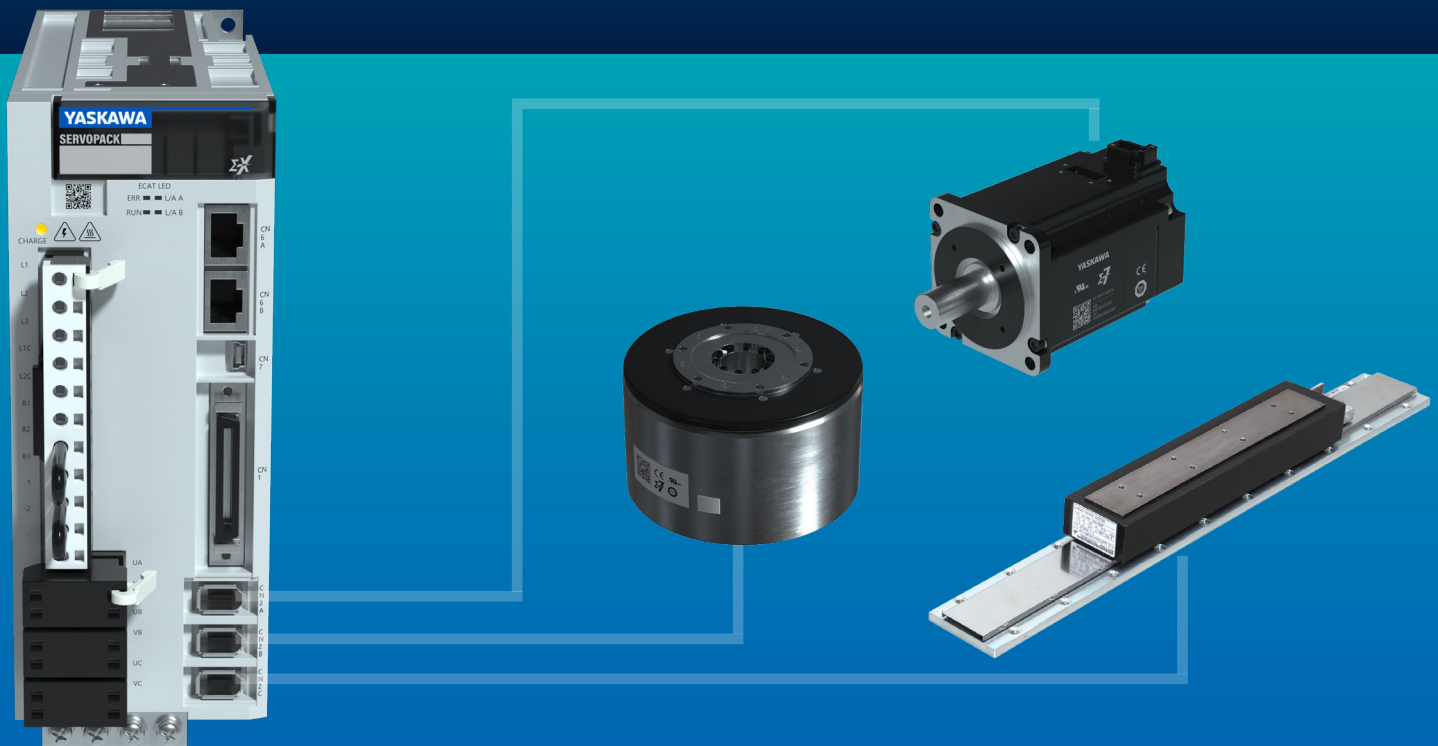


# YASKAWA

## FIVE ADVANTAGES OF MULTI-AXIS SERVO DRIVES

SIMPLIFY YOUR SYSTEM WHILE INCREASING EFFICIENCY



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*This article compares single- and multi-axis servo drives in motion control applications to reveal how multi-axis drives can reduce complexity and increase servo performance and efficiency.*

## INTRODUCTION

Multi-Axis Servo Drives started gaining popularity in the early 1990s, and since then, more technological advancements have been made to make these devices even more powerful. There is an immense upside in the differences in having multiple axes in one simple-to-use package rather than multiple single packaged drives. Selecting between these options in an application often comes with levels of complexity, especially when dealing with multiple axes. Multi-axis servo drives can help limit that complexity and increase performance in space, synchronization, energy, scalability, and data handling aspects.

### 1. SPACE EFFICIENCY

Space is a vital characteristic to consider in designing panels for servo applications. For a multi-axis system, the panel must contain fans and have strict spacing conditions based on safety standards.

With increasingly complex systems with multiple connections and routing points, saving even the smallest amount of space can become crucial.

For example, Yaskawa's Sigma-XT Three-Axis drive is 70 mm in width. The smaller models of Yaskawa's Sigma-XS Single Axis drives are 40 mm wide with 1mm of required spacing. So, by driving three axes with the identical power-rated drives, a designer can save 52 mm or 57% of total width by utilizing multi-axis drives. This idea will save exponentially more space for applications with more axes. Table 1 shows how this occurs.

With increasingly complex systems with multiple connections and routing points, saving even the smallest amount of space can become crucial.

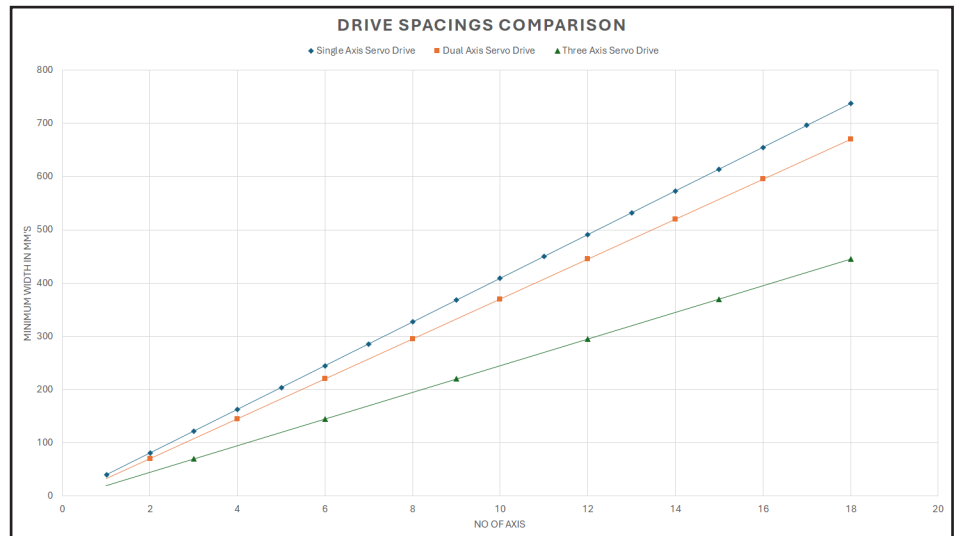


Table 1: Space Efficiency Chart for Servo Drives

## 2. COST SAVINGS (WIRING):

Consolidating multiple axes into a single servo drive also helps with panel spacing. Building a panel can become tedious work when following all standards, so space becomes a key issue when designing.

Power wiring becomes simpler because multi-axis servo drives often share a common DC bus. Input power circuit protection also becomes simpler because of that common bus.

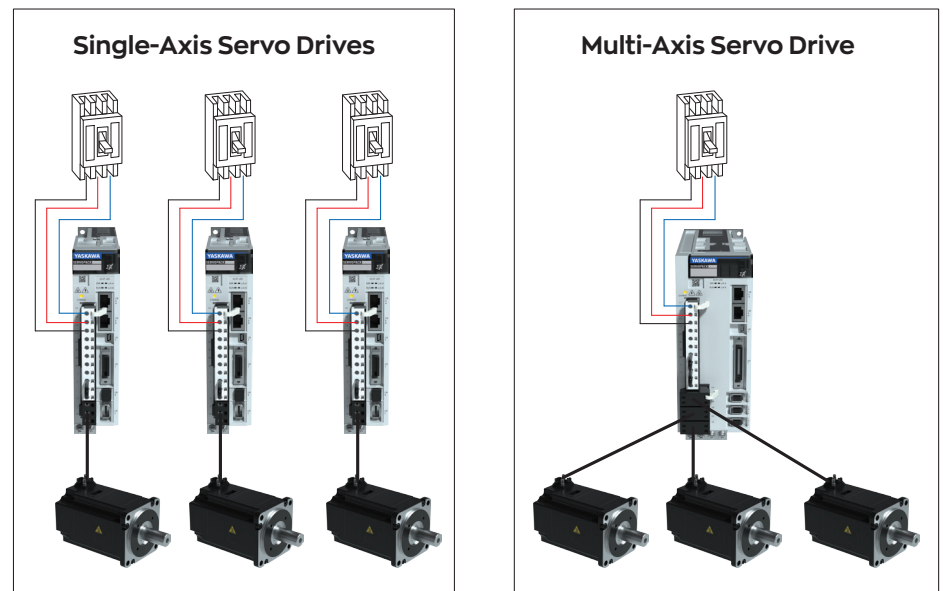
A panel designer does not need to provide circuit protection for multiple power lines to single-axis servo drives. Controller-to-drive communications connections are

simpler since multi-axis drives share one communication line, as opposed to the usual daisy-chained lines in multiple single-axis systems.

Although minor, in multi-axis servo drives, the motor power and encoder connections are condensed closer together, so the cables from each motor can be routed closer together and more organized.

The total space improvements also save cost due to fewer cables and the overall cost of the servo drives.

Reducing space requirements and wiring provides significant cost savings.



*Figure 1: Reduced components and less space required with multi-axis servos*

### 3. COMMUNICATION AND DATA HANDLING

Along with spacing improvements, programming multi-axis drives has its advantages as well. As stated before, the communication connections are greatly simplified when using a multi-axis drive. This goes hand in hand with how the drives are programmed. There is only one device, but each axis can be controlled and interfaced with much more simplicity.

Firmware updates to drives can often sideline an application, especially in the design and testing phase. Depending on where the servo drives are located, it can be tough to get cables to reach the correct connectors. With a multi-axis servo drive, you can significantly reduce the amount of device maintenance required.

Multi-axis servo drives simplify programming and reduce maintenance by using a single communication interface and minimizing the number of devices that need firmware updates.

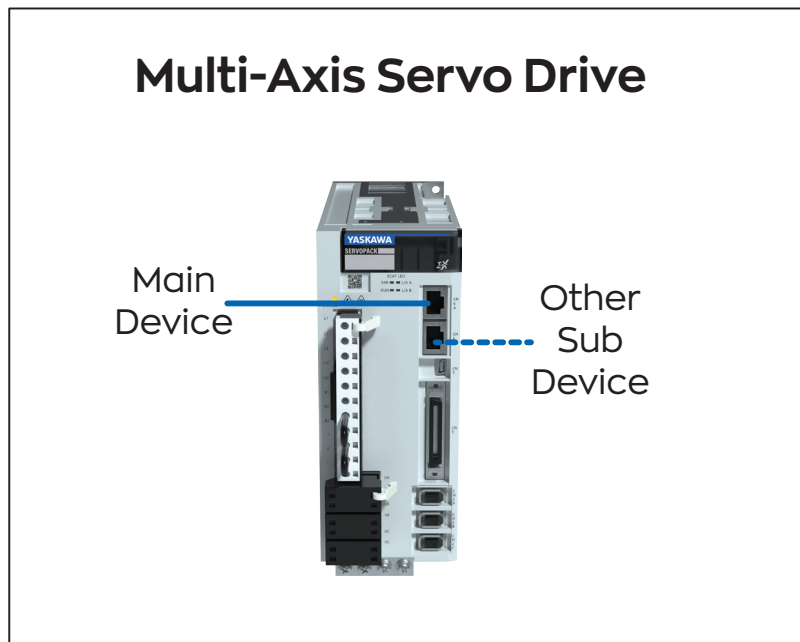
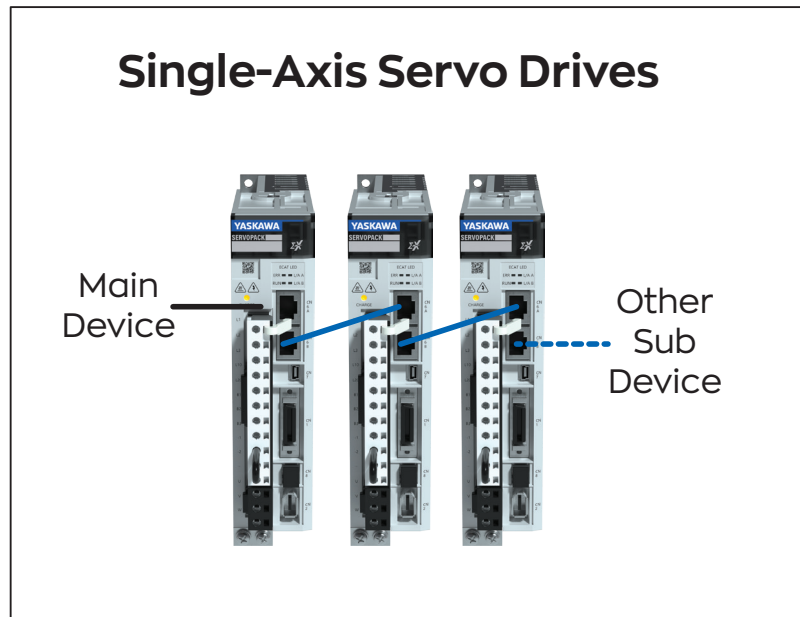


Figure 2: Communication and Data Handling

## 4. ENERGY EFFICIENCY

Energy efficiency can also be improved in applications that use multiple axes. The important thing to note is that multi-axis drives share a common DC bus, which is crucial in terms of energy dissipation. Take an application that runs two motors simultaneously with opposite motion profiles, where one motor accelerates while the other is decelerating. With a multi-axis drive, energy from the motor that decelerates can be used for the accelerating motor due to the common DC bus. There is no common DC bus with two single-axis servo drives unless extra

modifications are made to the drives. So, all the energy that comes from a decelerating motor is just wasted. If an application constantly has situations like this, using a multi-axis drive can drastically save energy, which means saving money. Figure 3 shows a basic flow of energy when this happens.

In addition, multi-axis servo drives are also more efficient in terms of power loss. Although small, the differences in power loss can save substantial amounts of energy and money in the long run.

A common DC bus is crucial in terms of energy dissipation with multi-axis drives

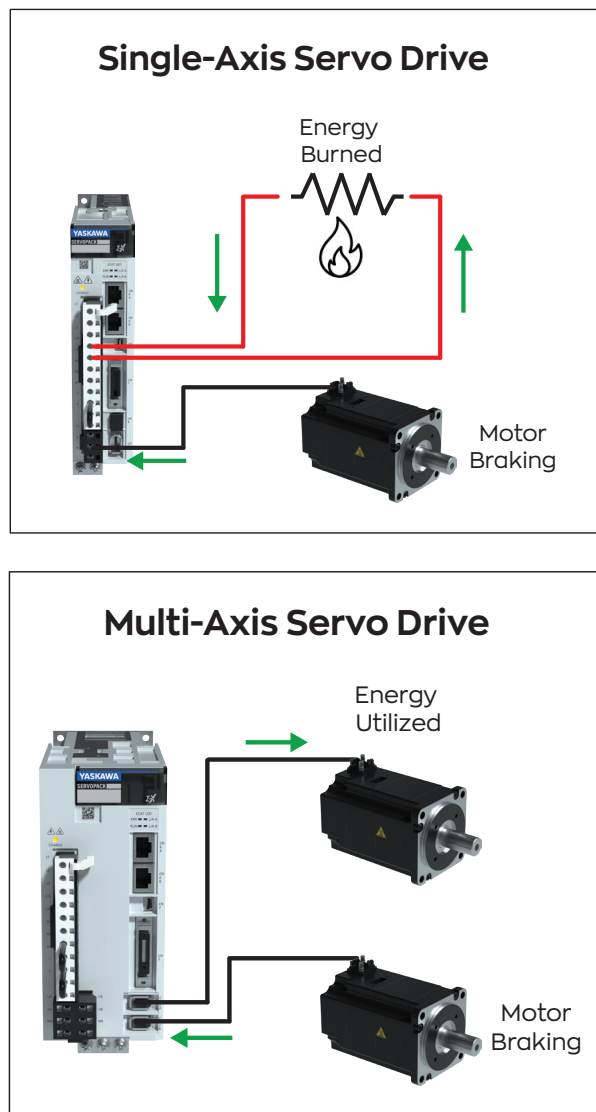


Figure 3: Energy Efficiency Comparison

## 5. SCALABILITY AND MODULARITY

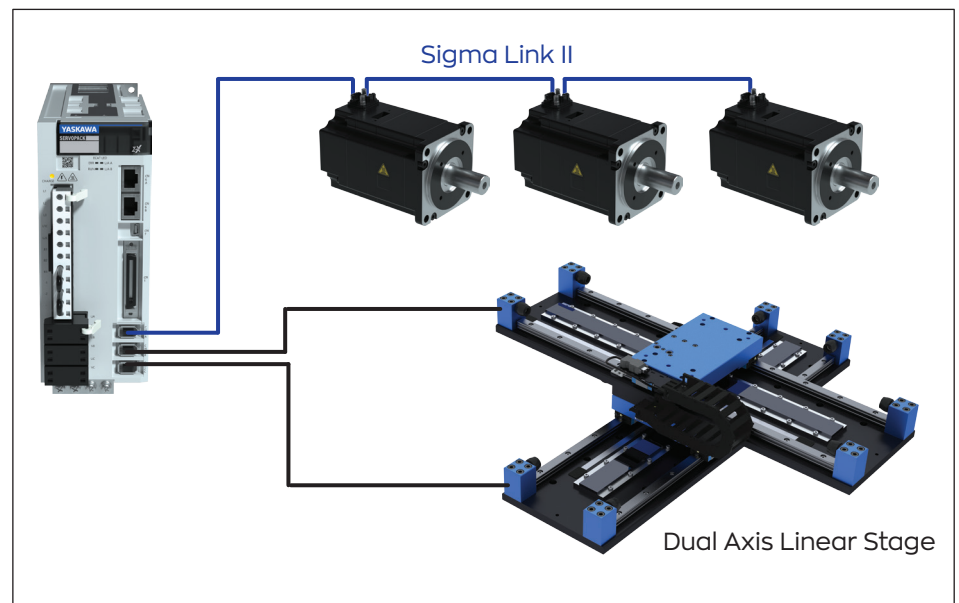
Scaling axes on an application is possible when using multi-axis drives. You can drive X, Y, and Z axes with one device.

More options are available when using something like Yaskawa's Sigma Link II. This allows you to connect multiple motors to a chained encoder line.

Changing node addresses allows each motor in that line to be individually controlled. A designer can specifically place up to three motors in a line in specific places to achieve an application.

With the number of setups and configurations available, the possibilities of applications on just one device become endless.

Multi-axis drives allow you to scale axes on an application to drive X, Y, and Z axes with one device.



*Figure 4: Connecting multiple motors to a chained encoder line with Sigma Link II.*

## MULTI-AXIS SERVO DRIVE APPLICATIONS

Applications that could benefit from using multi-axis servo drives include CNC machines, simple robotics, packaging machines, printing presses, gantry systems, and textile machines.

Any application that requires moving through three-dimensional space, requires synchronized joint motion, or precise timing and control between multiple points will require the use of multiple axes. As discussed above, many advantages exist in selecting multi-axis drives over single-axis drives.

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