



AUTOMATION CONTROLS TREND WATCH

# CHALLENGES AND TRENDS IN DESIGNING AUTOMATION CONTROL SYSTEMS

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## Automation control systems are used for a wide range of factory automation applications in a wide mix of industries — from chemical plants to factory production lines.

Design engineers for original equipment manufacturers (OEMs) face the challenges of increasingly complex requirements in designing automation control systems that offer the functionality, reliability, and safety necessary for these markets. Applications may have specific requirements for safety, performance, or maintenance, for example, that engineers must factor into the design as they balance standardization vs. customization and reliability vs. scalable solutions.

Connectivity is one part of automation control systems that may look very simple. At its core, it is a connection between a pin and a socket. However, in any electronic system the connection point can be a weak spot where the system fails first, and a broken or malfunctioning connector could take down the entire production line. This makes reliability the most critical factor for connectors in automation control systems.

Thinking about the common challenges involved can help engineers navigate the complexities and ever-changing requirements so they can create designs that comply with the necessary specifications and produce robust and reliable systems.

## Ask these questions to tackle challenges in system design

Navigating changing standards and specifications for a wide range of applications requires attention to numerous factors. These five questions can help point engineers down the right path.

### 1. Am I thinking upfront about connector design and specification?

Connectors are often seen as a modular and interchangeable commodity in automation control system design: one can be swapped out for another, and they will always be able to comply with necessary specifications. However, not all connectors are created equal, and there are several factors to consider when choosing a connector, including the necessary speed and power as well as any vibration or extreme temperature exposure. Thinking about the best connector for the application at the start of the design process — rather than waiting until the end of the process to choose a connector — will help ensure that all mechanical and electrical parameters are met and that the system will accomplish what it should. In addition, involving the connector manufacturer as early as possible means they can provide support, advice, and technical expertise.

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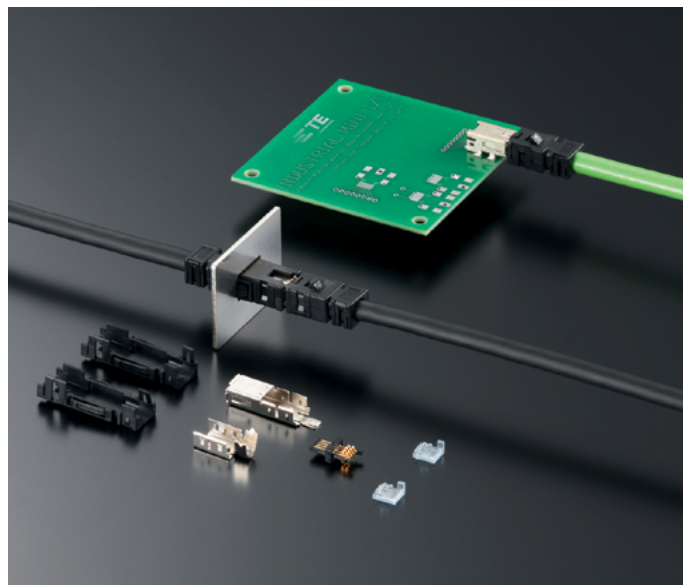
## 2. Do these components meet the requirements I need to deliver?

While design requirements vary by applications, in general they are becoming more complex to help ensure safer and more reliable operation in certain environments and for industry-specific end solutions. There are several complex requirements involved, including mechanical stability, electrical stability, and functionality. Be aware of the capabilities of a connector portfolio. All connectors may seem similar and interchangeable until there is a problem. Selecting consumer-grade connectors that are not designed for robust industrial applications, for example, can result in performance and results that do not meet your customer's standards or requirements. On many devices, engineers may copy a development board or reference board that worked in a previous system and adapt it to the new system layout. However, a more holistic approach is needed to help ensure a longer-lasting product for newer automation systems.

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## 3. Are these connectors robust enough to withstand the environment?

Every piece of hardware in automation control systems must be able to resist the worst conditions that may occur in the factory environment. The challenging conditions may include extreme temperatures, vibration, micromovements, and humidity. It is common for engineers to design one hardware solution that meets many needs and then make any necessary adjustments with software variations, it is important to optimize the hardware selection based on the most stringent safety and reliability requirements for the market and end applications. Electrical performance and stability are key, but do not forget to consider mechanical stability as well.



## 4. Is a smaller system more vulnerable?

Looking holistically at a system's design early in the process often results in the use of smaller components and parts; intelligence can be moved to the edge and more computing power can be planned for a smaller space. Starting with something smaller can make the product more competitive; however, it is important to think about the increased risks with much smaller products. They could be more vulnerable to breaking, electrical noise interference, or mechanical instability, so it is key to find a compromise between miniaturization technology and mechanical stability. You must optimize the combination of data speed, reliability, and miniaturization to make sure all mechanical stability and electrical performance requirements are met. The smaller your product becomes, the more critical the assembly and production of the product is, as well as the design and construction of the components inside the system. The mechanical tolerances in the system should be designed to help prevent generating friction or load that could jeopardize the connection over time.

## 5. What is the total applied cost of this solution?

Taking a holistic approach in system design helps deliver a total applied cost that is more competitive. It goes beyond looking only at component cost. Total applied cost also considers the design, manufacturing process, system life and any ongoing maintenance. Using well-designed, reliable components ultimately results in minimal quality problems and returns — for a lower total applied cost. Avoid the short-sighted approach of choosing the cheapest components based solely on the cheapest cost without considering other factors such as long-term maintenance or quality costs.

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## Evolving trends in automation control systems

Several trends are shaping the future of automation control systems and customer expectations. Paying attention to these evolving technologies and areas of interest can help design engineers stay ahead of the curve in producing more reliable, adaptable systems. Here are four trends to be aware of:

**Miniaturization:** The demand for miniaturization is affecting electronic components in many industries. As parts and machines used in industrial factories become smaller, the controllers and components inside those solutions must become smaller as well. But while the size is reduced, speed and power requirements remain the same — or are increasing. All of the environmental issues, such as vibration or temperature requirements, also remain the same. With miniaturization, choosing the right industrial connector solution becomes very important to get the durability and reliability needed from the component. The impact of a bad decision regarding components is amplified as the solutions become smaller.

**Increasing power requirements:** The processing power available in these components and systems continues to grow to new levels. One factor driving the adoption of new systems is the ability to extract information from the field and put it seamlessly into the hands of decision-makers — at their desks or on their laptops or tablets. Industrial connectors must be reliable and allow for greater bandwidth to take advantage of these advancements in power and capabilities. Think of the connector as a pipe. If there is a broken pipe, the water cannot flow.

**Impact of artificial intelligence (AI):** This technology could have a significant influence on design cycles and how automation control systems are designed. For example, if a manufacturer has very specific system requirements, these could be loaded into the solution using AI. The increasing processing power (as mentioned above) in these systems can allow engineers to make meaningful strides using AI. The implications for connectivity are all about more bandwidth and speed and continuing to increase those capabilities in harsh environments.

## Evolving trends in automation control systems

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**Sustainability and energy efficiency:** How will a push for sustainability impact a customer's selection of components? Sustainability requirements influence the specifications and what customers expect in terms of products and solutions. The push for more sustainability and energy efficiency in automation control systems is in the early stages, but customers will expect more from OEMs on this front in the coming years. It is important to consider such questions as how are we handling wastewater? Are products fully recyclable? Making these issues a key part of system design is not far down the road.

## How can TE Connectivity help design engineers be more nimble?

TE Connectivity (TE) has an expansive portfolio of reliable connectors designed to meet a wide variety of automation control system needs for factory and manufacturing applications. TE can help OEM design engineers navigate the ever-changing standards for these systems and their components, acting as a trusted partner in producing flexible and durable systems that deliver value.

Our engineers are connector experts skilled in helping you address connectivity requirements: bringing product and application expertise and engineering know-how so you can build your product offering with an application lens. For OEMs dealing with a shortage of skilled labor in-house, TE can help fill this expertise gap. Bringing in TE experts early in the process can help ensure that the solution is optimized to meet application requirements and needs.

In addition, TE's rugged and durable connector solutions will provide long-term performance and value, and the portfolio meets a broad range of application needs. For example, if the application standards require components that can endure high vibration or corrosive elements, TE has connectors specifically designed for optimized performance in these conditions.





## Connect With Us

You do not have to navigate the challenges and complex requirements of automation control system components alone. Partner with TE to find the right connector solutions for your customers' applications so you can deliver systems that provide reliability, functionality, safety, and optimized performance.

**Connect with us today.**

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