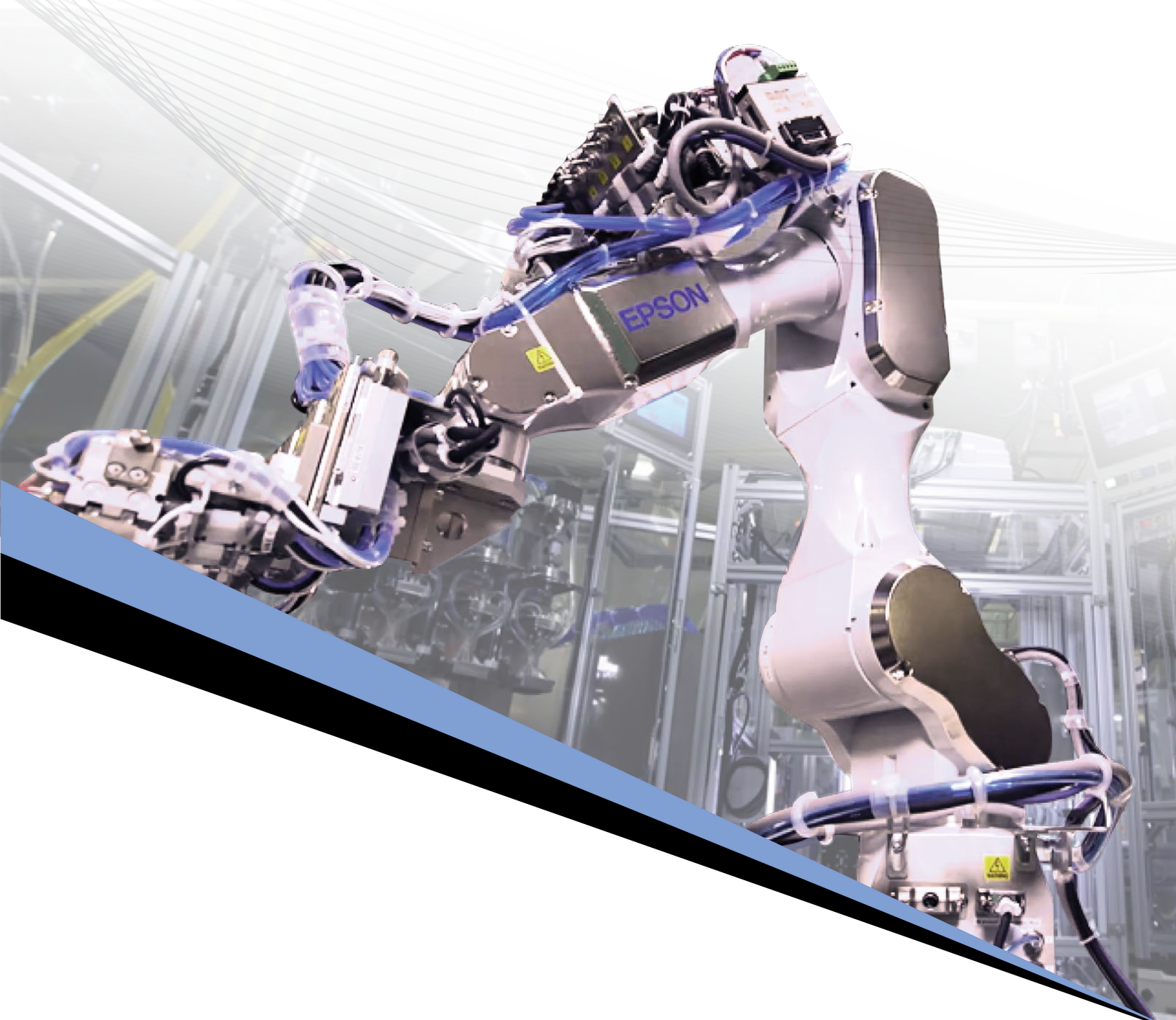
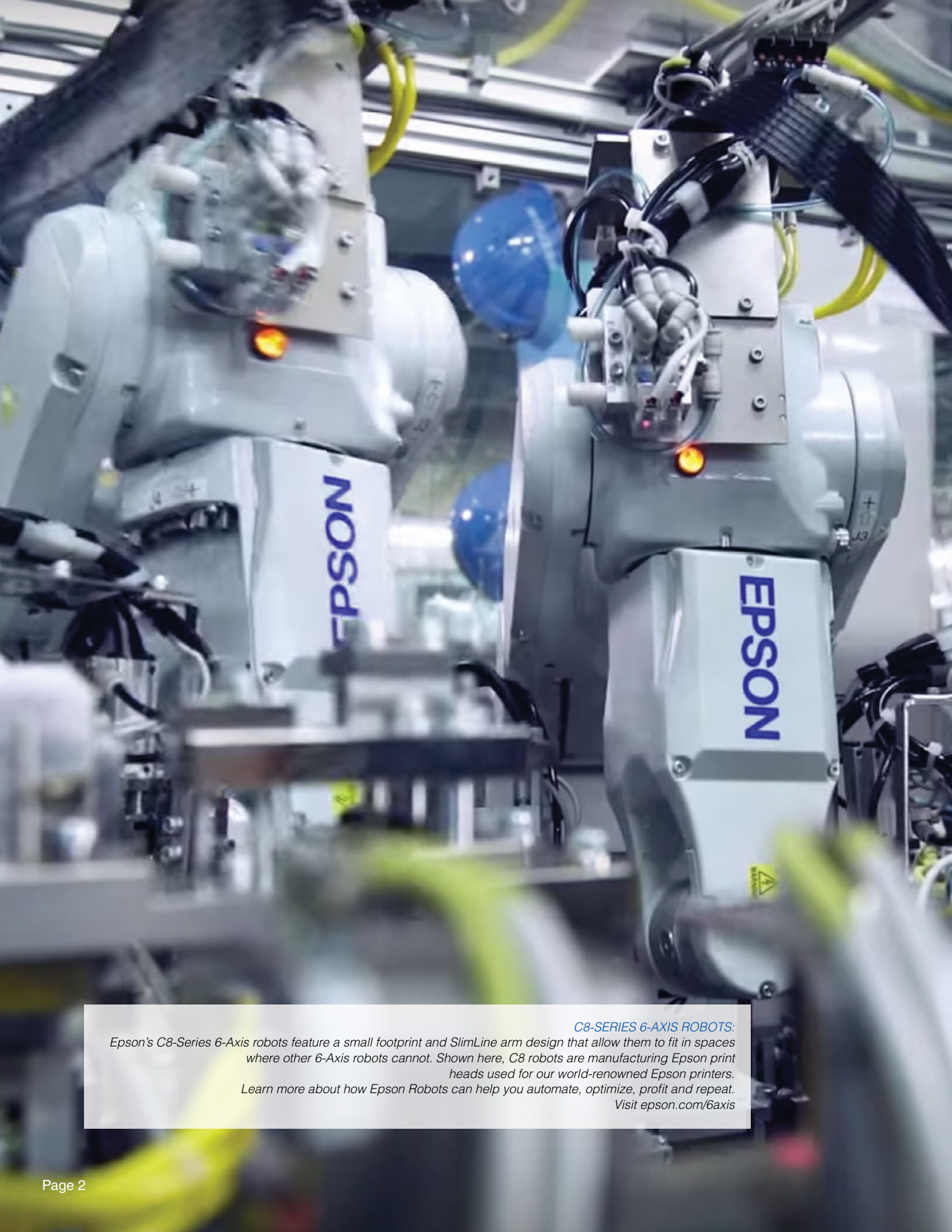


AUTOMATION 101

A Step-by-Step Guide to Getting Started With Robotics



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C8-SERIES 6-AXIS ROBOTS:

Epson's C8-Series 6-Axis robots feature a small footprint and SlimLine arm design that allow them to fit in spaces where other 6-Axis robots cannot. Shown here, C8 robots are manufacturing Epson print heads used for our world-renowned Epson printers.

Learn more about how Epson Robots can help you automate, optimize, profit and repeat. Visit epson.com/6axis



AUTOMATION 101

A Step-by-Step Guide to Getting Started

From assembly and pick-and-place to material handling and packaging, the use of robots is on the rise in factory automation. Extremely customizable in even the most complex applications, automation systems are beneficial for a wide variety of reasons. Taking the plunge into automation, however, can be confusing and daunting. With so many factors to consider, you may be wondering, “Where do I start?”

With over 35 years of experience in the automation industry, we have broken down the process, step-by-step, to guide you on your journey. Keep in mind that this guide is a broad overview, but can serve well as a starting point for those new to automation.

1

WHY AUTOMATE?

In order to best determine where to place your focus in the automation process, the first step is to ask yourself, “Why am I thinking about automating my current process?” The answer may lie within one or more of the following areas:

Cost — Do you need to reduce your current cost per unit?

Volume — Do you need to see an increase in volume, but lack the resources to do so?

Quality — Are your deliverables turning out perfectly each and every time, or are there quality issues?

Precision — Are your parts too small or precision requirements too tight for humans to handle?

Safety and Repetitive Motion — Are the materials you are handling unsafe for humans to work with, or are repetitive motions causing human injury?

Understanding your primary reasons for automating will help you focus on the right areas as you begin your automation project.

2

KNOW YOUR PROCESS

Now that you've determined why you want to automate, your next step is to analyze your current process. By doing so, you'll be able to determine which steps in the process are the most critical and might benefit from automation.

How do you do things today?

Think about your current process for building products. Is it documented? Can you explain it clearly to someone not familiar with your process? Begin thinking about how you would document or explain your current process to an automation expert so they can clearly understand and then offer ideas on how to automate. Consider questions like:

- Where do the components come from? (feeding)
- What are the assembly steps?
- What sort of jigs or special tooling are required for your current process?

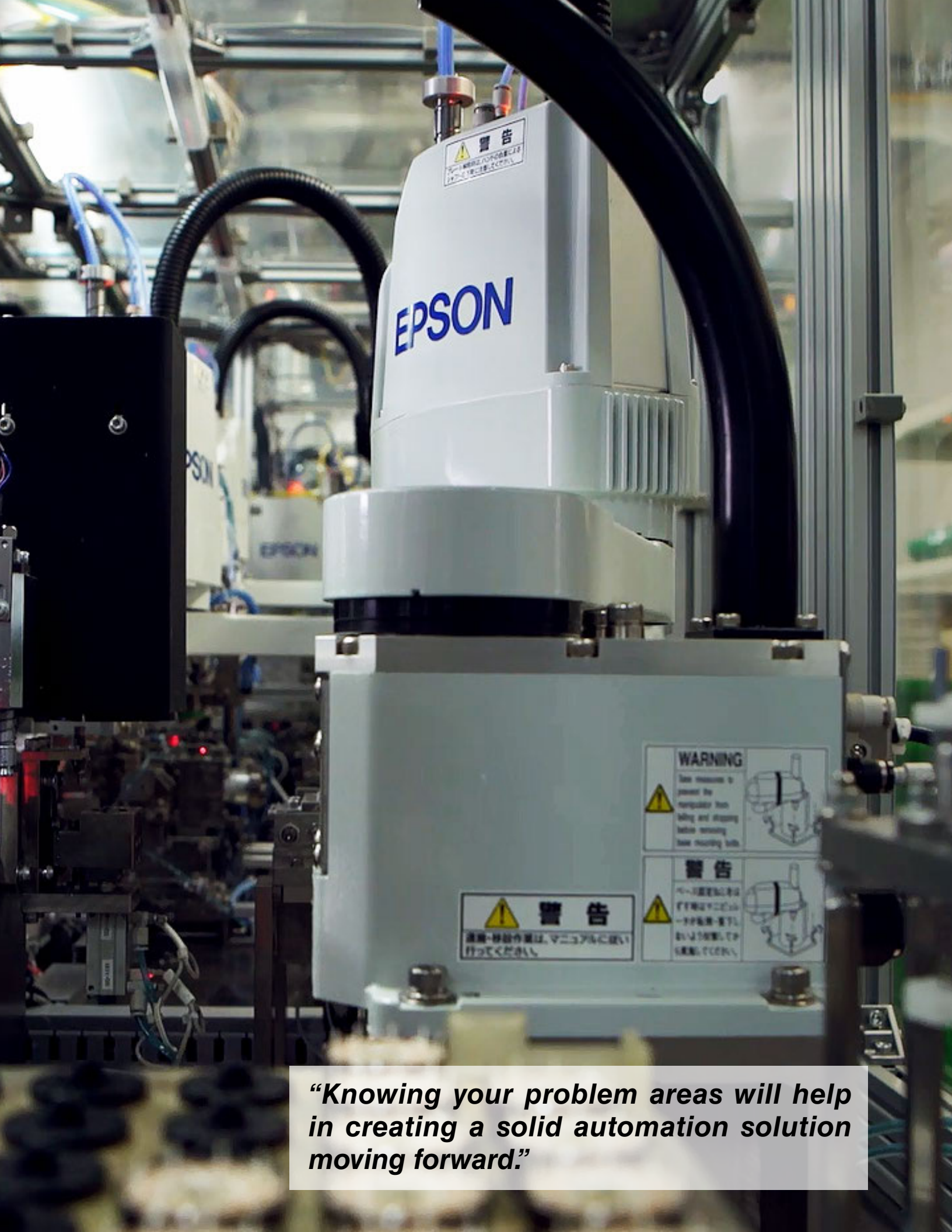
There are product and assembly design processes that should be considered when transitioning from a manual operation to an automated operation. DFA (Design for Assembly) is a method used to analyze components and minimize costs by optimizing the assembly process and reducing the number of parts used. Utilizing this method will help determine if you need to change parts or steps in your process when making the switch from manual assembly to automation.

Understanding and being able to explain your current process is a critical step as it can be used to identify the strong and weak points that can be improved upon in your automation solution.

G-SERIES SCARA ROBOTS:

Manufactured by the #1 SCARA robot vendor in the world, Epson G-Series robots are used in thousands of factories throughout the world building a diverse lineup of products including: hard drives, pacemakers, hearing aids, contact lenses, phones, watches and much more. Learn more at epson.com/scara





“Knowing your problem areas will help in creating a solid automation solution moving forward.”

Identify your problem areas.

Problem areas can range from bottlenecks in your process to poor quality parts. Think about the problem areas associated with your current process. Consider the following:

- What is currently slowing down your automation process?
- Are there easily identifiable bottlenecks?
- Are you consistently experiencing failures that require rework?
- Is the final product meeting your current quality standards?
- Are you producing enough product in a timely fashion?
- Are your costs to manufacture too expensive using your current process?



Let's use an example to help clarify identifying problem areas.

Assume you have a team of assemblers building a product with a molded plastic body and a couple metal inner parts. The process today is that an assembler pulls a plastic body shell out of a bag and places it in a fixture. Next, they grab two metal parts from two separate bins and slide them into slots on the plastic body. Then, they fasten the metal parts with an electric screwdriver. Sounds simple, right? On the surface, it may, but the potential for quality issues is huge, given the number of things that could go wrong. Let's list out just a few of these areas of concern:

Variety of plastic body shells — If there are several types, how do you keep them separated and make sure the correct one is used for each process?

Deviation of part tolerances — Many times, we tend to believe that the process doesn't work due to human error, but have you considered that the parts themselves may be out of tolerance?

Proper part insertion (right-side-up issue) — Sometimes parts can be inserted two or more different ways, but only one way is correct. How do you make sure parts are always inserted right side up?

Screw driving issues — How do you ensure that all the screws are fastened properly? (Stripped, missed, etc.)

Each of these items could be related to quality. But, they could also be related to cycle times. Which steps in the process take the most time? Which are the most prone for rework or readjustment and therefore take more time? Which might be too repetitive and therefore cause pain or injury to your workers? These could all be considered problem areas in your current process and are just a few items from one simple example. Knowing your problem areas will help in creating a solid automation solution moving forward. Sharing this information will allow a robot expert, Systems Integrator (SI) or other outside experienced party to more easily find the most effective solution.

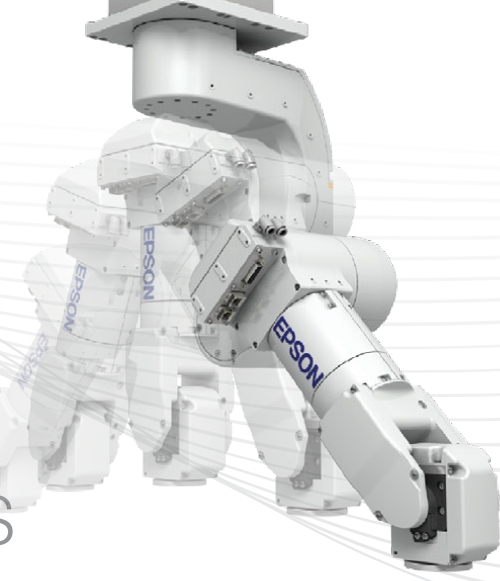
C8L 6-AXIS ROBOT:

Epson's C8L 6-Axis robot is used for higher payload applications (up to 8Kg) where space is at a premium. Utilizing Epson's proprietary Quartz Micro Electro Mechanical Systems (QMEMS) Technology with special gyro sensors, these innovative robots feature reduced residual vibration resulting in faster cycle times. Learn more about how Epson Robots can help you automate, optimize, profit and repeat. Visit epson.com/6axis



FLEXION™ N2 6-AXIS ROBOT:

The new Flexion N2 from Epson delivers faster cycle times in smaller workspaces. Unlike any other 6-Axis robot on the market, the Flexion N2 is revolutionizing the automation industry with the world's first compact folding arm technology. Learn more about how Epson Robots can help you automate, optimize, profit and repeat. Visit epson.com/6axis



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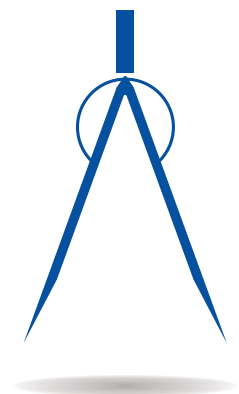
IDENTIFY YOUR REQUIREMENTS

In order to build the best system for your process, you will need to identify key requirements that are central to your business and prioritize them based on importance. There are three areas that must be considered for every robot-based application – speed, precision, and payload. These areas require prioritization because, for most applications, you must compromise between them. This means that you will need to decide which is most critical between the three.

For example, there are applications where customers request the absolute fastest speed possible because their PPM (parts per minute) cycle rate is critical. In these cases, we focus on activities to reduce overall cycle times, such as reducing tooling weight, or optimizing motion paths. Other times, precision is critical. In those cases, we might reduce speeds and payloads (again tooling) to help drive the best precision possible. The amount of tradeoff will vary from application to application. The important takeaway here is to know the requirements for your specific application.

Some key requirements you will need to identify for every application are:

Precision — Many customers simply aren't sure of their precision requirements. While Epson robots have repeatability down to 5 microns, most applications in the small assembly arena range from 25 – 200 microns in terms of precision requirements. Look at the components you are assembling and the tolerances required for the parts to be placed reliably. A qualified robot vendor or Systems Integrator can help you define placement tolerances (or precision requirements) for your application. This is an area where a target is required because it will affect all aspects of the overall solution.



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Payload — A common misconception is that payload is defined by only the weight of the part being moved. Payload, from a robot usage perspective, is the total weight put on the end of the arm, which also includes tooling (gripper, etc.). Usually, for smaller parts, the tooling weighs much more than the parts, so be sure to consider both the maximum part weight and the tooling weight when defining the maximum payload. Also, keep in mind that while robots are rated with maximum payload specifications, it is sometimes a good idea to move up to a larger robot when you get close to the maximum. This is an area where the robot vendor can guide you in selecting the proper robot for your application.



Cycle Time — How many parts do you need to produce each week? Knowing this will allow you to use a simple calculation to determine cycle time or PPM required for the robot automation system. With a cycle time in hand, the robot vendor or Systems Integrator (SI) can help determine which robot(s) to use for your application and whether or not a multiple robot system will be required. There are many ways to improve total throughput including multi-headed tooling, motion optimization, and more.



Reach — Things like part size and the distance required to move them are used to determine reach. Robot vendors and Systems Integrators can help define reach requirements. However, they will need to understand the total process and all parts and components required in the workcell. By understanding the layout, reach can be determined and a robot with the appropriate reach capacity can be selected.

4

AUTOMATION
COMPONENTS

Once you've defined your process and identified your requirements, it's time to start putting together your wish list of components. There are several factors to consider at this phase in your planning:

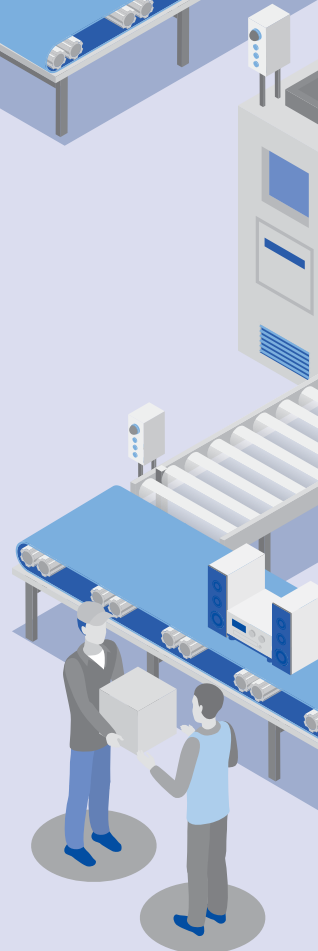
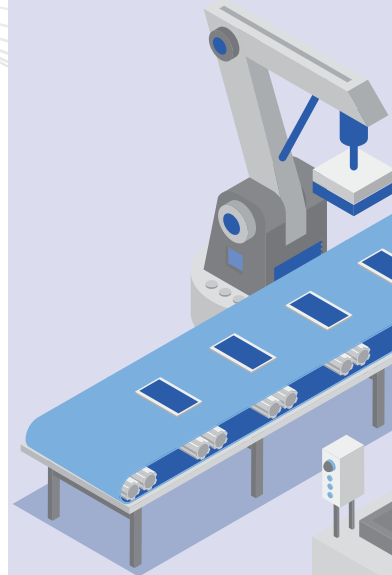
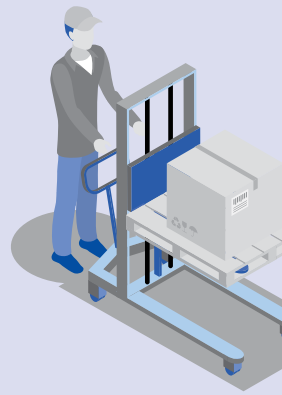
Parts Presentation — How will your parts get to the robot? (Bowl feeder, flexible feeder or some type of conveyor?) Also, think about any fixtures you might need during the assembly of your product. Many systems require special fixtures that hold parts in place, flip parts, etc. during the assembly process.

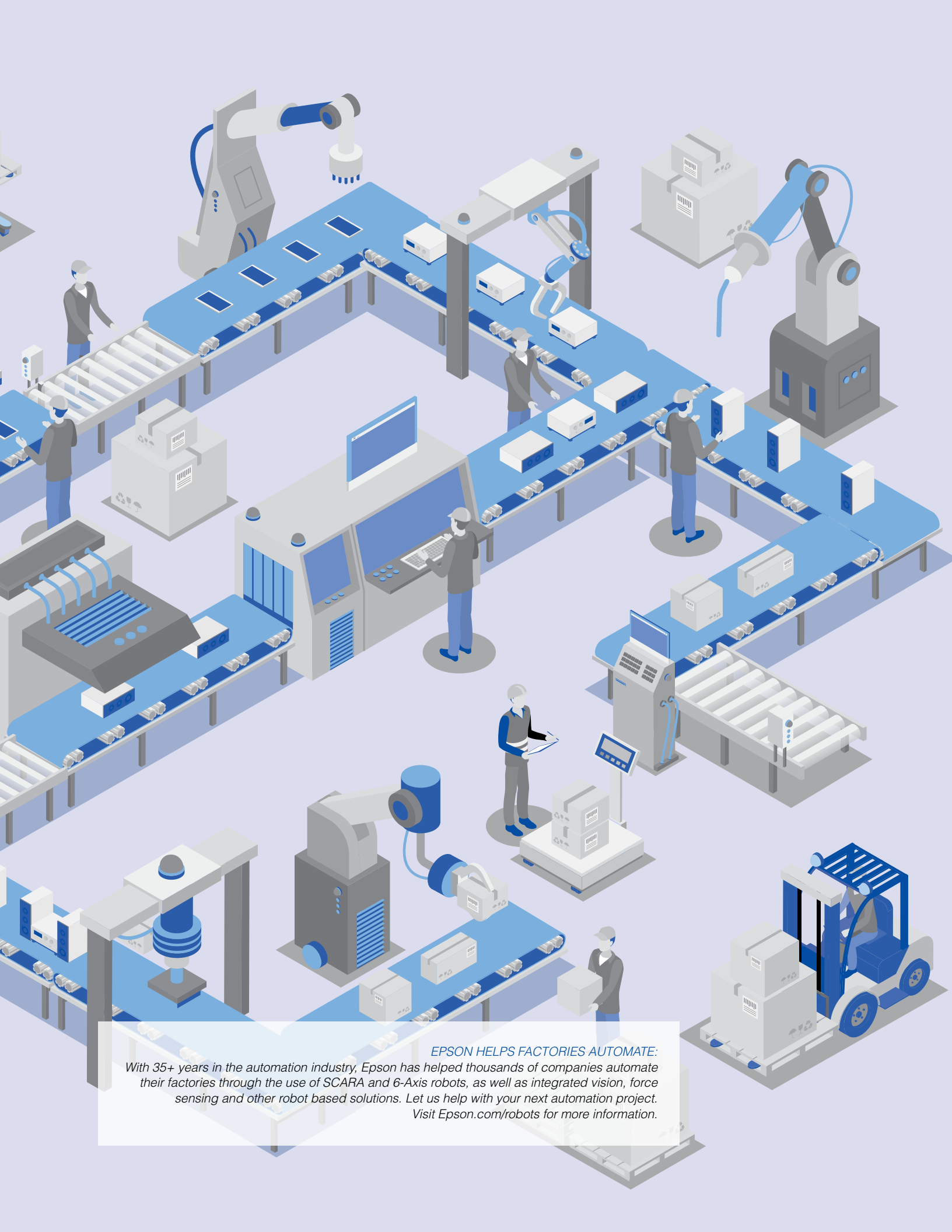
Vision — If the parts cannot be fed within proper tolerances, vision may be required and integrated with the robot for precise pickup or placement. Vision may also be required for inspection of components or finished assemblies.

End-of-arm Tooling (EOAT) — End-of-arm tooling encompasses all of the devices attached to the end of a robot's arm to help the robot grasp and work with parts. From pneumatic devices to mechanical grippers, end-of-arm tooling is vital to every robot automation application. While standard grippers can be used for some applications, often times, custom tools are required for higher speed or higher precision applications. Our suggestion in this case is to use an experienced tool designer to define and build your end-of-arm tooling.

Factory Standards — Do you have a standard fieldbus communications platform within your factory? Do you use Ethernet/IP, ProfiNet, DeviceNet, etc.? Are there any other standards you need to consider and let your SI know about?

Base — Every robot will need a base. The more mass that is moving (i.e., heavier robots or payloads), the more rigid the base will need to be to allow for fast motion and high precision. We have seen many situations where a lightweight or light-rigidity robot base moves when the robot moves. This slows down cycle times or requires the system to stabilize before placing components due to vibration. The base is the core for your system, so be sure to select or build an appropriate base depending upon your cycle time and precision requirements.





EPSON HELPS FACTORIES AUTOMATE:

With 35+ years in the automation industry, Epson has helped thousands of companies automate their factories through the use of SCARA and 6-Axis robots, as well as integrated vision, force sensing and other robot based solutions. Let us help with your next automation project. Visit Epson.com/robots for more information.

5

MANPOWER – WHO WILL BUILD IT?

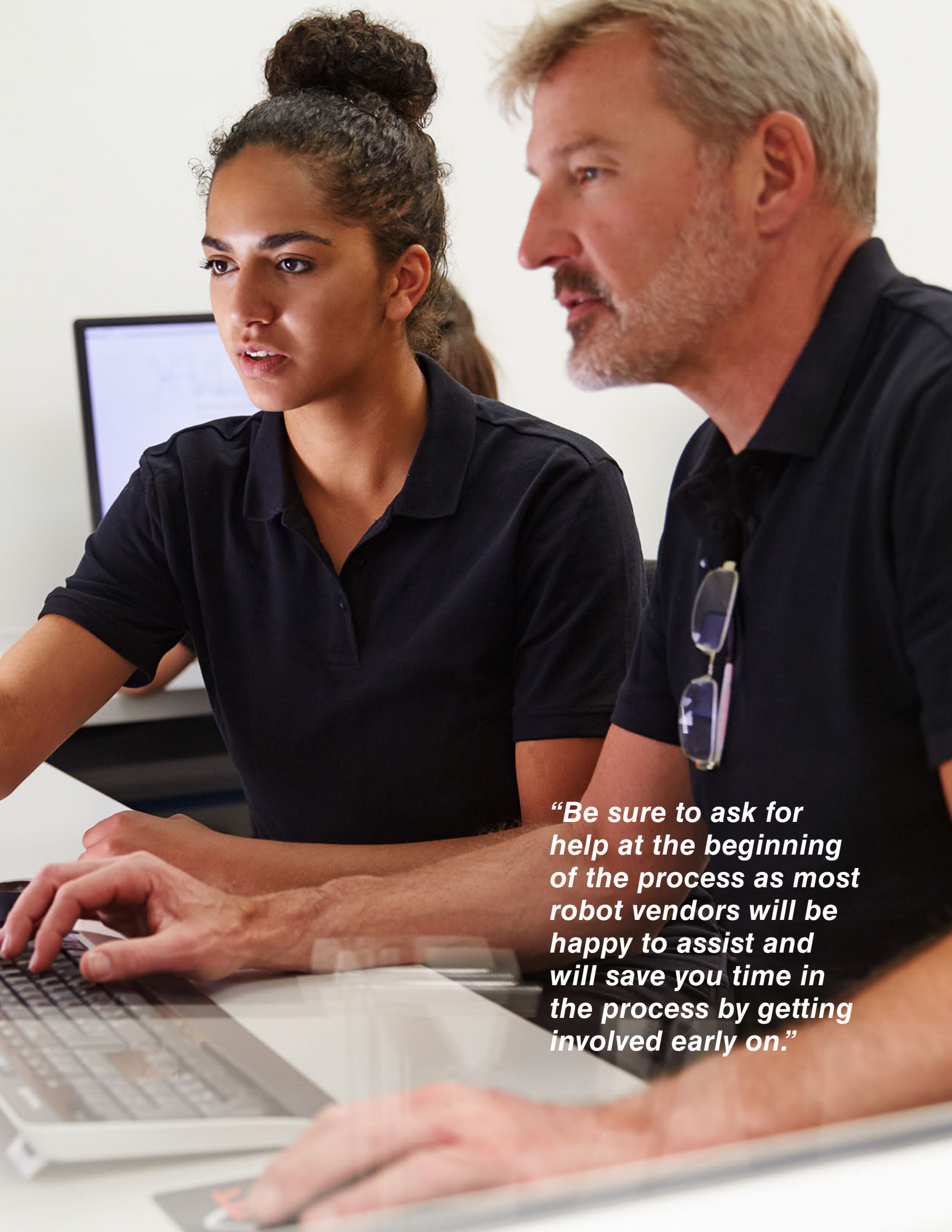
By now, you've figured out why you want to automate, what your current process is, the requirements needed to maximize automation, and many of the components needed for you to build the robot automation system required for your products. With all of these areas identified, the next logical question is "Who will build the system?" The answer may be within your company, or you may need to look outside. Chances are, you don't have every possible tool you need available in-house, but you may have some pieces of the puzzle.

Is there an in-house engineering team? You will typically need a Controls Engineer, Electrical Engineer, Mechanical Engineer and Software Engineer or people well versed in each of these disciplines.

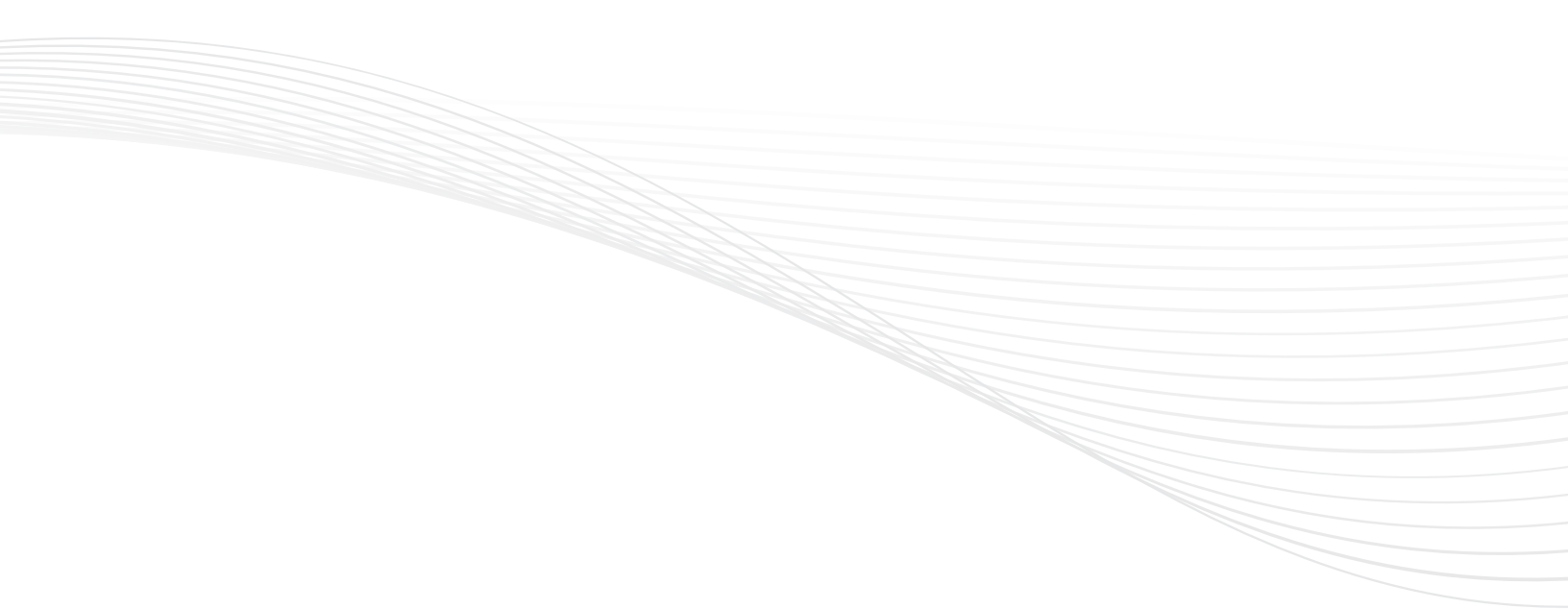
If you don't have the necessary resources in-house, contact a Systems Integrator. Systems Integrators specialize in designing customized robot workcells that build all types of products for the Automotive, Electronics, Medical, Consumer Product and other industries. They have the needed experience with best-in class solutions and component usage to build your automation system. Essentially a one-stop shop, SIs work with manufacturers to pull together every component of your system.

Whether you decide to design and build your robot automation solution in-house or with an SI, keep in mind that robot vendors have tremendous automation experience and can help with component decisions, system layout for maximum throughput, optimizing performance, tooling ideas, and many other areas of your automation project. Be sure to ask for help at the beginning of the process, as most robot vendors will be happy to assist, saving you time in the process by getting involved early on.





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Are you considering automation? The Epson Robots Applications team is here to provide insight and help you find the answers to your automation questions.

Let us help you find the right solution for your project or application by calling (562)-290-5997. Or visit epson.com/robots today.

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