WHITE paper

A complete overview of robotic solution integration

Discussing the various existing types of robots, applications, common misconceptions, and important questions to consider for optimal integration.

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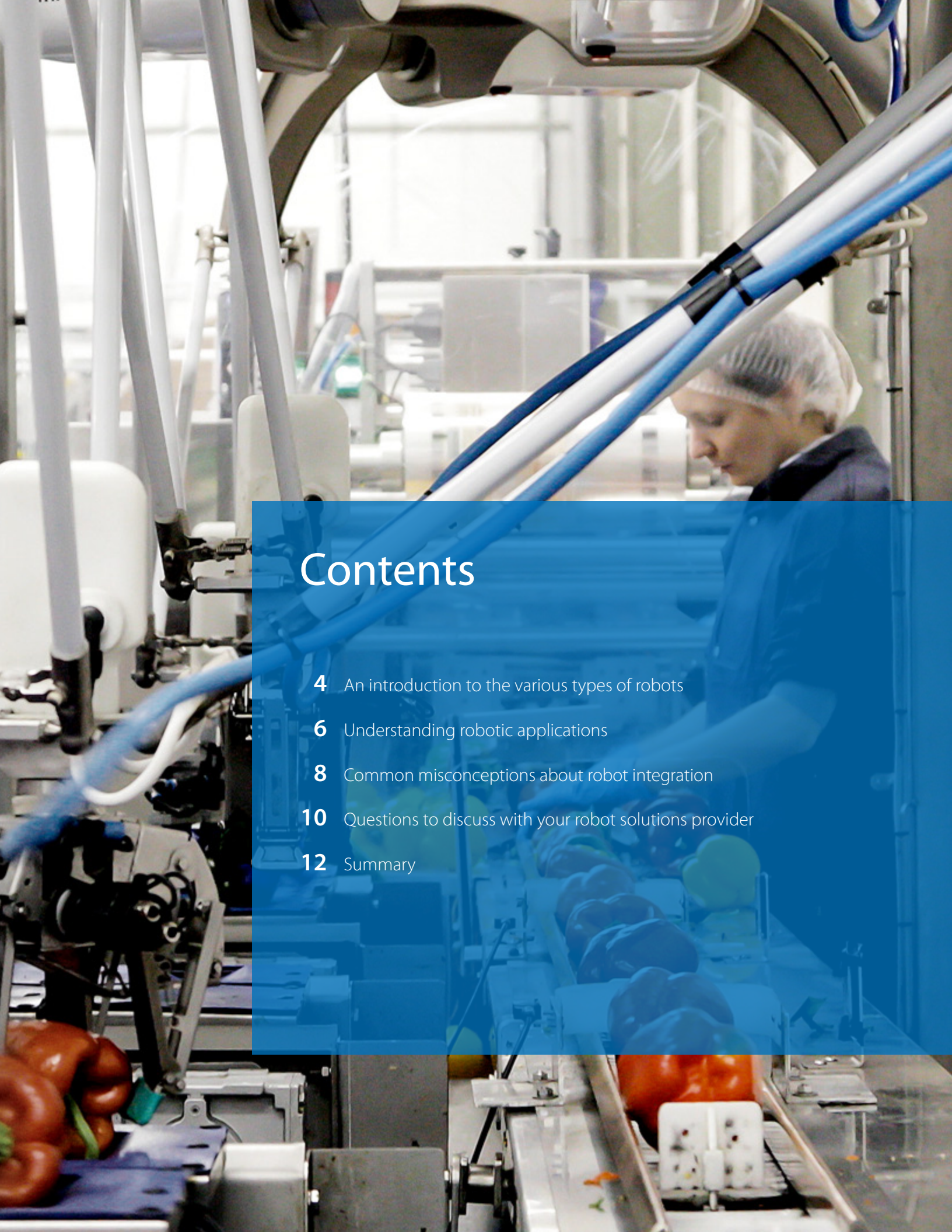
A complete overview of robotic solution integration

A robot is a machine that can carry out complex actions automatically, typically in response to sensing its external environment or via pre-programmed instructions. As more and more manufacturers adopt Industry 4.0, robots become one of the most needed automation solutions to improve day-to-day operational efficiency.

According to the Bureau of labor statistics EU-27, the average employee absence rate is now up to 6%. Estimated $2.4 billion minimum annual cost associated with employee absence (pre-covid). Adopting robotic solutions can help to reduce workplace injuries, improve job satisfaction, and addresses workforce shortage. Additionally, manufacturers will be able to enhance capabilities, improve quality, reduce cost, increase throughput, and enable "High mix / Low volume" flexibility.

In this white paper, we will introduce the most used robots for manufacturing, the type of robotic applications, misconceptions about robots, and how to select the right robots and robotic service providers.



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An introduction to the various types of robots

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Parallel robots

A parallel robot is a type of robot that consists of three or four motor-driven linkages, and they're primarily used for picking and placing parts. They are best in class for speed and excel at lighter payload operation for picking lightweight objects. Parallel robots are often used in applications where high precision and speed are required, such as in manufacturing, assembly, and testing processes.

SCARA robot

SCARA is an acronym that stands for "selective compliance assembly robot arm". As the name implies, SCARA robots are designed with some compliance in the X-Y axes while remaining rigid in the Z direction. The X-Y compliance allows for necessary tolerance in situation such as inserting parts into assemblies, while the Z rigidity ensure exact depth placement. SCARA robot allows you to perform high-speed and high-accuracy tasks such as assembly, material handling, pick and place operations, and other applications. SCARA robots are commonly used in the manufacturing industry for tasks such as assembling small components, handling electronic components, and packaging products.

Articulated robot arm

An articulated robot arm is a type of robotic arm with motors built into the arms. This type of robot offers the most diverse range of motion out of all the robot categories mentioned in this paper. This range of motion is very comparable to that of human arms. Articulated arms are adept at tasks including assembly, palletizing, and inspection. They are typically designed to be highly precise and efficient, allowing them to perform tasks with a high degree of accuracy and speed, which can increase productivity and reduce costs.

Collaborative robot arm

A cobot, short for collaborative robot, is a type of robot that is designed to work alongside humans in a shared workspace. Cobots typically have six motors integrated along the length of the arm. They have integrated hardware and software safeguards to safely respond to nearby humans and can be programmed to perform a wide range of tasks, such as assembly, packaging, and quality control. Cobots are becoming increasingly popular in industries such as manufacturing, automotive, and healthcare, where they can help improve productivity, efficiency, and safety.

Through parallel, SCARA, and articulated arms boast higher speed, payload, and overall performance. They typically require extensive safeguarding and can't be directly interacted with by humans. You might need to physically separate the human workers from the robots in your workspace. Cobots can potentially eliminate this step and provide you with the right programming and safeguarding so you can have peace of mind to have workers share the workspace with robot. This can reduce the footprint of the robotic solution.

Autonomous Mobile Robot (AMR)

An "AMR robot" usually refers to an Autonomous Mobile Robot that is designed to primarily perform material handling- a typically dull, repetitive, and low-value task for human workers. AMRs are incorporated with laser sensors that allow self-navigation in dynamic environments. This will not only avoid fixed equipment and obstacles within the workspace but also can dynamically navigate around forklifts and people.

AMRs can be configured to work in large fleets and self-manage transit tasks, dock to charging stations, and find optimal routes from and to where they need to go. You can attach a topper on top of them such as a pallet holder or conveyor belt to accomplish the task.

Understanding robotic applications

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Assembly

The tasks that robots are utilized in the assembly lines include the insertion and seating of the parts within a larger assembly line or screwdriving and fastening parts together. Robots can perform these types of tasks accurately with high repeatability, precision, and consistency.

Pick and Place

This is where manufacturers can take advantage of the fast speed and accuracy of robots.
This application is ideal for material handling, transporting parts, packing, palletizing, and sorting. Furthermore, thanks to the advancement in machine vision technology that allows robots to identify parts and placed them in specific positions as necessary.

Both applications are commonly needed and used across all industries for low-value-added tasks.

Test and Inspection

The demand for robots to do performing tests and inspection tasks has increased rapidly due to the improvements made by new technologies such as artificial intelligence and machine vision.

For part presence, robots will be used throughout a given process to visually detect certain elements such as electrical components on the boards or all the parts that are there to complete the assembly.

For measurement, robots are measuring and

"The cost of a robotics solution and integration is often less than traditional manual processes, not to mention more efficient."

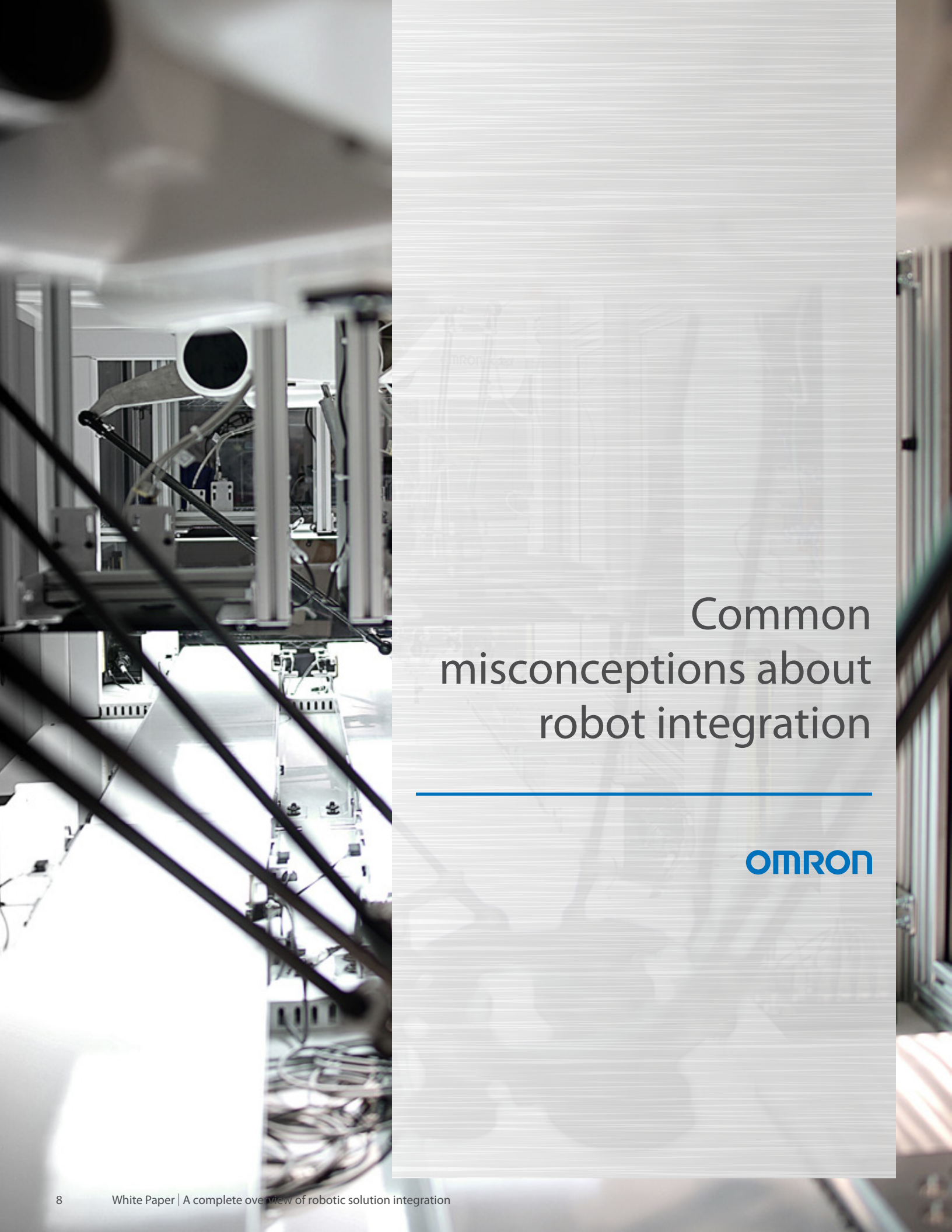
identifying certain parts to make sure they pass the quality standards within the process. Additionally, robots can incorporate sensing technology to ensure that you are performing a precise measurement.

Aside from inspection, robots equipped with cameras can also perform code-reading. They can be incorporated into larger traceability systems. By equipping a robot with the appropriate cameras and sensors, you can detect and inspect a wide variety of materials and parts.

Additionally, robots can support the processing of test samples. If you have material samples that you need to test you can do machine attending with a robot to load materials in and out. As well as, for anything specific such as electrical components or loading in medical samples. By taking advantage of robotics technology for testing and inspection, you can improve the output quality of your production and greatly review the risk of costly recalls.

Process Application

Articulated robot arms and collaborative robots can replicate the articulation of human arms to accomplish a task requiring higher skills such as welding, sanding, polishing, and deburring. If you want to achieve consistent coverage, robots can help you to go around complex parts and surfaces.



Common misconceptions about robot integration

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Misconception #1 - Robots are hard to use

This depends on what you want the robots to do and how you apply them to the application. Difficulty can vary based on engineering, programming, and integration needs. There are many tools available that you can add to a robot to make it more intuitive. Programming environments for all robot categories are becoming more accessible enabling wider adoption as robotic technology continues to develop. Common collaborative robots and autonomous mobile robots feature approachable programming environments tailored to be beginner friendly. System integrators and manufacturers often provide onsite support contracts and remote technical support. Many manufacturers, OEMs, and distributors offer programming and maintenance training for the workforce to ensure the customer has the most up to date robotic knowledge.

Misconception #2 - Robots are dangerous

Newer robotics technology, namely collaborative robots, and autonomous mobile robots, often come with integrated safety features that allow them to share workspaces with human workers. However, when we consider robotic safety, we must also consider the safety risk of the entire robotic application, including payload, tooling, environment, etc. It's important to understand the potential safety risk that can possibly occur during the operation process and then choose the most comprehensive safeguarding for the application. Risk assessments are highly recommended for solutions involving robotics technology, even for cobots and AMRs.

Misconception #3 - Robots take jobs

Automation technology shapes our life similar to the invention of computers and the internet. Computing technology created more jobs and brought more value to businesses and our day-to-day life. Automation technology is helping to re-shore operations and enables companies to be competitive in the global market. Robots can address low-value tasks so that people can focus on high-skilled and meaningful work. They also prevent repetitive strain injuries and prevent workers from engaging in potentially dangerous work processes or work environments. Robots can perform tasks that require skills beyond human capabilities such as ultra-precise assembly, high-resolution inspection, etc.

Misconception #4 - Robots are inflexible

Robots' flexibility depends on their programming and how they are applied in manufacturing. The advanced built-in features for robots allow for painless reconfiguration. For example, AMRs can self-navigate in dynamic environments. Cobots can be easily reconfigured and relocated. The End-of-arm tool changers enable fast application changeovers. With proper maintenance, robots can last a long time and be redeployed.

Misconception #5 - Robots are expensive

The cost of a robotics solution and integration is often less than traditional manual processes – an ROI can be calculated for a targeted timeframe. With proper maintenance, robots can last a long-term and further increase ROI. Many affordable options are available with a range of capabilities. Make sure to choose the appropriate robot specification for your application and choose the right licensing models for your operation.

Questions to discuss with your robotic solutions provider

Question to discuss with your robotic solution provider

- What are my application goals (cost saving, quality improvement, reducing risk, increasing flexibility, input through, optimizing workforce)?
- What are my application requirements (Desired throughputs, anticipated payloads, variants, tolerances, application environment, new VS retrofit installation, traceability)?
- What changes in my process will require future changes (Additional required capabilities, new variants/products to be produced, expansion of production/facilities, what other devices, systems, or processes will this solution need to interface with in the future)?

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Summary

The demand for robots in the manufacturing world is rapidly becoming one of the most needed automation solutions to improve day to day operational efficiency. By overcoming the various misconceptions about robotic integration, manufactures have access to a wide variety of possible applications.

Implementing these variety of applications will greatly contribute to enhancing capabilities, improving quality, reducing costs, and more. Manufactures and robotics solution providers work together to ensure optimal selection of robots and an efficient implementation process.

Click to learn more about Omron robotic solutions ›

Empowering people through automation

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