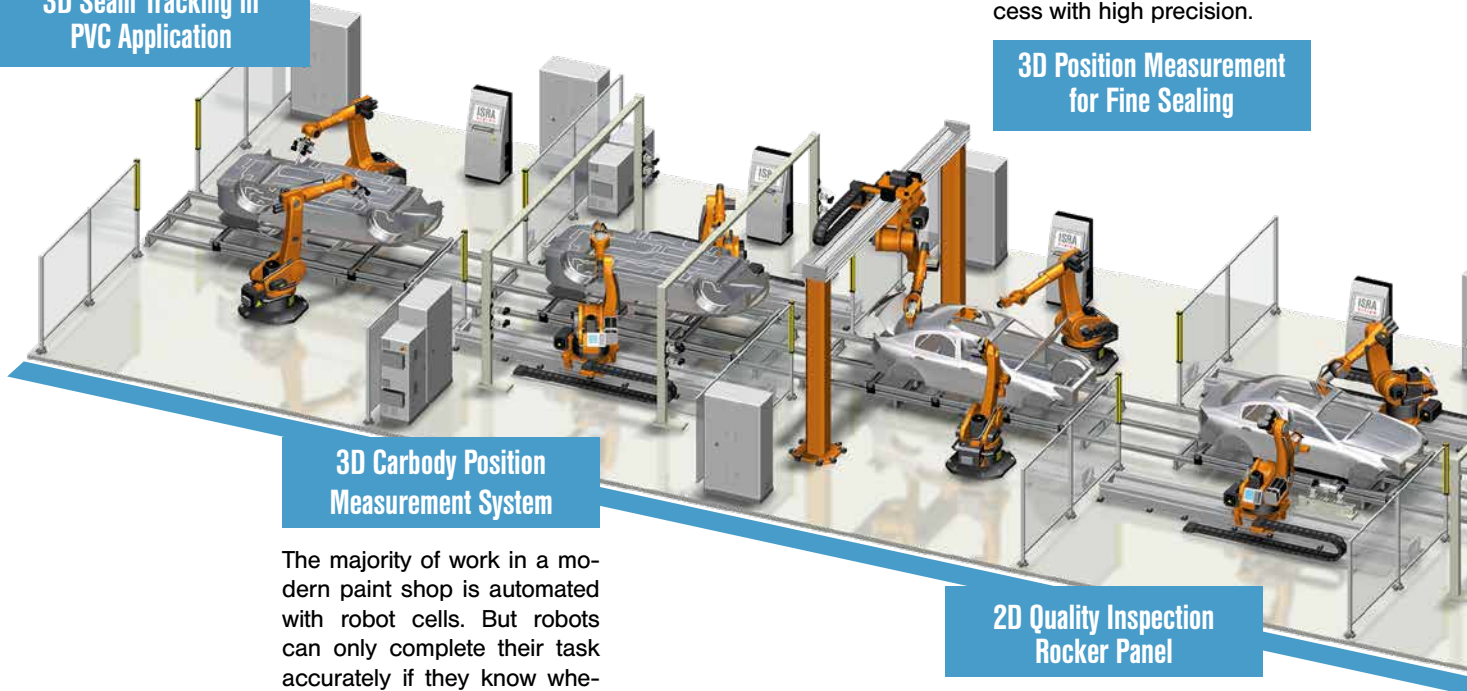
3D Carbody Position Measurement System

The majority of work in a modern paint shop is automated with robot cells. But robots can only complete their task accurately if they know where the vehicle to be applied is located. Because no mechanical vehicle centering units are used in the paint shop or the seam sealing area, contactless, optical 3D position detection of complete bodies is employed here.

2D Quality Inspection Rocker Panel

In some vehicles, a PVC layer is automatically applied around the rocker panel in order to prevent corrosion caused, for example, by stone chipping. Optical inspection systems check the PVC layer on the rocker panel, fully inspecting the completeness, homogeneity and contour definition of the application automatically.

Ensuring the highest painting surface and corrosion protection quality with automation

In the paint shop, multiple layers of paint and clear coating are applied to the body shell in order to give the vehicles the required appearance and protection. The body shell is first protected against corrosion by passing through immersion baths. During the painting process, one or more (depending on the process) protective coats are applied, ending with clear varnish. Industrial robots then seal the seams with PVC before painting begins. The process is made possible by using a camera-based 3D car body position measurement system. For the application of fine seams, 3D sensors guided by robots detect the components with the greatest precision. Many customers also require the applied

PVC seams or the sill application to be monitored automatically and optically using a machine vision system. The PVC seam application is followed by the first painting process. Here too, the efficiency of production is enhanced by high speed 3D position detection systems that continuously detect car bodies, doors, hoods and trunk lids in an optical real-time tracking process. Once the body has received its final coat of paint, optical inspection helps to bring the often inconsistent and tiring manual monitoring of painted surfaces up to an objective, standardized level.

Paint Shop

If the windows and panoramic roof are to be adhered to the vehicle in final assembly, the flanges need to leave the paint shop paint-free. Stationary or mobile 3D robot guidance systems determine the exact position of the flanges, so that the robot can apply tapes to them with high precision.

3D Window Flange Application

The top coat quality expectation in the paint shop, allowing no topological mistakes, is impossible to fulfill with the increasing number of carbody variants and reduced production time, using manual subjective inspection over multiple shifts. The Paintshop can now ensure, with the use of 2D/3D inspection sensors mounted on a robot, an objective inspection of the relevant carbody surface.

2D/3D Paint Surface Quality Inspection

3D Attachment Part Monitoring

Reliable and accurate robot paths are especially important during the interior painting process. The position of attachment parts must be continuously monitored in order to guarantee a stable process. Stationary machine vision systems monitor the vehicle throughout the entire process, detecting any obstacles or interference from contours early, stopping the plant if necessary.

3D Cavity Foaming

Premium manufacturers use PU foam to improve the interior acoustics and the rigidity of the body. These foams are sprayed through special application systems into various areas of the body, where they cure. Mobile 3D robot guidance systems enable the foams to be applied correctly by robots.
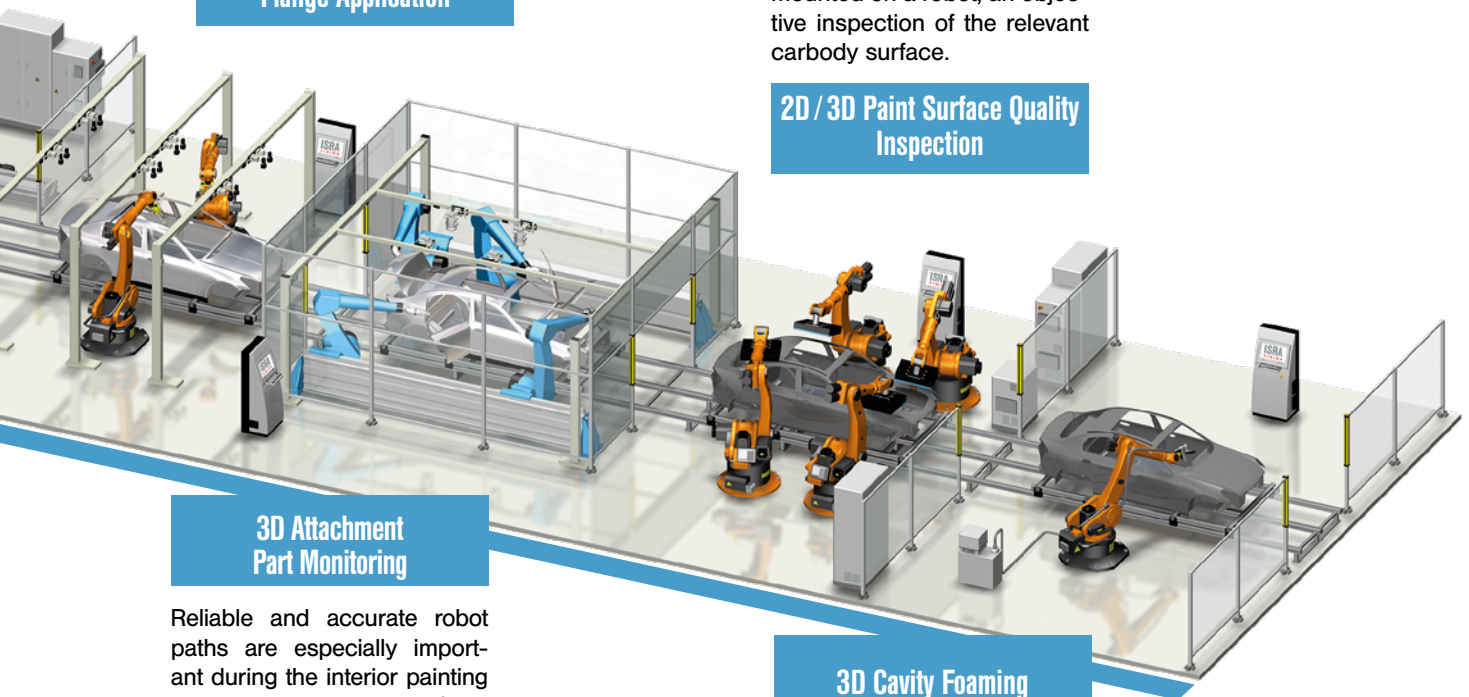
The number of vehicle versions that have to be produced on a single production line is continuously growing, placing high demands on flexible, high-precision automatic joining systems. Fully-automated joining of body windows is a prime example. In addition to front and rear windshields, robots also install side windows automatically. Highly-flexible 3D robot guidance sensors allow the windows to be installed in next to no time, in line with BestFit specifications.

3D Glass Decking

Cockpits are becoming ever more complex and are now often assembled in motion in order to reduce cycle times. The automatic installation is done with robot solutions. Stationary or mounted directly on the robot itself, 3D robot guidance systems ensure the required position accuracy.

3D Cockpit Assembly

Insertion of vehicle seats in the body is currently a manual process that demands a great deal of precision and strength from the operator, despite the aids available. This is especially the case when it is done in motion. Highly-flexible 3D robot guidance sensors determine the 3D position of the vehicle openings, so that the robot can insert the seats in the vehicle perfectly with its gripper.

3D Seat Insertion
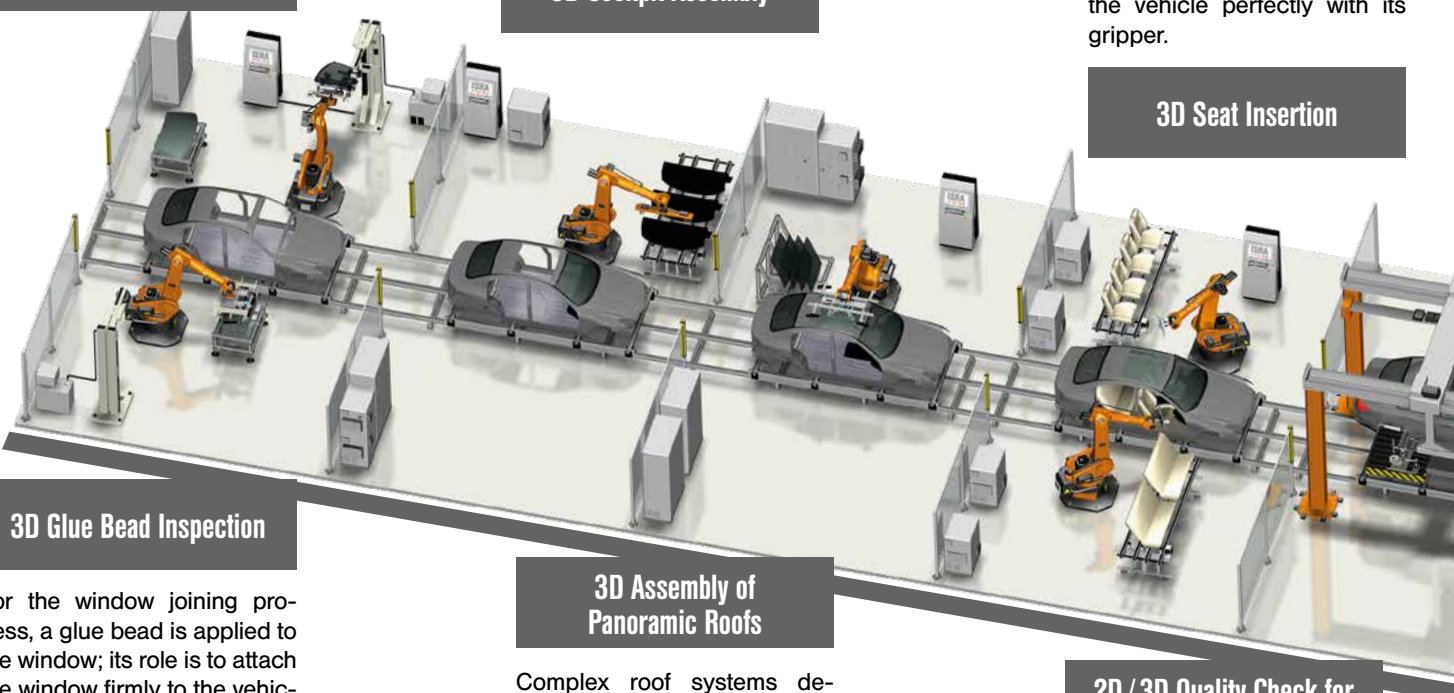
3D Glue Bead Inspection

For the window joining process, a glue bead is applied to the window; its role is to attach the window firmly to the vehicle and to compensate for body tolerances in the decking process. To secure the quality of the bead a 3D bead inspection system can be used. The system ensures that the shape, the continuity, the dosage and the right position of the bead on the glass is given.

3D Assembly of Panoramic Roofs

Complex roof systems demand extremely precise installation to ensure that the roof is watertight and prevent damage to the vehicle interior. To allow robots to achieve this application in the best possible way, highly-flexible 3D robot guidance sensors determine the exact position of the roof flange in every possible version.

2D / 3D Quality Check for Vehicle Marriage

The vehicle marriage, when the body and the drive train come together, is a complex assembly process in which precision is everything. Before the marriage itself can take place, all of the required modules and components in the drive drain have to be checked on the assembly carrier. This is done by stationary 2D / 3D inspection systems.

Precise Final Assembly with Minimal Cycle Times

In final assembly, all the remaining parts are installed on the painted body. The automakers add the interior components, such as the cockpit and attachment parts like windows, panoramic roofs, wheels and bumpers. Car producers refer to the moment the body is mated with the entire drive train as the "marriage". The final step in the production process is to fill the vehicle with consumables, such as fuel. More and more of the monotonous and strenuous steps are now conducted by industrial robots. Precise assembly, component completeness and short cycle times are essential – and highly-flexible machine vision systems play a decisive role.

Robot technology makes it possible to assemble front-end modules with high precision, in line with the specifications for gap width and flushness. Highly-flexible 3D robot guidance sensors allow the most common front-end modules to be installed much faster than in manual assembly.

3D Front-end Modules Assembly

A manual refueling or fluid filling station is an expensive investment today, especially given that people work in the area. Using robots equipped with a 3D robot guidance system now makes automatic fueling and filling of liquids possible. This saves investment costs both for procurement and throughout the process runtime.

3D Fluid Filling
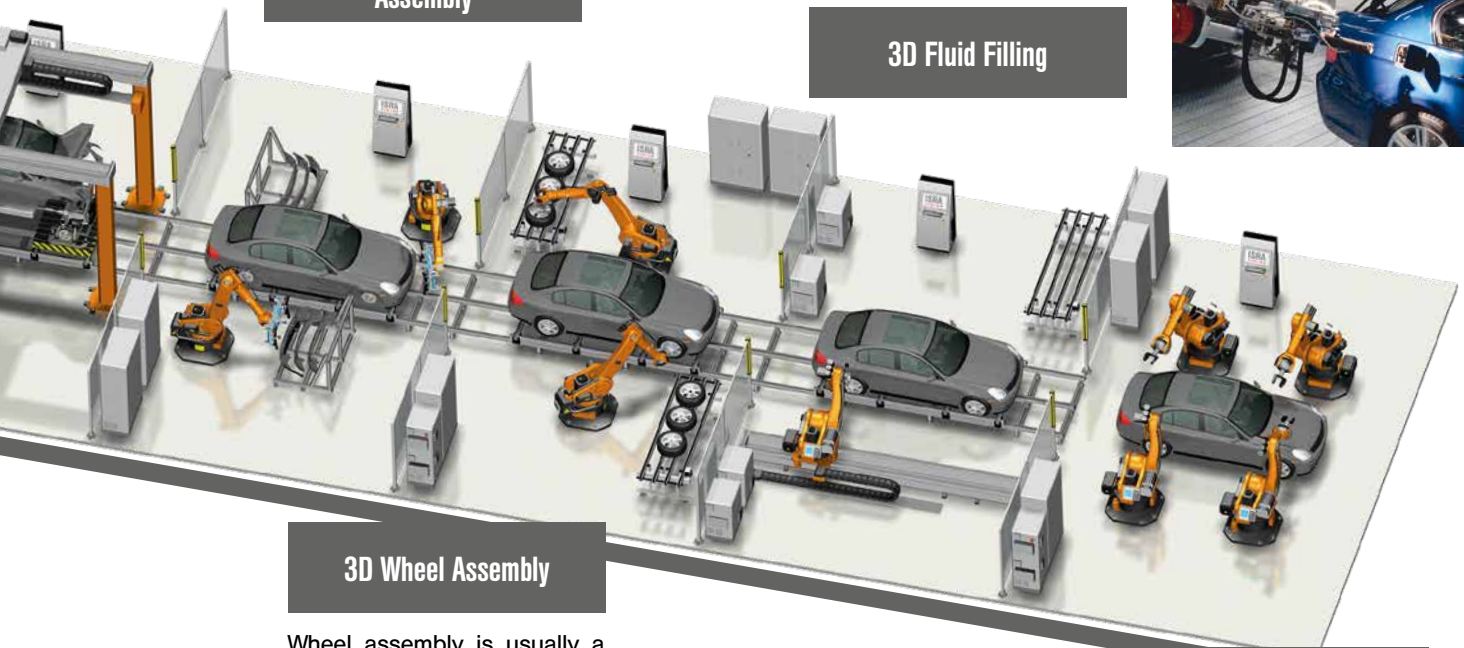
3D Wheel Assembly

Wheel assembly is usually a manual process still today, and is a monotonous and very physically demanding task. The assembly lines are designed for continuous or stop-and-go operation and can now be completed by robots period at end of sentence thanks to the support of a highly-flexible 3D robot guidance system. The sensors determine the 3D position and orientation of the brake disk and holes or bolts on it, so that the wheel can be installed reliably.

3D Gap and Flushness Measurement

The final step in the quality inspection process in the complete vehicle assembly is to check the gap and flushness of all attachment parts on a vehicle. This is done manually and optically by operators, who then reposition the components correctly if required. Using a robot cell with gap and flushness measuring sensors now enables the gap and flushness measurements to be detected objectively, ensuring and documenting the quality across all layers.

Innovation for Robot Automation
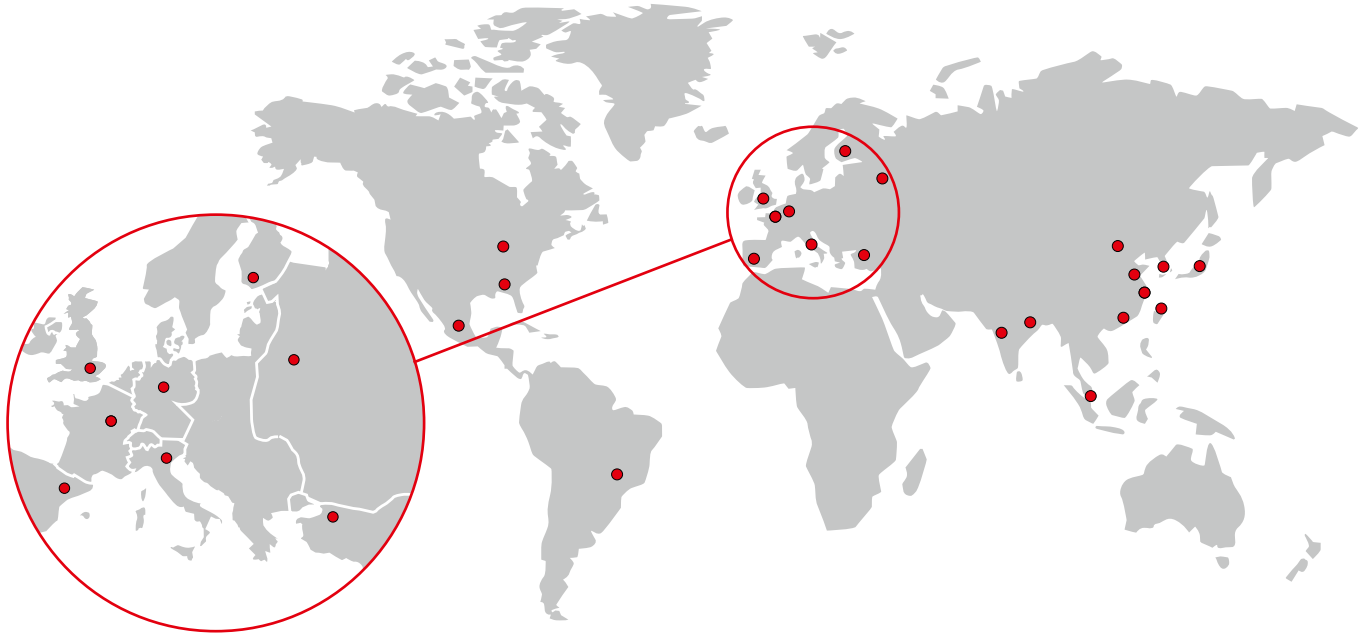
Automation at its best

ISRA VISION has been a leading supplier of high-performance quality inspection, robot guidance and production logistics systems for more than 30 years.

Our systems are used around the world in many different industries and applications. Our mission is to offer a comprehensive portfolio of standard solutions, covering all requirements along the process chain.

ISRA's experience and technological competence in the field of industrial image processing has been proven by thousands of successfully installed systems worldwide.

Benefits at a glance

Customers opt for ISRA's solutions for the following reasons:

- Our development activities are consistently aligned with our customers' requirements.
- We are continuously expanding our knowledge and expertise in all core areas of industrial image processing.
- Our customer relationships do not end with the delivery of new products. The Customer Support and Service Center provides comprehensive support for the use of your systems and helps you to increase your productivity – be it via our telephone hotline, remote service, on-site service, or our maintenance services.
- More than 900 employees at our sites in Europe, North and South America, and Asia are committed to your success.

ISRA VISION

Optimize your ROI with the technology leader ISRA

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