# HIGH-ACCELERATION SERVO MOTORS CREATE CABLING CHALLENGES

In automated production machines, faster acceleration and deceleration of motion axes can lead to productivity gains. It's no wonder that machine builders have started to adopt new low-inertia servo motors that offer maximum accelerations up to 5g, compared to less than 3g for conventional servo motors.

The new motors can reach the application's maximum operating speed faster, consuming less cycle time while ramping up to and down from that top speed. We've evaluated CNC applications, for example, in which an acceleration improvement to 5g shaved approximately 2.5 seconds off the time it takes a spindle to reach its operating speed of 12,000 rpm. The resulting gains in spindle efficiency came to more than 54%, which in turn contributed to improving the overall machine efficiency.

Many other applications with short cycle times can benefit from motor acceleration improvements, including:

- Packaging lines.
- Plastics and textile machinery.
- Robots and materials handling systems.
- Laser cutting machines.

So what does acceleration have to do with cable? Experience shows 5g represents a tipping point for servo cables. When subject to accelerations of 5g or greater, traditional servo cables can experience forces high enough to shorten their working life dramatically. And keep in mind that rapid deceleration can be just as punishing on the cable as rapid accelerations.

While the move to high-acceleration servo motors is in its infancy right now, the majority of motion control applications still rely on rotary with accelerations less than 5g. High-acceleration rotary motors and linear motors, however, are gaining ground as machine builders target to gain a productivity edge.

Lapp engineers have already started to prepare for tomorrow's high-acceleration motion control applications by developing a new class of servo cables for use in cable tracks or between fast-moving machine components. Every aspect of these cables—from the jacketing to the insulation to the conductors—has been optimized for a long life at 5g.

Some of the design details are proprietary, and here's an overview of what to expect from this new class of servo cables.

## DESIGN FOR ACCELERATION

High-acceleration cables, such as the new Lapp ÖLFLEX® SERVO FD 796 CP, have two key design differences compared to the traditional servo cables you've worked with in the past.


*High-acceleration cable*

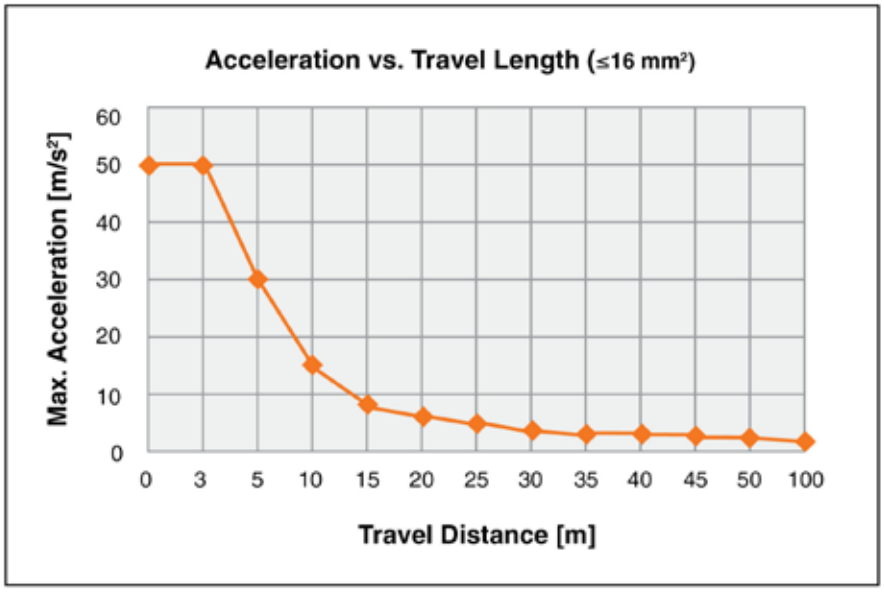
- **Greater stiffness to withstand stress.** High-acceleration cables need to be a bit stiffer. FD 796 CP, for example, has a polypropylene insulation which is slightly stiffer than the TPE or PVC insulations typically used for servo cables. The extra stiffness better resists the additional stresses seen by cables subjected to high accelerations and decelerations.

*Fast-moving automation systems increasingly see accelerations high enough to shorten the life of conventional servo cables.*

SERVO FD 796 CP may be the first of Lapp's new high-acceleration cables, and it won't be the last. We've introduced an unshielded version called ÖLFLEX® SERVO 796 P, which eliminates the control pairs and tinned copper braid found in FD 796 CP. Our high-acceleration cable lineup also includes an unshielded power circuit cable called ÖLFLEX CHAIN 896 P as well as an encoder-resolver signal cable called ÖLFLEX SERVO FD 798 CP.

As productivity-focused motion control systems turn up the dial on acceleration, the manner in which cables are specified will have to evolve. In addition to the usual check list of selection criteria—such as bend radius, the speed, flex life and operating environment—you'll increasingly have to evaluate servo cables for their ability to withstand the forces from acceleration.

- **Optimized to reduce cable mass.** It's also important that high-acceleration cables be as light as possible to limit forces. The FD 796 CP makes use of optimized materials and construction throughout. For example, it uses polypropylene insulation, which has a specific gravity of 0.96 for a mass density advantage relative to PVC whose specific gravity is 1.4. At the same time, polypropylene maintains a favorable dielectric constant of roughly 2.4 compared to 4 for PVC. The mass of the cable also derives from the manufacturing process. An optimized extrusion process allows us to minimize the variation in wall thickness for a further weight reduction. The optimized wall thickness, while still consistent with UL requirements,also results in a low capacitance, which limits leakage currents on the copper braid.




*Travel distance worsens the effects of acceleration.*

## HIGHER-ACCELERATION CABLE NOW AVAILABLE

The first Lapp servo cable designed from the ground up for high accelerations is ÖLFLEX® SERVO FD 796 CP. Its design features include extra-fine Class 6 copper stranding, polypropylene insulation, non-woven wrapping, tinned copper braiding and a polyurethane jacketing. The cable optionally contains either one or two control pairs.

The new cable supports accelerations in excess of 5g and travel speeds up to 5m/sec. Travel distances can range up to 100 m. Intended for flexible applications, it has a minimum bend radius of 7.5 x OD.

Other than its ability to withstand high accelerations, FD 796 CP behaves much like any other high-performance servo cable. It resists oil and flame to UL standards. Temperature range for flexible applications is –40 to 80ºC.