

Why high voltage doesn't need to mean high complexity

August 13, 2026

In industrial facilities where 400–480V three-phase power is standard, machine builders are often faced with a different kind of challenge. It is not a question of whether to use high voltage but how to design motion systems that work effectively within that environment without introducing unnecessary complexity.

In many cases, the assumption has been that operating in a high-voltage environment requires stepping up to more complex, higher-spec motion systems. Larger machines and higher throughput do place greater demands on certain parts of the system. However, that does not mean every axis within a machine needs to be designed to the same high specification.

The challenge is not about adopting high voltage, but about making the best use of it.

The challenge of scaling motion systems

Large manufacturing plants, automotive production lines, logistics hubs, and high-throughput packaging facilities are typically built around 400–480V infrastructure. In these settings, aligning motion systems with the available power supply is often the most practical and efficient approach. Introducing lower-voltage systems into these environments can add unnecessary complexity, requiring additional components such as transformers and extra protection hardware.

Historically, however, working within high-voltage environments has often meant moving toward more complex motion platforms designed for maximum performance. While these systems offer impressive capability, they are not always the best fit for every part of the machine.

Even in large industrial environments, not every axis is doing the kind of heavy lifting that warrants top-of-the-line specifications. Many are responsible for positioning, guiding, or handling materials. These tasks are essential, but they do not necessarily require the highest levels of power or performance. Applying a high-end solution across the board can therefore introduce unnecessary cost, increase commissioning time, and make systems harder to integrate and maintain.

This is where the real challenge lies: designing motion systems that fit naturally within high-voltage environments without over-specifying the solution.

The cost of complexity

This question reflects a broader shift in how motion systems are evaluated. Performance metrics like torque and speed still matter, but they are no longer the only factors that define a good solution. Engineering time, ease of integration, and long-term usability are becoming just as important.

More complex systems tend to demand more from the people working with them. They take longer to configure, require more specialist knowledge, and can be harder to troubleshoot when something goes wrong. None of this is immediately obvious from a specification sheet, but it has a real impact on project timelines and overall cost.

In many cases, the time required to integrate and commission a system can outweigh the benefits of higher performance on paper. As a result, machine builders are increasingly taking a more measured approach, focusing on solutions that meet the needs of the application without adding unnecessary complexity.

This is where the idea of “right-sizing” becomes important. The goal is not to limit capability, but to apply it where it is needed and avoid it where it is not.

Expanding the role of scalable motion platforms

To support this approach, motion suppliers are beginning to rethink how their platforms are structured. Rather than forcing engineers to move between entirely different product families as requirements change, there is a growing focus on scalability, allowing a consistent approach across a wider range of applications.

Kollmorgen’s Essentials system is a good example of this. Originally developed as a simplified, cost-effective motion solution for medium-voltage (120–240V) applications, the product line has now been expanded to include high-voltage options. This brings Essentials into alignment with standard industrial power, allowing it to be used directly within 400–480V environments without requiring additional infrastructure.

At its core, the Essentials platform is designed to reduce the time and effort required to specify and commission a motion system. Pre-matched motors and drives simplify selection, while a focused range of options helps engineers avoid unnecessary complexity. Commissioning is also streamlined, with intuitive tools that allow systems to be brought online quickly, even without deep motion expertise.

Availability is another key advantage. With products typically held in stock, Essentials can help shorten lead times and reduce project risk. By extending these benefits into high-voltage applications, the system allows machine builders to apply a consistent, scalable approach across different machines and environments.

This is particularly useful for applications that sit within larger machines but do not require the highest-end motion solutions. By using a more appropriately sized system for these axes, it becomes possible to optimize the machine as a whole rather than applying a single, uniform specification throughout.

A more flexible approach to motion design

As automation continues to expand into larger and more varied environments, this kind of flexibility will only become more important. Machine builders are being asked to deliver systems that are not only capable, but also efficient to design, build, and maintain.

In that context, the most effective solutions are not necessarily the most powerful or the most advanced. They are the ones that fit the application closely and make the best use of the infrastructure already in place.

High-voltage operation has long been a foundation of industrial automation. The challenge now is to ensure that motion systems take full advantage of that foundation – without adding unnecessary complexity along the way.

Images:

Images 1 and 2: Large manufacturing plants, automotive production lines, logistics hubs, and high-throughput packaging facilities are typically built around 400–480V infrastructure.



Image 3: Kollmorgen's Essentials system has been expanded to include high-voltage options.

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